

AN EVALUATION OF THE EFFECTS OF A LIFESTYLE INTERVENTION ON  
EATING AND PHYSICAL ACTIVITY BEHAVIOURS OF URBAN  
ADOLESCENTS IN JUNIOR PUBLIC SECONDARY SCHOOLS IN BOTSWANA:  
A PRAGMATIC RANDOMISED CONTROLLED TRIAL

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## ABSTRACT

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**Background:** The prevalence of overweight and obesity is an increasing health problem among adolescents due to unhealthy eating habits and inadequate physical activity. There are 434,000 (21%) adolescents aged 10-19 years in Botswana. The prevalence of overweight among adolescents aged 12-18 years in 2011 in urban private secondary schools in Botswana was 27.1% (192/702) and 13.1% (93/702) in public secondary schools. There is, however, a paucity of data on eating habits and physical activity behaviours and no published evidence was located on the prevalence of overweight among 13-15 year old adolescents in public junior urban secondary schools in Botswana. The determinants of adopting a healthy lifestyle such as information (knowledge), motivation (intentions) and behavioural skills (self-efficacy) have been identified in cross-sectional studies in other countries, but not in Botswana.

A culturally suited lifestyle intervention program aimed at motivating adolescents to adopt a healthy lifestyle was not located in the published literature. In the absence of such a lifestyle intervention program for adolescents, the development, implementation and evaluation of the intervention for this study was guided by the Information, Motivation and Behavioural skills (IMBs) model to measure change in eating habits and physical activity behaviours of adolescents in Botswana.

**Methods:** A 2-part study was conducted from 1 November 2015 to 18 March 2016. Study One - three research designs were employed: 1) a descriptive design for development of a 3-part questionnaire from existing published literature; 2) a mixed methods approach to validate the prototype questionnaire by determining the index of content validity (n=10 respondents), face validity by cognitive interviewing (n=33 respondents who were scholars), and reliability by test-retest pilot testing (same 33 respondents); and 3) a cross-sectional survey by validated questionnaire of n= 252 respondents' (scholars) eating habits, physical activity behaviours and weight, height

and waist circumference to determine the prevalence of overweight. Results from the cross-sectional survey provided baseline data for Study Two.

For Study Two a descriptive design was employed to develop and describe a lifestyle intervention movement (LIMO) program followed by a pragmatic randomised controlled trial for implementing and evaluating the effectiveness of the LIMO program (n=25 respondents in the intervention trial arm; n=21 in the control arm from Study One).

**Null hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will not result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

**Alternate hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

**Results: Study One:** Good response rate of 95%. The mean age of the respondents was 14.3 years (SD 0.79); mean body mass index (BMI) was 20.1 kg/m<sup>2</sup> (SD 3.9) and mean waist circumference score was 71.2 cm (SD 8.71). There were more females in the sample (147/252, 58.3%) than males (105/252, 41.7%). Most of the respondents (153/252, 53.6%) had a low socio-economic status as categorised by the present study. The majority (188/252, 74.6%) had a normal BMI and few (22/252, 8.7%) were underweight. Twenty-seven (10.7%) respondents were overweight, 4/252 (1.6%) were obese and 11/252 (4.4%) were obese with risk. Although few respondents had an abnormal waist circumference (females 17/252, 6.7%; males 14/252, 5.6%) more females (131/252, 52%) than males (90/252, 35.7%) had a normal waist circumference.

The most frequently eaten foods were sweets (132/252, 52.4%) and snacks (92/252, 38.1%). Television adverts were sometimes (137/252, 62.3%) considered to be honest. Parents controlled slightly more than half (128/252, 50.8%) of the respondents' food choices whereas peers had little influence (21/252, 8.3%). Of the food types, most ate breakfast comprising of coffee and bread (115/252, 45.6%). Dinner was mostly eaten at home with the whole family (181/252, 71.8%). Of the listed foodstuffs, the majority preferred foods that contained sugar (41/252, 16.3%). Slightly more than half (135/252, 53.6%) of the respondents walked 6 or more times per day each week and more (150/252, 58.7%) reported that they did get exercise. Many intended to change their eating habits (220/252, 87.3%) and physical activity behaviours (143/252, 56.7%) and reported self-efficacy to do so (180/252, 71.4% and 174/252, 69.1% respectively). The majority of respondents (142/252, 56.3%) failed ( $\leq 49\%$ ) the nutrition knowledge test. The prevalence of overweight was 16.7% (42/252) by body mass index (BMI) and 12.3% (31/252) by waist circumference (WC) respectively.

**Study Two:** There was no statistically significant difference in eating habits between the trial arms (fruit  $P=0.275$ , vegetables  $P=0.604$ , sweets  $P=0.066$ , fatty foods  $P=0.402$ ); although there was a difference in sugar consumption this was not statistically significant. There was no statistically significant difference in physical activity (walking 6 times or more a day each week) between trial arms ( $P=0.267$ ), in doing exercise ( $P=0.288$ ) and in sedentary behaviour ( $P=0.362$ ). There was a difference in nutrition knowledge between trial arms but it was not statistically significant ( $P=0.079$ ).

**Conclusion and recommendations:** Although adolescents had good intentions and self-efficacy to change their eating and physical activity behaviours they engaged in unhealthy behaviours. The LIMO program demonstrated minimal but promising effects on changing behaviours. However further research is needed to determine the best intervention to impact behaviour change.

## **EXECUTIVE SUMMARY**

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**Aim:** The aim of the study was twofold: first, to describe eating habits, physical activity (PA) behaviours, intention and self-efficacy for healthy eating and exercise and nutritional knowledge of adolescents in public junior urban secondary schools in Botswana. Secondly, the study aim was to develop, validate and test the impact of a lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model, on participants' eating habits and physical activity behaviours and nutrition knowledge. The aim of the study was achieved in two phases.

**Rationale:** The main causes of being overweight are poor eating habits and inadequate PA behaviour. However eating habits and PA behaviours and their determinants (nutrition knowledge, intentions and self-efficacy to change eating and PA behaviours) have not been adequately explored in developing countries and not yet investigated in Botswana, though overweight is a creeping health problem. Overweight in developed countries, even among adolescents, is deemed a public health crisis that is expected to increase the incidence of non-communicable diseases presently and in future.

### **Research questions**

#### **Study One**

- i. What are the eating habits and levels of physical activity in urban adolescents in public secondary schools in Botswana?
- ii. What is the level of nutritional knowledge and intention for healthy eating and physical activity in urban adolescents in public secondary schools in Botswana?
- iii. What is the level of self-efficacy for healthy eating and physical activity in urban adolescents in public secondary schools in Botswana?
- iv. What is the prevalence of overweight and obesity in urban adolescents in public secondary schools in Botswana?

## **Study Two**

Will an intervention aimed at changing eating habits, physical activity behaviour and level of nutrition knowledge influence eating habits and physical activity and effect behaviour change in adolescents?

A two-part study was designed to 1) describe eating habits and PA behaviour and their determinants of adolescents in junior secondary schools, and 2) develop and implement a lifestyle intervention program, and evaluate its effectiveness in changing behaviour.

## **Summary of Study One**

**Background:** Eating habits and PA behaviour and their determinants in adolescents in junior secondary schools in Botswana has not yet been described.

**Aim:** To establish baseline data, prior to the intervention, of the eating habits, physical activity behaviour, nutritional knowledge (information), motivation (intention) and behavioural skills (self-efficacy) that influence eating habits and physical activity behaviour of urban adolescents in public junior secondary schools in Gaborone City, Botswana, and to determine the prevalence of overweight and obesity in this population.

## **Objectives: to**

1. design and validate a questionnaire from existing published questionnaires;
2. describe respondents' self-reported socio-demographic characteristics;
3. describe eating habits;
4. identify self-reported influences on food choice and preferences;
5. determine awareness and knowledge of healthy eating/food intake behaviours;
6. describe self-reported physical activity behaviours;
7. determine respondents' self-rated degrees of intention to change eating and physical activity behaviours;
8. self-efficacy for changing eating and physical activity behaviours;
9. determine the prevalence of overweight by waist circumference and body mass index.

## **Methods and procedures**

**Study One:** Three research designs were employed: 1) a descriptive design for development of a 3-part questionnaire from existing published literature; 2) a mixed methods approach to validate the prototype questionnaire by determining the index of content validity, face validity by cognitive interviewing and reliability by test-retest pilot testing; and 3) a cross-sectional survey by validated questionnaire of respondents' eating habits, physical activity behaviours and weight, height and waist circumference to determine the prevalence of overweight. Results from the cross-sectional survey provided baseline data for Study Two.

**Outcomes:** eating habits, PA behaviours, nutrition knowledge, intentions and self-efficacy to change eating and PA behaviours, and prevalence of overweight by BMI and WC.

**Results:** There was a good response rate of 95% (252/264). Objective 1: The survey questionnaire was validated by determining the index of content validity (n=10 respondents), face validity by cognitive interviewing (n=33 respondents who were scholars), and reliability by test-retest (same 33 respondents) pilot testing. Objective 2: The majority of respondents were female (147/252, 58.7%) aged 15 years (120/252, 47.6%) and were from a low socio-economic status (107/252, 42.5%). Objective 3: Frequently eaten foods were sweets and snacks, fresh chips (French fries) and fatty cakes, and frequently eaten snacks were NIK-NAKS® and biscuits. Breakfast and dinner were mostly eaten at home with the family (181/252, 71.8%) respectively. Objective 4: Sometimes television adverts were deemed honest. Parents rather more than peers controlled food choices and most respondents preferred sugary foods (42/252, 16.1%). Objective 5: Nutrition knowledge was generally low (142/252, 56.7%). Objective 6: Slightly more than half the number of respondents (135/252, 53.6%) walked 6 times or more per day each week frequently but more (150/252, 58.7%) reported that they did get exercise. Objectives 7 & 8: Self-reported intentions were good (220/252, 87.3%) and self-efficacy to change eating and PA behaviours was high (180/252, 71.4%). Objective 9: The majority (188/252, 74.6%) had a normal BMI and few (22/252, 8.7%) were underweight. Twenty-seven (10.7%) respondents were overweight, 4/252 (1.6%) were obese and 11/252

(4.4%) were obese with risk. The prevalence of overweight was 16.7% (42/252) by BMI and 12.3% (31/252) by waist circumference.

**Implications:** Unhealthy eating habits, inadequate PA behaviour and inadequate nutrition knowledge needs to be targeted to promote a healthy lifestyle and prevent overweight. Therefore the development and implementation of a lifestyle intervention program was necessary to address these issues.

### **Summary of Study Two**

**Background:** Unhealthy eating habits and physical inactivity contribute to being overweight. Knowledge about good nutrition and the benefits of physical activity is paramount in improving decisions made about lifestyle habits. Lifestyle intervention programs should target eating habits, physical activity behaviours and other cognitive determinants such as knowledge, intentions and behavioural skills (self-efficacy) in order to promote health and prevent overweight.

**Aim:** The aim of Study Two was to implement and test the effectiveness of an 8 week LIMO program guided by the Information, Motivation and Behavioural skills (IMBs) model through a pragmatic randomised controlled trial of intervention versus information only.

### **Research objectives**

The objectives of Study Two were to establish whether the lifestyle intervention program results in a significant difference in:

1. improving eating habits between the intervention and control group;
2. physical activity levels between the intervention and control group;
3. nutritional knowledge between the intervention and control group;

**Design:** A descriptive design was employed to develop and describe a lifestyle intervention movement (LIMO) programme followed by use of a pragmatic randomised controlled trial for implementing and testing the effectiveness of the LIMO program (n=25 respondents in the intervention trial arm; n=21 in the control arm from Study One).

**Setting:** Junior secondary schools that participated in Study One.

**Population:** 13-15 year old boys and girls.

**Methods:** The development of a lifestyle intervention movement program (LIMO) was guided by the published literature. The LIMO program was evaluated for content by one nutritionist, one home economics teacher, one physical education teacher and one physiotherapist (co-supervisor). Voluntary participants who took part in Study One from four schools after consent and assent had been sought, participated voluntarily in Study Two. The validated 3-part (comprising 10 sections) nutrition questionnaire used in Study One was used to collect post-intervention data.

**Outcomes:** Eating habits (less fatty and sugar intake, increase in fruit and vegetable intake), increase in PA and reduced sedentary behaviour (walking 6 or more times a week, doing exercises and watching telecommunication media for less than 2 hours a day), and improved nutrition knowledge.

**Null hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will not result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

**Alternate hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

**Results:** There was no statistically significant difference in eating habits between the trial arms (fruit  $P=0.275$ , vegetables  $P=0.604$ , sweets  $P=0.066$ , fatty foods  $P=0.402$ ); although there was a difference in sugar consumption this was not statistically significant. There was no statistically significant difference in PA (walking 6 times or more a day each week) between

trial arms ( $P=0.267$ ), in doing exercise ( $P=0.288$ ) and in sedentary behaviour ( $P=0.362$ ). There was a difference in nutrition knowledge between trial arms but it was not statistically significant ( $P=0.079$ ).

**Implications:** The study has provided a database of adolescents' eating and physical activity behaviour as well as BMI and waist circumference. After the intervention there was no significant change in eating and physical activity behaviour. With further research on a larger sample and for a longer duration the LIMO program shows promise for behaviour change.

## **DECLARATION**

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I declare that this thesis, entitled: **An evaluation of the effects of a lifestyle intervention on eating and physical activity behaviours of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial** which I hereby submit for the degree of Doctor of Philosophy (Nursing) at the University of Cape Town, is my own work and has not previously been submitted by me for a degree at another university.

Name (Printed): Gaonyadiwe Lubinda-Sinombe

Researcher's Signature:

***Signed***

Date: 7<sup>th</sup> June, 2017

**Key Terms:** eating habits, knowledge, physical activity, intentions, self-efficacy, adolescents, information, motivation and behavioural skills, intervention.

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- Finally to my family, friends and prayer partners, who assisted me through a tough and challenging process. It was not easy but the challenging road was made easy and enjoyable by your absolute and unwavering financial, emotional and spiritual support.

**DEDICATION**

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To my daughter,

To my mother and late beloved granny

To my brothers

To all my prayerful friends

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## **ABBREVIATIONS**

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**BMI** - Body Mass Index

**CDC** - Centre for Disease Control and Prevention

**IHE** - Intention for Healthy Eating

**IMBs** - Information, Motivation and Behavioural Skills

**IOTF** - International Obesity Task-Force

**IPA** - Intentions for Physical Activity

**LIMO** - Lifestyle intervention movement

**NCDs** - Non-Communicable Diseases

**NK** - Nutrition Knowledge

**NOO** - National Obesity Observatory

**PA** - Physical Activity

**SEE** - Self-efficacy for exercise

**SEHE** - Self-efficacy for Healthy Eating

**WC** - Waist Circumference

**WHO** - World Health Organization

## OPERATIONAL DEFINITIONS

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- **Adequate nutrition knowledge level:** refers to scores of 80% and above.
- **Adolescents:** individuals aged 13-15 years.
- **Anthropometric measurements:** for this study this means weight, height and waist circumference.
- **Eating habits:** healthy eating means not eating fatty or sweetened foods and/or beverages, and snacks once per month and eating 2-3 servings of vegetables and fruits on a daily basis. Unhealthy eating means eating fatty or sweetened foods and/or beverages, and snacks daily and eating one serving of vegetables and fruits on a daily basis.
- **Overweight:** adolescents with a body mass index at the 85<sup>th</sup> percentile and above.
- **Physical activity behaviour:** refers to engaging in exercise and walking 6 times each day per week.
- **Risk factors:** consumption of fast foods and physical inactivity.
- **Socioeconomic status:** refers to a social class of a person determined by level of education, employment and income.<sup>1</sup>
- **Urban area:** a city.<sup>2</sup>
- **Walking 6 times or more per day each week:** refers to adequate physical activity.

## CONCEPTUAL DEFINITIONS

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- **Behavioural skills:** refers to self-efficacy to perform physical activity and eat healthily.
- **Information:** refers to knowledge about healthy foods and healthy eating.
- **Motivation:** refers to purposing to eat healthily and engage in physical activity.
- **Obesity:** refers to body mass index at the 95<sup>th</sup> percentile.<sup>3</sup>
- **Obesity with high risk:** refers to body mass index at and above the 97<sup>th</sup> percentile.<sup>4</sup>

## **1. INTRODUCTION**

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### **1.1 Background and significance**

The cause of overweight is multi-factorial.<sup>5 6</sup> The shift from a traditional way of life to a modern lifestyle in society has increased the prevalence of overweight among adolescents worldwide.<sup>7</sup> In Botswana and other African countries, increasingly, people eat modern food from restaurants rather than their own grown food, and walking has been replaced by use of public transport.<sup>8</sup>

In South Africa and Botswana traditional meals composed of porridge (ground maize meal or sorghum), legumes, wild vegetables, grains, wild fruit, groundnuts, maize, dried corn and sparing use of animal products have been replaced by modern meals that contain added sugars, increased use of animal products, refined foods and increased use of fat.<sup>9-11</sup> Diet in urban areas in South Africa is higher in fat intake than in rural areas.<sup>12</sup> This might be the reason behind the prevalence of overweight among children and adults living in urban areas in low and middle income developing countries.<sup>13</sup>

The school environment has also changed. Previously, the school menu was composed of traditional foods.<sup>11</sup> Currently most urban secondary schools in Botswana have a convenience store that sells snacks to supplement the school diet.<sup>10 14</sup> Students spend more time in school than at home on week days, making it an appropriate place to implement a lifestyle intervention program. School teachers and parents can provide a resource in addressing lifestyle eating habits and physical activity behaviours.<sup>15</sup>

Changing from an unhealthy to a healthy lifestyle is a difficult and complex endeavour. Individual determinants of a healthy lifestyle such as nutritional knowledge, intentions, and self-efficacy need to be explored in order to understand eating habits and physical activity behaviours, and to promote health.<sup>16</sup> A conceptual model: the Information, Motivation and Behavioural skills (IMBs) Model<sup>17</sup> has concepts that can be translated to be individual and social determinants of a healthy lifestyle.<sup>18</sup> Theories such as the Theory

of Planned Behaviour, Social Cognitive Theory, Trans-theoretical Model and the Health Belief Model have been used in understanding eating habits, physical activity behaviours and have been shown to impact adolescents' behaviour in a positive way. However the IMBs model has additional concepts to those listed above: the 'behavioural skills' component which is essential for behaviour change.<sup>19 20</sup>

There is still a paucity of data on the effectiveness of school-based lifestyle intervention programs among adolescents because of flawed methodologies and inconsistent findings worldwide.<sup>21-26</sup> It is reported in the published literature that there is still a need for additional theories, models or conceptual frameworks to better understand determinants of eating habits and physical activity behaviours of adolescents and to promote behaviour change.<sup>23 27</sup>

### **1.1.1 Overweight as a health issue**

#### *1.1.1.1 The situation globally*

At a global level, the overweight epidemic is a top priority health problem that needs urgent intervention. With the increase in prevalence of overweight world-wide, there has been an associated increase of noncommunicable diseases (NCDs) such as diabetes type 2, cardiovascular disease and cancer among adolescents.

NCDs are expected to increase in future because adolescent overweight persists to adulthood<sup>28</sup> and will result in an increase in the cost of health care in developing countries.<sup>29</sup> Other health and psychosocial health problems associated with overweight are asthma, sleep disorders, depression, social stigma and isolation, low self-esteem, poor school performance and fractures.<sup>30 31</sup> It is estimated that 200 million school aged children are overweight or obese worldwide.<sup>32</sup>

In Sub-Saharan Africa, the prevalence of overweight in South Africa was 17.7% for girls and 13.6% for boys in 2001-2004. In Zimbabwe, prevalence of obesity among ages 0-14 years was 15.3% in females and 19.5% in males. Among those aged 15-29 years the prevalence of obesity was 15.4% in males and 21.3% in females. In Nigeria, the prevalence

of overweight was 27.0% in girls and 18.6 % in boys in 2012.<sup>32</sup> Other Sub-Saharan African countries have incomplete or no documented overweight statistics.

### *1.1.1.2 The Botswana situation*

Botswana is a landlocked country, situated in the southern part of Africa. It is located on the northern side of South Africa, south-east of Angola, south of Zambia, west of Zimbabwe and east of Namibia. The total area is 600,700km<sup>2</sup>: land comprises 566,730km<sup>2</sup> and water 15000km.<sup>2</sup> The climate of Botswana is semi-arid, with warm winters and hot summers.<sup>33</sup>

The Botswana population was estimated at 2,038,228 in 2011. The age structure was as follows: 0-14 years 33.5% (702,836: male 358,254, 17.1%; female 345,115, 16.4%). For 15-24 year olds: 21.9% (459,466; male 227,527, 10%; female 232,004, 11.9 %). In Gaborone the capital city of Botswana, the population is estimated at 231,592.<sup>34</sup> The Botswana population residing in urban areas was projected at 233, 135. There are 434,000 (21%) adolescents aged 10-19 years in Botswana.<sup>34</sup>

For over 15 years Botswana's annual GDP growth was ranked the 4<sup>th</sup> worldwide, surpassed by China, Korea and Thailand.<sup>35</sup> Botswana is classified as an upper middle income country by the World Bank because of the diamond mining sector. There have been high rates of urbanization in recent decades.<sup>14 35</sup> The population in urban areas had increased to 62.3% in 2012 (1,279,790).<sup>36</sup>

Currently in Botswana there are few community health nurses and a lack of school health nurses<sup>37</sup> to address the emerging overweight adolescent problem. There is a decrease in physical activity among adolescents due to an increase in use of public transport to school.<sup>8 10</sup> In Botswana unhealthy eating habits such as the consumption of fast foods is on the increase among adolescents in urban areas.<sup>38</sup> There is an increase of NCDs, with hypertension being at 16% among adults.<sup>39</sup> No published lifestyle intervention model to address overweight in adolescence was located therefore intervention studies such as this are urgently needed in Botswana. By preventing overweight in this age group, the future anticipated increase in incidence of NCDs can potentially be halted in future generations.<sup>29</sup>

## **1.2 Problem statement**

There is a paucity of published evidence that there is a concern of creeping overweight among adolescents in secondary schools in Botswana, as reported by teachers, vendors and students.<sup>10</sup> The prevalence of overweight among adolescents aged 12-18 years in 2011 in urban private secondary schools was 27.1% (192/702) and 13.1% (93/702) in public secondary schools.<sup>40</sup> There is, however, a paucity of data on eating habits and physical activity behaviours, and no published evidence was located in the literature on the prevalence of overweight among 13-15 year old adolescents in public junior urban secondary schools in Botswana.

The determinants of adopting a healthy lifestyle behaviour such as information (knowledge), motivation (intentions) and behavioural skills (self-efficacy) have been identified in cross-sectional studies in other countries, but not in Botswana.

A culturally suited lifestyle intervention program aimed at motivating adolescents to adopt a healthy lifestyle was not located in the published literature. In the absence of such a lifestyle intervention program for adolescents, the development, implementation and evaluation of the intervention for this study was guided by the Information Motivation and Behavioural Skills (IMBs) model to measure change in eating habits and physical activity behaviour of adolescents in Botswana.

## **1.3 Research questions**

Study One addressed four questions. Study Two addressed one question.

### **Study One:**

- i. What are the eating habits and levels of physical activity in urban adolescents in public secondary schools in Botswana?
- ii. What is the level of nutritional knowledge and intention for healthy eating and physical activity in urban adolescents in public secondary schools in Botswana?
- iii. What is the level of self-efficacy for healthy eating and physical activity in urban adolescents in public secondary schools in Botswana?

iv. What is the prevalence of overweight and obesity in urban adolescents in public secondary schools in Botswana?

## Study Two

Will an intervention aimed at changing eating habits, physical activity behaviour and level of nutrition knowledge influence eating habits and physical activity behaviour of adolescents and effect behaviour change?

### 1.4 Aims and objectives

#### 1.4.1 Overall aim of the study

The aim of the study was to describe eating habits, physical activity behaviour and nutritional knowledge of adolescents in public junior urban secondary schools in Botswana and to develop, validate and test the impact of a lifestyle intervention program on eating habits and physical activity behaviour and factors that influence them. The aim of the study was achieved in two phases (Figure 1.1).

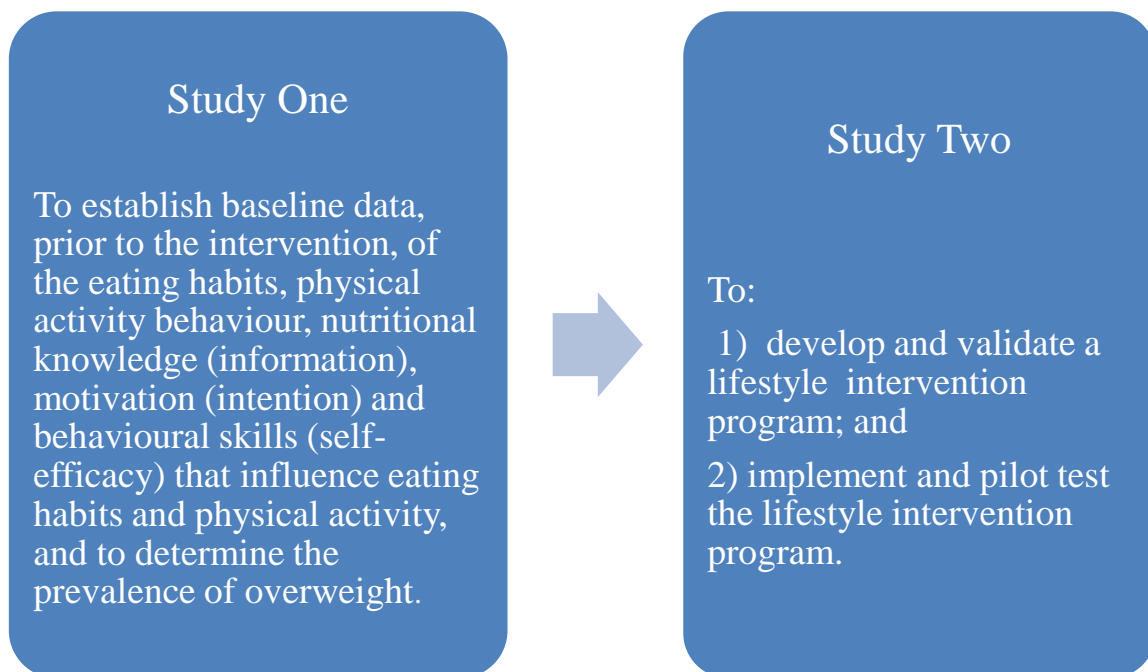


Figure 1.1: The aim of the study in two (2) phases

## 1.4.2 Study objectives

### 1.4.2.1 Study One

**Aim:** To establish baseline data, prior to the intervention, of the eating habits, physical activity behaviour, nutritional knowledge (information), motivation (intention) and behavioural skills (self-efficacy) that influence eating habits and physical activity behaviour of urban adolescents in public junior secondary schools in Gaborone City, Botswana, and to determine the prevalence of overweight and obesity in this population.

**Objectives:** To:

1. design and validate a questionnaire from existing published questionnaires;
2. describe respondents' self-reported socio-demographic characteristics;
3. describe eating habits;
4. identify self-reported influences on food choice and preferences;
5. determine awareness and knowledge of healthy eating/food intake behaviours;
6. describe self-reported physical activity behaviours;
7. determine respondents' self-rated degrees of intention to change eating and physical activity behaviours;
8. self-efficacy for changing eating and physical activity behaviours;
9. determine the prevalence of overweight by waist circumference and body mass index.

### 1.4.2.2 Study Two

**Aim:** To implement and test the effectiveness of an 8-week lifestyle intervention program guided by the Information, Motivation and Behavioural skills (IMBs) model through a pragmatic randomised parallel group controlled trial of intervention versus information only.

**Objectives**

The objectives of this study were to establish whether the lifestyle intervention programme was effective in improving eating habits, physical activity behaviour and nutritional knowledge.

### **1.5 Research setting**

The study was conducted in eight (8) junior secondary schools in Gaborone, Botswana. These are public junior schools located in different areas within the city of Gaborone.

### **1.6 Summary and significance**

The adolescent stage is marked by a burst in cognitive and physical development, which requires more personal dietary choices than in earlier stages of life. It is at this stage that great amounts of nutrients are needed.<sup>7</sup> Adolescents are also concerned about the way they look and this might affect their food choices and preferences. Health choices made at this stage form a base for adulthood eating and physical activity behaviours. The adolescent stage is therefore the best time for health promotion activities.<sup>7</sup>

The study was designed to provide descriptive data on adolescents' eating habits and physical activities, level of nutrition knowledge and their intention and self-efficacy for eating healthily and doing physical activity, whether overweight or not. Secondly, the next part of the study may add new knowledge about the effectiveness of a lifestyle intervention program on establishing healthy eating habits and physical activity behaviour among adolescents in Botswana using the IMBs model.

The results of the study may inform nursing curricula, national health policies and all levels of society towards the development of strategies to ensure the health of adolescents. The results of the study will form a base for future studies on a similar topic.

## **2. LITERATURE REVIEW**

---

### **2.1 Introduction**

The literature review focused on eating habits, physical activity behaviour and determinants such as information (nutrition knowledge), motivation (intentions ) and behavioural skills (self-efficacy) pertaining to adolescents and the global prevalence of overweight in adolescents aged 13-15 years. The literature review was guided by concepts of the Information, Motivation and Behavioural skills (IMBs) model.<sup>17</sup>

#### **2.1.1 Literature search strategy**

Key terms used were eating habits and/or knowledge and/or physical activity and/or intentions and/or self-efficacy and/or adolescents and/or information, motivation and behavioural skills, and intervention and/or adolescents searched from databases SAGE, Google Scholar, Science Direct, PubMed and EBSCOHost (CINAHL, ERIC, Medline). Hand searches of reference lists were included. The Cochrane Collaboration Risk of Bias Tool was used to appraise the quality of RCTs reviewed for this study (Appendix 40, 41).

##### *2.1.1.1 Inclusion criteria of published articles*

1. Subjective measurement scales
2. Adolescent population (9-19 years)
3. In English
4. Full text
5. Articles published or unpublished from January 1995 to August 2016
5. School-based intervention studies that addressed eating habits and physical activity behaviour and nutrition knowledge, intentions and self-efficacy.

##### *2.1.1.2 Exclusion criteria of published articles*

1. Studies on body image and eating disorders

## Lifestyle intervention

2. Studies that used objective measurements of physical activity and eating habits because it will be difficult to make a comparison with the current study which used subjective measures.
3. Intervention studies that evaluated physical activity (PA) behaviour objectively because it will be difficult to make a comparison with the current study which used subjective measures.

Search results are presented in Table 2-1.

**Table 2.1: Database search results**

| Database/search engine            | Keywords   | Results     | Number of relevant papers |
|-----------------------------------|--|-------------|---------------------------|
| EBSCOHost (CINAHL, ERIC, Medline) | Eating habits and/or knowledge and/or physical activity and/or intentions and/or self-efficacy and/or adolescents and/or information, motivation and behavioural skills, and intervention and/or adolescents | 798         | 55                        |
| Google scholar                    |  | 674         | 40                        |
| Science Direct                    |  | 326         | 10                        |
| PubMed                            |  | 234         | 10                        |
| SAGE                              |  | 141         | 2                         |
| <b>Total</b>                      |  | <b>2173</b> | <b>117</b>                |

## 2.2 Summary of reviewed literature

No prior studies were located in the published literature that reported on eating habits, PA behaviour, intentions, self-efficacy and nutrition knowledge level among adolescents in Botswana. There is a paucity of published studies on adolescents' eating habits and physical activity behaviour and their determinants using the IMBs Model. In a systematic review of theories used to guide the phenomenon under study, the Theory of Planned Behaviour (TPB) was frequently used.<sup>41</sup> There is a paucity of studies on eating habits and physical activity behaviour, and nutrition knowledge, intentions and self-efficacy for healthy eating and exercise among adolescents in developing countries.

Key issues emanating from the reviewed literature on eating habits and physical activity behaviour and their determinants among adolescents using the IMBs model as a guide:

1. there is inconsistency in the level of nutrition knowledge across adolescent populations which may be attributed to differing methodologies having been employed and that the majority of the participants in the studies indicated poor nutrition knowledge (of food groups, nutrients and contents);
2. evidence of engaging in unhealthy eating habits;
3. evidence of inadequate PA levels demonstrated by minimal self-reporting of physical activities;
4. lack of knowledge about the importance of engaging in physical activity;
5. unhealthy eating habits and inadequate physical activity levels are linked to overweight;
6. the majority of participants in published studies showed good intentions and self-efficacy for healthy eating and physical activity but this was not consistent with their behaviour;
7. a substantial number of published studies did not report psychometric information which impacted on the quality of the results, however some reported that they used previously validated and reliable instruments;
8. the majority of the researchers in the published studies used the Theory of Planned Behaviour and Social Cognitive Theory to guide their studies. Only two (2) published studies used the IMBs Model.

### **Recommendations**

1. More studies on eating habits and physical activity behaviour and their determinants among adolescents should be conducted in developing countries.
2. Strategies for strengthening school curricula toward prevention of overweight and obesity and eventual NCDs among adolescents are urgently needed.
3. Involving all stakeholders in promoting healthy living among adolescents is indispensable.

- 
4. Bias of instruments can be reduced by reporting validation and reliability of self-reported and self-developed instruments and thereby improving the quality of results.

Figure 2.1 presents a hierarchy of evidence of a preliminary summary of the published and unpublished literature on the research topic starting with systematic reviews followed by randomised controlled trials and the least robust evidence being expert opinion.<sup>42</sup>



**Figure 2.1: Hierachy of evidence** of a preliminary summary of the published and unpublished literature on adolescents’ eating habits, physical activity behaviour, nutrition knowledge and intentions and self-efficacy for healthy eating and physical activity.

A summary of published studies by hierarchy of evidence on adolescents’ eating habits, physical activity (PA) behaviour, nutrition knowledge and intentions and self-efficacy for healthy eating and physical activity is presented in Table 2-2. The Cochrane Collaboration Risk of Bias Tool was used to assess the quality of the included RCTs (Appendix 40, 41).

**Table 2-2: A hierarchy of evidence of studies on adolescents' eating habits, physical activity (PA) behaviours, nutrition knowledge and intentions and self-efficacy for healthy eating and physical activity**

| Systematic reviews | Authors               | Study objectives   | Sample size | Methods   | Outcomes          | Findings  |
|--------------------|-----------------------|--|-------------|---|-------------------|---|
| Systematic review  | Campbell, et al. 2001 | To assess the effectiveness of interventions designed to prevent obesity in childhood. | 7 studies   | Electronic databases were searched from January 1985 to October 1999. Randomized control trials and non-randomized trials with concurrent control group were included. The studies with follow up of 1 year minimum were selected however, this was amended to include studies with a minimum follow up of three months | Obesity reduction | Seven studies were included; three short term (above 3 and less than one year) and four long term (above one year) focusing on overweight reduction. In one of a sample of 596 and 12.2% participants had their weight reduced. Two studies evaluated the combination of dietary education and physical activity behaviours and the intervention was found to be effective in reducing overweight specifically among girls ( $p < 0.03$ ) in the intervention group, however it was effective in boys in the intervention group and control $p < 0.04$ . One study focused on reducing television use and the intervention was found to be effective in both girls ( $p < 0.02$ ) and boys ( $p < 0.05$ ) in the intervention schools. In the short term studies none evaluated the combination of physical activity and dietary education. Two |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>     | <b>Study objectives</b>   | <b>Sample size</b> | <b>Methods</b>  | <b>Outcomes</b>   | <b>Findings</b>   |
|---------------------------|--------------------|---|--------------------|---|---|---|
|                           |                    |   |                    |   |   | studies evaluated the effect of physical education on sedentary behaviours and it was found to be effective ( $p < 0.002$ ). One study evaluated the effect of pa and dietary education intervention after 12 weeks and it was found to be effective ( $p < 0.05$ ).  |
| Systematic review         | Brown, et al. 2013 | To systematically review the efficacy of physical activity interventions targeting 5-12 year old children on potential mediators and, where possible, to calculate the size of the intervention effect on the potential mediator. | 18                 | A systematic search identified intervention studies that reported outcomes on potential mediators of physical activity among 5-12 year old children. Original research articles published between 1985 and April 2012 | Physical activity self-efficacy, nutrition knowledge and intentions | Self-efficacy was the most frequently examined potential mediator ( $n=14$ studies). Seven studies found a positive significant effect on self-efficacy, with small to large effect sizes ranging from 0.11 to 0.82. Nine studies examined level of knowledge and of these, seven reported positive intervention Effects. Intentions to be active were examined in five studies and two studies reported effect on PA |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>        | <b>Study objectives</b>   | <b>Sample size</b> | <b>Methods</b>   | <b>Outcomes</b>                                      | <b>Findings</b>   |
|---------------------------|-----------------------|---|--------------------|--|--|---|
| Systematic review         | Torre, et al. 2015    | To systematically analyze the methodology of studies investigating the influence of Sugar Sweetened Beverages (SSB) consumption on risk of obesity and obesity among children and adolescents, and the studies' ability to answer this research question. | 23<br>Studies      | Systematic review of cohort and experimental studies published until December 2013 in peer-reviewed journals was performed on Medline, CINAHL, Web of Knowledge, and Clinical Trials.gov about the influence of SSB consumption on risk of obesity and obesity among children and adolescents. | Consumption of sugar sweetened beverages and obesity | There is positive association between SSB consumption and risk of obesity or obesity, especially among overweight children. Study results also highlight the need for accurate measurement of the consumption of SSBs and of important confounders.   |
| Umbrella Review           | Sleddens, et al. 2015 | To present a comprehensive overview of the current knowledge on potential determinants of dietary behaviour in children less than 18 years  | 17                 | Systematic reviews identified in four databases (i.e. PubMed, PsycINFO, The Cochrane Library and Web of Science) that summarized determinants of observable child and adolescent dietary behaviours.   | Determinants of eating behaviour                     | The most studied determinants were: Social-cognitive (studied mostly towards the end of the 20th century) and environmental (studied in past decade) which, showing a paradigm shift. Mixed findings about environmental determinants were reported. Sedentary behaviour and intention were found to be significant determinants of a wide range of dietary behaviours in most reviews with limited evidence due to the cross-sectional study designs. Potential determinants |

## Lifestyle intervention

| Systematic reviews | Authors            | Study objectives  | Sample size                             | Methods   | Outcomes  | Findings  |
|--------------------|--------------------|---|---|---|---|---|
|                    |                    |   |   |   |   | such as automaticity, self-regulation and subjective norm have been studied in relatively few studies, but results are promising.   |
| Systematic review  | Riebl, et al. 2015 | To determine, using a systematic literature review, how the TPB has been applied to investigate dietary behaviours, and to evaluate which constructs are associated with dietary behavioural intentions and behaviours in youth | 34 articles with 3 intervention studies | The Experts in the field were identified through electronic database, and examining an evolving Internet-based TPB-specific bibliography. Studies including participants aged 2–18 years, all TPB constructs discernible and measured with a description of how the variables were assessed and analyzed, were published in English and peer-reviewed journals, and focused on nutrition-related behaviours in youth were identified. | Not stated but assumed to be TPB constructs association with healthy eating | The TPB was mostly used to evaluate healthy eating and sugary snack and beverage consumption. Intention was the most common predictor of behaviour performance (mean $r=0.38$ ; $p<0.001$ ). All three interventions revealed beneficial outcomes when using the TPB (e.g. $\eta^2=0.51$ and $d_s=0.91, 0.89,$ and $0.79$ ) theory. |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>      | <b>Study objectives</b>  | <b>Sample size</b> | <b>Methods</b>  | <b>Outcomes</b>   | <b>Findings</b>   |
|---------------------------|---------------------|--|--------------------|---|-------------------|---|
| Systematic review         | Dumith, et al. 2011 | To systematically review the international literature regarding PA change during adolescence, and to quantify that change according to a series of study variables, exploring gender-and-age differences | 26 studies         | Medline/PubMed and Web of Science databases. Longitudinal studies with, at least, two PA measures throughout adolescence (10–19 years old) or the first PA measure during childhood and the second one during adolescence were selected. From each article, study project name, country, year of the first data collection, sample size, baseline age, follow-up duration, characteristics of the instrument (type, recall time, PA intensity and PA domain), unit of PA measure and report of statistical significance were collected. | Physical activity | <p>Majority of the studies were done in the USA, assessed using a PA questionnaire. A decline in PA levels during the adolescence was reported although earlier studies revealed a higher PA decline in boys, the decline has been greater in girls in more recent studies (commenced after 1997). Moreover, although the decline among girls was higher in younger ages at baseline (9–12 years), it was higher in older ages (13–16 years) among boys.</p> <p>Interventions that attempt to promote the PA decline, even without an increase in PA levels, could be considered a effective.</p> |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>      | <b>Study objectives</b>   | <b>Sample size</b>       | <b>Methods</b>   | <b>Outcomes</b>                             | <b>Findings</b>  |
|---------------------------|---------------------|---|--------------------------|--|---|--|
| Systematic review         | Rhodes, et al. 2011 | To retrieve, theme and appraise the variables that have been evaluated as the potential moderators of the intention behaviour relationship in the physical activity (PA) domain | 57 correlational studies | <p>Literature searches were conducted from September 2009 to March 2010 in Academic Search Complete, ERIC: Education Resources Information Center, Medline, PsychINFO and SPORTDiscus. The electronic search strategy was developed by RR and LD and executed by LD.</p> <p>The literature search yielded 2865 potentially relevant records. Of these, 248 abstracts and full text reports were obtained and reviewed.</p> <p>Studies that measured leisure-time PA (inclusive of exercise) as the dependent variable and an empirical test of moderation of intention and PA with a third variable were included.</p> | Potential moderators of intention behaviour | <p>Studies show a mixed evidence for a specific age effect on the I-PA relationship. Weight, class, gender and ethnicity are not a moderator of I-PA relationship.</p> <p>Intention to perform PA is conceived as the main determinant of PA in many theories, yet I-PA discordance is high.</p> <p>Intention stability may be the central determining factor for I-PA discordant.</p> |

## Lifestyle intervention

| Systematic reviews | Authors            | Study objectives   | Sample size   | Methods  | Outcomes  | Findings  |
|--------------------|--------------------|--|---|--|---|---|
|                    |                    |  |   | Studies that did not examine the I-PA relationship and not measure PA nor written in any language other than English were excluded.  |   |   |
| Systematic review  | Brown, et al, 2009 | To identify potential mediators reported in children's physical activity interventions and to review psychometric properties of measures of potential mediators. | 24 published studies; 17 for individual mediators, three for social and one for environmental mediators | A systematic search of literature was conducted and studies that reported potential mediators were retrieved and reviewed for psychometric properties of measures-face/logical, construct, criterion validity, test-retest and internal consistency reliability. | Mediators of PA and psychometric properties of mediators of PA. | <p>The reporting of the psychometric properties of PA and its potential mediators varied. Reliability was commonly reported than validity. The quality of the measures for mediators was low.</p> <p>The 21 potential mediators identified included among others self-efficacy, knowledge and intentions.</p> <p>Self-efficacy's internal consistency of measures was the most commonly reported form of reliability, with 12 studies reporting an acceptable Cronbach's <math>\alpha</math> value ranging from 0.61 to 0.89.</p> <p>The seven studies reported test-retest reliability analyses, with correlations between test and retest ranging from <math>r = 0.58</math> to 0.82.</p> |

## Lifestyle intervention

| Systematic reviews | Authors                       | Study objectives  | Sample size                                       | Methods   | Outcomes                                | Findings  |
|--------------------|-------------------------------|---|---|---|---|---|
|                    |                               |   |   |   |   | <p>Results of face validity were more commonly reported for measures of self-efficacy, from questionnaires developed by a panel of experts.</p> <p>It is recommended that both validity and reliability should be tested to ensure usage of appropriate measures and accurately determine the efficacy of physical activity interventions among children.</p> |
| Systematic review  | Van Cauwenberghe, et al. 2010 | To summarize the existing European published and 'grey' literature on the effectiveness of school-based interventions to promote a healthy diet in children (6–12 years old) and adolescents (13–18 years old). | 42 studies (29 in children and 13 in adolescents) | Eight electronic databases, websites and contents of key journals were systematically searched, reference lists were screened, and authors and experts in the field were contacted for studies evaluating school-based interventions promoting a healthy diet and aiming at primary prevention of obesity. The studies were included if they were published | Dietary behaviour or on anthropometrics | In adolescents, educational interventions were effective on behavior. There was limited evidence of effect for multicomponent programs on behaviour. In children and adolescents, effects on anthropometrics were often not measured, and therefore evidence was lacking and hence inconclusive evidence.   |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>          | <b>Study objectives</b>  | <b>Sample size</b>  | <b>Methods</b>   | <b>Outcomes</b>                              | <b>Findings</b>  |
|---------------------------|-------------------------|--|---------------------|--|--|--|
|                           |                         |  |                     | between 1 January 1990 and 31 December 2007 and reported effects on dietary behaviour or on anthropometrics.   |  |  |
| Systematic review         | De Meester, et al. 2009 | To summarize the effectiveness of interventions to promote physical activity among European teenagers. | 20 relevant studies | A systematic review was conducted to identify European intervention studies published in the scientific literature since 1995. Four databases were searched, reference lists were scanned and the publication lists of the authors of the retrieved articles were checked. | Physical activity, diet, smoking and alcohol | School-based interventions generally lead to short term improvements in physical activity levels; (2) improvements in physical activity levels by school-based interventions were limited to school related physical activity with no conclusive transfer to leisure time physical activity; (3) including parents appeared to enhance school-based interventions; (4) the support of peers and the influence of direct environmental changes increased the physical activity level of secondary school children; (5) the assumption that a multi-component approach should produce synergistic results cannot be confirmed; (6) when interventions aimed to affect more than one health behaviour the intervention appeared to be less. |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>        | <b>Study objectives</b>  | <b>Sample size</b> | <b>Methods</b>  | <b>Outcomes</b>   | <b>Findings</b>   |
|---------------------------|-----------------------|--|--------------------|---|---|---|
| Systematic review         | Marshall, et al. 2006 | To estimate the prevalence and dose of television (TV) viewing, video game playing and computer use, and assess age-related and secular trends in TV viewing among youth (less than 18 years). | 99 studies         | Published English-language studies were located in computerized databases MedLine (PubMed), OCLC First Search and uncover were searched. Key word combinations were used: physical activity and sedentary behaviour, epidemiology, inactivity, television, video, computer games youth and adolescence. hand-searches were conducted of relevant hard-copy journals that were kept by our host. | Prevalence and dose of television video game playing and computer use | <p>Youth watch on average 1.8–2.8 h of TV per day, depending on age and gender. Most (66%) are ‘low users’ (less than 2 hours/ day) of TV but 28% watch more than 4 hours/ day. Boys and girls with access to videogames spend approximately 60 and 23 min /day, respectively. Computer use accounts for an additional 30 min/ day. Age-specific data suggest TV viewing decreases during adolescence, but those considered ‘high users’ at young ages are likely to remain high users when older.</p> <p>For children with access to a television set, the number of hours spent viewing does not appear to have increased over the past 50 years.</p> |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b>                | <b>Study objectives</b>   | <b>Sample size</b> | <b>Methods</b>  | <b>Outcomes</b>                          | <b>Findings</b>  |
|---------------------------|-------------------------------|---|--------------------|---|--|--|
| Systematic review         | De Bourdeaudhuij, et al. 2011 | To systematically review the evidence of school-based interventions targeting dietary and physical activity behaviour in primary (6–12 years old) and secondary school (12–18 years old) children in Europe | 11 studies         | Six in primary school and five in secondary school children. Interventions were evaluated in terms of determinants, behaviour (diet and physical activity) and weight related outcomes (body mass index (BMI) behavioural] or other indicators of obesity). | Physical activity and dietary behaviours | Combining educational and environmental components that focus on both sides of the energy balance give better and more relevant effects. Computer-tailored personalized education in the classroom showed better results than a generic classroom curriculum. Environmental interventions might include organized physical activities during breaks, or before and after School.                       |
| Systematic review         | Cerin, et al. 2009            | To review and critique current experimentally-based evidence of theoretical mechanisms of dietary behaviour change in youth and provide recommendations on ways to enhance theory evaluation                | Seven studies      | Interventions that examined mediators of dietary behaviour change in youth (age 5-18 years) were identified via electronic database searches and reference scanning. Selected studies were reviewed for quality and content and findings were tabulated     | Dietary behaviour                        | All were school-based but differed in dietary outcome, target population, measures, methods of mediation analyses, and theoretical framework. Interventions were unsuccessful in changing mediators. Self-efficacy and outcome expectations were most consistently associated with dietary behaviour change. However, only outcome expectancies were identified as mediators in multiple interventions |

## Lifestyle intervention

| <b>Systematic reviews</b> | <b>Authors</b> | <b>Study objectives</b>  | <b>Sample size</b>   | <b>Methods</b>   | <b>Outcomes</b>              | <b>Findings</b>  |
|---------------------------|----------------|--|--|--|------------------------------|--|
| Systematic review         | Gibson, 2008   | To re-examined the evidence from epidemiological studies and interventions, up to July, 2008 | 23 cross-sectional, 17 prospective and 4 intervention, six reviews. in adults and children | Database searches of Medline, Cochrane reviews, Google scholar and a hand search of<br><br>Cross-references identified forty-four original studies. The studies were critically examined for methodology, results and interpretation | Sugar sweetened drinks (SSD) | Almost half the cross-sectional and prospective studies found a statistically significant association between SSD consumption and BMI, weight, adiposity or weight gain in at least one subgroup. Many studies were done in USA where consumption is higher. The majority of studies report that they seem to be small effect size on SSD intake and may studies has methodological weaknesses that compromise the quality of the information. |

| <b>Randomised controlled trials</b>      | <b>Authors</b>         | <b>Study objectives</b>   | <b>Sample size</b>   | <b>Methods</b>  | <b>Outcomes</b>  | <b>Findings</b>   |
|--|------------------------|---|--|---|--|---|
| Randomised control trial (RCT)- Low Bias | Guagliano, et al. 2015 | To evaluate the short-term efficacy of coach education on basketball players' physical activity (PA) intensity during practices. and motivation was also investigated | 38 intervention<br>38 control, greater western Sidney, Australia | A convenience sample of 76 players and eight coaches were recruited. Players were girls aged 9 to 12 years, then randomly selected to intervention and control group. | MVPA during practice for a five-day basketball program and after 12 months | Players in the intervention group spent a significantly higher proportion of practice time in MVPA, VPA,MPA, and a significantly lower proportion of practice time inactive, compared to the control group. A significant within-group change over time was found in the intervention group, where the proportion of practice |

## Lifestyle intervention

| Randomised controlled trials | Authors           | Study objectives   | Sample size | Methods   | Outcomes                  | Findings   |
|------------------------------|-------------------|--|-------------|---|---------------------------|--|
|                              |                   |  |             | <p>Intervention- two coach education sessions, Each coach education session lasted two hours. Topics covered during the coach education sessions were: strategies to increase MVPA and decrease inactivity during practice, self-monitoring, goal-setting.</p> <p>Measurements- Situational Motivation Scale (SIMS) reliable and valid. No theory used.</p> |                           | <p>time spent in MVPA was increased by 15.1% (SE = 1.4%).</p> <p>No significant change over time for motivation (SDI) from baseline to follow-up in the intervention and control groups.</p>   |
| RCT- High Bias               | Pate, et al. 2005 | To examined the effects of a comprehensive school-based intervention on physical activity among high-school girls in USA | 2744 girls  | <p>Schools from each pair were randomly assigned to control or intervention groups and all ninth-grade girls who attended an intervention school.</p> <p>Intervention- The intervention, which is called LEAP</p>   | PA Intensity and duration | <p>Physical activity was greater in the LEAP intervention schools than in the control schools (<math>P=.05</math>).</p> <p>Girls who were classified as overweight or at-risk for overweight (<math>\geq 85</math>th percentile BMI; approximately 34% of girls) or overweight (<math>\geq 95</math>th percentile BMI; approximately 17% of girls) did not</p> |

## Lifestyle intervention

| Randomised controlled trials | Authors               | Study objectives   | Sample size | Methods  | Outcomes | Findings  |
|------------------------------|-----------------------|--|-------------|--|----------|---|
|                              |                       |  |             | <p>(Lifestyle Education for Activity Program), based on social ecological model that was drawn primarily from social cognitive theory composing PE included a gender-specific, girl-friendly, choice-based instructional program and health education lessons for 12 months.</p> <p>Measurements- The three-Day Physical Activity Recall (3DPAR)-reliable and valid, BMI</p> |          | differ between the intervention and the control schools at follow-up.   |
| RCT- High Bias               | Taymoori, et al. 2008 | To report on PA intervention research conducted in all-female Iranian high schools | 161         | Students were randomly allocated to one of three conditions: an intervention based on Pender's Health Promotion Model (HPM), an intervention based on an integration of the health promotion   | PA       | <p>Adolescents in both intervention groups showed greater progression through stages of change and more PA compared to individuals in the control group. Participants in the THP group also reported more PA at post intervention than the HP group, although these differences were not statistically significant.</p> <p>At the end of intervention period both the THP and HP groups</p> |

Lifestyle intervention

| Randomised controlled trials | Authors | Study objectives | Sample size | Methods  | Outcomes | Findings   |
|------------------------------|---------|------------------|-------------|--|----------|--|
|                              |         |                  |             | <p>model and selected constructs from the Trans-theoretical model (THP), and a control group. Measures- Perceived self-efficacy was adapted from an existing exercise self-efficacy scale, PA was assessed using a modified child/adolescent activity log (CAAL), Perceived benefits/barriers, PA preferences were administered prior to the intervention, at post-intervention and at a six-month follow-up. These were measured by a modified scale,</p> <p>Intervention- participant received four 45 to 60 minute group educational sessions (at baseline, 4th, 10th, and 18th</p> |          | <p>reported spending about one hour more in activity per day compared to participants in the control group</p> |

## Lifestyle intervention

| Randomised controlled trials                       | Authors             | Study objectives   | Sample size  | Methods  | Outcomes  | Findings  |
|--|---------------------|--|--|--|---|---|
|  |                     |  |  | weeks) and was based on stages of change.  |   |   |
| Cluster randomised control trial (CRCT)- High Bias | Kocken, et al. 2015 | To study the effects of school lessons about healthy food on adolescents' self-reported beliefs and behaviour regarding the purchase and consumption of soft drinks, water and extra foods, including sweets and snacks in Netherlands | Experimental group (303 students) and Control group (311 students) | 26 schools were randomly selected. The intervention consisted of a health-education component and an environmental-change component based on Theory of Planned Behaviour.<br><br>Measures- attitudes, subjective norms, perceived behavioural control, intentions and behaviours regarding the consumption of soft drinks and sweets, cakes or snacks, BMI, and demographics.<br>Internal reliability acceptable | Purchase and consumption of drinks, water, extra foods such as sweets and snacks and health beliefs | At post-test, students in the intervention group had more knowledge of nutrition, energy intake and portion size than those in the control group.<br><br>No effect was found on the behavioural determinants of attitude, social norm, perceived behavioural control and intention with respect to drinking light drinks or water and eating low-calorie sweets, cakes or snacks. |

## Lifestyle intervention

| Randomised controlled trials | Authors           | Study objectives  | Sample size | Methods  | Outcomes            | Findings  |
|------------------------------|-------------------|---|-------------|--|---------------------|---|
| RCT- High Bias               | Kaur, et al. 2007 | To see the impact of nutrition education on nutrient adequacy of adolescent girls | 60          | <p>Girls age group of 13-19 years were selected randomly from government school of village Shousha district Solan, Himachal Pradesh.</p> <p>Intervention- Nutrition education about functions of food; balanced diet; nutrients - their functions and requirements. and cooking practices once a week for 12 weeks.</p> <p>Measurements- nutrient adequacy by 24 hr. recall method</p> | Nutrition education | Increase in nutrition knowledge scores after imparting nutrition education was significant ( $P < 0.01$ ). After imparting nutrition education, intake of respective nutrients increased to 59.5, 51.9, 130 and 52.2 per cent of the respective RDA. The increase in intake was statistically significant ( $P < 0.01$ ). |

## Lifestyle intervention

| Randomised controlled trials                       | Authors            | Study objectives   | Sample size                           | Methods   | Outcomes  | Findings   |
|--|--------------------|--|---------------------------------------|---|---|--|
| Cluster Randomised control trial (CRTC)- High Bias | He, et al. 2009    | To measure the influence of a government of Ontario, Canada health promotion initiative, the Northern Fruit and Vegetable Pilot Programme (NFVPP), on elementary school-aged children's psychosocial variables regarding fruit and vegetables, and fruit and vegetable consumption patterns. | 1277 students in grades five to eight | Students in Grade 5 and 6 in UK. intervention-9 week trial period- card game 'Top Grub' and a 'healthy eating' curriculum.<br><br>Three Interventions-1. Free fruit and vegetable snacks (FFVS) and enhanced education, 2. FFVS only and 3. control group<br><br>Content and pilot of the questionnaires on nutrition knowledge and attitudes, intentions and self-efficacy to healthy eating | <b>Primary</b> - nutrition knowledge scores, <b>Secondary</b> - attitudes, self-efficacy and intentions to healthy eating and acceptability of the intervention by children and teachers. | Intervention 1-Nutrition knowledge score increased in both intervention (baseline to follow-up: 28.3 to 29.2) and control schools (27.3 to 27.6). (mean difference = 1.1; 95% CI: 0.05 to 2.16; p = 0.042.<br><br>Intervention 2- more fruits and vegetable intake than control though not significant.<br><br>NK and intentions were high across the three groups but SE was moderate though not statistically significant. |
| Experimental with pre and post-tests- High Bias    | Gitau, et al. 2013 | To evaluate the effects of three main Nutrition Education strategies on nutrition knowledge and iron status among primary schools children in  | 601                                   | Study was preceded by a baseline survey. Demographic and socio economics, food consumption and intakes whereby an interview schedule was used to collect  | Nutrition knowledge and iron status   | The average mark in nutrition knowledge was 30.05% at pre-test and 46.8% in the intervention schools in the post-tests In both pre & post-tests females did better than males. Post-tests showed a significant difference with the experimental schools performing   |

Lifestyle intervention

| Randomised controlled trials | Authors | Study objectives          | Sample size | Methods   | Outcomes | Findings  |
|------------------------------|---------|---------------------------|-------------|---|----------|---|
|                              |         | Gatanga district in Kenya |             | data. Pre-test questionnaires on nutrition knowledge were administered before embarking on the interventions. Flip charts for trainings in the intervention were developed by the researcher and validation done by the teachers. Nutrition knowledge was offered to all the experimental schools using the three strategies; Peers, agriculture extension worker and the researcher. It included classroom lessons on nutrition, cookery and kitchen gardening activities in the school. |          | significantly better than the control school at $p < 0.001$ . Consumption of various nutrients was not statistically significant between both genders at $P > 0.05$ . |

## Lifestyle intervention

| Randomised controlled trials         | Authors                  | Study objectives   | Sample size  | Methods   | Outcomes  | Findings   |
|--------------------------------------|--------------------------|--|--|---|---|--|
| Two-stage cluster trial-<br>Low Bias | Levy, et al. 2012        | To assess the effectiveness of a nutrition and physical activity strategy, called “Nutrition on the Go” (“nutrición en movimiento”) in maintaining the BMI values of school children in the State of Mexico. | 1020 (fifth Grade students)                                    | Sixty schools were selected in the State of Mexico, of which 30 were randomly assigned to the intervention group (IG) and 30 to the control group (CG)<br><br>Intervention- Nutrition and physical activity workshops. These were divided into 6 sessions which included participatory recreational activities, over a 6-month period.<br><br>Measures- Food Frequency Questionnaire, BMI, PA, knowledge, self-efficacy. Valid measures | Decrease in the energy content, increase physical activity and the consumption of water | Statistically significant differences between intervention and control groups in knowledge about eating and physical activity, as well as between the ratings for both variables and self-efficacy.<br><br>No significant differences were found in BMI differentiated by sex, or in the prevalence of overweight and obesity. |
| CRCT- Low Bias                       | Jemmott III, et al. 2011 | To report the results of a study that tested a school-based cognitive behavioural health-promotion   | 17 matched pairs, we randomly selected nine pairs: seven pairs | Rural and urban schools participated and randomized one school to the cognitive-behavioural   | Diet, nutrition knowledge and physical activity   | The participants in the health-promotion intervention (reported eating approximately 0.54 more servings of fruit (p 0.003) over follow-up. In addition, health-promotion intervention participants   |

## Lifestyle intervention

| Randomised controlled trials | Authors | Study objectives   | Sample size | Methods  | Outcomes | Findings  |
|------------------------------|---------|--|-------------|--|----------|---|
|                              |         | intervention for Xhosa-speaking young adolescents in South Africa. |             | health-promotion intervention and the other to the HIV/STD risk-reduction control intervention. Interventions were based on social cognitive theory, the theory of planned behaviour. Measures-5-a-Day was used to measure fruit and vegetable consumption over the past 30 days, Physical activity was assessed with three open-ended items developed by the CDC. Health promoting- behaviour attitude and intention and drug-and-alcohol-use attitude and intention were assessed on 5-point rating scales. Health-promotion knowledge was the number correct out of 21 of true-false items. |          | reported eating 0.77 more servings of vegetables (p 0.0001).<br><br>Participants in the health promotion intervention scored on average 2.54 points higher in health-promotion knowledge ( p 0.0001) than participants in the control group. Intention to engage in such behaviour (mean difference P 0.45, p 0.0001) than did their counterparts in the HIV/STD control group. health-promotion intervention participants increased both their vigorous cardiovascular physical activity |

## Lifestyle intervention

| Randomised controlled trials                                    | Authors               | Study objectives  | Sample size   | Methods   | Outcomes   | Findings  |
|---|-----------------------|---|---|---|--|---|
| Pragmatic cluster randomised controlled trial (PRCT)- High Bias | Lakshman, et al. 2010 | To assess the effectiveness and acceptability of a novel educational intervention to increase nutrition knowledge among primary school children   | 12 intervention and 13 control schools (comprising 1133 children) | Students in Grade 5 and 6 (AGED 9-11 years) in UK. Intervention-9 week trial period- card game 'Top Grub' and a 'healthy eating' curriculum. Content and pilot of the questionnaires on nutrition knowledge and attitudes to healthy eating                                 | <b>Primary-</b> nutrition knowledge scores,<br><b>Secondary-</b> attitudes to healthy eating and acceptability of the intervention by children and teachers. | Nutrition knowledge score increased in both intervention (baseline to follow-up: 28.3 to 29.2) and control schools (27.3 to 27.6). (mean difference = 1.1; 95% CI: 0.05 to 2.16; p = 0.042).<br>Mean scores of eating balanced diet increased in both intervention (baseline to follow-up: 11.6 to 12.1) and control schools (11.3 to 11.5);<br>Ability to identify healthier foods mean scores in this domain did not increase in either intervention or control schools |
| RCT- Low Bias   | Singhal, et al. 2010  | To study the effectiveness of a multi-component intervention model of nutrition and lifestyle education on behaviour modification, anthropometry and metabolic risk profile of urban Asian-Indian adolescents in North India. | 99 intervention and 102 control group                             | Eight electronic databases, websites and contents of key journals were systematically searched, reference lists were screened, and authors and experts in the field were contacted for studies evaluating school-based interventions promoting a healthy diet and aiming at | Nutrition education, anthropometric measurements   | In adolescents, moderate evidence of effect was found for educational interventions on behaviour and limited evidence of effect for multicomponent programmes on behaviour. Effects on anthropometrics were often not measured, and therefore evidence was lacking or delivered inconclusive evidence.  |

## Lifestyle intervention

| Randomised controlled trials | Authors            | Study objectives  | Sample size | Methods  | Outcomes  | Findings  |
|------------------------------|--------------------|---|-------------|--|---|---|
|                              |                    |   |             | primary prevention of obesity. The studies were included if they were published between 1 January 1990 and 31 December 2007 and reported effects on dietary behaviour or on anthropometrics.                         |   |   |
| Intervention study           | Beech, et al. 1999 | To assess nutrition knowledge, attitudes and practices related to fruits and vegetables consumption | 2218        | Experimental design of 6 controls and 6 intervention schools in New Orleans. Content validity by specialists in nutrition. Pilot tested. Self-administered questionnaires tested knowledge on fruits and vegetables. | Nutrition knowledge, attitudes, self – efficacy | Baseline data show that 40.7% (902) girls scored higher in nutrition knowledge than boys (36.6%, 812) $p < 0.001$ . There was low nutrition knowledge level and daily intake of fruits and vegetables in both boys and girls. |

## Lifestyle intervention

| Randomised controlled trials | Authors            | Study objectives   | Sample size                   | Methods  | Outcomes                          | Findings  |
|------------------------------|--------------------|--|-------------------------------|--|-----------------------------------|---|
| RCT- High Bias               | Mihas, et al. 2009 | To assess the short-term (15-d) and long-term (12-month) effects of a school-based health and nutrition education intervention on diet, nutrition intake and BMI | 191 students aged 12–13 years | <p>All high schools in Vyronas, a densely populated district of Athens, Greece.</p> <p>Intervention-seminars on diet and nutrition knowledge implemented for 12 weeks.</p> <p>The participants were randomized to two study groups, the intervention group (IG) and control group (CG),</p> <p>Measures- health knowledge, dietary, behavioural and anthropometrics done at 15<sup>th</sup> day and 1 year after the intervention. Test–retest reliability of the FFQ acceptable</p> | Nutrition education, diet and BMI | The IG reported a significant decrease in daily energy intake and in some nutrient components (total fat, saturated fat) but not in CG. Regarding the weekly consumption frequencies offoods, a significant increase in poultry, ready-to-eat breakfast cereals and fruit consumption and a significant decrease of red meat consumption were found in the IG but not in CG. No significant difference was found between the 15 <sup>th</sup> Day and 12 <sup>th</sup> month. |

## Lifestyle intervention

| Non-RCT designs          | Author                    | Objective   | Sample size                            | Methodology   | Outcome  | Findings  |
|--------------------------|---------------------------|---|--|---|--|---|
| Explanatory mixed method | Habib-Mourad, et al. 2014 | To evaluate the feasibility and effectiveness of a multicomponent school-based intervention to promote healthy eating and physical activity (and prevent obesity) with school children aged 9–11 years in Lebanon | 387 (193 intervention and 181 control) | 8 schools purposively selected. The intervention was developed based on the Social Cognitive Theory. Topics were; class curriculum, family involvement and food service. intervention schools received the programme components over 3 months; control schools received their usual curriculum<br>Measures- Anthropometric measurements and, the questionnaire included dietary habits, physical activity/sedentary habits, nutrition knowledge and self-efficacy. questionnaires used before | Increasing consumption of fruits and vegetables, increasing the habit of having breakfast daily, increasing moderate-to-vigorous, decreasing overall sedentary behaviour | At post-test knowledge score increased on average by 2.86 units (95% CI = 1.7; 4.0; $p < 0.001$ ) for the students in the intervention group. Self-efficacy scores (range 0–18 higher for the intervention group at post-test ( $16.0 \pm 2.6$ versus $13.7 \pm 3.3$ in control. No significant changes in BMI (mean change for intervention group $0.37 \pm 1.5$ , mean change for controls $0.19 \pm 1.5$ ) or waist circumference were observed in either group at post-test ( $p > 0.05$ ). Eating breakfast daily at post-test for the intervention group is 3.5 times greater than that of an average student in the control group of having chips as snacks (OR = 0.14; CI = 0.11; 0.19) and the odds of drinking soft drinks (OR = 0.31; CI = 0.19; 0.52) |

## Lifestyle intervention

| Non-RCT designs    | Author           | Objective  | Sample size                        | Methodology  | Outcome                           | Findings  |
|--------------------|------------------|--|------------------------------------|--|-----------------------------------|---|
| Quasi-experimental | Lee, et al. 2013 | To determine the effects of a nutrition and exercise weight management program supported by social cognitive theory on self-efficacy, body mass index and psychosocial functioning in adolescents aged 10-13 years | 59 intervention and 60 control arm | <p>Four schools randomly selected. Intervention based on the Theory of self-efficacy-included daily self-weighing, a weekly dietary log sheet, monthly dietary consultation sessions, daily planned physical activity lessons, regular group gathering and sharing sessions with a reward system, and monthly behavioural counselling.</p> <p>Measures included weight efficacy Lifestyle Scale, Nutritional Self-efficacy Scale, Exercise Self-efficacy Scales, Psychosocial Functional Domain, Adolescent Lifestyle Questionnaire and Body Shape Scale, BMI and weight measurement. validity and reliability acceptable.</p> | Nutrition, physical activity, BMI | Intervention group showed short-term effects in all the self-efficacy scores, significant differences in weight and BMI from baseline to six months but there was no significant difference in lifestyle behaviours between the two groups, the mean score increased by 3.04 in the intervention group. The mean score for lifestyle behaviours decreased by 3.63 in the control group. |

## Lifestyle intervention

| Non-RCT designs    | Author              | Objective  | Sample size | Methodology   | Outcome          | Findings  |
|--------------------|---------------------|--|-------------|---|------------------|---|
| Quasi-experimental | Shilts, et al. 2012 | To assess efficacy of a youth development intervention targeting nutrition and physical activity behaviours with its goal setting focus in a low-income middle school setting. | 64          | 8th grade students participated in the study. Measures- assessed dietary behaviours (19 items), physical activity behaviours (4 items), dietary self-efficacy (19 items), physical activity self-efficacy (4 items), goal effort (2 items) and goal attainment scaling (2 items). Adapted from the Centres for Disease Control Youth Risk Behaviour Survey (YRBS). All items revised and retested. Items evaluated for content validity by experts in behavioural nutrition. The instrument was pilot tested with 6-8th students. | Nutrition and PA | Dietary behaviour (P=0.01) and physical activity self-efficacy (P=0.03) mean scores were different at the three testing times, T1, T2, and T3, while dietary self-efficacy (P=0.35) and physical activity behaviour (P=0.23) mean scores were not. After intervention, physical activity choices increased (34% vs. 24%, P < 0.05) and/or were planning to make more compared to the control. |

## Lifestyle intervention

| Non-RCT designs | Author                   | Objective  | Sample size | Methodology   | Outcome                                 | Findings   |
|-----------------|--------------------------|--|-------------|---|---|--|
| Not stated      | Kostanjevec, et al. 2012 | To acquire knowledge on nutrition to help them form healthy nutritional habits and whether the formal nutrition education carried out at schools influenced children's nutrition knowledge, attitudes, and nutritional habits. | 630         | <p>11-year-old children from 28 randomly selected schools. Intervention-home economics students listened to 38.6 hours of nutrition contents and 50.7 periods of practical work skills and problem solving.</p> <p>Measures-knowledge test included 27 multiple-choice questions. Questions were designed on the basis of knowledge standards defined in the home economics syllabus. The reliability of the knowledge tests was established, eating habits were assessed with a questionnaire containing questions on the frequency of consuming meals of food and foodstuffs.</p> | Nutrition education, diet and attitudes | Results showed statistically significant improvement in comparison to the examination of knowledge carried out before the course. Both boys and girls advanced in knowledge (Wilks' lambda = 0.887; $F = 66.819$ ; $P < 0.001$ ). There was a weak statistically significant connection ( $r < 0.20$ ) between the acquired nutrition knowledge and the frequency of consuming the above mentioned foodstuffs by children. The results showed that the nutrition knowledge of children indeed improved in the education process; however, it had no significant influence on their nutrition behaviour |

Lifestyle intervention

| Non-RCT designs                        | Author               | Objective  | Sample size                                  | Methodology   | Outcome                               | Findings   |
|--|----------------------|--|--|---|---------------------------------------|--|
| Pre/post assessment quasi-experimental | Fahlman, et al. 2008 | To determine the impact of the Michigan Model (MM) Nutrition Curriculum on nutrition knowledge, efficacy expectations, and eating behaviours in middle school students in metropolitan, USA. | 407 intervention group and 169 control group | <p>The middle school students from a large metropolitan area.</p> <p>Intervention- benefits of the food groups, eating based on the food groups, reading food labels, body image, and surviving fast food.</p> <p>Restaurants and the school cafeteria for 2 weeks. Measurements -1-day diet recall, knowledge, healthy eating efficacy, and scales valid and reliable.</p> | Nutrition knowledge, eating behaviour | The intervention group demonstrated significant improvements pre to post and were significantly higher than the controls at post in their consumption of fruits (F = 3.97, p = .047), vegetables (F = 5.61, p = .018), and other (F = 5.9, p = .025). intervention group showed significant increase in Self-efficacy for healthy eating (F = 9.4, p = .002) than the control group. |

## Lifestyle intervention

| Non-RCT designs                             | Author            | Objective  | Sample size | Methodology   | Outcome   | Findings   |
|---|-------------------|--|-------------|---|---|--|
| Quasi experimental pretest, posttest design | Long, et al. 2004 | To test the effects of a classroom and World Wide Web (WWW) educational intervention on self-efficacy (SE) for healthy eating (HE) and to examine the relationship of the theoretical concepts in a hypothesized model of eating behaviour in adolescents. | 121         | Adolescents from the 7th, 8th, and 9th aged 12-16 years were randomly selected from 2 junior high schools. Intervention group received 5 hours of WWW-based nutrition education and 10 hours of classroom curriculum delivered for 1-month. The classroom curriculum was provided by four science teachers and control group received the nutrition education embedded in the health, science, and home economics curriculum for 3 hours. Measurements- Three sections of the Health Behaviour Questionnaire (HBS) 15-item Likert type, "Fruit-Vegetable Consumption SE Scale Youth and Adolescent Food Frequency | SE for HE dietary, knowledge of lower fat, usual food choices, and fruit, vegetable, and fat consumption. | There was a statistically significant difference between the groups for SE for HE for fruits and vegetables, SE for HE for lower fat, usual food choices, and dietary knowledge of fat. The difference between the groups for fruit, vegetable, and fat consumption was not statistically significant. |

## Lifestyle intervention

| Non-RCT designs                           | Author              | Objective  | Sample size  | Methodology   | Outcome          | Findings   |
|---|---------------------|--|--|---|------------------|--|
| Cross-sectional, post-intervention survey | Jacobs, et al. 2013 | To evaluate the effectiveness of the Making the Difference program (MTDP), an education and activity-based intervention for Grade 4 learners at primary schools in the Western Cape. | 140 in the active schools and 185 in the non-participating school (grade 4-6)s | Schools were randomly sampled from two regions. Four interventions (active in the MTDP) and five controls (non-participating). This was a cross-sectional, post-intervention survey of an existing program, using control schools as a comparator. An active school was one that was registered for and received the curriculum modules of the MTDP, and which also visited Woolworth's supplier warehouses and held parent talks, or schools at which the teachers had undergone training for the Edu-Modules.<br><br>A non-participating school was a school that had never enrolled or taken part in the MTDP. | Education and PA | Mean age 11 years [standard deviation (SD) 0.8].<br><br>There was no difference in knowledge in relation to physical activity or nutrition between active and non-participating schools. Perceived social support for the adoption of healthy nutrition was significantly higher in the non-participating schools. There was also no significant difference between active and non-participating schools in terms of self-efficacy in relation to healthy eating or to perceived barriers to healthy eating. Perceived barriers to physical activity were significantly lower in the active schools (p-value < 0.01), and physical activity self-efficacy was higher (p-value < 0.02) in the active schools. |

## Lifestyle intervention

| Non-RCT designs | Author | Objective | Sample size | Methodology  | Outcome | Findings |
|-----------------|--------|-----------|-------------|--|---------|----------|
|                 |        |           |             | In the development of the questionnaire, certain themes were explored. These included knowledge, attitudes (self-efficacy) and practices in terms of nutrition and physical activity cronbach ranged between 0.65- 0.78. |         |          |

| Observational cohort studies | Author               | Objective  | Sample size | Methodology  | Outcomes                                       | Findings   |
|------------------------------|----------------------|--|-------------|--|--|--|
| Longitudinal                 | Dohnike, et al. 2014 | To predict eating habits using prototype-willingness model in southern Germany | 356         | Eight (8) secondary schools were followed at time 1 and 2. Prototype-willingness model (PWM) was used to guide the study.<br><br>Mplus program version 6.12, structural equation and confirmatory analyses was used for data analysis. | Not stated but assumed to be eating behaviours | PWM was limited to predict unhealthy diet but contributed to the prediction of a healthy diet and not unhealthy snack consumption. |

## Lifestyle intervention

| Observational cohort studies | Author                | Objective   | Sample size | Methodology  | Outcomes                                 | Findings   |
|------------------------------|-----------------------|---|-------------|--|--|--|
| Longitudinal                 | Owens, et al. 2013    | To investigate a possible change in physical activity and screen time (as the proxy measure for sedentary behaviour), and associated factors, longitudinally during the transition out of compulsory education 14-17 years old in UK. | 2204        | A self-report questionnaire was administered at baseline (final year of compulsory education) and follow-up (i.e. post compulsory education) to measure physical activity over the previous 7 days and screen time (weekday and weekend) in relation to recommended guidelines. Questionnaire previously validated. Ecological model was used. | Physical activity and screen time        | There was a significant change in participants meeting guidelines at baseline but not meeting guidelines at follow-up with 81.0% not meeting guidelines at baseline and follow-up. For screen time, there was no significant change between baseline and follow-up, with 70.6% not meeting guidelines at baseline and follow-up. Gender was associated with the change in physical activity with a decline less likely in females. |
| Longitudinal                 | Bellisle, et al. 2007 | To assess trends in food related behaviours and makers of activity/inactivity in French 9-11 years old children   | 1000        | 1993, 1995, 1997 surveys on food intake, nutrition attitudes and knowledge. standardised questionnaire containing socio-demographic, food related parameters, knowledge, physical  | Not stated but assumed to be food habits | Breakfast was eaten by 97%, lunch by 99% at school; dinner was eaten by 99% at home with family members. Foods preferred by children were; sugar, fried potatoes, ice cream, cakes, nut spread, chocolate.   |

## Lifestyle intervention

| Observational cohort studies | Author              | Objective  | Sample size | Methodology  | Outcomes                                | Findings  |
|------------------------------|---------------------|--|-------------|--|---|---|
|                              |                     |  |             | activity questions was used  |   |   |
| Longitudinal                 | Herman, et al. 2009 | To investigate BMI and PA tracking over 22 years from youth to adulthood | 374         | <p>Participants aged 7 to 18 years in the 1981 Canada Fitness Survey, who were re-evaluated in 2002_04. Leisure time physical activity energy expenditure(AEE) over 12 months was assessed using an adaptation of the Minnesota Leisure Time Physical Activity Questionnaire. Criterion validity (rho_0.30_0.45) and 1-month retest reliability was 0.91. BMI was checked.</p> | Not stated but assumed to be BMI and PA | <p>10% of participants were overweight or obese as youth, while 52.2% males, 40.4% females were overweight or obese (BMI-25 kg/m<sup>2</sup>) at follow-up.</p> <p>79% and 63% of males and females, respectively, were physically active (1.5 kcal/kg/day) in childhood or adolescence; 65% and 58% of men and women, respectively, were physically active in adulthood.</p> <p>BMI showed moderate to strong tracking (r_0.42_0.65) in females, and moderate tracking (r_0.29_0.53) in males.</p> <p>After 22 years, 37% (13/35) of males and 39% (12/31) of females in the highest BMI quintile at</p> |

## Lifestyle intervention

| Observational cohort studies | Author                        | Objective  | Sample size | Methodology   | Outcomes  | Findings   |
|------------------------------|-------------------------------|--|-------------|---|---|--|
|                              |                               |  |             |   |   | baseline remained in the highest quintile; 38% (13/34) of males and 47% (14/30) of females in the lowest BMI quintile at baseline remained in the lowest quintile at follow-up. Moderate tracking of BMI was observed in both genders, while no tracking was found for physical activity over this time span.  |
| Longitudinal                 | Burgess-Champoux, et al. 2009 | To examine longitudinal associations of participation in regular family meals (5 meals/week) with eating habits and dietary intake during adolescence in Minneapolis Metropolitan. | 677         | 303 males and 374 females who were in middle school at Time 1 (mean age 12.8 years) and high school at Time 2 (mean age 17.2). Development of the survey instrument was guided by Social Cognitive Theory (SCT) and focus group discussions with adolescents.<br><br>Frequency of family meals was assessed at Time 1 and Time 2.<br>Frequency of consuming breakfast, lunch, and dinner meals during the | Dietary intake, frequency of meals, and fast-food intake patterns | Regular family meals were positively associated with Time 2 frequency of breakfast, lunch, and dinner meals for males and breakfast and dinner meals for females. Among males, regular family meals were negatively associated with Time 2 fast-food intake. Regular family meals were also positively associated with Time 2 mean daily intakes of vegetables, calcium-rich food, fiber, calcium, magnesium, potassium, iron, zinc, folate, and vitamins A and B6 among both genders.<br><br>There was a steep decline in regular family meals as adolescents went from early |

## Lifestyle intervention

| Observational cohort studies  | Author              | Objective  | Sample size | Methodology   | Outcomes   | Findings   |
|-------------------------------|---------------------|--|-------------|---|--|--|
|                               |                     |  |             | past week was assessed using 3 separate items. Frequency of consuming fast-food meals during the past week was assessed using 1 item. Adolescents' intakes were assessed at Time 1 and Time 2 using the self-administered 149-item. No reliability stated   |  | adolescence (60%) to middle adolescence (30%)  |
| Longitudinal (5 years cohort) | Feeley, et al. 2011 | To assess changes in dietary habits and eating practices of adolescents over 5 years in SA | 1451        | Cohort was followed from birth to 20 years. 16 visits in all. Food frequency questionnaire was used. It was pilot tested and modified. Test-retest reliability by one week apart, k-coefficient was 0.89-1. STATA 10 was used for analysis- descriptive, paired t-test, independent t-tests, and McNemar, chi square test.. | Not stated but assumed to be dietary habits and eating practices | Dietary patterns-males ate breakfast regularly than females ( $p<0.001$ ). Snacking while watching television increased with age ( $p<0.001$ ). Females ate more snacks than males when watching television ( $p<0.001$ ).<br><br>Fast foods in a week was high with age ( $p<0.001$ ). 74% (1073) preferred fast foods and with most popular being fried chips, fish, pies and sausage.<br><br>Confectionery-females ate more confectionery than males ( $p<0.002$ ). Sweets, crisps and soft |

## Lifestyle intervention

| Observational cohort studies | Author            | Objective  | Sample size | Methodology  | Outcomes  | Findings  |
|------------------------------|-------------------|--|-------------|--|---|---|
|                              |                   |  |             | Wilcoxon sign test.  |   | drinks were preferred by 65% (943).<br><br>62% (899) of the participants mostly bought food from tuck-shop and frequently bought items were crisps, sweets, cold drinks, fried chips and white bread.   |
| Longitudinal                 | Bere, et al. 2007 | To explore why boys eat less fruit and vegetables (F&V) than girls, using longitudinal data following pupils from the age of 12.5 to 15.5 years, including perceived accessibility, modelling, intention, preferences, self-efficacy and knowledge of recommendations as potential mediators | 896         | 6th and 7th graders from Norwegian counties. The pupils within in the 20 control schools constitute the study sample of the present Study<br>F&V intake was measured by four frequency questions. Validated and reliable | Not stated but assumed to be eating vegetables and fruits | Girls reported eating fruit and vegetables more often than boys (14.5 vs. 11.9 times per week). Girls also reported significantly higher values for all of the determinants assessed.<br><br>Preferences alone explained 81% of the gender difference. Preference appears as the strongest mediator of the difference in F&V intakes between boys and girls. Further research should explore why girls like F&V more than boys. |

## Lifestyle intervention

| Observational cohort studies  | Author                     | Objective   | Sample size                  | Methodology   | Outcomes   | Findings  |
|-------------------------------|----------------------------|---|------------------------------|---|--|---|
| Prospective study             | Foley, et al. 2008         | To predict physical activity in school-aged children in New Zealand children (aged 11–13 years)   | Study 1-645, study 2-67      | Study 1- measures corresponding to the integrated model and a self-reported measure of PA one week later. Second study- self-efficacy measures objectively measured PA levels. Measures were- attitudes toward PA, subjective norm, perceived behaviour control, self-efficacy and PA. All had good internal consistency.       | Not stated but assumed to be Intentions                          | Participants with high efficacy expended significantly greater AEE than their lower efficacious counterparts.<br><br>Intention was the first variable entered in the regression and was found to be a significant predictor [ $F(1,630) = 97.95, p \leq .001$ ], accounting for 13% of the response variance.   |
| Retrospective cross-sectional | Bak-sosnowski, et al. 2012 | To analyse eating and physical activity preferences among adolescent school children in Katowice. | 711 students and 266 parents | Self- administered questionnaire (reliability and validity not recorded) consisting of breakfast consumption, types of food products eaten for breakfast, supper time, the daily number of meals, quantity of fruit and vegetables, food products purchased in the school shop, as well as type and level of physical activity. | Not stated but assumed to be eating habits and physical activity | Children aged 14–15 years, 10% do not eat 1 <sup>st</sup> breakfast and (at home), and 15% do not eat 2nd breakfast (at school), 50% eat dairy products for 1st breakfast, 70% have sandwiches for 2nd breakfast, 45% most frequently buy snacks in the school shop, 65% prefer physical activity in the form of team games, and 90% willingly participate in PE classes. Mean of meals per day was 3.75, SD .99, fruits consumption mean was 2.52 SD 0.62 and vegetables was 2.31 SD 0.69. |

## Lifestyle intervention

| Observational cohort studies    | Author              | Objective   | Sample size | Methodology  | Outcomes  | Findings  |
|---------------------------------|---------------------|---|-------------|--|---|---|
|                                 |                     |   |             |  |   | <p>45%, (346) purchased snacks more than drinks, <math>p &lt; 0.001</math>.</p> <p>Physical activity games were played more than other activities, 65% (501) participants preferred playing games as a team.</p>  |
| Prospective observational study | Wiecha, et al. 2006 | To examine whether increases in adolescents' television viewing time are associated with increases in total energy intake (TEI), and whether viewing increases are also associated with increases in intake of FCAT (candy, fast foods, fried potatoes, sweet baked snacks, salty snacks, and sugar-sweetened beverages). Also to examine whether changes in intakes of these foods mediate | 548         | Participants were studied between fall 1995 and spring 1997. Dietary intake, physical activity level, and television viewing were obtained via an optically scannable student food and activity survey, used with permission of the Brigham and Women's Hospital, The food frequency questionnaire component of the food and activity instrument was adapted and validated for use in ethnically and | Change in total energy intake and intake of foods commonly advertised on television | <p>The mean <math>\pm</math> SD BMI at baseline was <math>20.73 \pm 3.99</math></p> <p>PA-average hours of television viewing changed little, 152 subjects (27.7%) increased television viewing by 1 h/d or less and 83 (15.1%) increased viewing by more than 1 h/d.</p> <p>Diet-All mean foods commonly advertised on television intakes increased during the study period. The highest daily number of servings at follow-up was reported for baked sweet snacks, sugar-sweetened beverages, and fast food-type main courses and the combined category indicated roughly 5 servings of FCAT per day, or 35 per week.</p> |

## Lifestyle intervention

| Observational cohort studies   | Author              | Objective   | Sample size | Methodology  | Outcomes   | Findings   |
|--------------------------------|---------------------|---|-------------|--|--|--|
|                                |                     | the relationship between change in viewing time and change in TEI in Boston, Metropolitan   |             | socioeconomically diverse populations.<br><br>Time spent watching television was measured with the 11-item television and video measure.   |  | Increases in television viewing predict increases in Total Energy Intake, and that increasing intakes of (FCAT)— mediate this relationship.<br><br>The TEI increased from baseline to follow-up.   |
| Longitudinal and observational | Nelson, et al. 2006 | To investigate longitudinal and secular trends in physical activity and sedentary behaviour in a large, diverse cohort of adolescents in Minnesota. | 2516        | Project EAT-II, a 5-year longitudinal study, changes from early to<br><br>Mid-adolescence (junior high to high school; <i>n</i> = 806; mean baseline age: 12.8 ± 0.8 years) and mid-to late adolescence (high school to post-high school; <i>n</i> = 1710; mean baseline age: 15.8 ± 0.8 years). EAT-II also examined secular trends in health behaviour from 1999 to 2004 in mid-adolescence. Projects EAT-I and EAT-II | Not stated but assumed to be Self-reported weekly hours of moderate to vigorous physical activity, television/video viewing, and leisure-time computer use | Substantial longitudinal changes in moderate to vigorous physical activity, particularly among girls (decreasing 5.9–4.9 hours/week from early to mid-adolescence and 5.1–3.5 hours/week from mid- to late adolescence), and leisure-time computer use, particularly among boys (increasing 11.4– 15.2 hours/week from early to mid-adolescence and 10.4–14.2 hours/week from mid- to late adolescence). Secular trends further indicate dramatic increases in mid-adolescent computer use from 1999 to 2004; girls increased from 8.8 to 11.1 hours/week, and boys increased from 10.4 to 15.2 hours/week |

## Lifestyle intervention

| Observational cohort studies | Author               | Objective  | Sample size | Methodology  | Outcomes                               | Findings  |
|------------------------------|----------------------|--|-------------|--|--|---|
|                              |                      |  |             | surveys included several questions to assess physical activity and sedentary behaviour, developed from survey items that were validated previously   |  |   |
| Prospective study            | Backman, et al. 2002 | To identify predictors of healthful dietary practices in adolescents using the Theory of Planned Behaviour and determine how gender and ethnicity influence the relationship among the theoretical constructs. | 780         | Adolescents aged 14 to 19 years, from 4 public high schools in San Bernardino, California. Initially intention, attitude, subjective norm, perceived behavioural control, behavioural beliefs and outcome evaluations, normative beliefs and motivation to comply, and control beliefs and perceived facilitation toward healthful dietary behaviour were tested using 10-point Likert-type scales and bipolar adjective scales ranging from 0 to 9. The 1-month | Healthful dietary practices predictors | Intention to eat a healthful diet was a predictor of healthful dietary behaviour. Intention was influenced most by attitude and then by perceived behavioural control and subjective norms. |

## Lifestyle intervention

| Observational cohort studies | Author | Objective | Sample size | Methodology   | Outcomes | Findings |
|------------------------------|--------|-----------|-------------|---|----------|----------|
|                              |        |           |             | follow-up The 1-month follow-up instrument was a food frequency questionnaire (FFQ), which measured healthful dietary behaviour. All valid and reliable and pilot tested. |          |          |

| Cross-sectional studies | Author                         | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|--------------------------------|--|-------------|--|---|---|
| Descriptive             | Garcia-Continente, et al. 2015 | To describe overweight and obesity among secondary school students aged 13-17 years old in Barcelona and to analyse their association with eating habits and sedentary behaviours. | 3089        | Self-reported questionnaire used. Weight and height measured. No record of reliability and validity. | Not stated but assumed to be BMI, eating habits, sedentary and physical activity behaviours | The prevalence of overweight and obesity in males (19.9% for overweight and 6.2% for obesity), in females (17%, and overweight were 3.7%, $P < .001$ ).<br><br>66.5% (2053) of male and 56.1% (1732) of female reported consuming unhealthy foods in excess of the recommended intake ( $P < .001$ ). 19.1% (589) never ate breakfast and among these 15% (463) were males,<br><br>60.2% (1859) of males and 28.9% (892) of females reported to exercise regularly, ( $P < .001$ ). |

## Lifestyle intervention

| Cross-sectional studies | Author                | Objective  | Sample size | Methods   | Outcomes  | Findings   |
|-------------------------|-----------------------|--|-------------|---|---|--|
|                         |                       |  |             |   |   | 80% (2480) of the students reported to spend more hours of screen time a day.<br><br>In male students, there was a positive association between not exercising regularly and being obese (a OR = 1.76; 95% CI:1.08-2.85) |
| Cross-sectional         | Muhammad, et al. 2015 | Investigates the differences in terms of intention to eat traditional food between boys and girls in Malaysia. | 655         | 15 to 18 years rural and urban areas. Theory of Planned Behaviour (TPB) used. Self-administered questionnaire with 5 sections- 21 items for attitudes towards traditional food,16 items for social norms and 17 items for perceived behavioural control (PBC) as the independent variables to determine the adolescents intention to eat traditional food, while 5 items in intentions of the adolescents and the | Not stated but assumed to be Intentions in boys and girls | For both urban and rural areas, girls' R2 showed higher than boys". The value of R2 is 0.47 for girls in rural area and 0.46 for the boys,   |

## Lifestyle intervention

| Cross-sectional studies | Author             | Objective   | Sample size | Methods   | Outcomes  | Findings  |
|-------------------------|--------------------|---|-------------|---|---|---|
|                         |                    |   |             | demographic profile of the participants   |   |   |
| Cross-sectional         | Stok, et al. 2014  | To investigate association of self - perceived eating related norms with adolescents eating intentions and intake of healthy and unhealthy food | 2764        | 10-17 years old in Europe Self-reported reliable questionnaires on demographics, healthy eating intentions, food intake and subjective norms questions on weight and height, SES,   | Not stated but assumed to be Healthy eating intentions, intake of healthy food (Fruits and vegetables) and intake of unhealthy food (snacks and soft drinks). | Intention for healthy eating was more among young girls than older ones. Young girls ate more fruits and vegetables than older ones. Older boys with normal BMI ate more snacks and drank soft drinks than younger girls who were overweight. Overweight prevalence was 16.6%   |
| Cross-sectional         | Silva, et al. 2014 | To determine the association between low levels of physical activity and consumption of fruits and vegetables among adolescents                 | 2057        | Adolescents aged 13 to 18 years from the city of Aracaju, Northeastern Brazil. The item consists of the following question: During the last 7 days, on how many days were you physically active for at least 60 minutes a day. Validated for Brazil and had a moderate to high Kappa value. | Not stated but assumed to be association of PA and eating habits  | The prevalence of low levels of physical activity was 81.9%; 79.1% inadequately consumed fruits and 90.6% inadequate consumed vegetables. Inadequate consumers of few fruits daily had 40% higher chance of being insufficiently active and, for those who consumed few vegetable's the likelihood of being insufficiently active was 50% higher, compared to those who had adequate intake of these foods.<br><br>Low levels of physical activity were associated with inadequate fruit and vegetable intake among |

## Lifestyle intervention

| Cross-sectional studies        | Author               | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|--------------------------------|----------------------|--|-------------|--|---|---|
|                                |                      |  |             |  |   | adolescents in a city in north eastern Brazil.  |
| Validation and cross-sectional | Ferro-Lebres, 2014   | To validate nutrition knowledge and physical activity questionnaires, analyse relationship between nutrition and physical activity knowledge in relation to adiposity and to determine relationship between knowledge and practices in nutrition and physical activity of Portuguese adolescents | 1315        | Self-administered questionnaire with questions on nutrition-dietary recommendation, sources of nutrients, diet related diseases, and food choices a total of 137 points and physical activity knowledge-true/false and multiple-choice questions, a total of 10 points and practices-, weight and height were checked.<br><br>Content validity, test-retest reliability was .0.71; cohen's kappa agreement was 1. Concurrent validity p<.01. | Nutrition knowledge, physical activity knowledge, BMI and relationships | Poor nutrition knowledge of 46.5% (341) but 66.2% (479) for physical activity knowledge. Overweight and physical activity adolescents had the worst knowledge about expert 'nutritional recommendations. No association between nutrition knowledge and practices p=.03 and between physical activity knowledge and practices p=.083.<br><br>High physical activity knowledge was associated with practice p<0.44 |
| Cross-sectional study          | Mokwena, et al. 2014 | To describe the eating patterns of adolescent girls and to identify barriers to healthy eating   | 73          | Participants were in grades 9 to 11 (14 to 17 years) from three schools Researcher-developed and -   | Not stated but assumed to be eating patterns and sources of information | 76.7% (56) brought lunch from home daily, 19.2% (14) brought lunch from home at least three times a week and only 4% (3) do not bring food from home and  |

## Lifestyle intervention

| Cross-sectional studies                    | Author                       | Objective   | Sample size | Methods   | Outcomes  | Findings   |
|--|------------------------------|---|-------------|---|---|--|
|  |                              |   |             | administered questionnaire to participant in Durban. No validity and reliability.   |   | <p>always buy lunch at school. Supper and lunch are considered more important meals than breakfast or a snack (chi-square = 24.008 with p-value = 0.000). 14.6% (11) of the participants reported not eating breakfast daily.</p> <p>54.8% (40) ate all three meals and a snack daily, with 4.1% (3) eating supper only, 67% (49) of the participants ate breakfast, lunch, and supper as a meal combination daily, and 68% (50) ate lunch, supper, and a snack daily.</p> |
| Not stated but seems to be Cross-sectional | Oldewage-Theron, et al. 2014 | The aim of the study was to assess the nutrition knowledge, nutrient intake, and association between nutrition knowledge and dietary intake of adolescents in rural Cofimvaba, SouthAfrica. | 98          | Self- administered questionnaire containing socioeconomic questionnaire, two 24-hour-recall questionnaires, and food-frequency and nutrition knowledge questionnaires based on general nutrition and the South African Food-Based Dietary Guidelines. | Not stated but seem to be nutrition knowledge, nutrient intake and its association. | <p>72.9% correctly identified South African Food-Based Dietary Guidelines, 75.4% correctly identified food groups; and 41.3% correctly identified food portions/serving sizes.</p> <p>Nutrient intakes-failed to meet average requirements, except protein, carbohydrates, chromium, riboflavin, pantothenate, and vitamin K. Lower total carbohydrate and fat and higher protein intakes were associated</p>  |

## Lifestyle intervention

| Cross-sectional studies          | Author                       | Objective  | Sample size | Methods  | Outcomes   | Findings   |
|----------------------------------|------------------------------|--|-------------|--|--|--|
|                                  |                              |  |             |  |  | with a higher quartile score for nutrition knowledge.  |
| Cross-sectional                  | Oldewage-Theron, et al. 2014 | To determine the nutritional status, socio-economic situation and nutrition knowledge of adolescents attending five purposively selected schools in rural Eastern Cape Province in South Africa and investigate if socio-economic factors have an influence on nutrition knowledge and nutritional status. | 100         | dietary intake (24-hour recall questionnaire) and anthropometric (weight and height) measurements  | Not stated but seem to be nutritional status, SES, Nutrition knowledge | Girls had a higher total nutrition knowledge score of 61.1% compared to 55.6% for the boys ( $p>0.05$ ). 10.0% of the boys were more stunted than girls (6.3%) and 15.3% of boys and 22.9% of girls were at risk of becoming obese.<br><br>Girls were significantly more at risk compared to the boys (8.0%). No significant associations were established between the nutrition knowledge and the socio-economic and anthropometric indicators. |
| Exploratory qualitative research | Sedibe, et al 2014           | To investigate the narratives pertaining to dietary and physical activity practices by female adolescents in Soweto.   | 29          | Grade 12 female adolescents, mean age of 18 years. The interview schedule was piloted on four pairs of friends, who were not part of the study sample.<br><br>Interview schedule was modified. | Not stated but assumed to be dietary and PA practices.                 | Respondents did not know the meaning of healthy dietary practices, and why unhealthy food choices involved a health risk. What they knew did not tally with what they practiced.<br><br>Respondents consumed C fast foods, such as <i>kotas</i> and “fat” cakes, and consumed less fruit and vegetables at home and at school,   |

## Lifestyle intervention

| Cross-sectional studies | Author                  | Objective   | Sample size | Methods  | Outcomes   | Findings   |
|-------------------------|-------------------------|---|-------------|--|--|--|
|                         |                         |   |             | Questions were rephrased.<br>Theory of Triadic Influence was used.   |  | they also skipped meals.<br>Respondents knew the importance of breakfast, but most of them did not consume it before school.<br>Respondents engaged in minimal active recreational activities.   |
| Survey                  | Haeng-Shin, et al. 2014 | To examine associations of demographic and behavioural characteristics with plain water intake by using nationally representative sample of South Korean adolescents. | 1,288       | High school-aged adolescents (15-18 years). Demographic variables. Dietary intake variables included were milk, soda (both non-diet and diet), coffee drinks (all types of coffee), meeting fruit intake guideline for Koreans (yes or no), meeting vegetable intake guidelines for Koreans (yes or no), and sodium intake (< 2,000 and $\geq$ 2,000 mg/day) Behavioural variables included being physically active at least 20 minutes/day during the past seven days (< 3 and $\geq$ 3 days/week) and frequency of | Not stated but assumed to be plain water intake and behavioural characteristics. | The mean plain water intake was 5.7 cups/day for males and 4.1 cups/day for females. Females had significantly higher odds for drinking water < 2.5 cups/day (OR = 2.2) than males. Factors significantly associated with a greater odds for drinking water < 4 cups/day were being female (OR = 2.8) and not meeting physical activity recommendations ( $\geq$ 20 min/day on < 3 days/week) (OR = 1.6). Being underweight, overweight, and obese were significantly associated with reduced odds for drinking water < 4 cups/day (OR = 0.7, 0.4 and 0.5, respectively). However, intake of soda, coffee drinks, fruits, vegetables, sodium and eating out were not significantly associated with low or very low water intake. |

## Lifestyle intervention

| Cross-sectional studies     | Author            | Objective   | Sample size | Methods   | Outcomes  | Findings  |
|-----------------------------|-------------------|---|-------------|---|---|---|
|                             |                   |   |             | eating out (< 1, 1, and > 1 time/day).  |   |   |
| Descriptive cross-sectional | Wang, et al. 2014 | To investigate knowledge, attitudes, and behaviour of 7 <sup>th</sup> grade students regarding nutrition and dietary intake and to collect data that would facilitate the design and implementation of intervention aimed at promoting good nutrition in China. | 1736        | Three schools randomly selected from 15 schools. A reliable self-administered questionnaire with 27 questions on knowledge, attitudes, behaviours on nutrition, demographics and diet intake. | Not stated but assumed to be diet intake, and attitudes | <p>Mean age 12.80 SD 0.15</p> <p>68.6 (1190) ate breakfast daily, 43% (746) did not. They ate cereals, soy milk, milk or yogurt at breakfast and few ate fruits and vegetables, and meat. Girls ate more cereals and grains at breakfast than boys. 43.6% (756) ate fruits daily and 71.3% (1237) ate vegetables, 22.3% 9 (387) ate milk daily, 21.3% (369) did not.</p> <p>Knowledge did not correlate with eating behaviour.</p> <p>87.8% (165) and 68.8% (129) knew nutrients in vegetables and fruits, and that beans respectively. 68.8% (129) knew breakfast is the most important meal, 67% (126) knew food poisoning, 16% (30) knew functions of vegetables, 50% (94) did not know symptoms of food poisoning, recommended water intake/day and foods rich in protein.</p> <p>No association between gender and nutrition knowledge, no association between nutrition</p> |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective   | Sample size | Methods   | Outcomes   | Findings   |
|-------------------------|----------------------|---|-------------|---|--|--|
|                         |                      |   |             |   |  | knowledge and eating behaviour.<br>No association with gender  |
| Cross-sectional         | Hamrani, et al. 2015 | To assess the dietary habits and physical activity and sedentary behaviours in adolescents age 15-19 in Morocco | 669         | Dietary habits and physical activity reliable and valid self-administered questionnaires were used. | Not stated but assumed to be dietary habits, BMI, physical activity and sedentary behaviours | BMI mean was 19.4 kg/m <sup>2</sup> for males and 20.3 kg/m <sup>2</sup> for females.<br><br>Dietary habits-28% (187) of participants ate fruits and 49% (327) ate vegetables. No eating of breakfast. More ate doughnuts, candy, cakes and chocolate 3 times per week. 50% (335) drank sugary drinks 3 times per week.<br><br>Physical activity-males were more active than females. 45% (301) watched television more than 2 hours per day and 38% (254) spent time in the computer. |

## Lifestyle intervention

| Cross-sectional studies | Author                        | Objective   | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|-------------------------------|---|-------------|---|--|---|
| Cross-sectional         | Djordjevic-Nikic, et al. 2013 | To evaluate eating and physical activity behaviours and habits, nutritional and food knowledge, beliefs and self-efficacy related to diet and health of the adolescents in high school in the city of Belgrade, Serbia. | 707         | Self-administered questionnaires on eating habits, physical activity, meaning of healthy and unhealthy dietary habits and food, self-efficacy, barriers affecting food choices, nutritional and food safety, and body mass index (BMI).pilot tested and reliable. | Not stated but assumed to be BMI, eating and physical activity behaviours, nutrition knowledge, beliefs, self-efficacy for diet. | <p>The mean BMI was <math>22.2 \pm 3.1</math> kg/m<sup>2</sup> in males and <math>20.5 \pm 2.6</math> kg/m<sup>2</sup> in females, 21.2% (150) of the males and 7.7 % (55) of the females were classified as overweight. Obesity was 3.3% (23) in males and 1.9% (14) in females, 3% (22) of males and females were underweight.</p> <p>33.3% (235) of adolescents were not eating balanced meals, 45% (320) had partially satisfactory eating habits, and 26.7% (189) showed satisfactory eating habits. Wrong eating habits are skipping breakfast with mean score of <math>30.5 \pm 4.8</math> with a statistically significant difference (<math>p = 0.000</math>).</p> <p>81.7% had good Self-efficacy with mean of 14.1, SD 2. more in females than males <math>p &lt; 0.010</math></p> <p>27.4% (194) of adolescents indicated sedentary behaviours, 33% (230) of the students were very active, while 39% (275) were moderately active. The mean score obtained was <math>11.7 \pm 3.8</math> with a statistically significant difference (<math>p = 0.000</math>) between males and females (<math>12.4 \pm 3.7</math> for</p> |

## Lifestyle intervention

| Cross-sectional studies | Author                   | Objective   | Sample size | Methods  | Outcomes   | Findings  |
|-------------------------|--------------------------|---|-------------|--|--|---|
|                         |                          |   |             |  |  | <p>males and <math>11 \pm 3.7</math> for females). 49% (346) watched television or used the computer in free time. A statistically significant difference between normal and overweight and obese males, with the highest score obtained in normal weight males (<math>12.5 \pm 3.6</math> score versus <math>12.1 \pm 4.2</math> score) (<math>p = 0.01</math>).</p> <p>A statistically significant negative correlation was found between physical activity score and BMI (<math>p = 0.012</math>) in males.</p> <p>26% (184) had insufficient nutritional knowledge, 66.7% (471) had good nutritional knowledge (more females), while only 7% (50) of the adolescents had highest nutritional knowledge (highest among females).</p> |
| Cross-sectional         | Kostanjevec, et al. 2013 | To evaluate the connection between nutrition knowledge of children aged 11 years old and their eating habits as well as their attitudes towards healthy | 630         | Self-administered questionnaire consisting of 27 nutrition knowledge questions. Nutrition knowledge scores categories: low, fairly | Nutrition knowledge and eating habits, attitudes toward healthy eating | Children with better nutrition knowledge had healthier eating habits and a more positive attitude towards healthy eating than children with poor nutrition knowledge.   |

## Lifestyle intervention

| Cross-sectional studies | Author                   | Objective  | Sample size | Methods   | Outcomes                             | Findings  |
|-------------------------|--------------------------|--|-------------|---|--------------------------------------|---|
|                         |                          | eating habits in Slovenia.   |             | good, and good nutrition knowledge.   |                                      |   |
| Cross-sectional         | Pucciarelli, et al. 2013 | To assess 7 <sup>th</sup> grade adolescents' nutrition knowledge and dietary choices, and to measure the relationship between students' nutrition knowledge and the type of food items purchased in their school cafeteria using Indiana's legal definition of 'better choice' food. | 287         | A 25-question nutrition knowledge survey was pilot-tested and used to measure general nutrition knowledge. The questionnaire is reliable ( $r=0.79$ ) | Nutrition knowledge, dietary choices | The participants had a low nutrition knowledge level ( $12.1\pm 4.0$ ). Females scored higher on the nutrition knowledge survey than males ( $12.8\pm 3.3$ vs. $11.6\pm 4.3$ ; $t=2.6$ ; $p=0.01$ ). There was no relationship between the nutrition knowledge score and dietary choice score ( $r=.06$ ).  |
| Survey                  | Tallarini, et al. 2013   | To evaluate general knowledge about nutrition in North of Italy (Bergamo, Milan) in 9-11 and 12-16 years old groups.   | 614         | The QuesCA IT questionnaire containing thirty-one questions validated (content validity, and pilot test).   | Nutrition knowledge                  | In group 1-1.2% scored $\leq 25\%$ , 98.4% scored between 25-75% and 0.4% scored $\geq 75\%$ . In group 2, 0.5% scored $\leq 25\%$ , 98.1% scored between 25-75% and 1.4% scored $\geq 75\%$ , demonstrating good knowledge but the lowest scores were obtained in fats and dressing, fish and legumes, snacks, eggs and meats, milk and dairy, and sweets questions. There was significant difference of $p<0.005$ between the groups. |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective   | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|----------------------|---|-------------|--|---|---|
| Descriptive             | Pascale, et al. 2013 | To describe the eating and physical activity behaviours in Canada | 5250        | <p>Participants, from secondary school 5250 (13-17 years).The self-administered questionnaire consisted of two (2) sections: eating behaviours and physical activity.</p> <p>Face validity and clarity was established by experts (nurses, nutritionists, physical education teachers). Pilot testing with parents of primary and secondary students. previously tested for reliability.</p> | Not stated but assumed to be consuming sweetened beverages and physical activity behaviours | <p>In the 13-year-olds group, females were more likely to eat fruits and vegetables than males, and sweetened-beverage consumption was more among male groups. Fruit drinks were popular (34%, 1789) among the groups of 13-year-olds to 65% (3416) among the groups of 17-year-olds. Soft drinks were popular among (12%, 630) among the groups of 13-year-olds to 52% (2730) among groups 17 years. 60% (3150) in 17-year-old groups ate at restaurant. 41% (2153) participants engaged in a minimum of 60 minutes of physical activity per day and more male groups achieved recommended physical activity levels by experts than female groups. 49% (2577) of males and 34% (1785) of females were physically active for minimum of 60 minutes on a daily basis.</p> <p>Males played soccer, ice hockey, and football, and females played activities such as dance, water activities, and gymnastics.</p> |

## Lifestyle intervention

| Cross-sectional studies | Author           | Objective  | Sample size | Methods   | Outcomes  | Findings   |
|-------------------------|------------------|--|-------------|---|---|--|
| Descriptive             | Öun, et al. 2013 | To analyse how students' aged 13-16 years old eating habits and physical activity are related to the height-weight classes in Parnu, Russia. | 142         | Anonymous Self-administered previously used questionnaire on personal details, eating habits during the day, and understanding about healthy food, favorite food, and frequency of eating some food, PA. Self-reported Height and weight. | Not stated but assumed to be eating habits and physical activity behaviours, height and weight. | <p>13% (18) of females and 18% (26) of males among 13-year-old were overweight or obese</p> <p>Among the 15-year-olds, they were 9% (6) and 16% (12). The respondents ate sandwiches for breakfast and the males ate it more often, followed by dry cereals.</p> <p>Overweight females did not prefer to eat porridge in the morning. They ate more yogurt and dry cereals than sandwiches.</p> <p>24.8% (35) females ate snacks in school, while 25.3% (36) of the males did.</p> <p>Normal-weight males ate rye bread, milk and fruits every day. Females ate more fruits, juice and milk products every day. Males ate more pasta, fish and sausage once a week, but females liked more pasta, meat and vegetables. Chips and nuts were eaten rarely by both genders.</p> <p>50% (71) of the both genders took sweets and beverages with sugar daily.</p> |

## Lifestyle intervention

| Cross-sectional studies | Author                  | Objective  | Sample size | Methods  | Outcomes                                 | Findings  |
|-------------------------|-------------------------|--|-------------|--|--|---|
|                         |                         |  |             |  |  | Twenty-five percent (36) females practiced sports 1-2 or 3-4 times in a week, but 32% (45) males practiced 3-4 times per week. 43% (61) of overweight males were physically more active 27% (38) males trained every day and 8% (11) females did. |
| Survey                  | Plotnikoff, et al. 2012 | To examine the utility TPB for explaining physical activity (PA) intention and behaviour among a large population sample of overweight and obese adolescents (Alberta, Canada) using a web-based survey.<br><br>Secondary objectives were to examine the mediating effects of the TPB constructs and moderating effects of weight status | 560         | Self-administered web-based questionnaire on health and PA behaviours, including assessment of attitude, subjective norm, perceived behavioural control (PBC), and intention to participate in regular PA. | Not stated but assumed to be TPB and PA. | The findings showed that attitude was the strongest predictor of PA intention, whereas PBC was the strongest predictor for PA behaviour. Intention was not predictive of PA behaviour.  |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective  | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|------------------------|--|-------------|---|--|---|
| Cross-sectional         | Al-Hazzaa, et al. 2012 | To evaluate the association between obesity measures and several lifestyle factors, physical activity sedentary and diet behaviours in Saudi Arabia. | 2906        | 14-19 years olds. BMI and waist circumference was measured. Self-administered questionnaire containing questions on diet, sedentary, physical activity was used to collect data. content validity and Cronbach alpha was 0.85 | Not stated but assumed to be Weight, height, waist circumference, hip ratio, screen time, dietary habits and physical activity behaviours. | Boys mean BMI was 24.6 SD 6.7 and girls mean was 23.6, SD 6.1. Overweight- boys were 43.6% (1249) and girls 34.8% (1104). Waist circumference mean was 79.7 and SD 15.4 for boys and girls 74.2 SD 13.1.<br><br>Sedentary-females were more than boys inactive. Diet habits- females ate breakfast, fruits, milk, sugar drinks, and fast foods on fewer days than males. They also ate more French fries, cakes, sweets than males $P < 0.05$ . |
| Cross-sectional         | Amos, et al. 2012      | To find out whether factors such as parental, peer, and media influences predict Ghanaian adolescent students' eating habits.                        | 150         | Eating Habits Questionnaire for Adolescents reliable.   | Not stated but assumed to be influence of eating habits  | There was positive correlation between peer influence and eating habits ( $r = .214; p < .01$ ).<br><br>Media ( $r = .016, p > .05$ ) and parental influence ( $r = .094, p > .05$ ) were not significant.  |
| Cross-sectional study   | Arora, et al. 2012     | To describe the frequency of breakfast consumption among school-going adolescents in Delhi and evaluate its association with                         | 1814        | BMI was determined objectively. The measures of dietary intake, physical activity, sedentary behaviour, and psychosocial risk factors was developed by adapting measures  | Not stated but assumed to be Body mass index, self-reported breakfast consumption, diet and physical activity related behaviours, and      | Out of 1814 participants, 30% (544) consumed breakfast occasionally especially in older adolescents. Association between age and breakfast consumption was Chi-square statistic=12.09; $P=0.027$ , higher among Government schools than Private schools (Chi-square   |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective  | Sample size | Methods   | Outcomes  | Findings  |
|-------------------------|----------------------|--|-------------|---|---|---|
|                         |                      | overweight and obesity as well as other dietary, physical activity, and sedentary behaviours.                                    |             | from previously used reliable instruments that have been validated with adolescents. Pilot testing.   | psychosocial factors.   | <p>statistic=14.26; P=0.002), and higher among 8<sup>th</sup> graders than 10<sup>th</sup> graders (Chi-square statistic=7.97; P=0.019). There was no gender difference.</p> <p>The prevalence of overweight and obesity was lowest among those students who consumed breakfast daily (14.6%, 265), higher among those who consumed breakfast sometimes (15.2%, 276) and highest among those who never consumed breakfast (22.9%, 415) (P=0.039), differences were statistically significant among boys only (P=0.043).</p> |
| Cluster sample survey   | Gronhoj, et al. 2012 | To predict behavioural intention of adolescents aged 11-16 years old for healthy eating by applying theory of planned behaviour. | 410         | Self-administered questionnaire with eating habits, perceived behavioural control for healthy eating, eating intentions, subjective norms questions. Questionnaire was tested for reliability Cronbach alpha= 0.64 to 0.81. | Not stated but assumed to be eating habits, subjective norm, perceived behavioural control for healthy eating, intention for healthy eating, attitudes. | <p>BMI ranged between 12-31.2 kg/m<sup>2</sup> and mean was 18.3 kg/m<sup>2</sup>.</p> <p>Eating habits- 60% (246) ate breakfast; one portion of fruits and vegetables 3-4/week, 305 (74.4%) ate candies and chips, soft drinks and snacks late at night 3-4/week. fast foods intake was less often because 9.5% (38) ate them less than 3 times per week.</p> <p>22% (90) indicated to be definitely intending to eat healthily, 39% (160) mostly, 11% (45) not mostly and 5% (21) not</p>                                 |

## Lifestyle intervention

| Cross-sectional studies | Author                | Objective  | Sample size | Methods   | Outcomes  | Findings   |
|-------------------------|-----------------------|--|-------------|---|---|--|
|                         |                       |  |             |   |   | definitely intending to eat healthily. Gender correlated with intentions $p < 0.05$ . Females had high intentions than males. Intentions were also related to age and BMI though they were not predictors of intentions.   |
| Not stated              | Ickes, et al. 2012    | To examine the extent behavioural intention predicted physical activity (PA) and sedentary behaviours linked to childhood obesity. | 318         | A 129-item valid and reliable instrument.   | Not stated but assumed to be behavioural intention (BI) predict PA.           | The mean scores for participating in less than two hours of screen time per day ( $M = 12.31$ , $SD = 5.42$ ) and at least 60 minutes of PA per day ( $M = 12.84$ , $SD = 7.18$ ) denoted a moderate intent to participate in the behaviour. However, 25% and 33% of students indicated a weak intention to participate in the respective behaviours. Regression showed BI was predictive for screen time among overweight students, and participation in PA among all students, ( $p < 0.05$ ). BI was linked to PA and sedentary behaviours related to obesity prevention in adolescents |
| Cross-sectional survey  | Bibiloni, et al. 2012 | To assess association between sedentary, physical and socioeconomic factors, diet and lifestyle among the                          | 1961        | Physical activity was assessed using the International Physical Activity Questionnaire for adolescents (IPAQ-A, | Not stated but assumed to be BMI, WC, HC, demographics, and physical activity | 37.1% (725). showed Sedentary behaviours.<br>50.8% (996) females showed higher sedentary behaviours than males (22.0%, 431. 64% (1255) of  |

## Lifestyle intervention

| Cross-sectional studies | Author         | Objective   | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|----------------|---|-------------|--|---|---|
|                         |                | Balearic Islands adolescents aged 12-17 years old   |             | <p>short form was used. BMI (International Obesity Task Force cut off points), and Waist circumference (WC) and hip circumference (HC)</p> <p>were measured , diet assessed by validated recall FFQ with 145 items (past year recall).</p> <p>Sedentary and physical was defined as &lt;300 min/week of moderate and vigorous physical activity.</p> | and sedentary behaviours  | <p>males were more active and spend more weekly time in both moderate and vigorous physical activity than females (50%, 980).</p> <p>Time for media screen was higher among 14 years old in both genders.</p> <p>Active males consumed cereals and fruits at breakfast frequently than their sedentary peers. Active females consumed yogurt and cheese, fruits and cereals at breakfast than their sedentary counterparts. Sedentary females consumed more frequently high fat foods and soft drinks than their active peers.</p> <p>Univariate analysis showed that parental educational and profession levels are directly associated to sedentary behaviour in females.</p> |
| Survey                  | Silangwe, 2012 | To examine the nutritional status and dietary pattern of adolescent girls attending school in Lindelani, KwaZulu-Natal. | 157         | Adolescent girls aged 13 to 18 years. Interviewing the adolescent girls and the parents using pre-designed and pre-tested questionnaires. Weight and height  | Not stated but assumed to be Nutritional status and dietary pattern | <p>Prevalence of under-nutrition was 7.6%/ The results revealed that 92.4% of the girls were of normal height for age 10.8% were overweight and 1.9% were obese.</p> <p>High intake of carbohydrates and carbohydrate intake correlated</p>   |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective  | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|------------------------|--|-------------|---|--|---|
|                         |                        |  |             | were measured and socio-demographic data collected by means of a questionnaire. Dietary intake data were gathered by using two 24hr recall questionnaires and a QFFQ.   |  | positively with the BMI-for-age Z-score. 44 and 144 who consumed protein and dietary fiber did not meet the dietary recommended intake measured by the 24hr recall. low intake of essential nutrients such as vitamin A, vitamin C, iron and calcium. |
| Cross-sectional         | Zach, et al, 2012      | To assess physical activity levels of Israel adolescents on 7-12 <sup>th</sup> grade   | 6274        | Questionnaires were self-administered comprising of six questions. Participants were asked to report the entire amount of physical activity at school and outside in activities such as running, swimming, football, walking/cycling to school. | Not stated but assumed to be Physical activity habits.                                   | 10.5% (660) of the participants were performing adequate amount of physical activity. Males were more active than females; 41.7% (2612) of the females and 29.1% (1838) of the males lead a sedentary lifestyle.                                      |
| Survey                  | Escalante, et al. 2012 | To identify stages of behaviour change and knowledge, attitudes and habits concerning nutrition and physical activity in Mexico. | 48          | Reliable questionnaire on knowledge, attitudes, and behaviour about nutrition and physical activity of Cronbach's $\alpha=0.71$ .   | Not stated but assumed to be physical activity habits, nutrition knowledge and attitudes | 65% (31) reported to be eating fruits daily. 79% (37) had breakfast before going to school. 90% (43) recommended water intake than juice.<br><br>35% (17) were able to distinguish physical activity from sedentary                                   |

## Lifestyle intervention

| Cross-sectional studies | Author       | Objective  | Sample size | Methods  | Outcomes      | Findings   |
|-------------------------|--------------|--|-------------|--|---------------|--|
|                         |              |  |             | SPSS-Descriptive statistics, correlation analysis.   |               | <p>activity and 25% (12) knew daily recommended physical activity levels. 58% (28) were involved in extracurricular activities. 19% (9) were doing physical activity daily and 25% (12) 3 times per week, 14% (7) less than 3 times per week. 46% (22) spent more than 2 hours a day watching television.</p> <p>96% (46) of the participants; however, 38% (18) could not identify low-fat food preparations. 99% (47) of children recommended water consumption rather than industrial juices, soft drinks, or sports drink. 35% (17) were able to distinguish physical activity from sedentary activity and 25% (12) knew daily recommended physical activity levels.</p> |
| Cross-sectional         | Naidoo, 2011 | To determine the prevalence of self-reported physical activity behaviours among adolescents in Grades 8-11 in Western Cape public schools from the YRBS 2, to determine if there | 1134        | Grade 8-11 classes in public secondary schools sampled in the Western Cape Province from 22 schools. the study was an analysis of part of the national data on PA conducted in 2008. The | PA behaviours | The majority of the learners spent 2-4 hours/day watching TV or playing video games  |

## Lifestyle intervention

| Cross-sectional studies      | Author         | Objective  | Sample size | Methods  | Outcomes  | Findings   |
|------------------------------|----------------|--|-------------|--|---|--|
|                              |                | were statistically significant differences in these behaviours in comparison to the YRBS 1 and to identify the characteristics of physically inactive participants |             | questionnaire included only closed-ended questions,<br><br>and only 1 multiple response question and consisted of 135 questions. Face and construct validity done.   |   |  |
| Qualitative and quantitative | Patcheep, 2011 | To examine eating behaviour and the identify factors influencing Thai adolescents' eating behaviour  | 336         | 184 urban and 152 rural adolescents from public high schools in Ratchaburi Province, Thailand. Thai Eating Questionnaire (TEQ) developed based on the TPB included food frequency questionnaire (FFQ). Digital photography and 24-hour dietary recall were used to explore the eating, weight, height, and waist circumference checked. Focus groups were used to further examine factors influencing adolescents' eating behaviour. Content | Not stated but assumed to be Factors influencing eating behaviour | Factors influencing eating-food preference, convenience, price, important role of mother, perceived outcomes of eating behaviour, food availability at home and community, and advertising. Eating intention was significantly predicted by attitude towards eating behaviour ( $r^2=.241$ ).<br><br>80% of rural and 69% of urban adolescent adolescents had normal weight, 4% rural were overweight and urban were 5%. pre-obese rural were 4% and urban 6%, obese rural were 6% and urban 11%. 65 rural were underweight and 8% urban were underweight.<br><br>urban adolescents' eating behaviour had a very low |

## Lifestyle intervention

| Cross-sectional studies | Author            | Objective  | Sample size | Methods  | Outcomes   | Findings   |
|-------------------------|-------------------|--|-------------|--|--|--|
|                         |                   |  |             | validity and reliability recorded  |  | correlation with eating intention ( $r=.151$ ).<br><br>For rural adolescents, eating intention was significantly correlated with eating behaviour, but this association was low ( $r=.234$ )   |
| Survey                  | Chan, et al. 2011 | To use constructs of Theory of Planned Behaviour (TPB) and advertising intervention to predict intention for healthy eating in adolescents aged 11-19 years in China | 570         | Pilot tested self-administered questionnaire containing frequency of eating practices, attitudes, subjective norm, perceived behavioural control, intentions for healthy eating and Cronbach's ranged between 0.79-0.86. | Not stated but assumed to be eating habits, attitudes, subjective norms, intention for healthy eating, perceived behavioural control | BMI range was between 12.6 32.4 kg/m <sup>2</sup> , mean was 19.7. 12% (68) of the participants were overweight.<br><br>Eating habits- 60% (342) practiced healthy Eating (regular breakfast, 3-4 times intake of fruit and vegetables. 40% (228) ate candies and fast foods, drank soft drinks 3 times/week.<br><br>Participants ate late snacks and 14.9% (85) ate snacks less than 3 times/week.6% (34) definitely intend to eat healthily during the coming 2 weeks, 30% (171) indicated mostly, 41% (233) were not sure and 2.2% (11) were not definitely intending to eat healthily. Females had high intentions to eat healthily than males. Participants with high BMI had lower intentions to eat healthily than those with low |

## Lifestyle intervention

| Cross-sectional studies | Author                | Objective   | Sample size | Methods   | Outcomes  | Findings   |
|-------------------------|-----------------------|---|-------------|---|---|--|
|                         |                       |   |             |   |   | BMI. Age and gender were not predictors of intentions on multiple regression analysis. TPB was not predictor of healthy eating among adolescents.  |
| Cross-sectional         | Lambros et al. 2011   | To examine the social cognitive predictors of leisure time physical activity intentions among Greek secondary school students.                      | 254         | 3 secondary public schools in the urban area of Thessaloniki were randomly selected from 8th and 9th grades. Past physical activity behaviours were assessed using adapted version, and intentions were measured with three items by Hagger (2007). TPB and prototype model were used. measures tested for reliability. | Not stated but it might be psychosocial predictors of adolescent physical activity. | Multiple regression analysis indicated that leisure time physical activity intentions were predicted by past behaviour and perceived behavioural control. Beliefs and prototypes were non-significant predictors of intentions |
| Survey                  | Hallstrom et al. 2011 | Describe breakfast habits, factors that influence food choices at breakfast within the framework of EU-funded HELENA STUDY from 10 European cities. | 3528        | Questions were selected from food choice and preference, healthy diet determinant and young living environment, breakfast consumption questionnaire-  | Not stated but assumed to be Breakfast habits, and determinants.                    | 54% were regular in eating breakfast. Fewer girls than boys indicate to be eating regular breakfast $p < 0.05$ Girls from high parental education, boys from traditional families, and low SES families ate regular breakfast. |

## Lifestyle intervention

| Cross-sectional studies           | Author             | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|-----------------------------------|--------------------|--|-------------|--|---|---|
|                                   |                    |  |             | All test-retest reliability, socioeconomic factors, all used previously.   |   | Most influential adolescents from western Europe said they are influenced to eat breakfast by personal factors, and socio-environmental factors were parental encouragement, hunger, taste and health concerns.   |
| Descriptive cross-sectional study | Kelly, et al. 2011 | To assess the relationships among cognitive variables, social support, and healthy lifestyle behaviours in adolescents | 404         | Cognitive behavioural theory was the conceptual framework that guided the selection of variables in this study. Measures were; healthy lifestyle belief scale, perceived difficulty scale, choices scale and attitude scale, social support-family and demographics. Face validity and Cronbach acceptable levels. | Not stated but assumed to be Relationships among cognitive variables, social support, and healthy lifestyle behaviours. | Cognitive beliefs about leading a healthy lifestyle, including attitudes and intended choices, are related to physical activity as well as the intake of fruits and vegetables. Adolescents who reported greater behavioural skills related to fruit and vegetable intake ate more servings of fruits and vegetables. Those who reported greater behavioural skills for physical activity also reported being more physically active. |
| Survey                            | Wang, et al. 2011  | To examine physical activity patterns and psychological correlates of physical activity among primary, secondary and   | 3333        | Modified self-administered physical activity checklist with 7-day recall and sedentary behaviours which was used previously with   | Not stated but assumed to be Physical activity intentions   | 60% (1999) of participants had high physical activity, 22% (733) had low activity.<br><br>Sedentary-46.8% (1533) spent 14 hours per week watching television and females were watching more than boys,  |

## Lifestyle intervention

| Cross-sectional studies     | Author                  | Objective   | Sample size | Methods   | Outcomes  | Findings  |
|-----------------------------|-------------------------|---|-------------|---|---|---|
|                             |                         | college students in Singapore.  |             | Cronbach's alpha ranging between 0.70-0.95 was used to collect data. Intention for physical activity was assessed using two items with 7-likert scale of 1-7. 32 physical activities grouped into sports, dance exercise and general physical activity. |   | p<0.001. 73.3% (2433) spent zero hour per week on video games.<br><br>Intentions for physical activity differed as per age but not per gender. No correlation between computer or video with other variables except for physical activity.  |
| Comparative cross-sectional | Ojofeitimi, et al. 2011 | To investigate the pattern and determinants of obesity among adolescent females in private and public schools in the Olorunda Local Government Area of Osun State, Nigeria. | 520         | Pre-tested, semi-structured questionnaires were administered to 257 girls from private schools and 263 girls from public schools.   | Not stated but assumed to be determinants of obesity. | Dietary practice and active lifestyles were more among respondents in public schools than private schools: 167 (64.5%) and 180 (63.8%), respectively. BMI-majority of the girls from private schools were underweight (52.0%), 10 (4.0%) were overweight and 3 (1.2%) were obese. For public schools, the majority (55.4%) fell within the normal group, 6 (2.3%) were overweight and none was obese BMI had a significant association with the school type ( $\chi^2=10.85$ ; P=0.013).<br><br>Most of the respondents from private schools (65.2%) had good |

## Lifestyle intervention

| Cross-sectional studies | Author                       | Objective   | Sample size | Methods   | Outcomes                                   | Findings   |
|-------------------------|------------------------------|---|-------------|---|--|--|
|                         |                              |   |             |   |  | knowledge about obesity and related matters while most of those from public schools (65.9%) had poor knowledge.  |
| Cross-sectional         | Sichert-Hellert, et al. 2011 | To build up sufficient knowledge of healthy diet in adolescents aged 12-17 years old.   | 3546        | 10 countries in Europe Validated and pilot tested nutrition knowledge test with 23 multiple choice questions in subscales; knowledge concept, instrumental, and knowledge of causal relationship. | Nutrition Knowledge, BMI, SES correlation  | 60% had good knowledge-scores for each subscale were close to total score, girls scored higher than boys (62% versus 59%), nutrition knowledge correlated with age $p < 0.001$ , but no correlation with BMI, parental education correlated with knowledge $p < 0.0128$ .  |
| Cross-sectional survey  | Nabhani-Zeidan, et al. 2011  | To explore the difference in nutrients intake and nutrition related knowledge among 17-19 years old Lebanese adolescents of contrasting socioeconomic status (SES). | 209         | Reliable self-administered questionnaire-24hour recall nutrition knowledge, weight and height.  | Nutrition knowledge, nutrient intake, BMI. | High SES adolescents consumed more vegetables, meats, fats and oils $p < 0.05$ . high SES adolescents group consumed higher amounts of calories, proteins, fat, vitamin A and C, and iron $< 0.001$ but lower intake of carbohydrates $p < .05$ .<br><br>Nutrition knowledge was high in all participants though higher in high SES than low SES $p < 0.05$ .<br><br>High SES adolescents consumed more vegetables, meats, fats and oils $p < 0.05$ . high SES adolescents group consumed higher amounts |

## Lifestyle intervention

| Cross-sectional studies   | Author                  | Objective   | Sample size | Methods   | Outcomes  | Findings  |
|---------------------------|-------------------------|---|-------------|---|---|---|
|                           |                         |   |             |   |   | of calories, proteins, fat, vitamin A and C, and iron < 0.001 but lower intake of carbohydrates p<.05.  |
| Survey                    | Sen, et al. 2010        | To examine the association between frequency of family dinners (FFD) and selected problem behaviours for adolescents after adjusting for family connectedness, parental awareness, other family activities, and other potentially confounding factors | 6748        | The data is drawn from the National Longitudinal Survey of Youth, 1997 a nationally representative sample of the U.S. population who were 12–16 years of age on December 31, 1996                                   | Not stated but assumed to be Association between frequency of family dinners (FFD) and selected problem behaviours. | FFD is negatively associated with substance-use and running away for females; drinking, physical violence, property-destruction, stealing and running away for males. Family meals are negatively associated to certain problem behaviours for adolescents even after controlling rigorously for potentially confounding factors.   |
| Qualitative investigation | Fitzgerald, et al. 2010 | To examine developmental differences between children's and adolescents' perceptions of factors influencing their food choices  | 29          | 9 and 18 years in Irish. six single-sex focus groups, two at each age group, with approximately five participants per group. semi-structured interview schedule was developed to guide the focus group discussions. | Not stated but assumed to be Factors influencing food choice.   | Three key themes-intra-individual factors: the link between food preferences and awareness of healthy eating, and food preferences were consistently identified as a major influence on the food choices of young people. Taste, texture and the appearance of food were three factors that appeared to be crucial when making decisions about food. Rather, food preferences appear to |

## Lifestyle intervention

| Cross-sectional studies | Author                | Objective  | Sample size | Methods  | Outcomes  | Findings   |
|-------------------------|-----------------------|--|-------------|--|---|--|
|                         |                       |  |             |  |   | <p>be the central motivation for young people's food choices.</p> <p>-Intra-familial factors: the role of the home food environment</p> <p>-Extra-familial factors: eating away from the home.</p>   |
| Survey                  | Koch, et al. 2010     | To report views of pupils on healthy nutrition and knowledge about healthy diet in Slovenia.   | 242         | <p>Self-administered previously used questionnaire on attitudes on nutrition, healthy eating and knowledge on healthy eating.</p> <p>Nutrition knowledge score was categorized into 0-8 represented fail, 9-10-pass, and 11-13-fair, 14-15-very good, 16-17-excellent. Maximum score was 17.</p> | Knowledge on healthy eating and attitudes on nutrition.   | <p>Participant's nutrition knowledge was poor. Participants aged 12 who failed were 51.9% (69), those who passed were 23.3% (31), fairly were 23.3% (31), and very good were 1.5% (2) and none got excellent score, while those aged 13 years got 37.6(41) failed, 32.1% (35) pass, 25.7% (28) fair and 4.6 (5) very good and none got excellent score.</p> <p>Mean score for males was 8.81 and females 8.75.</p> |
| Cross-sectional         | Burkhart, et al. 2010 | To assess basic nutrition knowledge of talented adolescents, define what influences their nutrition knowledge and practices of choosing foods, | 100         | Five athletes organisations volunteered to participate. Questionnaire was developed from published research to measure basic   | Basic knowledge, sport nutrition knowledge, food skills and nutrition behaviour, attitudes toward sport, most preferred sources | 88% (88) did not know food that provide most energy while 45 knew, 91% (91) knew that fat intake increase body fat, 76% (76) knew source of protein, 95% (95) knew source of carbohydrates and 57% (57) knew that even fruits and vegetables are source of   |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective   | Sample size | Methods  | Outcomes  | Findings   |
|-------------------------|----------------------|---|-------------|--|---|--|
|                         |                      | assess sports nutrition knowledge and sports nutrition behaviours and to develop a curriculum and resources that can be used with talented adolescents athletes, (13-20 year olds in New Zealand) |             | knowledge, sport nutrition knowledge, food skills and nutrition behaviour, attitudes toward sport, most preferred sources of information, and most favoured nutrition resources. It was pilot tested but not validated nor tested for reliability.   | of information, and most favoured nutrition resources | carbohydrates. Generally participants had good knowledge except for food components.   |
| Cross-sectional survey  | Letlape, et al. 2010 | To ascertain the knowledge of students on the composition of a healthy diet, daily nutritional requirements and the importance of regular exercise  | 485         | Nutrition knowledge questionnaire for 13–19 year olds-south African food-based dietary guidelines using a self-administered questionnaire with closed and open-ended questions to collate information on knowledge of diet, nutrition and physical exercise of students at Tswaing High School, Winterveldt, valid and reliable nutrition knowledge questionnaire that was developed for urban | Nutrition and physical activity                       | 77% of the students do not have adequate knowledge on diet, nutrition and exercise while 23% of the students showed satisfactory knowledge. Approximately 26% and 16% of the students reported that they participated in rigorous and moderate exercise respectively. The study also showed that the majority of the students were however not engaged in physical activities.<br><br>38% of the students responded correctly on the question of what physical activity means to them and 62% of them did not know what physical activity was. |

## Lifestyle intervention

| Cross-sectional studies             | Author              | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------------------|---------------------|--|-------------|--|---|---|
|                                     |                     |  |             | South African adolescents participating in the Birth-to-Twenty Cohort Study.   |   |   |
| Cross-sectional descriptive survey. | Venter, et al. 2010 | To primarily investigate the dietary fat knowledge and intake of the 17-year-old in public schools in the Bellville/Durbanville from middle and upper socioeconomic status | 168         | The pilot tested questionnaire had three sections; dietary fat knowledge, 18 questions, dietary fat intake and biographic information, interest in nutrition, perceived nutritional knowledge, source of nutritional information, perceived food and beverage consumption and perception of body weight status. Questionnaire not tested for reliability, but pilot tested among 12 <sup>th</sup> graders for face validity. | Not stated but assumed to be Fat dietary knowledge and intake | Food intake of many participants consists of high-fat diet 30% (50) consumed hot dogs, frankfurters, salami and sausage once or less than once per month, but 30% (50) consumed these items two to three times per month. 46%, (77) consumed fried chicken with skin and 45% (75) consumed cheeseburgers and 45% (75) consumed red meat, 43% (72) consumed ice cream, 42% (67) consumed hamburgers 41% (66) consumed bacon or pork sausage potato chips, 30% (50) potato crisps, 32% (53) consumed corn chips and 29% (48) consumed doughnuts, cake, cookies, puddings two to three times per month. 40% (67) consumed eggs, 53% (89) ate margarine or butter, and 30% (50) ate full-cream milk and 24% (40) ate cheese or cheese spread five or more times per week. Both genders consumed a high fat. Dietary fat knowledge |

## Lifestyle intervention

| Cross-sectional studies | Author            | Objective   | Sample size | Methods   | Outcomes  | Findings   |
|-------------------------|-------------------|---|-------------|---|---|--|
|                         |                   |   |             |   |   | <p>was positively associated with fat intake <math>p &lt; 0.05</math>.</p> <p>98% (164) obtained good score, 46% (77) obtained an average score and 52% (87) obtained poor score. More females than males achieved average scores (58% versus 26%), while more males than females achieved poor scores (72% versus 39%) (<math>p &lt; 0.001</math>). Dietary fat knowledge was positively associated with fat intake <math>p &lt; 0.05</math>. Generally good knowledge</p>            |
| Survey                  | Chin, et al. 2009 | To examine eating behaviours among female adolescents aged 13-19 years old in Malaysia. | 407         | Self-administered questionnaire containing eating behaviours was pretested. height and weight were checked. | Not stated but assumed to be Height, weight, eating behaviours. | <p>BMI- 5% (20) were underweight, 74% (301) had a normal BMI, and 18.7% (76) were overweight.</p> <p>Meal consumption- 52.6% (214) ate breakfast daily, 19.7% (79) not daily, 4.4% (9) once per week. 75.2% (304) ate lunch daily, 16.2% (72) 4-6 times a week, 62.4% (253) ate dinner. Meal skipping-35.9% (146) never skipped meals, 52.6% (214) skipped at least one meal especially breakfast 47.4% (192).</p> <p>Snacking- 43.5% (177) snacked between meals daily, 8.4% (34)</p> |

## Lifestyle intervention

| Cross-sectional studies      | Author                | Objective   | Sample size | Methods  | Outcomes                          | Findings  |
|------------------------------|-----------------------|---|-------------|--|-----------------------------------|---|
|                              |                       |   |             |  |                                   | once a month. Type of snacks used were fruits, bread, cakes, chocolate and juice.<br><br>Eating away- 10.6% (36) ate at hawkers, 4.7% (9) at coffee shop, 35.1% (142) ate fast foods at restaurants.  |
| Qualitative and quantitative | Gray, 2009            | To examine whether or not the students who continue to enrol in health and physical education classes at the high school level or have taken a course in which nutrition is part of the curriculum at the high school level have greater nutrition knowledge. | 90          | Females from 9-12 grades in Ontario, Canada. Socio-demographics and nutrition knowledge questionnaire- adapted from one developed by Parmenter and Wardle (1999) to assess the general nutritional knowledge of adults. Modifications to the original questionnaire were made to reflect the high school curriculum. | NK, eating habits and body image. | NK-1(1.11%) scored high, 19 (21.1%) medium score, and 50(77.8%) scored low. Many of the students who had been exposed to nutrition curriculum were unable to take the information learned in the classroom and translate it into healthier eating habits. |
| Cross-sectional              | Abudayya, et al. 2009 | To describe the association between socioeconomic status (SES) and food intake and meal   | 944         | Food frequency questionnaire with 42 food items was used. Questionnaire previously used and  | SES, food habits                  | 40% (377) were from high SES, 22.2% (209) from middle and 15.5% (146) from low SES.<br><br>Meal patterns- 80% (755) had lunch daily, and less dinner.   |

## Lifestyle intervention

| Cross-sectional studies | Author           | Objective   | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|------------------|---|-------------|--|---|---|
|                         |                  | patterns in Gaza Strip.   |             | adopted to the Gaza situation.   |   | <p>Breakfast eaten daily by 62% (585), more males than females, <math>p &lt; 0.05</math>. SES high with meals daily. Females skipped lunch than males <math>p &lt; 0.01</math>, OR=0.55, 95% CI 0.36-0.87.</p> <p>Females ate more fruits and vegetables and western diet than males. Milk, animal food, fruits and vegetables, sweets, western diet was high in those from high SES than low SES.</p>  |
| Cross-sectional         | Mota, et al.2009 | To assess association and impact of increase in meal frequency and physical activity and skipping breakfast on obesity levels in adolescents in Portugal. | 886         | Daily meal frequency was assessed by the question: How many meals per day do you consume? Possible answers were 1, 2, 3, 4, 5 or 6. To define a meal examples were given (i.e. breakfast, lunch, dinner and small snacks such as mid-morning, mid-afternoon and evening. | Not stated but assumed to be Meal frequency and PA, skipping breakfast and BMI. | <p>BMI-mean 20.9 SD 3.8 for boys and 21 SD 3.2 for girls. Overweight boys 23.6 % and girls 17.3%.</p> <p>Meal scores <math>\leq 3</math> were 10.3% boys and 15.6% girls, <math>\leq 4</math> were 32.8% boys and 29.9% girls, <math>\geq 5</math> were 56.4% boys and 54.9% girls.</p> <p>Most of participants ate breakfast 87-94%.</p> <p>Meal frequency correlated with BMI in girls <math>r = 0.09</math> and 44.1% girls, high score were 41.1% boys and 12.4% girls. Boys more active than girls <math>p &lt; 0.05</math>. Logistic regression- meals in boys were OR: 2.75 <math>P \leq 0.05</math>, GIRLS or: 1.97</p> |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective   | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|------------------------|---|-------------|--|---|---|
|                         |                        |   |             |  |   | $p \leq 0.05$ . Boys (OR: 2.10; $p < 0.003$ ), but not girls, who were moderately active were more likely to be of normal weight  |
| Quantitative study      | Kok Sonk , et al. 2009 | To identify the psychosocial and environmental factors that influence physical activity in a representative sample of Singaporean adolescents.                    | 1,814       | Physical activity was assessed using Three-Day Physical Activity Recall (3DPAR). Measures of physical activity self-efficacy, attitude towards physical activity, and social norms regarding physical activity were modeled on the measurement scales developed by Saunders and coworkers. | Physical activity, self-efficacy, attitudes, social norms.                      | Boys reported significantly higher mean MET scores than girls. Boys also scored significantly higher than girls on the self-efficacy and social norms scales. No significant gender differences were observed for the remaining variables. Of the four psychological variables entered, self-efficacy and enjoyment of physical activity emerged as significant independent predictors. It significantly increased the predictive power of the model (incremental $F(4, 887) = 10.91$ , $p < 0.0001$ ), accounting for an additional 4% of the variance in physical activity. |
| Population-based survey | Tina, et al. 2009      | To examine whether eating while watching television poses a risk for poor nutrition and excess body weight over and above that of time spent watching television. | 4966        | Grade 5 students participating in a comprehensive population-based survey in the Canadian province of Nova Scotia. Harvard's Youth Food  | Not stated but assumed to be Effect of eating while watching TV on body weight. | Eating supper while watching television negatively affected the consumption of fruits and vegetables and overall diet quality. More frequent supper while watching television was associated with more soft drink consumption, a higher percentage energy intake from sugar out of  |

## Lifestyle intervention

| Cross-sectional studies | Author              | Objective  | Sample size | Methods  | Outcomes  | Findings   |
|-------------------------|---------------------|--|-------------|--|---|--|
|                         |                     |  |             | Frequency Questionnaire, students' height and weight measurements, and a parent survey. validated 147-item instrument that is suitable for grade 5 students who are primarily 10 or 11 years of age. international BMI cut-off points established for children and adolescents.            |   | total energy from carbohydrate, a higher percentage energy intake from fat, and a higher percentage energy intake from snack food. These associations appeared independent of time children spent watching television. Both watching television and eating while watching television were positively and independently associated with overweight.   |
| Cross-sectional         | Storey, et al. 2009 | To assess the overall diet quality of a sample of adolescents living in Alberta, Canada, and evaluate whether diet quality, nutrient intakes, meal behaviours (i.e. meal skipping and consuming meals away from home) and physical activity are related. | 4936        | 7 to 10 <sup>th</sup> graders in Alberta, Canada.<br>Web-SPAN, a 24 h dietary recall was administered to students to measure weekday dietary intake.<br>Food Behaviour Questionnaire (FBQ), Self-efficacy and physical activity questionnaires<br>The 24 h dietary recall component of the | Not stated but assumed to be Diet quality, meal habits, physical activity relationship. | 42% (2073) of students had poor diet quality, 50% (2468) had averagediet quality and 8% (395) had superior diet quality. Among boys, 32% (1579), 56% (2764) and 12% (592) had poor, average and superior diet quality, respectively. Those with poor diet quality were consuming foods containing mostly sugar, high-salt/fat foods, high-calorie beverages and high-sugar/fat foods compared with both those with average diet quality as well as those with superior diet quality. |

## Lifestyle intervention

| Cross-sectional studies | Author             | Objective   | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|--------------------|---|-------------|---|--|---|
|                         |                    |   |             | FBQ has been validated and reliable.  |  | 57% (2913) had physical activity levels below a score of 3 (moderate activity), Boys had significantly higher physical activity levels (p,0001) than girls. |
| Survey                  | Wu, et al. 2009    | To describe the intention for healthy eating and its correlation among Southern Appalachian teens | 416         | Adolescents 14 to 16 years old. Eating behaviours-assessed with a statement about a healthy diet. The intention for healthy eating was assessed using the question "If you take the time to think about healthy eating, would you try to be a healthy eater during the next 2 weeks? using a 5-point Likert scale.<br><br>Sex, age, grade, race, self-reported weight, and height were also obtained through the questionnaire. All reliable instruments. | Not stated but assumed to be Intentions for healthy eating | About 30% of the adolescents surveyed had definite intentions and 34.6% were mostly intending to eat healthfully during the next 2 weeks.                   |
| Descriptive             | Zapata, et al 2008 | To obtain data on middle school students' physical activity and nutrition                         | 4452        | Nutrition, physical activity, health promotion, and Epidemiology experts  | Not stated but assumed to be Dietary behaviours,           | 22.8% (1002) of respondents reported consuming 5 or more fruits and vegetables per day and  |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective   | Sample size | Methods  | Outcomes   | Findings   |
|-------------------------|------------------------|---|-------------|--|--|--|
|                         |                        | knowledge and practices in the UK.  |             | developed content for the self-reported questionnaire which had 92 items. and readability was done by an expert. | nutrition knowledge<br>Physical activity and sedentary behaviours. | <p>differences by grade level was <math>p = .0001</math>.</p> <p>Soda- 26% (1157) drank 2 or more per day for past 7 days<br/>46.6% (2074) ate breakfast daily, and grade 6 ate more than other grades.</p> <p>Females attended more physical activity classes than males, <math>p = .0001</math>. 39.4% (1754) did physical activity after school and more among males. 49.4% (2199) watched television/played video games per day.</p> <p>17.8% (792) had good nutrition knowledge, 61.4% (2715) had poor and 20.8% (926) were not sure of the correct answer to questions. Physical activity knowledge, 31.2% (1429) of males and 22.5% (1001) of females had knowledge about physical activity. Difference in gender was <math>p &lt; 0.05</math>. Generally poor knowledge.</p> |
| Survey                  | Eun-suil , et al. 2008 | To investigate the nutrition and diet related knowledge and behaviours of | 439         | 206 boys and 203 girls, self-administered questionnaire with nutrition knowledge,                                | Nutrition knowledge, attitudes, BMI and diet behaviours            | Nutrition knowledge was low in males (6.79 point) and females (6.82 points). Females with high   |

## Lifestyle intervention

| Cross-sectional studies                    | Author                | Objective  | Sample size | Methods  | Outcomes   | Findings   |
|--|-----------------------|--|-------------|--|--|--|
|  |                       | elementary school children in the USA.   |             | attitudes and diet behaviour questions   |  | knowledge and proper attitudes had proper eating habits.   |
| Cross-sectional                            | Sluijs, et al. 2008   | To assess eating habits of adolescents.  | 926         | Food choice was assessed using an adapted version of the Health Behaviour in School Children (HBSC) questionnaire, a 15-item. Self-reported height and weight, SES.  | Not stated but assumed to be Eating habits, physical activity and BMI.                   | Females had high BMI than males<br>Diet-fruits and vegetables consumption were high in females (56.8%) and 49.9% in males. 18.4% males ate sweets than females (12.1). 16.1% males drank coke while 9.3% females did, 17.4% males ate cheese while 16.4% females did and 24.1% males ate crisps while 20.5% females did, 7.8% males ate French chips while 5.3% females did. Males ate unhealthy diets than females. |
| Not stated but assumed its cross-sectional | Sangperm, et al. 2008 | To predict healthy eating behaviour in Thai early adolescents using attitude, subjective norm, intention, and self-schema. | 191         | Students in grade 7, 8, and 9 in Bangkok Metropolitan area.<br>Three-day food-consumption diary to record the types and amounts of food taken by a participant during the period of this study. Intention was measured by the quantified responses | Not stated but Attitude, subjective norm, intention, and self-schema for healthy eating. | Intention scores ranged from 3-15 mean was 10.64 and SD 2.03.<br>TPB constructs and the self-schema were significantly correlated with each other ( <i>rs</i> value from .203 with .475, $p < .01$ ), but neither of them correlated with healthy eating behaviour ( $p > .05$ ).<br>Healthy eating behaviour in both the girl group and the boy group   |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|----------------------|--|-------------|--|---|---|
|                         |                      |  |             | to three statements regarding the participants motivation to eat healthily.<br><br>All reliable instruments.       |   | did not correlate with any of the other four variables.<br><br>Results from hierarchical multiple regressions revealed that subjective norm was the only significant predictor of healthy eating intention in all participants ( $p < .05$ ). Only in the girls group that attitude could predict healthy eating intention.   |
| Cross-sectional         | Péter, et al. 2008   | To investigate lifestyle of Hungarian adolescents: observation among metropolitan secondary school students aged 15- 19 years. | 1273        | Self –administered questionnaire on leisure activities, physical education, eating habits, knowledge of nutrition. | Leisure activities, physical education, eating habits, nutrition knowledge. | 955 (75%) lived a sedentary lifestyle, 636 (50%) take vitamin and minerals supplements, 25% (318) did not eat breakfast and 47.5% (605) smoked and 50% (636) were dissatisfied with their body weight.<br><br>More than ½ of the adolescents did not know how often they should eat during the day, 50% (636) have not heard of unsaturated fats, 30% (381) of dietary fibre, and 30% (381) about food pyramid. |
| Cross-sectional study   | Feldman, et al. 2007 | To examine associations between watching television during family meals and dietary intake among adolescents.                  | 4746        | Self-administered questionnaire. - Dietary intake, family meal frequency, and watching television during meals was | Television behaviour and family meal association, diet intake.              | 66.9% (3175) of adolescents reported eating regular family meals.<br><br>Among adolescents reporting eating regular family meals, 1587  |

## Lifestyle intervention

| Cross-sectional studies | Author             | Objective  | Sample size | Methods  | Outcomes                              | Findings  |
|-------------------------|--------------------|--|-------------|--|---------------------------------------|---|
|                         |                    |  |             | measured. Only dietary questionnaire was validated previously.   |                                       | (3.4%) reported watching TV during the family meal.<br><br>Family meal patterns and TV watching were similar among both genders. 36% (1708) of males and 31.4% (1490) females reported not eating regular family meals. Adolescents from higher SES reported more family meals without TV, and adolescents from middle to low SES reported more family meals with TV.   |
| Cross-sectional         | Funke, et al. 2007 | Investigate determinants of food choices in aged 10-19 years in Nigeria. | 401         | 32 schools sampled from local government schools in south-western Nigeria, pre-tested structured questionnaire containing food pictures. | Nutrition knowledge and Food choices. | NK was high but knowledge on home non-alcoholic beverages was low therefore had fair knowledge.<br><br>Foods perceived healthy-70% said rice, fruits, stewed beans, bread, the least choice was snacks. Healthy drinks were-water, milk, fruits juice. and chocolate drink. 70% from rural and 47% from urban preferred soft drinks though they said its unhealthy. 51% preferred to eat snacks though they said its unhealthy. |

## Lifestyle intervention

| Cross-sectional studies                    | Author               | Objective  | Sample size | Methods  | Outcomes  | Findings  |
|--|----------------------|--|-------------|--|---|---|
| Survey                                     | Bellisle et al. 2007 | To assess trends in food related behaviours and makers of activity/inactivity in French 9-11 years old children. | 1000        | 1993, 1995, 1997 surveys on food intake, nutrition attitudes and knowledge. standardised questionnaire containing socio-demographic, food related parameters, knowledge, physical activity questions was used.             | Food habits, knowledge, physical activity.          | Good nutrition on identifying healthy and unhealthy foods and in terms of terms used in nutrition such as calories, servings. Children were aware of the link between nutrition and diseases.   |
| Not stated but assumed its cross-sectional | Pearson, et al. 2007 | To identify correlates of healthy eating and physical activity among students in grades 6 to 12.                 | 700         | 92-item questionnaire eliciting religiosity, fruit and vegetables intake, physical activity, use of tobacco, alcohol and other drugs and sexual behaviour were used before but does not give details of reliability tests. | Correlates of healthy eating and physical activity. | Physical activity: exercise at least three times a week (72%), regularly do exercises to strengthen cardiovascular fitness (48%), and regularly do exercises to build muscular strength and endurance (63%).<br><br>Healthy eating habits: adequate vegetable intake (62%), adequate fruit intake (99%), and adequate dairy intake (98%). |
| Cross-sectional                            | Savige, et al. 2007  | This study aimed to evaluate the food intake patterns of adolescents with respect to the                         |             | 3841 secondary students in years seven (12-13 years) and nine (14-15 years) drawn from 37  | Food intake.  | Two-thirds of participants failed to consume foods from the five recommended food groups daily; over a third reported eating fruit 'rarely or never'; and 22%   |

## Lifestyle intervention

| Cross-sectional studies | Author              | Objective   | Sample size | Methods   | Outcomes                  | Findings   |
|-------------------------|---------------------|---|-------------|---|---------------------------|--|
|                         |                     | Australian Guide to Healthy Eating, and to examine variations in food intake patterns by age, gender and region of residence.                         |             | secondary schools in Victoria, Australia. Food Frequency Questionnaire (FFQ), and categorized according to the five basic food groups (fruit, vegetables, meat, dairy, cereal) and the 'extra' food group as defined by the Australian Guide to Healthy Eating (AGHE). The foods groups were examined in the study population and compared across age, gender and region. |                           | reported eating fast foods every day. Food intakes were generally more in line with dietary guidelines among girls than boys. Regional differences were less consistent, and there were few differences by age.  |
| Cross-sectional         | Savige, et al. 2007 | To examine context in which adolescents aged 12-15 years old snacks and whether contexts associate with SES and meal skipping in Victoria, Australia. | 3250        | Self-administered questionnaire containing questions on snacking and meal skipping. face validity done .  | Self –report food habits. | Snacking-was done 4 times per week, 75% (2437) snacked every day, 43% (1397) females and 39% (1267) males.<br><br>Meal skipping- 20% (650) skipped breakfast, 12% lunch and 2% (65) dinner. Females skipped breakfast than males. Snacking was associated with skipping breakfast. |

## Lifestyle intervention

| Cross-sectional studies | Author                | Objective  | Sample size | Methods   | Outcomes                            | Findings  |
|-------------------------|-----------------------|--|-------------|---|-------------------------------------|---|
| Not stated              | Kim, et al. 2007      | Hypothesis-determine whether self-concept, self-efficacy will mediate between social support and PA and eating habits. | 2938        | Adolescents from Busan, South Korea were selected from 7 districts.<br><br>Measurements-social support, self-concept, self-efficacy, PA and eating habits. All valid and reliable.  | Not stated.                         | Self-efficacy directly predicted PA and eating habits.  |
| Cross-sectional         | Te Velde, et al. 2007 | To describe gender differences in physical activity and sedentary behaviours and associated with overweight status.    | 12538       | Nine countries in Europe were selected. A questionnaire containing questions on physical activity behaviours and sedentary behaviours as recommended by American Academy of Paediatrics. Height and weight were reported by parents.<br><br>SES was determined by parental education. No validation stated. | Physical and sedentary behaviours.  | All countries reported more than two hours of watching television for both gender except in one country. More sedentary behaviours among boys though they were also more active than girls. Prevalence of overweight was ranged between 7.9-21.6% in all the 9 countries. |
| Cross-sectional         | Temple, et al. 2006   | To investigate the food consumption patterns of adolescents aged 12-16 years old at                                    | 476         | 7-10 <sup>th</sup> graders. questionnaire containing questions on eating habits, food brought to school,  | Eating habits, nutrition knowledge. | 77.8% had breakfast at home, 79.7% ate at school, 56% brought food to school, and 69.3% bought food at tuck-shop in school.   |

## Lifestyle intervention

| Cross-sectional studies | Author                        | Objective   | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|-------------------------------|---|-------------|---|--|---|
|                         |                               | schools in Cape Town.   |             | food purchases and breakfast consumption before school and knowledge in healthy and unhealthy foods previously used in Limpopo province among black children and in private schools in Cape Town.   |  | Generally students had good knowledge; 84% (400) knew healthy and unhealthy foods and 47 (224)-61% (290) knew foods that were less healthy. High SES students scored high marks in identifying healthy and unhealthy foods but were not likely to buy healthy foods $p < 0.001$ .   |
| Cross-sectional         | De Bourdeaudhuij, et al. 2006 | To investigate differences in correlates of vegetable intake between the normal weight and the overweight boys to explore whether the association between vegetable intake and potential correlates is different in overweight boys compared with normal weight boys in 11 years old in European countries. | 3960        | Validated self-report questionnaire was used to measure vegetable intake, and personal, social and environmental factors related to vegetable intake in the classroom. Weight and height were reported by the parents of the children test-retest reliability (Spearman $r$ from 0.45 to 0.77), and adequate validity correlations. | Not stated but assumed to be Correlates of vegetable intake. | Fruits intake-Liking, self-efficacy and bringing vegetables to school were related to intake in both normal weight and overweight boys ( $p > 0.10$ ). Active parental encouragement and availability at home was only related to intake in overweight boys ( $p > 0.10$ ), knowledge about the vegetable intake recommendations, liking vegetables a lot, general self-efficacy, modeling, and bringing vegetables to school showed the strongest associations with vegetable intake (Beta $> .10$ ).<br><br>Focusing on mediators such as increase in liking and preferences, increase in self-efficacy, and increase in bringing vegetables to school might result in higher |

## Lifestyle intervention

| Cross-sectional studies | Author             | Objective   | Sample size | Methods   | Outcomes  | Findings  |
|-------------------------|--------------------|---|-------------|---|---|---|
|                         |                    |   |             |   |   | vegetable consumption levels in normal weight and overweight boys.  |
| Cross-sectional         | O'Dea, et al. 2006 | To evaluate Socioeconomic status (SES) and other demographic variables, nutrition knowledge, self-efficacy and dietary locus of control in Australia. | 4441        | Face validity and reading level of the dietary self-efficacy, dietary locus of control, food frequency questionnaire was evaluated in 383 students aged 6-18 years. Pilot tested self-administered questionnaire was used. Cronbach alpha ranged between 0.75-0.89. | Socioeconomic status (SES), self-efficacy and dietary locus of control Nutrition knowledge. | <p>Overweight participants were 19% males and 16.8% females and obese males were 9% and 5.8% females., food variety mean was 17.92 and breakfast quality was 5.34. 43.2% of the participants ate cereals and milk at breakfast and 23.9% drank tea and soft drink, 21% ate bread. Males choose cereals for breakfast than girls (52% versus 41.7%). Low SES had high BMI <math>p&lt;0.001</math>, poor nutrition level <math>p&lt;0.001</math>, poor breakfast quality compared with other participants from middle and high SES. Self-efficacy was associated with SES and BMI <math>p&lt;0.001</math>, <math>r=0.06</math>.</p> <p>Self-efficacy for healthy eating was associated with eating variety of food but small association with BMI.</p> <p>Predictor of BMI were age <math>p&lt;0.001</math>, <math>R=0.45</math>, nutrition knowledge <math>r=0.48</math>, <math>p&lt;0.001</math>, self-efficacy <math>r=0.07</math>, <math>p&lt;0.001</math>.</p> |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective   | Sample size | Methods  | Outcomes                                  | Findings  |
|-------------------------|------------------------|---|-------------|--|---|---|
|                         |                        |   |             |  |   | Low SES boys had significantly greater BMI ( $P < 0.01$ ), poorer nutritional knowledge ( $P < 0.01$ , with the middle/high SES boys. Low SES girls had significantly greater BMI ( $P < 0.01$ ), poorer nutritional knowledge ( $P < 0.001$ ) and poorer self-efficacy ( $P < 0.001$ ).  |
| Cross-sectional study   | Howard, et al. 2005    | To investigate the role of snacks in the adolescent aged 11-14 years old' diet in relation to recommendations.  | 28          | Food intake recorded using diaries and computer package CompEat. No validity nor reliability,  | Snacking.                                 | Adolescents mostly ate snacks and it is assumed that they get a lot of all their nutrients from snacks. However those that consumed them had high levels of fat than those who were not. Preferred snacks were high in sugar and fat. According to preference priority of snacks was: sweets, crisps, biscuits, fruits, cereal bars, toast, surprisingly olives were eaten. |
| Cross-sectional study   | Al-Almaie, et al. 2005 | To determine the level and sources of knowledge about foods and healthy diets among male and female adolescents of third intermediate grades and all three grades | 2645        | (1240 males. And 1331 females). Self-administered questionnaire with questions on knowledge of dietary. Fats, cholesterol, dangers of high-cholesterol-containing foods, examples of | Sources and level of nutrition knowledge. | Males did not know what type of fat in food is healthy (saturated versus unsaturated), 65.3% (1727) of females and 51.1% (1351) males answered unsaturated fats 10% (264) of the males and 8% (211) of females considered saturated fats as healthy food items. More female (66%, 1745) than male (49%, 1296) students  |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective  | Sample size | Methods   | Outcomes  | Findings  |
|-------------------------|----------------------|--|-------------|---|---|---|
|                         |                      | of secondary schools.  |             | high-cholesterol containing foods, dangers of obesity, benefits of fiber-rich diets on human health and examples of fiber-rich diets. Pilot study done and questions amended.   |   | correctly defined cholesterol as a type of saturated fat or animal fat ( $P < 0.00001$ ). Females had better knowledge about the dangers of obesity (12% versus 7.5%, $P = 0.0001$ ) but not on the benefits of fibre-rich diets (3.9% of the males compared with 2.1% for the females, $P = 0.006$ ). Both genders had inadequate nutrition knowledge about types of healthy fats in food. Generally poor knowledge.   |
| Cross-sectional survey. | Martens, et al. 2005 | To investigate the relative importance of personal and social environmental predictors of the consumption of fruit, high-fat snacks and breakfast. | 204         | 14-14 years old in Netherlands. Separate questionnaires were developed for each of the three types of risk behaviour: consumption of fruit, intake of high-fat snacks and breakfast habits. Intention was assessed with one item on plans to change the behaviour in the next 6 months. Attitude was assessed by means of 12 to 14 items and personal | Not stated but assumed to be Consumption and predictors of the consumption of fruit, high-fat snacks and breakfast. | Favorite fruits were apples, bananas, pears and oranges. 76% ate 2 serving of fruits daily.<br>Frequently drank fake fruit beverages, such as soft drinks with fruit taste, lemonade and yogurt drinks with a fruit taste deemed to be fruit juice.<br>Self-efficacy towards eating fruit were positive.<br>High fat snacks on 2.4 (SD 1.3) days a week. (63%) consume fried snacks and nuts/potato chips most often at home, compared with at school (2%), elsewhere (14%) or varying (21%). Snacks were |

## Lifestyle intervention

| Cross-sectional studies                | Author           | Objective  | Sample size | Methods   | Outcomes                                      | Findings  |
|--|------------------|--|-------------|---|---|---|
|  |                  |  |             | data. All validated and reliable.   |   | mainly eaten in the evening (67%). Fewer afternoons (33%).<br><br>Pastries, candy bars or cookies were most often eaten at home (52%), compared with at school (36%) or elsewhere (12%).<br><br>80% never had breakfast and 50% eat breakfast every day at home (87%), some reported to eat breakfast at school (9%), or on the way to school (2%), or elsewhere (2%). Self-efficacy towards having breakfast were positive.        |
| Descriptive survey                     | Hamilton, 2005   | To assess Sylvania public high school students' knowledge and understanding of diet choices as they relate to heart disease. | 1081        | Anonymous questionnaire contained questions on about demographic data and general knowledge of heart disease, dietary choices, and understanding of how dietary choices influence cardiac health. | Knowledge of diet choices and heart diseases. | 76.5% (827) identified link between diet choices and heart disease, though less than half of the participants could not identify bad fats, food groups with high saturated fats, omega-3 containing food, choose protein as food that can reduce cholesterol, and soluble fibre, however 58.2% (629) identified that high salt diet increase the risk of heart problems and 67.4% (729) identified food groups that contains sugar. |
| Cross-sectional, cluster design survey | Shi, et al. 2005 | To identify the differences in food habits and   | 824         | A self-administered food frequency questionnaire  | Food habits and food preferences per SES.     | Meal patterns- 76% (626) had 3 meals a day. Among those who stay at home 50% (412) ate  |

## Lifestyle intervention

| Cross-sectional studies | Author | Objective  | Sample size | Methods  | Outcomes | Findings  |
|-------------------------|--------|--|-------------|--|----------|---|
|                         |        | <p>preferences among the adolescents aged 12-14 years old according to socio-demographic Characteristics in China.</p> |             | <p>containing questions on food and meal frequencies, food preferences and socio-demographic characteristics questionnaires were validated and reliable in adult population.</p> |          | <p>breakfast at home, 90% (741) ate dinner with parents and 10% (82) with grandparents. 53% (436) snacked while watching television. Snacks eaten were crisps, soft drinks, seeds and snacking was associated with SES <math>p &lt; 0.001</math>. 60% (494) drank milk daily, 74% (609) ate vegetables daily 42% (346) males and 55% (453) females ate fruits daily. Consumption of fast foods and soft drinks was associated with SES. Eating of soft porridge was more in low SES group.</p> <p>Grouping of food into 5 scores- females ate more fruits and vegetables than males who ate animal food frequently.</p> <p>Food preferences-hamburger, soft drinks, milk, yogurt, ice cream were consumed daily. Low SES was associated with preferences of ice cream, High SES was associated with soft drinks. Males preferred unhealthy diets than females. 60% (494) made decision on what to eat while the rest did not. SES was a determinant of food scores while gender a</p> |

## Lifestyle intervention

| Cross-sectional studies | Author              | Objective  | Sample size | Methods   | Outcomes        | Findings  |
|-------------------------|---------------------|--|-------------|---|-----------------|---|
|                         |                     |  |             |   |                 | determinant of fruits and vegetable intake.   |
| Cross-sectional-survey  | Parvin, et al. 2005 | To determine nutritional behaviours of Tehran adolescents. | 7699        | Validated food frequency and knowledge, attitudes and practice questionnaires used Cronbach's alpha 0.70. | Diet behaviours | <p>Mean age 14 years SD 1, mean BMI 27.2 kg/m<sup>2</sup> SD 11,</p> <p>Females ate more saturated fats than boys. Crisps, cream wafers and sweet snacks were commonly eaten snacks.</p> <p>There was weak correlation between nutrition knowledge and behaviours. There was significant difference between females and males <math>p &lt; 0.001</math>. Correlation between nutrition knowledge and SES was <math>p &lt; 0.001</math>.</p> <p>Mean knowledge was 30, SD 3.8. Knowledge scores- 4% (307) boys had poor score, 11.4% (885) had fair score, 34% (2622) good score, and 2% (153) girls got poor score, 7.7% (593) had fair score, 34.6% (2664) got good score.</p> <p>36% (2771) of the Participants did not know that sweets and candy may increase weight, and 85% (6544) knew that soft drinks lead to overweight or obesity and 56% (4311) did not know fish oil. 85% (6544) knew that crisps and corn</p> |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective  | Sample size | Methods  | Outcomes                                 | Findings  |
|-------------------------|------------------------|--|-------------|--|--|---|
|                         |                        |  |             |  |  | ball are unhealthy yet 45% (3464) used them. 75% (5774) females had good nutrition knowledge than males (25%, 1924). There was correlation between SES and nutrition knowledge and there was significant difference between boys and girls 'nutrition knowledge (p<0.001).  |
| Cross-sectional         | Triches, et al. 2005   | To evaluate the association between obesity and eating habits and nutrition knowledge of children aged 8-10 year old in Brazil | 607         | Questions from questionnaire evaluated by experts and pilot tested.                          | BMI, eating habits, nutrition knowledge. | 84% (510) were from low SES. Eating habits were associated with nutrition knowledge p<0.05. Healthy eating was associated with nutrition knowledge.<br><br>90.8% (551) knew answers to questions on sources of vitamins and minerals, 24.4% (148) knew healthier foods, 19% (115) knew foods rich in fats, 4.9% (29) knew foods that supply energy. more nutrition knowledge among obese participants was high. |
| Cross-sectional Survey  | Vereecken, et al. 2004 | To describe food habits in adolescents in thirty-five countries and regions (European countries/regions, Israel, Canada and    | 162 305     | Students were asked how many times a week they usually eat or drink the selected food items. | Food habits.                             | The lowest weekly fruit consumption frequency was found in Greenland. Spain, Italy, Greece and Portugal and Malta had the lowest average vegetable consumption.   |

## Lifestyle intervention

| Cross-sectional studies | Author            | Objective   | Sample size | Methods   | Outcomes          | Findings  |
|-------------------------|-------------------|---|-------------|---|-------------------|---|
|                         |                   | the USA), based on the food-frequency questions from the cross-sectional Health Behaviour in School-aged Children (11, 13 or 15 years old) survey of the year 2001-2. |             |   |                   | <p>The highest consumption frequencies of soft drinks were in Great Britain (Scotland, Wales, and England), Israel, the Netherlands, the USA, Slovenia, Belgium and Ireland.</p> <p>The highest consumption frequencies of sweets are found in Ireland and Scotland.</p> <p>Highest consumption frequencies of light soft drinks was found in countries that also have a high consumption frequency of regular soft drinks Belgium, Ireland and Israel, while the lowest consumption frequencies was found in Estonia. In Estonia about 10% consume crisps, and up to 39% in Ireland. The lowest consumption frequency of chips is found in Belgium (Flemish) and in the USA, where fried potatoes are served as vegetables. Ireland, Greece and Israel more than 20% consume chips on 5 times / week</p> |
| Cross-sectional         | Cooke, et al.2005 | To examine the developmental patterns of food preferences in a large sample of  | 1291        | Three (3) primary and three (3) secondary schools. Food frequency questionnaire | Food preferences. | 98% (1265) foods were liked by children. Food preferences increase with age $p<0.05$ and younger males disliked more foods than females $p<0.05$ . The  |

## Lifestyle intervention

| Cross-sectional studies | Author                   | Objective   | Sample size | Methods   | Outcomes   | Findings   |
|-------------------------|--------------------------|---|-------------|---|--|--|
|                         |                          | British school children aged 4-16 years old and to investigate possible gender differences. |             | containing 115 items of food preferences was used. It was validated before by parents for young children. |  | <p>ten most liked foods were; chocolate, pizza, ice cream, pasta, strawberries, biscuits, ice lollies, grapes, cake, fruit sweets. The ten lowest ranked foods were spinach, leeks, sprouts, meat, meat substitutes, soya, and liver.</p> <p>Fat and sugar were the most liked followed by fruits, starch, meat, eggs, fish, vegetables, fruits and dairy products. Fruits and vegetables preferences was high in females than males <math>p &lt; 0.05</math>. Fat and sugar were liked by males <math>p &lt; 0.05</math>.</p> |
| Epidemiological survey  | Yannakoulia, et al. 2004 | To investigate nutritional related habits of Greek adolescents.                             | 4211        | Self-administered questionnaire and self-reported weight and height.                                      | Eating habits, physical activity and sedentary behaviours. | <p>Soda, sweets, chocolate and coffee were consumed daily. 47% (1979) were drinking soda daily. Food preferences were lower in females as compared to males, <math>p &lt; 0.001</math>. 92.8% (3908) consumed less fruits and 76.3% (3212) consumed fewer vegetables daily.</p> <p>Physical activity behaviour- 50.7% (2135) females were active and 74.1% (3120) males were active.</p> <p>Sedentary behaviours- 7.3% (307) watched for 30 minutes a day, 27.8% (1171) for 30-1 hour,</p>                                     |

## Lifestyle intervention

| Cross-sectional studies | Author                  | Objective  | Sample size | Methods   | Outcomes   | Findings  |
|-------------------------|-------------------------|--|-------------|---|--|---|
|                         |                         |  |             |   |  | 39.1% (1647) for 2-3 hours and 25.6% (1078) for more than 4 hours per day.  |
| Cross-sectional         | Hassapidou, et al. 2001 | To assess the dietary intakes and food habits of adolescents aged 11-14 years old in Northern Greece.                | 582         | A questionnaire regarding personal characteristics (age, parental occupation, etc.) and issues related to their eating habits and knowledge; a weekly food frequency questionnaires 3-day weighed dietary diary and a 24-hour recall questionnaires were used. Reliability was tested but values not stated | Diet intake, food habits, BMI, triceps skinfolds thickness (TST)   | Males- 29% (168) were overweight (85 <sup>th</sup> percentile), 20% (116) were classified as obese (90 <sup>th</sup> percentile) and 9% (52) were super obese (95 <sup>th</sup> percentile), Females-13.6% (75) were overweight, only 7.9% (46) were classified as obese and 2.9% (17) as super obese.<br><br>43% (250) females ate fat compared to 40% (232) males. Weekly intake of carbohydrate was higher in males and they had a statistically higher consumption of sausages ( $P < 0.05$ ), eggs ( $P < 0.01$ ), bread ( $P < 0.01$ ), milk ( $P < 0.01$ ), sugar ( $P < 0.01$ ), honey ( $P < 0.01$ ), sweets ( $P < 0.01$ ) and soft drinks ( $P < 0.05$ ) when compared to females. |
| Cross-sectional study   | French, et al. 2001     | To examine demographic, behavioural and dietary correlates of frequency of fast food restaurant use among adolescent | 4746        | Minnesota, United States. Height and body weight were measured questionnaires containing questions on Frequency of fast   | Not stated but assumed to be Dietary behaviours, and demographics. | 75% (3559) of students reported eating at a fast food restaurant during the past week. 24.8% (1139) of females from low SES reported visiting a fast food restaurant three or more times during the past week compared  |

## Lifestyle intervention

| Cross-sectional studies | Author          | Objective  | Sample size | Methods   | Outcomes                                  | Findings   |
|-------------------------|-----------------|--|-------------|---|---|--|
|                         |                 | students in grade 7-12   |             | <p>food restaurant use (FFFRU), demographics, perceived barriers and benefits of healthy diet, healthy eating self-efficacy, weight concerns, physical activity and inactivity with cronbach alpha ranging between 0.71-0.83 was used.</p> <p>SAS was used to analyze data-mixed models regression, logistic regression and bivariate correlations.</p> |   | <p>with females of high SES (17.5%), <math>P &lt; 0.0001</math>.</p> <p>Among both females and males, significant positive associations were observed between FFFRU and high-fat, high-sugar food choices such as soft drinks, French fries and cheeseburgers.</p> <p>Females who reported eating at a fast food restaurant three or more times during the past week reported 45% greater soft drink consumption, 100% greater cheeseburger consumption and 60% greater French fries consumption; 23% less fruit consumption, 29% less vegetable consumption, and 21% less milk consumption.</p> |
| Cross-sectional         | Pirouznia, 2001 | To examine the correlation of nutrition knowledge and eating behaviour of a sample of middle school children in Lima, Ohio, USA. | 532         | Students in the 6 <sup>th</sup> , 7 <sup>th</sup> , and 8 <sup>th</sup> grades between the ages of 11 and 13. CANKAP (Comprehensive Assessment of Nutrition Knowledge, Attitudes, and Practices) self-administered questionnaire was  | Nutrition knowledge and eating behaviour. | <p>The overall mean score on knowledge questions were 11.5 for 6<sup>th</sup> graders, 11.80 for 7<sup>th</sup> grader students and 11.5 for 8<sup>th</sup> grader students.</p> <p>There was no statistical association between 6<sup>th</sup> grade boys and girls but there was between 7-8<sup>th</sup> graders, There was no correlation between nutrition knowledge and eating behaviour</p>   |

## Lifestyle intervention

| Cross-sectional studies | Author                 | Objective   | Sample size  | Methods   | Outcomes                           | Findings   |
|-------------------------|------------------------|---|--|---|------------------------------------|--|
|                         |                        |   |  | used. Content validity checked by the researchers, nutritionists and food science, educationists, and human developmental professionals. Level of readability checked by reading specialist.. Reliability- Cronbach's alpha reliability coefficient of 0.70.  |                                    | of 6 <sup>th</sup> grader, but there was among 7-8 <sup>th</sup> graders. Generally poor knowledge.  |
| Cross-sectional         | Frobisher, et al. 2001 | To assess the attitudes and the level of nutritional knowledge of a group of 11-12 year olds in European cities | England 541, Northern Ireland 128, Sweden 87, Lithuania 50 | Questionnaire was previously used to test attitudes and knowledge of nutrition (7 questions) and healthy eating (14 questions) and pilot tested in school children. Face validity by specialists in home economics, education and nutrition. The repeatability was assessed in 37 adolescents. Reliability test -three weeks apart. | Attitudes and nutrition knowledge. | Poor knowledge on fat, carbohydrates and dietary fiber, and good knowledge of fruit and vegetables, breakfast cereals and salt. The mean of theoretical knowledge scores from England and the practical score from Lithuania were significantly higher than those from the other countries (p<0.05). Knowledge appears not always to provide them with the means of making healthy eating choices. |

## Lifestyle intervention

| Cross-sectional studies                         | Author                | Objective  | Sample size | Methods  | Outcomes   | Findings   |
|---|-----------------------|--|-------------|--|--|--|
| Not stated but it seems it's a cross-sectional; | Cavadini, et al. 2000 | To describe food habits and dietary intakes of athletic and non-athletic adolescents in Switzerland. | 3540        | Self-reported anonymous questionnaire to assess lifestyles, physical plus sports activity and food habits. 246 subjects aged $11 \pm 15$ also participated in an in-depth ancillary study including a 3 day dietary record completed by an interview with a dietician. No validity nor reliability stated. | Not stated but assumed to be food habits and dietary intake. | <p>69% of boys and 48% of girls from grade 8 report engaging in sports activity at least <math>2 \pm 3</math> times a week; only 56% of boys and 38% of girls at grade <math>10 \pm 11</math>.</p> <p>95% of the participants report eating breakfast daily. The most frequent content of this meal is bread and cereals, which are consumed by <math>50 \pm 70\%</math> then 45-65%, eat milk, 25% drink fruits juice and eat yogurt and fruits all of with a decreasing trend with age.</p> <p>90% of adolescents consume a hot meal at lunch until 15 y. Among older adolescents, this proportion falls to 45% in girls and 70% in boys. 70% of girls and 80% of boys consume a hot dinner. Snacks are regularly consumed. 68% of adolescents consume a morning snack. The proportion of consumers reaches <math>80 \pm 90\%</math> during the afternoon and falls to between 45 and 65% during the evening. Only 50% of girls and 30% of boys eat fruit daily. Consumption of vegetables, daily, is still lower: 20% of girls and 10% of boys.</p> |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective  | Sample size         | Methods  | Outcomes                             | Findings   |
|-------------------------|----------------------|--|---------------------|--|--------------------------------------|--|
| Cross-sectional         | Allison, et al. 1999 | To determine if self-efficacy is positively related to participation in 3 settings of physical education, other school activity and out of school activity | 1041                | 9-11 graders in Toronto. Modified measures from Campbell's survey and the U.S. National Adolescent Student Health Survey were used in the current study. 20-item scale of self-efficacy in relation to overcoming perceived barriers to vigorous physical activity was used. The items are adapted versions of previously validated. | Physical activity and self-efficacy. | Physical activity mean values for outside school was high 2.9 SD 2.2 compared with physical education classes 2.2 SD 1.7 and school activity mean value was 1.5 SD 1.9. Self-efficacy was positively related to physical activity mostly school activity $r=.22$ and out of school $r=.28$ . Females participated less as compared to males. Age negatively correlated to vigorous physical activity. Older children less likely to participate in physical activity as compared to young children and females less likely to do physical activity than males. |
| Cross-sectional         | Diehl, et al. 1999   | To determine food preferences of adolescents.  | 537 girls, 696 boys | Questionnaire contained a list of 114 foods and 14 beverages.<br><br>Factor analysis and frequency of food preferences was determined.   | Food preferences.                    | Highest food preferred were pizza, ice cream, pasta, French fries, hamburgers, pudding, cornflakes, popcorn. Food disliked were cabbage, canned fish, liver.<br><br>The highest foods liked were fast foods, candy, salty snacks, but fruits and vegetables were ranked low. In boys preferences were fast foods, meat, nuts, fish while girls preferred fruits and vegetables,  |

## Lifestyle intervention

| Cross-sectional studies | Author               | Objective   | Sample size | Methods  | Outcomes                             | Findings  |
|-------------------------|----------------------|---|-------------|--|--------------------------------------|---|
|                         |                      |   |             |  |                                      | and cheese. BMI was not related to food preferences or SES.   |
| Cross-sectional         | Thakur, et al. 1999  | To describe nutrition knowledge and obesity in adolescence aged 14-18 years in USA.     | 258         | Students in high schools in urban areas. Pilot tested questionnaire contained- food-related behaviours, food preferences was used, height and weight reported by students. | Nutrition knowledges                 | <p>Students had poor nutrition knowledge; 28% (72) incorrectly chose pop as a food high in fat calories. 31% (80) did not know that peanut butter is a food high in fat. 75% (193) of the students were unaware of the daily recommended fruits and vegetables intake, they thought only 2–3 servings while actually its 5 servings.</p> <p>There was no difference in response about other food items between obesity and non-obesity group except for fibre diet, whereby only 31% (91) of obese and 19 % (55) of non-obese answered the question on fibre correctly <math>P=.033</math>. There was no significant difference between obese and non-obese in terms of nutrition knowledge and their eating behaviour.</p> |
| Survey                  | Johnson, et al. 1997 | To describe eating habits and sedentary behaviours of adolescents aged 11-14 years old. | 707         | 24 hour recall computerised questionnaire was used to probe for lifestyle habits.  | Eating habits, sedentary behaviours. | Participants ate less milk, sugar and fibre cereals. Boys ate more chips and 20% (141) did not eat breakfast. Younger girls also skipped breakfast than older ones.   |

## Lifestyle intervention

| Cross-sectional studies | Author              | Objective   | Sample size | Methods  | Outcomes  | Findings  |
|-------------------------|---------------------|---|-------------|--|---|---|
|                         |                     |   |             | Sedentary behaviours -question on playing Television game/video/sports were asked. Nothing stated on reliability of the questionnaires.  |   | Few participants ate school lunch. Both boys and girls ate snacks five (5) times during the survey day.<br><br>Boys of all ages indicated to be taking part in sports than girls though small difference. Younger girls were the least active.  |
| Survey                  | Gracey, et al. 1996 | To determine nutritional knowledge and behaviours including stage of change; health beliefs and values; barriers to change; self-efficacy; locus of control; dietary patterns, weight, height and body image among 15-16 year olds from Perth, Australia. | 480         | Self-administered questionnaire- Self-report of age, weight and height, seven items on stages of behaviour change, 18 items on each of health belief and values, 18 items on self-efficacy, five items on locus of control, 16 items on barriers to change, and seven items on eating patterns all reliable instruments<br><br>Fatty foods, water and soft drinks was determined using a 16-item questionnaire; the variety of foods | Self-efficacy and barriers to change behaviours, BMI. | Eating habits-boys ate more fat than girls, $p<0.000$ . Soda and water was drank by girls more than boys $p<0.03$ . 81.6% and 83.8% drank more soft drinks per week in each school respectively.<br><br>Television was watched more by participants from private school. Television viewing was correlated with nutrition knowledge negatively $r=-0.117$ .<br><br>All respondents had normal BMI.<br><br>Self-efficacy was high in girls than boys, and it was strongly related to healthy eating.<br><br>65% (312) of the participants scored well in all nutrition questions except for fat questions.<br><br>22% of students believed that white bread rather than meat |

## Lifestyle intervention

| Cross-sectional studies | Author | Objective | Sample size | Methods   | Outcomes | Findings  |
|-------------------------|--------|-----------|-------------|---|----------|---|
|                         |        |           |             | eaten was determined using an 22 items.<br>Questionnaires tested for reliability. |          | contained no fiber, 22% considered that boiled sweets rather than margarine were high in fat, 42% thought a ham and cheese sandwich was low in fat, and 25% thought bread and polony was lower in fat than a baked potato and baked beans. Nutrition knowledge not related to eating patterns Generally good knowledge. |

| Literature review | Authors           | Objectives   | Sampla size | Methods   | Outcomes  | Findings  |
|-------------------|-------------------|--|-------------|---|---|---|
| Literature review | Coon, et al. 2001 | To summarize results of studies published in peer review journals since 1970 with data pertaining to the relationship between television use and children's food intake. | Not stated. | Studies fall into four categories: content analyses; effects of television advertising on children's food behaviours; television and pediatric obesity, with effects on children's dietary intake and physical activity; and television use and children's food consumption patterns. | Relationship between television use and children's food intake. | Food is the most frequently advertised product on children's TV and majority of these adverts promote sweetened products, and fast food meal.<br><br>Therefore children exposed to this adverts choose advertised food products at significantly higher rates than do those not exposed. The more the number of hours spent on watching television the more the number of requests from the child to the mother for specific food items, as well as the |

## Lifestyle intervention

| Literature review | Authors             | Objectives   | Sampla size                  | Methods  | Outcomes                        | Findings  |
|-------------------|---------------------|--|------------------------------|--|---------------------------------|---|
|                   |                     |  |                              |  |                                 | presence of those items in the home. The more one is exposed to TV for long time the higher the intakes of energy, fat, sweet and salty snacks, and carbonated beverages and lower intakes of fruit and vegetables. Long hours of watching TV is associated to both the prevalence and incidence of obesity.  |
| Literature review | Taylor, et al. 2005 | To state knowledge and research gaps in the area of determinants of healthy eating among children and youth. | Number of papers not stated. | Health-Relevant data bases were searched for papers published between January 1992 and March 2003 that focussed on children or youth and reported at least one factor relevant to healthy eating. Among collective factors, familial factors and the nature of foods available in the physical environment, including at home, schools and in fast-food establishments, stand out as significant influences on healthy | Determinants of healthy eating. | <p>The media, particularly television. Individual factors identified include knowledge, attitudes and food preferences (the strong determinant of healthy eating in both children and adolescents).</p> <p>Low nutrition knowledge levels among children and adolescents generally, weak understanding of the connection between food choice, physical activity, and health. Level of knowledge does not always influence dietary behaviour, inconsistent findings may reflect past methodological problems or the inter-relation between knowledge and other determinants, which may make independent effects difficult to assess.</p> |

## Lifestyle intervention

| Literature review        | Authors                | Objectives   | Sampla size | Methods   | Outcomes   | Findings   |
|--------------------------|------------------------|--|-------------|---|--|--|
|                          |                        |  |             | eating in children and youth.   |  |  |
| Review of the literature | Rasmussen, et al. 2006 | To review literature for potential determinants of fruit and vegetable intake in children and adolescents. | 98 papers   | Quantitative research examining determinants of fruit and/or vegetable intake among children and adolescents aged 6–18 years were included. | Potential determinants of fruits and vegetables.       | Determinants - age, gender, socio-economic position, preferences, parental intake, and home availability/accessibility. Girls and younger children tend to have a higher or more frequent intake than boys and older children. Socio-economic position, preferences, parental intake, and home availability/accessibility are all consistently positively associated with intake.  |
| Literature review        | Fruh, 2011             | To review literature on the surprising benefits of family meals.   | Not stated. | Not stated.   | Not stated but assumed to be benefits of family meals. | Decline in family meal since 1966. Benefits-: enhanced vocabulary, academic success, healthy food selections, demonstration of positive values, and avoidance of high-risk behaviours (substance abuse, sexual activity, depression/suicide, violence, school problems, binge eating/purging, and excessive weight loss).<br><br>Another benefit of family meals is family connectedness. Younger children benefit from the routine of family meals, which creates a |

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| Literature review | Authors | Objectives | Sampla size | Methods | Outcomes | Findings   |
|-------------------|---------|------------|-------------|---------|----------|--|
|                   |         |            |             |         |          | <p>sense of belonging and emotional security.</p> <p>Family meal frequency may prevent high-risk behaviours among youth. Children who enjoy frequent family meals are less likely to smoke, drink, or use drugs.</p> |

| Qualitative studies | Authors                       | Objectives   | Sample size | Methods  | Outcomes                     | Findings   |
|---------------------|-------------------------------|--|-------------|--|------------------------------|--|
| Qualitative Survey  | Neumark-sztainer, et al. 1999 | To assess adolescents' (7-10 <sup>th</sup> grade) perception about factors influencing their food choices and eating behaviours. | 141         | Focus groups with semi-structured interviews audiotaped, and interview for an hour. Qualitative analysis with themes was done. | Food choices and behaviours. | <p>Influence of food choices- craving, hunger, appeal of food, time, convenience of food, food availability, and parental influence, benefits of foods, mood, body image, cost, media, culture, and vegetarian beliefs.</p> <p>Factors perceived most important- primarily; appeal and taste of food, time and convenience.</p> <p>Secondarily importance- availability, perceived benefits, parental influence.</p> |

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| Qualitative studies                          | Authors           | Objectives  | Sample size | Methods   | Outcomes  | Findings  |
|--|-------------------|---|-------------|---|---|---|
|  |                   |   |             |   |   | Less important factors-body image, habit, media, vegetarian lifestyle   |
| Not stated but seem like a Qualitative study | Berg, et al. 2002 | To investigate dietary knowledge and beliefs of adolescents aged 11-15 years old, in relationship to breakfast choices, with specific attention to fat and fibre content in Sweden. | 181         | Food choices studied using stacking box methodology. Interviews for 30 minutes recorded manually and taped. | Beliefs, knowledge on fibre and fat, and breakfast choices. | 108 (59.7%) 6 <sup>th</sup> did not know healthy breakfast, low fat and high fibre, but grade 7 & 9 knew.<br><br>Those who considered fat to be important for the body selected milk as their choice of source of fat. Knowledge about sources and health attributes of dietary fibre was associated with usual consumption of bread and breakfast rich in fibre. No association was found between food choices and knowledge. Generally poor knowledge |

## **2.3 Discussion of the hierarchy of evidence of studies on adolescents' eating habits, physical activity (PA) behaviour, nutrition knowledge and intentions and self-efficacy for healthy eating**

### **2.3.1 Information (nutrition knowledge)**

Information is a prerequisite for behaviour change.<sup>43</sup> An individual may not change their behaviour unless they are equipped with factual information.<sup>17</sup> Knowledge is the application of information learned<sup>44</sup> therefore to determine if an individual is informed, the level of knowledge has to be tested. Knowledge is defined as being aware of things and processes (declarative knowledge) and knowing how to choose one thing over the other (procedural knowledge). Nutrition knowledge is knowledge of nutrition.<sup>45</sup>

One of the developmental tasks of adolescence is to make right choices regarding health. Adolescents are faced with life challenges that require them to make health decisions in the absence of their parents and teachers or health professionals.<sup>44</sup> Therefore they need to be equipped with factual information about a healthy lifestyle in order to make the correct health-related decisions. However, it is not yet conclusively known globally if adolescents have adequate nutrition knowledge (NK) to effect eating behaviour change because of different methodologies and inconsistencies in the results.<sup>46 47</sup>

Out of the 13 systematic reviews on school-based interventions in adolescents, only one reported the effect of nutrition education on knowledge of participants. In this review, seven out of nine published studies reported positive effects on nutrition knowledge.<sup>48</sup>

Forty-three reviewed published studies investigated level of NK among adolescents: seven were randomised controlled trials (RCTs) (intervention studies), one was a matched pair study, two were literature reviews, 23 were cross-sectional studies, seven were surveys, one a comparative cross-sectional study, one employed a triangulation method, and one was a qualitative study. Three studies evaluated level of NK of food nutrients, food contents, recommended daily intake of fruit and vegetables, healthy and unhealthy foods, benefits of

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foods and nutrition-related health problems.<sup>44 49</sup> Of the 43 studies, 14 evaluated NK in the above-mentioned components individually<sup>46 47 50-62</sup> and other studies required the participants to identify healthy and unhealthy foods<sup>52 63-68</sup> while one study evaluated knowledge on benefits of fruit and vegetables only.<sup>69</sup> Six RCT studies evaluated the effectiveness of school-based interventions on nutrition knowledge.<sup>70-74</sup> The results from these studies showed a positive effect on behaviour change.

Of the 43 studies, 19 revealed that adolescents had good NK although very few had excellent NK<sup>46 51 54 59 62 64 67 69 75-81</sup> and 14 revealed that adolescents had inadequate NK.<sup>47 49 50 52 55 56 61 63 65 77 81-83</sup>

Nutrition knowledge correlates were reported in some of the published studies. NK was reportedly higher among females<sup>64 75 81 82</sup> and those with a high socioeconomic status and it increased with age and parental knowledge.<sup>75</sup> NK level did not correlate with eating behaviour<sup>49 82 83</sup> although it correlated with food choices<sup>65 81 82</sup> and with several food items.<sup>84</sup> There was no association between BMI and NK.<sup>50 75</sup>

Nutrition knowledge has been studied mostly in the developed countries. However, no prior published studies were located in the literature that evaluated the level of nutrition knowledge (NK) of 13-15 year old adolescents in junior secondary schools in Botswana. Although there is variability in characteristics of the questionnaires used, sample size, adolescent age categories, theories guiding the studies and research quality, in one systematic review that evaluated nutrition knowledge, findings revealed that adolescents had inadequate nutritional knowledge but it was acknowledged that more research is needed to evaluate the adolescents' knowledge of nutrients, nutrition and practical knowledge.<sup>45</sup> However RCTs have shown that nutrition education changes the level of nutrition knowledge. A gap in the literature is that not all authors reported on validity or reliability of the questionnaires used.

### **2.3.2 Information (physical activity knowledge)**

Physical activity knowledge is the ability to appreciate what it entails and its benefits.<sup>85 86</sup> Few studies were located in the published literature that explored physical activity knowledge<sup>44 54 61</sup> and no published studies were located in the literature from Botswana. Adolescents in South Africa had inadequate knowledge about physical activity (62% of 485);<sup>61</sup> in Portugal this was 66.2%.<sup>44</sup> However, in one study conducted in Mexico, adolescents knew what PA is and its benefits.<sup>54</sup>

### **2.3.3 Motivation (Intentions) to change eating behaviour**

Motivation is composed of two components: personal and social components. The personal component includes intentions, social norms, barriers, social support,<sup>17</sup> but for the purpose of this review, only intentions for healthy eating will be discussed. Intentions demonstrate one's decision to perform certain behaviour.<sup>87 88</sup> In order to ascertain how adolescents will behave, it is important to ask them how they intend to behave.<sup>88</sup> The stronger the intention the higher the possibility that an individual will perform a certain desired behaviour.<sup>89</sup> Intentions alone can predict eating behaviour.<sup>88 90</sup> However on the other hand, there is the possibility that one who intends to change his behaviour might not and one who did not intend to change may end up changing his behaviour. In conceptual and empirical reviews of correlational studies, the gap between intention and behaviour was reported.<sup>88</sup>

Knowledge of nutrients and nutrition is not adequate to effect behaviour change.<sup>18</sup> Motivation (intentions) to eat healthy is paramount. An intention for healthy eating among adolescents has been studied in developed countries<sup>41 90-98</sup> but the results are inconsistent.

Two systematic reviews of healthy eating and sugary snack and beverage consumption<sup>41</sup> and potential determinants of healthy eating<sup>93</sup> reported that intention was the main determinant of healthy eating but with limited evidence due to the use of cross-sectional designs. In the two RCT studies, one study reported that level of intention increased following an intervention program<sup>99</sup> while in one study there was no effect.<sup>97</sup>

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In four cross-sectional studies level of intention for healthy eating was reported<sup>92 100 101</sup> and to eat traditional food.<sup>91</sup> The results of these studies showed that adolescents had low intentions to eat healthy. Intentions were reported to be good predictors of healthy eating behaviour<sup>88 94</sup> while in others studies it was not found to predict healthy eating.<sup>102 103</sup> Intention seems to be associated with gender ( $P < 0.05$ ): girls had higher intentions than boys<sup>91 92 96</sup> and intentions correlated with healthy eating.<sup>96</sup> Lack of motivation was identified as a barrier to healthy eating behaviour among adolescents, and that adolescents may be motivated by setting specific goals for healthy eating behaviour.<sup>104</sup>

### **2.3.4 Eating Habits**

#### *2.3.4.1 Healthy eating*

For adolescents to be motivated to eat healthily, the concept of healthy eating has to be understood by researchers.<sup>44</sup> Healthy eating is a habit of choosing what to eat to improve and maintain good health. Healthy eating involves the intake of foods containing carbohydrates, proteins, vitamins and minerals, water and limited amounts of fat and sugars.<sup>105</sup> Adolescents define healthy eating in terms of food characteristics, balanced diet and benefits of healthy eating.<sup>106</sup> An unhealthy diet refers to eating foods high in fat and sugar. Evaluation of healthy eating therefore may include meal frequency, meal patterns, fast foods, sweetened beverages, and dietary quality.

The eating habits of adolescents in the United States of America (USA)<sup>107</sup> has changed since 1973 from a well-balanced traditional diet to a diet rich in fat and sugar.<sup>108</sup> Studies revealed that few adolescents in the USA consume a healthy diet according to national nutrition guidelines. In one literature review about eating habits of adolescents<sup>109</sup> fewer adolescents ate fewer servings of 5 major food groups such as grains, vegetables, fruit, dairy, meat and meat substitutes. In Beijing China, adolescents consumed inadequate quantities of fruit, vegetables and meat<sup>69</sup> and in Morocco, the intake of fruit and vegetables was inadequate.<sup>110</sup> In a study conducted in Greenland, Spain, Italy, Greece and Portugal low intake of fruit was reported, while in Malta low vegetable intake was reported.<sup>111</sup> A USA study reported less consumption

of fruit and failure to meet the recommended daily intake.<sup>108</sup> In Brazil adolescents were reported to consume inadequate quantities of fruit and vegetables.<sup>112</sup>

However other studies reported that a substantial percentage of adolescents ate a healthy diet by consuming fruit and vegetables 3-4 times per week,<sup>101</sup> and 5 or more fruits and vegetables were consumed daily.<sup>113</sup> Adolescents consumed fruit and vegetables but did not specify the frequency of intake<sup>114</sup> and in the Netherlands adolescents consumed 2 servings of fruit daily.<sup>102</sup> It appears that a high intake of fruit and vegetables was more common in younger girls than older girls<sup>96 102 115 116</sup> and less common in boys.<sup>117 118</sup> There was also a high intake of eggs, meat, milk, and bread among females,<sup>119</sup> although some consumed less milk.<sup>108</sup> Adolescents with a high SES consumed vegetables and meat frequently but less carbohydrate.<sup>78</sup>

Water is part of a healthy diet and plays a role in prevention of overweight.<sup>120</sup> There is a paucity of studies on the level of water intake among adolescents. There is a lack of a standard recommended level of water intake since water requirements vary from country to country (World Health Organization, 2004). The literature that was located showed that the consumption of water was higher in girls than boys<sup>51 121</sup> while in the USA consumption was higher in boys and the mean intake was 2.4L amongst those aged 12-19 years.<sup>122</sup> In a study of Spanish adolescents, 71% (137/194) did not meet the average recommended water intake according to the European Food Safety Agency.<sup>123</sup>

#### *2.3.4.2 Unhealthy eating habits*

Although in some countries adolescents are reported to be eating a healthy diet, most adolescents in developed countries consumed unhealthy foods that contained a high fat and sugar content.<sup>107 124</sup> In middle income countries like Botswana knowledge about adolescents' eating habits is still a grey area. Sweetened foods and a high fat diet is linked to prevalence of obesity.<sup>31</sup> Fat consumption is composed of fast foods, french fries, sausages, pies, fried chicken, margarine, butter, cheese, hamburgers, hot dogs, more than two eggs per week and

full cream milk. These fatty food items were consumed daily and up to 3 or more times a week.<sup>46 51 63 78 92 101 108 115 116 119 125-127</sup>

In the USA the intake of sweetened foods has increased among adolescents from 1977-1979 and in 1994.<sup>107</sup> In a systematic review about sugar sweetened soft drinks in the USA, the occurrence of the effect on body weight is related to high consumption.<sup>128</sup> Sweetened foods that adolescents commonly consumed were doughnuts, candy/sweets, ice cream, biscuits, chocolate and cakes and sweetened beverages include soft drinks, fruit juice and ice lollies which were consumed several times daily and up to 3-4 times per week.<sup>51 55 63 67 92 110 129</sup> Adolescents who consumed candy also drank a lot of soda: 3 times a week,<sup>110</sup> others once a day<sup>129</sup> and consumption was associated with a high SES. Daily consumption of soda was reported to be high in Great Britain, Israel, the Netherlands, USA, Slovenia and Belgium.<sup>111</sup> However, soda intake was less popular in other countries.<sup>130</sup> In a systematic review about the influence of sugar sweetened beverages (SSB) consumption on the risk of obesity, drinking soda was positively associated with obesity and adolescents who drank soda frequently were at risk of obesity.<sup>131</sup>

The intake of fast foods has been increasing among adolescents<sup>132</sup> because the traditional family meal is rarely practiced and the majority of families in the USA (46%) eat out daily.<sup>107</sup> A traditional family meal is where all family members gather together to eat meals at home.<sup>133</sup> In the USA, adolescents aged 13-19 years old who liked to eat away from home and ate at fast food restaurants were classified as high fast food consumers.<sup>134</sup> Fast foods included french fries, pizza, pies, hot dogs and hamburgers, and consumption of these food was associated with obesity.<sup>132</sup> Adolescents consumed fast foods three times a week, and females ate in restaurants three or more times a week.<sup>108</sup> Fast food consumption was associated with low parental education.<sup>113</sup>

### **2.3.5 Meal habits**

The absence of a family meal practice has been replaced by eating away from home which leads to unhealthy meal habits such as meal skipping. Botswana nutritional guidelines

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recommend three meals a day.<sup>105</sup> The consumption of three regular meals a day with families is a challenge to adolescents due to time constraints.<sup>135</sup> Although three regular meals have been associated with better health outcomes the practice is slowly disappearing among families. The practice of eating together as a family has declined since 1966 and has been replaced by eating outside home, alone or while watching television in the USA.<sup>133</sup> There are no prior published studies located in the literature about meal habits among adolescents in Botswana.

Published studies reported inconsistent findings regarding family meals. Breakfast consumption has been decreasing among adolescents aged 14-18 years in the USA from 1996-2006.<sup>136</sup> Few participants ate school lunch in the USA.<sup>116</sup> In Soweto South Africa, adolescents skipped breakfast before going to school.<sup>137</sup> However, results from other studies paint a better picture on breakfast meals.<sup>57 68 92 113 138-141</sup> Foods consumed at breakfast were cereals, milk and yoghurt<sup>69</sup> and sandwiches.<sup>142</sup> Males rather than females regularly consumed breakfast.<sup>124</sup> Although the majority of the studies seem to have focused on eliciting information on breakfast habits, a few studies reported results on lunch and dinner meal habits<sup>134 140</sup> and on consumption of all three meals.<sup>83</sup> Two studies reported that adolescents ate lunch and dinner with the family.<sup>57 64 113</sup> Family meals without watching television have been found to be associated with a high SES.<sup>143</sup>

Snacking is a very common risky eating habit among adolescents.<sup>107 114 124</sup> Snacks frequently consumed were fruit, soft drinks, chocolate, salty snacks, crisps, cream wafers, sweet snacks, and seed bars.<sup>92 113 127 142</sup> The results on snacking habits are inconsistent. The majority of adolescents consumed snacks several times daily<sup>116</sup> while some consumed 4-6 times after school<sup>144</sup> and 2-4 times when with their friends,<sup>121</sup> while some consumed snacks 3-4 times while watching television (TV).<sup>124 144</sup> Some studies reported less frequent consumption.<sup>92 96 101 130 134</sup> Snacking has been linked to obesity in the developed countries.<sup>114 144</sup> In Botswana frequently consumed snacks is still unknown.

### **2.3.6 Influences on food choice**

Certain factors influence food choice and habits namely food preference, media, parental modeling, availability of foods, cost and convenience. Food preferences are the main influencing factor for food choice<sup>87</sup> and are learned during childhood<sup>145-147</sup> and are well established by the adolescent stage<sup>147 148</sup> and may even progress to adulthood.<sup>149</sup> Most adolescents liked certain foods over others because they tasted nice and were appealing<sup>87 146 150-153</sup> and taste is reportedly the main determinant of food preference.<sup>154</sup> Adolescents seem to mostly prefer salty, fatty and sugary foods<sup>67 113 150 155 156</sup> and food preferences are associated with SES<sup>113</sup> and linked to overweight and obesity.<sup>86</sup> Television advertisements also influence food choices, lead to unhealthy eating habits,<sup>157</sup> and enhance food preferences.<sup>158</sup> In Ghana it is reported that peer influence correlated with eating habits but not media or parental influence.<sup>159</sup> No prior studies on influences on food choice and preference in Botswana were located in the literature.

### **2.3.7 Discussion of studies on intentions to change physical activity (PA) behaviours**

Intentions to change physical activity among adolescents have been studied widely in the developed countries<sup>103 160-162</sup> and PA has been found to be declining in the adolescent girl population.<sup>163 164</sup> In two systematic reviews, intention predicted various behaviours including physical activity and it is recommended that it be targeted in promotion of physical activity.<sup>165 166</sup> The effects of a lifestyle intervention on intention to change physical activity in RCT studies are inconsistent. Intentions increased in the intervention arm more than the control arm following an intervention program,<sup>167</sup> while there was no change in another study.<sup>168</sup> In two cross-sectional studies, results on intention to pursue physical activity are inconsistent; in one study, intentions predicted a person's behaviour although they indicated weaker intentions for PA.<sup>160</sup> However, in another study it was not a predictor of physical activity.<sup>103</sup> Intentions for physical activity differed by age; older adolescents indicated more intentions.<sup>161</sup>

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### **2.3.8 Discussion of adolescents' physical activity behaviour**

There is a decline in physical activity among adolescents. Despite a decline in physical activity reported in longitudinal studies among adolescents,<sup>169 170</sup> a few cross-sectional studies had reported that adolescents engaged in physical activity. In the study conducted in Barcelona, participants were reported to be exercising regularly<sup>171</sup> and males were more active and spent more time weekly on both moderate and vigorous physical activity than females. In adolescents aged 12-17 years in the Balearic Islands<sup>172</sup> and in Morocco 15-19 years<sup>110</sup> males were more active than females. In Canada adolescents were moderately active.<sup>130</sup> It must be noted that the samples in these studies were not representative of the populations studied.

The specific time taken by adolescents per week in physical activity has been investigated; females practiced sports 1-2 times a week, but males practiced 3-4 times a week.<sup>173</sup> Low levels of PA have been reported in northern Brazil and Soweto, South Africa<sup>59 112 137</sup> and low levels of physical activity was associated with inadequate intake of fruit and vegetables.<sup>112</sup>

Sedentary behaviour is also common among adolescents. In Barcelona 13-17 years spent more hours of screen time a day<sup>171</sup> and 37.1% (725) showed sedentary behaviours, especially females who showed higher sedentary behaviours than males in the Balearic Islands.<sup>172</sup> The time spent on media screen watching was higher among 14 year olds in both genders.<sup>110</sup> Girls spent more than 2 hours watching television than boys.<sup>125</sup> In Belgrade Serbia, sedentary behaviour correlated with fat intake and parental education<sup>64</sup> while in the Balearic Islands it correlated with profession.<sup>172</sup>

### **2.3.9 Discussion of behavioural skills (Self-efficacy): Self-efficacy for healthy eating and PA**

Behavioural skill is the third component of the IMBs model. Behavioural skills are one's ability to perform a task; a sense of self-efficacy.<sup>17</sup> Behavioural skills for performing specific overweight preventative acts include setting of personal goals, self-monitoring and problem solving. Information and motivation are not adequate to change behaviour; therefore

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behavioural skill is a critical step in behaviour change.<sup>17</sup> Information and motivation influence behavioural skills to affect behaviour, especially in cases of uncomplicated tasks.<sup>174</sup>

Self-efficacy (SE) is defined as one's belief to achieve a task without difficulty.<sup>175</sup> The stronger one's SE, the higher the possibility of achieving a specific goal. In one systematic review, SE was mostly examined and found to be associated with PA although the effect was small.<sup>48</sup> In two RCTs, SE was moderately associated with healthy eating in the intervention arm but not statistically significant.<sup>99 176</sup> In cross-sectional studies a high level of self-efficacy improved and predicted PA levels<sup>164 177 178</sup> however few studies reported on the level of SE for healthy eating.<sup>51 64</sup>

SE can predict healthy eating and PA behaviours. The majority of adolescents demonstrated good self-efficacy for eating<sup>64</sup> and self-efficacy predicted PA and healthy eating.<sup>51 179</sup>

### **2.3.10 Discussion of prevalence of overweight in adolescents**

The prevalence of overweight and obesity among adolescents is deemed a public health crisis.<sup>31</sup> In the developed world prevalence of overweight among adolescents has been documented, although documentation is still a challenge especially in the developing countries. In nine cross-sectional studies,<sup>50 63 64 83 110 117 119 139 180</sup> four surveys,<sup>92 101 134 181</sup> two descriptive cross-sectional studies,<sup>127 173</sup> one qualitative and quantitative study<sup>87</sup> and in two longitudinal and prospective studies,<sup>170 182</sup> Body Mass Index (BMI) was used as the yardstick to determine overweight and obesity and not waist circumference. In one study that met inclusion criteria in Saudi Arabia, both BMI and WC were used to determine overweight and obesity in adolescents.<sup>125</sup>

### **2.3.11 Discussion of intervention studies similar to the current lifestyle intervention study**

Thirty-two studies met the inclusion criteria in section 2.1.1.1; 1032 were excluded because they used objective measurements especially for PA, were conducted outside school settings and amongst persons other than adolescents. Of these, 13 studies were systematic reviews,

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including RCTs that were conducted in schools between 1985 and 2013, one was on diet and PA,<sup>183</sup> two on diet determinants,<sup>93 184</sup> three on PA interventions and potential mediators for PA,<sup>48 165 185</sup> two on theories that guided dietary interventions,<sup>41 186</sup> one on interventions to prevent obesity,<sup>23</sup> one on methodologies of sugar sweetened beverages,<sup>131</sup> one on intention for PA,<sup>166</sup> one on barriers and facilitators of healthy eating<sup>146</sup> and lastly one on prevalence and dose of sedentary behaviours.<sup>187</sup>

There were 10 randomised controlled trials of which the majority were cluster randomised controlled studies. One study used the Pender Theory of Health Promotion and the Trans-theoretical Model and the outcome was PA,<sup>167</sup> three used no theory and the outcomes were PA and nutrition knowledge,<sup>70 168 188</sup> while one used social ecological theory and the outcome was also PA.<sup>189</sup> One pragmatic RCT reported no use of theory and outcomes were nutrition knowledge, diet and attitudes,<sup>72</sup> and four used cluster randomised controlled trials, two used the Theory of Planned Behaviour and outcomes were nutrition knowledge, intention, water and soft drink intake, and PA and fruit and vegetable consumption respectively,<sup>73 97</sup> while two authors used no theory to guide the intervention and they measured nutrition knowledge and attitudes, PA, and diet intake.<sup>99 176</sup> The results of these studies are inconsistent; some studies showed that the interventions had an effect on the outcomes while other studies did not. It may be because of differing methodologies, and the quality of the studies. The quality of RCTs was assessed with the use of the Cochrane (2009) common classification scheme for bias (Appendix 40). Out of 10 RCTs, five were of high quality (low bias) and these studies showed effect on the outcomes while five were of low quality (high bias) and showed no effect on the outcomes (Appendix 41). The studies were mostly conducted in the developed countries except for two that were done regionally.

In addition there were six quasi-experimental designs and four studies did not report the use of a theory to guide the intervention; outcomes were not stated,<sup>76 177 190 191</sup> but in one study outcomes were stated: self-efficacy for healthy eating, increase in knowledge on low fat diet.<sup>192</sup> One study used the Model of Self-efficacy but outcomes were not stated<sup>177</sup> while in the other study social cognitive theory was used.<sup>193</sup> One study was a post-intervention survey that

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used an existing program in the Western Cape in South Africa.<sup>194</sup> The results of both the short and long term non-experimental intervention studies were mixed; some did not report any effect on the outcome while others reported significant change in eating and PA in the intervention group compared to the control group. All the studies were done in the developed countries except for one conducted in South Africa, a middle income country. There is a paucity of published studies that used the IMBs model to guide intervention studies.

The Information, motivation and behavioural skills (IMBs) model was first developed by Fisher, William and Malloy in 1994. The model was initially developed to understand AIDS risk behaviour among sexually active urban adolescents and it is constructed from a combination of social and health psychology concepts for understanding and promoting healthy behaviour.<sup>17</sup> The model consists of three concepts: information, motivation and behavioural skills. The model posits that risk reduction information, internal and external motivation and providing cognitive skills can lead to behaviour change<sup>175</sup> as shown in Figure 2.3.

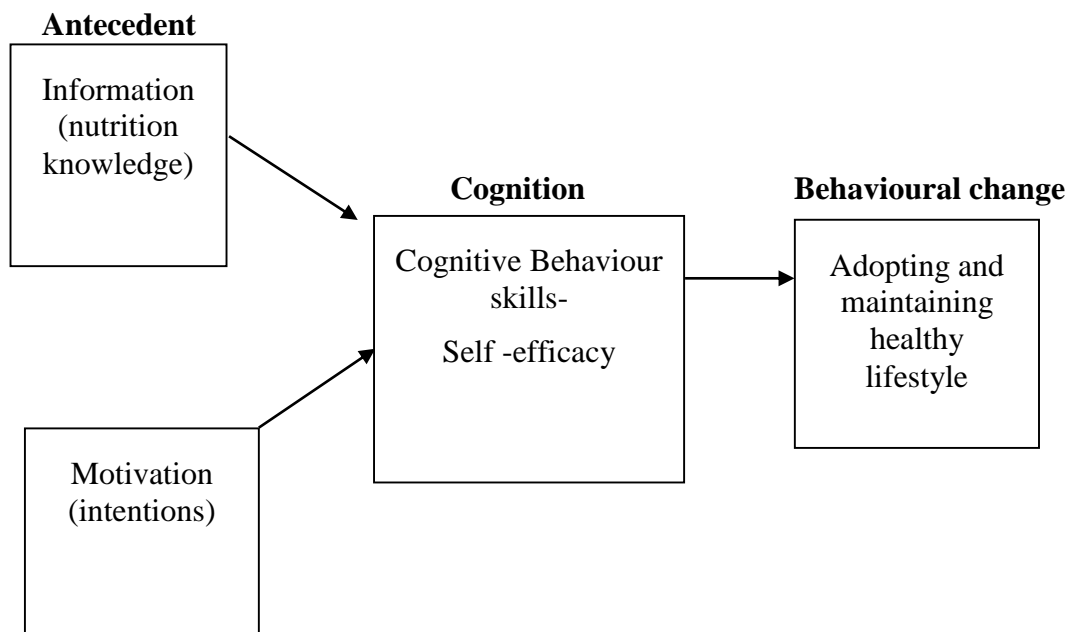


Figure: 2.3: Information, Motivation and Behavioural Skills Model

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The IMBs Model has recently been used in dietary/nutrition adherence studies in diabetes, promotion of health in the elderly, adherence to antiretroviral therapy, in predicting lifestyle behaviours in adolescents and in lifestyle intervention studies to try to understand nutritional intake and behaviours. There is evidence that studies guided by this model effect behaviour change among adolescents<sup>175 195 196</sup> diabetic adults<sup>197</sup> and the elderly who have osteoporosis.<sup>198</sup> In the systematic review of interventions that used the IMBs model for behavioural change in people with chronic diseases, the model was found to be useful and effective in effecting behaviour change.<sup>199</sup>

### 2.3.12 Discussion of measurement issues

In order to collect quality data, instruments must be checked for validity and reliability before use.<sup>200</sup> Eating and physical activity behaviour and their determinants have no standard instruments of measurement; they have been assessed using a variety of assessment measures. Errors are inevitable in instrument measurements and before data can be collected the amount of random error should be reduced to an acceptable level by testing instruments for validation and reliability.<sup>201</sup> The variety of instrument measures makes comparison across studies difficult.

Researchers in the studies reviewed used different methodologies to evaluate eating habits, physical activity, intentions and self-efficacy. Among the questionnaires used to collect data a food frequency questionnaire was used by many researchers.<sup>57 63 101 113 144 155</sup> However, few validated and tested for its reliability<sup>63 101 155</sup> while in one study a questionnaire used previously was reported<sup>57</sup> and in one study there was no record of validated or reliability results.<sup>113</sup> Two studies reported to have used 24 hour recall questionnaires<sup>78 116</sup> of which one tested for reliability and the other did not record the information. In one study, food diaries were used and were validated.<sup>114</sup> One study reported the use of structured interviews.<sup>151</sup>

In the majority of the studies the name of the questionnaire used was not stated but the items evaluated were stated.<sup>46 55-57 64 68 69 83 92 110 111 117 121 125 129 134 139 143 155 171 173 180 202-204</sup> Among these questionnaires, reporting of validity and reliability was inconsistent. In some studies the

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questionnaires used were tested for reliability,<sup>51 69 78 92 108 119 124 130 152</sup> while in other studies reliability was reported<sup>63 114</sup> while other studies did not report questionnaire validity or reliability,<sup>46 56 68 111 113 116 129 134</sup> in three studies the questionnaires were used previously.<sup>57 117</sup>

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Eating habit is a subjective phenomenon, so it requires valid and reliable questionnaires to reduce bias in the responses. Therefore studies that use valid and reliable questionnaires are needed because this will assist future researchers to build on the body of knowledge on existing valid and reliable eating habits questionnaires. Studies that used invalid and unreliable questionnaires may be the cause for inconsistent results.<sup>107</sup>

Questionnaires used to evaluate physical activity behaviour included the international physical activity questionnaire for adolescents with established validity and reliability,<sup>170 202</sup> a 3-day recall for physical activity<sup>161 177</sup> and 7-day recall for physical activity.<sup>112</sup> In one study an interview schedule was used<sup>137</sup> and in another a health behaviour school children questionnaire was used<sup>117</sup> and one questionnaire was used in a US national adolescent health survey.<sup>164</sup> Researchers did not report the name of the questionnaire but rather the items they used to elicit physical activity levels were evaluated.<sup>54 55 103 110 138 169 203 205 206</sup>

## 2.4 Summary

No studies from Botswana reporting on all the following aspects were located in the reviewed literature: adolescents' eating habits, PA behaviours, intentions, self-efficacy and nutrition knowledge. There is inconsistency in the level of nutrition knowledge across populations which might be attributed to the use of differing methodologies. The majority of respondents in the reviewed studies indicated poor nutrition knowledge of food groups and nutrients, reported unhealthy habits, inadequate PA levels yet good intentions and self-efficacy. A substantial number of studies did not report measurement aspects such as validity and reliability which impact the quality of the results. Most studies on adolescents' eating habits and physical activity levels were conducted in the developed countries, leaving a gap in the

literature about adolescents' eating habits and physical activity levels in developing and certain middle income countries. If adolescents in developing countries are engaging in unhealthy eating habits and are not having adequate exercise, interventions toward the prevention of overweight and obesity and the promotion of a healthy lifestyle should be developed and implemented. Water intake, an essential part of a healthy diet has not yet been fully studied and only three studies were found.

## **3. Study One: establishing baseline data for Study Two**

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### **3.1 Background and significance**

The prevalence of overweight has increased in developed and developing countries among adolescents worldwide.<sup>207</sup> Unhealthy eating habits and lack of physical activity and inactivity are implicated in causing overweight among adolescents.<sup>208</sup> Overweight poses a risk for development of noncommunicable diseases (NCDs) that are occurring in adolescents.<sup>208</sup> An increase in NCDs is considered a major factor in the increased health cost burden.<sup>29 209</sup> Promoting a healthy lifestyle among adolescents is critical as the prevalence of overweight continues to increase in developing countries.<sup>210</sup> A healthy lifestyle includes physical activity and a healthy diet. Strategies that promote a healthy lifestyle should target adolescents as they are the adults of tomorrow, thereby preventing a potential increase in the incidence of NCDs.

The adoption of healthy eating habits begins in childhood<sup>84 211</sup> and it is established by the age of 15 years.<sup>7 212</sup> Adolescents start to make independent decisions about health and become responsible for their eating habits, physical activities, health attitudes, food choices and preferences.<sup>212 213</sup> Adolescents' reliance on the family for guidance about selection of food and eating behaviours also begins to lessen at this stage. Physical activity among adolescents in the USA has reportedly decreased dramatically for over a decade and in Botswana it is assumed to have decreased for the past 20 years due to an increase in the use of public transport.<sup>8 18</sup>

Overweight fuels the incidence of NCDs such as hypertension, type 2 diabetes, cancer and respiratory problems that are now occurring in adolescents.<sup>7 29</sup> A study conducted in Botswana in 2011 revealed that food insecurity in urban areas may increase overweight among adolescents.<sup>38</sup> Botswana is a developing country which is already economically overburdened

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by HIV/AIDS. The increase in NCDs among the adult population is reported to be at 16%.<sup>39</sup> There is an urgent need to prevent overweight and to halt resultant NCDs to help reduce the health cost burden in Botswana.<sup>39</sup>

Eating and physical activity behaviours of adolescents in Botswana need further description. Prevention of overweight among adolescents is also paramount and the ideal place to promote healthy lifestyle is in schools.<sup>214 215</sup> Many tools are available for measuring eating habits and physical activity levels among adolescents. The eating habits/nutritional questionnaire by Turconi et al. (2003, 2008, & 2013) has been widely used in cross-sectional studies to determine eating habits and physical activity levels of adolescents in Albania, Serbia and Italy. The eating habits/food questionnaire is comprehensive<sup>84 211</sup> compared to food frequency questionnaires (FFQ), dietary checklists, dietary records and 24 hour diet recall that are limited in some of the characteristics of eating behaviours.<sup>216</sup> The eating habits/food questionnaire is less burdensome compared to long FFQs and 24 hour recall questionnaires.<sup>84</sup>

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One way of promoting a healthy lifestyle among adolescents is to provide them with information, motivation (intention) and behavioural skills (self-efficacy). Adolescents need information to make informed choices and to believe that they can adopt a healthy lifestyle. The information, motivation and behavioural skills (IMBs) model<sup>218</sup> has been proven to be useful in different settings and populations in guiding the development of intervention studies to prevent overweight.<sup>18 197</sup>

### **3.2 Literature review**

The purpose of the literature review for Study One was to glean useful information for the design of a questionnaire for use in Botswana to describe adolescents' eating habits, physical activity behaviours and their determinants, nutrition knowledge, intentions and self-efficacy to change unhealthy eating habits and inadequate physical activity behaviour. The review also provided results from the developed countries on psychometric evaluation of data collection

tools used in the published studies. In developing countries there is a paucity of evidence of these issues. Few published and unpublished studies regionally and locally were located in the literature. Nine studies that met the inclusion criteria were conducted in South Africa,<sup>46 57 61 83 126 135 137 219 220</sup> one was conducted in Nigeria<sup>67</sup> and one in Ghana.<sup>221</sup>

Published studies from Botswana on adolescents' meal habits, influences on food choice and preferences, nutrition knowledge, intentions and self-efficacy for healthy eating and physical activity were not located in the literature. One published study reported eating patterns, snacking and prevalence of obesity in adolescents aged 12 to 18 years.<sup>38</sup>

### *3.2.1 Eating habits*

Of the 704 secondary school students aged 12-18 years in urban and rural areas in Botswana, food intake and eating patterns reportedly varied in rural and urban areas.<sup>38</sup> Eighty-four percent (591/704) of these students did not eat fruit, 12% (84) reported having one serving of fruit and 3% (21) had two servings. Results show that though fruit intake was generally low in both areas, adolescents from urban and town areas ate more fruit than those in rural areas. On the other hand, vegetables were eaten by fewer students (64%, 450), and among these, 81% (162) had one serving and 17% (77) two servings of vegetables. No published studies on consumption of other food items from different food groups such as protein and sugar rich foods and sweetened beverages were located in the available published literature except for the report on eating a less traditional diet such as samp with beans, sorghum porridge, maize meal and phane (caterpillar).<sup>38</sup> Secondary school students with a high socioeconomic status and living in urban areas in Botswana reportedly skipped breakfast due to leaving home very early to go to school.<sup>38</sup> In some published studies conducted in South Africa, adolescents from the ages of 10-18 years ate an unhealthy diet as explained in Chapter 2<sup>126 137</sup> and had the habit of skipping breakfast,<sup>57</sup> while others ate lunch and supper regularly.<sup>135 137</sup> However no studies have been conducted to evaluate eating habits inclusive of water intake, a factor that influences meal habits.

Eating habits have been studied in the developed countries and published studies reveal that adolescents consume both healthy and unhealthy diets. However results are mixed because of variability in methodology. The majority of researchers did not validate nor report validation of the instruments they used prior to data collection. Validated data collection tools are needed for purpose of quality data.

### *3.2.2 Snacking*

Adolescents in the city of Gaborone rely on buying food from street food outlets which mostly sell snacks such as fat cakes, fresh chips, doughnuts, roasted beef and chicken, corn-on-the-cob, fruit and beverages such as ice pop, soft drinks and juice.<sup>14</sup> Adolescents from urban areas ate snacks more frequently than those from rural areas and snacking was associated with overweight. The term snacks refers to a low nutrition dense food containing high fat and high salt.<sup>38</sup> These are calorie dense but nutritionally poor foods that are associated with overweight.<sup>38 222 223</sup> Adolescents in South Africa snacked daily<sup>135</sup> and while watching television.<sup>126</sup> There is a paucity of published studies on the type of snacks commonly consumed by adolescents in public schools in Gaborone, Botswana.

### *3.2.3 Physical activity*

A national survey was conducted in Botswana in 2005 of 2197 junior secondary schools students aged between 13-15 years, commissioned by the WHO for the purpose of having descriptive data on adolescents' risk behaviours at global level. The survey provides no data on food intake, eating habits and food preferences, but did show that 15.9% (329) of the boys and 12.8% (263) of the girls had gone hungry for the previous 30 days.<sup>224</sup> In the same study it is reported that 13.0% (287) and 10.4% (220) of boys and girls respectively reported active physical activity for at least 60 minutes a day during the previous 7 days and both boys (34.5%, 768) and girls (33.7%, 746) spent considerably more time sitting watching television and playing computer games.<sup>225</sup> Two published studies were from South Africa; one reported that students included in a Youth Behavioural Survey 2 from Grades 8-11 in Western Cape public schools spent 2-4 hours a day watching TV or playing video games.<sup>107 220</sup> In Soweto

South Africa, adolescents engaged in minimal active recreational activities<sup>137</sup> while adolescents in the Tswaing High School in the Winterveldt did not engage in physical activities although 38% of 485 of the students responded to the question on what physical activity means to them and 62% of 485 did not know what physical activity was.<sup>61</sup> No published studies on knowledge of physical activity and frequency of walks taken a week in public schools in Gaborone Botswana, were located in the literature.

### *3.2.4 Nutrition knowledge*

The results of three published studies conducted in Cofimvaba, Bellville/Durbanville and Tswaing High School in the Winterveldt South Africa,<sup>46 61 219</sup> were mixed because of differing methodologies. One study reported that 77% of 485 adolescents had poor knowledge of diet and nutrition<sup>61</sup> and three reported that adolescents had good nutrition knowledge on South African nutrition guidelines and diet respectively,<sup>219</sup> dietary fat<sup>46</sup> and a healthy and unhealthy diet.<sup>57</sup> One published study from Nigeria reported that adolescents had fair nutrition knowledge.<sup>67</sup> However no published studies were located on the evaluation of all nutrition knowledge components: food nutrients, healthy and unhealthy foods, benefits of and nutrition-related disease.

### *3.2.5 Prevalence of overweight*

The prevalence of overweight is a creeping public health problem in the developed countries and it is being investigated in developing countries to find out if it is also a public health concern. Different ways of determining overweight and obesity were used in many studies such as the WHO, International Obesity Task-Force (IOTF) and Centre for Disease Control and Prevention (CDC) cut off points. The prevalence of overweight and obesity using both BMI and WC specifically among adolescents aged 13-15 years in public schools was not located in the published literature internationally, regionally nor locally. However in different age groups of adolescents, prevalence of overweight and obesity has been determined internationally, regionally and locally.

In a sample of 520 adolescent girls in South Nigeria 10% of scholars in private schools were overweight and 1.2% were obese; in public schools 2.3% were overweight.<sup>83</sup> In Kwazulu-Natal South Africa, of 157 adolescents aged 13-18 years, 10.8% were overweight and 1.9% were obese<sup>181</sup> while in Belgrade, Serbia of 707 adolescents in high schools, 7.7% females were overweight and 1.9% were obese while 21.2% males were overweight and 3.3% obese.<sup>64</sup> In China in a sample of 570 adolescents aged 11-19 years 12% were overweight<sup>101</sup> while in parts of Malaysia 18.7% of 407 adolescents aged 13-19 years were overweight.<sup>134</sup> In parts of Portugal in a sample of 886 adolescents in secondary schools 23.6% boys and 17.3% girls were overweight.<sup>139</sup> In Australia in a representative sample of 4441 adolescents, 19% males and 16.8% females were overweight while 9% males and 5.85% females were obese.<sup>180</sup> In Northern Greece among 11-14 year olds, 29% males were overweight, 20% were obese and 9% were super obese while 13.6% females were overweight, 7.9% obese and 2.9% were super obese.<sup>119</sup> In Barcelona, 19.9% males were overweight and 6.2% were obese while 17% females were overweight and 3.7% were obese among those aged 13-17 years old.<sup>127</sup> Amongst 14-19 year old adolescents in Saudi Arabia, 43.6% males and 34.8% females were overweight but only the means (SD) for WC were reported: 79.7 cm (15.4) for males and 74.2 cm (13.1) for females.<sup>125</sup> Among school going adolescents in New Delhi, 14.6% of those eating breakfast were overweight.<sup>138</sup> In Parnu Russia, among 142 adolescents aged 13-16 years, the prevalence of overweight was 13% in females and 18% in males in those aged 13 years and 9% in females and 16% in males aged 15 years.<sup>173</sup> It must be noted that not all the samples were representative of the populations studied except for the Australian study. The results of these studies indicate that overweight and obesity in adolescents is a public health concern especially in the developed countries because that is where most of the studies were conducted.

### **3.3 Aim and Objectives**

#### **3.3.1 Aim**

The aim of Study One was to design and validate a questionnaire, establish baseline data prior to the intervention of the eating habits, physical activity behaviours, nutritional knowledge (information), motivation (intention) and behavioural skills (self-efficacy) that influence eating habits and physical activity behaviour of urban adolescents in public junior secondary schools in Gaborone City, Botswana, and to determine the prevalence of overweight and obesity.

#### **3.3.2 Study objectives**

To:

1. design a questionnaire from the existing literature and validate it;
2. describe respondents' self-reported socio-demographic characteristics; and
3. describe eating habits;
4. identify self-reported influences on food choice and preferences;
5. determine awareness and knowledge of healthy eating/food intake behaviour ;
6. describe self-reported physical activity behaviours ;
7. determine respondents' self-rated degree of intention to change eating and physical activity behaviours; and
8. self-efficacy for changing eating and physical activity behaviours;
9. determine the prevalence of overweight by WC + BMI.

### **3.4 Methods**

#### **3.4.1 Research design**

Three research designs were employed for Study One: 1) a descriptive design for development of a 3-part questionnaire with 10 components from existing published literature; 2) a mixed

methods approach to validate the prototype questionnaire by determining the index of content validity, face validity by cognitive interviewing, and reliability by test-retest pilot testing; and 3) a cross-sectional survey by validated questionnaire of respondents' eating habits, physical activity behaviours and weight, height and waist circumference to determine the prevalence of overweight. Results from Study One pilot test provided baseline data for Study Two that tested the effectiveness of a lifestyle intervention program guided by the IMBs model to improve eating habits and physical activity behaviours, and the level of nutrition knowledge of adolescents in public junior schools.

### **3.4.2 Respondents**

The education system in Botswana enrolls mostly 13-15 year olds in junior secondary schools. The target population for the study comprised public junior secondary school students aged 13-15 in Gaborone City. Adolescents are starting to be independent with regard to food choice and preferences and physical activities.<sup>226</sup> It is at age 15 years that eating habits are established with no or fewer changes between 16-18 years.<sup>227 228</sup> Public junior secondary schools are owned by the government of Botswana. Gaborone is the capital city of Botswana (Map in Appendix10).

#### *3.4.2.1 Inclusion criteria for respondents*

1. males and females aged 13-15 years;
2. resident in Gaborone city;
3. who attend public junior secondary schools;
4. who assent and whose parents consent to participate in the study;
5. whether overweight or not;
6. in schools where administrators agree to participate.

#### **3.4.2.2** *Exclusion criteria for respondents*

1. Known pregnancy after the 3rd trimester.
2. Respondents who answer yes to one or more questions about health problems in the physical activity readiness questionnaire (Appendix 11).
3. Respondents with a known metabolic disorder because it will affect the outcome measures.
4. Respondents with known physical impairment or disability because it is beyond the scope of this study.

#### **3.4.3** **Ethical considerations**

The proposal was submitted to the University of Cape Town, Department of Health and Rehabilitation Sciences' Research Committee for approval. Thereafter, it was submitted to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for ethical approval. After approval, a letter quoting the HREC reference number (REF REC 631/2014; Appendix 34) and a summary of the proposal was submitted to the Ministries of Education Research Ethics committees in Botswana, where the study was to be conducted. Then the letter bearing the University of Cape Town HREC number was submitted to the Ministries of Education Research Ethics committees in Botswana to seek permission in public urban junior secondary schools in Botswana to conduct the study and was approved (Appendix 33a, b). The trial was registered with Pan African Clinical Trials Registry (Number 201412000926216) after the proposal had ethics approval. The study adheres to the ethical principles outlined in the Declaration of Helsinki.<sup>229</sup>

##### **3.4.3.1** *Confidentiality/privacy/anonymity*

Respondents were assured that information collected from them will not be divulged. Completed questionnaires were kept in a locked filing cabinet and only the researcher has the key to the cabinet. Data entry and analysis was stored in a password protected computer. Each

respondent had their anthropometric measurements taken at a time and in a designated room where privacy was provided. Boys had their measurements taken by male research assistants and girls by female research assistants. The BMI charts for boys and girls were used to record information. Each sheet contained a unique code number and age for each respondent.

Questionnaires were coded to maintain anonymity and confidentiality and respondents were informed that only the researcher linked the coded questionnaires to respondents. Respondents allowed their parents/guardians, school teachers and some health professionals to take part in delivery of intervention as they played a role in supporting them to meet the requirements of the study.

#### *3.4.3.2 Autonomy/justice/rights*

Respondents volunteered to participate in the study and there was no payment for study One. The participants were not coerced to participate in the study. Respondents were informed that they could withdraw at any time they felt like doing so without fear of victimization or of losing their place at school. Assurance was given pertaining to confidentiality of information and that the information would not be used against them or significant others. Respondents were assured that privacy would be maintained at all times.

#### *3.4.3.3 Risks/benefits*

Participants were informed that the study carries minimal risk of psychological harm. They might feel uncomfortable as they were expected to undress up to waist level and reduce clothing during anthropometric measurements. Psychological risk was minimized by separating tests sites for girls and boys and each participant was tested by a person of the same gender in a private area and out of sight of other students. No participant sustained an injury.

There was no monetary benefit for Study One. For Study Two respondents randomised to the intervention arm were given R13.00 (P10.00) weekly and were given a certificate of participation at the end of 8 weeks. They also benefited from the information and skills that they can use to adopt a healthy lifestyle. Water was provided during intervention sessions and

food used in cooking demonstrations was tasted by participants at the end of the sessions. At the end of the research project (examination by external examiners and the award of the degree), participants will be given the overall results of the study and recommendations to schools and significant others will be given.

Letters were sent to the Ministry of Education and the Director of the Southern region secondary schools to solicit permission to conduct the study in junior secondary schools in Gaborone. Permission was granted by the Ministry of Education on 18 October, 2014 (Appendix 33) and February, 2015 (Appendices 35). The administrators of the 13 junior secondary schools were approached to solicit their participation in the study. They all indicated a desire to participate in the study. However, one school declined due to overwhelming school administration issues. The same school was excluded from the randomisation selection process.

#### **3.4.4 Sampling method**

After permission was granted by the Ministry of Education on the 16<sup>th</sup> October, 2014, the list of 13 junior secondary schools in Gaborone city was collected from the ministry administrator and each school was visited to solicit their participation in the study up until 31<sup>st</sup> October, 2015. The following information was given to the School Heads and Heads of Departments: background to the study, purpose, objectives, processes for content validation of the questionnaire, assistance with recruitment and data collection (Appendix 9). All schools indicated a desire to participate in the study.

On 22 January, 2015 the list of 13 schools was given to an independent statistician for simple random sampling of 8 schools by assigning the numbers 00 to 12 to the schools in alphabetical order.

Starting from row 1 of the statistical table of random digits the following 8 schools were randomly selected: 02, 04, 09, 03, 05, 12, 06, and 11.

Of the schools selected to participate, school number 06 declined to participate due to overwhelming school administrative issues. The statistician re-randomised the schools, excluding the school that had declined to participate. The same randomisation procedure was followed the second time and random numbers were assigned to the remaining 12 schools.

The following 8 schools were selected by randomisation to participate in Study One: 02, 04, 09, 07, 11, 03, 05, and 12.

The School Head of school number 07 that had been randomly selected in the second round was visited and informed that they had been selected to participate in the study. At that point the School Head declined to participate due to an overwhelming number of researchers at the school but suggested that the study could commence in the following school term starting April 14<sup>th</sup>, 2015.

#### *3.4.4.1 Sample size determination of respondents*

Each of the 13 urban junior public secondary schools has three streams of Form 1, 2 and 3 students. Each stream has approximately 8 classes, each class is estimated to have 40 students. The total estimated number of students in urban public schools was approximately 12480 as shown in Table 3-1.

**Table 3-1: Population of students in Urban Junior Schools**

| Number of schools | Number of Form 1-3 streams per school | Number of classes per stream | Number of classes per stream per school | Number of students/ Class | Total estimated number of students |
|-------------------|---------------------------------------|------------------------------|---|---------------------------|------------------------------------|
| Urban N=13        | 3x13                                  | 8                            | 8x3x13                                  | 40                        | 312x40                             |
| Total             | 39                                    |                              | 312                                     |                           | 12480                              |

Using OpenEpi version 2.3.1<sup>230</sup> set at a Confidence Interval of 90%, design effect of 1 and cluster of 1, the required sample size in the eight randomly selected schools was 264 (Appendix 8a), therefore  $n=265/8$  (number of schools)= 33 respondents per school. Since

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there were 3 strata (streams) per school,  $33/3= 11$  respondents per strata were required from each school (Appendix 8b).

After permission was granted by the Director of Secondary Schools of the South East Region on 18<sup>th</sup> February 2015, student lists were obtained from the School Heads of the selected junior secondary schools between 20<sup>th</sup> of February and 3<sup>rd</sup> of March 2015. From these lists, the statistician conducted stratified random sampling for 11 respondents per strata from each school and the data is presented in Table 3.2.

**Table 3.2: Stratified randomly selected respondents from 8 randomly selected schools**

| School code | Number of students per strata | Number of selected participants per strata |
|-------------|-------------------------------|--|
| 02          | Grade 8= 269                  | 11   |
|             | Grade 9=264                   | 11   |
|             | Grade 10=266                  | 11   |
| 04          | Grade 8= 247                  | 11   |
|             | Grade 9=255                   | 11   |
|             | Grade 10=249                  | 11   |
| 09          | Grade 8= 254                  | 11   |
|             | Grade 9=236                   | 11   |
|             | Grade 10=233                  | 11   |
| 07          | Grade 8=                      | 11   |
|             | Grade 9=                      | 11   |
|             | Grade 10=                     | 11   |
| 11          | Grade 8= 227                  | 11   |
|             | Grade 9=255                   | 11   |
|             | Grade 10=261                  | 11   |
| 03          | Grade 7=                      | 11   |
|             | Grade 8                       | 11   |
|             | Grade 9=                      | 11   |
| 05          | Grade 7=179                   | 11   |
|             | Grade 8=179                   | 11   |
|             | Grade 9=176                   | 11   |
| 12          | Grade 8= 234                  | 11   |
|             | Grade 9=264                   | 11   |
|             | Grade 10=216                  | 11   |

### **3.4.5 Data collection**

#### ***3.4.5.1 Instrument construction***

A 3-part questionnaire was developed (Appendix 4). Part 1 consisted of a nutrition questionnaire with six sections: A) general information; B) food frequency consumption; C) meal habits; D) influences on food choice; E) lifestyle and physical activity; and F) nutrition knowledge. Part 2 consisted of a self-efficacy questionnaire with two sections (for healthy eating and for exercise). Part 3 explored intentions to eat healthily and to do physical activity. The questionnaire was in English only because English is the medium of instruction in Botswana schools.

##### **Part 1. Nutrition questionnaire**

The Nutrition questionnaire (Appendix 1) comprises a scale developed from an existing scale<sup>211</sup> designed by Turconi et al. (2003 & 2008) which was improved by including the components: food consumption and influence on food choice.<sup>84</sup> The seven components of the nutrition questionnaire are described below.

##### **Section A. Demographic Data component**

The demographic data tool (section A, Appendix 1) elicited age, gender, social class and school code. Weight, height and WC were filled in by the researcher after being measured by research assistants using a weight and height scale to measure weight and height to determine BMI, and tape measure for waist circumference. The weight and height measurements were used to calculate BMI. Both BMI and waist circumference findings were recorded on the relevant chart.<sup>231</sup>

### Section B. Food Frequency Consumption

Section B consist of 12 questions assessing frequency of foods and beverages consumption with much emphasis on major food groups; proteins, fats and carbohydrates. It has 10 option categories of seldom/never up to 6/more times per day. Foods were classified into five groups: 1) dairy (cheese, milk, and eggs), 2) fruits, 3) vegetables, 4) meats (fish, red meat, chicken), 5) bread/pasta/rice/maize meal and sorghum, and 6) extra foods (sweets, confectionery, snacks, crisps, biscuits). The frequencies were collapsed into four categories and assigned scores: seldom/never =0, occasionally =1 (once-three per month and per week), often =2 (2-3 per week, 4-6 per week and once per day) and very often =4 (2-6 times per day).<sup>46 121</sup>

### Section C. Meal Habits

Section C consists of 7 items that investigate food choices and preferences at meal times such as what one eats daily for breakfast, lunch and dinner, where one eats and with whom one eats.

### Section D. Influence on food choice

Section D assessed parental control and influence of media on food choice. It contains nine items addressing factors that influence eating habits.

### Section E. Lifestyle and Physical activity

Section E consists of 6 items that assessed frequency of physical activity (question E1), doing exercise and the type they do (question E2&2B), sedentary behaviours (question E3&4) and its benefits (question E5&6). The adequate frequency of PA was determined by walking 6 or more per day each week. Sedentary behaviours was determined by the recommended time spent on television/video of 2 hours or less.<sup>232</sup>

### Section F. Nutritional Knowledge

Section F consists of 24 items focusing on factors influencing food choices, eating habits, food contents, healthy foods and drinks and energy expenditure. Questions have four option categories to choose from with a single correct answer and an additional answer of ‘not sure’ to discourage missing data. The correct actual scores obtained were calculated out of the total mark of 24 and a percentage was calculated for each actual score.<sup>46</sup>

#### Part 2A. Self-efficacy for healthy eating questionnaire

This questionnaire measures one’s confidence in adopting healthy eating habits in relation to sugar, fat and fruit and vegetables. It has eight items using a Likert scale of: not at all hard, a little hard and very hard. The score is the sum of all ratings and ranges between 0-18. The lowest score denotes high self-efficacy (0-8), and the highest score denotes low self-efficacy (9-18) for healthy eating.<sup>226</sup>

#### Part 2B. Self-efficacy for exercise questionnaire

The 5-point Likert scale consists of eight questions assessing confidence to engage in physical activity under various conditions. For analysis of data the 5-point Likert scale was collapsed into three categories: disagree (disagree and disagree a lot were merged), agree (slightly agree and agree were merged) agrees a lot.

#### Part 3A. Intention to eat healthily scale

It is a scale developed to determine the individuals’ motivation to perform healthy behaviour with a strong purpose. It has three items and the score of the intention to eat healthy is the sum score of all the three statements with the highest score (scoring 9-15) representing high levels of intention to eat healthily.

#### Part 3B. Intention to engage in physical activity

The scale consists of three statements that assess the intent to engage in physical activity. It uses a 5-point Likert scale: 1 strongly disagrees and 5 strongly agree. For analysis the scale

was collapsed into three categories: disagree (strongly disagree and disagree were merged), agree (slightly agree and agree were merged) and strongly agree.

#### *3.4.5.2 Physical (anthropometric) measurements instrument*

In addition, BMI graphic charts for girls (Appendix 6a) and boys (Appendix 6b)<sup>231</sup> were used to record weight and height to determine BMI. WC graphic charts (Appendix 7) were used to record waist circumference.

BMI graphic charts for girls<sup>231</sup> were used to record weight and height to determine BMI. WC graphic charts were used to record waist circumference. Though anthropometric measurements are not primary or secondary outcome measures in this study, it is one of the objective ways of determining overweight prevalence and nutritional status before and after the intervention study. The anthropometric measurements are recommended to form part of every nutritional surveillance and nutrition intervention study, as an objective measure of nutritional assessment.<sup>233</sup>

#### *3.4.5.3 Participants for validation procedures*

Participants who agreed to validate the questionnaire are listed in Table 3-3.

**Table 3-3: Respondents and sampling methods for validation of the questionnaire**

| Research activity   | Sampling method | Inclusion/exclusion criteria  | Respondents/ Participants  | Rationale   |
|---|-----------------|---|--|---|
| Internal validation of Questionnaire using index of content validity (CVI) criteria | Convenience     | Teaching food and nutrition and physical education,<br>Being a local nutritionists or dietician                             | 3 Food and nutrition teachers<br>4 physical education teachers<br>1 nutritionist<br>2 dieticians | To adapt the questionnaire for the context of Botswana  |
| Cognitive interviewing  | Convenience     | Any student attending junior secondary school<br>Not attending school in any of the randomly selected schools for the study | 33 Students from junior secondary schools in Gaborone  | To determine the face validity of the questionnaire   |
| Pilot testing of the questionnaire  | Convenience     | Any student attending junior secondary school<br>Not attending school in any of the randomly selected schools for the study | 33 Students from junior secondary schools in Gaborone  | To identify the time taken by participants to complete the questionnaire, modify the questionnaire and data analysis plan, to try out data analysis methods, to determine reliability of the questionnaire using the Pearson's correlation coefficient statistical test |

#### *3.4.5.4 Content validation of questionnaire: methods, procedures and results*

Data in Table 3-3 show that ten experts considered to have expert knowledge and experience in either nutrition or activities related to a healthy lifestyle were recruited to evaluate the content of the questionnaire<sup>234</sup> using the Content Validity Index (CVI)<sup>235-238</sup> tool (Appendix 5) adapted for this purpose with permission. Voluntary respondents included four Physical Education teachers (n=4), one from each of four schools (00, 03, 08, 10), three food and nutrition teachers (n=3), one from each of three schools (00, 03, 08), and one Nutritionist and two Dieticians from the Princess Marina Hospital outpatient clinics who were met individually. The six experts in nutrition evaluated the nutrition component of the

questionnaire and the four physical education experts evaluated the physical activity component of the questionnaire.

The content validity of each item on the questionnaire was evaluated using a 4-point ordinal rating scale on the CVI checklist (Appendix 5) adapted from Kyriacos (2011) with permission. Validity was pre-set at 70% and was taken as a proportion of items that received a rating of 3 or 4.<sup>239</sup> Data from the CVI were analysed using SPSS version 22 to compute percentages and the median. Results as well as the additions and alterations recommended by the experts are presented in Table 3-4.

**Table 3-4: Changes made to the questionnaire following expert opinion on Content Validity Index (CVI)**

| Item                                | 1=<br>irrelevant | 2=unable to assess<br>relevance without<br>item revision or<br>items in need of<br>such revision that<br>it would no longer<br>be relevant | 3=relevant<br>but needs<br>minor<br>alterations | 4=extremel<br>y relevant | Median | Changes  |
|-------------------------------------|------------------|--|---|--------------------------|--------|--|
| <b>Food frequency questionnaire</b> |                  |  |   |                          |        |  |
| B.1                                 | 0                | 0  | 1(16.7%)  | 5(83.3%)                 | 4      | Sorghum, maize meal and bread, were added to the response list<br>Replaced consume with eat                |
| B.2                                 | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.3                                 | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.4                                 | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.5                                 | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.6                                 | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.7                                 | 0                | 0  | 1(16.7%)  | 5(83.3%)                 | 4      | Replaced consume with eat  |
| B.8                                 | 0                | 0  | 1(16.7%)  | 5(83.3%)                 | 4      | Replaced consume with eat  |
| B.9                                 | 0                | 0  | 2(33.3%)  | 4(66.7)                  | 4      | Replaced consume with eat  |
| B.10                                | 0                | 0  | 0   | 6(100%)                  | 4      | Replaced consume with eat  |
| B.11                                | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 3.5    | Replace the word sugary with fizzy. Replaced consume with eat  |
| B.12                                | 0                | 0  | 4(66.7%)  | 2(33.3%)                 | 3      | Questions rephrased: How many litres of water do you drink per day? Response list in litres were added.    |
| B13-15                              |                  |  |   |                          |        | Questions about food they like and dislike and why, and indigenous foods they eat (B13, 14 &15) were added |
| C.1                                 | 0                | 0  | 5(83.3%)  | 1(16.7%)                 | 3      | Response list improved by adding local foods   |
| C.2                                 | 0                | 0  | 5(83.3%)  | 1(16.7%)                 | 3      | Response list improved by adding local foods<br>Replaced consume with eat                                  |
| C.3                                 | 0                | 0  | 5(83.3%)  | 1(16.7%)                 | 3      | Options improved by adding local foods<br>Replaced consume with eat  |

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| Item | 1=irrelevant | 2=unable to assess relevance without item revision or items in need of such revision that it would no longer be relevant | 3=relevant but needs minor alterations | 4=extremely relevant | Median | Changes  |
|------|--------------|--|--|----------------------|--------|--|
| C.4  | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      | Packed lunch response was added to the list  |
| C.5  | 0            | 0  | 4(66.7%)                               | 2(33.7%)             | 3      | Eating with maid response option was added   |
| C.6  | 0            | 0  | 3(50%)                                 | 3(50%)               | 3      | Eating with maid response option was added   |
| C.7  | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      | Add with maid response option  |
| D.1  | 0            | 0  | 4(66.7%)                               | 2(33.3%)             | 3      | Question D1 was changed to ‘how often do you eat breakfast?’<br>Response options: no one to cook, not enough money, I don’t like to eat in the morning were added if they have answered never to question D1 |
| D.2  | 0            | 0  | 4(66.7%)                               | 2(33.3%)             | 3      | The word eating was added to the question  |
| D.3  | 0            | 0  | 5(83.3%)                               | 1(16.7%)             | 3      | Rephrase question: how often do you eat outside home at pizzeria/restaurant/tuck-shop?   |
| D.4  | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      | Add snacking   |
| E. 1 | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      | Added the phrase: if you have no TV do not answer the following questions  |
| E.2  | 0            | 0  | 4(66.7%)                               | 2(33.3%)             | 3.5    | Removed the word which   |
| E.3  | 0            | 0  | 3(50%)                                 | 3(50%)               | 3.5    | locally available food items were added to response option list  |
| E.4  | 0            | 0  | 5(83.3%)                               | 1(16.7%)             | 3      | Removed the word commercial<br>Replaced are with is  |
| E.5  | 0            | 0  | 3(50%)                                 | 3(50%)               | 3.5    | Removed the word commercial<br>Corrected options   |
| E.6  | 0            | 0  | 4(66.7%)                               | 2(33.3%)             | 3      | Removed the word commercial<br>Replaced honestly with honest   |
| E.7  | 0            | 0  | 3(50%)                                 | 3(50%)               | 3.5    | Removed the word commercial  |
| E.8  | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      | Replaced restrict with control   |
| E.9  | 0            | 0  | 2(33.3%)                               | 4(66.7%)             | 4      |  |

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| Item   | 1=<br>irrelevant | 2=unable to assess<br>relevance without<br>item revision or<br>items in need of<br>such revision that<br>it would no longer<br>be relevant | 3=relevant<br>but needs<br>minor<br>alterations | 4=extremel<br>y relevant | Median | Changes  |
|--|------------------|--|---|--------------------------|--------|--|
| <b>Food frequency questionnaire</b>            |                  |  |   |                          |        |  |
| G.1  | 0                | 0  | 3(50%)  | 3(50%)                   | 3.5    | Corrected spelling for macronutrients  |
| G.2  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.3  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.4  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.5  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.6  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.7  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.8  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.9  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.10   | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.11   | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G. 12  | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 4      | Replaced sugary with fizzy   |
| G. 13  | 0                | 0  | 3(50%)  | 3(50)                    | 3.5    | Added locally available food items to the list                                   |
| G.14   | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.15   | 0                | 0  | 1(16.7%)  | 5(83.3%)                 | 4      |  |
| G.16   | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 4      | Replaced milk cake with carrot cake  |
| G. 17  | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 4      | French fries replaced with fresh chips   |
| G. 18  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G.19   | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G. 20  | 0                | 0  | 0   | 6(100%)                  | 4      |  |
| G. 21  | 0                | 0  | 3(50%)  | 3(50)                    | 3.5    |  |
| G. 22  | 0                | 0  | 0   | 6(100%)                  | 4      | Rephrased the question, add nutrition-related health problems questions (G23&24) |
| <b>Self-efficacy for healthy eating (SEHE)</b> |                  |  |   |                          |        |  |
| SEHE1  | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 4      |  |
| SEHE2  | 0                | 0  | 1(16.7%)  | 5(83.3%)                 | 4      |  |
| SEHE3  | 0                | 0  | 2(33.3%)  | 4(66.7%)                 | 4      |  |

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| Item                                     | 1= irrelevant | 2=unable to assess relevance without item revision or items in need of such revision that it would no longer be relevant | 3=relevant but needs minor alterations | 4=extremely relevant | Median | Changes   |
|--|---------------|--|--|----------------------|--------|---|
| SEHE4                                    | 0             | 0  | 1(16.7%)                               | 5(83.3%)             | 4      |   |
| SEHE5                                    | 0             | 0  | 3(50%)                                 | 3(50%)               | 3.5    | Replaced fried with fresh   |
| SEHE6                                    | 0             | 0  | 3(50%)                                 | 3(50%)               | 3.5    | Gave examples of locally fat foods  |
| SEHE7                                    | 0             | 0  | 4(66.7%)                               | 2(33.3%)             | 3      | Rephrased statement using familiar words  |
| SEHE8                                    | 0             | 0  | 5(83.3%)                               | 1(16.7%)             | 3      | Rephrased statements with familiar words  |
| <b>Intention to healthy eating (IHE)</b> |               |  |  |                      |        |   |
| IHE1                                     | 0             | 0  | 3(50%)                                 | 3(50%)               | 3.5    |   |
| IHE2                                     | 0             | 0  | 1(16.7)                                | 5(83.3%)             | 4      |   |
| IHE3                                     | 0             | 0  | 1(16.7%)                               | 5(83.3%)             | 4      |   |
| <b>Physical activity (PA)</b>            |               |  |  |                      |        |   |
| F. 1                                     | 4(100%)       | 0  | 0                                      | 0                    | 0      |   |
| F. 2                                     | 4(100%)       | 0  | 0                                      | 0                    | 0      | Added question: Do you usually walk or dropped at school?<br>With response options as recommender             |
| F. 3                                     | 1(25%)        | 0  | 1(25%)                                 | 2(50%)               | 3.5    | Replaced never with sleeping  |
| F. 4                                     | 1(25%)        | 0  | 1(25%)                                 | 2(50%)               | 3.5    | Added knowledge questions (F5&6): what is physical activity and what is/are the benefits of physical activity |
| F7                                       |               |  |  |                      |        | Question about the physical activities they do (F7) was added as recommended                                  |
| <b>Self-efficacy for exercise (SEE)</b>  |               |  |  |                      |        |   |
| SEPA1                                    | 1(25%)        | 0  | 1(25%)                                 | 02 (50%)             | 3.5    | Replaced engage with do   |
| SEPA2                                    | 1(25%)        | 0  | 1(25%)                                 | 2(50%)               | 3      | Replaced engage with do   |
| SEPA3                                    | 0             | 0  | 0                                      | 4(100%)              | 4      |   |
| SEPA4                                    | 0             | 0  | 0                                      | 4(100%)              | 4      |   |
| SEPA5                                    | 0             | 0  | 2(50%)                                 | 2(50%)               | 3.5    |   |
| SEPA6                                    | 1(25%)        | 0  | 3(75%)                                 | 0                    | 3      | Replaced engage with do   |
| SEPA7                                    | 3(75%)        | 0  | 1 (25%)                                | 0                    |        | Removed statement   |
| SEPA8                                    | 3 (75%)       | 0  | 1 (25%)                                | 0                    |        | Removed statement   |

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| Item  | 1=<br>irrelevant | 2=unable to assess<br>relevance without<br>item revision or<br>items in need of<br>such revision that<br>it would no longer<br>be relevant | 3=relevant<br>but needs<br>minor<br>alterations | 4=extremel<br>y relevant | Median | Changes                         |
|---|------------------|--|---|--------------------------|--------|---------------------------------|
| <b>Intention for physical activity(IPA)</b> |                  |  |   |                          |        |                                 |
| a   | 1(25%)           | 0  | 3(75%)  | 0                        | 3      | Added agree option to the scale |
| b   | 0                | 0  | 3(75%)  | 1(25%)                   | 3      | Added agree option to the scale |
| c   | 1(25%)           | 0  | 3(75%)  | 0                        | 3      | Added agree option to the scale |

Overall, all the items in the questionnaire were rated relevant needing minor alterations (3) or 4 (extremely relevant) except for two statements in self-efficacy for exercise (SEE) and 1 statement in self-efficacy for healthy eating (SEHE) components which were rated 1 or 2 respectively. The content validity was acceptable as it exceeded the pre-set 70%.

Experts advised that local food items and names be used to culturally adapt the questionnaire to the context of Botswana. Food items such as soft porridge (motogo), mabudula (different types of NIK-NAKS<sup>®</sup>), sorghum (bogobe jwa mabele), maize rice, fat cakes and tripe (serobe) were added to the answer option lists. Words such as kebabs, cola, French fries, carrot cakes and soda were replaced with local words such as fizzy drinks, fresh chips and muffins because they are available and familiar to students in Botswana. They also suggested additional questions as follows:

Part 1 section B, questions on the food items that students like, dislike and why, and indigenous foods they know were recommended. Section F; knowledge questions such as what is physical activity and its health benefits were also recommended, and Section G, questions relating to the benefit of healthy diet and lifestyle nutrition-related health problems were recommended.

#### *3.4.5.5 Face validity procedure and results: cognitive interviews*

For face validity of the questionnaire a probing method was used for the cognitive debriefing.<sup>240</sup> Six questions were developed for the probing method for the cognitive interviews.<sup>234 240</sup> The questionnaire had to be validated for the context of Botswana because in prior studies it had been tested for reliability and validity in some European countries, the USA, Thailand and in Malaysia. Face validity supports content validity and its purpose is to evaluate whether the instrument will measure what it intends to measure. Face validity ensures that the instrument is valid to respondents.<sup>237</sup> Cognitive debriefing is a form of interview to check if respondents understood questions, words and terms in the questionnaire.<sup>240</sup> There are two ways of performing cognitive interviewing; think aloud (observation) and probing. Think aloud is where respondents are asked to verbalize their thought processes as they read questions. While in probing the interviewer asks direct questions to respondents for the purpose of understanding their interpretations of words. The probing method was used because it was feasible to use in a group of participants than think aloud method.<sup>241</sup>

The schools that were not randomly selected for the study were approached to solicit student participation in face validity of the questionnaires. The 33 respondents who verbally agreed to participate in face validation through help from teachers were conveniently selected to participate in face validity were from two (2) schools that were not randomly selected for the study (00 and 08 coded schools). Initially the plan was to do face validity in one school; however two schools were used because it was not possible to access all 33 students in one school. Most students were reluctant to participate because it was not convenient for them to be interviewed after school because they were ready to go home. Most students are picked up by their parents immediately after school. Audio-recording was not done and voice recorders

were not bought due to financial constraints; instead two (2) trained research assistants captured the interviews as probing questions were used. The researcher met with groups of students at set times convenient for them.

Convenient samples of students were met as a group through the help of the teachers in a designated area, because it was impossible to access them individually. Introductions to the participants and the background of the study, purpose, objectives, what cognitive interviewing is and its purpose was explained to them. They were given the opportunity to ask questions and to ask for clarification. They were informed by the researcher that the purpose of the exercise is to complete the questionnaire and participate in a pre-scheduled interview and cognitive interview processes through the probing method. They were informed that the exercise will take an hour or so. The purpose of conducting pre-scheduling of the interview was for the participants to familiarize themselves with the questionnaire and type of questions that will be asked so that misunderstandings, problems with interpretation of phrases maybe avoided beforehand.<sup>237</sup>

Students were divided into two groups per school; therefore four focus groups of students from all grades were cognitively interviewed. Each student had a separate response sheet coded 1-33 which the recorders used to record their responses to questions as probed. This was done to gather a wide range of responses to questions and discover wide areas to be improved.<sup>240</sup> Then the participants were taken through the pre-interview and cognitive interview process. The processes were done the same day to help participants not to forget the cognitive interview process. For the pre-interview, materials included colored pictures of fruit and vegetables and of adolescents playing sports downloaded from the Google website, a pencil and recording sheets for each participant and chairs (no tables because of inadequate resources). The first probing question was: “Tell me what you’re thinking about when you look at the pictures”. The recorders captured the respondent’s response as shown in Table 3-5.

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**Table 3-5: Respondent's response to pre-interview question**

| Respondents' code number | Responses   |
|--------------------------|---|
| 1                        | ' I think about what I am doing about my diet and exercise'   |
| 2                        | ' I think about improving my life'  |
| 3                        | 'I think about what I am not doing right'   |
| 4                        | 'I think about my diet and sports activities that are engage in'  |
| 5                        | 'I think about what I can do to improve the way I eat and do activities'  |
| 6                        | 'I think about my lifestyle'  |
| 7                        | 'I think about my eating habits'  |
| 8                        | 'I think about food and sports'   |
| 9                        | 'I think about changing the way I eat and exercise'   |
| 10                       | 'I think about nice food and what I can do to exercise my body'   |
| 11                       | 'I think about my eating habits'  |
| 12                       | 'I think about my eating habits'  |
| 13                       | 'I think about what I am not doing right in my life'  |
| 14                       | 'I do not know, it is just pictures of food and children playing'   |
| 15                       | 'I think about food and games'  |
| 16                       | 'I feel guilty because I am not doing the right thing about my eating and exercising'   |
| 17                       | 'Eish eating right is a challenge, but exercising is not'   |
| 18                       | 'I think of what I am not doing right in eating and in sports'  |
| 19                       | I think about food and the game we were playing yesterday, it was fun'  |
| 20                       | 'I think about my lifestyle'  |
|                          | 'I think about the unhealthy food that is cooked in our school, it is very un-tasty. I think of how we played skipping rope the game yesterday and it was nice' |
| 21                       | 'I think of what I learnt about in our food and nutrition class that we should eat healthy. There is no sports in our school this days'                         |
| 22                       | She laughs and said ' I think about what I am not doing right about my diet, but I try to play sports'  |
| 23                       | 'I think about how hard it is to eat right and exercise at times'   |
| 24                       | 'I think about a healthy diet and sports '  |
| 25                       | 'I think about what the teacher said yesterday about mafresh(fresh chips), that it is unhealthy and I feel like playing sports'                                 |
| 26                       | 'I think of eating right and the game we are supposed to play tomorrow with another team from local school'   |
| 27                       | 'I think of yum-yum food and sports'  |
| 28                       | 'I think of vegetables that I do not like and that sport is good'   |
| 29                       | 'Eish I think of starting to eat healthy food and engage in sports'   |
| 30                       | 'I think about eating healthy and the game we are to play tomorrow with my neighbours'  |
| 31                       | 'I think of how I can improve the way I eat and play sports'  |
| 32                       | 'I think of going shopping with my mother and I miss fruits so much, it has been a while without eating them and I think how I do not like sports'              |
| 33                       | 'I think of my lifestyle that it is not good'   |

After answering this question the respondents were prepared for the cognitive interviews.

Prior to conducting the cognitive interview, respondents were given a questionnaire to

complete which took approximately 20-25 minutes to complete. Thereafter the cognitive interviewing technique was employed using six (6) semi-structured questions to probe respondents' understanding of the words, interpretation of questions and their feelings about the questionnaire and whether it is relevant to the context of Botswana.<sup>240</sup>

1. How well they recalled information?
2. How to describe what the question is asking in their own words?
3. Why they answered questions the way they did?
4. How comfortable were they in answering questions and if not what made them feel uncomfortable?
5. Any questions they did not want to answer and why?
6. Whether they think the questions are relevant to the context of Botswana?

During the cognitive interviews, two trained research assistants captured the responses as the principal investigator (researcher) was probing the respondents. Content analysis was used to analyse the data. Responses to the questions by each participant were categorised into ideas and then words were developed that represented the idea. Similar words were grouped together and these words were recorded as the response to each question and entered into SPSS version 22 to calculate frequencies and percentages as shown in Table 3.6.

**Table 3-6: Frequency table of responses for assessing face validity of questions for the cognitive interviews by students (n=33) in schools not randomly selected**

| Question | Results  | Changes/explanations made  |
|----------|--|--|
| 1        | 78.8% (26) understood the questions  |  |
|          | 21.2% (7) did not understand B3, F2, F4 and Section C                      | Question F2 and F4 were clarified. The word 'both' was added to F2 option list |
| 2        | 48.5% (16) Described questions well  | None   |
|          | 51.5% (17) misinterpreted the word usually                                 | The word 'usually' was explained to mean very frequently                       |
| 3        | 90.9% (30) answered question because it asked about their daily activities | None   |
|          | 9.1% (3) said they had to answer question as asked                         | None   |
| 4        | 63% (21) were comfortable to answer questions                              | None   |
|          | 36.4% (12) were uncomfortable, questions are too personal                  | The purpose of B13, 14, 15 questions was clarified                             |
| 5        | 51.5% (17) no hard feelings towards the questions asked                    |  |
|          | 48.5% (16) did not want to answer  | The purpose of B13, 14, 15 questions was clarified                             |
| 6        | 100% (33) questions reflect everyday life of students                      | None   |

In addition to answering questions, the respondents also suggested additional options or words that needed to be replaced because they were difficult to understand as shown in Table 3.7.

**Table 3-7: Cognitive interview: three issues identified by respondents**

| <b>Problems Identified by respondents during Cognitive Testing Interviews</b>  | <b>Solution Proposed by respondents</b>                       | <b>Final item or content</b>   |
|--|---|--|
| <b>Interpretation of specific terms</b>  |   |  |
| Participants interpreted the word ‘usually’ as meaning frequent things they do and not just one frequent thing they do | Instead of using the word usually, we used ‘most of the time’ | Questions item C1-3 we inserted the phrase ‘most of the time’  |
| <b>Response options</b>  |   |  |
| Students stated that during the week they walk at times or are dropped off at school                                   | To insert the option ‘both’                                   | Item F1 – the word ‘both’ was inserted   |
| <b>Removing words that are difficult to understand</b>   |   |  |
| The words ‘commercial’ and ‘restrict’ were difficult to understand   | Remove the word commercial                                    | The word ‘commercial’ was removed from item E5 & 6 E8 - The word ‘restrict’ was changed to ‘control’ |

Face validity of the questionnaire was achieved as 91% of the respondents, who were similar to the randomly selected respondents who would complete the questionnaire, indicated that the questions were clear, and 100% stated that the questions reflected the context of Botswana. They also identified words that they did not understand and additional options that they deemed necessary. The questionnaire was amended accordingly (Appendix 3).

#### *3.4.5.6 Reliability*

Content and face validation are subjective judgemental procedures that evaluate the degree to which items are representative of the domains of the construct. Reliability tests are mandatory to measure whether the scale would accurately stand the test of time.<sup>242</sup>

The questionnaire was given to the same students to complete 3 weeks apart for test-retest reliability testing. The data obtained from the 33 conveniently sampled students from non-randomly selected schools who completed the modified questionnaire, was analysed using the Cronbach’s alpha ( $\alpha$ ) test in SPSS for internal consistency of the questionnaire. Analysis was done for Part 1 sections B) food frequency consumption; C) meal habits; D) influences on

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food choice; E) lifestyle and physical activity; and F) nutrition knowledge.; Part 2 - Self efficacy for healthy eating, intention for healthy eating; and Part 3 - Self efficacy for exercise, and intention for exercise. Results for the test-retest reliability of the items and Cronbach's alpha are presented in Table 3.8.

**Table 3-8: Reliability results**

| Questionnaire components                       | Reliability Time 1 results | Retest Reliability Time 2 results |
|--|----------------------------|-----------------------------------|
| Part 1 section B                               | 0.72                       | 0.79                              |
| Part 1 section C                               | 0.47                       | -0.86                             |
| Part 1 section D                               | -0.63                      | -0.01                             |
| Part 1 section E                               | 0.07                       | 0.313                             |
| Part 1 section F                               | 0.31                       | 0.497 (delete item F2)            |
| Part 1 section G                               | 0.80                       | 0.84                              |
| Part 2 Self-efficacy for healthy eating (SEHE) | 0.97                       | 0.93                              |
| Part 2 intention for healthy eating (IHE)      | 0.999                      | 0.68                              |
| Part 3 self-efficacy for exercise (SEE)        | 0.999                      | 0.64                              |
| Part 3 intention for physical activity (IPA)   | 0.999                      | 0.88                              |
| All questionnaire components                   | 0.85                       | 0.936                             |

An acceptable reliability is between 0.60-1.<sup>243</sup> The reliability of the questionnaire by test-retesting was set at 0.60. Reliability of all the items of the questionnaire is 0.885, however if done per subscale sections, Part 1, section D indicates that it is unreliable for both Time 1 and Time tests. For Part 1 section F reliability is 0.31 for Time 1 and 0.497 for Time 2. A Cronbach's alpha of 0.31 and 0.497 is unacceptable and may be attributable to the small number of items (n=4) and small sample size (n=33).<sup>244</sup> The remaining sections (part 1 G, part 2 SEHE, part 2 IHE, part 3 SEE and part 3 IPA) are reliable in both Time 1 test and the retest (Time 2) with values ranging between 0.64 and 1.

Part 1 section D was not reliable and it warranted deletion from the questionnaire. Other Parts of the questionnaire were acceptable because Cronbach's alpha ranged between 0.63 and 0.99 for both Time 1 test and the Time 2 retest which met the pre-set Cronbach's alpha of 0.60. The questionnaire was amended accordingly (Appendix 4).

### **3.4.6 Procedures**

#### *3.4.6.1 Training of research assistants*

Following two (2) weeks of advertising (15<sup>th</sup> to 30<sup>th</sup> January 2015), 14 research assistants (RA) were recruited. Research Assistant interviews were conducted during the week of 2<sup>nd</sup> to 6<sup>th</sup> February, 2015. Ten RAs were selected; six (6) females and four (4) males. Four (4) RAs were postgraduate students and six (6) RAs were undergraduate students from the faculties of Education, Science and Health Science. The RAs were trained for two (2) days (10<sup>th</sup> to 11<sup>th</sup> February 2015) and the focus of the training was on the background, purpose and objectives of the study, cognitive interviewing, professionalism and familiarization with the questionnaire. During the training program RAs practiced a uniform method of doing weight, height and waist circumference measurements and recording results.

#### *3.4.6.2 Recruitment of respondents and interventionists*

Following approval from the Departments of Health and Rehabilitation Sciences and before the commencement of the study, the principal investigator (PI) approached the school administrators in the eight randomly selected schools in the urban areas of Gaborone to solicit participation in the study. The randomisation process was repeated twice until there were eight schools because one of the schools that was chosen in the first round of the randomisation process declined to participate. The PI was given permission to meet with guidance and counselling, food and nutrition and physical education teachers from each school that indicated interest in participating in the study and informed them about the study, what it entailed and solicited their assistance in obtaining student participation in the study. The teachers agreed to help, though they stated that they were overwhelmed with school work activities.

The PI met with 33 randomly selected respondents (n=11 Grade 8, n=11 Grade 9, n=11 Grade 10) in each school (n=8), a total of 264 and further explain the purpose of the study, inclusion and exclusion criteria, and assent and informed consent matters. The randomly selected respondents who agree to participate voluntarily in the study were given assent forms, and

consent forms (Appendix 36) to give to their parents and return them after two (2) weeks to their class teachers. The respondents preferred English rather than Setswana consent forms. There were substantial number of students who were randomly selected who declined to participate in the study and the randomisation process was repeated to select the required number of students from each school. Though some students agreed to participate, their parents declined to allow them to participate in the study. The big challenge was that students who agreed to participate in the study and had been given assent and consent forms did not return them at the stipulated time. Some students lost the papers and the PI realised that asking students to return consent forms after two weeks was not practical. The recruitment process was completed on the 6<sup>th</sup> of June 2015. All the consent and assent forms were collected from the teachers responsible for recruiting respondents. The number of consent and assent forms corresponded with the number given out (n=264).

#### *3.4.6.3 Data collection procedure*

Voluntary respondents (n=252) randomly selected from eight randomly selected schools were met at different dates and time at designated places as arranged by the respective school administrators for questionnaire administration and measurement of weight, height and waist circumference. Findings for measurements were plotted on a chart according to participants' age and gender to determine BMI (Appendix 6a & b), and findings for WC were recorded on the chart in the space provided (Appendix 7).

Data collection ran from 18<sup>th</sup> June 2015 to 9<sup>th</sup> July 2015. Each school had specific dates for data collection as authorised by the school administration. Data collection was done in the afternoons so that teaching was not disrupted. The respondents took 20-30 minutes to complete the questionnaire. There were two sites, one for boys and one for girls. In each site there were two research assistants, one for checking weight and height and waist circumference and one for recording. They were expected to swap roles for each respondent for quality purposes. The male research assistants took and recorded the boys' anthropometric measurements and female research assistants did this for the girls. Privacy was provided, even

though in some schools, the venue provided by school administrations was not conducive for data collection neither for checking anthropometric measurements. A scale that checks both the weight and height (Detecto 439 Eye-Level Mechanical Beam Doctor Scale with Height Rod) was used (Appendix 12). The scale was put to zero before each participant was weighed. The respondents were asked to reduce excess clothing like jerseys, to remove their shoes and items from their pockets such as coins, cell phones and or wrist watches but to leave socks on. The height was checked immediately using the same scale. All the measurements were recorded independently by both research assistants and then averaged to get one reading, which was recorded on the relevant chart.

Waist circumference was measured using non-elastic tape for males and females. The respondents were asked to expose the top of their hip bone up to the bottom of their ribs while standing and taking a breath. Each research assistant placed the non-elastic tape midway between the points just below the belly button at different times to take the measurement. The two measurements were then averaged to get one reading, which was recorded on the relevant chart.

The PI and the trained research assistants supervised voluntary respondents to complete coded questionnaires (Appendix 4) to address any difficulties that arose. Twelve participants did not participate in data collection; nine respondents who re-located from the schools were mostly from grade 8 (form 1) and three were absent from school during data collection period. Data in Table 3-9 show the number of respondents who were recruited and who participated in Study One.

**Table 3-9: Number of respondents for data collection in Study One**

| School code | Number recruited | Number of respondents | Number of non-participants   |
|-------------|------------------|-----------------------|------------------------------|
| 09          | 33               | 33                    | Nil                          |
| 03          | 33               | 31                    | 2 (re-located)               |
| 12          | 33               | 33                    | Nil                          |
| 05          | 33               | 33                    | Nil                          |
| 04          | 33               | 31                    | 2 (re-located)               |
| 02          | 33               | 31                    | 2 (re-located)               |
| 07          | 33               | 30                    | 3 (2 re-located, 1 absent)   |
| 11          | 33               | 30                    | 3 (2 re-located, one absent) |
| Total       | 264              | 252                   | 12                           |

The PI used the data from Study One (Appendix 4, 6 a & b, and 7) as the pre-test data for the voluntary respondents for Study Two. Pre-test data for respondents who had not shown interest in participating in Study Two, were not included for Study Two.

### 3.5 Data management and analysis

#### 3.5.1 Data management

Data were captured directly onto Microsoft® Excel software (Redmond, Washington: Microsoft 2010) spreadsheets, cleaned by the researcher and stored in a password protected computer. Data were then imported directly from Microsoft Excel spreadsheets into a Statistical Package Software System (SPSS) version 22 to be further cleaned before analysis. Data were sent to a statistician for further cleaning before analysis. In all eight (8) schools there were missing data especially for section B (food frequency consumption), questions 13-15. These questions required the respondents to indicate food they prefer or do not prefer and to state why they prefer or do not prefer a particular food. Expectation maximisation in SPSS version 22 was used and results showed that missing data were not missing at random because the chi square was not significant (0.5) but the respondents possibly chose not to respond to

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the questions. Therefore missing data were replaced using mean substitution in SPSS, one of the best alternatives recommended for use in behavioural studies as it is very simple to use and it maintains the original data.<sup>245 246</sup>

### 3.5.2 Data analysis strategy for Study One

The Data analysis strategy is presented in Table 3-10.

**Table 3-10: Data analysis strategy: Study One**

| Variables                    | Type of data/indicator variables            | Statistical analysis  |
|------------------------------|---|---|
| Age                          | Continuous                                  | Measures of central tendency: Mean and standard deviation if data are normally distributed, median if data are skewed.<br>Minimum to maximum.<br>Number, proportion and percentage. |
| Gender                       | Categorical/Nominal<br>Binary: male, female | Number, proportion and percentage   |
| Socio-economic status (SES)  | Ordinal (low, middle, high)                 | Number, proportion and percentage   |
| BMI                          | Ordinal (percentiles)                       | Measures of central tendency: as above<br>Minimum to maximum<br>Number, proportion and percentage totals and by gender  |
| WC                           | Ordinal (categories)                        | Number, proportion and percentage by gender   |
| WC                           | Raw scores                                  | Measures of central tendency: as above<br>Minimum to maximum.   |
| Eating habits                | Ordinal                                     | Number, proportion and percentage   |
| Influence on food choice     | Nominal                                     | Number, proportion and percentage   |
| Nutrition knowledge          | Interval                                    | Measures of central tendency: as above.<br>Minimum to maximum<br>Number, proportion and percentage  |
| Physical activity behaviours | Ordinal                                     | Number, proportion and percentage   |
| Intention to change          | Ordinal                                     | Measures of central tendency: as above.<br>Minimum to maximum<br>Number, proportion and percentage  |
| Self-efficacy for change     | Ordinal                                     | Measures of central tendency: as above<br>Minimum to maximum<br>Number, proportion and percentage   |

### **3.6 Results of Study One**

In this chapter findings are presented following the validation of a 3-part questionnaire comprising 10 components: demographic characteristics, food frequency consumption, meal habits, influences on food choices, physical activity behaviour, nutrition knowledge, self-efficacy for healthy eating and self-efficacy for physical activity, and intention for healthy eating and physical activity behaviours. The objectives of the study were to describe participants' demographic characteristics and eating habits, to identify influences on food choice and preferences, to determine awareness and knowledge of healthy eating and food intake, to describe physical activity behaviours, and to determine levels of intentions and self-efficacy for healthy eating and exercise and the prevalence of overweight. The results are presented for each objective.

#### **3.6.1 Objective 1: Demographic characteristics of the respondents**

Data in Table 3-11 show respondents' demographic characteristics (Section A of the questionnaire, Appendix 4).

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**Table 3-11: Respondent's Demographic Characteristics (N= 252)**

| Characteristics                       | Variables   | Proportion<br>N (%) |
|---------------------------------------|---|---------------------|
| Gender                                | Male  | 105 (41.7)          |
|                                       | Female  | 147 (58.3)          |
| Age                                   | 13  | 54 (21.4)           |
|                                       | 14  | 78 (31.0)           |
|                                       | 15  | 120 (47.6)          |
| Socio-economic status <sup>a</sup>    | Low   | 135 (53.6)          |
|                                       | Middle  | 107 (42.5)          |
|                                       | High  | 10 (4.0)            |
| Body Mass Index (BMI) <sup>b</sup>    | Underweight (<5 <sup>th</sup> percentile)                     | 22 (8.7)            |
|                                       | Normal BMI (5 <sup>th</sup> to <85 <sup>th</sup> percentile)  | 188 (74.6)          |
|                                       | Overweight (85 <sup>th</sup> to <95 <sup>th</sup> percentile) | 27 (10.7)           |
|                                       | Obese (≥95 <sup>th</sup> percentile)                          | 4 (1.6)             |
|                                       | Obese with risk(≥97 <sup>th</sup> percentile )                | 11 (4.4)            |
| By gender                             | Underweight females   | 10 (3.9)            |
|                                       | Underweight males   | 12 (4.8)            |
|                                       | Normal weight females   | 114 (45.2)          |
|                                       | Normal weight males   | 74 (39.4)           |
|                                       | Overweight females  | 16 (6.3)            |
|                                       | Overweight males  | 11 (4.4)            |
|                                       | Obese females   | 2 (0.8)             |
|                                       | Obese males   | 2 (0.8)             |
|                                       | Obese with risk females                                       | 5 (2.0)             |
|                                       | Obese with risk males   | 6 (2.4)             |
| Waist circumference (WC) <sup>c</sup> | WC for females (≤81.5cm) <sup>n</sup>                         | 131 (52.0)          |
|                                       | WC for males (≤80.5cm) <sup>n</sup>                           | 90 (35.7)           |
|                                       | WC for males (≥80.5cm)  | 17 (6.7)            |
|                                       | WC for females (≥81.5cm)                                      | 14 (5.6)            |

Note on table:

a Socioeconomic status was determined by parents/guardians' employment and level of education.<sup>202</sup>

b BMI was determined by CDC cut off points<sup>85</sup>

c WC was determined by Nigerian cut off points.<sup>247</sup>

n- normal value.

Data in Table 3-11 show that there were more females in the sample (147/252, 58.3%) than males (105/252, 41.7%). Data for age were not normally distributed ( $P<001$ ) nor data for knowledge scores ( $P<004$ ) using the Kolmogorov-Smirnov test for a sample size greater than 50.<sup>248</sup> The majority of respondents were aged 15 years (120/252, 47.6%). Most of the respondents had a low socioeconomic status (153/252, 53.6%). Levels of socioeconomic status are explained in Appendix 39. The majority of respondents had a normal BMI (188/252, 74.6%) and few were underweight (22/252, 8.7%). Twenty-seven respondents (10.7%), 4/252

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(1.6%) were obese and 11/252 (4.4%) were obese with risk. More females (131/252, 52%) than males (90/252, 35.7%) had a normal WC and few females (17/252, 6.7%) and males (14/252, 5.6%) had an abnormal WC respectively.

Data in Table 3-12 show descriptive statistics of the demographics of respondents in Study One.

**Table 3-12: Demographic Statistics for respondents in Study One (N= 252)**

|   | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> | <b>SD</b> | <b>Median</b> |
|---|----------------|----------------|-------------|-----------|---------------|
| Age in years                                | 13             | 15             | 14.26       | 0.79      | 14            |
| Body mass index scores in kg/m <sup>2</sup> | 10.3           | 33.0           | 20.08       | 3.90      |               |
| Waist Circumference scores in cm            | 48.4           | 102.4          | 71.24       | 8.71      |               |

Note on table: SD, standard deviation.

Data in Table 3-12 show that the mean age of respondents was 14.3 years (SD 0.79), mean BMI was 20.1 kg/m<sup>2</sup> (SD 3.9) and mean waist circumference score was 71.2 cm (SD 8.71). The minimum BMI (10.3 kg/m<sup>2</sup>) is below the 5<sup>th</sup> percentile.

### 3.6.2 Objective 2: Describe eating habits

Data indicating respondents' self-reported eating habits are presented in Tables 3-13a – 3-13c (Section B of the questionnaire, Appendix 4).

**Table 3-13a: Respondent’s Eating Habits – Section B questionnaire (N= 252)**

| <b>Food/Drinks</b> | <b>Seldom/Never<br/>Proportion<br/>N (%)</b> | <b>Occasionally<br/>Proportion<br/>N (%)</b> | <b>Often<br/>Proportion<br/>N (%)</b> | <b>Very Often<br/>Proportion<br/>N (%)</b> |
|--------------------|--|--|---------------------------------------|--|
| B1. Starch         | 3 (1.2)                                      | 57 (22.6)                                    | 141 (56.0)                            | 51 (20.2)                                  |
| B2. Meat           | 3 (1.2)                                      | 39 (15.5)                                    | 127 (50.4)                            | 83 (32.9)                                  |
| B3. Fish           | 36 (14.3)                                    | 183 (72.6)                                   | 29 (11.5)                             | 4 (1.6)                                    |
| B4. Cheese         | 81 (32.1)                                    | 116 (46.0)                                   | 45 (17.9)                             | 10 (4.0)                                   |
| B5. Eggs           | 13 (5.2)                                     | 125 (49.6)                                   | 102 (40.5)                            | 12 (4.8)                                   |
| B6. Vegetables     | 10 (4.0)                                     | 52 (20.6)                                    | 116 (46.0)                            | 74 (29.4)                                  |
| B7. Fruits         | 4 (1.6)                                      | 58 (23.0)                                    | 107 (42.5)                            | 83 (32.9)                                  |
| B8. Sweets         | 7 (2.8)                                      | 42 (16.7)                                    | 71 (28.2)                             | 132 (52.4)                                 |
| B9. Snacks         | 10 (4.0)                                     | 56 (22.2)                                    | 90 (35.7)                             | 96 (38.1)                                  |
| B10. Fried foods   | 12 (4.8)                                     | 100 (39.7)                                   | 94 (37.3)                             | 46 (18.3)                                  |
| B11. Fizzy drinks  | 11 (4.4)                                     | 85 (33.7)                                    | 96 (38.1)                             | 60 (23.8)                                  |

Note on table: Frequency categories in Table 3-13a reflect the 11 categories in the questionnaire (Appendix 4) that were collapsed for the analysis: Seldom/Never has remained unchanged, occasionally refers to 1/month, 2-3/month and 1/week, often refers to 2-3 times per week, 4-6/week and 1/day, while Very Often refers to 2-3/day, 4-5 /day and 6 or more/day.<sup>121</sup> Categories of data were collapsed so that they may be more sensible for easier interpretation.

Data in Table 3-13a show that the majority of respondents consumed sweets very frequently (132/252, 52.4%), followed by snacks (96/252, 38.1%). Fish, eggs and cheese were occasionally consumed (182/252, 72.6%; 125/252, 49.6%; 116/252, 46%) respectively.

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Data in Table 3-13b show respondents eating habits in respect of 6 food groups.

**Table 3-13b: Respondent's eating habits – 6 food groups (N= 252)**

| Food groups  | Seldom/Never<br>Proportion<br>N (%) | Occasionally<br>Proportion<br>N (%) | Often<br>Proportion<br>N (%) | Very Often<br>Proportion<br>N (%) |
|--|-------------------------------------|-------------------------------------|------------------------------|-----------------------------------|
| 1. Dairy (cheese, milk, eggs)                          | 94 (37.3)                           | 241 (95.6)                          | 147 (58.4)                   | 22 (8.8)                          |
| 2. Fruits  | 4 (1.6)                             | 58 (23.0)                           | 107 (42.5)                   | 83 (32.9)                         |
| 3. Vegetables  | 10 (4.0)                            | 52 (20.6)                           | 116 (46.0)                   | 74 (29.4)                         |
| 4. Meat and substitutes (fish, nuts, legumes, poultry) | 39 (15.5)                           | 222 (88.1)                          | 156 (61.9)                   | 87 (34.5)                         |
| 5. Bread, pasta, rice, maize meal, sorghum             | 3 (1.2)                             | 57 (22.6)                           | 141 (56.0)                   | 51 (20.2)                         |
| 6. Extra foods   |                                     |                                     |                              |                                   |
| Sweets   | 7 (2.8)                             | 42 (16.7)                           | 71 (28.2)                    | 132 (52.4)                        |
| Snacks   | 10 (4.0)                            | 56 (22.2)                           | 90 (35.7)                    | 96 (38.1)                         |
| Fried foods  | 12 (4.8)                            | 100 (39.7)                          | 94 (37.3)                    | 46 (18.3)                         |
| Fizzy drinks   | 11 (4.4)                            | 85 (33.7)                           | 96 (38.1)                    | 60 (23.8)                         |

Note on table: food groups 1 to 5 are deemed nutritionally essential foods and food group 6 is not deemed a nutritionally essential food.<sup>121</sup>

Data in Table 3.13b show that the majority of the respondents ate foods from food groups 1 to 5 occasionally (222/252, 88.1%) and often (156/252, 61.9%). However 52.4% (132/252) respondents ate sweets and snacks (96/252, 38.1) from food groups 6 very often.

Respondents' daily water consumption is presented in Table 3-13c (Section B, question 12).

**Table 3-13c: Respondents' daily water intake (N=252)**

| <b>Water Intake</b> | <b>Proportion<br/>N (%)</b> |
|---------------------|-----------------------------|
| 2-4 cups            | 98 (38.9)                   |
| 2 cups              | 68 (27.2)                   |
| 4-6 cups            | 60 (23.8)                   |
| 6-8 cups            | 26 (10.3)                   |

Note on table: 2 cups refers to  $\leq 1$  litre, 2-4 cups refers to 1-2 litres, 4-6 cups refers to 2-3 litres, and 6-8 cups refers to  $\geq 3$  litres

Data in Table 3-13c indicate that the majority (98/252, 38.9%) of the respondents drank 2-4 cups (1-2l) of water daily and fewer drank 6-8 cups daily (26/252, 10.3%).

Data in Tables 3-14 to 3-16 and Fig 1-4 represent respondents' meal habits (Section C of the questionnaire, Appendix 4).

**Table 3-14: Food items for breakfast (N= 252)**

| <b>Food item</b>         | <b>Proportion<br/>N (%)</b> |
|--------------------------|-----------------------------|
| Coffee/tea, sugar, bread | 115 (45.6)                  |
| Cornflakes and milk      | 43 (17.1)                   |
| Soft porridge (motogo)   | 36 (14.3)                   |
| Fat cakes                | 25 (9.9)                    |
| Fruits                   | 17 (6.7)                    |
| Oats, milk and sugar     | 10 (3.9)                    |
| Snacks                   | 4 (1.6)                     |
| Sweets                   | 2 (0.8)                     |

Note on table: motogo refers to soft porridge.

Data in Table 3-14 show that the majority of respondents (115/252, 45.6%) had coffee/tea, sugar and bread for breakfast while very few (2/252, 0.8%) had sweets and snacks (4/252, 1.6%) for breakfast.

**Table 3-15: Food eaten frequently (N= 252)**

| <b>Food item</b> | <b>Proportion<br/>N (%)</b> |
|------------------|-----------------------------|
| Fresh chips      | 96 (38.1)                   |
| Fat cakes        | 81 (32.1)                   |
| Pizza            | 29 (11.5)                   |
| Pie              | 17 (6.7)                    |
| Sandwich         | 14 (5.6)                    |
| Hotdog           | 9 (3.6)                     |
| Tripe            | 6 (2.4)                     |

Note on table: tripe (Serobe) refers to digestive organs of a cow, fat cakes (Magwinya) refer to bread cooked in boiling oil, fresh chips refer to French fries.

Data in Table 3-15 show that the majority of respondents (96/252, 38.1%) ate fresh chips frequently, followed by fat cakes (81/252, 32.1%) and pizza (29/252, 11.5%).

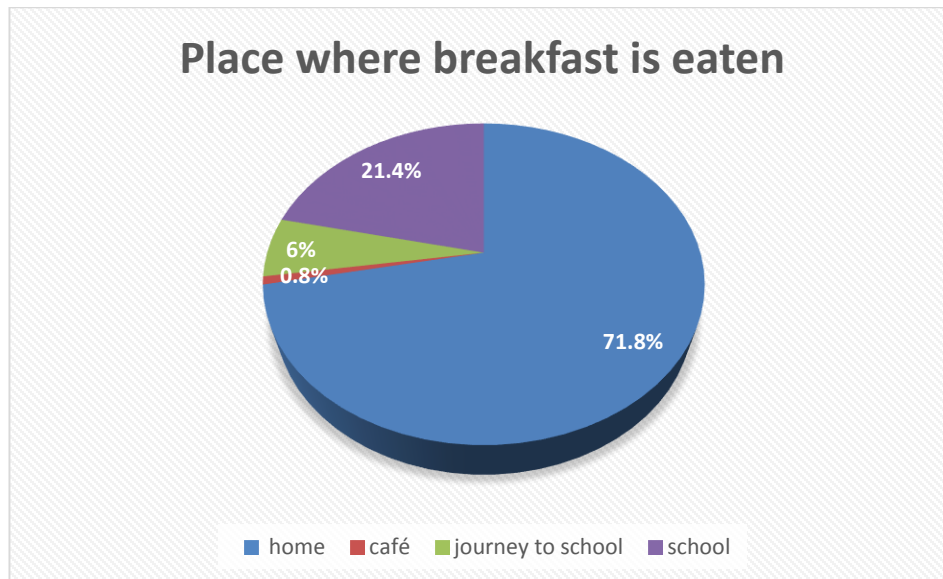
Data in Table 3-16 show the number and proportion of respondents who ate snacks frequently.

**Table 3-16: Snacks eaten frequently (N= 252)**

| <b>Food item</b> | <b>Proportion<br/>N (%)</b> |
|------------------|-----------------------------|
| Nik Naks®        | 97 (38.5)                   |
| Biscuits         | 70 (27.8)                   |
| Fruit            | 36 (14.3)                   |
| Popcorn          | 25 (9.9)                    |
| Sandwich         | 9 (3.6)                     |
| Homemade cake    | 8 (3.2)                     |
| Crisps           | 7 (2.8)                     |

Data in Table 3-16 show that respondents (97/252 38.5%) ate NIK-NAKS® that contain a lot of salt and sugar, followed by biscuits 70/252 (27.8%) that contain a lot of sugar. Few respondents (36/252, 14.3%) ate fruit as a snack or popcorn (25/252, 9.9%).

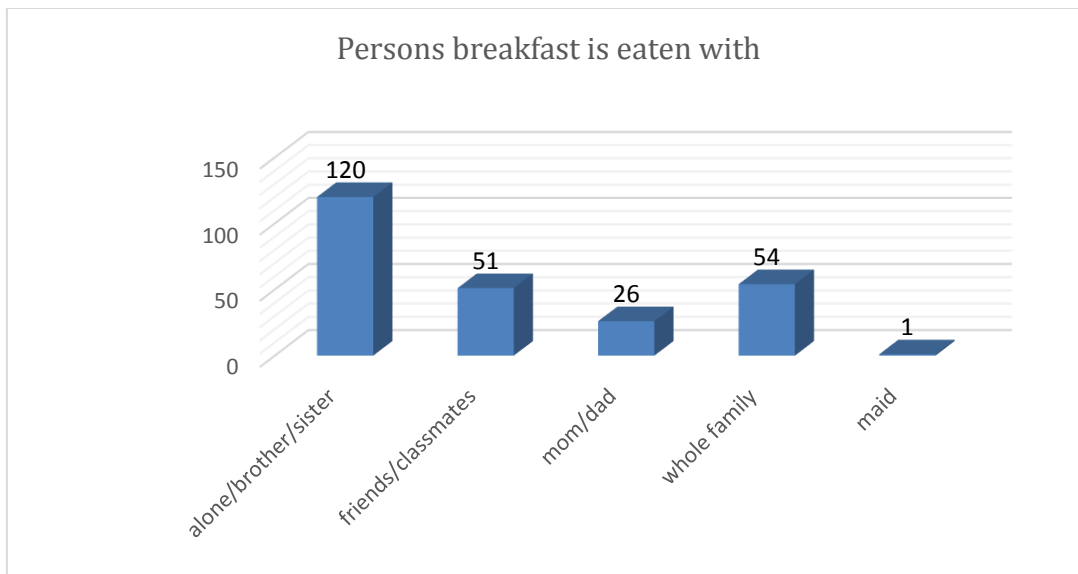
Data in Figure 3-1 represent places where respondents ate breakfast and data in Figure 3-2, with whom breakfast is eaten.



**Fig 3-1: Place where respondents ate breakfast**

Data in Fig 3-1 show that the majority of respondents (181/252, 71.8%) ate breakfast at home rather than at a café (20/252, 7.9%).

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**Figure 3-2: Persons with whom breakfast is eaten (N=252).**

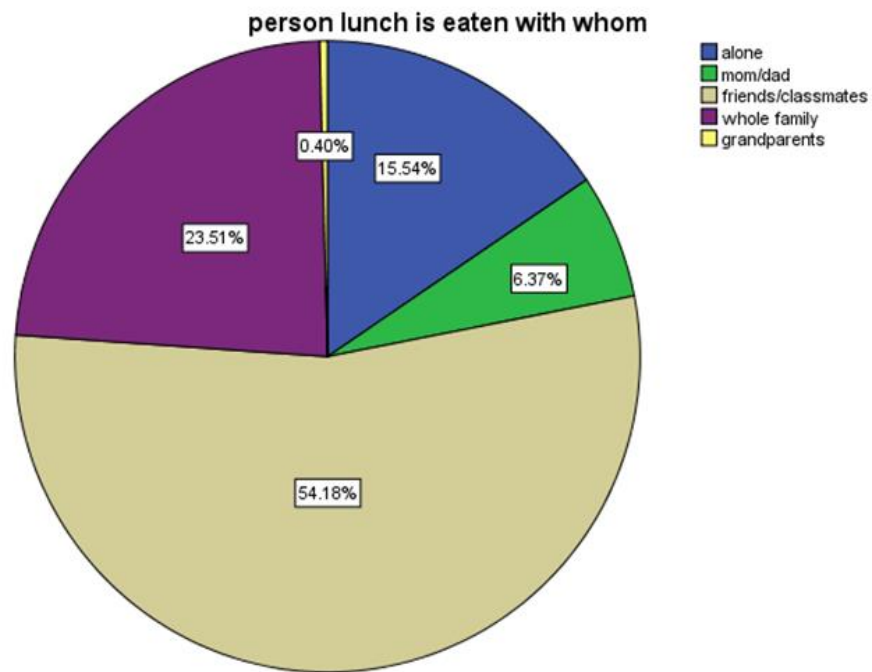
Note on fig 3-2: The numbers on top of the bars represent the actual count.

Data in Fig 3-2 show that the majority of respondents (120/252, 47.6%) ate breakfast alone or with a brother or sister, 54/252 (20.6%) ate breakfast with whole family, while one (1/252, 0.39%) respondent ate breakfast with a maid.

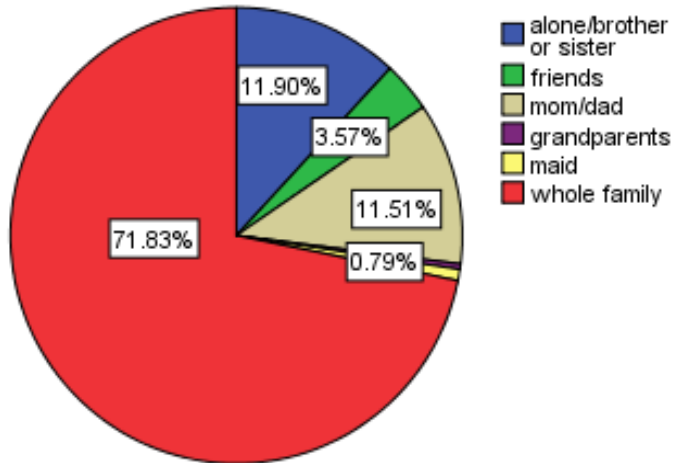
Data in Figures 3-3 and 3-4 represent people with whom respondents ate lunch and dinner respectively.

**Fig 3-3: People with whom respondents ate lunch**

Respondents mostly ate lunch with friends/classmates (137/252, 54.18%).



### Persons dinner is eaten with



**Fig 3-4: People with whom respondents ate dinner**

Respondents mostly ate dinner with the whole family (181/252, 71.83%).

### **3.6.3 Objective 3: Identify self-reported influences on food choice and preferences**

Data in Tables 3-17 to 3-20 and Fig 3-5 show influences on respondents' food choice and their food preferences (Section D and B Appendix 4).

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**Table 3-17: Influences on food choices (N= 252)**

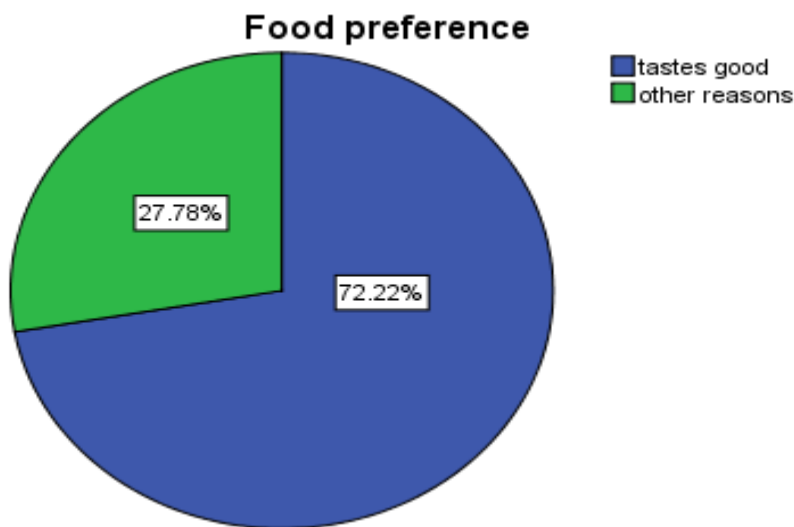
| Variables                               | Responses                  | Proportion<br>N (%) |
|---|----------------------------|---------------------|
| Television at home                      | no                         | 2 (0.8)             |
|   | yes                        | 250 (99.2)          |
| Own choice of program                   | sometimes                  | 159 (63.1)          |
|   | always                     | 73 (29)             |
|   | never                      | 18 (7.1)            |
|   | Not applicable             | 2 (0.8)             |
| Television advertising                  | nice                       | 108 (42.9)          |
|   | Very nice                  | 67 (26.6)           |
|   | Boring but I watch         | 57 (22.6)           |
|   | I do not watch             | 20 (7.9)            |
| Television adverts honest               | sometimes                  | 157 (62.3)          |
|   | always                     | 25 (9.9)            |
|   | rarely                     | 25 (9.9)            |
|   | often                      | 24 (9.5)            |
|   | never                      | 21 (8.3)            |
| Eat food advertised                     | sometimes                  | 147 (58.3)          |
|   | never                      | 37 (14.7)           |
|   | often                      | 29 (11.5)           |
|   | rarely                     | 25 (9.9)            |
|   | always                     | 14 (5.6)            |
| Watch TV at meals                       | sometimes                  | 137 (54.4)          |
|   | always                     | 90 (35.7)           |
|   | never                      | 25 (9.9)            |
| What is eaten while watching television | pop corn                   | 148 (58.7)          |
|   | niknaks                    | 39 (15.5)           |
|   | crisps                     | 26 (10.3)           |
|   | ice cream                  | 23 (9.1)            |
|   | Mabudula (colored waffles) | 16 (6.3)            |
| Influence on food choice                | family                     | 123 (48.8)          |
|   | no one                     | 59 (23.4)           |
|   | Television advertising     | 31 (12.3)           |
|   | friends                    | 21 (8.3)            |
|   | school                     | 18 (7.1)            |
| Parental control on food                | sometimes                  | 128 (50.8)          |
|   | always                     | 55 (21.8)           |
|   | never                      | 35 (13.9)           |
|   | often                      | 26 (10.3)           |
|   | rarely                     | 8 (3.2)             |

Note on table: N/A refers to not applicable that is, those respondents who did not have television sets at home.

Data in Table 3-17 show that almost all the respondents had television at home (250/252, 99.2%); they sometimes believed that television adverts are honest (157/252, 62.3%), and they sometimes watched TV during meals (137/252, 54.4%). Respondents indicated that they ate

popcorn while watching television (148/252, 58.7%), crisps (26/252, 10.3%) and Nik Naks<sup>®</sup> (39/252, 15.5%). Almost half of the respondents (123/252, 48.8 %) indicated that family influenced their food choices and few respondents indicated that television advertising influenced their food choice (31/252 (12.3%), and that their parents controlled their food choice (128/252, 50.8%).

Data in Fig 3-5 represent reasons respondents gave for preferring certain foods (Section B, question 13 and 14).



**Fig 3-5: Reasons for respondents' food preferences**

Participants' food preferences and the reasons are shown in Fig 3-5: it 'tastes good' was the main reason for preferring certain foods (182/252, 72.22%), while other reasons included a healthy meal, balanced meal, boosts immunity and gives the body energy (70/252, 27.78%).

Data in Table 3-18 represent respondents' food preferences (Section B, question 13).

**Table 3-18: Frequency of respondent's food preferences (N= 252)**

| <b>Foods liked</b>                      | <b>Proportion<br/>N (%)</b> |
|---|-----------------------------|
| Sugary foods (cakes, ice cream, sweets) | 41 (16.3)                   |
| Rice                                    | 34 (13.5)                   |
| fast/fried foods                        | 30 (11.9)                   |
| Meat/fish//tripe (spiced/salty)         | 27 (10.7)                   |
| Fruits and vegetables                   | 22 (8.7)                    |
| None liked                              | 21 (8.3)                    |
| Pasta                                   | 19 (7.5)                    |
| Snacks                                  | 16 (3.0)                    |
| bread(white/brown)                      | 15 (6.1)                    |
| Vegetables                              | 11 (4.4)                    |
| Grains                                  | 13 (5.2)                    |
| balanced meal                           | 2 (3.0)                     |
| Dairy products                          | 1 (0.4)                     |

Data in Table 3-18 show that 41/252 (16.3%) of the respondents preferred sugar rich foods, 34 (13.5%) preferred rice compared to other foods and 22/252 (8.7%) liked fruits and vegetables.

Data in Table 3-19 represent food items disliked by respondents (Section B, question 14).

**Table 3-19: Foods disliked by respondents (N= 252)**

| <b>Foods disliked</b>                 | <b>Proportion<br/>N (%)</b> |
|---------------------------------------|-----------------------------|
| Fried/fast foods                      | 43 (17.1)                   |
| Fish/meat/tripe                       | 41 (16.3)                   |
| Legumes                               | 41 (16.3)                   |
| Wild & non-wild vegetables            | 29 (11.5)                   |
| Pasta                                 | 19 (7.5)                    |
| Sugar rich foods                      | 18 (7.1)                    |
| Grains (sorghum/millet/samp/porridge) | 14 (5.6)                    |
| Dairy (cheese, eggs, sour milk)       | 14 (5.6)                    |
| Beverages (coffee/fizzy drinks)       | 12 (4.8)                    |
| Rice & meat/chicken                   | 7 (2.8)                     |
| Boiled foods                          | 4 (1.6)                     |
| Soya products                         | 4 (1.6)                     |
| None disliked                         | 3 (1.2)                     |
| Fruits                                | 1 (0.4)                     |

Curiously, although respondents listed fried/fast foods as the third most preferred food (Table 3-18), data in Table 3-19 show that respondents (43/252, 17.1 %) disliked fried/fast foods compared to certain foods.

Data in Table 3-20 represent indigenous foods known to respondents (Section B, question 15).

**Table 3-20: Indigenous foods known to respondents (N= 252)**

| <b>Foods known</b> | <b>Proportion<br/>N (%)</b> |
|--------------------|-----------------------------|
| Wild vegetables    | 56 (22.2)                   |
| Water lily         | 35 (13.9)                   |
| Grains             | 33 (13.1)                   |
| Samp & beans       | 33 (13.1)                   |
| Wild fruits        | 28 (11.1)                   |
| Groundnuts         | 27 (10.7)                   |
| Seswaa/tripe       | 19 (7.5)                    |
| Sweet potatoes     | 11 (4.4)                    |
| None liked         | 7 (2.8)                     |
| Legumes            | 2 (0.8)                     |
| Phane (worm)       | 1 (0.4)                     |

Note on table: Phane refers to a dried worm, seswaa refers to boiled pounded beef

Data in Table 3-20 show that the indigenous foods best known to respondents were wild vegetables (56/252, 22.2%), followed by water lily (35/252, 13.9%).

#### **3.6.4 Objective 4: Determine awareness and knowledge of healthy eating/food intake behaviour**

Data in Table 3-21: represent respondents' level of knowledge of nutrition (Section F, Appendix 4).

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**Table 3-21: Respondent’s awareness and knowledge of healthy eating and food intake behaviours (N= 252)**

| <b>Knowledge Variables</b>                      | <b>Correct response<br/>Proportion<br/>N (%)</b> | <b>Incorrect response<br/>Proportion<br/>N (%)</b> |
|---|--|--|
| <b>Food nutrients</b>                           |  |  |
| Macronutrients <sup>Q1</sup>                    | 86 (34.1)  | 166 (65.9)   |
| Vitamins <sup>Q1</sup>                          | 81 (32.1)  | 171 (67.9)   |
| Balanced diet <sup>Q1</sup>                     | 22 (8.7)   | 230 (91.3)   |
| Most essential food <sup>Q1</sup>               | 53 (21.0)  | 199 (79.0)   |
| <b>Food contents</b>                            |  |  |
| Egg contains <sup>Q2</sup>                      | 100 (39.7)                                       | 152 (60.3)   |
| Fibre <sup>Q2</sup>                             | 34 (13.5)  | 218 (86.5)   |
| Meat rich in <sup>Q2</sup>                      | 121 (48.0)                                       | 131 (52)   |
| Pasta& bread rich in <sup>Q2</sup>              | 161 (63.9)                                       | 91(36.1)   |
| Fruits & vegetables rich in <sup>Q2</sup>       | 174 (69.0)                                       | 78 (31.0)  |
| Fruits rich in <sup>Q2</sup>                    | 135 (53.6)                                       | 117 (46.4)   |
| Milk food for <sup>Q2</sup>                     | 167 (66.3)                                       | 85 (33.7)  |
| Quench thirst <sup>Q2</sup>                     | 169 (67.1)                                       | 83 (32.9)  |
| <b>Healthiest foods and drinks</b>              |  |  |
| Healthiest food 1 <sup>Q3</sup>                 | 153 (60.7)                                       | 99 (39.3)  |
| Healthiest food 2 <sup>Q3</sup>                 | 135 (53.6)                                       | 117 (46.4)   |
| Healthiest food 3 <sup>Q3</sup>                 | 140 (55.6)                                       | 112 (44.4)   |
| Healthiest food 4 <sup>Q3</sup>                 | 168 (66.7)                                       | 84 (33.3)  |
| Healthiest food 5 <sup>Q3</sup>                 | 147 (58.3)                                       | 105 (41.7)   |
| Healthiest food 6 <sup>Q3</sup>                 | 117 (46.4)                                       | 135 (53.6)   |
| Healthiest food 7 <sup>Q3</sup>                 | 128 (50.8)                                       | 124 (49.2)   |
| <b>Energy expenditure</b>                       |  |  |
| Use energy <sup>Q4</sup>                        | 154 (61.1)                                       | 98 (38.9)  |
| Energy rich food <sup>Q4</sup>                  | 98 (38.9)  | 154 (61.1)   |
| Amount of food depends on <sup>Q4</sup>         | 40 (15.9)  | 212 (84.4)   |
| <b>Nutrition related issues</b>                 |  |  |
| Benefits of healthy diet <sup>Q5</sup>          | 75 (29.8)  | 177 (70.2)   |
| Nutrition related health problems <sup>Q5</sup> | 164 (65.1)                                       | 88 (34.9)  |

Note on table:

Q1- refers to quartile 1 (food nutrients), Q2-refers to quartile 2 (food contents), Q3-refers to quartile 3 (healthy foods and drinks), Q4 refers to quartile 4 (energy expenditure) and Q5 refers to nutrition related issues).<sup>84</sup>

Data in Table 3-21 show that the majority of respondents ( $\geq 65\%$ ) did not know what food nutrients are (Q1), what fibre (Q2) is (218/252, 86.5%), the healthiest foods 6 (Q3) (135/252, 53.6%), and the answer to the question on what the amount of energy (Q4) depends on (212/252, 84.4%) and did not know the benefits of a healthy diet (177/252, 70.2%) (Q5).

Data in Table 3-22 represent respondents' level of knowledge of nutrition displayed in grading (percentage) categories.

**Table 3-22: Respondent's knowledge of nutrition (N= 252)**

| Grading %    | Grading   | Proportion<br>N (%) |
|--------------|-----------|---------------------|
| 0-49         | Fail      | 142 (56.3)          |
| 50-59        | Pass      | 69 (27.4)           |
| 60-69        | Fair      | 22 (8.7)            |
| 70-79        | Very good | 18 (7.1)            |
| 80 and above | Excellent | 2 (0.8)             |

Note on table:

Results were grouped into five (5) categories 0-49% fail, 50-59% pass, 60-69% fair, 70-79% very good and  $\geq 80\%$  excellent.<sup>66</sup>

Data in Table 3-22 indicate that most respondents (56.3%, 142/252) failed the knowledge test and scored below 50% and only two respondents (0.8%) had excellent nutrition knowledge.

Data in Table 3-23 represent descriptive statistics for respondents' knowledge of nutrition

**Table 3-23: Descriptive statistics for respondent's knowledge of nutrition (N= 252)**

| Knowledge | Mean  | SD    | Minimum | Maximum |
|-----------|-------|-------|---------|---------|
| Score     | 11.05 | 3.8   | 2       | 21      |
| %         | 46.07 | 15.91 | 8.3     | 87.5    |

Data in Table 3-23 indicate that the mean knowledge score was 11.05 (SD 3.8), ranging from a minimum of 2/24 to a maximum score of 21/24. The mean percentage achieved was 46.1% (SD 15.91) ranging from 8.3% to 87.5%.

### 3.6.5 Objective 5: Describe self-reported physical activity behaviour

Data in Table 3-24 represent respondents' self-reported physical activity behaviour (Section E of the questionnaire, Appendix 4).

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**Table 3-24: Respondents' self-reported physical activity behaviour (N= 252)**

| Variables                   | Responses                         | Proportion<br>N (%) |
|-----------------------------|-----------------------------------|---------------------|
| Frequency of walks<br>a day | 6 or more per week                | 135 (53.6)          |
|                             | 4-5 per week                      | 55 (21.8)           |
|                             | 2-3 per week                      | 37 (14.7)           |
|                             | 1 per week                        | 25 (9.9)            |
| Do you exercise             | No                                | 104 (41.3)          |
|                             | Yes                               | 148 (58.7)          |
| Physical activity           | vigorous intensity                | 94 (37.3)           |
|                             | moderate intensity                | 54 (21.4)           |
|                             | not engaging in physical activity | 105 (41.7)          |
| Usage of spare time         | watch TV/listen to music/read     | 199 (79.0)          |
|                             | practice sport                    | 37 (14.7)           |
|                             | Sleep                             | 16 (6.3)            |
| Hours spent on<br>TV/Videos | 1-2 hours                         | 94 (37.3)           |
|                             | 3-4 hours                         | 56 (22.2)           |
|                             | less than an hour                 | 53 (21.0)           |
|                             | more than 4 hours                 | 49 (19.4)           |
| What is PA?                 | Correct                           | 211 (83.7)          |
|                             | Wrong                             | 41 (16.3)           |
| Benefits of PA              | Correct                           | 236 (93.7)          |
|                             | Wrong                             | 16 (6.3)            |

Note on table: \*Of the respondents who indicated that they did not participate in any kind of physical activity, 22 (33.3%) indicated in a subsequent question that they did but this response was not considered reliable and was not included in the data in the table.

Data in Table 3-24 show that the majority (135/252, 53.6%) of respondents walked 6 or more times a week but 41.3% (104/252) indicated that they did not exercise. Ninety-four (37.3%) respondents spent 1-2 hours watching television/videos. The majority (211/252, 83.7%) knew what physical activity is and even more (236/252, 93.7%) knew the benefits of physical activity.

### 3.6.6 Objective 6: Determine respondents' self-rated degrees of intention to change eating and physical activity behaviours

#### 3.6.6.1 Intention to change eating behaviour

Data in Table 3-25 represent respondents' intentions to change eating habits (Section I of the questionnaire, Appendix 4) and eat healthily.

**Table 3-25: Respondent's intention to eat healthily (N= 252)**

| Variables                           | Mean | Standard deviation | Minimum | Maximum | Proportion<br>N (%) |
|-------------------------------------|------|--------------------|---------|---------|---------------------|
| <b>Intention for eating Healthy</b> | 11   | 3                  | 0       | 15*     | 252                 |
| Poor                                |      |                    |         |         | 32 (12.7)           |
| Good                                |      |                    |         |         | 220 (87.3)          |

Note on table: Intention for healthy eating was determined by adding up scores (total score is 15), the higher the score (8-15) the higher the intention to eat healthily.<sup>249</sup>

Data in Table 3-25 show that most respondents had good intentions to eat healthily (220/252, 87.3%).

#### 3.6.6.2 Intention for physical activity

Data in Table 3-26 represent respondents' intentions to engage in physical activity (Section I of the questionnaire, Appendix 4).

**Table 3-26: Respondents' intention to participate in physical activity (N= 252)**

| Variables                      | Disagree a lot<br>Proportion<br>N (%) | Slightly agree<br>Proportion<br>N (%) | Agree a lot<br>Proportion<br>N (%) |
|--------------------------------|---------------------------------------|---------------------------------------|------------------------------------|
| <b>Intention</b>               |                                       |                                       |                                    |
| Regularly in PA                | 47 (18.7)                             | 62 (24.6)                             | 143 (56.7)                         |
| PA in spare time               | 37 (14.7)                             | 77 (30.6)                             | 138 (54.7)                         |
| Expect to do physical activity | 46 (18.3)                             | 66 (26.2)                             | 140 (55.6%)                        |

Data in Table 3-26 show that the majority of respondents (143/252, 56.7%) had good intentions (agree a lot) to engage in PA regularly, do PA in spare time (138/252, 54.7%) and they expected to do PA 3 or more times in the next weeks (140/252, 55.6%).

### 3.6.7 Objective 7: Determine Self-efficacy to change eating and physical activity behaviours

#### 3.6.7.1 Self-efficacy for changing eating habits

Data in Table 3-27 represent respondents' self-efficacy for eating behaviours (Section G of the questionnaire, Appendix 4).

**Table 3-27: Respondents self-efficacy for changing eating behaviour (N= 252)**

| Variables                          | Mean | Standard deviation | Minimum | Maximum | Proportion N (%) |
|------------------------------------|------|--------------------|---------|---------|------------------|
| Self-efficacy for eating behaviour | 6    | 4                  | 0       | 16      | 252              |
| Poor                               |      |                    |         |         | 72 (28.6)        |
| Good                               |      |                    |         |         | 180 (71.4)       |

Note on table: Self-efficacy was determined by adding up scores (total score is 16), the lower the score (0-8) the higher the self-efficacy for healthy eating<sup>226</sup>.

Data in Table 3-27 show that 71.4% (180/252) of respondents had good intentions to changing eating habits.

#### 3.6.7.2 Self-efficacy for changing physical activity behaviour

Data in Table 3-28 show respondents' self-reported self-efficacy for physical activity (Section J of the questionnaire Appendix 4).

**Table 3-28: Respondents' self-efficacy for physical activity (N= 252)**

| Physical activity Variables          | Disagree Proportion N (%) | Slightly agree Proportion N (%) | Agree Proportion N (%) |
|--------------------------------------|---------------------------|---------------------------------|------------------------|
| PA during free time                  | 29 (11.5)                 | 49 (19.4)                       | 174 (69.1)             |
| PA with parents/friends              | 63 (25.0)                 | 48 (19.0)                       | 141 (56.0)             |
| PA instead of watching TV            | 56 (22.3)                 | 67 (26.6)                       | 129 (51.1)             |
| PA even if cold/hot outside          | 100 (39.6)                | 73 (29.0)                       | 79 (31.4)              |
| PA irrespective of having abuser day | 125 (49.6)                | 63 (25.0)                       | 64 (25.4)              |

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Note on table: PA refers to physical activity. Frequency categories reflect 5 categories in the questionnaire (Appendix 4) that were collapsed for the analysis: disagree a lot and disagree were incorporated into the category. Disagree, Slightly Agree remains the same and agree and agree a lot refers to Agree. Categories were collapsed to make data more sensible.

Data in Table 3-28 show that for the variable engaging in ‘PA during free time’ the majority of respondents agreed or agreed a lot (174/252, 69.1%). Most respondents (141/252, 56.0%) engaged in PA with parents or friends and would do PA instead of watching television (129/252, 51.1%). Most respondents (100/252, 39.6%) would not engage in PA if the weather was hot or cold or if they had a busy day (125/252, 49.6%).

### 3.6.8 Objective 8: Determine the prevalence of overweight by Body Mass Index and Waist Circumference

Data in Tables 3-29a and b represent respondents’ prevalence of overweight by Body Mass Index (BMI) and Waist Circumference (WC) respectively (Section A of the questionnaire, Appendix 4).

**Table 3-29a: Prevalence of overweight by BMI (N= 252)**

| Variable<br>BMI Percentiles              | Females<br>Proportion<br>N (%) | Males<br>Proportion<br>N (%) | Total<br>Proportion<br>N (%) |
|--|--------------------------------|------------------------------|------------------------------|
| Under weight ( $\leq 5$ percentile)      | 10 (4%)                        | 12 (4.8%)                    | 22 (8.7)                     |
| Healthy weight (5 to 85 percentile)      | 114 (42.5%)                    | 74 (29.4%)                   | 188 (74.6%)                  |
| Overweight ( $\geq 85$ to 95 percentile) | 16 (6.3%)                      | 11 (4.4%)                    | 27 (10.7%)                   |
| Obese ( $\geq 95$ to 97 percentile)      | 2 (0.8%)                       | 2 (0.8)                      | 4 (1.6%)                     |
| Obese with risk ( $\geq 97$ percentile)  | 5 (2%)                         | 6 (2.4%)                     | 11 (4.4%)                    |
| Total                                    | 147 (58.3%)                    | 105 (41.7%)                  | 252 (100%)                   |

Note to table: BMI = Body Mass Index.

Data in Table 3-29a show that the normal measurement of BMI was exceeded in 16.7% (42/252) of male and female scholars: 23 (9.1%) females and 19 (7.5%) males

**Table 3-29b: Prevalence of overweight by WC (N= 252)**

| Variable                    | Normal for females<br>(≤81cm)<br><br>Proportion<br>N (%) | Normal for<br>males<br>(≤80.5cm)<br><br>Proportion<br>N (%) | Abnormal for<br>males (≥80<br>cm)<br><br>Proportion<br>N (%) | Abnormal for<br>females<br>(≥81.5cm)<br><br>Proportion<br>N (%) |
|-----------------------------|--|---|--|---|
| Waist<br>circumference (cm) | 131 (52.0)   | 90 (35.7)   | 17 (6.7)   | 14 (5.6)  |

Data in Table 3-29b show that the majority of females (131/252, 52.0%) and males (90/252, 35.7%) had a waist circumference within normal limits but that this was exceeded in 17 (6.7%) males and 14 (5.6%) females, a total of 31 (12.3%) scholars.

### 3.6.9 Ancillary analyses

Analysis for establishing an association between variables is not directly related to study objectives and therefore is presented in the ancillary analysis section (Appendix 37). There was a strong positive correlation between age and knowledge scores ( $r=1$ ). There was an association between BMI and socioeconomic status (SES) ( $P \leq 0.005$ ), between waist circumference and gender ( $P < 0.001$ ), between physical activity (usage of spare time) and self-efficacy for exercise (physical activity during free time) ( $P = 0.001$ ) but no association linear by linear. There was an association between physical activity (doing exercise) and self-efficacy for exercise (physical activity during free time) ( $P = 0.001$ ).

## 3.7 Discussion

Study One established a baseline dataset prior to the intervention, by describing the eating habits, physical activity levels, nutritional knowledge, motivation (intention) and self-efficacy (behavioural skills) that influence eating habits and physical activity behaviours of urban adolescents in public junior secondary schools in Gaborone City, Botswana, and determined the prevalence of overweight and obesity

### **3.7.1 Summary of results**

The main self-reported findings of Study One are summarized.

#### *3.7.1.1 Eating habits*

The typical respondents had unhealthy eating habits. They consumed salty, fat and sugary foods and snacks were eaten very often and they drank an inadequate amount of water daily.

#### *3.7.1.2 Self-reported food choices and preferences*

The typical respondents ate three regular meals with dinner being eaten mainly with the family. Sometimes parents and media influenced their food choices but not their peers. The taste of food was the main reason for liking certain foods over others.

#### *3.7.1.3 Awareness and knowledge of healthy eating habits*

Most respondents had inadequate nutrition knowledge (scored below 50%). The poorly answered questions included those on food nutrients, what constituted a balanced diet, and activities where energy were expended.

#### *3.7.1.4 Self-reported physical activity behaviours*

Many respondents reported inadequate physical activity levels, infrequent weekly walks, not engaging in exercise, and they watched television and/ or played video games for more than 2 hours a day.

#### *3.7.1.5 Self-rated intentions to change eating and physical activity behaviours*

The respondents reported good intentions to change eating habits and physical activity behaviours although these intentions did not correspond with their self-reported eating and physical activity behaviours.

### *3.7.1.6 Self-rated self-efficacy to change eating and physical activity behaviours*

The respondents reported good self-efficacy to change eating habits and physical activity although it did not correspond to their eating and physical activity behaviours.

### *3.7.1.7 Prevalence of overweight*

The prevalence of overweight was 16.7% as determined by BMI and 12.3% by WC.

## **3.7.2 Generalizability of results**

A sample size of n=265 was calculated to be required but the actual sample was n=252 (95.1%). The study results may therefore not be representative of scholars in public junior secondary schools in Gaborone city.

## **3.7.3 Study results compared to existing literature and in wider context**

### *3.7.3.1 Discussion on eating habits*

The second part of the nutrition questionnaire (section B) obtained information about food frequency consumption and included questions on how often adolescents ate starch, meat, fish, cheese, eggs, vegetables, fruit, sweets, snacks, fried foods, fizzy drinks and water. Starch (bread, rice, sorghum, maize, pasta) was consumed generally by the majority of the respondents and more than twice a day (very often) by a few. Starch provides energy and it is recommended that 6-11 servings should be consumed daily.<sup>105</sup> It is of concern that some adolescents in this study did not consume starch daily. It could be that they did not understand the question or they responded to the question for the sake of it. The results of the current study are consistent with studies that found that adolescents included foods from each food group (dairy, fruit, vegetables, meat, bread and cereals) daily,<sup>121</sup> but not consistent with another study.<sup>141</sup> It must be noted that these cited studies used differing methods especially the type of questionnaire used.

The majority of respondents consumed protein: meat almost daily while fish, eggs, cheese were seldom/never and occasionally (1/month, 2-3/month and 1/week) consumed. Protein consumption is typical in traditional households in Botswana. Meat is readily available and less costly compared to cheese. Fish is not as readily available in the city of Gaborone compared to villages with rivers and dams, particularly in the northern part of Botswana where fish is frequently consumed. The consumption of eggs, high in cholesterol, was not frequent. It is recommended that at least 2-3 eggs should be consumed per week.<sup>105</sup> High consumption of eggs may lead to high levels of cholesterol and potential health problems.<sup>50</sup> Protein is needed especially during rapid stages of growth and development in adolescence and a recommendation is 2-3 servings daily.<sup>105</sup> Infrequent consumption of cheese is consistent with findings from published studies and one study<sup>117</sup> reported that few adolescent males consumed cheese compared to females. The results for frequency of consumption of protein are similar to other studies,<sup>78 121</sup> but different methods and questionnaires were used.

Vegetables and fruit were consumed more than twice daily but the majority of the respondents did not consume adequate or recommended quantities (3-4 servings of vegetable and 2-3 servings of fruit a day).<sup>105</sup> Surprisingly, a few participants never consumed either. These results are of concern because the majority of participants were at risk of a nutritionally inadequate diet. The reasons may have been economic or food preferences. Long term consumption of an inadequate diet may result in poor health outcomes<sup>29</sup> therefore a lifestyle intervention program is essential for this group. The current WHO<sup>13</sup> dietary guidelines recommend that a healthy diet should include more fruit and vegetables and should contain a low fat and sugar content. The results of the current study relating to fruit and vegetable consumption are consistent with results from a number of published studies<sup>55 101 105 110-112 129 250</sup> but differ from other studies<sup>102 113</sup> reporting that fruit and vegetables were consumed daily but the consumption of fruit was low.

The majority of the respondents consumed unhealthy foods (sweets, snacking, fried foods and fizzy drinks) and sweets more than twice a day (very often). It is not surprising because it was

observed that in all eight schools that participated in the study, there is a tuck-shop on the school premises and street vendors at each school entrance, selling different kinds of sweets. The long-term intake of sweets has been linked with overweight, dental health problems and NCDs. It may be concluded that the majority of the respondents are at risk of becoming overweight and nutrition education programs are needed to curb this habit. The results are consistent with a study<sup>113</sup> reporting that adolescents consumed candy daily, and the highest consumption frequencies of sweets was found in Ireland and Scotland.<sup>111</sup> Conversely a study<sup>117</sup> reported that few adolescents consumed sweets daily. The majority of adolescents snacked more than twice a day (very often), similar to results from a study undertaken in Durban South Africa, and another study that reported that sweets/candy are regularly consumed by athletic and non-athletic adolescents in Switzerland.<sup>135 141</sup> Snacking is linked to overweight.<sup>38</sup>

Fried foods were consumed by a few respondents more than twice per day (very often). Fried foods contain a lot of fat that the body does not need. According to the Botswana Nutritional guidelines for people living with HIV/AIDS (2007) fat should be eaten sparingly and natural fat such as nuts and seeds are recommended. Fizzy drinks (soda) were frequently consumed by a few participants more than twice a day (very often). Fizzy drinks contain a lot of sugar which is linked to overweight.<sup>131</sup> The results are consistent with studies reporting that few adolescents in the United Kingdom (UK) consumed fizzy drinks frequently,<sup>55 117</sup> whereas other studies that reported that the majority of participants consumed fizzy drinks frequently.<sup>102 111 129 130</sup>

Fatty and salty snacks, fried foods and fizzy drinks are energy dense foods that do not necessarily have nutrients that the body need. It appears that these foods are readily available in the local school environment yet are inconsistent with Botswana nutrition guidelines.

The majority of boys and girls drank 1-4 cups (1-2 litre) a day and did not meet the WHO (2004) draft recommendations for daily water intake: 2.4 litres (4-6 cups) for boys, 2.1 litres (4-6 cups) for girls aged 13 years and 3.3 litres (6-8 cups) for boys, 2.3 litres (4-6 cups) for

girls aged 14-18 years. Botswana is a hot country and one would expect adolescents to drink more water than those in the northern hemisphere. Few studies have investigated water intake in adolescents. This is the first study to investigate water consumption by adolescents in Botswana. Adolescents in Korea had an inadequate daily water intake<sup>251</sup> and studies undertaken in the USA reported the same findings.<sup>122</sup> Inadequate water intake may be attributed to lack of knowledge on the amount of water needed by the body daily or that water intake is part of a healthy diet; however this is yet to be explored.

### *3.7.3. 2 Meal habits and influences on food choices and preferences*

Adolescents in junior schools ate breakfast daily and the majority consumed coffee or tea (with sugar) and bread, while few ate cornflakes and milk, fruit, sweets, snacks and fat cakes for breakfast, evidence of unhealthy breakfast habits; coffee/tea containing caffeine and taken with sugar is unhealthy. Sugar in tea or coffee adds to the problem as the majority of adolescents indicated frequent daily consumption of sweets. It is also worrisome that some respondents ate sweets and snacks at breakfast.

The majority of respondents frequently consumed fatty foods such as french fries (french fries), fat cakes and Pizza. Snacks most frequently consumed: NIK-NAKS® and biscuits; the healthiest included fruit and popcorn. NIK-NAKS® contain lot of salt and some are sweet, biscuits also contain a lot of sugar, indicating that the majority respondents frequently ate a lot of sugar and salt. Snacks commonly consumed contain fat and sugar.<sup>107</sup> Results indicate that respondents' meal habits were unhealthy. The results are consistent with a study<sup>252</sup> reporting that snacks consumed in rural villages in India contained high levels of saturated fats and trans-fats which are unhealthy, although the methodology is different. The results on breakfast habits are similar to results from published studies<sup>56 57 68 69 92 127 135 139 140</sup> reporting that a substantial number of respondents in their studies ate breakfast and only a few did not.

Literature on the current popular low-carbohydrate, high-fat banting trend was not explored.

Many factors influence food choices. Influences on food choice in the current study were the family and a few respondents indicated television adverts and friends. The results are similar

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to a study<sup>95</sup> reporting that social pressure was not a significant contributor amongst urban adolescents. The majority of the respondents indicated that sometimes parents controlled what they ate; the family still played a role in controlling family meals and respondents still participated in family meals which made it easier for parents to sometimes control what they ate. It is worrisome to find that the majority of the respondents sometimes ate food that was advertised believing that television advertisements are honest and they ate while watching television; only a few always did so. The food they ate while watching television included snacks such as popcorn, ice cream, crisps and NIK-NAKS<sup>®</sup> containing fat, salt and sugar. Snacking was also done at home after school.

Although the family still seems to influence adolescents' eating habits, in the current study it is suspected that watching television also had an impact on food choices and influenced snacking habits. The habit of eating while watching television is unhealthy that needs to be controlled at an early stage because it is linked to overeating and overweight later in life. Eating while watching an absorbing television programme makes it difficult to control the amount of food consumed. The results are consistent with published studies<sup>147 157</sup> but inconsistent with results showing a positive correlation between peer influence and eating habits ( $r = 0.214$ ;  $p < 0.01$ ).<sup>159</sup>

The majority (181/252, 72.2%) of respondents preferred certain foods because they "taste good" while few indicated that they preferred food because they are healthy, readily available and easy to cook. Adolescents preferred food mainly because of the taste.<sup>87 150-153 156 157</sup> Foods that were liked by many adolescents were rich in sugar content such as sweets, cakes, ice cream, followed by rice and then fast/fried foods (30/252, 11.9%). Fruit and vegetables were liked by a few adolescents (22/252, 8.7%). Foods disliked by many participants were fried foods (43/252, 17.1%), followed by fish/meat and legumes. However respondents still liked foods that were high in fat (fat cakes and fresh chips). Food preferences are similar to results from other studies<sup>113 149 155</sup> reporting that adolescents in Britain, China and the USA liked soft drinks, yogurt, ice cream, chocolate, biscuits, ice lollies, grapes, cake, fruit and sweets while some liked pasta, rice, hamburger, pizza and others disliked legumes.

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### 3.7.3.3 Discussion on information (nutrition knowledge)

One objective of the current study was to determine the level of awareness and knowledge of healthy eating and food intake of adolescents aged 13-15 years in junior secondary schools in Gaborone, Botswana. Responses revealed inadequate nutrition knowledge. This might be due to lack of awareness and inadequate nutrition education on healthy eating in junior secondary schools. Results are similar to studies undertaken to assess the level of nutritional knowledge in Italy,<sup>53 84</sup> Europe,<sup>65 66 68</sup> USA,<sup>50 52 81 82</sup> Saudi Arabia,<sup>47</sup> Nigeria,<sup>83</sup> Portugal<sup>44</sup> and Korea<sup>77</sup> that revealed that nutritional knowledge was inadequate especially on fat, carbohydrate, dietary fibre, foods rich in protein, contents of eggs and meats, milk, food that provide most energy though they studied different age groups from those in the current study.<sup>47 50 55 65 77 81-83</sup>

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Respondents in the current study did not have knowledge of food nutrients. Generally the respondents performed poorly in questions about what a balanced diet comprises, the most essential nutrients and what macronutrients are. Inadequate knowledge of food nutrients reveals that both male and female respondents lacked nutrition education. The results are similar to studies<sup>44 84</sup> reporting that adolescents lacked knowledge on food nutrients, especially the question on what a balanced diet is. This may be because the respondents, some of whom had a BMI below the 5<sup>th</sup> percentile, were not eating a balanced diet therefore they could not define a balanced diet, but this assumption needs further exploration.

On the question about food contents, the majority of adolescents answered most of the questions correctly, except the question about what an egg contains and what fibre is.<sup>47 64 65</sup> Results are inconsistent with a study conducted in Italy<sup>84</sup> where the same questionnaire was used but adolescents answered questions well except for the question on pasta and bread. On the question regarding identification of the most healthy foods and drinks, adolescents identified these correctly except for the one on orange and orange juice, where less than 50% chose orange juice as the healthiest rather than orange as a fruit. The results of the study are also inconsistent with studies<sup>47 63 68</sup> reporting that adolescents did not know that saturated fats

are unhealthy fats, although the questions did not specifically require participants to identify the healthiest foods and drinks as in the current study.

Adolescents in the current study answered questions about energy expenditure poorly, especially questions on factors that influence the amount of food needed and the most energy rich foods. The results are similar to studies<sup>59 64</sup> reporting that adolescents failed to identify energy rich foods but different to a study<sup>84</sup> reporting that adolescents knew the answer.

#### *3.7.3.4 Discussion on physical activity behaviours*

Half of the respondents walked 6 times or more a day each week (135/252, 53.6%) and were exercising (148/252, 58.7%). A substantial number of respondents were not walking enough or exercising in a week. Results are similar to studies undertaken in Soweto South Africa<sup>137</sup> and Brazil<sup>112</sup> that reported low levels of physical activity. However results from studies conducted in Barcelona<sup>127</sup> and the Balearic Islands<sup>202</sup> indicated that the respondents regularly engaged in physical activity. The majority of respondents in the present study spent more than two hours watching television or playing video games (158/252, 62.7%) as found in other studies,<sup>64 110 125 127</sup> whereas another study<sup>202</sup> reported that respondents spent less than two hours watching television.

#### *3.7.3.5 Discussion on intention to change physical activity behaviours*

The majority of the respondents agreed that they were intending to engage in more physical activity. The intention to change certain behaviour does not necessarily translate into action. Some factors may be beyond one's control such as the environment. The majority of the respondents walked 6 or more times a day each week but almost half of the adolescents walked less than 4 times a week indicating that they did not walk daily. Almost half indicated not exercising and showed inadequate physical activity and excessive sedentary behaviours. The respondents had good intentions and adequate knowledge of the benefits of physical activity and yet a substantial number (105/252, 41.7%) were inactive and sedentary. It is recommended that only 1-2 hours/day should be spent on watching television.<sup>31</sup> The majority of the respondents indicated that they could confidently participate in physical activities at all

times except when it is cold outside and on a busy day. Engaging in physical activity should not only be done when it is convenient; it has to be a lifestyle where one decides to overcome all obstacles. It was not explored whether the respondents who were inactive were also those for whom the situation was not conducive to undertake activities. There was no association between gender and physical activity although some studies did find associations.<sup>110 127 202</sup>

#### **3.7.3.6 Discussion on behavioural skills (self-efficacy for healthy eating and exercise)**

In the current study the respondents showed high self-efficacy for healthy eating although it did not correspond with their eating behaviour. The results are consistent with other studies<sup>164 177 178</sup> reporting that respondents showed high self-efficacy for exercise during free time, when they played with parents/friends and instead of watching television but not when it is cold or when they are busy.

### **3.8 New knowledge generated**

Adolescents' eating habits and physical activity behaviour and their determinants is an issue that has not yet been studied in Botswana. This type of study is urgently needed in Botswana and should be of interest to all educational and healthcare stakeholders.

### **3.9 Conclusion, and implications and recommendations for research**

Study One answered the research questions: What are the eating habits, physical activity behaviours and level of nutrition knowledge, level of intentions for healthy eating and physical activity, and of self-efficacy for healthy eating and physical activity that influence eating habits and physical activity behaviour of urban adolescents in public junior secondary schools in Botswana and what is the prevalence of overweight and obesity?

The findings of the current study reveal that adolescents aged 13-15 years in public junior secondary schools in urban Botswana lacked knowledge of nutrition, they had unhealthy eating habits and were inactive and at risk of overweight and obesity. Some, however, had a

BMI below the 5<sup>th</sup> percentile. The potential for NCDs later in life for those at risk of obesity or already obese, is of concern.

### *3.9.1 Strengths of the study*

The study used a validated and reliable questionnaire for data collection. The response rate of returned questionnaires was 95%. The sample of respondents was 95% of the required sample size and possibly representative of adolescents in junior secondary schools in Gaborone, Botswana. The data provide information on the frequency of food and water consumption, data on meal habits, nutrition knowledge, and frequency of physical activity practised per week, the level of intention and self-efficacy to change behaviour and the prevalence of overweight among the 13-15 year olds.

### *3.9.2 Limitations of the study*

Although the study answered the research questions it was limited to junior schools in the city and a larger study needs to be done using a larger sample that includes junior schools in rural areas. The study used subjective self-reporting measures to investigate eating and physical activity behaviours. Subjective measures have limited validity and reliability. Although the use of objective measures is important, it is not easy to carry out in epidemiological studies.<sup>254</sup>

Another limitation was a Cronbach's alpha ranging between 0.63 and 0.99 for the questionnaire which, although this met the pre-set Cronbach's alpha of 0.60, the acceptable level is 0.70.

Analysis for establishing an association between variables is not directly related to study objectives and although some analyses are presented in the ancillary analysis section it would have strengthened the study to have done more inferential statistics.

### *3.9.3 Recommendations*

A lifestyle intervention program is needed to address unhealthy lifestyle behaviours. Further research is recommended among rural junior secondary school students and out of school adolescents that includes environmental factors that influence eating habits and physical

activity behaviours. Nutrition and physical activity education needs to be incorporated in the school curriculum.

## **4 STUDY TWO: Pragmatic Randomised Controlled Trial**

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### **4.1 Background and significance**

There is a concern in the developed world that adolescents become overweight and obese because of unhealthy eating habits and physical inactivity<sup>109 255-257</sup> hence the call for lifestyle interventions to prevent overweight and promote healthful living.<sup>233</sup> Study One results provided the baseline for Study Two which revealed that participants in junior schools in Gaborone, Botswana engaged in unhealthy eating habits and were not physically active. They also exhibited inadequate nutrition knowledge; however they self-reported good intentions and high levels of self-efficacy for healthy eating and physical activity though this was not consonant with their behaviour.

One way of promoting a healthy lifestyle among adolescents is to provide them with information, motivation (intention) and behavioural skills (self-efficacy). Adolescents need information to make informed choices and to believe that they can adopt a healthy lifestyle. The information, motivation and behavioural skills (IMBs) model<sup>218</sup> has been proven to be useful in two published intervention studies conducted in developed countries to prevent overweight and promote a healthy lifestyle.<sup>18 197</sup> More intervention studies are needed especially in developing countries that use IMBs to guide studies.

A pragmatic randomised controlled trial was employed in Study Two to test the effectiveness of a lifestyle intervention program guided by the IMBs model to improve eating habits and physical activity behaviours, and the level of nutrition knowledge of adolescents in public junior schools in Botswana. The literature review in chapter 2 dealt with eating habits, physical activity behaviour and their determinants but in this chapter the following issues are presented:

1. designing a lifestyle intervention program to effect behaviour change through a literature review; and a
2. systematic review of studies on health promotion intervention programs.

## **4.2 Literature review**

One RCT reviewed in Chapter 2 used both the Pender Theory of Health Promotion and the Trans-theoretical model,<sup>167</sup> eight RCTs reported no theory,<sup>70 72 74 99 168 176 188 258</sup> while in one study the Social Ecological Theory was used.<sup>189</sup> In two studies the Theory of Planned Behaviour was used.<sup>73 97</sup> These studies were conducted in the developed countries except for one in Kenya and another in South Africa. The most widely used theory applied in research on behaviour change was the theory of planned behaviour.<sup>41</sup> The IMBs model has scarcely been used to guide eating and physical activity health promotion studies in any country. No study was located that used the IMBs model in Botswana.

### **4.2.1 Designing an intervention program to effect behaviour change**

There are widely published studies on lifestyle intervention programs to improve eating habits, physical activity behaviour and their determinants among adolescents in the developed countries. Most of the lifestyle intervention programs were school-based.<sup>165</sup> Adolescents spend most of their time at school where they eat breakfast and lunch<sup>109</sup> making school the best place to promote health.<sup>255 257</sup>

Designing a suitable school-based lifestyle intervention program to promote healthy eating and physical activity is necessary. Concepts of the IMBs model can easily be translated into intervention strategies.<sup>17</sup> Designing a lifestyle intervention program includes: establishing baseline data/a needs assessment through the use of questionnaires, developing behaviour specific interventions to achieve behavioural goals based on the information, motivation and behavioural skills components of the model and lastly evaluating the effectiveness of the intervention. In addition an intervention mapping (IM) protocol guide was used to guide the development of a lifestyle intervention program,<sup>175</sup> a more explicit guide composed of six

steps: a needs assessment, program objectives, theory based methods and practical activities, designing program documents, implementing the program and evaluating the effectiveness of the intervention program. The concepts of IMBs and IM protocol's six steps guided the development, implementation and evaluation of the current lifestyle intervention program for Study Two.

In a systematic review and meta-analysis of The Theory of Planned Behavior's application to understand and predict nutrition-related behaviors in youth intentions were more widely tested than other determinants.<sup>41</sup> The use of different theories is recommended to ascertain an effective theory or model to improve healthy eating habits, physical activity behaviours.<sup>186 233</sup> The inclusion of both nutrition and physical activity education and skills in an intervention program is paramount<sup>165</sup> and should include clear specific behavioural goals, teaching strategies, counselling and should involve parents.

#### **4.2.2 Summary of evidence from systematic reviews of school-based interventions targeting eating habits and PA behaviours**

In a systematic review<sup>259</sup> of studies conducted in Europe of participants aged between 6-18 years, 10 of 27 studies met the inclusion criteria and quality for the present study.<sup>260-267</sup> A systematic review of school-based interventions conducted among adolescents aged 13-15 years was not located in the published literature. Both RCTs and non-RCTs were included in the review according to . The 10 studies focusing on both nutrition and physical activity<sup>259</sup> are summarized in Table 4-1.

## Lifestyle intervention

**Table 4-1: Systematic reviews of studies of school-based interventions targeting eating and/or physical activity behaviours by type of study**

| RCT designs        | Authors                       | Objectives  | Conclusions  |
|--------------------|-------------------------------|---|--|
| RCT                | Van Cauwenberghe, et al. 2010 | To summarize the existing European published and 'grey' literature on the effectiveness of school-based interventions to promote a healthy diet in children (6–12 years old) and adolescents (13–18 years old).               | In adolescents, educational interventions were effective on behavior. There was limited evidence of effect for multicomponent programs on behaviour. In children and adolescents, effects on anthropometrics were often not measured, and therefore evidence was lacking and hence inconclusive. |
| RCT                | Singh, et al. 2007            | To determine whether a multicomponent health promotion intervention for Dutch adolescents would successfully influence body composition and aerobic fitness   | Multicomponent Dutch obesity intervention can positively influence waist circumference and TFS among girls and boys  |
| RCT                | Haerens, et al. 2006          | To evaluate the effect of a middle school physical activity and healthy eating intervention including environmental and computer tailored component and to investigate the effects of parental involvement in Belgium schools | Physical activity and eating behaviours of middle school children can be improved by school based strategies and combining environmental and personal interventions implemented by school teachers   |
| RTC                | Muller, et al. 2001           | To address the steady rise in prevalence of obesity   | First results of Kiel Obesity Prevention study are promising to prevent obesity. A better school and social support seem to be promising for future interventions  |
| Group RCT          | Sahota, et al. 2001           | To assess if a school based intervention was effective in reducing risk factors for obesity   | The intervention was successful in producing changes at school level, but the program had little effect on children's behaviour except for increase in consumption of vegetables.  |
| RCT                | Manios, et al. 1999           | To examine the effects of a health and nutrition intervention schools in Crete on health knowledge, nutrition intake and physical activity of the intervention population   | The intervention has the ability to prevent diseases and promote health in school children   |
| Cluster Randomised | Haerens, et al. 2007          | To evaluate the effect of a middle school healthy eating promotion intervention   | Combining physical and social environmental changes with computer tailored feedback in girls and their parents may   |

Lifestyle intervention

| RCT designs             | Authors                | Objectives   | Conclusions  |
|-------------------------|------------------------|--|--|
| Controlled Trial (CRCT) |                        | combining environmental changes and computer tailored feedback with or without an explicit parental involvement component.   | lead to lower fat intake in middle school girls, but to have impact on consumption of soft drinks and water, the government laws on restricting the at school quantity of low-nutritive food items is necessary  |
| CRCT                    | Amaro, et al. 2006     | To test the efficacy of the Kaledo, a new educational board game on changes in nutrition knowledge (NK) and diet behaviours in middle schools in Naples, Italy.  | Kaledo intervention may increase NK and modify dietary behaviour. Additional longitudinal studies are needed to confirm the results obtained in this study and for the purpose of using the intervention in other settings.  |
| Quasi RCT               | Danielzik, et al. 2007 | To evaluate a 4 year outcome of school based health promotion on weight status as part of the Kiel obesity prevention Study (KOPS)   | A school based health promotion can reduce incidence of overweight. More prevention measures are needed in order to have effect on obesity.  |
| Quasi experimental      | Moon, et al. 1999      | To evaluate a 3-year study on the efficacy of a Wessex Health School Award Scheme (WHSA) intervention in changing health promotion policy and practice in school and influencing health-related knowledge and attitudes and behaviours of pupils | Award scheme has positive influence on development of health promoting school education program. However research is needed to into ways to improve pupil's diet and activity levels and how it can be implemented at school environment, and other community settings |

## **Issues of methodology**

Study Two is about the design and implementation of a lifestyle intervention movement (LIMO) program using a pragmatic randomised controlled trial. Poor reporting of RCTs has led to the development of Consort Statement guidelines that have been revised and include a 25-item checklist to make reporting of RCTs more transparent.<sup>268</sup>

This chapter describes aims and objectives of Study Two.

### **4.3 Research question**

Will an intervention aimed at changing eating habits, physical activity behaviours, level of nutrition knowledge influence eating habits and physical activity behaviours of adolescents effect behaviour change?

### **4.4 Aim and Objectives**

The aim of Study Two was to develop and validate, implement and test the effectiveness of an 8-week lifestyle intervention program guided by the Information, Motivation and Behavioural skills (IMBs) model through a pragmatic randomised controlled trial of intervention versus information only.

#### **4.4.1 Research objectives**

The objectives of Study Two were to establish whether a self-developed lifestyle intervention program resulted in a significant difference in improving:

1. eating habits between the intervention and control group (Question B1 to B11);
2. physical activity levels between the intervention and control group (Questions E1 to E4); and
3. nutritional knowledge between the intervention and control group (Question F1 to F24).

## 4.5 Methods

### 4.4.2 Main outcome measures

The primary outcomes for the intervention group were:

1. Healthy eating habits - less fatty and sugar intake, and an increase in fruit and vegetable consumption.
2. Engaging in physical activity 6 or more times a week and doing exercises.
3. Reduction in sedentary behaviours such as television viewing, playing video or computer games to less than 2 hours per day.

A secondary outcome was an increase in nutrition knowledge.

**Null hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will not result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

**Alternate hypothesis:** A lifestyle intervention movement (LIMO) program guided by the Information, Motivation and Behavioural skills (IMBs) model will result in less fatty and sugar intake, an increase in fruit and vegetable consumption, engaging in physical activity 6 or more times a week and doing exercises, a reduction in sedentary behaviour and an increase in nutrition knowledge ( $P \geq 0.05$ ).

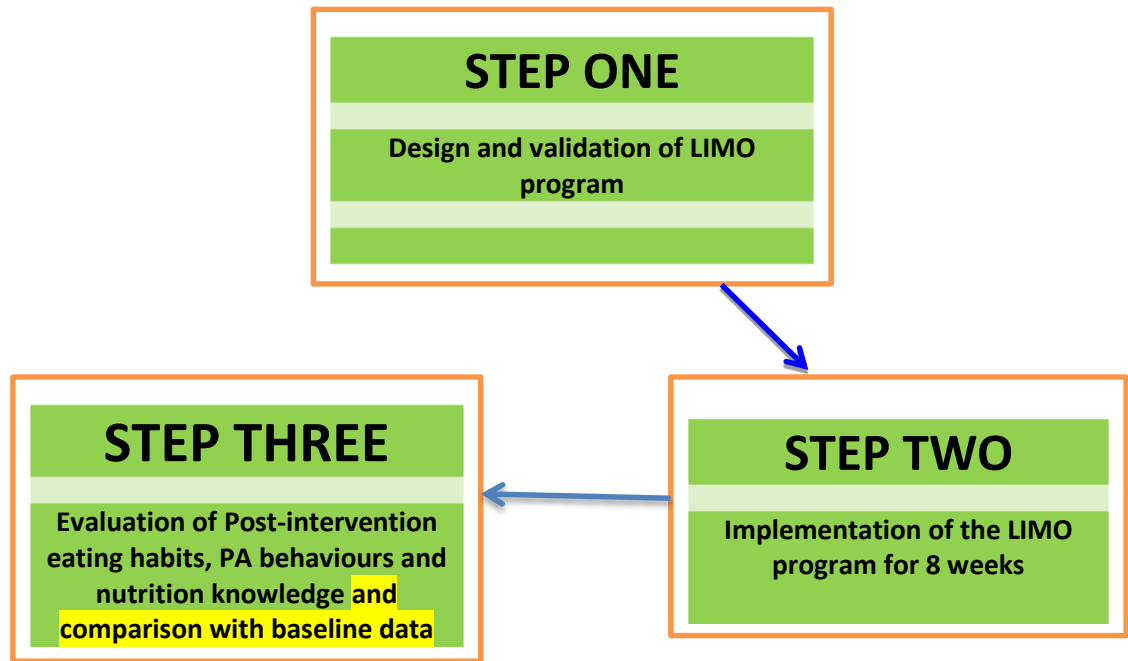
#### 4.5.1 Research description and design

In Study Two a pragmatic randomised controlled design was employed, comprising three steps for the intervention arm: Step 1 was the development and validation of a LIMO program; Step 2 was implementation of the validated LIMO program and Step 3 was the

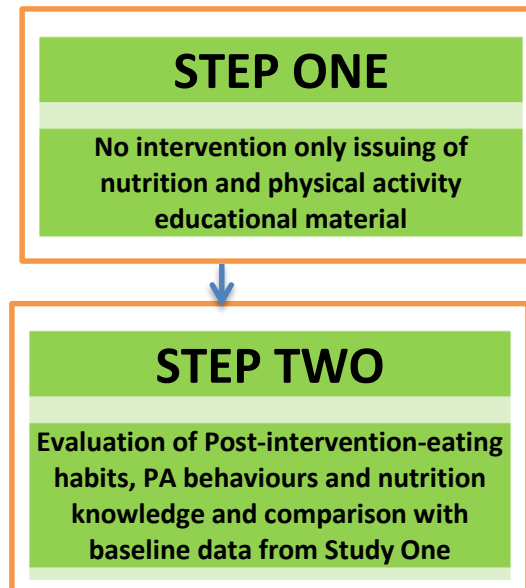
Lifestyle intervention

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evaluation of the LIMO program. There were two steps for the control arm: Step 1 - no intervention but the issuing of educational material and Step 2 - evaluation of the LIMO program. Respondents in the intervention arm received the lifestyle intervention program for one hour a week for eight weeks while those in the control arm received educational pamphlets only at the beginning of the lifestyle intervention program. The planned activities of the LIMO program for the intervention arm are shown in Fig 4-1 and for the control arm in Fig 4-2.



**Fig: 4-1** Diagram of activities of the LIMO program in the intervention arm



**Fig: 4-2:** Diagram of activities of the control arm

A pragmatic randomised controlled trial design was used because of the following features<sup>268</sup> presented in Table 4-2:

**Table 4-2: Selected features of pragmatic trials**<sup>268</sup>

| Key Items             | Features  |
|-----------------------|---|
| Research question     | Intervention can be used in normal practice                                   |
| Setting               | Conducted in normal practice  |
| Intervention          | Applied flexibly  |
| Outcome               | Directly relevant to participants   |
| Relevance to practice | Directly used by decision makers  |
| Participants          | No selection beyond focus of study  |
| Blinding              | It may be difficult to blind participants, for example, exercise intervention |

#### 4.5.2 Features of pragmatic randomised trials

The purpose of pragmatic trials is to inform decisions about practice by adopting a pragmatic approach to key features (Table 4.3) in its design.

**Table 4-3: Key features of pragmatic trials**

| Application to Study Two |   |  | Pages   |
|--------------------------|---|--|---------|
| Research question        | Is about effectiveness: does the intervention work in normal practice?  | The intervention was run hourly for 8 weeks after school at 4-5pm  | 228     |
| Setting                  | Usual practice  | Schools was used as the site for the intervention  | 235     |
| Participants             | Little or no selection beyond the focus of the study                    | Attrition rate of 20% was used, which added 10 more participants to the initial number of 22 participants, however no selection beyond the focus group (participants from study one) | 233-234 |
| Intervention             | Not strictly enforced but applied flexibly as in normal practice        | The intervention was not strictly enforced to suit the context of the school environment   | 237     |
| Outcomes                 | Directly relevant to participants, funders and healthcare practitioners | The outcomes were directly relevant to participants in junior secondary schools  | 229     |
| Relevance to practice    | Directly relevant to the setting  | The intervention was relevant to school environment  | 223     |

The trial number registered with the Pan African Clinical Trials Registry (PACTR) is: PACTR201412000926216. The next section describes methodological issues in pragmatic randomised controlled trials (PRCTs).

#### *4.5.2.1 Methodological issues in randomised trials*

The CONSORT Statement 2010<sup>269</sup> was used for reporting the pragmatic randomised controlled trial because it assists in adequately reporting such a trial. The key features are outlined in Table 4-4.

**Table 4-4: Features of design, sample size, analysis and conduct of RCTs**

| <b>Features</b> | <b>Report</b>   |
|-----------------|---|
| Design          | Pragmatic randomised controlled trial   |
| Sample size     | 46 participants from 4 schools  |
| Analysis        | Individual level analysis   |
| Conduct of RCT  | Sampling of the schools was done by an independent statistician and the two intervention and two control schools were only known by the principal investigator and hidden from teachers and participants and research assistants. |

### **4.5.3 Participants**

#### *4.5.3.1 Eligibility criteria: Inclusion Criteria*

The (n= 252) participants from Study One were eligible to participate in Study Two if:

1. they assented to participate in the intervention for Study Two;
2. whether overweight or not;
3. their parents gave written consent, and;
4. their school administrations agreed to participate.

#### *4.5.3.2 Eligibility criteria: Exclusion Criteria*

Participants were excluded from Study Two if they:

1. missed the intervention program for two (2) days or more;
2. were in the 3<sup>rd</sup> trimester of pregnancy;
3. had answered 'yes' to one or more questions about having health problems in the physical activity readiness questionnaire (Appendix 11);
4. had a known metabolic disorder, and;
5. had a known physical impairment or disability.

#### **4.5.4 Sample size**

##### *4.5.4.1 Sample size determination*

For Study Two the PI was guided by results for Study One for determining sample size from the previous study, specifically the nutritional knowledge aspect of the questionnaire.<sup>84</sup> The mean for nutrition knowledge in Study One was 11.5 (actual score), it was entered into the EPI Info™ software to calculate the sample size. The power was set at 80% and confidence interval at 95%. Data in Table 4-5 show the represent the sample size calculation.

**Table 4-5: Sample size for comparing means****Input Data**

|  |     |
|--|-----|
| Confidence Interval (2-sided)          | 95% |
| Power                                  | 80% |
| Ratio of sample size (Group 2/Group 1) | 1   |

|                    | <b>Group 1</b> | <b>Group 2</b> | <b>Difference</b> |
|--------------------|----------------|----------------|-------------------|
| Mean               | 11.04          | 14.04          | 3                 |
| Standard deviation | 3.80789        | 3.60555        |                   |
| Variance           | 14.5           | 13             |                   |

|                        |    |
|------------------------|----|
| Sample size of Group 1 | 24 |
| Sample size of Group 2 | 24 |
| Total sample size      | 48 |

The result was a required sample size of  $n=48$  participants. An attrition rate was set at 20% therefore 20% of 48 is 10 participants and  $10 + 48 = 58$  participants were required to achieve a study powered at 80%.

#### **4.5.5 Study setting**

The study was conducted in junior public secondary schools in Gaborone- the the capital city of Botswana with a population of 2,038,228.<sup>2</sup> In 2011 it was reported that the prevalence of overweight in Botswana was 13.1% (93/702) in public and private secondary schools in rural and urban areas.<sup>40</sup>

#### **4.5.6 Randomisation**

Every effort was made to minimize bias tabulated in section 4.7.3.5 and as described below.

#### *4.5.6.1 Screening and Randomisation*

Of the four selected schools, two were randomised to the intervention arm (coded 04 and 12); and two schools to the control arm (coded 03 and 07). 58 participants were randomly selected to participate in Study Two out of 88 participants who were eligible to participate, however 55 participants agreed to participate. Random assignment of voluntary participants was at an individual level (n=29 participants to the intervention arm; n=26 participants to the control arm).

#### *4.5.6.2 Sequence generation*

The list of the names of the eight schools were each written in a paper which were folded and given to an independent statistician to randomly select four schools; two intervention arm and two control arm. Then the participants who already were randomly selected to participate in Study Two were recruited to volunteer to participate. The list of voluntary participants was collected from each school.

#### *4.5.6.3 Allocation concealment*

The result of the allocation of the schools into intervention arm and control arm was concealed from the school administrations, teachers, research assistants and participants. They were only informed about the activities of the intervention program for each arm. Only the principal investigator was aware of the allocation of schools to the intervention and control arms.

#### *4.5.6.4 Implementation*

The participants who had been randomised to each trial arm were met and were given consent and assent forms for signing and return to teachers prior to implementation of the trial. Participants whose parents/guardians consented in writing were included in the study.

The voluntary participants in each arm were met and the background, objectives, activities and requirements, and expectations of the lifestyle intervention movement (LIMO) program were explained to them.

#### 4.5.6.5 Blinding

Two of the four randomly selected urban schools from the eight schools that participated in Study One were randomly allocated to either an intervention or control trial arm using allocation concealment to minimize bias.<sup>268</sup> Two schools were in the intervention trial arm and two in the control trial arm to avoid contamination.<sup>268</sup> Only the PI knew the outcome of the allocation known as a single blinded study, but the participants, teachers and research assistants were blinded to the allocation.

#### 4.5.7 Intervention

The planned intervention program is outlined in Table 4-6.

**Table 4-6: Schema representation of planned program of intervention**

| Baseline         |   | Intervention   | Outcome Measure   |
|------------------|---|--|---|
| Intervention arm | Pre-intervention assessment of eating habits physical activity behaviours, nutrition knowledge test scores, intention and self-efficacy for healthy eating(Study One)<br>Development and validation of LIMO program | Limo program one hour weekly for 8 weeks                                       | Eating habits, physical activity behaviours, nutrition knowledge. |
| Control arm      | Pre-intervention, assessment of eating habits physical activity behaviours, nutrition knowledge test scores, intention and self-efficacy for healthy eating   | Information only: participants were given nutrition and PA education pamphlets | Eating habits, physical activity behaviours, nutrition knowledge. |

#### 4.5.8 Instrumentation

The questionnaire which was validated and used to collect pre-intervention data in Study One (baseline) was used to collect post-intervention data in Study Two (intervention) (Appendix 4).

The intervention program focussed on disseminating information to fill knowledge gaps, increase motivation by developing personal goals to change and self-monitoring in relation to adopting a healthy lifestyle. Furthermore the information was aimed at increasing motivation

by encouragement from parents and peers to meet set goals in order to maintain healthy behaviour and demonstrate an increase in self-efficacy to adopt a healthy behaviour. The intervention was school-based and was offered for 8 weeks, one hour per week, outside normal school hours.

#### *4.5.8.1 Design and validation of LIMO program*

The design of the LIMO program was guided by the literature review described in this chapter (4). Two experts, a nutritionist and a physiotherapist (co-supervisor of this study) evaluated the intervention program for content validity (Appendix 38). Slides were emailed to the home economics and physical education teacher and nutritionist for content evaluation (Appendix 5). Results and changes incorporated are presented in Table 4-7.

## Lifestyle intervention

**Table 4-7: Index of content validity (CVI) LIMO program**

| Items                                 | 1=<br>irrelevant | 2=unable to<br>assess relevance<br>without item<br>revision or items<br>in need of such<br>revision that it<br>would no longer<br>be relevant | 3=relevant<br>but needs<br>minor<br>alterations | 4=extremely<br>relevant | Median | Changes   |
|---------------------------------------|------------------|---|---|-------------------------|--------|---|
| <b>LIMO Schedule</b>                  |                  |   |   |                         |        |   |
| Week 1                                |                  |   |   | 4                       | 4      |   |
| Week 2                                |                  |   |   | 4                       | 4      |   |
| Week 3                                |                  |   |   | 4                       | 4      |   |
| Week 4                                |                  |   |   | 4                       | 4      |   |
| Week 5                                |                  |   |   | 4                       | 4      |   |
| Week 6                                |                  |   |   | 4                       | 4      |   |
| Week 7                                |                  |   |   | 4                       | 4      |   |
| Week 8                                |                  |   |   | 4                       | 4      |   |
| LIMO manual                           |                  |   | 3   |                         | 3      | Allocate time for all the activities  |
| <b>Power-point Slides</b>             |                  |   |   |                         |        |   |
| Nutrition slides                      |                  |   | Slides 1, 2, 6, 8                               |                         | 3      | Add a slide on what is nutrition, more items on benefits of good nutrition, reduce number of slides |
| Physical activity slides              |                  |   | Slides 3, 5                                     |                         | 3      | Give examples and reduce number of slides   |
| Interventionist workshop slides       |                  |   | Slide 6, 7, 21                                  |                         | 3      | Reduce number of slides, correct spellings and grammar  |
| <b>Hand-outs</b>                      |                  |   |   |                         |        |   |
| Week 1                                |                  |   |   | 2                       | 2.5    | Use simple English language   |
| Week 2                                |                  |   |   | 3                       | 3      | Use simple English language   |
| Week 3                                |                  |   |   | 3                       | 3      | Use simple English language   |
| Week 5                                |                  |   |   | 3                       | 3      | Use simple English language   |
| Educational materials for control arm |                  |   |   | 3                       | 3      | Add local food pictures to the hand-outs  |
| <b>Videos</b>                         |                  |   |   |                         |        |   |
| Week 2                                |                  |   |   | 3                       | 4      |   |
| Week 3                                |                  |   |   | 3                       | 4      |   |
| Week 4                                |                  |   |   | 3                       | 4      |   |
| Week 5                                |                  |   |   | 3                       | 4      |   |

## Lifestyle intervention

All components of the LIMO program had a high CVI rating of 3 to 4: weekly activities, presentation PowerPoint slides, hand-outs to be given to participants weekly, interventionists' workshop slides and LIMO manual.

The lifestyle intervention movement program outline is presented in Table 4-8.

**Table 4-8: LIMO program outline**

| Intervention week | Theme of the week                  | Goal/objectives   | Activities   | Duration        | Facilitators                               |
|-------------------|------------------------------------|---|--|-----------------|--|
| 1                 | <b>Getting to know each other!</b> | Objective-establishing rapport with students and PE and HE teachers                                       | <ul style="list-style-type: none"> <li>• Introductions,</li> <li>• Distribution and discussions of program goals &amp; schedules</li> <li>• Detailed explanation of expectations</li> <li>• Opportunity to ask questions and clarifications</li> </ul>   | 1 hour per week | Research Team, PE and HE teachers, parents |
| 2                 | <b>My health my priority</b>       | Objective-raise awareness and increase knowledge and promote positive attitudes toward healthy diet       | <ul style="list-style-type: none"> <li>• Nutrition and adolescent statistics,</li> <li>• Drama video by CDC-CCB Biology Nutrition MB,CDC, SR for 10 minutes and CBC Biology Nutrition video GTG &amp; ISV for 7 minutes followed by discussion on</li> <li>• Benefits of proper nutrition,</li> <li>• Recommended daily intake of carbohydrate, protein, fruits and vegetables, fats.</li> <li>• Reading of food labels.</li> <li>• Guide on setting of nutrition goals</li> </ul> | 1 hour per week | HE teachers and research team              |
| 3                 | <b>My health is in my hands</b>    | Objective-raise awareness and increase knowledge and promote positive attitudes toward physical activity, | <ul style="list-style-type: none"> <li>• Background of physical activity and adolescent</li> <li>• What is physical activity, types of physical activity, duration, intensity, frequency,</li> </ul>   | 1 hour per week | PE teachers, researcher team               |

## Lifestyle intervention

| Intervention week | Theme of the week             | Goal/objectives  | Activities  | Duration        | Facilitators                                |
|-------------------|-------------------------------|--|---|-----------------|---|
|                   |                               |  | <ul style="list-style-type: none"> <li>Show video by CDC on active children and adolescents for 7 minutes followed by discussion,</li> <li>Benefits of PA</li> <li>Recommended daily physical activity</li> </ul> Setting of goals  |                 |   |
| 4                 | <b>Practice makes perfect</b> | Objective-reinforce knowledge and increase behavioural skills          | <ul style="list-style-type: none"> <li>Cooking classes- display of colourful healthy food pictures, demonstrations, and practice to make simple healthy meals e.g. fruit salad, vegetable salad.</li> <li>Reinforce information on healthy-behaviour, food preferences,</li> <li>Review eating goals</li> <li>Distribution of pamphlets with overcoming barriers of eating habits to take home</li> </ul> | 1 hour per week | HE teacher, researcher, research assistants |
| 5                 | <b>I am on the move</b>       | Objective-increase physical activity skills and promote good attitudes | <ul style="list-style-type: none"> <li>Introductions,</li> <li>Distribution and discussions of program goals &amp; schedules</li> <li>Detailed explanation of expectations</li> <li>Opportunity to ask questions and clarifications</li> </ul>  | 1 hour per week | PE teacher, guest lecturer, research team   |
| 6                 | <b>I can do it</b>            | Objective-personal goals review and re-setting, reinforce knowledge    | <ul style="list-style-type: none"> <li>Nutrition and adolescent statistics,</li> <li>Drama video by CDC- CCB Biology Nutrition MB,CDC, SR for 10 minutes and CBC Biology Nutrition video GTG &amp; ISV for 7 minutes followed by discussion on</li> <li>Benefits of proper nutrition,</li> </ul>  | 1 hour per week | Motivational speaker, research team         |

## Lifestyle intervention

| Intervention week | Theme of the week      | Goal/objectives  | Activities  | Duration        | Facilitators   |
|-------------------|------------------------|--|---|-----------------|--|
|                   |                        |  | <ul style="list-style-type: none"> <li>• Recommended daily intake of carbohydrate, protein, fruits and vegetables, fats.</li> <li>• Reading of food labels</li> <li>• Guide on setting of nutrition goals</li> </ul>  |                 |  |
| 7                 | <b>Let's get going</b> | Objective-reinforce knowledge on physical activity, and practice | <ul style="list-style-type: none"> <li>• Background of physical activity and adolescent</li> <li>• What is physical activity, types of physical activity, duration, intensity, frequency,</li> <li>• Show video by CDC on active children and adolescents for 7 minutes followed by discussion,</li> <li>• Benefits of PA</li> <li>• Recommended daily physical activity</li> <li>• Setting of goals</li> </ul>   | 1 hour per week | Guest lecturer, PE teachers, research team               |
| 8                 | <b>Wrapping up</b>     | Objective-develop coping and monitoring skills                   | <ul style="list-style-type: none"> <li>• Cooking classes- display of colourful healthy food pictures, demonstrations, and practice to make simple healthy meals e.g. fruit salad, vegetable salad.</li> <li>• Reinforce information on healthy-behaviour, food preferences,</li> <li>• Review eating goals</li> <li>• Distribution of pamphlets with overcoming barriers of eating habits to take home</li> </ul> | 2 hours a day   | Parents, research team, PE and HE teachers, school heads |

## 4.5.9 Procedure

### *4.5.9.1 Implementing the Lifestyle intervention movement (LIMO) program*

The PI approached the administrators of each of the four randomly selected schools that had participated in Study One to seek permission to meet with the home economics and physical education teachers in each school to 1) solicit their assistance in recruiting study participants for the intervention and 2) invite them to be trained as interventionists. A 30 minute presentation was made to the administrators for the purpose of explaining the study and to answer questions.

The PI recruited two teachers from one intervention school to become interventionists in the other school (Appendix 35), some teachers declined to participate due to busy schedules. One nutritionist (who evaluated the LIMO intervention program) volunteered to assist in implementing the intervention. The PI conducted a 4 hour (09:00 to 13:00 hours) training workshop (Appendix 21, 22) on 20 January, 2016 for the two interventionists, nutritionist and two research assistants at School coded 12. The focus of the workshop was the importance of a healthy diet and physical activity, what a healthy diet entails and benefits, what physical activity entails followed by a video clip.<sup>85</sup> The focus of the workshop entailed importance of a healthy diet and physical activity, what a healthy diet entails and benefits, what physical activity entails followed by a video clip on health tips. The research team was introduced to the intervention plan and activities (Appendix 32). Expectations for participants in Study Two were shared with them and the delivery of the intervention is outlined in the lifestyle intervention program in Table 4-10 (Appendix 25). Their expectations (Appendix 26) were shared with them and the delivery of the intervention is outlined in the lifestyle intervention program in Table 4-10 below. The role of teachers was to deliver the intervention to the participants in the intervention schools one hour per week after school as scheduled and assist in making sure that voluntary participants attend all the intervention program sessions as scheduled.

Then the PI, teachers who volunteer to assist and trained research assistants met with all the students who indicated a desire to participate in the study in the designated hall in each school and further explanations about the purpose and expectations of the study, benefits, inclusion and exclusion criteria and study requirements were discussed. They were encouraged to ask questions for clarification. The participants were given assent forms to fill after their parents have consented.

The issued consent forms and assent forms were returned by the participants within a week as requested by PI. The PI and research assistants counted the returned forms and they corresponded to the number issued except for two of which parents did not consent.

#### 4.5.9.1.1 Week One: Intervention arm

The PI met separately with the potential participants allocated to the intervention arm (two schools) and to the control arm (two schools) respectively and further explained the purpose of Study Two expectations. The intervention arm was informed about the weekly lessons that will entail watching nutrition and physical activity videos by the Centres for Disease Control and Prevention (CDC), education and motivational video and talks on healthy living that are open to the public and games for one hour per week for 8 weeks. At the end of the study they filled in nutrition questionnaires and were weighed and had their height and waist circumference measured to check if their lifestyle had improved or not. They were requested to give issued information sheets about the study expectations to their parents (Appendix 24).

#### 4.5.9.1.2 Control group

The control arm was given printed educational materials (Appendix 17) on nutrition knowledge and physical activity at the beginning of Study Two. At the end of the 8 weeks they were given nutrition questionnaires to fill in and were weighed and had their height and waist circumference measured.

During the course of the implementation of the intervention an attendance register was kept by the trained research assistants and teachers weekly to monitor participants attendance in

intervention schools. The activities of the LIMO program were presented by the home economics teacher and PI with the help of nutritionists, and physical education teacher. The two trained research assistants captured details of the program weekly.

#### 4.5.9.1.3 Week One

##### 4.5.9.1.3.1 Intervention arm

The two trained interventionists, two trained research assistants and respondents were met on the 21<sup>st</sup> January to discuss the logistics of implementing the intervention. The school coded 04 agreed that the intervention meetings be on Mondays after school between 16:00 – 17:00 hours in one of the classrooms. The school coded 12 agreed that the meetings would also be held on Mondays between 16:00 – 17:00 hours after school in the computer laboratory.

Week One of the program started on 25 January, 2016 at School 04 at 16h00 and ended at 17h00. Eleven participants, two interventionists (teachers), one nutritionist, two research assistants and the principal investigator attended the meeting. The objective of week one was to establish rapport and the theme was '**GETTING TO KNOW EACH OTHER**'. The principal investigator introduced the research team and participants introduced themselves. The principal investigator presented the background of the study, study objectives, shared weekly schedules and respondent's expectations. The team and participants were allowed time to ask questions and clarifications. Meeting ended at 5pm. The participants were issued with LIMO program schedule (Appendix 25) and participants expectations (Appendix 24).

On 26<sup>th</sup> January 2016, the research team met at the school coded 12 between 16:00-17:00 hours. There were 18 participants who attended the meeting. The principal investigator presented the background of the study, study objectives, shared weekly schedules and participants's expectations (Appendix 17). The team and participants were allowed time to ask questions and clarifications. The meeting ended at 17:00 hours.

### **Challenges**

1. The school heads could not attend the LIMO meetings due to other school administration commitments.
2. The school venue coded 04 was not conducive for running an intervention program.
3. As there was no scheduled parent teachers association meeting at the beginning of the school term the researcher did not manage to meet with participants parents prior to starting The LIMO program as planned. The researcher only communicated with parents through parental expectation sheets and informed consent forms.

### **Successes**

1. All the voluntary participants in the intervention arm managed to attend the first meeting.
2. The meeting finished at the scheduled time.

#### 4.5.9.1.3.2 Control arm

The 13 voluntary respondents in the school coded 03 were met at 14:00 hours on the 28<sup>th</sup> January, 2016 and 14 voluntary respondents at the school coded 07 were met on the 29<sup>th</sup> January 2016 at 14:30 hours. They were given printed education materials on nutrition and physical activity. Both the groups were informed that at their spare time they can read the materials to inform themselves about healthy lifestyle. They were both informed that they will be given a questionnaire to complete and have their weights and heights, and waist circumference be checked at the end of 8 weeks.

#### 4.5.9.1.4 Week Two

Week 2 meetings were held on the 1<sup>st</sup> and 2<sup>nd</sup> February, 2016 at the schools coded 04 and 12 and the intervention meeting was held between 16:00-17:00 hours. There were 11 respondents

at school 04 and 18 at school 12 and two interventionists (teachers), one nutritionist, two research assistants and principal investigator attended the meeting. The objective of the week was to raise awareness and increase knowledge and promote positive attitudes toward healthy diet. The interventionist (home economics teacher) facilitated the deliberations of the day. The theme was '**MY HEALTH MY PRIORITY**'

The activities entailed:

- drama videos by CDC-CCB Biology Nutrition MB, CDC, SR for 10 minutes, and CBC Biology Nutrition video GTG & ISV for 7 minutes
- followed by a presentation on nutrition (Appendix 14); and
- discussion on Nutrition; and
- adolescent statistics;
- benefits of proper nutrition, recommended daily intake of carbohydrate, protein, fruits and vegetables, fats, reading of food labels.

Participants were given guidance on setting nutrition goals by a nutritionist and the PI. They were issued with information sheets on food labels (Appendix 28).

### **Challenges**

1. Two (2) respondents at school coded 12 came late, and one was absent.

### **Successes**

1. The meeting was exciting for the participants, and finished on time.
2. All participants at the school coded 04 were present and punctual.

#### 4.5.9.1.5 Week Three

Week three meetings were held on the 8<sup>th</sup> and 9<sup>th</sup> February, 2016 at schools coded 04 and 12 and the intervention meeting was between 16:00-17:00 hours. There were 10 participants at school 04 and 18 at school 12 and two interventionists (teachers), two (2) research assistants and the principal investigator attended the meeting. The objective of the week was to raise awareness, increase knowledge and promote physical activity behaviour. The interventionist

(physical education teacher) facilitated the deliberations of the day. The theme was **MY HEALTH IS IN MY HANDS.**

The activities of the day entailed Physical Activity (PA) and adolescent health presentation which included the following subtopics; definition of physical activity, types of physical activity, duration, intensity, frequency, and benefits of PA and recommended daily PA for adolescents for 20 minutes (Appendix 30), followed by discussion. Principal investigator assisted respondents to make realistic goals for daily PA such as walking daily for 30 minutes in the morning/evening in the coming weeks. The research assistants recorded the deliberations of the day.

### **Challenges**

1. One participant was absent and some participants in the schools coded 4 and 12 came late for the meeting.
2. The planned viewing of the video failed for technical reasons.

### **Successes**

1. The meeting was exciting and it was finished on scheduled time.
2. The participants had an opportunity to stretch both their arms, neck and head for five minutes.

#### 4.5.9.1.6 Week four

Week four meetings were held on the 15<sup>h</sup> and 16<sup>th</sup> February, 2016 at schools coded 04 and 12 between 16:00-17:00 hours. There were 10 participants at school 04 and 16 at school 12 and two interventionists (teachers), one nutritionist, two research assistants and principal investigator attended the meeting. The objective of the week was to review personal goals, re-set goals if needed and reinforce nutrition information. The interventionist (home economics teacher) facilitated the deliberations of the day. The theme was '**I CAN DO IT.**'

The activities entailed watching of an awesome motivational video for 4 minutes followed by discussion and questions (10 minutes), review of personal goals on healthy eating and practices and PA behaviours for 30 minutes. The participants were divided into two groups at the school coded 04 and four groups at the school coded 12. They shared their goals and challenges that were impeding achievement of their goals.

Some challenges highlighted by participants regarding adopting a healthy eating lifestyle were availability of healthy foods at home, late tea break at school, the temptation to buy fast foods from school tuck-shops and the school policy that prevented students to come to school with packed meals from home. The research assistants recorded the deliberations of the day. Some respondents whose goals were to jog daily indicated that they tired easily and reported feeling dizzy.

The principal investigator, home economics teacher and physical education teacher provided ways to overcome barriers such as eating breakfast at home since the school tea break was always late and convincing their parents/guardians to provide healthy foods at home. They were advised to start gradually and increase the intensity and duration of each physical activity with time.

### **Challenges**

1. One participant was absent from school 04 and two from school 12.
2. Some participants still came late to the meeting despite being encouraged to be on time the previous week.

### **Successes**

1. The meeting was exciting, and finished 10 minutes beyond the scheduled time.
2. The participants had an opportunity to do body stretching of both legs for five minutes.

#### 4.5.9.1.7 Week five

Week five meetings were held on the 22<sup>nd</sup> and 23<sup>rd</sup> February, 2016 at the school coded 04 and 12 and the intervention meeting was held between 16:00-17:00 hours. There were 11 participants at school 04 and 18 at school 12 and two interventionists (teachers), one nutritionist, two research assistants and principal investigator attended the meeting. The objective of the week was to reinforce knowledge and provide simple cooking skills. The interventionist (home economics teacher) facilitated the deliberations of the day. The theme was ‘**PRACTICE MAKES PERFECT**’.

The activities entailed Display of colourful healthy food pictures (Appendix 31), discussion on how to make healthy meals using locally available foods, demonstrations on how to make smoothies, vegetable salad and home-made salad dressing (Appendix 32). The participants watched 3-minute videos on how to make smoothies and vegetable stir fry by Stanford University, School of Medicine videos.

The participants participated in making the smoothies and vegetable salad, and the served each other to taste the dishes they made. They were encouraged to eat vegetables by reinforcing information on benefits of vegetables since they indicated that they do not like them. The participants had time to review their goals in their groups and counselling was provided by the principal investigator and home economics teacher.

#### **Challenges**

1. Two participants at the school coded 12 came late and one was absent.

#### **Successes**

1. The meeting was exciting to the participants, and finished on time.
2. All the participants in the school coded 04 were present and punctual.
3. The participants had an opportunity to do body stretches of arms, head and neck.

#### 4.5.9.1.8 Week six

Week six meetings were held on the 29<sup>th</sup> February and 1<sup>st</sup> March, 2016 at schools coded 04 and 12 between 16:00-17:00 hours. There were 6 participants at school 04 and 18 at school 12 and two interventionists (teachers), two research assistants and principal investigator attended the meeting. The objective of the week was to reinforce knowledge and provide skills. The interventionist (home economics teacher) facilitated the deliberations of the day. The theme was **I AM ON THE MOVE**.

The activities entailed demonstrations of a 6 metre run for 6 minutes for 20 minutes and aerobics with background music for 30 minutes. The activities were done in a spacious dining hall. Participants wore shorts, (loose) t-shirts and comfortable shoes appropriate for physical activity. The planned activities started with body warm up exercises and ended with body relaxation activities. Respondents were provided with water for hydration purposes.

The participants had time to review their PA goals and reinforce information on PA health-behaviour for 10 minutes and counselling was provided by the principal investigator and physical activity teacher. Most of the participants mentioned that they do not have time to do physical activity for 60 minutes daily as recommended. They were encouraged to plan different activities throughout the day so that by the end of the day they would have reached their goal of 60 minutes of moderate to vigorous physical activity.

#### **Challenges**

1. The 6 meter run could not be done on school playgrounds because it was a very hot day.
2. Five participants from the school coded 04 missed the meeting and one was excluded from the study because she missed the meetings twice.

#### **Successes**

1. The meeting was very exciting and participants did not want the activity to end, and it finished 10 minutes later than the scheduled time. Participants

agreed to have photographs and videos taken of them for the purpose of sharing it with the researcher's supervisors.

2. All the participants at the school coded 12 were present and punctual.

#### 4.5.9.1.9 Week seven

Week seven meetings were held on the 7<sup>th</sup> and 8<sup>th</sup> March, 2016 at the schools coded 04 and 12 between 16:00-17:00 hours. There were 6 participants at school 04 and 16 at school 12 and two interventionists (teachers), one nutritionist, two research assistants and the principal investigator attended the meeting. The objective of the week was to develop self- management and monitoring skills.

The interventionists (home economics and physical education teachers) and nutritionist facilitated the deliberations of the day. The theme was **'LET'S GET GOING'**. The activities of the day were composed of reinforcing messages on healthy eating and physical activity behaviours through a LIMO game. The participants were divided into 4 groups at school 12 and two groups at school 04 to play a LIMO game (Appendix 30). They planned a balanced meal using food cards and an adequate physical activity for a day using a physical activity pyramid. They also identified healthy and unhealthy food items and different kinds of physical activities according to intensity and PA types (low, moderate and vigorous) and their benefits.

Baskets full of food cards and PA pictures were given to each group by the research assistants. The participants were requested to use the researcher's plate and food pyramid and physical activity pyramid charts (Appendix 27a and b) to plan a balanced meal and an adequate physical activity for a day. Each group took turns presenting their balanced meal plans and adequate PA plans, and they give reasons and benefits for each meal and PA they had planned. Each correct combination of healthy foods and type of PA was awarded 5 marks. The group that won the game was given pens and healthy seed bars. Group B at school 04 won the game and group 1 at school 12.

Participants reviewed their eating and physical activity goals to see if they were progressing well or not. Some participants reported to be experiencing challenges in meeting their goals because of lack of time to plan and eat a healthy meal and perform adequate physical activity of 60 minutes per day spread throughout the day. Group counselling was provided to those that needed assistance with planning simple healthy meals and ways for self-monitoring to do different physical activities that adds to 60 minutes through-out the day.

### **Challenges**

1. Four participants from school 04 missed the meeting and were excluded from the study because they missed the meetings twice. Two participants were absent from school 12.
2. All the groups had a challenge to plan for an adequate physical activity.

### **Successes**

1. The meeting was very exciting and participants really showed that they were knowledgeable and skilful in planning a balanced meal. Participants agreed to have their photographs taken for the purpose of sharing these with the researcher's supervisors.

#### **4.5.9.1.10 Week eight**

Week eight meetings were held on the 14<sup>th</sup> and 15<sup>th</sup> March, 2016 at schools coded 04 and 12 between 16:00-17:00 hours. There were 7 participants at school 04 and 16 at school 12 and two interventionists (teachers), one nutritionist, two research assistants, one parent, two teachers and principal investigator attended the meeting. The objective of the week was to reinforce self-management skills. The principal investigator facilitated the deliberations of the day. The theme was **'MY DECISIONS MY LIFE'**.

The participants gave 30-minute oral presentations in their respective groups, of their successes, challenges they encountered during the implementation of the lifestyle intervention

program, the lessons they learnt and the way forward in terms of their eating and PA behaviour change goals. Some teachers and parents were invited to the meeting. The participants stated that they had learnt about a balanced diet, healthy eating, healthy and unhealthy foods, risks of unhealthy eating, how to prepare simple healthy meals and that they had been motivated to adopt a healthy lifestyle. They also stated that they had learnt about adequate physical activity (PA), different kinds of PA and how to plan their daily PA.

The participants thanked the research team for bringing such a valuable program into their school and for the exciting activities they had enjoyed. The only parent present also thanked the research team for teaching children on healthy lifestyle, which had already impacted her family, because her child (one of the participants) had been sharing all the information and skills she learnt during the lifestyle intervention program with the family. The school representatives also thanked the research team for choosing their schools to implement such an important lifestyle intervention program and mentioned that their schools were open for future lifestyle activities since they want to promote healthy lifestyle in their schools.

The principal investigator thanked the school administration, participants, parent and research team for making the program a success and enjoyable. She mentioned that the purpose of issuing the certificates was to motivate the participants to take part in the intervention study for their own health benefit. In addition, the certificates were to remind them of the eating and physical activity goals they had set during the course of the intervention program and to motivate them to strive to achieve their goals.

The school representatives issued the participation certificates to the participants (Appendix 29).

### **Challenges**

1. Four participants dropped out of the program because of non-attendance more than two times.
2. The meeting ended at 17:30 hours, 30 minutes beyond the scheduled time.

3. Most parents did not attend the meeting as planned.
4. The school principals could not attend the meeting because of other commitments.

### **Successes**

1. One parent attended the meeting from the school coded 04.

#### **4.5.10 Statistical methods**

The statistical methods that were used to analyse the data are outlined in Table 4-9. The results of Study Two are presented in tables.

**Table 4-9: Statistical analysis**

| <b>Socio-demographic variables</b>          | <b>Indicator variables</b>   | <b>Data</b>               | <b>Statistical analysis</b>   |
|---|--|---------------------------|---|
| Gender                                      | Female=1, male=0   | Categorical<br>Binary     | Number, Proportion, percentage, Chi-Square,   |
| Age   |  | Continuous and ordinal    | Number, proportion, percentage<br>Mean, min-max, SD, Independent t-test if data are normally distributed; if not, nonparametric analysis<br>Fisher's exact test |
| SES   | low=1, middle=2, high=3  | Ordinal                   | Number, Proportion, percentage<br>Fisher's exact test   |
| BMI   | underweight=1, normal=2, overweight=3, obese=4, obese with risk =5                       | Categorical/<br>Numerical | Number, proportion, percentage<br>Mean, SD if data are normally distributed; if not, nonparametric analysis<br>Fisher's exact test, t-test, Kruskal-Wallis test |
| WC  | abnormal for females=1, normal for females=4 abnormal for males=2 and normal for males=3 | Categorical               | Number, Proportion, mean, SD, Chi-square if data are normally distributed; if not, nonparametric analysis.<br>Fisher's exact test, t-test, Kruskal-Wallis test  |
| <b>Eating habits<br/>Table 13a-13b</b>      |  | Categorical/<br>Numerical | Mean, SD<br>Number, proportion, percentage, t-test  |
| <b>Nutrition<br/>knowledge<br/>Table 16</b> |  | Categorical/<br>Numerical | Number, proportion, percentage<br>Independent t-test (mean and SD or median and IQR, p-value)   |
| <b>PA behaviour<br/>Table 14 &amp; 15</b>   |  | Categorical/<br>Numerical | Mean, SD<br>Number, proportion, percentage, t-test  |

Note on table: SES: Socio-economic; BMI: Body Mass Index; WC:Waistcircumference, PA: Physical activity

#### 4.5.11 Data management and analysis

Data were captured directly onto Microsoft® Excel software (2010, Redmond, Washington) spreadsheets, cleaned and stored in a password protected computer (Microsoft, 2010). Data for participants who missed three or more intervention sessions and follow-up sessions were not included in the data analysis for Study Two. Statistical Package for Social Sciences (SPSS) and STATA software were used to analyse data. *Per protocol* analysis refers to

analysis of data of randomised participants excluding those who were non-compliant.<sup>270</sup> *Per protocol* analysis was undertaken in Study Two because the drop-outs could not be followed up because they could not be reached even through the help of the teacher.

Intention-to-treat refers to data analysis for all participants randomised to the trial arm to which they were assigned irrespective of non-compliance with the requirements of the study.

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#### **4.5.12 Ethical considerations**

##### **Autonomy and Beneficence**

The participants in Study Two were requested to volunteer to participate. Written consent and assent forms written in English (preferred language) were issued pre-intervention. Two sets of consent forms were issued for the intervention (Appendix 19) and control arm (Appendix 20). The participants were known already to research assistants and PI, however the participants' names were not used instead codes that were used in Study One were used. The participants had the liberty to withdraw from the study, of which some did without being asked the reasons for withdrawal.

##### **Benefits**

The participants in the control arm were given an incentive of R17.00 (Equivalent of P20.00) at the end of the study, while those in the intervention arm were given R7.00 (Equivalent of P10.00) weekly and a participation certificate at the end of the intervention to motivate them to participate in the study.

##### **Risks**

The participants did not experience nor report any risk especially with planned physical activities.

## **4.6 Results**

In this chapter findings are presented obtained from a 3-part questionnaire comprising 10 components: demographic characteristics, food frequency consumption, meal habits, influence on food choices, physical activity behaviour, self-efficacy for healthy eating and self-efficacy for physical activity, and intention for healthy eating and physical activity behaviours and nutrition knowledge.

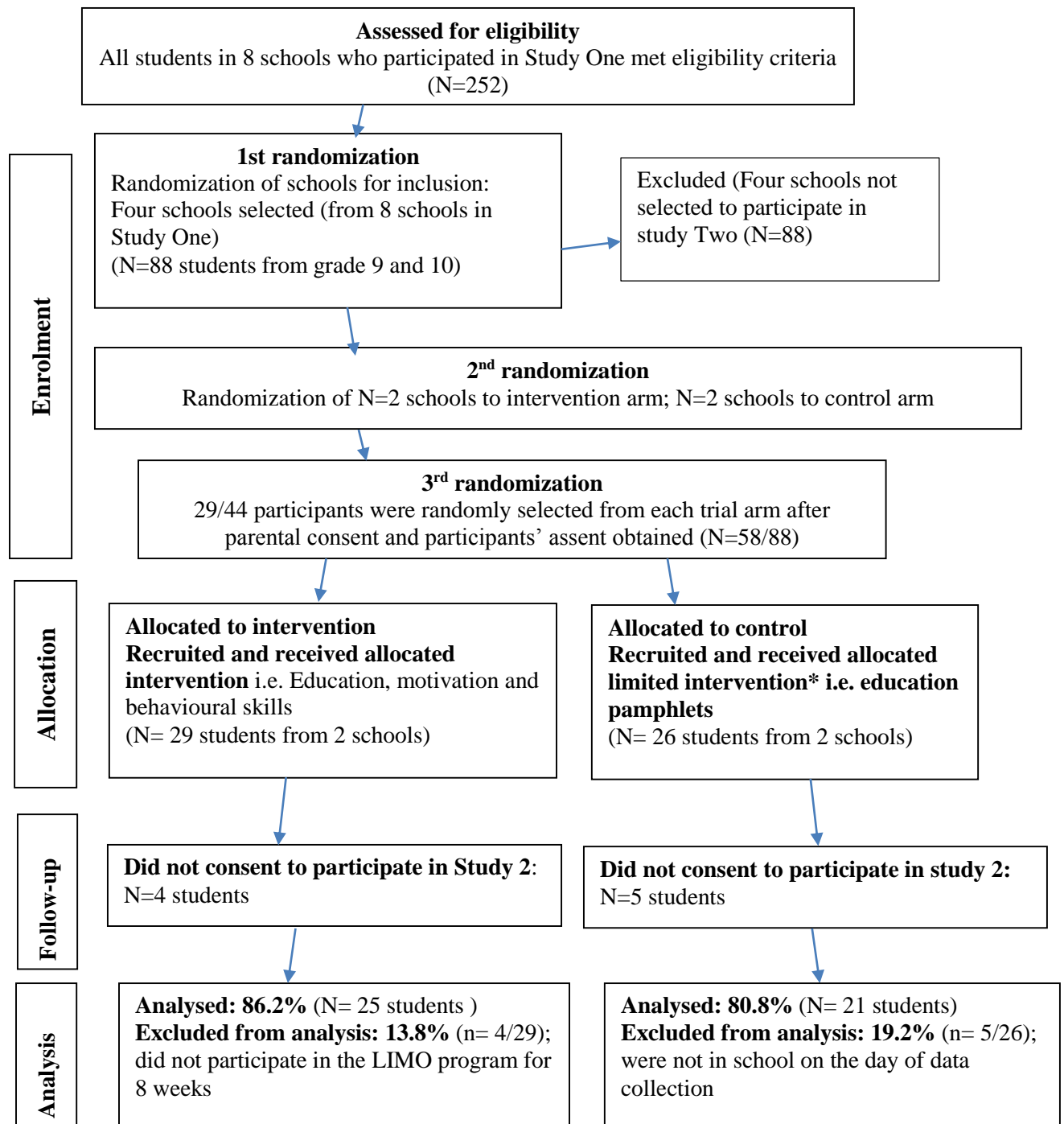
The objectives of the study were to establish whether the lifestyle intervention program resulted in a significant difference in improving eating habits between the intervention and control group, physical activity levels between the intervention and control group and nutritional knowledge between the intervention and control group. The results are presented for each objective of Study Two.

### **4.6.1 Participants**

#### *4.6.1.1 Participant flow for the LIMO program*

The flow diagram in Figure 4-1 shows scholars for the intervention group (who participated in the LIMO program) and for the control group (only received educational material).

Lifestyle intervention



**Figure 4-3: Flow diagram of scholars for the intervention group (participated in the LIMO program) and control group (only received educational material)**

#### **4.6.2 Recruitment of participants**

The participants who were randomly selected to participate in Study One were invited to participate in Study Two. The required sample size for Study Two was 48. With an additional 10 (20% of 48=10) participants for attrition purposes, the total sample of participants required was n=58 (48+10=58): n=29 participants in each arm; however n=46 (79.3%) volunteered to participate in the study.

##### *4.6.2.1 The recruitment schedule*

School heads in the randomly selected schools were met on the 5-7<sup>th</sup> of January, 2016 to solicit their participation in Study Two. They were briefed on the objectives and what Study Two entails as well as the requirements of participants. Teachers were requested to assist as interventionists. Respondents who participated in Study One were met on the 12<sup>th</sup> January, 2016 to solicit their participation in Study Two and they were requested to register with the home economics or physical education teachers if they were interested. Recruitment flyers were placed at the school tuckshop and administration notice boards for easy access (control arm Appendix 15; intervention arm Appendix 16;).

Recruitment lists were collected from home economics and physical education teachers on the 14<sup>th</sup> January, 2016. Volunteering participants were met in front of the school administration block at 2:30pm on the 15<sup>th</sup> January 2016. Volunteering participants were informed about the objectives of Study Two (intervention), duration of the study, what it entailed and what would be expected from them and the incentives they would receive if they participated in the study. They were given assent and informed consent forms to give to their parents/guardians to sign and return the following day. On the 15-18<sup>th</sup> informed consents and assents were collected from participants. Data in Table 4-10 show the number of participants in intervention schools. Data in Table 4-11 show those in control schools.

**Table 4-10: Number of participants recruited into the intervention arm**

| Intervention schools | Number recruited | Number who agreed to participate |
|----------------------|------------------|----------------------------------|
| 04                   | 22               | 11                               |
| 12                   | 22               | 18                               |
| <b>Total</b>         | 44               | 29                               |

**Table 4-11: Number of participants recruited into the control arm**

| Control schools | Number recruited | Number who agreed to participate |
|-----------------|------------------|----------------------------------|
| 03              | 22               | 13                               |
| 07              | 22               | 13                               |
| <b>Total</b>    | 44               | 26                               |

As shown in Figure 4-1 a total of 9 potential participants were excluded from the study (intervention arm = 4; control arm = 5), leaving a sample of n=25 and n=21 respectively.

#### **4.7 Pre-intervention baseline demographic characteristics of participants**

Data in Table 4-12 show the pre-intervention baseline demographic characteristics of participants in control and intervention arms.

## Lifestyle intervention

**Table 4-12: Pre-intervention baseline demographic characteristics of participants in both trial arms (N=46)**

| Characteristics                |  | RCT arms baseline                   |  |          |
|--------------------------------|--|-------------------------------------|--|----------|
|                                |  | Control arm<br>(n=21)<br>Number (%) | Intervention arm<br>(n=25)<br>Number (%) | P-value  |
| <b>Gender</b>                  | Females  | 13 (28.3)                           | 15 (32.6)                                | 0.895*   |
|                                | Male   | 8 (17.4)                            | 10 (21.7)                                |          |
| <b>SES<sup>a</sup></b>         | Low  | 7 (15.2)                            | 12 (26.1)                                | 0.176**  |
|                                | Middle   | 14 (30.4)                           | 11 (23.9)                                |          |
|                                | High   | 0 (0)                               | 2 (4.3)                                  |          |
| <b>Age (Years)</b>             | 13   | 0 (0.0)                             | 1 (2.2)                                  | 0.050**  |
|                                | 14   | 5 (10.9)                            | 13 (28.3)                                |          |
|                                | 15   | 16 (34.8)                           | 11 (23.9)                                |          |
| <b>BMI<sup>b</sup></b>         | Underweight ( $\leq 5^{\text{th}}$ )                     | 0 (0.0)                             | 2 (8.0)                                  | 0.213**  |
|                                | Normal ( $5^{\text{th}}$ to $\geq 85^{\text{th}}$ )      | 20 (95.2)                           | 18 (72.0)                                |          |
|                                | Overweight ( $85^{\text{th}}$ to $\leq 95^{\text{th}}$ ) | 0 (0.0)                             | 3 (12.0)                                 |          |
|                                | Obese ( $\geq 95^{\text{th}}$ )                          | 1 (4.8)                             | 1 (4.0)                                  |          |
|                                | Obese with risk ( $\geq 97^{\text{th}}$ )                | 0 (0.0)                             | 1 (4.0)                                  |          |
|                                | Mean (SD)  | 21.3 (4.1)                          | 20.6 (4.6)                               |          |
| Median (IQR)                   | 21.2 (18.5-23)   | 20.6 (17.1-22)                      | 0.530#                                   |          |
| <b>WC<sup>c</sup></b>          | Female   |                                     |  | 0.787**  |
|                                | Normal $\leq 81.5\text{cm}$                              | 9 (19.6)                            | 9/25 (19.6)                              |          |
|                                | Abnormal $\geq 81.5\text{cm}$                            | 1/21 (2.2)                          | 3/25 (6.5)                               |          |
|                                | Male   |                                     |  |          |
|                                | Normal $\leq 80.5\text{cm}$                              | 10 (21.7)                           | 10/25 (21.7)                             |          |
|                                | Abnormal $\geq 80.5\text{cm}$                            | 1/21 (2.2)                          | 3/25 (6.5)                               |          |
|                                | Mean - female and male (SD)                              | 70.9 (8.9)                          | 70.6 (9.8)                               |          |
| Median - female and male (IQR) | 68.4 (66.0-72.1)   | 69.5 (63.4-75.0)                    | 0.708#                                   |          |
| <b>Eating habits</b>           | Mean (SD)  | 63.8 (11.7)                         | 65.7 (12.4)                              | 0.578*** |
| <b>Meal habits</b>             | Mean (SD)  | 11.9 (2.2)                          | 11.1 (2.7)                               | 0.270*** |
| <b>PA behaviours (walking)</b> | Mean (SD)  | 3 (0.8)                             | 2.7 (1.2)                                | ***0.028 |
| <b>Sedentary behaviours</b>    | Mean (SD)  | 2.8 (0.9)                           | 2.7 (1.0)                                | 0.753*** |
| <b>Doing exercise</b>          | Mean (SD)  | .57 (.51)                           | .60(.50)                                 | 0.849*** |
| <b>Knowledge score</b>         | Mean(SD)   | 47.2 (16.2)                         | 49.5 (12.5)                              | 0.590*** |
|                                | Median (IQR)   | 50 (42-58)                          | 50 (38-54)                               | 0.904#   |
| <b>Nutrition knowledge</b>     | Mean(SD)   | 11.3 (3.9)                          | 11.8 (3.0)                               | 0.620*** |
|                                | Median (IQR)   | 12 (10-14)                          | 12 (9-13)                                | 0.930#   |

Note on table: <sup>a</sup> SES refers to socioeconomic status, determined by parents/guardians' employment and level of education; <sup>b</sup> BMI was determined by CDC cut off points and indicates percentiles; <sup>c</sup> WC was determined by Nigerian cut off points.

\* Chi-squared test \*\* Fisher's exact test \*\*\* t-test # Kruskal-Wallis test

PA = physical activity; SD = standard deviation; IQR = interquartile range.

Data in Table 4-12 show that there were more females in the sample (28/46; 60.9%) than males (18/46, 39.1%) and the majority of participants were aged 15 years (27/46, 58.7%). Most of the participants had a middle socioeconomic status (25/46, 54.3%) and had a normal BMI (38/46, 82.6%) with few being underweight (3/46, 6.5%), overweight (3/46, 6.5%), or obese (2/46, 4.3%). No participants in either the intervention or control trial arms were obese with risk. The majority of females and males had a normal WC (18/46, 39.2%; 20/46, 43.4%) respectively. Of the eight participants (17.4%) who had a greater WC (within the range of 80.5 to 81.5 cm), most (3 males and the same number of females) were within the intervention trial arm. There were no statistically significant differences between the two trial arms except for age ( $P=0.05$ ) and physical activity ( $P=0.028$ ). Data for the nine non-participants that were not included in data analysis show that they were younger (mean age (SD) = 13.7 (0.707) years) and the majority 55.6% (5/9) were females.

#### **4.7.1 LIMO program Objective 1: Improving eating habits between the intervention and control arms**

##### *4.7.1.1 Pre and post-intervention results*

Data in Table 4-13a show the difference between pre- and post-intervention consumption of fruit, vegetables, fatty foods and sugar (Section B questions B6-B11, section C questions C2, and C3) between the trial arms.

## Lifestyle intervention

**Table 4-13a: Difference in consumption of fruit, vegetables, fatty foods and sugar at baseline (pre-intervention) and follow-up (post-intervention) between trial arms (N=46)**

| Outcomes   | Control<br>N=21<br>Median (IQR) | Intervention<br>N=25<br>Median (IQR) | <i>P</i> -value | Control<br>N=21<br>Median<br>(IQR) | Intervention<br>N=25<br>Median<br>(IQR) | <i>P</i> -value |
|--|---------------------------------|--------------------------------------|-----------------|------------------------------------|---|-----------------|
|  | Pre Intervention                |                                      |                 | Post-Intervention                  |   |                 |
| Fruit (B7)   | 8 (8 to 10)                     | 7 ( 5 to 8)                          | 0.026           | 6 ( 5 to 7)                        | 6 (6 to 8)                              | 0.275           |
| Vegetables<br>(B6)                                 | 6 (3 to 10)                     | 7 ( 5 to 9)                          | 0.675           | 6 ( 6 to 8)                        | 6 ( 6 to 8)                             | 0.604           |
| F & V<br>(combined<br>B6+B7))                      | 15 (13 to 18)                   | 14 (11 to 16)                        | 0.415           | 12 ( 11 to 15)                     | 13 (12 to 16)                           | 0.213           |
| Sugar 1 (B8)                                       | 8 ( 6 to 10)                    | 8 ( 6 to 10)                         | 0.930           | 5 (3 to 5)                         | 6 ( 4 to 9)                             | 0.066           |
| Sugar 2 (B11)                                      | 5 ( 3 to 8)                     | 5 (3 to 8)                           | 0.965           | 5 ( 4 to 7)                        | 4 ( 3 to 6)                             | 0.321           |
| Sugar 1 & 2<br>(combined<br>B8+B11)                | 13 (11 to 17)                   | 13 ( 10 to 16)                       | 0.930           | 9 (8 to 12)                        | 12 (8 to 13)                            | 0.290           |
| Fat (B10)  | 5 ( 3 to 7)                     | 5 ( 3 to 7)                          | 0.791           | 4 ( 4 to 6)                        | 4 ( 3 to 5)                             | 0.402           |
| Sugar & Fatty<br>foods<br>(combined<br>B8+B10+B11) | 20 (16 to 22)                   | 19 (17 -21)                          | 0.965           | 15 ( 11 to 18)                     | 14 (12 to 18)                           | 0.834           |

Note to table: IQR, interquartile range. B8 = sweets; B10 = fried foods; B11 = fizzy drinks.

Data in Table 4-13a show that there was a statistically significant difference ( $P=0.026$ ) between trial arms for fruit consumption before the intervention but no statistical difference for vegetables, fatty foods and sugar pre-intervention or for fruit, vegetables, fatty foods and sugar post intervention between the trial arms ( $P\geq 0.05$ ). The null hypothesis for eating habits is accepted.

## Lifestyle intervention

Data in Table 4-13b show results for adjusted odds ratio (OR) for difference in consumption of fruit, vegetables, fatty foods and sugar at baseline and follow-up for both trial arms.

**Table 4-13b: Difference in consumption of fruit, vegetables, fatty foods and sugar at baseline and follow-up for both trial arms (N=46)**

|  | Control)<br>N=21 | Intervention<br>N=25 | Test statistic<br>Kruskal-Wallis<br>OR and<br>P-value | Adjusted OR *       |
|--|------------------|----------------------|---|---------------------|
| Difference: fruit (F)<br>& vegetables (V)<br>(Pos. value =<br>increase in F & V)<br>Median (IQR) | -2 (-5 to 2)     | 0 (-2 to 1)          | 0.090   |                     |
| Increased F&V<br>intake  | n (%)<br>7 (33)  | n (%)<br>10 (40)     | 0.641   | 0.933 (0.234-3.721) |
| Difference sugar<br>(S) & fatty foods<br>(F) (Neg. value =<br>decrease in S & F)<br>Median (IQR) | -5 (-7 to -1)    | -4 (-8 to 0)         | 0.939   |                     |
| Decreased S & F<br>intake  | n (%)<br>16 (76) | n (%)<br>17 (68)     | 0.539   | 0.682 (0.163-2.860) |

Note to table: OR, odds ratio. \*OR adjusted for gender, age category, socio-economic status.

There was no significant difference between the trial arms ( $P \geq 0.05$ ) even after adjusting for confounding factors for increase of fruit and vegetables intake (0.933, 0.234-3.721) and decrease in sugar and fatty foods (0.682, 0.163-2.860) intake. The null hypothesis for eating habits is accepted.

### Objective 2: Physical activity levels between the intervention and control arm

Data in Table 4-14 show the difference between pre- and post-intervention physical activity levels between trial arms. (Section E, question E1 & E2).

## Lifestyle intervention

**Table 4-14: Difference in physical activity (walking 6 or more times a day per week) between trial arms (N= 46)**

|  | Control<br>N=21<br>Number (%) | Intervention<br>N=25<br>Number (%) | Exact test<br><i>P</i> -value |
|--|-------------------------------|------------------------------------|-------------------------------|
| Started exercising (i.e. Pre-intervention = NO and post-intervention = YES ) | 3 (14.3)                      | 3 (12.0)                           | 0.288                         |
| Difference in walking frequency (Post-preintervention):                      |                               |                                    |                               |
| <6x/wk to ≥6x/wk   | 8 (38.0)                      | 12 (48.0)                          | 0.267                         |
| No change  | 13 (61.9)                     | 11 (44.0)                          |                               |
| ≥6x/wk to <6 x/wk  | 0 (0)                         | 2 (8.0)                            |                               |

Data in Table 4-14 show that there was no significant difference in physical activity between the trial arms ( $P \geq 0.05$ ) after the intervention.

Data in Table 4-15 show the difference between pre- and post-intervention sedentary behaviours between trial arms.

**Table 4-15: Pre and post-intervention sedentary behaviours between trial arms (N= 46)**

|   | Control<br>N=21<br>Number (%) | Intervention<br>N=25<br>Number (%) | Exact test<br><i>P</i> - value |
|---|-------------------------------|------------------------------------|--------------------------------|
| Changed sedentary time (post-pre-intervention): |                               |                                    |                                |
| >2hrs to ≤2hrs                                  | 3 (14)                        | 5 (20)                             | 0.362                          |
| No change                                       | 12 (57)                       | 17 (68)                            |                                |
| ≤2hrs to >2hrs                                  | 6 (29)                        | 3 (12)                             |                                |

Data in Table 4-15 show that there was no significant difference between the trial arms ( $P \geq 0.05$ ).

**Objective 3: Nutritional knowledge between the intervention and control arms**

Data in Table 4-16 represent a difference in the effect of the LIMO program on nutrition knowledge between trial arms (Section F, questions 1-24).

**Table 4-16: Effect of the LIMO program on nutrition knowledge between trial arms (N=46)**

| Knowledge score  | Control<br>N=21  | Intervention<br>N=25 | P-value | Control<br>N=21   | Intervention<br>N=25                  | P-value |
|--|------------------|----------------------|---------|-------------------|---------------------------------------|---------|
|  | Pre-intervention |                      |         | Post-intervention |                                       |         |
| Mean (SD)  | 47.2 (16.2)      | 49.5 (12.5)          | 0.600*  | 50.0 (15.5)       | 57.8 (13.9)                           | 0.079   |
| Median (IQR)   | 50 (42-58)       | 50 (38-54)           | 0.904** | 50 (38-58)        | 58 (56-67)                            | 0.082   |
|  | Control          | Intervention         | P-value |                   | Regression<br>coefficient<br>Adjusted | P-value |
| Difference pre-post  |                  |                      |         |                   |                                       |         |
| Mean (SD)  | 2.8 (12.2)       | 8.3 (15.2)           | 0.190*  |                   | -.184                                 | 0.198   |
| Median (IQR)   | 1.2 (0 to 12)    | 12 (-4 to 20)        | 0.234** |                   |                                       |         |
| Multivariable<br>regression:<br>Group Beta<br>coefficient*** |                  |                      |         |                   | 4.579<br>(-4.484 to<br>13.642)        | 0.313   |

Note on table:

\* T-test

\*\* Kruskal-Wallis test

\*\*\*Difference in Knowledge Score by Group, adjusted for gender, age, socioeconomic status.

There was no significant difference in knowledge scores between the trial arms ( $P \geq 0.05$ ).

#### 4.7.2 Discussion

The aim of Study Two was to design, validate, implement and test the effectiveness of an 8-week lifestyle intervention program guided by the Information, Motivation and Behavioural skills (IMBs) model through a pragmatic randomised controlled trial of intervention versus no intervention. The results are summarised as follows for each objective.

##### 4.7.2.1 New knowledge generated

The main findings of Study Two are summarized.

**Objective 1** – To establish whether the lifestyle intervention program resulted in a significant difference in improving eating habits between the intervention and control trial arms.

Analysis of the data showed no significant change in eating habits (consumption of fruit, vegetables, sugar and fatty foods) between trial arms (Tables 4-13a & b). There was a decrease in consumption of sweets (B8) amongst participants in both trial arms but the difference only approached statistical significance ( $P=0.066$ ). The post-intervention value increase for fruit and vegetables in the intervention arm showed an increase ( $P=0.090$ ) (Table 4-13b) although not statistically significant.

**Objective 2** – To establish whether the lifestyle intervention program resulted in a significant difference in physical activity behaviours between the intervention and control arm.

Analysis of the data showed that post-intervention there was no significant difference in physical activity (number of walks a day per week and doing exercise) between the control and intervention arms (Table 4-14). The data also showed that there was no statistically significant difference in sedentary behaviours between trial arms (Table 4-15).

**Objective 3**- To establish whether the lifestyle intervention program resulted in a significant difference in nutritional knowledge between the intervention and control arm.

Analysis of the data showed that although there was an improvement in nutrition knowledge within each trial arm, the difference was not statistically significant ( $P=0.079$ ) between the control and intervention arms (Table 4-16).

#### *4.7.2 Generalizability of results*

The study power, set at 80%, required a sample size of  $n=48$  (58 to allow for attrition) to detect differences between the intervention and control arms. The sample size was not achieved therefore results of the study are limited to the sample size of the study ( $n= 46$ ). The study results are disappointing although there was a slight improvement in nutrition knowledge.

### 4.7.3 Study results compared to existing literature and in wider context

Pragmatic randomised controlled trials have not been reported adequately<sup>268</sup> therefore CONSORT guidelines were developed to improve trial reporting. To improve reporting of Study Two, an extension of the CONSORT statement was used.<sup>268</sup>

Published studies that are similar to the current study as presented in Table 4.1 previously are discussed in Table 4-17. A comparison of Study Two findings to selected findings of school-based lifestyle intervention programs implementation studies described in Chapter Two (Table 2-2) including reasons for differences/similarities and for including each is also presented in Table 4-17.

**Table 4-17: A comparison of Study Two results to selected findings of relevant existing school-based studies**

| Author and study Design | Findings relevant to Study Two   | Application to Study Two and reasons for differences/similarities and for including each  |
|-------------------------|--|---|
| Pate, et al. 2005       | PA was greater in the intervention arm than control arm ( $p=.05$ ) after 12 months of intervention                | <b>Design and setting similarity:</b> school based study, RCT, outcome was PA, and subjective PA measurement, the study was done in one state, and the result of this study is relevant to the current study though results are different.<br><b>Difference :</b> 12 months trial done in girls only, 3-day recall questionnaire was used |
| Amaro, et al            | Increase in weekly intake of vegetables $p= .01$ and PA ( $p= .05$ ) NK was significant between arms ( $p= 0.05$ ) | <b>Design and setting similarity:</b> RCT, school based study, outcomes were; NK, vegetable consumption and PA, subjective measurements were used.<br><b>Difference:</b> CRCT, duration of 24 weeks, intervention lasted 15-30 minutes weekly, not validated questionnaires, and no theory stated   |
| Kocken, et al. 2013     | At post-test, the intervention arm knew significantly more about healthy food than the control arm                 | <b>Design and setting similarity:</b> school based, RCT, outcome was consumption of soft drinks<br><b>Difference:</b> CRCT, intervention had environmental component, Theory of Planned Behaviour was used, duration of intervention was 6 weeks.   |
| Kaur, et al. 2007       | NK and nutrients intake increased after intervention ( $p= .001$ ) after intervention.                             | <b>Design and setting similarity:</b> school based, RCT, subjective measurement of dietary behaviour<br><b>Difference:</b> duration of intervention 12 weeks, no theory stated.   |

## Lifestyle intervention

| Author and study Design | Findings relevant to Study Two   | Application to Study Two and reasons for differences/similarities and for including each   |
|-------------------------|--|--|
| He, et al. 2009         | Increase in fruits and vegetable intake ( $p= .005$ ) and NK ( $p=.005$ ) IN intervention arm than control arm | <b>Design and setting similarity:</b> school based, outcomes were fruit and vegetable intake, NK, <b>Difference:</b> CRCT duration of intervention was 21 weeks, evaluated SE and intentions,  |
| Singhal, et al. 2010    | NK increased significantly post intervention and increase in fruit intake ( $p= .001$ )                        | <b>Design and setting similarity:</b> school based, RCT, valid questionnaire, outcomes were fruits consumption and NK, <b>Difference:</b> duration of intervention was 8 months, evaluated biochemical, attitudes, anthropometrics and body image satisfaction. no theory stated                                 |
| Siega-Riz, et al. 2006  | Increase in NK post intervention ( $p= .016$ )   | <b>Design setting similarity:</b> school based, RCT, outcomes were, dietary intake, validated questionnaires<br><b>Differences:</b> CRCT, five semester intervention, no theory stated   |
| Lakshman, et al. 2010   | Increase in nutrition knowledge ( $p= .0042$ ) and eating of balanced diet ( $p= .018$ )                       | <b>Design setting similarity:</b> RCT, outcome is NK, questionnaire was reliable and valid, <b>Differences:</b> CRCT, duration of intervention 9 weeks, no use theory stated   |
| Taymoori, et al. 2008   | Increase in PA per week ( $p=.01$ )  | <b>Design and setting similarity:</b> RCT, school based study, outcome was PA, questionnaires validated, subjective measurements used<br><b>Difference:</b> used Pender's Health Promotion model (HP) and health promotion model, duration of intervention was 6 months. two concurrent interventions, follow-up |

#### *4.7.3.1 Discussion of the effect of the intervention on eating habits (increased consumption of fruit and vegetables and less sugar and fatty foods)*

The three-part questionnaire used in Study One was used post-intervention. The study is the first intervention study undertaken in Botswana among 13-15 year-old junior secondary school pupils. After the 8-week LIMO program, there was a decrease in the consumption of sweets (B8) amongst participants in both trial arms but the difference only approached statistical significance ( $P=0.066$ ). Disappointingly, post-intervention, fewer participants in both trial arms ate fruit and there was hardly any change in the consumption of vegetables. There was only a slight decrease in consumption of fried foods (B10), which is worrisome. Reasons for the apparent lack of significant improvement in adopting healthier eating habits

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could be attributed to the short duration of the LIMO program during which education and skills imparted may not have translated into behaviour change. Environmental influences might be another reason because in each school there was a tuckshop within the school premises, and a street vendor at the entrance to the schools selling fat cakes, sweets and fizzy drinks. Study results are similar to another study where the intake of fruit increased although it was not statistically significant<sup>188</sup> but the findings are inconsistent with other published studies where a significant increase was reported<sup>99</sup> and where there was no change in consumption of sweets and sweetened beverages.<sup>271</sup>

#### *4.7.3.2 Discussion of the effect of the intervention on physical activity behaviours*

The intervention showed no effect between trial arms on PA frequency of walks taken a day per week or on doing exercise. The results of this study show that the physical activity education and skills imparted during the intervention program did not make any impact on behaviour. Study findings are inconsistent with other studies reporting that PA increased in the intervention arm.<sup>188</sup> The reason for this could be attributed to the short duration of the LIMO intervention, and also to an observation made during the implementation of the intervention that participants could not meet their personal set goal of doing physical activity and exercising because they did not have adequate time to do so. However the reason for the non-effect remains unknown.

#### *4.7.3.3 Discussion of the effect of the intervention on nutrition knowledge*

Knowledge of nutrition is a pre-requisite for changing eating habits. The intervention showed no statistically significant difference in nutrition knowledge between trial arms ( $P=0.079$ ). The lack of improvement in nutrition knowledge could be the reason there was no statistically significant difference in the consumption of healthy foods and in PA behaviours. However, there could be other reasons for the non-effect of the intervention on behaviour and further studies are needed. The study is inconsistent with other studies in which a significant difference was noted between trial arms ( $P=0.0042$ ,  $P=0.0016$ ,  $P=0.005$ ,  $P=0.01$  and  $P=0.05$ )<sup>70 72 97 99 271</sup> respectively, however these studies were of longer duration. The reason for

the discrepancy is not yet known, however it could be attributed to the fact that there was no significant difference between the intervention and control arm pre-intervention knowledge scores.

### **4.7.3 Critique of the study**

#### *4.7.3.1 Strengths of Study Two methods*

The current study has several strengths. It appears to be the first pragmatic randomised controlled trial to evaluate the effectiveness of a lifestyle intervention program in adolescents aged 13-15 years in Botswana. The study included students who were recruited on a voluntary basis and who were randomly selected from different classes in each school to enhance generalisation of the results to the population studied. The questionnaire was useful in identifying the nutritional problems and primary needs of children aged 4 to 16 years.<sup>84</sup> Therefore it was used in the current study because the age group falls within the age bracket of 4-16 years. It is brief, inexpensive and easy to administer in that it does not require trained staff to administer.<sup>84</sup> In using self-report measures especially in nutritional intervention studies, there is difficulty verifying the truthfulness of participants' responses.<sup>217</sup> This was minimised to some extent by having well trained research assistants to collect data and teachers to supervise the pupils when completing the questionnaires. The PI was also available to answer questions. It is believed that there was minimal contamination since the schools were far apart from each other. The LIMO program demonstrated a promising impact in promoting a healthy lifestyle among adolescents.

The researcher followed the CONSORT guidelines for a pragmatic randomised controlled trial in Study Two (Table 4-19) in reporting and interpreting the study results for the purpose of transparency. The study was conducted in a school setting, in the usual environment for participants (school students) and interventionists (teachers). The interventionists had input in the evaluation of the content of the LIMO program and it gave them an opportunity to own the program to promote quality assurance.

#### *4.7.3.2 Limitations of Study Two*

The current study has limitations. Despite a response rate of 79.3% (46/58), having factored in ten participants to allow for attrition, nine participants of the 46 were lost to follow-up resulting in an attrition rate of 13.8% (4/29) in the intervention arm and 19.2% (5/26) in the control arm. However 79.3% of respondents were included in the analysis at the end of the study. Intention-to-treat refers to data analysis for all participants randomised to the trial arm to which they were assigned irrespective of non-compliance with the requirements of the study.<sup>270</sup> Data from the participants who dropped out of Study Two could not be obtained and *per protocol* analysis was undertaken, a weaker and potentially biased analysis method. The study would have been strengthened if both unadjusted and adjusted effects had been presented.

The results can be only generalised to the population studied in one city in Gaborone.

The study used subjective self-reporting measures and because the LIMO program was a multicomponent program, it was difficult to ascertain which component made more of an impact on behaviour. The duration of the LIMO program was short (8 weeks) and there was no follow-up. The IMBs Model has recently been used in dietary/nutrition adherence studies in diabetes, promotion of health in the elderly, adherence to antiretroviral therapy, in predicting lifestyle behaviours in adolescents and in lifestyle intervention studies to try to understand nutritional intake and behaviours. There is evidence that studies guided by this model effect behaviour change among adolescents but in this study inadequate reference was made to the IBM Model which guided the study.

The objectives of this study were partly achieved. Although the results were not statistically significant between trial arms this does not render the trial ineffective. Further postdoctoral work is indicated.

## **Practical issues**

The environment where the intervention was conducted imposed a few constraints. A substantial number of participants came late for the program lessons because they had to attend other school activities. The LIMO program was not implemented as it was planned because of resource constraints.

### *4.7.3.3 Strengths of the Study One*

The study was the first of its kind in Botswana. The response rate was 95.5%. The nutrition questionnaire was valid and reliable adapted to the context of Botswana. The questionnaire was administered in the classroom in the presence of teachers and the PI, and trained research assistants collected data. The results are representative of a sample of adolescents in junior schools in Gaborone city.

### *4.7.3.4 Limitations of the Study One*

The study cannot be generalised to all adolescents in schools in Gaborone city. The reliability of rest of subscales of the questionnaire have at least Cronbach alpha  $>0.6$ . The acceptable level should be 0.7 for group use.

### *4.7.3.5 Bias for Study Two*

Bias was minimised by following the Cochrane classification and risk of bias assessment tool (Table 4-18). Selection of participants in Study One was done by an independent statistician and the same participants from randomly selected schools were recruited to participate in Study Two by the statistician. Participants in the selected schools were randomly selected and were requested to volunteer to participate in Study Two.

Evidence from the study is presented in Table 4-18 using the Cochrane classification and 'Risk of bias' assessment tool.<sup>269</sup>

**Table 4-18: Application of the Cochrane (2009) common classification scheme for bias**

| Type of bias     | Description  | Relevant domains in the Collaboration's 'Risk of bias' tool – evidence from the study  |
|------------------|--|--|
| Selection bias   | Systematic differences between baseline characteristics of the arms that are compared. | Randomization was at the level of individual selection. The total population of volunteering participants (N=46). Statistician randomly selected 4 schools which participated in Study One into intervention and control arm and participants who participated in Study One were randomly selected and approached to solicit their participation in Study Two. Researcher was not blinded to outcome and implemented the interventions to the respective participants. Allocation concealment – the participants and research assistants were blinded to the allocation. |
| Performance bias | Systematic differences between arms in the interventions implemented.                  | The researcher was not blinded to allocation. The same pre- and post-intervention tests were used for the intervention and control arms.   |
| Attrition bias   | Systematic differences between arms in withdrawals from a study.                       | Incomplete outcome data – low risk of bias as participants who did not attend the planned lifestyle activities for 8 weeks were excluded. Four participants from the intervention arm did not attend all the planned lifestyle activities for 8 weeks and were excluded, while 5 were not present on the day of data collection in the control arm and were excluded (Figure 4-1).   |
| Detection bias   | Systematic differences between arms in how outcomes are determined.                    | Other potential threats to validity were minimised by having an index of content validity (CVI) of the LIMO manual and teaching material by the physical activity teacher, home economics teacher, nutritionist and physiotherapist.   |
| Reporting bias   | Systematic differences between reported and unreported findings.                       | low risk of bias by using CONSORT guidelines extended to pragmatic randomised trials.  |

#### 4.7.3.5 Evaluation of Study

Study Two was evaluated using CONSORT guidelines extended to pragmatic randomised trials as outlined in Table 4.19.<sup>269</sup>

**Table 4-19: CONSORT Statement extended to pragmatic randomised controlled trials**

| Items  | Activities  | Item number | Pages       |
|--|---|-------------|-------------|
| <b>Title and abstract</b>                        | 1a Identification as a randomised trial in the title  | 1           | i and ii    |
|  | 1b Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)              | 1           | Ii          |
| <b>Introduction</b><br>Background and objectives | 2a Scientific background and explanation of rationale   | 2           | 4.1         |
|  | 2b Specific objectives or hypotheses  |             | 4.4.1       |
| <b>Methods</b><br><b>Trial design</b>            | 3a Description of trial design (such as parallel, factorial) including allocation ratio   | 3           | 4.5.1       |
| <b>Participants</b>                              | 4a Eligibility criteria for participants  | 4           | 4.5.3.1     |
|  | 4b Settings and locations where the data were collected   |             | 4.5.5       |
| <b>Interventions</b>                             | 5 The interventions for each group with sufficient details to allow replication, including how and when they were actually administered | 5           | 4.5.7-4.5.9 |
| <b>Outcomes</b>                                  | 6a Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed                   | 6           | 4.4.2       |
|  | 6b Any changes to trial outcomes after the trial commenced, with reasons  |             |             |
| <b>Sample size</b>                               | 7a How sample size was determined   | 7           | 4.5.4       |
|  | 7b When applicable, explanation of any interim analyses and stopping guidelines   |             |             |
|  | 3b Important changes to methods after trial commencement (such as eligibility criteria), with reasons<br>Participants                   |             |             |
|  | 6b Any changes to trial outcomes after the trial commenced, with reasons  |             |             |
| <b>Randomisation:</b>                            |   | 8           | 4.5.6       |
| <b>Sequence generation</b>                       | 8a Method used to generate the random allocation sequence   |             | 4.5.6.2     |

## Lifestyle intervention

| Items  | Activities   | Item number | Pages        |
|--|--|-------------|--------------|
|  | 8b Type of randomisation; details of any restriction (such as blocking and block size)   |             |              |
| <b>Allocation concealment mechanism</b>                                | 9 Mechanism used to implement the random allocation sequence (such as sequentially numbered containers),<br>describing any steps taken to conceal the sequence until interventions were assigned | 9           | 4.5.6.3      |
| <b>Implementation</b>  | 10 Who generated the random allocation sequence, who enrolled participants, and who assigned participants to<br>Interventions  |             | 4.5.9.1      |
| <b>Blinding</b>  | 11a If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how   |             | 4.5.6.5      |
| <b>Statistical methods</b>   | 11b If relevant, description of the similarity of interventions  | 10          |              |
|  | 12a Statistical methods used to compare groups for primary and secondary outcomes  |             | 4.5.10       |
|  | 12b Methods for additional analyses, such as subgroup analyses and adjusted analyses   |             |              |
| <b>Results</b><br>Participant flow (a diagram is strongly recommended) | 13a For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome   | 11          | 4.6.1.1      |
|  | 13b For each group, losses and exclusions after randomisation, together with reasons<br>Recruitment 14a Dates defining the periods of recruitment and follow-up                                  |             | 4.6.1.1      |
|  | 14b Why the trial ended or was stopped   |             |              |
| <b>Baseline data</b>   | 15 A table showing baseline demographic and clinical characteristics for each group  | 12          | 4.7          |
| Numbers analysed   | 16 For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups   |             | 4.7 to 4-7.1 |
| <b>Outcomes and estimation</b>   | 17a For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)  |             | 4.7.1        |

## Lifestyle intervention

| Items   | Activities   | Item number | Pages                          |
|---|--|-------------|--------------------------------|
|   | 17b For binary outcomes, presentation of both absolute and relative effect sizes is recommended  |             |                                |
| <b>Ancillary analyses</b>                       | 18 Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory |             |                                |
| <b>Harms</b>                                    | 19 All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)                                     |             |                                |
| <b>Discussion</b>                               |  | 12          | 4.7.2                          |
| <b>Limitation</b>                               | 20 Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses                          | 13          | 4.7.3.2                        |
| Generability                                    | 21 external validity, applicability) of the trial findings   | 14          | 4.7.2                          |
| Interpretation                                  | 22 Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence                             |             | 4.7.3.1                        |
| <b>Other information</b><br><b>Registration</b> | 23 Registration number and name of trial registry<br>Protocol  |             | 4.5.2                          |
| <b>Registration</b>                             | 24 Where the full trial protocol can be accessed, if available   |             |                                |
| <b>Funding</b>                                  | Sources of funding and other support (such as supply of drugs), role of funders  |             | Xi<br>(acknowledgment section) |

[From Zwarenstein M, Treweek S, Gagnier JJ, Altman DG, Tunis S, Haynes B, Oxman AD, Moher D. British Medical Journal 2008;337: a2390:3.]

#### 4.7.4 Conclusions, implications and recommendations

The research question for Study Two was not adequately answered and did not adequately generate new knowledge as described below.

What is the effect of a lifestyle intervention program on eating habits, physical activity behaviours, and nutritional knowledge to adopt a healthy lifestyle of adolescents in urban junior public secondary schools in Botswana?

The intervention did not result in a statistically significant difference in the eating habits (fruit, vegetables, sweets and fatty food consumption), PA behaviours (walks and doing exercise) and nutrition knowledge in the intervention arm compared to the control arm. The majority of participants were from a low to middle socioeconomic class and this may have influenced eating habits, or the unavailability of fruit at home or possibly food preferences. The intervention program, although of short duration, has shown promising effects on changing behaviour particularly sugar consumption and nutrition knowledge although it was not statistically significant. There is published evidence that school-based lifestyle intervention programs affect behaviour change though the results are inconsistent.<sup>259</sup> Results from the 10 studies in the systematic review done in developed countries were inconsistent with findings from this study.

### **Recommendations for education**

1. Curricula for student nurses in nurse training institutions ought to include courses to promote a healthy lifestyle among students and to teach them to promote the health of the community to prevent overweight and eventual NCDs.
2. School tuck-shops and vendors should sell healthy foodstuffs and parents should be involved in this regard.
3. School grounds should be improved and made conducive to a healthy lifestyle by encouraging a variety of physical activities.

### **Recommendation for educational policy makers**

1. Educational policy makers may use the results of this study, particularly baseline data of the respondents to influence change in scholars' eating habits and physical activity levels.
2. In more general terms, policy makers could influence commercial industry policies by promoting the manufacturing and selling of healthy foods, particularly to schools.
3. School nurses should investigate the reasons some 13-15 year old scholars had a BMI below the 5<sup>th</sup> percentile.

### **Recommendations for research**

1. Researchers should find ways to include parents, teachers, communities and government officials in healthy lifestyle intervention programs.
2. Further research is needed to incorporate sustainable interventions and contextualize and fine-tune the intervention to encourage a healthy lifestyle among adolescents in schools in Gaborone city.

The concluding chapter that follows presents the new knowledge contributed by the thesis and the implications, practical applications and recommendations for practice related to eating habits and physical activity behaviours, nutrition knowledge level, intentions and self-efficacy to change behaviours and prevalence of overweight in the field of nursing.

## 5. New knowledge generated by the thesis

The current study seems to be the only Botswana study to describe the eating habits, PA behaviours, nutrition knowledge level for healthy eating, intentions and self-efficacy to change eating and PA behaviours, and evaluation of a lifestyle intervention program among adolescents aged 13-15 years. The new knowledge is brought about by the two-part study presented in Table 5-1:

**Table 5-1: New knowledge generated**

|   |
|---|
| <p><b>Study One - Research question:</b></p> <p>What are the eating habits, physical activity behaviours and level of nutrition knowledge, level of intentions for healthy eating and physical activity, and of self-efficacy for healthy eating and physical activity that influence eating habits and physical activity behaviour of urban adolescents in public junior secondary schools in Botswana and what is the prevalence of overweight and obesity?</p>   |
| <p><b>Eating habits:</b> The respondents had unhealthy eating habits. They consumed salty, fatty and sugary foods and snacks were eaten very often and they drank inadequate quantities of water daily. The participants ate three regular meals with dinner being eaten with the whole family. Sometimes parents and media influence their food choices but not their peers. The taste of food was the main reason for liking certain foods over others.</p> <p><b>PA behaviours :</b> Many respondents had inadequate physical activity levels. They had less frequent walks weekly and did not engage in exercise, and they watched television or played video games for more than 2 hours.</p> <p><b>Nutrition knowledge level:</b> Many respondents had inadequate nutrition knowledge (scored below 50%). The poorly answered questions included food nutrients, balanced diet, and energy expenditure activities.</p> <p><b>Intention to change eating habits and PA behaviours:</b> The respondents had good intentions to change eating habits and physical activity though it did not correspond to their eating and physical activity behaviours as such.</p> <p><b>Self-efficacy to change eating habits and PA behaviours:</b> The respondents had good self-efficacy to change eating habits and physical activity though it did not correspond to their eating and physical activity behaviours.</p> |
| <p><b>Study Two – Research questions:</b></p> <p>What is the effect of a lifestyle intervention program on eating habits, physical activity and sedentary behaviours, and nutritional knowledge to adopt a healthy lifestyle of adolescents in urban junior public secondary schools in Botswana?</p> <ul style="list-style-type: none"> <li>• The analysis of data showed that there was not a statistically significant difference in eating habits (food frequency consumption (B6-B11) between trial arms (Table 13a &amp; b). The median for the control arm was 6 (5 to 7) and for the intervention arm was 6 (6 to 8) post-intervention. However the difference in consumption of sweets approached statistical significance (<math>P= 0.066</math>).</li> <li>• The difference in sedentary behaviour between trial arms was not statistically significant.</li> <li>• The difference in nutrition knowledge was not statistically significant although there was an improvement in both trial arms (mean SD for the control arm was 50.0 (15.5)) and for the intervention arm was 57.8 (13.9).</li> </ul>  |

The main findings, implications and practical applications are presented as follows.

## **5.1 Implications and practical applications**

### **5.1.1 Implications and practical applications for practice**

The results of the current study showed that adolescents aged 13-15 years had unhealthy eating habits: they consumed salty, fatty and sugary foods, snacks were eaten very often, they had an inadequate daily water consumption and were physically inactive. Many published studies did not report on the validity of the measurements they used to evaluate eating habits, PA behaviours, nutrition knowledge level, intentions and self-efficacy to change eating and PA behaviours which have an impact on the quality of study findings.

The prevalence of overweight was 16.7% by BMI and 12.4% by WC. There is a paucity of studies that reported WC of adolescents though it is a good indicator for risk of metabolic syndrome. Measurement of BMI and WC is of paramount importance for early detection of overweight and metabolic syndrome among adolescents. Failure to measure BMI and WC especially at primary level may impede public health efforts to curb overweight and reduce the incidence of NCDs. Issues of SES are important when assessing anthropometric measurements particularly as 22/252 (8.7%) of the scholars were underweight having a BMI of below the 5<sup>th</sup> percentile.

### **5.1.2 Implications and practical applications for education**

Adolescent health is in danger due to nutrition and PA related health problems. The results show that although adolescents may have good intentions to change their behaviour, there could be other reasons that prevented them from doing so. Therefore these reasons need to be identified and addressed appropriately. The results raise a concern because adolescents maybe at risk of overweight which later predisposes them to non-communicable diseases.

Prior to implementation of the LIMO program adolescents had poor eating habits and inadequate nutrition knowledge (< 50%, (mean 49.48, SD 12.51)) but after the LIMO program

there was no statistically significant difference in their behaviour although there was a difference in sugar consumption and nutrition knowledge although not statistically significant. Therefore it is quite clear that there is need for nutrition and PA education and motivational strategies to encourage early adoption of a healthy lifestyle at junior secondary schools. The results of this study also may inform nurse education curricula to promote issues of health assessment emphasizing dietary habits and PA behaviours during training. School health nurses also need to emphasize nutrition assessment in their school health program.

### **5.1.3 Implications and practical applications for research**

The nutrition questionnaire was validated to suit the Botswana context and was found to be valid and reliable to collect data from participants but needs further evaluation for its usefulness. A comparison of Study Two findings to selected findings of school-based relevant existing studies described in Chapter Two (Table 2-2) showed positive effect of intervention programs on behaviour change though there are still conflicting results possibly due to differing methodologies. A LIMO intervention program has promising effects on behaviour change but it needs to be explored further.

## **5.2 Recommendations**

Recommendations are presented in relation to the study findings.

### **5.2.1 Recommendations for education**

The study showed a promising outcome to improve adolescents' nutrition and healthy lifestyle related knowledge and a reduction in sugar consumption although not statistically significant. It is recommended that:

1. a LIMO program may be implemented in other schools in other parts of the country and even for older adolescents for a longer duration;
2. the duration of the LIMO program should be extended for up to one year in secondary schools;

3. an inclusion of the environmental component in future interventions is of paramount importance to address environmental influence on behaviour;
4. parents should be involved to a greater extent in a LIMO program to support the efforts of their children to adopt a healthy lifestyle;
5. a LIMO program and the components of the nutrition questionnaire should be used to guide the development of comprehensive health assessment tools that emphasize nutrition and PA behaviours in nursing training institutions; and
6. nutrition and PA education should be taught at primary school level.

### **5.2.2 Recommendations for practice**

1. A LIMO program should be implemented in all secondary schools in urban and rural areas.
2. There should be follow-ups after implementation of a LIMO program to ascertain the effectiveness of the program in maintaining healthy lifestyle.
3. All adolescents should be checked for weight and height, and BMI be calculated, and WC should be checked to detect risk of overweight and metabolic syndrome in all youth friendly health facilities and also for being underweight.
4. Teachers who volunteered to be interventionists should participate in further studies to train other future interventionists when a LIMO program is rolled out to other schools.

### **5.2.3 Recommendations for research**

Further research is needed to:

1. collect data using the 3-part questionnaire in different populations to ascertain its stability,
2. use objective measures in determining PA behaviours;
3. ascertain why participants' intentions and self-efficacy did not correspond to their eating habits and PA behaviours;

4. implement a LIMO program for a longer duration and do follow-up;
5. evaluate the effectiveness of LIMO program in maintaining a healthy lifestyle;
6. identify predisposing factors to sedentary behaviours and plan appropriate intervention programs for adolescents;
7. determine the effectiveness of lifestyle intervention programs because in systematic reviews and cross sectional studies results are mixed; and
8. to make more overt use of the IMBs Model in predicting lifestyle behaviours in adolescents and in lifestyle intervention studies to try to understand nutritional intake and behaviours.

### **5.3 Conclusion**

No study appears to have been done in Botswana on adolescents' eating habits and PA behaviour and their determinants, nor one that evaluated the effectiveness of a lifestyle intervention program to address these behaviours and their determinants. The study generated new knowledge in this area: descriptive data on eating habits and PA behaviours, nutrition knowledge and intentions and self-efficacy to change eating and PA behaviours, and prevalence of overweight among 13-15 years old in junior secondary schools in Gaborone. The LIMO program shows promise to reduce sugar consumption and improve nutrition knowledge although results were not statistically significant. Future randomised controlled trials are needed to further identify the best intervention to prevent overweight and promote healthful living amongst adolescents in Botswana.

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**Appendix 1: Original nutrition questionnaire, self-efficacy for healthy eating and for exercise and intention for healthy eating and physical activity**

Nutrition Questionnaire

**SECTION A (Generality)**

|  |                             |
|--|-----------------------------|
| 1) School name: .....  | 7) Father's education:..... |
| 2) Class:.....   | 8) Mother's education:..... |
| 3) Age:.....   | 9) Father's job:.....       |
| 4) Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female | 10) Mother's job:.....      |
| 5) Weight:.....  | 11) Nationality: .....      |
| 6) Height:.....  |                             |

**SECTION B. Food frequency consumption**

|  | Seldom/<br>Never         | 1 per<br>month           | 2-3<br>per<br>month      | 1 per<br>week            | 2-3<br>per<br>week       | 4-6<br>per<br>week       | 1 per<br>day             | 2-3<br>per<br>day        | 4-5<br>per<br>day        | 6 or<br>more<br>per<br>day |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| B1. How often do you usually consume pasta/rice? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B2. How often do you usually consume meat?       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B3. How often do you usually consume fish?       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B4. How often do you usually consume cheese?     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B5. How often do you usually consume eggs?       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B6. How often do you usually consume vegetables? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B7. How often do you usually consume fruit?      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B8. How often do you usually consume sweets?     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |

Lifestyle intervention

|   | Seldom/<br>Never         | 1 per<br>month           | 2-3<br>per<br>month      | 1 per<br>week            | 2-3<br>per<br>week       | 4-6<br>per<br>week       | 1 per<br>day             | 2-3<br>per<br>day        | 4-5<br>per<br>day        | 6 or<br>more<br>per<br>day |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| B9. How often do you usually consume snacks?        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B10. How often do you usually consume fried foods?  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B11. How often do you usually drink sugary drinks?  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B12. How many liters of water do you usually drink? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |

**SECTION C: Meal Habits**

**C1. What do you usually eat at breakfast (1 answer)?**

- milk / yogurt / cereals
- chocolate / milk / biscuits
- coffee / cappuccino / tea
- pizza / focaccia / toast
- fruit juice
- sweets
- marmalade / rusks / butter
- snacks

**C2. Which fast-food do you usually consume (1 answer)?**

- pizza
- hamburger/hot dog
- sandwiches
- kebab

**C3. Which snacks do you usually consume (1 answer)?**

- bakery/biscuit
- sandwiches/pizza
- home-made cake
- fruit
- yogurt
- potato chips/pop corn

**C4. Where do you usually eat breakfast?**

- at home
- at cafe
- during the journey to school

**C5. With whom do you eat breakfast?**

- alone or with brother/sister
- mom/dad
- the whole family
- friends
- grandparents

**C6. With whom do you eat at lunch?**

- alone or with brother/sister
- mom/dad
- the whole family
- friends
- grandparents

**C7. With whom do you eat at dinner?**

- alone or with brother/sister
- mom/dad
- the whole family
- friends
- grandparents

Lifestyle intervention

**SECTION D. Breakfast and snack habits**

**D1. Do you eat breakfast?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

[ if NEVER ] → why?

- not enough time
- I don't like
- anyone cook
- other

**D2. How long do you spend on breakfast?**

- less than 5 minutes
- 5-10 minutes
- 10-15 minutes
- 15-20 minutes
- more than 20 minutes

**D3. How many times do you eat at a pizzeria/ pub/ fast-food/restaurant during 1 week?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

**D4. How many times a day do you eat in-between meals?**

- never
- 1 per day
- 2 per day
- 3 per day
- 3 or more per day

**SECTION E. Influences on Food Choices**

**E1. Do you have a television in your room?**

- yes
- no

**E2. Do you independently choose which programs you watch on TV?**

- always
- sometimes
- never

**E3. Do you watch TV during meals?**

- always
- sometimes
- never

**E4. What do you eat when you watch TV (or at cinema)? [inappropriate responses]**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

**E6. According to you, how often are commercial adverts honest?**

- always
- often
- sometimes
- rarely
- never

**E7. Who or what influences your food choice?**

- family
- friends
- school
- commercial advertisings
- no, anyone

**E8. How often do your parents restrict your food choice?**

- always
- often
- sometimes
- rarely
- never

**E9. How often do you like to eat food advertised on TV?**

- always
- often
- sometimes
- rarely
- never

Lifestyle intervention

**E5. According to you, commercial advertisings:**

- are very funny
- are nice
- indifferent
- are boring but you watch them
- change channel and you don't watch them

**SECTION F. Lifestyle and Physical Activity**

**F1. Do your parents smoke?**

- neither
- one
- both

**F2. Do you smoke?**

- no
- less than 10 cigarettes a day
- 11-20 cigarettes a day
- more than 20 cigarettes a day

**F3. How many of your classmates smoke?**

- anyone
- few
- many

**F4. How many times do you practice a physical activity during 1 week?**

- 6 or more per week r
- 4-5 per week
- 2-3 per week
- 1 per week
- never

**F5. What do you prefer to do during free time?**

- practice a sport
- watch TV/listen to music/read a book/use computer/play video-games

**F6. How many hours do you spend watching TV or on a computer?**

- less than 1 a day
- 1-2 a day
- 3 a day
- more than 3 a day

**SECTION G. Nutrition knowledge**

**FOOD NUTRIENTS**

**G1. What are macronutrients?**

- carbohydrates and proteins
- carbohydrates, proteins and fats
- carbohydrates and fats
- carbohydrates, proteins, fats and vitamins
- not sure

**G3. In a balanced diet you should avoid:**

- carbohydrates
- fats
- any of them
- proteins
- not sure

**G2. How do you define vitamins?**

- essential substances present in small amounts in food
- energy-rich substances
- essential substances synthesized in our body
- useless substances
- not sure

**G4. Which of these is more essential for your body?**

- vitamins and minerals
- proteins and carbohydrates
- fats
- all of them
- not sure

Lifestyle intervention

**FOOD CONTENTS**

**G5. Which part of egg contains fat?**

- both of them
- albumen (whites)
- yolk
- any of them
- not sure

**G6. What does “dietary fibre” mean?**

- the fibrous part of the meat
- the skin of fruits
- indigestible part of vegetables
- a dietary supplement
- not sure

**G7. Which fruit contains the most vitamin C?**

- apple
- melon
- orange
- grapes
- not sure

**HEALTHY FOODS AND DRINKS**

**G11. According to you, milk is a food for:**

- children
- people of all ages
- elderly people
- sick people
- not sure

**G8. Meat is rich in:**

- carbohydrates
- proteins
- fats
- vitamins
- not sure

**G9. Pasta and bread are rich in:**

- carbohydrates
- fats
- proteins
- vitamins
- not sure

**G10. Fruit and vegetable are rich in:**

- vitamins
- fats
- proteins
- carbohydrates
- not sure

**G12. Which do you think is better a drink to quench your thirst?**

- water
- fruit juice
- sugary drink
- energy drink
- not sure

According to you, which is the healthiest food?

|            |  |   |   |                                   |
|------------|--|---|---|-----------------------------------|
| <b>G13</b> | <input type="checkbox"/> toast with tomato | <input type="checkbox"/> snack          | <input type="checkbox"/> toast with ham | <input type="checkbox"/> not sure |
| <b>G14</b> | <input type="checkbox"/> fish              | <input type="checkbox"/> hamburger      | <input type="checkbox"/> fried fish     | <input type="checkbox"/> not sure |
| <b>G15</b> | <input type="checkbox"/> yogurt            | <input type="checkbox"/> yogurt cake    | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G16</b> | <input type="checkbox"/> a glass of milk   | <input type="checkbox"/> milk cake      | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G17</b> | <input type="checkbox"/> fried potatoes    | <input type="checkbox"/> baked potatoes | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G18</b> | <input type="checkbox"/> orange            | <input type="checkbox"/> orange juice   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G19</b> | <input type="checkbox"/> fruit smoothie    | <input type="checkbox"/> fruit salad    | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |

**ENERGY EXPENDITURE**

**G20. In which activity do you expend more energy?**

- playing soccer
- reading a book
- playing video-games
- sleeping
- not sure

**G21. Which of these foods is more energy-rich?**

- bread
- nuts
- rice
- cereals
- not sure

**G22. What does the amount of food you eat depend on?**

- energy expenditure
- age
- weight
- height
- not sure

## Lifestyle intervention

## Self-efficacy for Healthy Eating Questionnaire

**Instructions:** The next eight (8) statements ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods. please tick the box that suits your answer.

| Please rate on a scale of 0-2 how confident you are that you can do the following                 | Not hard at all            | A little hard              | Very hard                  |
|---|----------------------------|----------------------------|----------------------------|
| 1. eat fruits instead of a snack  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 2. eat vegetables instead of a snack  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 3. choose to drink water instead of pop-ice<br>When you are thirsty                               | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 4. drink 1% or skim milk instead of 2% or whole milk  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 5. Choose a small instead of a large Fresh chips  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 6. Eat smaller servings of high fat foods like Fresh chips, cakes, magwinya, cookies or ice cream | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 7. Eat a low fat snack like nik-nacks instead of fresh chips                                      | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 8. Drink less pop-ice/sweet aid   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |

## Self-Efficacy for Exercise Questionnaire

**Instructions:** please tick the box that suits your answer.

| Please rate on a scale of 1-5 how confident you are that you can do the following                                    | Disagree a Lot             | Disagree                   | Slightly agree             | Agree                      | Agree a lot                |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I can engage in physical activity during my free time on most days.   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I can ask my parent/friends to do physically activity with me.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I can be physically active during my free time on most days even if I could watch TV or play video games instead. | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 4. I can be physically active during my free time on most days even if it is very hot or cold outside                | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 5. I can be physically active during my free time on most days even if I have to stay at home.                       | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 6. I can engage in physical activity during my free time on most days no matter how busy my day is.                  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

## Lifestyle intervention

**Intentions to eat Healthily Scale**

**Instruction:** Please specify how much you intend to practice healthy eating behaviour. Tick the number that is most appropriate to your decision.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b> | <b>Definitely not true</b> | <b>Not true</b>            | <b>Undecided</b>           | <b>True</b>                | <b>Definitely true</b>     |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I plan to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I will try to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I intend to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Intention to do Physical Activity Scale**

**Instruction:** Please specify your intention to do physical activity. Tick the number that best suits you.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>          | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>Agree a lot</b>         |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| a) I plan to do physical activity on a regular basis over the next weeks                          | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| b). I plan to do physical activity at least 3 or more times during my free time in the next weeks | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| c). I expect to do at least 3 or more physical activity in the next weeks                         | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Appendix 2: Modified nutrition questionnaire after experts’ content validity evaluation**

- |  |                             |
|--|-----------------------------|
| 1. School name.....  | 7. Father’s education:..... |
| 2. Class.....  | 8. Mother’s education:..... |
| 3. Age.....  | 9. Father’s job:.....       |
| 4. Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female | 10. Mother’s job:.....      |
| 5. Weight:.....  | 11. WC:.....                |
| 6. Height:.....  |                             |

**SECTION B. Food frequency consumption**

| Questions   | Seldom /Never            | 1 per month              | 2-3 per month            | 1 per week               | 2-3 per week             | 4-6 per week             | 1 per day                | 2-3 per day              | 4-5 per day              | 6 or more per day        |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| B1. How often do you usually eat pasta/rice, sorghum, maize meal and bread? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B2. How often do you usually eat meat?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3. How often do you usually eat tinned fish or fresh fish?                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4. How often do you usually eat cheese?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B5. How often do you usually eat eggs?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B6. How often do you usually eat vegetables?                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B7. How often do you usually eat fruits?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B8. How often do you usually eat sweets?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B9. How often do you usually eat snacks?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B10. How often do you usually eat fried foods?                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Lifestyle intervention

| Questions   | Seldom /Never            | 1 per month              | 2-3 per month            | 1 per week               | 2-3 per week             | 4-6 per week             | 1 per day                | 2-3 per day              | 4-5 per day              | 6 or more per day        |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| B11. How often do you usually drink fizzy drinks? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Question                                  | ≤1L (2 cups)             | 1-2L (2-4 cups)          | 2-3L (4-6 cups)          | ≥3L (6-8 cups)           |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| B12. How much water do you drink per day? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

B13. Which food do you like and why?.....

B14. Which food do you not like and why?.....

B15. which indigenous foods do you know?.....

**SECTION C. Meal habits**

**Instruction: choose one option for question 1-3**

**C1. What do you usually eat at breakfast?**

- motogo with milk and sugar
- oats with milk and sugar
- coffee /tea and bread
- fat cakes
- corn flakes and milk
- fruits
- sweets
- snacks

**C2. Which fast food do you usually eat?**

- Pizza
- hamburger/hotdog
- sandwich
- fresh chips
- pie
- fat cakes
- tripe

**C3. Which snacks do you usually eat?**

- biscuits
- sandwich
- home-made cake
- fruits
- crisps/pop corn
- niknaks/mabudula

**C4. Where do you usually eat breakfast?**

- at home
- at cafe
- during the journey to school (packed B/fast)
- at school

**C5. With whom do you eat breakfast?**

- alone or with brother/sister
- friends/classmates
- mom/dad
- the whole family
- grandparents
- maid

**C6. With whom do you eat lunch?**

- alone or with brother/sister
- mom/dad
- friends/class mates
- whole family
- grandparents
- maid

**C7. With whom do you eat dinner?**

- alone or with brother/sister
- friends
- mom/dad
- grandparents
- maid
- whole family

Lifestyle intervention

**SECTION D. Breakfast and Snack Habits**

**D1. How often do you eat breakfast?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

[ if NEVER ] → why?

- not enough time
- I don't like
- anyone cook
- other

**D3. How many times do you eat at a pizzeria/ pub/ fast-food/restaurant during 1 week?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

**D2. How long do you spend on breakfast?**

- less than 5 minutes
- 5-10 minutes
- 10-15 minutes
- 15-20 minutes
- more than 20 minutes

**D4. How many times a day do you eat in-between meals?**

- never
- 1 per day
- 2 per day
- 3 per day
- 3 or more per day

**SECTION E. Influences on food choice**

**Instruction: if you have answered no to question 1, proceed to answer question 7 & 8 only**

**E1. Do you have television (TV) at your home?**

- yes
- no

**E2. Do you independently choose which programs you watch on TV?**

- always
- sometimes
- never

**E3. Do you watch TV during meals?**

- always
- sometimes
- never

**E4. What do you eat when you watch TV (or at cinema)?**

- pop-corn
- ice-cream
- crisps
- nikkaks
- mabudula

**E5. According to you, commercial advertisings:**

- are very funny
- are nice
- indifferent
- are boring but you watch them

**E6. According to you, how often are commercial adverts honest?**

- always
- often
- sometimes
- rarely
- never

**E7. Who or what influences your food choice?**

- family
- friends
- school
- commercial adverts
- no, anyone

**E8. How often do your parents restrict your food choice?**

- always
- often
- sometimes
- rarely
- never

**E9. How often do you like to eat food advertised on TV?**

- always
- often
- sometimes
- rarely
- never

Lifestyle intervention

- change channel and you don't watch them

**SECTION F. Lifestyle and Physical Activity**

- F1. How many times do you walk per day during one week?**  
 6 or more per week  
 4-5 per week  
 2-3 per week  
 1 per week
- F2. Do you usually walk or dropped at school?**  
 walk to school  
 dropped at school
- F3. Do you do any kind of physical activity? If yes List them .....**
- F4. What do you usually prefer to do during your free time?**  
 sleeping  
 practice a sport  
 watch TV/listen to music/read a book/use computer/play video-games
- F5. How many hours do you spend watching TV or on a Computer or play video game?**  
 less than an hour  
 1-2 hours  
 3-4 hours  
 more than 4 hours
- F6. What is physical activity?.....**
- F7. What is the benefit of physical activity?.....**

**SECTION G. Nutrition Knowledge**

**FOOD NUTRIENTS**

- G1. What are macronutrients?**  
 carbohydrates and proteins  
 carbohydrates, proteins and fats  
 carbohydrates and fats  
 carbohydrates, proteins, fats and vitamins  
 not sure
- G2. How do you define vitamins?**  
 essential substances present in small amounts in food  
 energy-rich substances  
 essential substances synthesized in our body  
 useless substances  
 not sure
- G3. In a balanced diet you should avoid:**  
 carbohydrates  
 fats  
 any of them  
 proteins  
 not sure
- G4. Which of these is more essential for your body?**  
 vitamins and minerals  
 proteins and carbohydrates  
 fats  
 all of them  
 not sure

**FOOD CONTENTS**

- G5. Which part of egg contains fat?**  
 both of them  
 albumen (whites)  
 yolk  
 any of them  
 not sure
- G6. What does "dietary fibre" mean?**  
 the fibrous part of the meat  
 the skin of fruits  
 indigestible part of vegetables  
 a dietary supplement  
 not sure
- G7. Which fruit contains the most vitamin C?**  
 apple
- G8. Meat is rich in:**  
 carbohydrates  
 proteins  
 fats  
 vitamins  
 not sure
- G9. Pasta and bread are rich in:**  
 carbohydrates  
 fats  
 proteins  
 vitamins  
 not sure
- G10. Fruit and vegetables are rich in:**  
 vitamins

Lifestyle intervention

- melon
- orange
- grapes
- not sure

- fats
- proteins
- carbohydrates
- not sure

**HEALTHY FOODS AND DRINKS**

**G11. According to you, milk is a food for:**

- children
- people of all ages
- elderly people
- sick people
- not sure

**G12. Which do you think is better a drink to quench your thirst?**

- water
- fruit juice
- sugary drink
- energy drink
- not sure

**According to you, which is the healthiest food?**

|            |  |   |   |                                   |
|------------|--|---|---|-----------------------------------|
| <b>G13</b> | <input type="checkbox"/> toast with tomato | <input type="checkbox"/> snack(nik-naks, crisps, peanuts, pop-corn, mabudula) | <input type="checkbox"/> toast with ham | <input type="checkbox"/> not sure |
| <b>G14</b> | <input type="checkbox"/> fish              | <input type="checkbox"/> hamburger  | <input type="checkbox"/> fried fish     | <input type="checkbox"/> not sure |
| <b>G15</b> | <input type="checkbox"/> Banana smoothie   | <input type="checkbox"/> yogurt cake  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G16</b> | <input type="checkbox"/> a glass of milk   | <input type="checkbox"/> carrot cake  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G16</b> | <input type="checkbox"/> fresh chips       | <input type="checkbox"/> baked potatos  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G17</b> | <input type="checkbox"/> orange            | <input type="checkbox"/> orange juice   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G19</b> | <input type="checkbox"/> fruit smoothie    | <input type="checkbox"/> fruit salad  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |

**ENERGY EXPENDITURE**

**G20. In which activity do you use more of energy?**

- playing soccer
- reading a book
- playing video-games
- sleeping
- not sure

**G22. What does the amount of food you eat depend on?**

- energy expenditure
- age
- weight
- height
- not sure

**Instruction:** For the following questions you may tick more than one (1) answer.

**G21. Which of this food is more energy rich?**

- bread
- nuts
- rice
- cereals
- not sure

**G23. What is/are the advantage/s of a healthy diet?**

- prevention of heart and diabetes diseases
- Boost immunity
- live a longer healthier life
- gaining weight
- not sure

**G24. Which of the following is the most nutrition related health problem?**

- diabetes
- obesity
- poor appetite
- headache
- painful body

## Lifestyle intervention

**Self-efficacy for Healthy Eating Questionnaire**

**Instructions:** The eight (8) statements ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods. please tick the box that suits your answer.

| <b>Please rate on a scale of 0-2 how confident you are that you can do the following</b>                     | <b>Not hard at all</b>     | <b>A little hard</b>       | <b>Very hard</b>           |
|--|----------------------------|----------------------------|----------------------------|
| 1. eat fruits instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 2. eat vegetables instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 3. choose to drink water instead of pop-ice when you are thirsty   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 4. drink 1% or skim milk instead of 2% or whole milk   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 5. choose a small instead of a large Fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 6. eat smaller servings of high fat foods like Fresh chips, cakes, fat cakes(magwinya), cookies or ice cream | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 7. eat a low fat snack like nik-nacks instead of fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 8. drink less pop-ice/sweet aid  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |

**Intentions to eat Healthily Scale**

**Instruction:** Please specify how much you intend to practice healthy eating behaviour. Tick the number that is most appropriate to your decision.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b> | <b>Definitely not true</b> | <b>Not true</b>            | <b>Undecided</b>           | <b>True</b>                | <b>Definitely true</b>     |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2.4 I plan to eat healthily  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2.5 I will try to eat healthily  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2.6 I intend to eat healthily  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

Lifestyle intervention

**Self-Efficacy for Exercise Questionnaire**

**Instructions:** please tick the box that suits your answer.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>                             | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>Agree A Lot</b>         |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I can do physical activity during my free time on most days.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I can ask my parent/friends to do physical activity with me.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I can be physically active during my free time on most days even if I could watch TV or play video games instead. | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 4. I can be physically active during my free time on most days even if it is very hot or cold outside                | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 5. I can do in physical activity during my free time on most days no matter how busy my day is.                      | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Intention to do Physical Activity Scale**

**Instruction:** Please specify how much you intend to do physical activity. Tick the number that best suits you.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>          | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>A Lot</b>               |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| a) I plan to do physical activity on a regular basis over the next weeks                          | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| b). I plan to do physical activity at least 3 or more times during my free time in the next weeks | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| c). I expect to do at least 3 or more physical activity in the next weeks                         | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

### Appendix 3: Modified questionnaire after face validity

- 1.School name.....  
 2.Class.....  
 3.Age.....  
 4.Gender:  Male  Female  
 5.Weight:.....  
 6.Height:.....  
 7. Father’s education:.....  
 8. Mother’s education.....  
 9. Father’s job:.....  
 10. Mother’s job.....  
 11. WC.....

#### SECTION B. Food frequency consumption

| Questions   | Seldom/<br>Never         | 1 per<br>month           | 2-3 per<br>month         | 1 per<br>week            | 2-3<br>per<br>week       | 4-6<br>per<br>week       | 1 per<br>day             | 2-3<br>per<br>day        | 4-5<br>per<br>day        | 6 or<br>more<br>per<br>day |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|
| B1. How often do you usually eat pasta/rice, sorghum, maize meal and bread? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B2. How often do you usually eat meat?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B3. How often do you usually eat tinned fish or fresh fish?                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B4. How often do you usually eat cheese?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B5. How often do you usually eat eggs?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B6. How often do you usually eat vegetables?                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B7. How often do you usually eat fruits?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B8. How often do you usually eat sweets?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B9. How often do you usually eat snacks?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B10. How often do you usually eat fried foods?                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |
| B11. How often do you usually drink fizzy drinks?                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   |

Lifestyle intervention

| Question                                  | ≤1L (2 cups)             | 1-2L (2-4 cups)          | 2-3L (4-6 cups)          | ≥3L (6-8 cups)           |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| B12. How much water do you drink per day? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

B13. Which food do you like and why?.....

B14. Which food do you not like and why?.....

B15. Which indigenous foods do you know?.....

**SECTION C : Meal Habits**

**Instruction:** choose one option for question 1-3

**C1. What do you eat most of the time at breakfast?  
time?**

- motogo with milk and sugar
- oats with milk and sugar
- coffee /tea and bread
- fat cakes
- corn flakes and milk
- fruits
- sweets
- snacks

**C2. Which fast food do you eat most of the time?**

- Pizza
- hamburger/hotdog
- sandwich
- fresh chips
- pie
- fat cakes
- tripe

**C3. Which snacks do you eat most of the time?**

- biscuits
- sandwich
- home-made cake
- fruits
- crisps/pop corn
- niknacks/mabudula

**C4. Where do you eat breakfast most of the**

- at home
- at cafe
- during the journey to school (packed B/fast)
- at school

**C5. With whom do you eat breakfast?**

- alone or with brother/sister
- friends/classmates
- mom/dad
- the whole family
- grandparents
- maid

**C6. With whom do you eat lunch?**

- alone or with brother/sister
- mom/dad
- friends/class mates
- whole family
- grandparents
- maid

**C7. With whom do you eat dinner?**

- alone or with brother/sister
- friends
- mom/dad
- grandparents
- maid
- whole family

**SECTION D. Breakfast and snack habits**

**D1. How often do you eat?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

[ if NEVER ] →why?

- not enough time

**D2. How long do you spend on breakfast?**

- less than 5 minutes
- 5-10 minutes
- 10-15 minutes
- 15-20 minutes
- more than 20 minutes

Lifestyle intervention

- I don't like
- anyone cook
- other

**D3. How many times do you eat at a pizzeria/ pub/ fast-food/restaurant during 1 week?**

- never
- 1 per week
- 2-3 per week
- 4-5 per week
- 6 or more per week

**D4. How many times a day do you eat in-between meals?**

- never
- 1 per day
- 2 per day
- 3 per day
- 3 or more per day

**SECTION E. Influences on food choice**

**Instruction: if you have answered no to question 1, proceed to answer question 7&8 only**

**E1. Do you have television (TV) at your**

- yes
- no

**E2. Do you independently choose which programs you watch on TV?**

- always
- sometimes
- never

**E3. Do you watch TV during meals?**

- always
- sometimes
- never

**E4. What do you eat when you watch TV (or at cinema)?**

- pop-corn
- ice-cream
- crisps
- nknaks
- mabudula

**E5. According to you, commercial advertisings:**

- are very funny
- are nice
- indifferent
- are boring but you watch them
- change channel and you don't watch them

**E6. According to you, how often are commercial adverts honest?**

- always
- often
- sometimes
- rarely
- never

**E7. Who or what influences your food choice?**

- family
- friends
- school
- commercial advertisings
- no, anyone

**E8. How often do your parents restrict your food choice?**

- always
- often
- sometimes
- rarely
- never

**E9. How often do you like to eat food advertised on TV?**

- always
- often
- sometimes
- rarely
- never

**SECTION F. Lifestyle and Physical Activity**

**F1. How many times do you walk per day during one week?**

- 6 or more per week
- 4-5 per week
- 2-3 per week
- 1 per week

**F2. Do you usually walk or dropped at school?**

- walk to school
- dropped at school
- both

Lifestyle intervention

**F3. Do you do any kind of physical activity? If yes List them.....**

**F4. What do you usually prefer to do during your free time?**

- sleeping
- practice a sport
- watch TV/listen to music/read a book/use computer/play video-games

**F5. How many hours do you spend watching TV or on a Computer or play video game?**

- less than an hour
- 1-2 hours
- 3-4 hours
- more than 4 hours

**F6. What is physical activity?**

- any bodily movement produced by skeletal muscles that requires a person to spend energy.
- any bodily movement not produced by skeletal muscles
- any bodily movement produced by skeletal muscles that requires no spending of energy

**F7. What is the benefit of physical activity?**

- reduce risk of heart problems
- gives bone and muscle strength
- increase risk of cancer
- control body weight

**SECTION G. Nutrition Knowledge**

**FOOD NUTRIENTS**

**G1. What are macronutrients?**

- carbohydrates and proteins
- carbohydrates, proteins and fats
- carbohydrates and fats
- carbohydrates, proteins, fats and vitamins
- not sure

**G2. How do you define vitamins?**

- essential substances present in small amounts in food
- energy-rich substances
- essential substances synthesized in our body
- useless substances
- not sure

**G3. In a balanced diet you should avoid:**

- carbohydrates
- fats
- any of them
- proteins
- not sure

**G4. Which of these is more essential for your body?**

- vitamins and minerals
- proteins and carbohydrates
- fats
- all of them
- not sure

**FOOD CONTENTS**

**G5. Which part of egg contains fat?**

- both of them
- albumen (whites)
- yolk
- any of them
- not sure

**G8. Meat is rich in:**

- carbohydrates
- proteins
- fats
- vitamins
- not sure

**G6. What does “dietary fibre” mean?**

- the fibrous part of the meat
- the skin of fruits
- indigestible part of vegetables
- a dietary supplement
- not sure

**G9. Pasta and bread are rich in:**

- carbohydrates
- fats
- proteins
- vitamins
- not sure

**G7. Which fruit contains the most vitamin C?**

- apple
- melon
- orange
- grapes
- not sure

**G10. Fruit and vegetable are rich in:**

- vitamins
- fats
- proteins
- carbohydrates
- not sure

Lifestyle intervention

**HEALTHY FOODS AND DRINKS**

**G11. According to you, milk is a food for:**

- children
- people of all ages
- elderly people
- sick people
- not sure

**G12. Which do you think is better a drink to quench your thirst?**

- water
- fruit juice
- sugary drink
- energy drink
- not sure

**According to you, which is the healthiest food?**

|            |  |  |   |                                   |
|------------|--|--|---|-----------------------------------|
| <b>G13</b> | <input type="checkbox"/> toast with tomato | <input type="checkbox"/> snack(nik-nacks, crisps, peanuts, pop-corn, mabudula) | <input type="checkbox"/> toast with ham | <input type="checkbox"/> not sure |
| <b>G14</b> | <input type="checkbox"/> fish              | <input type="checkbox"/> hamburger   | <input type="checkbox"/> fried fish     | <input type="checkbox"/> not sure |
| <b>G15</b> | <input type="checkbox"/> Banana smoothie   | <input type="checkbox"/> yogurt cake   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G16</b> | <input type="checkbox"/> a glass of milk   | <input type="checkbox"/> carrot cake   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G16</b> | <input type="checkbox"/> fresh chips       | <input type="checkbox"/> baked potatos   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G17</b> | <input type="checkbox"/> orange            | <input type="checkbox"/> orange juice  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>G19</b> | <input type="checkbox"/> fruit smoothie    | <input type="checkbox"/> fruit salad   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |

**ENERGY EXPENDITURE**

**G20. In which activity do you use more of energy?**

- playing soccer
- reading a book
- playing video-games
- sleeping
- not sure

**G22. What does the amount of food you eat depend on?**

- energy expenditure
- age
- weight
- height
- not sure

**Instruction:** For the following questions you may tick more than one (1) answer.

**G21. Which of this food is more energy rich?**

- bread
- nuts
- rice
- cereals
- not sure

**G23. What is/are the advantage/s of a healthy diet?**

- prevention of heart and diabetes diseases
- Boost immunity
- live a longer healthier life
- gaining weight
- not sure

**G24. Which of the following is the most nutrition related health problem?**

- diabetes
- obesity
- poor appetite
- headache
- painful body

## Lifestyle intervention

**Self-efficacy for Healthy Eating Questionnaire**

**Instructions:** The eight (8) statements ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods. please tick the box that suits your answer.

| <b>Please rate on a scale of 0-2 how confident you are that you can do the following</b>                     | <b>Not hard at all</b>     | <b>A little hard</b>       | <b>very hard</b>           |
|--|----------------------------|----------------------------|----------------------------|
| 1. eat fruits instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 2. eat vegetables instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 3. choose to drink water instead of pop-ice when you are thirsty   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 4. drink 1% or skim milk instead of 2% or whole milk   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 5. choose a small instead of a large Fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 6. eat smaller servings of high fat foods like Fresh chips, cakes, fat cakes(magwinya), cookies or ice cream | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 7. eat a low fat snack like nik-nacks instead of fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 8. drink less pop-ice/sweet aid  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |

**Intentions to eat Healthily Scale**

**Instruction:** Please specify how much you intend to practice healthy eating behaviour. Tick the number that is most appropriate to your decision.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b> | <b>Definitely not true</b> | <b>Not true</b>            | <b>Undecided</b>           | <b>True</b>                | <b>Definately true</b>     |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I plan to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I will try to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I intend to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

## Lifestyle intervention

**Self-Efficacy for Exercise Questionnaire****Instructions:** please tick the box that suits your answer.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>                             | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>Agree a lot</b>         |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I can do physical activity during my free time on most days.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I can ask my parent/friends to do physical activity with me.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I can be physically active during my free time on most days even if I could watch TV or play video games instead. | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 4. I can be physically active during my free time on most days even if it is very hot or cold outside                | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 5. I can do in physical activity during my free time on most days no matter how busy my day is.                      | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Intention to do Physical Activity Questionnaire****Instruction:** Please specify how much you intend to do physical activity. Tick the number that best suits you.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>          | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>Agree A Lot</b>         |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| a) I plan to do physical activity on a regular basis over the next weeks                          | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| b). I plan to do physical activity at least 3 or more times during my free time in the next weeks | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| c). I expect to do at least 3 or more physical activity in the next weeks                         | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Appendix 4: Modified questionnaire after reliability and Pearson Correlation**

**SECTION A: Demographic data**

- 1.School code.....
- 2.Class/grade.....
- 3.Age.....
- 4.Gender:  Male     Female
- 9. BMI.....
- 5. Father’s education:.....
- 6. Mother’s education.....
- 7. Father’s job:.....
- 8. Mother’s job.....
- 10. Waist circumference.....

**SECTION B. Food frequency consumption**

| Questions   | Seldom/<br>Never         | 1 per<br>month           | 2-3 per<br>month         | 1 per<br>week            | 2-3<br>per<br>week       | 4-6 per<br>week          | 1 per<br>day             | 2-3 per<br>day           | 4-5 per<br>day           | 6 or<br>more per<br>day  |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| B1. How often do you usually eat pasta/rice, sorghum, maize meal and bread? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B2. How often do you usually eat meat?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B3. How often do you usually eat tinned fish or fresh fish?                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B4. How often do you usually eat cheese?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B5. How often do you usually eat eggs?                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B6. How often do you usually eat vegetables?                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B7. How often do you usually eat fruits?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B8. How often do you usually eat sweets?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B9. How often do you usually eat snacks?                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B10. How often do you usually eat fried foods?                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B11. How often do you usually drink fizzy drinks?                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Lifestyle intervention

| Question                                  | ≤1L (2 cups)             | 1-2L (2-4 cups)          | 2-3L (4-6 cups)          | ≥3L (6-8 cups)           |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| B12. How much water do you drink per day? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

B13. Which food do you like and why?.....

B14. Which food do you not like and why?.....

B15. which indigenous foods do you know?.....

**SECTION C. Meal Habits**

**Instruction:** choose one option for question 1-3

**C1. What do you eat most of the time at breakfast?**

- motogo with milk and sugar
- oats with milk and sugar
- coffee /tea and bread
- fat cakes
- corn flakes and milk

**C2. Which fast food do you eat most of the time?**

- Pizza
- hamburger/hotdog
- sandwich
- fresh chips
- pie
- fat cakes
- tripe

**C3. Which snacks do you eat most of the time?**

- biscuits
- sandwich
- home-made cake
- fruits
- crisps/pop corn
- nikhaks/mabudula

**C4. Where do you eat breakfast most of the time?**

- at home
- at café
- during the journey to school
- at school (packed B/fast)

**C5. With whom do you eat breakfast?**

- fruits
- alone or with brother/sister
- sweets
- friends/classmates
- snacks
- mom/dad

**C6. With whom do you eat lunch?**

- the whole family
- grandparents
- maid
- alone or with brother/sister
- mom/dad
- friends/class mates
- whole family

**C7. With whom do you eat dinner?**

- grandparents
- maid
- alone or with brother/sister
- friends
- mom/dad
- whole family

**SECTION D. Influences on Food Choice**

**Instruction: if you have answered no to question 1, proceed to answer question 7&8 only**

**D1. Do you have television (TV) at your home?**

- yes
- no

**D3. Do you watch TV during meals?**

- always
- sometimes
- never

**D5. According to you, TV advertising:**

- is very funny
- is nice
- is boring but you watch them
- i don't watch them

**D7. Who or what influence your food choice?**

- family
- friends
- school
- commercial advertisings
- no, anyone

**D2. Do you independently choose programs you watch on TV?**

- always
- sometimes
- never

**D4. What do you eat when you watch TV (or at cinema)?**

- pop-corn
- ice-cream
- crisps
- niknaks
- mabudula

**D6. According to you, how often are TV adverts honest?**

- always
- often
- sometimes
- rarely

**D8. How often do your parents control your meals?**

- always
- often
- sometimes
- rarely
- never

**D9. How often do you eat food advertised on TV?**

- always
- often
- sometimes
- rarely
- never

Lifestyle intervention

**SECTION E. Lifestyle and Physical Activity**

**E1. How many times do you walk per day during one week?**

- 6 or more per week
- 4-5 per week
- 2-3 per week
- 1 per week

**E2. Do you do any kind of physical activity? If yes List them**

.....

.....

.....

**E3. What do you usually prefer to do during your free time?**

- sleeping
- practice a sport
- watch TV/listen to music/read a book/use computer/play video-games

**E4. How many hours do you spend watching TV or on a Computer or play video game?**

- less than an hour
- 1-2 hours
- 3-4 hours
- more than 4 hours

**E5. What is physical activity?**

- any bodily movement produced by skeletal muscles that requires a person to spend energy.
- any bodily movement not produced by skeletal muscles
- any bodily movement produced by skeletal muscles that requires no spending of energy

**E6. What is the benefit of physical activity?**

- reduce risk of heart problems
- gives bone and muscle strength
- increase risk of cancer
- control body weight

**SECTION F. Nutrition Knowledge**

**FOOD NUTRIENTS**

**F1. What are macronutrients?**

- carbohydrates and proteins
- carbohydrates, proteins and fats
- carbohydrates and fats
- carbohydrates, proteins, fats and vitamins
- not sure

**F2. How do you define vitamins?**

- essential substances present in small amounts in food
- energy-rich substances
- essential substances synthesized in our body
- useless substances
- not sure

**F3. In a balanced diet you should avoid:**

- carbohydrates
- fats
- proteins
- none of them
- not sure

**F4. Which of these is most essential for your body?**

- vitamins and minerals
- proteins
- vitamins
- fats
- all of them
- not sure

**FOOD CONTENTS**

**F5. Which part of egg contains fat?**

- albumen (whites)
- yolk
- both of them
- any of them
- not sure

**F7. Meat is rich in:**

- proteins and carbohydrates
- fats
- proteins
- all of them
- not sure

**F6. What does “dietary fibre” mean?**

- the fibrous part of the meat
- the skin of fruits
- indigestible part of vegetables

**F8. Pasta and bread are rich in**

- proteins
- fats
- proteins

Lifestyle intervention

- a dietary supplement
- not sure

- vitamins
- not sure

**F9. Fruits and vegetables are rich in:**

- vitamins
- fats
- proteins
- carbohydrates
- not sure

**F10. Which fruit contains most vitamin C?**

- apple
- melon
- orange
- grapes
- not sure

**HEALTHY FOODS AND DRINK**

**F11. According to you milk is food for:**

- children
- people of all ages
- elderly people
- sick people
- not sure

**F12. Which of the following do you think is a better to quench your thirst?**

- water
- fruit juice
- sugary drink
- energy drink
- not sure

**According to you, which is the healthiest food?**

|            |  |  |   |                                   |
|------------|--|--|---|-----------------------------------|
| <b>F13</b> | <input type="checkbox"/> toast with tomato | <input type="checkbox"/> snack (nik-naks, crisps, peanuts, pop-corn, mabudula) | <input type="checkbox"/> toast with ham | <input type="checkbox"/> not sure |
| <b>F14</b> | <input type="checkbox"/> fish              | <input type="checkbox"/> hamburger   | <input type="checkbox"/> fried fish     | <input type="checkbox"/> not sure |
| <b>F15</b> | <input type="checkbox"/> Banana smoothie   | <input type="checkbox"/> yogurt cake   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>F16</b> | <input type="checkbox"/> a glass of milk   | <input type="checkbox"/> carrot cake   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>F17</b> | <input type="checkbox"/> fresh chips       | <input type="checkbox"/> baked potatoes  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>F18</b> | <input type="checkbox"/> orange            | <input type="checkbox"/> orange juice  | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |
| <b>F19</b> | <input type="checkbox"/> fruit smoothie    | <input type="checkbox"/> fruit salad   | <input type="checkbox"/> both           | <input type="checkbox"/> not sure |

**ENERGY EXPENDITURE**

**F20. In which activity do you use more of energy**

- playing soccer
- reading a book
- playing video-games
- sleeping
- not sure

**F21. Which food is more energy rich?**

- bread
- nuts
- rice
- cereals
- not sure

**Instruction:** For the following questions you may tick more than one (1) answer.

**F22. What does the amount of food you eat depend on?**

- weight
- energy expenditure
- age
- height
- not sure

**F23. What is/are the advantage/s of a healthy diet?**

- prevention of heart and diabetes diseases
- boost immunity
- living healthier lives
- gaining weight
- not sure

**F24. Which of the following is the most lifestyle nutrition related health problem?**

- diabetes
- obesity
- poor appetite
- headache
- painful body

## Lifestyle intervention

**Section G: Self-efficacy for Healthy Eating**

**Instructions:** The eight (8) statements ask about your eating habits and how hard you think it would be for you to eat more of some foods and eat less of other foods. please tick the box that suits your answer.

| <b>Please rate on a scale of 0-2 how confident you are that you can do the following</b>                     | <b>Not hard at all</b>     | <b>A little hard</b>       | <b>Very hard</b>           |
|--|----------------------------|----------------------------|----------------------------|
| 1. eat fruits instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 2. eat vegetables instead of a snack   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 3. choose to drink water instead of pop-ice when you are thirsty   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 4. drink 1% or skim milk instead of 2% or whole milk   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 5. choose a small instead of a large Fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 6. eat smaller servings of high fat foods like Fresh chips, cakes, fat cakes(magwinya), cookies or ice cream | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 7. eat a low fat snack like nik-nacks instead of fresh chips   | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |
| 8. drink less pop-ice/sweet aid  | 0 <input type="checkbox"/> | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> |

**Section H: Intentions to eat Healthily Scale**

**Instruction:** Please specify how much you intend to practice healthy eating behaviour.

Tick the number that is most appropriate to your decision.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b> | <b>Definitely not true</b> | <b>Not true</b>  | <b>Undecided</b>           | <b>True</b>                | <b>Definitely true</b>     |
|--|----------------------------|--|----------------------------|----------------------------|----------------------------|
| 1. I plan to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/>                               | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I will try to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/>                               | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I intend to eat healthily   | 1 <input type="checkbox"/> | 2 <input type="checkbox"/><br>5 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

**Section I: Self-Efficacy for Exercise**

**Instructions:** please tick the box that suits your answer.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>                             | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>Slightly agree</b>      | <b>Agree</b>               | <b>Agree A Lot</b>         |
|--|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1. I can do physical activity during my free time on most days.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 2. I can ask my parent/friends to do physical activity with me.  | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 3. I can be physically active during my free time on most days even if I could watch TV or play video games instead. | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 4. I can be physically active during my free time on most days even if it is very hot or cold outside                | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| 5. I can do in physical activity during my free time on most days no matter how busy my day is.                      | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

## Lifestyle intervention

**Section J: Intention to do Physical Activity**

**Instruction:** Please specify how much you intend to do physical activity. Tick the number that best suits you.

| <b>Please rate on a scale of 1-5 how confident you are that you can do the following</b>          | <b>Disagree a Lot</b>      | <b>Disagree</b>            | <b>slightly agree</b>      | <b>agree</b>               | <b>Agree A Lot</b>         |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| a) I plan to do physical activity on a regular basis over the next weeks                          | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| b). I plan to do physical activity at least 3 or more times during my free time in the next weeks | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |
| c). I expect to do at least 3 or more physical activity in the next weeks                         | 1 <input type="checkbox"/> | 2 <input type="checkbox"/> | 3 <input type="checkbox"/> | 4 <input type="checkbox"/> | 5 <input type="checkbox"/> |

## Appendix 5: CVI checklist

Expert code number.....

### CHECKLIST FOR CONTENT VALIDITY OF A SELF-ADMINISTERED STRUCTURED QUESTIONNAIRE

**Researcher:**

GaonyadiweLubinda-Sinombe

PhD student

Tel: + 27 83 715 6039

Email:gaonyadiwesinombe@yahoo.com

**Supervisor:**

Dr Una Kyriacos, Tel: 27-21-4066410

Title of the study:**An evaluation of the effects of a lifestyle intervention on eating and physical activity behaviours of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial pilot study**

#### INFORMATION:

Thank you for agreeing to evaluate the content validity of the self-administered questionnaire. Please email the completed checklist to the researcher at the above email address.

The purpose of this checklist is to ensure uniform evaluation by all experts using a structured procedure.

You the experts will establish the index of content validity (CVI) for each item using a point-4 ordinal rating scale and this will be taken as a proportion of items that received a rating of 3 or 4.<sup>1</sup> If, in your opinion, there are omissions, this can be listed at the end of each item.

In addition to establishing the CVI of each item, this will also be determined for the questionnaire as a whole and will be taken to be a proportion of total items judged content valid.

Lifestyle intervention

**Table: Expert opinion on Content Validity Index (CVI) of each item in the questionnaire**

| Items                        | 1=<br>irrelevant | 2=unable to assess relevance<br>without item revision or items in<br>need of such revision that it would<br>no longer be relevant | 3=relevant but needs minor alterations | 4=extremely<br>relevant |
|------------------------------|------------------|---|--|-------------------------|
| Food frequency questionnaire |                  |   |  |                         |
| B.1                          |                  |   |  |                         |
| B.2                          |                  |   |  |                         |
| B.3                          |                  |   |  |                         |
| B.4                          |                  |   |  |                         |
| B.5                          |                  |   |  |                         |
| B.6                          |                  |   |  |                         |
| B.7                          |                  |   |  |                         |
| B.8                          |                  |   |  |                         |
| B.9                          |                  |   |  |                         |
| B.10                         |                  |   |  |                         |
| B.11                         |                  |   |  |                         |
| B.12                         |                  |   |  |                         |
| C.1                          |                  |   |  |                         |
| C.2                          |                  |   |  |                         |
| C.3                          |                  |   |  |                         |
| C.4                          |                  |   |  |                         |
| C.5                          |                  |   |  |                         |
| C.6                          |                  |   |  |                         |
| C.7                          |                  |   |  |                         |
| D.1                          |                  |   |  |                         |
| D.2                          |                  |   |  |                         |
| D.3                          |                  |   |  |                         |
| D.4                          |                  |   |  |                         |
| E. 1                         |                  |   |  |                         |
| E.2                          |                  |   |  |                         |
| E.3                          |                  |   |  |                         |
| E.4                          |                  |   |  |                         |
| E.5                          |                  |   |  |                         |
| E.6                          |                  |   |  |                         |
| E.7                          |                  |   |  |                         |
| E.8                          |                  |   |  |                         |
| E.9                          |                  |   |  |                         |
| F.1                          |                  |   |  |                         |
| F.2                          |                  |   |  |                         |
| F.3                          |                  |   |  |                         |
| F.4                          |                  |   |  |                         |
| F.6                          |                  |   |  |                         |
| G.1                          |                  |   |  |                         |
| G.2                          |                  |   |  |                         |
| G.3                          |                  |   |  |                         |
| G.4                          |                  |   |  |                         |
| G.5                          |                  |   |  |                         |
| G.5                          |                  |   |  |                         |
| G.6                          |                  |   |  |                         |

Lifestyle intervention

| Items                               | 1=<br>irrelevant | 2=unable to assess relevance<br>without item revision or items in<br>need of such revision that it would<br>no longer be relevant | 3=relevant but needs minor alterations | 4=extremely<br>relevant |
|-------------------------------------|------------------|---|--|-------------------------|
| Food frequency questionnaire        |                  |   |  |                         |
| G.7                                 |                  |   |  |                         |
| G.8                                 |                  |   |  |                         |
| G.9                                 |                  |   |  |                         |
| G.10                                |                  |   |  |                         |
| G.11                                |                  |   |  |                         |
| G.12                                |                  |   |  |                         |
| G.13                                |                  |   |  |                         |
| G.14                                |                  |   |  |                         |
| G.15                                |                  |   |  |                         |
| G.16                                |                  |   |  |                         |
| G.17                                |                  |   |  |                         |
| G.18                                |                  |   |  |                         |
| G.19                                |                  |   |  |                         |
| G.20                                |                  |   |  |                         |
| G.21                                |                  |   |  |                         |
| G.22                                |                  |   |  |                         |
| Self-efficacy for healthy eating    |                  |   |  |                         |
| 1                                   |                  |   |  |                         |
| 2                                   |                  |   |  |                         |
| 3                                   |                  |   |  |                         |
| 4                                   |                  |   |  |                         |
| 5                                   |                  |   |  |                         |
| 6                                   |                  |   |  |                         |
| 7                                   |                  |   |  |                         |
| 8                                   |                  |   |  |                         |
| 9                                   |                  |   |  |                         |
| Self-efficacy for physical activity |                  |   |  |                         |
| 1                                   |                  |   |  |                         |
| 2                                   |                  |   |  |                         |
| 3                                   |                  |   |  |                         |
| 4                                   |                  |   |  |                         |
| 5                                   |                  |   |  |                         |
| 6                                   |                  |   |  |                         |
| 7                                   |                  |   |  |                         |
| 8                                   |                  |   |  |                         |
| Intention to healthy eating         |                  |   |  |                         |
| 1                                   |                  |   |  |                         |
| 2                                   |                  |   |  |                         |
| 3                                   |                  |   |  |                         |
| Intention for physical activity     |                  |   |  |                         |
| a                                   |                  |   |  |                         |
| b                                   |                  |   |  |                         |
| c                                   |                  |   |  |                         |

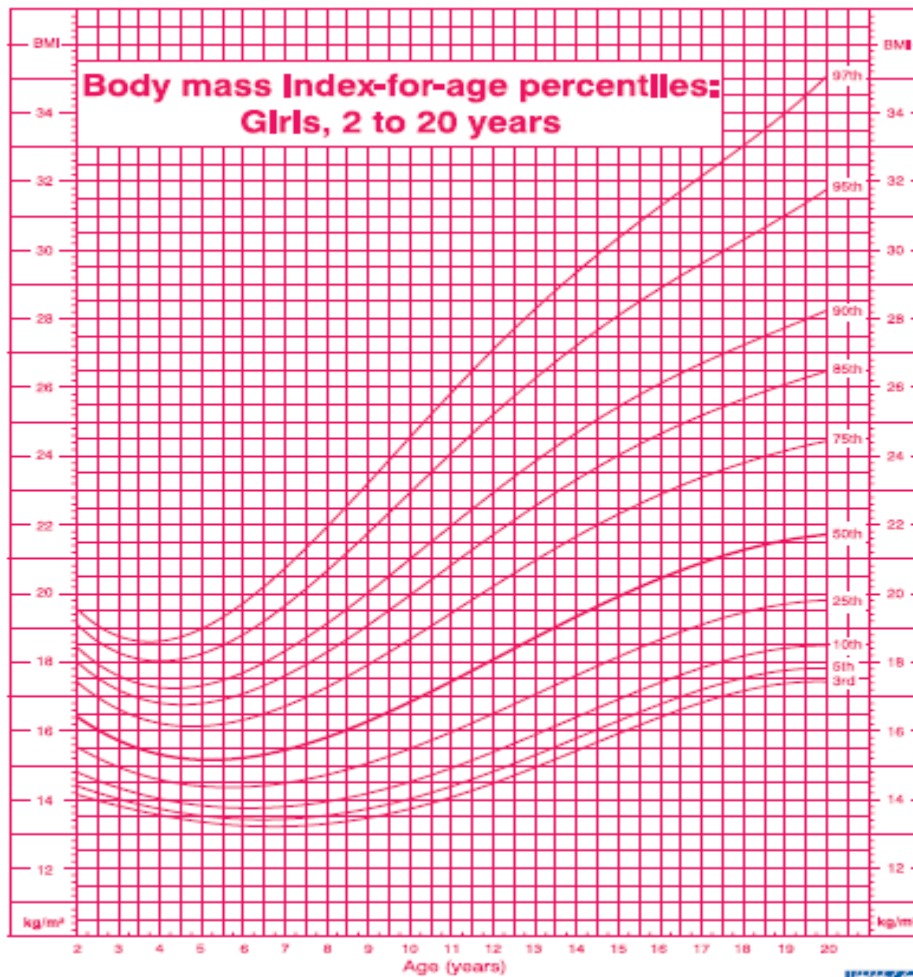
Omissions:

Comments:

**THANK YOU**

**Appendix 6 a and b: BMI Charts for girls (a) and boys (b)**

Page 32 □ Series 11, No. 246



Published May 30, 2000.  
SOURCE: Developed by the National Center for Health Statistics in collaboration with  
the National Center for Chronic Disease Prevention and Health Promotion (2000).  
CDC SAFER • HEALTHIER • PEOPLE™

Figure 14. Individual growth chart 3rd, 5th, 10th, 25th, 50th, 75th, 85th, 90th, 95th, 97th percentiles, 2 to 20 years: Girls body mass index-for-age

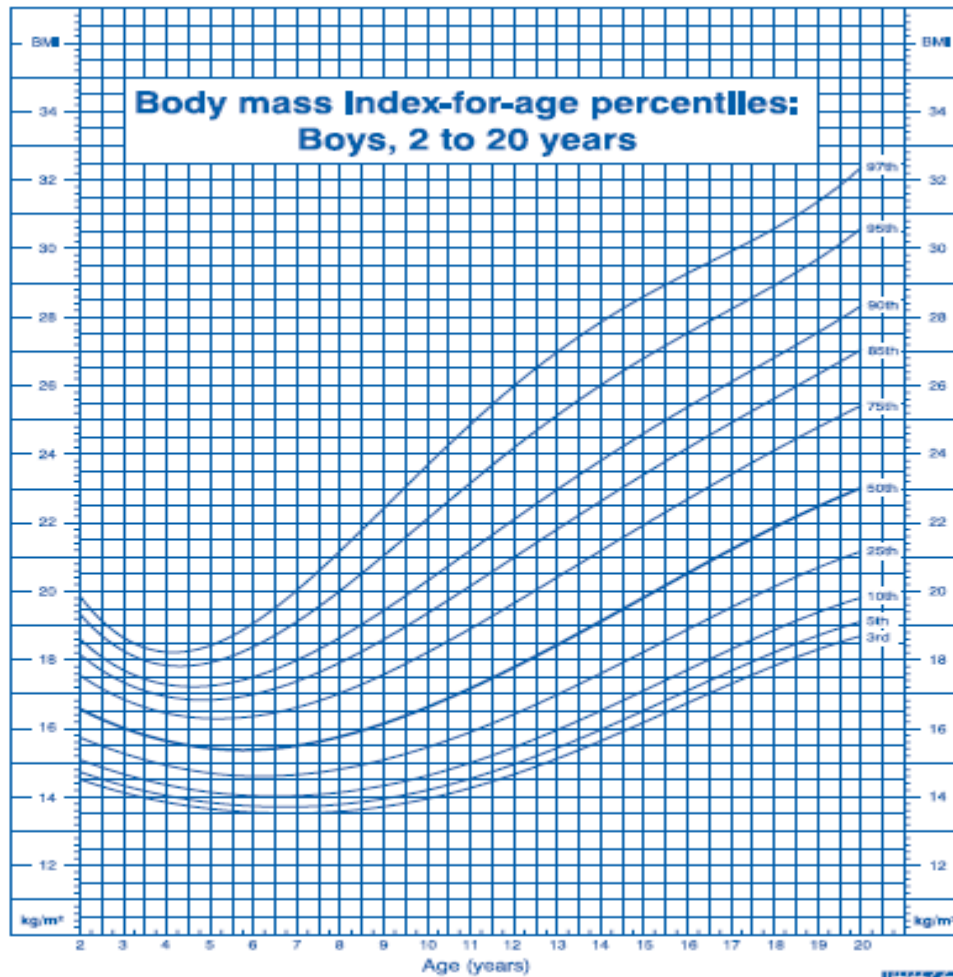


Figure 13. Individual growth chart 3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, 97th percentiles, 2 to 20 years: Boys body mass index-for-age

**Appendix 7: Waist Circumference for boys and girls**

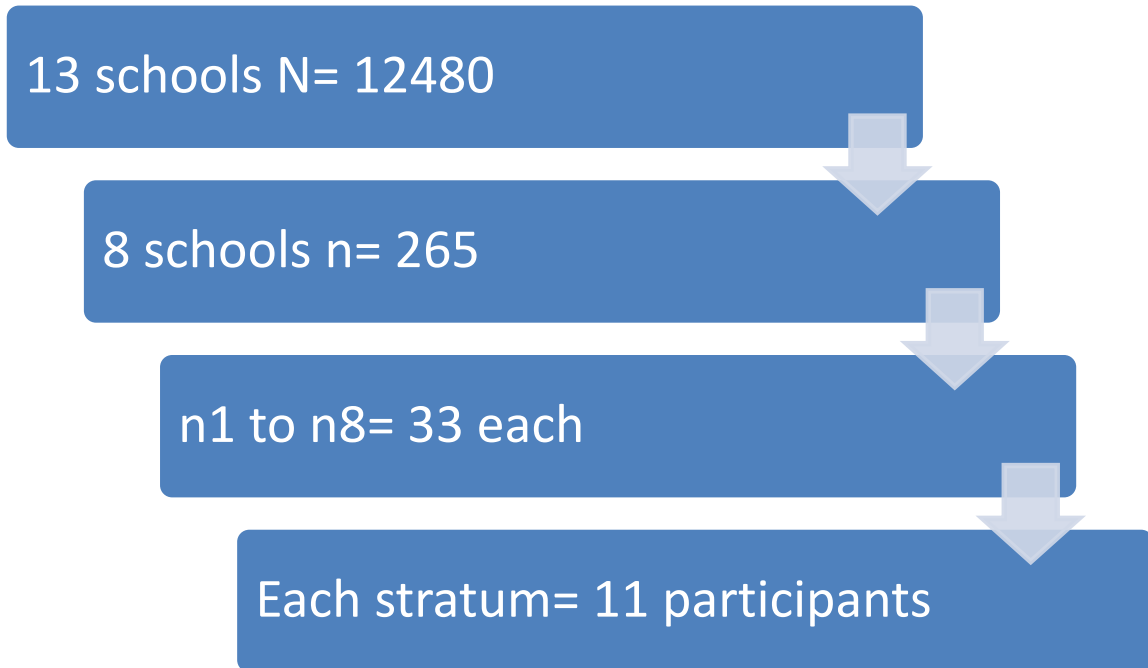
|           | Percentile for boys |                  |                  |                  |                  | Percentile for girls |                  |                  |                  |                  |
|-----------|---------------------|------------------|------------------|------------------|------------------|----------------------|------------------|------------------|------------------|------------------|
|           | 10 <sup>th</sup>    | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> | 10 <sup>th</sup>     | 25 <sup>th</sup> | 50 <sup>th</sup> | 75 <sup>th</sup> | 90 <sup>th</sup> |
| Intercept | 39.7                | 41.3             | 43.0             | 43.6             | 44.0             | 40.7                 | 41.7             | 43.2             | 44.7             | 46.1             |
| Slope     | 1.7                 | 1.9              | 2.0              | 2.6              | 3.4              | 1.6                  | 1.7              | 2.0              | 2.4              | 3.1              |
| Age (y)   |                     |                  |                  |                  |                  |                      |                  |                  |                  |                  |
| 2         | 43.2                | 45.0             | 47.1             | 48.8             | 50.8             | 43.8                 | 45.0             | 47.1             | 49.5             | 52.2             |
| 3         | 44.9                | 46.9             | 49.1             | 51.3             | 54.2             | 45.4                 | 46.7             | 49.1             | 51.9             | 55.3             |
| 4         | 46.6                | 48.7             | 51.1             | 53.9             | 57.6             | 46.9                 | 48.4             | 51.1             | 54.3             | 58.3             |
| 5         | 48.4                | 50.6             | 53.2             | 56.4             | 61.0             | 48.5                 | 50.1             | 53.0             | 56.7             | 61.4             |
| 6         | 50.1                | 52.4             | 55.2             | 59.0             | 64.4             | 50.1                 | 51.8             | 55.0             | 59.1             | 64.4             |
| 7         | 51.8                | 54.3             | 57.2             | 61.5             | 67.8             | 51.6                 | 53.5             | 56.9             | 61.5             | 67.5             |
| 8         | 53.5                | 56.1             | 59.3             | 64.1             | 71.2             | 53.2                 | 55.2             | 58.9             | 63.9             | 70.5             |
| 9         | 55.3                | 58.0             | 61.3             | 66.6             | 74.6             | 54.8                 | 56.9             | 60.8             | 66.3             | 73.6             |
| 10        | 57.0                | 59.8             | 63.3             | 69.2             | 78.0             | 56.3                 | 58.6             | 62.8             | 68.7             | 76.6             |
| 11        | 58.7                | 61.7             | 65.4             | 71.7             | 81.4             | 57.9                 | 60.3             | 64.8             | 71.1             | 79.7             |
| 12        | 60.5                | 63.5             | 67.4             | 74.3             | 84.8             | 59.5                 | 62.0             | 66.7             | 73.5             | 82.7             |
| 13        | 62.2                | 65.4             | 69.5             | 76.8             | 88.2             | 61.0                 | 63.7             | 68.7             | 75.9             | 85.8             |
| 14        | 63.9                | 67.2             | 71.5             | 79.4             | 91.6             | 62.6                 | 65.4             | 70.6             | 78.3             | 88.8             |
| 15        | 65.6                | 69.1             | 73.5             | 81.9             | 95.0             | 64.2                 | 67.1             | 72.6             | 80.7             | 91.9             |
| 16        | 67.4                | 70.9             | 75.6             | 84.5             | 98.4             | 65.7                 | 68.8             | 74.6             | 83.1             | 94.9             |
| 17        | 69.1                | 72.8             | 77.6             | 87.0             | 101.8            | 67.3                 | 70.5             | 76.5             | 85.5             | 98.0             |
| 18        | 70.8                | 74.6             | 79.6             | 89.6             | 105.2            | 68.9                 | 72.2             | 78.5             | 87.9             | 101.0            |

## Appendix 8a: Sample size determination

**Population survey or descriptive study**  
**For simple random sampling, leave design effect and clusters equal to 1.**

|                     |                                    |                         |                     |                     |
|---------------------|------------------------------------|-------------------------|---------------------|---------------------|
| Population size:    | <input type="text" value="12480"/> | <b>Confidence Level</b> | <b>Cluster Size</b> | <b>Total Sample</b> |
| Expected frequency: | <input type="text" value="50"/> %  | 80%                     | <b>162</b>          | <b>162</b>          |
| Confidence limits:  | <input type="text" value="5"/> %   | 90%                     | <b>265</b>          | <b>265</b>          |
| Design effect:      | <input type="text" value="1.0"/>   | 95%                     | <b>373</b>          | <b>373</b>          |
| Clusters:           | <input type="text" value="1"/>     | 97%                     | <b>454</b>          | <b>454</b>          |
|                     |                                    | 99%                     | <b>630</b>          | <b>630</b>          |
|                     |                                    | 99.9%                   | <b>996</b>          | <b>996</b>          |
|                     |                                    | 99.99%                  | <b>1350</b>         | <b>1350</b>         |

**Appendix 8b: Sampling Process Study One**



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**Appendix 9: Information given to the School Heads and Heads of Departments**

| <b>Information items</b>  |
|---|
| 1. Background of the study  |
| 2. Study objectives and purpose   |
| 3. Participants inclusion and exclusion criteria                              |
| 4. Ethical issues- confidentiality, volunteerism, informed consent and assent |
| 4. Content evaluation of the questionnaire used in data collection            |
| 5. Recruitment process of participants  |
| 6. What is expected from teachers   |

**Appendix 10: Map of Botswana**



## Appendix 11: Physical Activity Readiness Questionnaire

### PAR-Q and YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 to 69, the Par-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly. Check YES or NO.

| YES                      | NO                       |   |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <b>1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?</b>            |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>2. Do you feel pain in your chest when you do physical activity?</b>   |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>3. In the past month, have you had chest pain when you are not doing physical activity?</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>4. Do you lose your balance because of dizziness or do you ever lose Consciousness?</b>  |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>5. Do you have a bone or joint problem (for example, back, neck, knee, or hip) that could be made worse by a change in your physical activity?</b> |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?</b>                           |
| <input type="checkbox"/> | <input type="checkbox"/> | <b>7. Do you know <u>any other reason</u> why you should not do physical activity?</b>  |

**if you answered** YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want—as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful to you.

**NO to all questions**

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active – begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal – this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

**DELAY BECOMING MUCH MORE ACTIVE:**

- If you are not feeling well because of a temporary illness such as a cold or a fever – wait until you feel better; **or**
- If you are or may be pregnant – talk to your doctor before you start becoming more active.

**PLEASE NOTE:** If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

**Informed use of the PAR-Q:** The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completion of this questionnaire, consult your doctor prior to physical activity.

**NOTE:** If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

SIGNATURE OF PARENT: \_\_\_\_\_ WITNESS: \_\_\_\_\_  
or GUARDIAN (for participants under the age of majority)

**NOTE: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.**

ParQ\_0805

## Appendix 12: Height and weight scale



## **Appendix 13: Information Sheet for Teachers (Study Two)**

### **Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial study.**

I invite you to assist me, as the PI, in implementing the planned intervention for my research study. This study will invite participation of junior secondary school students in urban areas who are aged 13-15 years.

### **What is the purpose of the study?**

Daily eating habits of adolescents have changed over the past ten years in Botswana. This has resulted in heart problems and high levels of blood sugar. The purpose of my study is:

1. To describe adolescents' eating habits and physical activity levels and the factors that influence healthy behaviour (Study One).
2. To find out if there is a change in eating habits and physical activity following a lifestyle intervention program (Study Two).

The activities of the study will entail:

- Delivering of different lessons on nutrition and physical activity for 1 hour weekly after school for 8 weeks.

### **Who is doing the study?**

I Mrs Gaonyadiwe Lubinda-Sinombe, a Family Nurse Practitioner is the primary researcher and I will be assisted by 4 senior university students studying health courses and a nutritionist and physiotherapist.

### **Does the study have ethics approval?**

The study has been approved by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (REF REC 631/2014), the Ministry of Health Research Ethics Committee, and Ministry of Education Research Ethics Committee, Directors of Secondary Schools, Heads of Schools and teachers. I am here to ask if you will agree to deliver the intervention to students for one hour per day for 12 weeks.

### **What is required of you?**

- You will be requested to volunteer to train as an interventionist and deliver the intervention to students.
- If you agree to volunteer you will be trained by a nutritionist and physiotherapist and principal investigator on how to deliver the intervention for two hours per day for two days.

### **Reimbursement for participation**

You will be paid R150.00 per hour.

### **What if something goes wrong?**

Lifestyle intervention

---

The University of Cape Town (UCT) undertakes that in the event of you suffering any significant deterioration in health or well-being, or from any unexpected sensitivity or toxicity, that is caused by your participation in the study, it will provide immediate medical care. UCT has appropriate insurance cover to provide prompt payment of compensation for any trial-related injury according to the guidelines outlined by the Association of the British Pharmaceutical Industry, ABPI 1991. Broadly-speaking, the ABPI guidelines recommend that the insured company (UCT), without legal commitment, should compensate you without you having to prove that UCT is at fault. An injury is considered trial-related if, and to the extent that, it is caused by study activities. You must notify the study doctor immediately of any side effects and/or injuries during the trial, whether they are research related or other complications.

UCT reserves the right not to provide compensation if, and to the extent that, your injury came about because you chose not to follow the instructions that you were given while you were taking part in the study. Your right in law to claim compensation for injury where you prove negligence is not affected.

**Who to contact if you have any questions or concerns about the study**

**You may contact the following:**

Researcher: Gaonyadiwe Lubinda-Sinombe  
PhD candidate  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel: +27 83 715 6039  
Email:gaonyadiwesinombe@yahoo.com

Supervisor: Dr Una Kyriacos  
Division of Nursing and Midwifery  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel:+ 27-21-4066410

**HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

Faculty of Health Sciences  
Room E52-24 Groote Schuur Hospital Old Main Building  
OBSERVATORY  
7925  
Professor Marc Blockman TEL: +27 21-406 6626

**MINISTRY OF HEALTH HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

24 Amos Street  
Government Enclave  
Gaborone  
Botswana  
Tel: +267 363 2400  
Toll free customer number: 08006007400

.....

.....

Name and signature of witness

date

Thank you

## **Appendix 14: Week 2 nutrition slides**

### **What is nutrition**

- It is the study of food and how the body uses food

### **What is a balanced diet**

- Combination of macronutrients which are; carbohydrates, proteins and fats and micronutrients which are vegetables and fruits; vitamins and minerals that the body need daily.

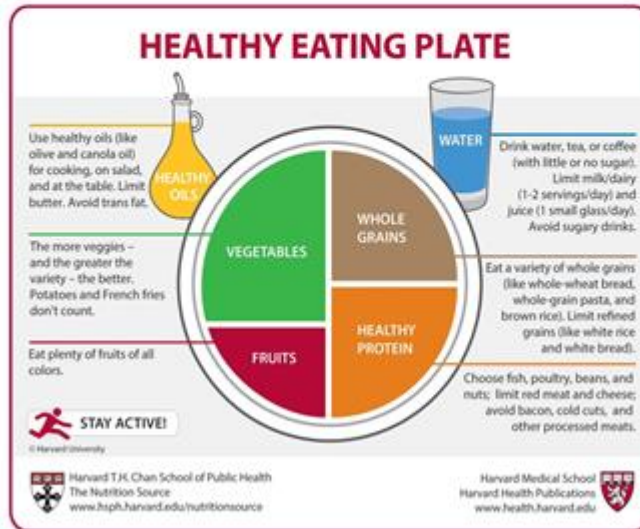
## Carbohydrates

- Simple carbohydrates-single sugar units-glucose, fructose, sucrose
- complex carbohydrates-dietary starches and indigestible starches that make dietary fiber
- They give body energy

## Grains



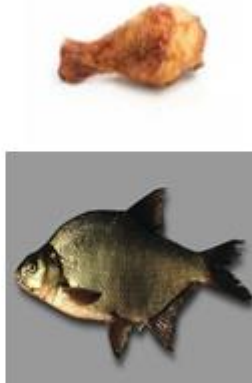
## How much to eat per day



## Proteins

- Foods that repair body tissues and build the body such as meat, fish, nuts, beans, lentils, etc.
- They are broken down into amino acids
- and they give the body energy

## Beans & meat



## How much to eat per day

- **Protein power – ¼ of your plate:**
- Fish, chicken, beans, and nuts are all healthy, [protein](#) sources
- they can be mixed into salads, and pair well with vegetables on a plate.
- Limit red meat, and avoid processed meats such as bacon and sausage.

## Fats

- They give body energy
- Solid fats such as butter, margarine (unhealthy)
- Liquid fats are healthy for the body such as olive, canola, unrefined vegetable oils
- They should be eaten sparingly or moderately

## How much to eat per day

- Eat fats sparingly
- Choose healthy oils like olive, canola, soy, corn, sunflower, peanut, and others, and avoid partially hydrogenated oils, which contain unhealthy trans fats e.g. ordinary oils.
- Remember that a label low fat might not always mean low fat because it might not be true.

Michael Pollen, 2009



## Benefits of healthy eating

- Increased immunity
- Improve performance at school
- Prevention of diseases such as diabetes, high blood, Cancer, and obesity

## Dangers of unhealthy eating

- Overweight/obesity
- Diseases such as diabetes, high blood pressure, cancer, etc
- Poor performance at school

Appendix 15: Control arm recruitment flyer



**LIFESTYLE MOVEMENT STUDY  
(LIMO)**

**ATTENTION: BOYS AND GIRLS WHO  
PARTICIPATED IN STUDY ONE**

**Would you like to learn about a healthy lifestyle?  
Would you like to know why a healthy lifestyle is  
important? The LIMO STUDY is open to those who  
participated in STUDY ONE. In this study you will  
receive information about a healthy lifestyle.**

**COME JOIN US FOR INFORMATION SHARING AND  
YOU WILL BE GIVEN P20.00 FOR PARTICIPATING  
IN THE STUDY.**

**Appendix 16: Recruitment flyer for the intervention arm**

**LIFESTYLE MOVEMENT STUDY (LIMO)**

**ATTENTION: BOYS AND GIRLS WHO PARTICIPATED IN  
STUDY ONE**

**Would you like to learn about a healthy lifestyle? Would you like to know why a healthy lifestyle is important? The LIMO STUDY is open to those who participated in STUDY ONE. In this study you will receive information AND skills about a healthy lifestyle.**

**COME JOIN US FOR INFORMATION SHARING AND PRACTICALS AND YOU WILL BE GIVEN P10.00 WEEKLY.**

## **Appendix 17: Nutrition and physical activity information for the control arm**

### 1. Starch/carbohydrates

**Function**-provides energy

Daily recommended amount to be eaten-Teenagers need 45-65% daily=225-325g

**Sources**-

- complex-rice, maize-meal, sorghum, potatoes
- Simple-table sugar, fruits

Fiber-soluble and insoluble:

- Soluble fiber keeps gut healthy and balance sugar in the body and
- Insoluble-prevents constipation –these are fruits and vegetables-for example traditional fruits and vegetables- (MOROGO WA DINAWA, DELELE, THEPE, ROTHWE).

### 2. Proteins-

**Functions**-boost body immunity, builds muscles and tissues, transport chemicals in the body for chemical reactions, and maintains fluid distribution in the body.

Daily recommended amount to be eaten -Teenagers need 10-15%=52g per day

**Sources**- eggs, chicken, fish, red meat, cheese, yogurt, tofu, nuts, beans, lentils, whole grains

### 3. Fats-

**Function**-provides energy as well.

**Sources**-

- Animal –saturated, unhealthy fat
- Vegetables- nuts and seeds-healthy fat, vegetable oils, solid oils they have saturated (margarine),
- The use of liquid oil is recommended.

**NB: Variety and use in moderation OF ALL FOODS is the key to healthy lifestyle.**

## **BENEFITS OF PHYSICAL ACTIVITY**

1. Makes bones, muscles and joints healthy
2. Makes heart and lungs healthy
3. Good coordination and movement
4. Maintains a healthy body weight
5. Life longevity (WHO, 2011)

**PHYSICAL ACTIVITY INTENSITY**

1. Light-scaled 0-4, does not require much effort
2. Moderate-scaled 5-6, make heart, lungs, muscles work harder. One can talk but not sing
3. Vigorous- scaled 7-8, make heart, lungs and muscles work harder, one can hardly speak coz of loss of breath

**TYPES OF PHYSICAL ACTIVITY AND EXAMPLES**

1. Aerobics-run, jog, swim, dance, jump jacks and soccer
2. Muscle strengthening-push-ups, sit-ups, weight lifting, climbing stairs, digging in the garden
3. Bone strengthening-similar to aerobics
4. Stretching-touch toes, side stretches and yoga

## Appendix 18: Week one power point slides

### THE BACKGROUND OF STUDY TWO

- Background of lifestyle issues
- 1. Eating habits
- 2. Physical activity (PA)
- 3. Lack of nutrition knowledge
- 4. Poor intentions and self-efficacy to change lifestyle behaviors

### EATING HABITS

- Eating of fat, sugary and snacks
- Need to reduce the above
- Increase of fruits and vegetables intake
- Improve eating a balanced diet daily

### PHYSICAL ACTIVITY (PA)

- Decrease in physical activity
- increase in use of transportation
  - Increase in sedentary behaviors
  - Need to reduce sedentary and transportation

Lifestyle intervention

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NUTRITION KNOWLEDGE

- Lack of nutrition knowledge on benefits of healthy diet,
- composition of healthy diet-balanced diet, and unhealthy diet
- Food nutrients
- Healthy beverages

INTENTIONS AND SELF-EFFICACY TO CHANGE LIFESTYLE BEHAVIORS

- Intentions to eating and PA
- Self-efficacy to eating and PA

IMPACT ON HEALTH

- Nutrition related health benefits
- Nutrition related health problems
- PA related health benefits and problems

## OBJECTIVE OF STUDY TWO

**The objectives are to establish whether the lifestyle intervention program results in significant differences in improving:**

- eating habits between the intervention and control group;
- physical activity behaviors between the intervention and control group;
- nutritional knowledge between the intervention and control group;

## PARTICIPANTS' EXPECTATIONS

- Attend all weekly sessions of the LIMO INTERVENTION PROGRAM FOR 1 HOUR AFTER SCHOOL
- To be punctual
- Bring along the issued limo intervention program schedule and your dairy/pocket book to every session
- To set your own personal realistic lifestyle goals
- Write your signature against your name in the weekly attendance register
- **NOTE: IF YOU MISS 2 OR MORE OF THE WEEKLY SESSIONS YOU WILL AUTOMATICALLY BE REMOVED FROM THE STUDY.**

## **Appendix 19: Information sheet for participants in Study Two (control arm)**

Participant code number.....

### **Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial study**

I invite you to participate in a research Study Two since you participated in Study One. This study is for junior secondary school students in urban areas.

### **What is the purpose of the study?**

Daily eating habits of adolescents have changed over the past ten years in Botswana. This has resulted in heart problems and high levels of blood sugar. The purpose of my study is:

1. To find out if there is a change in eating habits and physical activity following a lifestyle intervention program (Study Two).

The activities of the study will entail:

1. Receiving educational material at the beginning of the study.
2. Filling in a questionnaire prior to receiving educational material.
3. Filling in a questionnaire on eating habits and physical activity, nutrition knowledge, and show your willingness and readiness to change your lifestyle at the end of 8 weeks
4. You will be checked for weight, and have your height and waist circumference checked at the end of the 8 weeks. If you are a girl, a female research assistant will take your measurements. If you are a boy, a male research assistant will take your measurements.

The tests and questions will allow me to find out your eating habits and physical activity and factors that influence them and if there has been a change in your eating habits and physical activity.

### **Who is doing the study?**

I Mrs Gaonyadiwe Lubinda-Sinombe, a Family Nurse Practitioner is the student researcher and I will be assisted by 4 senior university students studying health courses and/or a nutritionist.

### **Does the study have ethics approval?**

The study has been approved by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (REF REC 631/2014), the Ministry of Health Research Ethics Committee, and Ministry of Education Research Ethics Committee, Directors of Secondary Schools, Heads of Schools and teachers. I am here to ask if you will agree to participate in the study voluntarily and if so, you and your parents or legal guardians are now being asked to participate voluntarily once you are satisfied and clear about what the study entails.

## Lifestyle intervention

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### What is required of you?

1. You will be requested to volunteer to participate in study and to sign the assent form.
2. If you agree to participate in study you will be asked to give information about the study to your parents or legal guardians as reflected in the consent forms in Setswana ( to parents who prefer Setswana) or English (to parents who prefer English) and ask them to complete the consent form and return it to your teachers.
3. You will be asked to fill in a questionnaire, and have your weight, height and waist circumference checked at the end of the lessons.

### Confidentiality and anonymity

Information collected from you will not be shared with anyone. Questionnaires will be coded by number and not your name to maintain confidentiality. All completed questionnaires will be kept in a locked filing cabinet and only the researcher will have the key to the cabinet, and data entry and analysis will be entered and kept in a password protected computer. You will have weight, height and waist circumference measured at a time and in a designated male or female room and privacy will be provided.

Weight, height and waist circumference charts for boys and girls will be used for recording the information. The charts will only contain a participant unique code number and your age. You are requested to allow your parents/guardians, school teachers and some health professionals to play a role in supporting you to meet the requirements of the study at a given time that will be communicated to them.

### Risks

The study will not put you at psychological risk. You might experience some psychological or social risk in relation to removing shirts or undressing up to waist level but you keep your underclothes on to be checked for weight, height and waist circumference. This will be minimized by separating test sites for girls and boys and each participant will be tested by a person of the same gender in a private room out of sight of other students. The study carries minimal risk such as muscle soreness that follows when one engages in an activity. If you feel uncomfortable you may stop the activity at any time. Most sessions will be guided by your physical education teachers and research team, who will explain the right way of doing the exercises.

### Benefits

If you volunteer again to participate in Study Two you will benefit from the knowledge and skills that will motivate you for life to eat healthily and to do physical activities. You will be given P20 at the end of the study.

### Autonomy

You may choose to take part in the study or not. Even if you choose to participate now and later change your mind, you can do so without fear of being punished, loss of your place at school or strained relationships with your teachers. If you want to quit, you can do so without being requested to give reasons.

### Reimbursement for participation

There is no reimbursement for participating in the study.

Lifestyle intervention

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**What if something goes wrong?**

The University of Cape Town (UCT) undertakes that in the event of you suffering any significant deterioration in health or well-being, or from any unexpected sensitivity or toxicity, that is caused by your participation in the study, it will provide immediate medical care. UCT has appropriate insurance cover to provide prompt payment of compensation for any trial-related injury according to the guidelines outlined by the Association of the British Pharmaceutical Industry, ABPI 1991. Broadly-speaking, the ABPI guidelines recommend that the insured company (UCT), without legal commitment, should compensate you without you having to prove that UCT is at fault. An injury is considered trial-related if, and to the extent that, it is caused by study activities. You must notify the study doctor immediately of any side effects and/or injuries during the trial, whether they are research related or other complications.

UCT reserves the right not to provide compensation if, and to the extent that, your injury came about because you chose not to follow the instructions that you were given while you were taking part in the study. Your right in law to claim compensation for injury where you prove negligence is not affected.

**Dissemination of study findings**

Upon completion of the study, the PI will inform you about the research findings through posters and you will be given a thank you letter containing research findings to give to your parents.

**Who to contact if you have any questions or concerns about your rights or welfare as research participants?**

**You may contact the following:**

Researcher: Gaonyadiwe Lubinda-Sinombe  
PhD candidate  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel: +27 83 715 6039  
Email:gaonyadiwesinombe@yahoo.com

Supervisor: Dr Una Kyriacos  
Division of Nursing and Midwifery  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel:+ 27-21-4066410

**HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

Faculty of Health Sciences  
Room E52-24 Groote Schuur Hospital Old Main Building  
OBSERVATORY  
7925  
Professor Marc Blockman TEL: +27 21-406 6626

**MINISTRY OF HEALTH HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

24 Amos Street  
Government Enclave  
Gaborone  
Botswana

Tel: +267 363 2400

Toll free customer number: 08006007400

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**ASSENT TO PARTICIPATE IN A RESEARCH STUDY**

**Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial pilot study.**

I \_\_\_\_\_ have read the provided Information Sheet/or had it read to me. I understand what is required of me, as a participant. I have had all my questions answered. I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can leave the study at any time if I wish and that it will have no bad consequences for me.

.....

Respondent's Signature

.....

Date

.....

Name and signature of witness

.....

Date

THANK YOU FOR YOUR TIME

## **Appendix 20: Information sheet for participants in Study Two (intervention arm)**

Participant code number.....

### **Study Title**

#### **An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial**

I invite you to participate in a research Study Two since you participated in Study One. This study is for junior secondary school students in urban areas.

#### **What is the purpose of the study?**

Daily eating habits of adolescents have changed over the past ten years in Botswana. This has resulted in heart problems and high levels of blood sugar. The purpose of my study is:

1. To find out if there is a change in eating habits and physical activity following a lifestyle intervention

program (Study Two).

The activities of the study will entail:

1. Attending different lessons for 1 hour weekly after school for 8 weeks.
2. Filling in a questionnaire prior to start of the weekly lessons.
3. Filling in a questionnaire on eating habits and physical activity, nutrition knowledge, and show your willingness and readiness to change your lifestyle, readiness to perform physical activity.
4. You will be checked for weight, and have your height and waist circumference checked at the end of the lessons. If you are a girl, a female research assistant will take your measurements. If you are a boy, a male research assistant will take your measurements.

The tests and questions will allow me to find out your eating habits and physical activity and factors that influence them and if there has been a change in your eating habits and physical activity after attending some lessons and demonstrations on healthy lifestyle.

#### **Who is doing the study?**

I Mrs Gaonyadiwe Lubinda-Sinombe, a Family Nurse Practitioner is the student researcher and I will be assisted by 4 senior university students studying health courses and a nutritionist.

#### **Does the study have ethics approval?**

The study has been approved by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (REF REC 631/2014), the Ministry of Health Research Ethics Committee, and Ministry of Education Research Ethics Committee, Directors of Secondary Schools, Heads of Schools and teachers. I am here to ask if you will agree to participate in the study voluntarily and if so, you and your parents or legal guardians are now being asked to participate voluntarily once you are satisfied and clear about what the study entails.

#### **What is required of you?**

## Lifestyle intervention

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- You will be requested to volunteer to participate in study and to sign the assent form.
- If you agree to participate in study you will be asked to give information about the study to your parents or legal guardians as reflected in the consent forms **in Setswana ( to parents who prefer Setswana) or English (to parents who prefer English)** and ask them to complete the consent form and return it to your teachers.
- You will be asked to fill in a questionnaire, and have your weight, height and waist circumference checked at the end of the lessons.

### **Confidentiality and anonymity**

Information collected from you will not be shared with anyone. Questionnaires will be coded by number and not your name to maintain confidentiality. All completed questionnaires will be kept in a locked filing cabinet and only the researcher will have the key to the cabinet, and data entry and analysis will be entered and kept in a password protected computer. You will have weight, height and waist circumference measured at a time and in a designated male or female room and privacy will be provided.

Weight, height and waist circumference charts for boys and girls will be used for recording the information. The charts will only contain a participant unique code number and your age. You are requested to allow your parents/guardians, school teachers and some health professionals to play a role in supporting you to meet the requirements of the study at a given time that will be communicated to them.

### **Risks**

The study will not put you at psychological risk. You might experience some psychological or social risk in relation to removing shirts or undressing up to waist level but you keep your underclothes on to be checked for weight, height and waist circumference. This will be minimized by separating test sites for girls and boys and each participant will be tested by a person of the same gender **in a private room out of sight of other students.** The study carries minimal risk such as muscle soreness that follows when one engages in an activity. If you feel uncomfortable you may stop the activity at any time. Most sessions will be guided by your physical education teachers and research team, who will explain the right way of doing the exercises.

### **Benefits**

If you volunteer again to participate in Study Two you will benefit from the knowledge and skills that will motivate you for life to eat healthily and to do physical activities. You will be given P10.00 weekly and a certificate of participation at the end of 8 weeks.

### **Autonomy**

You may choose to take part in the study or not. Even if you choose to participate now and later change your mind, you can do so without fear of being punished, loss of your place at school or strained relationships with your teachers. If you want to quit, you can do so without being requested to give reasons.

### **Reimbursement for participation**

There is no reimbursement for participating in the study.

### **What if something goes wrong?**

The University of Cape Town (UCT) undertakes that in the event of you suffering any significant deterioration in health or well-being, or from any unexpected sensitivity or toxicity that is caused by your participation in the study it will provide immediate medical care. UCT has appropriate insurance cover to provide prompt payment

Lifestyle intervention

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of compensation for any trial-related injury according to the guidelines outlined by the Association of the British Pharmaceutical Industry, ABPI 1991. Broadly-speaking, the ABPI guidelines recommend that the insured company (UCT), without legal commitment, should compensate you without you having to prove that UCT is at fault. An injury is considered trial-related if, and to the extent that, it is caused by study activities. You must notify the study doctor immediately of any side effects and/or injuries during the trial, whether they are research related or other complications.

UCT reserves the right not to provide compensation if, and to the extent that, your injury came about because you chose not to follow the instructions that you were given while you were taking part in the study. Your right in law to claim compensation for injury where you prove negligence is not affected.

**Dissemination of study findings**

Upon completion of the study, the PI will inform you about the research findings through posters and you will be given a thank you letter containing research findings to give to your parents.

**Who to contact if you have any questions or concerns about your rights or welfare as research participants?**

**You may contact the following:**

Researcher: Gaonyadiwe Lubinda-Sinombe  
PhD candidate  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel: +27 83 715 6039  
Email:gaonyadiwesinombe@yahoo.com

Supervisor: Dr Una Kyriacos  
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Faculty of Health Sciences  
University of Cape Town  
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**MINISTRY OF HEALTH HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

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Gaborone  
Botswana  
Tel: +267 363 2400  
Toll free customer number: 08006007400

**ASSENT TO PARTICIPATE IN A RESEARCH STUDY**

**Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial pilot study.**

I \_\_\_\_\_ have read the provided Information Sheet/or had it read to me. I understand what is required of me, as a participant. I have had all my questions answered. I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can leave the study at any time if I wish and that it will have no bad consequences for me.

.....

.....

Respondent's Signature

Date

.....

.....

Name and signature of witness

Date

THANK YOU FOR YOUR TIME

## Appendix 21: Workshop for interventionists power point training slides

Study Two background

**Study one objectives-**


- Prevalence of overweight, describe eating habits, physical activity behaviors, influence on food choice and preferences, nutrition knowledge, level of intention to change behavior and level of self efficacy to change.
- A baseline for Study Two

Balanced lifestyle



The graphic features the text "Lifestyle Balance" in a blue, curved font at the top. Below it is a black horizontal line representing a balance scale. On the left side of the scale is a red apple and a yellow banana. On the right side is a black silhouette of a person walking. Below the scale, the words "Healthy Eating" and "Being Active" are written in black, separated by a black triangle pointing upwards.

Evolving healthy lifestyle



The graphic shows a colorful pyramid divided into five sections: green (vegetables), red (fruit), blue (milk), yellow (grains), and purple (meat & beans). To the left of the pyramid is a black silhouette of a person climbing a set of white stairs. The text "MyPyramid" is written in black at the top right of the pyramid, with "MyPyramid" in a smaller font below it. At the base of the pyramid are various food items like a carrot, apple, banana, bread, and meat.

## Videos watched

- Health tips by the CDC, 2000
- Awesome motivational video for 4 minutes followed by discussion
- Video by CDC on active children and adolescents for 7 minutes followed by discussion,
- Introduction to child nutrition by Stanford School of Medicine for 3 minutes followed by discussion

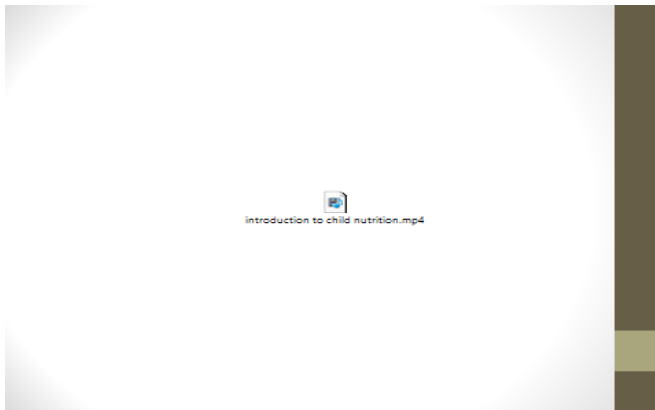
## Summary of Study One preliminary results

1. Meal frequency-high sugar and snack intake,
2. Meal habits- coffee and bread and sugar at breakfast, biscuits and nknaks mostly snacks eaten, fresh chips followed by fat cakes are foods mostly eaten.
3. Influence on food- sometimes TV but mostly parents, eat while watching TV- snacks; popcorn, biscuits.  
Mostly preferred food is rice and chicken, and snacks

## Conti...

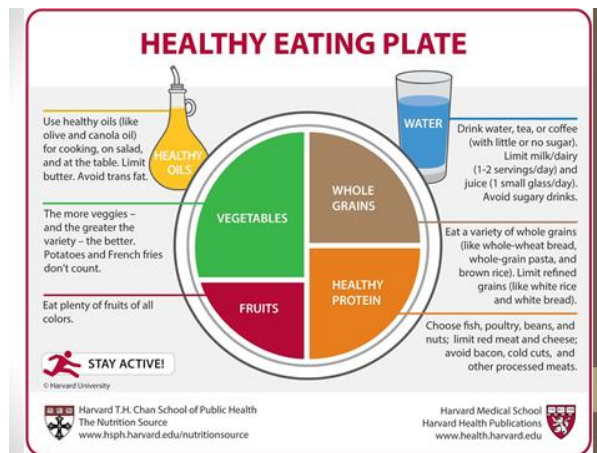
4. Physical activity-not adequate
5. Nutrition knowledge-generally inadequate
6. Intention for healthy eating and exercise-very good
7. Self efficacy for healthy eating and exercise-very good
8. 16.7% of overweight in public schools in Gaborone by Body mass index and Waist Circumference.

Lifestyle intervention



- Eating habits-NEED TO CHANGE
- Regular meals
  - Increase of fruits and vegetables intake
  - Improve eating a balanced diet daily
  - Increase awareness, motivation and skills
  - Reduce snacks, sweets, fresh chips, fat cakes





#### Barriers to healthy eating

- Lack of information on healthy eating,
- Contradictory and inconsistent messages on healthy eating
- Lack of motivation to eat healthy
- No time to prepare healthy meals

(Abdulrahman, et al. 2013; Story, et al. 2002; Stevenson, et al. 2007)

#### CONTI...

- Food preferences
- Failing to balance between health and taste (not considering diet as a whole)
- Healthy diet is seen as a quick fix for health problems (overweight/obesity, NCDs) but not as a way of preventing future health problems.

## Lifestyle intervention

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### How to overcome barriers

- Healthy eating should be a goal in its own right
- Set health personal goals
- Provide consistent messages and information on importance of balanced diet
- Motivation-videos and speaking, peer counseling, and monitoring and support
- Demonstrate preparation of simple healthy meals

### Physical activity (PA)-Need for change

- Decrease in sedentary behaviors
- Need to reduce use of transportation
- Promote exciting physical activities

### Benefits of PA

- Makes bones, muscles and joints healthy
- Makes heart and lungs healthy
- Good coordination and movement
- Maintains a healthy body weight
- Life longevity  
(WHO, 2011)

## Lifestyle intervention

---

### DOSAGE OF PA

- Light-scaled 0-4, does not require much effort,
- Moderate-scaled 5-6, make heart, lungs, muscles work harder, Such that one can talk but not sing,
- Vigorous- scaled 7-8, make heart, lungs and muscles work harder, one can hardly speak coz of loss of breath.

### Impact poor eating and low PA on health

- Overweight/obesity,
- NCDs- cancer, diabetes, cardiovascular, respiratory diseases
- stigma and discrimination,
- poor memory/forgetfulness
- poor academic performance

### Objective of Study Two

**The objectives are to establish whether the lifestyle intervention program results in significant differences in improving:**

- eating habits between the intervention and control group;
- physical activity behaviors between the intervention and control group;
- nutritional knowledge between the intervention and control group;
- intention and self-efficacy for adopting a healthy lifestyle between the intervention and control group

## Lifestyle intervention

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### Intervention activities

#### Delivery of contents in the LIMO MANUAL

- Nutrition and PA education,
- Motivation- goal setting, peer counseling
- Behavioural skills- simple cooking demonstration

### Interventionists expectations

- The role of the interventionists will be to deliver the intervention to the participants in the intervention schools one hour per week after school as scheduled,
- Assist in making sure that voluntary participants attend all the intervention program sessions as scheduled.
- Assist in making sure that parents attend the scheduled activities

### Role of Research Assistants

- To attend all weekly sessions
- To register participants weekly
- To distribute relevant materials to participants weekly as guided by PI
- To record the deliberations of weekly sessions

### EXPECTATIONS FOR PARTICIPANTS

- Attend all weekly sessions of the LIMO program for 1 hour after school
- To be punctual
- Bring along the issued LIMO program schedule and diary/pocket book to every session
- To set own personal realistic lifestyle goals
- Weekly attendance registration
- **NOTE: IF 2 SESSION OR MORE OF THE WEEKLY SESSIONS ARE MISSED THE PARTICIPANT WILL AUTOMATICALLY BE REMOVED FROM THE STUDY.**

**Appendix 22: Workshop schedule for interventionists**

| <b>Time</b>        | <b>Activity</b>                         | <b>Facilitator</b> |
|--------------------|---|--------------------|
| 9:00-9:10 am       | Introductions                           | PI                 |
| 9:10-9:30 am       | Discussion on background of the study   | PI                 |
| 9:30-10:00         | Study Two                               | PI                 |
| <b>SHORT BREAK</b> |   |                    |
| 10:30-11 am        | Watching of videos                      | PI                 |
| 11-11:30 am        | Nutrition education                     | Nutritionist       |
| 11:30-12:00        | Physical activity education             | PI                 |
| 12:00-12:40        | LIMO program introduction and role play |                    |
| 12:40-13:00 hours  | Study Roles and Expectation             | PI                 |
| <b>LUNCH</b>       |   |                    |

## **Appendix 23: Information sheet for interventionists (Study Two)**

### **Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial study**

I invite you to assist me, as the PI, in implementing the planned intervention for my research study. This study will invite participation of junior secondary school students in urban areas who are aged 13-15 years.

### **What is the purpose of the study?**

Daily eating habits of adolescents have changed over the past ten years in Botswana. This has resulted in heart problems and high levels of blood sugar. The purpose of my study is:

1. To describe adolescents' eating habits and physical activity levels and the factors that influence healthy behaviour (Study One).
2. To find out if there is a change in eating habits and physical activity following a lifestyle intervention program (Study Two).

The activities of the study will entail:

- Delivering of different lessons on nutrition and physical activity for 1 hour weekly after school for 8 weeks.

### **Who is doing the study?**

I Mrs Gaonyadiwe Lubinda-Sinombe, a Family Nurse Practitioner is the primary researcher and I will be assisted by 4 senior university students studying health courses and a nutritionist and physiotherapist.

### **Does the study have ethics approval?**

The study has been approved by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (REF REC 631/2014), the Ministry of Health Research Ethics Committee, and Ministry of Education Research Ethics Committee, Directors of Secondary Schools, Heads of Schools and teachers. I am here to ask if you will agree to deliver the intervention to students for one hour per day for 12 weeks.

### **What is required of you?**

- You will be requested to volunteer to train as an interventionist and deliver the intervention to students.
- If you agree to volunteer you will be trained by a nutritionist and physiotherapist and principal investigator on how to deliver the intervention for two hours per day for two days.

### **Reimbursement for participation**

You will be paid R150.00 per hour.

## **Appendix 24: Information to Parents about Lifestyle Intervention study**

This is a study undertaken in fulfilment of a doctoral degree, at the University of Cape Town, funded by the University of Botswana. The Principal researcher, a family nurse practitioner and her team together with teachers trained specifically for the study will implement the intervention. The team will have name tag for identification purpose.

### **Rationale for the study**

Eating habits and lack of physical activity are implicated as the cause for overweight and diabetes, high blood pressure and cancer. Overweight teenagers are becoming a problem in Botswana. The Botswana government acknowledges overweight in children as a serious health problem that will increase the chances of high blood pressure, diabetes and cancer in future generations and prevention is the way to go. The study seeks to examine teenagers' eating habits and physical activity and to promote their health.

### **Study Expectations**

- Parents are asked to allow their children to participate in a lifestyle intervention for 8 weeks.
- Parents are asked to support and encourage their children to achieve their health goals of eating healthy and engaging in adequate physical activity during the study.
- Parents are asked to participate in some of the planned activities such as issuing of the certificates of participation at the end of the study that will be communicated to them in due course.

For further details contact:

Researcher: Gaonyadiwe Lubinda-Sinombe  
PhD student  
Department of Health and Rehabilitation Services  
Faculty of Health Sciences  
University of Cape Town

Supervisor: Dr Una Kyriacos  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel: 27-21-4066410

Tel: 27 83 715 6039

Email:gaonyadiwesinombe@yahoo.com

una.kyriacos@uct.ac.za

### **HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

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OBSERVATORY  
7925

Chairperson: Professor Marc Blockman TEL: +27 21-406 6626

### **MINISTRY OF HEALTH HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

24 Amos Street  
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## Lifestyle intervention

**Appendix 25: LIMO schedule**

| <b>Inter-vention week</b> | <b>Theme of the week</b>           | <b>Goal/objectives</b>  | <b>Activities</b>  | <b>Duration</b> | <b>Facilitators</b>                        |
|---------------------------|------------------------------------|---|--|-----------------|--|
| 1                         | <b>Getting to know each other!</b> | Objective-establishing rapport with students and PE and HE teachers                       | Introductions,<br>Distribution and discussions of program goals & schedules<br>Detailed explanation of expectations<br>Opportunity to ask questions and clarifications   | 1 hour          | Research Team, PE and HE teachers, parents |
| 2                         | <b>My health my priority</b>       | Objective-raise awareness and increase knowledge and promote healthy eating habits        | Nutrition and adolescent statistics,<br>Drama video by CDC-CCB<br>Biology Nutrition MB,CDC, SR for 10 minutes and CBC Biology Nutrition video GTG & ISV for 7 minutes followed by discussion on Benefits of proper nutrition,<br>Anatomy of habit<br>Recommended daily intake of carbohydrate, protein, fruits and vegetables, fats.<br>Reading of food labels.<br>Guide on setting of nutrition goals | 1 hour          | HE teacher and research team               |
| 3                         | <b>My health is in my hands</b>    | Objective-raise awareness and increase knowledge and promote physical activity behaviours | Background of physical activity and adolescent<br>What is physical activity, types of physical activity, duration, intensity, frequency,<br>Show video by CDC on active children and adolescents for 7 minutes followed by discussion,<br>Benefits of PA<br>Recommended daily physical activity<br>Setting of goals  | 1 hour          | PE teacher, researcher team                |
| 4                         | <b>I can do it</b>                 | Objective-personal goals review and re-setting, reinforce knowledge                       | Introduction to motivation.<br>Awesome motivational video for 4 minutes followed by discussion<br>Review of personal goals on nutrition and physical activity,<br>Barrier identification and problem solving, peer counselling and group counselling   | 1 hour          | Research team                              |
| 5                         | <b>I am on the move</b>            | Objective-increase physical activity  | Discussion on proper exercise posture,   | 1 hour          | PE teacher, guest lecturer,                |

## Lifestyle intervention

| Inter-vention week | Theme of the week             | Goal/objectives  | Activities  | Duration           | Facilitators  |
|--------------------|-------------------------------|--|---|--------------------|---|
|                    |                               | skills and promote good behaviours                               | Demonstrations of 6 m run for 6 minutes; practice at play grounds.<br>Review PA goals<br>Reinforce information on health-behaviour link<br>Distribution of pamphlets with overcoming barriers of physical activity to take home   |                    | research team   |
| 6                  | <b>Practice makes perfect</b> | Objective-reinforce knowledge and increase behavioural skills    | Cooking classes-display of colourful healthy food pictures, demonstrations, and practice to make simple healthy meals e.g fruit salad, vegetable salad.<br>Reinforce information on healthy-behaviour, food preferences,<br>Review eating goals<br>Distribution of pamphlets with overcoming barriers of eating habits to take home | 1 hour             | HE teacher, researcher, research assistants             |
| 7                  | <b>Let's get going</b>        | Objective-reinforce knowledge on physical activity, and practice | Aerobics from in the designated hall with energy music on the back ground for 30 minutes<br>Reinforce information on healthy-behaviour<br>Review of goals   | 1 hour             | PE teachers, research team                              |
| 8                  | <b>Wrapping up</b>            | Objective-develop coping and monitoring skills                   | Power point student presentations on challenges and successes and way forward.<br>Reinforce messages on healthy eating and physical activity.<br>Renewed goals shared with parents.<br><b>Closing Remarks by School Head, vote of thanks by researcher.</b>   | 1 hour, 30 minutes | Parents, research team, PE and HE teachers school head. |

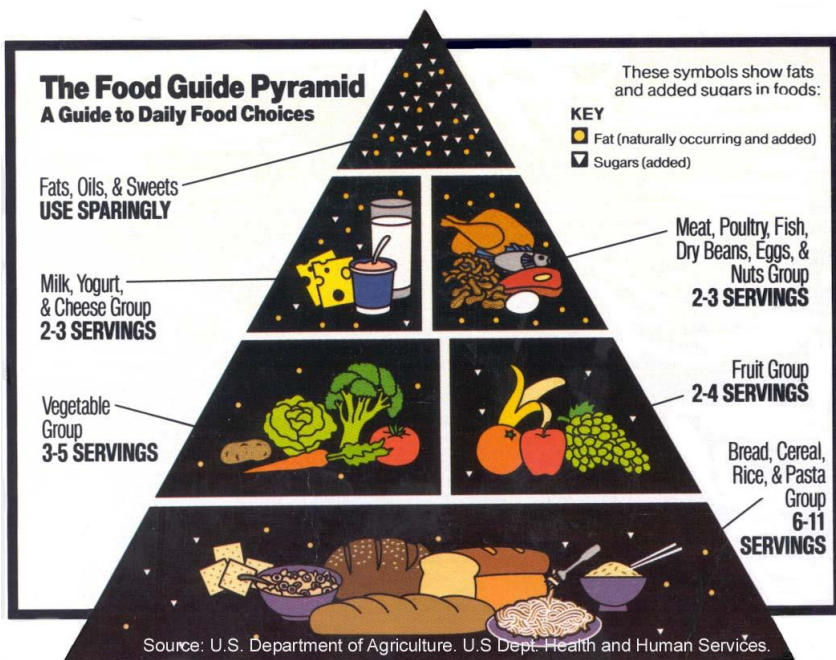
## **Appendix 26: Study Two participants' expectations**

YOU ARE REQUESTED TO DO THE FOLLOWING:

- Attend all weekly sessions of the LIMO intervention program for 1 hour after school
- To be punctual
- Bring along the issued LIMO intervention program schedule and your dairy/pocket book to every session
- To set your own personal realistic lifestyle goals
- Sign against your name in the weekly attendance register

**NOTE:IF YOU MISS 2 OR MORE OF THE WEEKLY SESSIONS YOU WILL AUTOMATICALLY BE REMOVED FROM THE STUDY.**

**Appendix 27a: Food pyramid**



## Appendix 27b: PA pyramid

According to the World Health Organisation, physical activity means **'any effort involving the muscle-skeletal system which entails higher energy consumption than that required during rest'**<sup>13</sup>

### Physical Activity Pyramid<sup>272</sup>



## **Appendix 28: Nutrition facts food Labels information sheet**

Nutrition facts label gives you information about what is contained in the food you are eating. This information includes nutrients in the food such as vitamins, minerals fat, protein etc. These nutrients are good for the body to grow and function well.

The nutrition facts label is written on the container/package of every food you buy from the supermarket or tuck-shop. Fresh foods do not necessarily have food labels.

The other information given on food containers are nutrient measurements such as amount of salt or sugar the food contains in grams or milligrams. Also the recommended daily intake is written on the foods containers/packages

### **Important:**

It is better and healthier to eat fresh foods and avoid packaged foods because they are highly processed and thereby not good for your health.

Always read nutrition facts label before you buy food so that you may know what you are eating.

---

**Appendix 29: The certificate of participation**

# CERTIFICATE OF PARTICIPATION

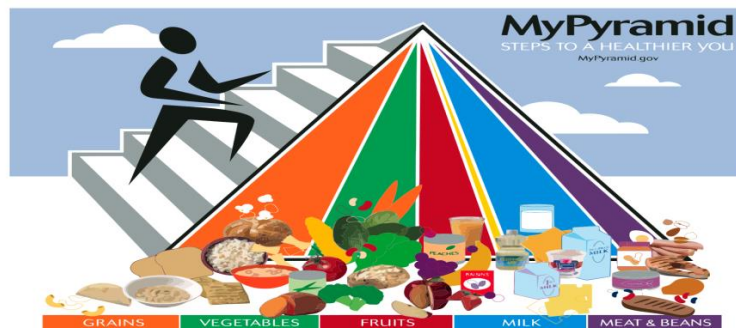
AWARDED TO

.....

For successfully participating in a Lifestyle Intervention Movement Program for 8 weeks

From 25<sup>th</sup> January to 14<sup>th</sup> March, 2016

GABORONE, BOTSWANA



---

Date

---

Ms Gaonyadiwe Lubinda-Sinombe (RN, MNS-FNP)  
PhD Nursing Student, Division of Nursing and  
Midwifery, Department of Health and Rehabilitation,  
University of Cape Town

### Appendix 30: Week 3 physical activity slides

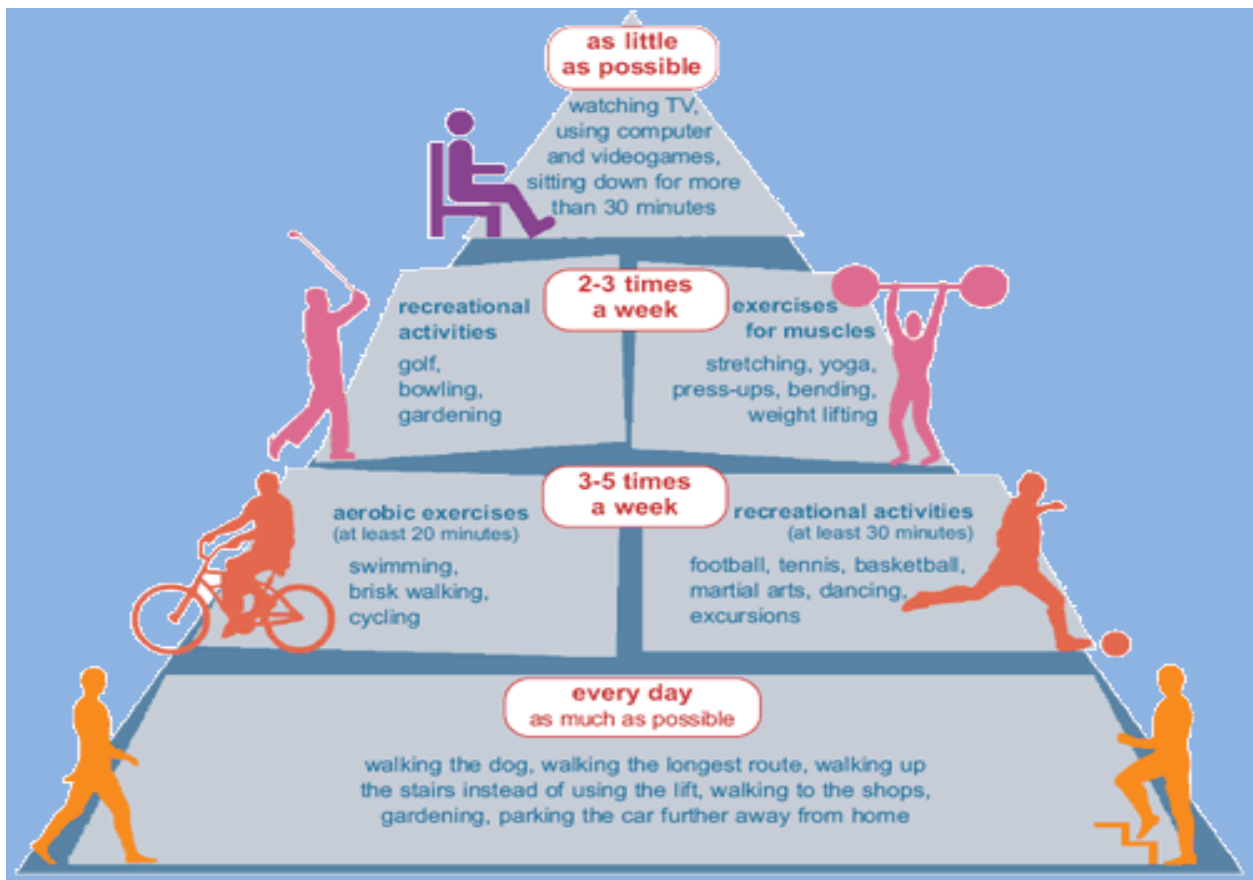
## What is physical activity

- **Physical activity:** as ‘any bodily movement that produces contractions of skeletal muscles and increase in energy expenditure, heart rate, and breathing’ (p.20).
- This definition therefore includes not only sporting activities but also simple daily activities such as walking, cycling, dancing, playing, gardening and housework.

## Example



Lifestyle intervention



## Types of PA

- AEROBICS-run, jog, swim, dance, jump jack



NIH Website.

- Muscle strengthening-pushups, sit-ups, weight lifting, climbing stairs, digging in the garden



- Bone strengthening-similar to aerobics
- Stretching-touch toes, side stretches, yoga etc



## Duration & frequency

- 60 minutes daily moderate or vigorous physical activity spread throughout the day
- Muscle and bone strengthening 3 times per week
- This is recommended adequate physical activity for 5-17 year olds

WHO, 2011

## Intensity

- Light-scaled at 0-4, it does not require much effort
- Moderate-scaled at 5-6, make heart, lungs, muscles work harder. One can talk but not sing
- Vigorous- scaled 7-8, make heart, lungs and muscles work harder, one can hardly speak coz of loss of breath

NIH

## Benefits of PA

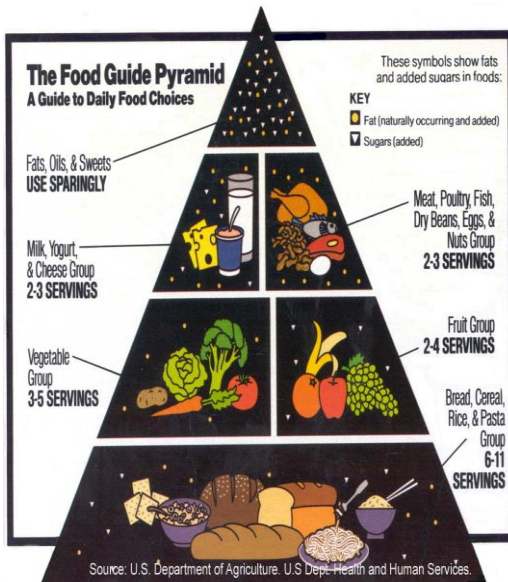
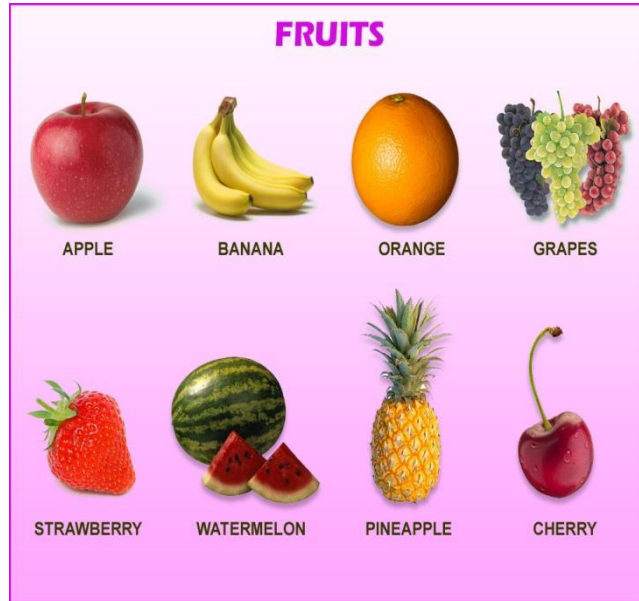
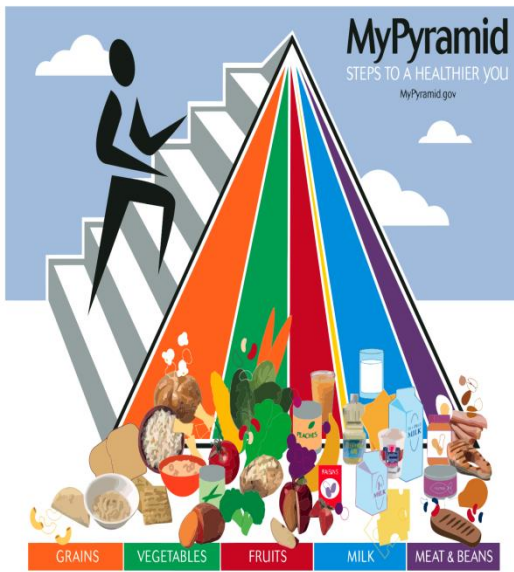
- Makes bones, muscles and joints healthy
- Makes heart and lungs healthy
- Good coordination and movement
- Maintains a healthy body weight
- It prolongs life

WHO, 2011

## **Regular and moderate physical activity**

- Prevent overweight/obesity
- improves **heart muscles**
- burns fats and improves the cholesterol level in the blood
- Helps fight stress
- An opportunity to socialize with others
- Keeps body in good shape.

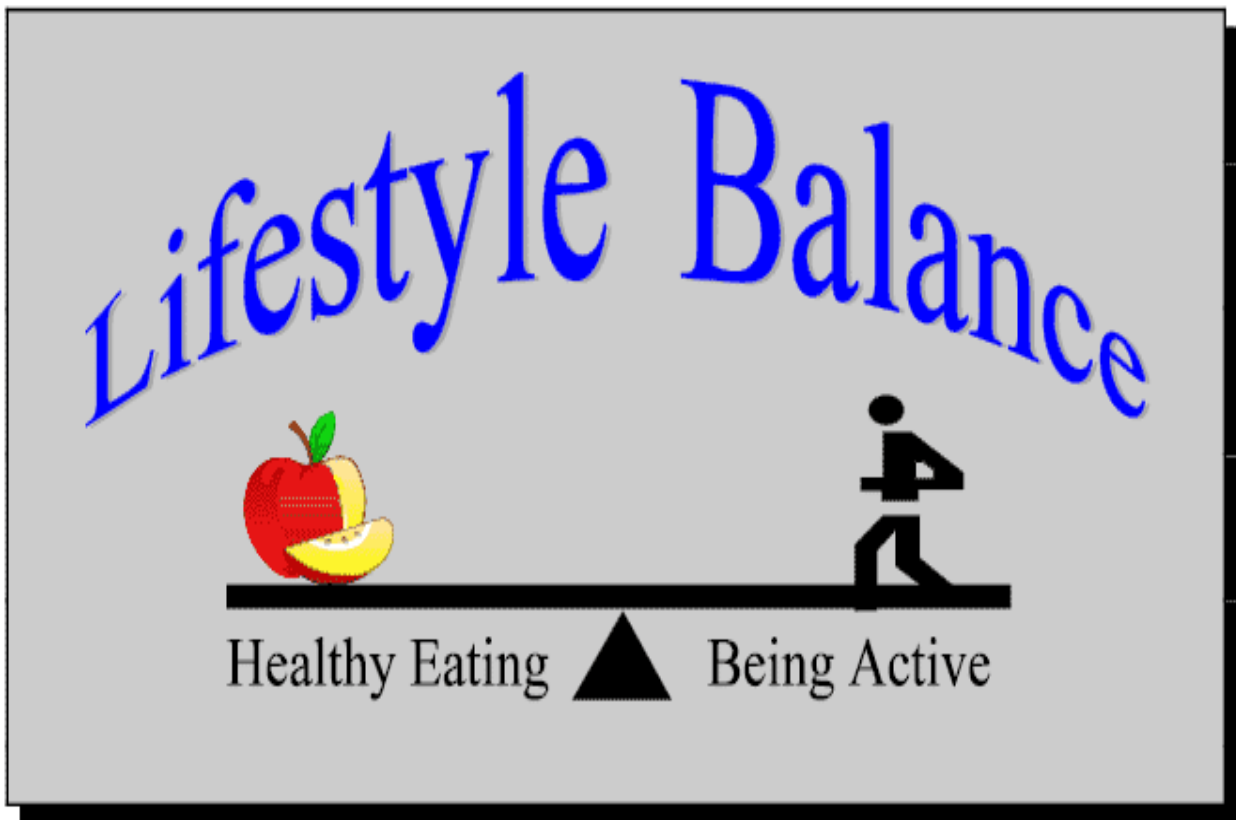
Appendix 31: Food Pictures



NB: pictures of a food pyramid and wild fruits

**Appendix 32: LIMO Manual for interventionists**

**THE LIFESTYLE  
INTERVENTION MOVEMENT  
(LIMO) FOR ADOLESCENTS  
IN JUNIOR SECONDARY**



**STUDY TITLE: AN EVALUATION OF THE EFFECTS OF A LIFESTYLE INTERVENTION ON EATING AND PHYSICAL ACTIVITY BEHAVIOURS OF URBAN ADOLESCENTS IN JUNIOR PUBLIC SECONDARY SCHOOLS IN BOTSWANA: A PRAGMATIC RANDOMISED CONTROLLED TRIAL PILOT STUDY**



**The objectives are to establish whether the lifestyle intervention program results in significant differences in:**

1. Improving eating habits between the intervention and control group;
2. Improve Physical activity behaviours between the intervention and control group;
3. Nutritional knowledge between the intervention and control group;
4. Intention and self-efficacy for adopting a healthy lifestyle between the intervention and control group

## Week 1

---

### **Theme: Getting to know each other!**

#### **Duration: 1 hour**

**Objective:** establishing rapport with students and PE and HE teachers and research team.

#### **Facilitator: Principal investigator**

#### **Activities of the day:**

- Introductions (20 minutes)

The school head

Research team

Students and parents will introduce themselves

Principal investigator thanks everyone for coming to the meeting

- Background of the study(30 minutes)

The background of Study Two and its objective

Background of lifestyle issues and its impact on health of adolescents

Distribution and discussions of program goals & schedules

Detailed explanation of expectations and questions and clarifications

## WEEK 2

---

### **Theme: My health my priority**

**Duration: 1 hour**

**Objective**-raise awareness, increase knowledge, promote healthy eating habits

**Facilitator/s: HE teacher and research team**

#### **Activities of the day:**

- Video watching

Drama video by CDC-CCB Biology Nutrition MB,CDC, SR for 10 minutes and CBC Biology Nutrition video GTG & ISV for 7 minutes (20minutes)

- Discussion on Benefits of proper nutrition, and questions led by participants (10 minutes).

Healthy benefits to be emphasized.

**Let participants repeat: My health my priority**

- Teach participants the recommended daily intake of starch, protein, fruits, vegetables and fats (10 minutes).
- Research assistants will display charts: containing food groups and recommended daily intake on the notice board.

**Two students will read out from each chart to the group of participants**

**Break .....break.....break.....break.....break (5 minutes body stretching)**

- Reading of food labels.

Let the research assistants distribute food packets and participants to read out ingredients in each food packet followed by discussion on tips of choosing healthy foods and questions (10 minutes).

- Summary of activities of the day and guide participants to set nutrition goals (5 minutes)

Principal investigator will assist participants to make goals for healthy eating and practices.

Distribution of information leaflets on how to overcome barriers of eating habits to take home.

## Week 3

---

### **Theme: My health is in my hands**

**Duration: 1 hour**

**Objective**-raises awareness and increase knowledge and promote physical activity behaviours

**Facilitator/s: PE teacher, researcher team**

#### **Activities of the day:**

- Watching video on physical activity

Show video by CDC on active children and adolescents for 7 minutes followed by discussions and questions (15 minutes)

- Physical activity (PA) and adolescent health (20 minutes)

Including definition of physical activity, types of physical activity, duration, intensity, frequency, benefits of PA and recommended daily PA for adolescents

**Let students repeat: My health is in my hands**

Summary of activities of the day (5 minutes)

**Break .....break.....break.....break.....break (5 minutes body stretching)**

- Setting of PA goals (5 minutes)

Principal investigator will assist participants to make goals for daily PA.

Distribution of information leaflets on PA to take home.

## Week 4

---

### **Theme: I can do it**

**Duration: 1 hour**

**Objective**-personal goals review and re-setting, reinforce knowledge

**Facilitator/s: HE teacher and Research team**

#### **Activities of the day:**

- **Watching video**

Awesome motivational video for 4 minutes followed by discussion and questions (10 minutes)

- Review of personal goals on healthy eating and practices and PA behaviours (30 minutes)

**Research assistants to pin the charts with food pyramids and recommendation daily intake on the notice board**

Let all participants take out their goals they set the previous 2 days.

Participants form 4 groups, and share their goals with each other.

Encourage them to identify barrier if any.

The Principal investigator and HE teacher provide problem solving skills, peer counselling and group counselling if necessary.

**Let students repeat: I can do it**

**Break .....break.....break.....break.....break (5 minutes body stretching)**

- Time for questions and clarifications (5 minutes)
- Summary of the activities of the day (5 minutes)

## Week 5

---

### **Theme: Practice makes perfect**

**Duration: 1 hour**

**Objective**-reinforces knowledge and increase behavioural skills

**Facilitator/s: HE teacher and Research team**

#### **Activities of the day:**

- Cooking demonstrations of simple meals (40 minutes)

Display of colourful healthy food pictures

Demonstrate to participants how to make simple healthy meals e.g. fruit salad, vegetable salad and fruit smoothie (video).

Let participants divide into 4 groups and collect necessary equipment, food items for practice

Reinforce information on healthy behaviour (influence of food choice and preferences, and benefits of healthy foods)

#### **Let students repeat: Practice makes perfect**

**Break .....break.....break.....break.....break (5 minutes body stretching)**

- Review healthy eating goals and evaluation(10 minutes)
- Summary of activities of the day (5 minutes)

Distribution of simple recipes information leaflets to take home by nutritionists.

## Week 6

---

### **Theme: I am on the move**

**Duration: 1 hour**

**Objective**-increase physical activity skills and promote good behaviours

**Facilitator/s:** PE teacher and Research team

#### **Activities of the day:**

- Demonstrations of 6 m run for 6 minutes (25 minutes)

Let all participants put on their PA attire and go to the play grounds.

- Aerobics in the designated hall with energy music on the background for 20 minutes

#### **Let students repeat: I am on the move**

**Break .....break.....break.....break.....break**  
**(drinking water)**

Remind participants to review their PA goals and reinforce information on PA health-behaviour (5 minutes)

## Week 7

---

### **Theme: Let's get going**

**Duration: 1 hour**

**Objective**-develop self- management and monitoring skills

**Facilitator/s:** Research team

#### **Activities of the day:**

- Reinforce messages on healthy eating and physical activity behaviors (40 minutes).

Let the participants divide into 4 groups to play a LIMO game (where they identify healthy foods (fruits and vegetables, low fat foods, less sweets and more water intake, and PA types (low, moderate and vigorous) and its benefits.

Distribute baskets with cards containing pictures of healthy and unhealthy foods and PA activities to each group.

(There will be competition between the groups and each correct combination of healthy foods and type of PA is awarded 5 marks. The group that wins the game is given an incentive.)

#### **Let students repeat: Let's get going**

**Break .....break.....break.....break.....break (5 minutes body stretching)**

- Sharing of experiences in relation to healthy eating goals and PA (10 minutes)
- Summary of activities of the day (5 minutes)

## Week 8

---

**Theme: It is my life it is your life**

**Duration: 1 hour**

**Objective**-reinforce self-management skills

**Facilitator/s:** Principal investigator

**Let students repeat: It is my life it is your life**

**Activities of the day:**

- Power point participants presentations on successes and challenges, lessons learnt and way forward as per group (40 minutes)
- Renewed goals shared with parents.

**Let students repeat: It is my life it is your life**

- Issuing of participation certificates by Junior Secondary School head (10 minutes)

**Closing Remarks by School Head and vote of thanks by principal investigator.**

---

## Appendix 33a: Study permit letter

TELEPHONE (027) 3655469  
TELEX: 2944 THUTO BD  
FAX: 3185167



REPUBLIC OF BOTSWANA

MINISTRY OF EDUCATION  
AND SKILLS DEVELOPMENT  
PRIVATE BAG 005  
GABORONE

REFERENCE: DPRS 7/1/6 I (5)

29 September 2015

Gaonyadiwe Lubinda - Sinombe  
Private Bag 00712  
Gaborone

**RE: EXTENSION FOR A RESEARCH PERMIT (ref: DEPRS 7/1/5 XV (23)).**

This serves to extend your permit to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

**An evaluation of the effects of a lifestyle intervention on eating habits of urban adolescents in junior public secondary schools in Botswana; A pragmatic randomized controlled trial pilot study.**

It is of paramount importance to seek **Assent** and **Consent** from the Department of basic Education, South East Regional Director, School Heads, Teachers and Students of sampled Schools Junior that you are going to collect data from. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from **29<sup>th</sup> September 2015 to 29<sup>th</sup> September 2016**.

**You are requested to submit a copy of your final report of the study as stated in the Research Guidelines (as per article 4.5 and 4.6) to the Ministry of Education and Skills Development, in the Department of Educational Planning and Research Services, Botswana.**

Thank you.

A handwritten signature in black ink, appearing to be 'A.K. Galeboe'.

A.K. Galeboe  
For/Permanent Secretary

---

**Appendix 33b: Study permit letter**

TELEPHONE (027)  
3655469  
TELEX: 2944 THUTO BD  
FAX: 3185167



MINISTRY OF EDUCATION  
AND SKILLS DEVELOPMENT  
PRIVATE BAG 005  
GABORONE

**REPUBLIC OF BOTSWANA**

REFERENCE: DPRS 7/1/5 XV (23)

16 October 2014

Gaonyadiwe Lubinda-Sinombe  
Private Bag 00712  
Gaborone

Dear Madam

**RE: REQUEST FOR A PERMIT TO CONDUCT A RESEARCH STUDY**

This serves to grant you permission to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

**An Evaluation of the effects of a lifestyle intervention on eating and physical activity behaviours of urban adolescents in Junior Secondary Schools in Botswana: a pragmatic randomized controlled trial pilot study.**

It is of paramount importance to seek **Assent** and **Consent** from the Department of Basic Education, South East Regional Director, School Heads, teachers and students of sampled Junior Secondary School schools that you are going to collect data from. Administering of questionnaires to both Teachers and students should be done in the afternoon to avoid disturbances to their normal class lessons. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from **16 October 2014 to 15 October 2015**.

**You are requested to submit a copy of your final report of the study to the Ministry of Education and Skills Development, in the Department of Educational Planning and Research Services, Botswana.**

Thank you.

pp.   
A. Galeboe  
For/Permanent Secretary

## Appendix 34: Ethical approval letter

**UNIVERSITY OF CAPE TOWN**  
**Faculty of Health Sciences Human Research Ethics**



**Room E52-24 Old Main Building Groote Schuur Hospital Observatory 7925**  
**Telephone** [021] 406 6492 • **Facsimile** [021] 406 6411  
**Email:** Sumayah.ariefdien@uct.ac.za  
**Website:** [www.health.uct.ac.za/fhs/research/humanethics/forms](http://www.health.uct.ac.za/fhs/research/humanethics/forms)

---

23 September 2014 HREC/REF:631/2014

Dr U Kyriakos Nursing & Midwifery Health & Rehab OMB

Dear Dr Kyriakos

**Project Title: AN EVALUATION OF THE EFFECTS OF A LIFESTYLE INTERVENTION ON EATING HABITS AND PHYSICAL ACTIVITIES OF URBAN ADOLESCENTS IN JUNIOR PUBLIC SECONDARY SCHOOLS IN BOTSWANA: A PRAGMATIC RANDOMISED CONTROLLED TRIAL PILOT STUDY (PhD -candidate-G Lubinda-Sinombe)**

Thank you for your response letter dated 22 September 2014, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has formally approved the above mentioned study.

Approval is granted for one year until the 30 September 2015.

Please submit a progress form, using the standardised Annual Report Form, if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

*We acknowledge that the following student:-Gaonyadiwe Lubinda-Sinombe is also involved in this project.*

Please note that the on-going ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number : FWA00001637. Hrec/ref:631/2014

## **Appendix 35: Consent for teachers**

### **Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial study**

I \_\_\_\_\_

Print Name

Signature of the teacher

date

have read the provided Information Sheet. I understand what is required of me. I have had all my questions answered. I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can leave the study at any time if I wish and that it will have no bad consequences for me. I have agreed to volunteer to be an interventionist for one hour per week after school for 8 weeks.

## **Appendix 36: Informed consent for Study One**

### **INFORMATION SHEET FOR PARTICIPANTS IN STUDY ONE**

Participant code number.....

#### **Study Title**

#### **An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial study**

I invite you to participate in a research study. This study is for junior secondary school students in urban areas who are aged 13-15 years.

#### **What is the purpose of the study?**

Daily eating habits of adolescents have changed over the past ten years in Botswana. This has resulted in heart problems and high levels of blood sugar. The purpose of my study is:

1. To describe adolescents' eating habits and physical activity levels and the factors that influence healthy behaviour (Study One).
2. To find out if there is a change in eating habits and physical activity following a lifestyle intervention program (Study Two).

#### **The activities of the Study One will entail:**

- Filling in a 3-part questionnaire on nutrition, self-efficacy for health (ability to keep healthy), self-efficacy for exercise, intention for physical activity and intention for healthy eating.
- You will be checked for weight, and have your height and waist circumference checked. If you are a girl, a female research assistant will take your measurements. If you are a boy, a male research assistant will take your measurements.

The tests and questions will allow me to find out your eating habits and physical activity and factors that influence them.

#### **Who is doing the study?**

I Mrs Gaonyadiwe Lubinda-Sinombe, a Family Nurse Practitioner is the student researcher and I will be assisted by 4 senior university students studying health courses and a nutritionist.

#### **Does the study have ethics approval?**

The study has been approved by the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee (REF REC 631/2014), the Ministry of Health Research Ethics Committee, and Ministry of Education Research Ethics Committee, Directors of Secondary Schools, Heads of Schools and teachers. I am here to ask if you will agree to participate in the study voluntarily and if so, you and your parents or legal

## Lifestyle intervention

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guardians are now being asked to participate voluntarily once you are satisfied and clear about what the study entails.

### What is required of you?

- You will be requested to volunteer to participate in the study and to sign the assent form.
- If you agree to participate in the study you will be asked to give information about the study to your parents or legal guardians as reflected in the consent forms in **Setswana (to parents who prefer Setswana) or English (to parents who prefer English)** and ask them to complete the consent form and return it to your teachers.
- You will be asked to fill in 5 questionnaires and have your weight, height and waist circumference checked at the beginning of the study.

### Confidentiality and anonymity

Information collected from you will not be shared with anyone. Questionnaires will be coded by number and not your name to maintain confidentiality. All completed questionnaires will be kept in a locked filing cabinet and only the researcher will have the key to the cabinet, and data entry and analysis will be entered and kept in a password protected computer. You will have weight, height and waist circumference measured at a time and in a designated male or female room and privacy will be provided.

Weight, height and waist circumference charts for boys and girls will be used for recording the information. The charts will only contain a code number and your age. You are requested to allow your parents/guardians, school teachers and some health professionals to play a role in supporting you to meet the requirements of the study at a given time that will be communicated to them.

### Risks

The study will not put you at psychological risk. You might feel uncomfortable having to remove your shirt up to waist level but you keep your underclothes on to be checked for weight, height and waist circumference. This will be minimized by separating test sites for girls and boys and each participant will be tested by a person of the same gender **in a private room out of sight of other students.**

### Autonomy

You may choose to take part in the study or not. Even if you choose to participate now and later change your mind, you can do so without fear of being punished, loss of your place at school or strained relationships with your teachers. If you want to quit, you can do so without being requested to give reasons.

### Reimbursement for participation

There is no payment for participating in the study.

### Dissemination of study findings

Upon completion of the study, I will inform you about the research findings through posters and you will be given a thank you letter containing a summary of research findings to give to your parents.

Lifestyle intervention

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**Who to contact if you have any questions or concerns about your rights or welfare as research participants?**

Researcher: Gaonyadiwe Lubinda-Sinombe  
PhD candidate  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel: +27 83 715 6039  
Email:gaonyadiwesinombe@yahoo.com

Supervisor: Dr Una Kyriacos  
Division of Nursing and Midwifery  
Department of Health and Rehabilitation Sciences  
Faculty of Health Sciences  
University of Cape Town  
Tel:+ 27-21-4066410

**HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

Faculty of Health Sciences  
Room E52-24 Groote Schuur Hospital Old Main Building  
OBSERVATORY  
7925  
Chairperson: Professor Marc Blockman TEL: +27 21-406 6626

**MINISTRY OF HEALTH HUMAN RESEARCH ETHICS COMMITTEE DETAILS:**

24 Amos Street  
Government Enclave  
Gaborone  
Botswana  
Tel: +267 363 2400  
Toll free customer number: 08006007400

**ASSENT TO PARTICIPATE IN A RESEARCH STUDY**

**Study Title**

**An evaluation of the effects of a lifestyle intervention on eating habits and physical activity of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial pilot study.**

I \_\_\_\_\_ have read the provided Information Sheet/or had it read to me. I understand what is required of me, as a participant. I have had all my questions answered. I do not feel that I am forced to take part in this study and I am doing so of my own free will. I know that I can leave the study at any time if I wish and that it will have no bad consequences for me.

.....

Respondent's Signature

.....

Date

.....

Name and signature of witness

.....

Date

THANK YOU FOR YOUR TIME

**Appendix 37: Ancillary Analysis Study One data****Table 37-1: Association between knowledge of nutrition and gender**

| Knowledge score in % | t-test for equality of means |         |                                   |              |
|----------------------|------------------------------|---------|-----------------------------------|--------------|
|                      | Mean difference              | p-value | t-value (df)                      | F-statistics |
|                      | .848 (3.155-4.852)           | .667    | .417 (250) Equal variance assumed | .233         |

Note on table: df refers to degree of freedom

There is no statistical relationship between gender and nutrition knowledge ( $p= 0.667$ ).

**Table 37-2: Correlation between participants' (N=252) knowledge and age**  
**Correlations**

| Variables             | Pearson correlation<br>Sig. (2-tailed) | Mean  | Std. Deviation |
|-----------------------|--|-------|----------------|
| Age of participants   | 1                                      | 14.26 | .790           |
| Knowledge scores in % | 1                                      | 46.05 | 15.881         |

There was a strong positive correlation between age and knowledge scores ( $r=1$ ).

**Table 37-3: Correlation between BMI and gender (N=252)**  
**Symmetric Measures**

|   | Value  | Asymp. Std. Error <sup>a</sup> | ApproxT <sup>b</sup> | Approx. Sig.       |
|---|--------|--------------------------------|----------------------|--------------------|
| Interval by Interval Pearson's R        | 0.019  | 0.065                          | 0.297                | 0.767 <sup>c</sup> |
| Ordinal by Ordinal Spearman Correlation | -0.014 | 0.065                          | -0.226               | 0.822 <sup>c</sup> |
| N of Valid Cases                        | 252    |                                |                      |                    |

There was a strong positive correlation between BMI and gender.

**Table 37-4: Association between BMI categories and SES (N=252)**

| Chi-square tests                                     |                              |
|--|------------------------------|
| Variables  | Linear-by-linear association |
| Body mass index categories *<br>Socioeconomic status | 0.001                        |

There was an association between body mass index and socioeconomic status (SES) ( $p \leq 0.05$ ).

**Table 37-5: Association between BMI and gender (N=252)**

| Chi-square tests            |                              |
|-----------------------------|------------------------------|
| Variables                   | Linear-by-linear association |
| Body mass index *<br>Gender | 0.766                        |

There was no statistical association between body mass index and gender ( $p \geq 0.05$ ).

**Table 37-6: Association between WC and gender (N=252)**

|                              | Chi-Square Tests     |    |                       |
|------------------------------|----------------------|----|-----------------------|
|                              | Value                | df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square           | 244.059 <sup>a</sup> | 3  | 0.000                 |
| Likelihood Ratio             | 323.719              | 3  | 0.000                 |
| Linear-by-Linear Association | 63.040               | 1  | 0.000                 |
| N of Valid Cases             | 252                  |    |                       |

There was a statistical association between waist circumference and gender ( $p < 0.001$ ).

**Table 37-7: Association between physical activity and gender (n=252)**

|                              | Value              | df | Asymp. Sig. (2-sided) | Monte Carlo Sig. (2-sided) | 95% Confidence Interval |             |
|------------------------------|--------------------|----|-----------------------|----------------------------|-------------------------|-------------|
|                              |                    |    |                       |                            | Lower Bound             | Upper Bound |
| Pearson Chi-Square           | 4.171 <sup>a</sup> | 4  | 0.383                 | 0.388 <sup>b</sup>         | 0.379                   | 0.398       |
| Likelihood Ratio             | 4.139              | 4  | 0.388                 | 0.401 <sup>b</sup>         | 0.391                   | 0.410       |
| Fisher's Exact Test          | 4.169              |    |                       | 0.382 <sup>b</sup>         | 0.373                   | 0.392       |
| Linear-by-Linear Association | 0.598 <sup>c</sup> | 1  | 0.439                 | 0.469 <sup>b</sup>         | 0.459                   | 0.479       |
| N of Valid Cases             | 252                |    |                       |                            |                         |             |

There was no association between PA during free time and gender ( $p = 0.598$ ).

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**Table 37-8: Association between physical activity and self-efficacy (N=252)**

|                              | Chi-Square Tests |    | Asymp. Sig. (2-sided) |
|------------------------------|------------------|----|-----------------------|
|                              | Value            | df |                       |
| Pearson Chi-Square           | 25.420           | 8  | 0.001                 |
| Likelihood Ratio             | 24.679           | 8  | 0.002                 |
| Linear-by-Linear Association | 0.671            | 1  | 0.413                 |
| N of Valid Cases             | 252              |    |                       |

a. 6 cells (40.0%) have expected count less than 5. The minimum expected count is .70

There was an association between physical activity (usage of spare time) and self-efficacy for exercise (physical activity during free time) ( $p= 0.001$ ) but no association linear by linear.

**Table 37-9: Association between physical activity and self-efficacy (N=252)**

| Chi-square tests                                  |                              |
|---|------------------------------|
| Variables   | Linear-by-linear association |
| Physical activity during free time<br>Do exercise | 0.001                        |

There was an association between physical activities (do exercise) and self-efficacy for exercise (physical activity during free time) ( $p= 0.001$ ).

## Appendix 38: Index of content validity (CVI) for the LIMO program

Expert code number.....

### CHECKLIST FOR CONTENT VALIDITY FOR LIMO PROGRAM

**Researcher:**

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 Harris EdD, DPT, Professor Emerita North-eastern  
 University  
 Boston MA, UCT Mellon Scholar

Title of the study: **An evaluation of the effects of a lifestyle intervention on eating and physical activity behaviours of urban adolescents in junior public secondary schools in Botswana: a pragmatic randomised controlled trial.**

**INFORMATION:**

Thank you for agreeing to evaluate the content validity of the LIMO Program, manual/ and videos and PowerPoint presentation slides. Please email the completed checklist to the researcher at the above email address.

The purpose of this checklist is to ensure uniform evaluation by all experts using a structured procedure.

You the experts will establish the index of content validity (CVI) for each item using a point-4 ordinal rating scale and this will be taken as a proportion of items that received a rating of 3 or 4. If, in your opinion, there are omissions, this can be listed at the end of each item.

**Table: Expert opinion on Content Validity Index (CVI) of LIMO program**

| Items                          | 1=<br>irrelevant | 2=unable to assess<br>relevance without<br>item revision or<br>items in need of<br>such revision that<br>it would no longer<br>be relevant | 3=relevant but<br>needs minor<br>alterations | 4=extremely<br>relevant | Changes |
|--------------------------------|------------------|--|--|-------------------------|---------|
| Week 1                         |                  |  |  |                         |         |
| Week 2                         |                  |  |  |                         |         |
| Week 3                         |                  |  |  |                         |         |
| Week 4                         |                  |  |  |                         |         |
| Week 5                         |                  |  |  |                         |         |
| Week 6                         |                  |  |  |                         |         |
| Week 7                         |                  |  |  |                         |         |
| Week 8                         |                  |  |  |                         |         |
| LIMO<br>manual                 |                  |  |  |                         |         |
| Nutrition<br>slides            |                  |  |  |                         |         |
| Physical<br>activity<br>slides |                  |  |  |                         |         |

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| <b>Items</b>                          | <b>1= irrelevant</b> | <b>2=unable to assess relevance without item revision or items in need of such revision that it would no longer be relevant</b> | <b>3=relevant but needs minor alterations</b> | <b>4=extremely relevant</b> | <b>Changes</b> |
|---------------------------------------|----------------------|---|---|-----------------------------|----------------|
| Intervention-ist workshop slides      |                      |   |   |                             |                |
| Week 1                                |                      |   |   |                             |                |
| Week 2                                |                      |   |   |                             |                |
| Week 3                                |                      |   |   |                             |                |
| Week 5                                |                      |   |   |                             |                |
| Educational materials for control arm |                      |   |   |                             |                |
| Week 2                                |                      |   |   |                             |                |
| Week 3                                |                      |   |   |                             |                |
| Week 4                                |                      |   |   |                             |                |
| Week 5                                |                      |   |   |                             |                |

Omissions:

Comments:

Thank you

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**Appendix 39: Socioeconomic table interpretation**

Determined by parental/guardian's educational background and employment

| Respondent code | Socioeconomic status | Education of Father | Employment of Father      | Education of Mother | Employment of Mother   |
|-----------------|----------------------|---------------------|---------------------------|---------------------|------------------------|
| 1               | 2                    | tertiary            | secondary teacher         | tertiary            | primary teacher        |
| 2               | 1                    | primary             | driver                    | primary             | farmer                 |
| 3               | 1                    | primary             | car mechanic              | secondary           | hair dresser           |
| 4               | 1                    | primary             | sanitation department     | primary             | cleaner                |
| 5               | 2                    | n/a                 | n/a                       | tertiary            | accountant             |
| 6               | 1                    | primary             | self-employed             | secondary           | cleaner                |
| 7               | 2                    | tertiary            | horticulturalist          | tertiary            | nurse                  |
| 8               | 1                    | Secondary           | record clerk              | primary             | sells food             |
| 9               | 1                    | n/a                 | n/a                       | secondary           | driver                 |
| 10              | 2                    | tertiary            | court clerk               | tertiary            | secondary teacher      |
| 11              | 1                    | primary             | driving school instructor | primary             | cleaner                |
| 12              | 99                   |                     |                           |                     |                        |
| 13              | 99                   |                     |                           |                     |                        |
| 14              | 2                    | tertiary            | secondary school teacher  | tertiary            | Editor                 |
| 15              | 1                    | primary             | driver                    | primary             | hair dresser           |
| 16              | 1                    | n/a                 | n/a                       | primary             | restaurant waitress    |
| 17              | 99                   |                     |                           |                     |                        |
| 18              | 2                    | tertiary            | nurse                     | tertiary            | nurse                  |
| 19              | 1                    | n/a                 | n/a                       | primary             | cleaner                |
| 20              | 1                    | n/a                 | n/a                       | secondary           | rent out tents         |
| 21              | 1                    | n/a                 | n/a                       | secondary           | driver                 |
| 22              | 1                    | n/a                 | n/a                       | secondary           | Bee keeper             |
| 23              | 1                    | n/a                 | n/a                       | primary             | farmer                 |
| 24              | 1                    | secondary           | self-employed             | primary             | house keeper           |
| 25              | 2                    | n/a                 | n/a                       | tertiary            | nurse                  |
| 26              | 1                    | primary             | self employed             | primary             | hair dresser           |
| 27              | 1                    | primary             | farmer                    | secondary           | cleaner                |
| 28              | 2                    | tertiary            | lawyer                    | n/a                 | n/a                    |
| 29              | 2                    | tertiary            | nurse                     | tertiary            | teacher                |
| 30              | 2                    | tertiary            | editor                    | tertiary            | secondary teacher      |
| 31              | 2                    |                     | n/a                       | tertiary            | Head teacher           |
| 32              | 99                   |                     |                           |                     |                        |
| 33              | 1                    | secondary           | fitting mechanic          | primary             | cleaner                |
| 34              | 1                    | primary             | farmer                    | primary             | driver                 |
| 35              | 2                    | tertiary            | electrician               | tertiary            | primary school teacher |
| 36              | 2                    | tertiary            | accountant                | tertiary            | nurse                  |
| 37              | 1                    | secondary           | driver                    | secondary           | waitress               |
| 38              | 1                    | secondary           | driving school instructor | primary             | self-employed          |
| 39              | 1                    | primary             | farmer                    | primary             | cleaner                |
| 40              | 2                    | n/a                 | n/a                       | tertiary            | social worker          |
| 41              | 2                    | tertiary            | secondary school teacher  | tertiary            | counselor              |
| 42              | 2                    | tertiary            | Politician                | tertiary            | nurse                  |

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|    |    |           |                          |           |                          |
|----|----|-----------|--------------------------|-----------|--------------------------|
| 43 |    |           |                          |           |                          |
|    | 3  | tertiary  | water pump mechanic      | tertiary  | primary school teacher   |
| 44 | 2  | n/a       | n/a                      | tertiary  | Accountant               |
| 45 | 3  | tertiary  | soil engineer            | tertiary  | lawyer                   |
| 46 | 1  | primary   | driver                   |           | hair dressed             |
| 47 | 2  | n/a       | n/a                      | tertiary  | nurse                    |
| 48 | 2  | n/a       | n/a                      | tertiary  | secondary teacher        |
| 49 | 2  | tertiary  | lecturer                 | tertiary  | business-salon           |
| 50 | 1  | n/a       | n/a                      | secondary | cleaner                  |
| 51 | 2  | tertiary  | secondary school teacher | tertiary  | secondary school teacher |
| 52 | 2  | n/a       | n/a                      | tertiary  | police officer           |
| 53 | 2  | n/a       | n/a                      | tertiary  | Laboratory technician    |
| 54 | 1  | n/a       | n/a                      | secondary | waitress                 |
| 55 | 2  | tertiary  | Soldier                  | tertiary  | police officer           |
| 56 | 1  | primary   | farmer                   | secondary | cleaner                  |
| 57 | 1  | n/a       | n/a                      | primary   | house keeper             |
| 58 | 2  | n/a       | n/a                      | tertiary  | business-catering        |
| 59 | 1  | n/a       | n/a                      | secondary | council secretary        |
| 60 | 1  | primary   | pastor                   | secondary | cleaner                  |
| 61 | 1  | n/a       | n/a                      | secondary | lay counselor            |
| 62 | 1  | secondary | driver                   | secondary | farmer                   |
| 63 | 2  | tertiary  | nurse                    | tertiary  | pharmacy technician      |
| 64 | 1  | secondary | plumber                  | secondary | cleaner                  |
| 65 | 1  | primary   | farmer                   | secondary | driver                   |
| 66 | 1  | n/a       | n/a                      | primary   | hair dresser             |
| 67 | 2  | tertiary  | pharmacy technician      | tertiary  | police officer           |
| 68 | 1  | n/a       | n/a                      | secondary | business-catering        |
| 69 | 2  | tertiary  | agriculturalist          | tertiary  | school teacher           |
| 70 | 1  | primary   | security Guard           | primary   | cook                     |
| 71 | 1  | n/a       | n/a                      | primary   | self-employed            |
| 72 | 1  | primary   | taxi driver              | secondary | cleaner                  |
| 73 | 1  | secondary | plumber                  | primary   | cleaner                  |
| 74 | 1  | n/a       | n/a                      | secondary | self-employed            |
| 75 | 1  | n/a       | n/a                      | primary   | House keeper             |
| 76 | 2  | n/a       | n/a                      | tertiary  | nurse                    |
| 77 | 2  | tertiary  | lecturer                 | tertiary  | school teacher           |
| 78 | 2  | tertiary  | health inspector         | tertiary  | secretary                |
| 79 | 2  | n/a       | n/a                      | tertiary  | accountant               |
| 80 | 1  | secondary | driver                   | secondary | record clerk             |
| 81 | 1  | primary   | security Guard           | primary   | shop keeper              |
| 82 | 3  | n/a       | n/a                      | tertiary  | bank manager             |
| 83 | 1  | primary   | farmer                   | primary   | cleaner                  |
| 84 | 2  | tertiary  | nurse                    | tertiary  | account clerk            |
| 85 | 2  | tertiary  | soldier                  | secondary | messenger                |
| 86 | 2  | n/a       | n/a                      | tertiary  | head teacher             |
| 87 | 1  | secondary | sales representative     | primary   | works at laundry         |
| 88 | 2  | tertiary  | school teacher           | tertiary  | school teacher           |
| 89 | 1  | primary   | builder                  | primary   | tailor                   |
| 90 | 2  | tertiary  | police officer           | secondary | business-tuck-shop       |
| 91 | 2  | n/a       | n/a                      | tertiary  | librarian                |
| 92 | 2  | n/a       | n/a                      | tertiary  | IT officer               |
| 93 | 1  | n/a       | n/a                      | secondary | lay counselor            |
| 94 | 99 |           |                          |           |                          |

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|     |    |           |                      |           |                       |
|-----|----|-----------|----------------------|-----------|-----------------------|
| 95  | 2  | tertiary  | court clerk          | tertiary  | school teacher        |
| 96  | 1  | secondary | driver               | primary   | self-employed         |
| 97  | 99 |           |                      |           |                       |
| 98  | 2  | n/a       | n/a                  | tertiary  | town clerk            |
| 99  | 99 |           |                      |           |                       |
| 100 | 1  | n/a       | n/a                  | secondary | cleaner               |
| 101 | 2  | n/a       | n/a                  | tertiary  | lecturer              |
| 102 | 1  | primary   | farmer               | secondary | cleaner               |
| 103 | 1  | primary   | driver               | primary   | hair dresser          |
| 104 | 2  | tertiary  | school teacher       | secondary | secretary             |
| 105 | 1  | n/a       | n/a                  | secondary | furniture shop        |
| 106 | 1  | n/a       | n/a                  | secondary | security guard        |
| 107 | 2  | tertiary  | police officer       | secondary | laboratory assistance |
| 108 | 2  | tertiary  | school teacher       | tertiary  | school head           |
| 109 | 1  | secondary | car mechanic         | secondary | receptionist          |
| 110 | 1  | primary   | driver               | primary   | cleaner               |
| 111 | 1  | n/a       | n/a                  | primary   | Bank messenger        |
| 112 | 1  | n/a       | n/a                  | secondary | Self-employed         |
| 113 | 1  | primary   | cab driver           | secondary | business- hawker      |
| 114 | 1  | n/a       | n/a                  | secondary | hair dresser          |
| 115 | 2  | n/a       | n/a                  | tertiary  | pharmacist            |
| 116 | 1  | secondary | farmer               | secondary | farmer                |
| 117 | 3  | n/a       | n/a                  | tertiary  | private doctor        |
| 118 | 2  | secondary | self-employed        | tertiary  | police officer        |
| 119 | 1  | primary   | Gardner              | primary   | school cook           |
| 120 | 2  | tertiary  | x-ray department     | secondary | self-employed         |
| 121 | 1  | primary   | bank driver          | primary   | cleaner               |
| 122 | 99 |           |                      |           |                       |
| 123 | 2  | n/a       | n/a                  | tertiary  | bank teller           |
| 124 | 1  | n/a       | n/a                  | secondary | cleaner               |
| 125 | 3  | tertiary  | school teacher       | tertiary  | lawyer                |
| 126 | 1  | primary   | cleaner              | primary   | Self-employed         |
| 127 | 2  | tertiary  | school teacher       | tertiary  | shop manager          |
| 128 | 1  | secondary | insurance company    | secondary | receptionist          |
| 129 | 2  | tertiary  | manager              | secondary | school teacher        |
| 130 | 2  | secondary | business-car parts   | tertiary  | nurse                 |
| 131 | 1  | n/a       | n/a                  | secondary | cleaner               |
| 132 | 2  | tertiary  | head teacher         | tertiary  | school teacher        |
| 133 | 1  | primary   | driver               | primary   | self-employed         |
| 134 | 2  | n/a       | n/a                  | tertiary  | dietician             |
| 135 | 1  | primary   | security guard       | primary   | receptionist          |
| 136 | 2  | tertiary  | business-bus         | tertiary  | nurse                 |
| 137 | 1  | n/a       | n/a                  | secondary | cook                  |
| 138 | 2  | n/a       | n/a                  | tertiary  | town planner          |
| 139 | 1  | secondary | business-makes sofas | secondary | driver                |
| 140 | 2  | tertiary  | pastor               | tertiary  | school teacher        |
| 141 | 1  | primary   | self-employed        | primary   | cleaner               |
| 142 | 1  | primary   | farmer               | secondary | self-employed         |
| 143 | 1  | tertiary  | police officer       | primary   | business- catering    |
| 144 | 1  | primary   | tailor               | primary   | driver                |
| 145 | 2  | tertiary  | Journalist           | tertiary  | school teacher        |
| 146 | 2  | tertiary  | pilot                | tertiary  | social worker         |
| 147 | 1  | n/a       | n/a                  | primary   | business- tuck-shop   |
| 148 | 2  | tertiary  | school teacher       | tertiary  | IT officer            |
| 149 | 1  | n/a       | n/a                  | primary   | business-hawker       |

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|     |    |           |                       |           |                        |
|-----|----|-----------|-----------------------|-----------|------------------------|
| 150 | 1  | secondary | carpenter             | primary   | cleaner                |
| 151 | 1  | n/a       | n/a                   | primary   | farmer                 |
| 152 | 2  | n/a       | n/a                   | tertiary  | school teacher         |
| 153 | 1  | n/a       | n/a                   | secondary | driver                 |
| 154 | 2  | tertiary  | manager               | secondary | secretary              |
| 155 | 1  | primary   | self-employed         | primary   | house keeper           |
| 156 | 1  | secondary | driver                | secondary | self-employed          |
| 157 | 2  | tertiary  | school teacher        | tertiary  | nutritionist           |
| 158 | 1  | n/a       | n/a                   | secondary | messenger              |
| 159 | 2  | n/a       | n/a                   | tertiary  | school head            |
| 160 | 1  | primary   | driver                | primary   | self-employed          |
| 161 | 2  | n/a       | n/a                   | tertiary  | lecturer               |
| 162 | 1  | primary   | builder               | secondary | receptionist           |
| 163 | 1  | primary   | self-employed         | primary   | self-employed          |
| 164 | 1  | primary   | security guard        | primary   | self-employed          |
| 165 | 2  | tertiary  | IT officer            | tertiary  | nurse                  |
| 166 | 1  | primary   | self-employed         | primary   | cleaner                |
| 167 | 1  | n/a       | n/a                   | secondary | cleaner                |
| 168 | 2  | n/a       | n/a                   | tertiary  | accountant             |
| 169 | 1  | secondary | fridge master         | secondary | tailor                 |
| 170 | 99 |           |                       |           |                        |
| 171 | 1  | secondary | electricity           | secondary | cleaner                |
| 172 | 2  | tertiary  | school teacher        | tertiary  | medical insurance      |
| 173 | 2  | tertiary  | soldier               | secondary | house keeper           |
| 174 | 2  | tertiary  | roads department      | tertiary  | veterinary officer     |
| 175 | 1  | n/a       | n/a                   | secondary | self-employed          |
| 176 | 1  | n/a       | n/a                   | secondary | farmer                 |
| 177 | 1  | secondary | builder               | primary   | self-employed          |
| 178 | 2  | tertiary  | finance officer       | tertiary  | lecturer               |
| 179 | 2  | n/a       | n/a                   | tertiary  | school teacher         |
| 180 | 2  | tertiary  | environmental officer | tertiary  | shop manager           |
| 181 | 1  | primary   | farmer                | primary   | self-employed          |
| 182 | 1  | secondary | self-employed         | primary   | cook                   |
| 183 | 1  | secondary | chef                  | primary   | cleaner                |
| 184 | 2  | tertiary  | school teacher        | tertiary  | social worker          |
| 185 | 1  | secondary | self-employed         | secondary | business-sells clothes |
| 186 | 1  | secondary | driver                | secondary | self-employed          |
| 187 | 1  | primary   | self-employed         | secondary | security guard         |
| 188 | 1  | primary   | builder               | primary   | self-employed          |
| 189 | 1  | primary   | self-employed         | primary   | self-employed          |
| 190 | 1  | primary   | shoe fixer            | primary   | self-employed          |
| 191 | 1  | n/a       | n/a                   | primary   | hair dresser           |
| 192 | 1  | tertiary  | self-employed         | secondary | driver                 |
| 193 | 2  | secondary | economist             | secondary | receptionist           |
| 194 | 1  | tertiary  | plumber               | primary   | cleaner                |
| 195 | 3  | tertiary  | school head           | tertiary  | nurse                  |
| 196 | 2  | tertiary  | accountant            | tertiary  | school teacher         |
| 197 | 2  | n/a       | lecturer              | tertiary  | business-bookstore     |
| 198 | 2  | tertiary  | n/a                   | tertiary  | social worker          |
| 199 | 2  | tertiary  | coordinator           | tertiary  | Journalist             |
| 200 | 2  | tertiary  | news reader           | secondary | self-employed          |
| 201 | 2  | primary   | statistics lecturer   | primary   | business-catering      |
| 202 | 1  | secondary | driver                | primary   | self-employed          |
| 203 | 1  | primary   | carpenter             | primary   | cleaner                |
| 204 | 2  | n/a       | n/a                   | tertiary  | administrator          |

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|     |    |           |                        |           |                       |
|-----|----|-----------|------------------------|-----------|-----------------------|
| 205 | 1  | n/a       | n/a                    | secondary | business-sells food   |
| 206 | 2  | secondary | n/a                    | tertiary  | psychologist          |
| 207 | 1  | secondary | kombi- driver          | primary   | self-employed         |
| 208 | 1  | secondary | self-employed          | secondary | bursar                |
| 209 | 1  | n/a       | n/a                    | secondary | school librarian      |
| 210 | 2  | n/a       | n/a                    | tertiary  | school principal      |
| 211 | 2  | tertiary  | Finance officer        | tertiary  | immigration officer   |
| 212 | 2  | tertiary  | architecture           | secondary | self-employed         |
| 213 | 2  | tertiary  | school teacher         | tertiary  | chemists              |
| 214 | 2  | secondary | water engineer         | tertiary  | Laboratory officer    |
| 215 | 1  | primary   | driver                 | secondary | self-employed         |
| 216 | 1  | primary   | politician             | secondary | medical records       |
| 217 | 1  | primary   | fire department        | secondary | cleaner               |
| 218 | 1  | n/a       | shop keeper            | primary   | self-employed         |
| 219 | 2  | tertiary  | n/a                    | tertiary  | police officer        |
| 220 | 2  | tertiary  | lecturer               | secondary | waitress              |
| 221 | 2  | tertiary  | soldier                | tertiary  | hotel manager         |
| 222 | 2  | tertiary  | bank officer           | tertiary  | tourism manager       |
| 223 | 3  | n/a       | lawyer                 | tertiary  | nurse                 |
| 224 | 2  | n/a       | n/a                    | tertiary  | nurse                 |
| 225 | 2  | n/a       | n/a                    | tertiary  | lecturer              |
| 226 | 2  | n/a       | n/a                    | tertiary  | human resource        |
| 227 | 1  | tertiary  | nurse                  | secondary | hair dresser          |
| 228 | 2  |           | meteorological officer | tertiary  | prison officer        |
| 229 | 99 |           |                        |           |                       |
| 230 | 1  | secondary | mortuary attendant     | secondary | cleaner               |
| 231 | 1  | tertiary  | builder                | primary   | cleaner               |
| 232 | 2  | tertiary  | immigration            | tertiary  | school teacher        |
| 233 | 2  | tertiary  | school teacher         | secondary | school teacher        |
| 234 | 1  | tertiary  | principal              | primary   | self-employed         |
| 235 | 3  | tertiary  | medical doctor         | tertiary  | school teacher        |
| 236 | 3  | tertiary  | IT                     | tertiary  | Bank manager          |
| 237 | 2  | tertiary  | principal              | tertiary  | administrator         |
| 238 | 2  | tertiary  | lecturer               | tertiary  | pharmacy officer      |
| 239 | 2  | primary   | television officer     | secondary | self-employed         |
| 240 | 1  | primary   | business-tax-driver    | primary   | self-employed         |
| 241 | 1  | n/a       | n/a                    | primary   | shop assistant        |
| 242 | 99 | primary   | Self-employed          |           |                       |
| 243 | 1  | tertiary  | self-employed          | secondary |                       |
| 244 | 3  | tertiary  | finance officer        | secondary | shop manager          |
| 245 | 1  | n/a       | n/a                    | secondary | administrator         |
| 246 | 99 |           |                        |           |                       |
| 247 | 2  | secondary | n/a                    | tertiary  | environmental officer |
| 248 | 2  | primary   | plumber                | tertiary  | police officer        |
| 249 | 1  | tertiary  | driver                 | primary   | self-employed         |
| 250 | 2  | primary   | car sales rep          | tertiary  | teacher               |
| 251 | 1  | secondary | panel beater           | secondary | Shop assistant        |
| 252 | 99 |           |                        |           |                       |

Key: n/a- not applicable, 99: missing information; 1-LOW SES, 2-MIDDLE SES, 3-HIGH SES

**Appendix 40: Cochrane Collaboration Risk of Bias Tool.****The Cochrane Collaboration's tool for assessing risk of bias**

| <b>Domain</b>  | <b>Support for judgement</b>   | <b>Review authors' judgement</b>  |
|--|--|---|
| <i>Selection bias.</i>   |  |   |
| <b>Random sequence generation.</b>   | Describe the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.   | Selection bias (biased allocation to interventions) due to inadequate generation of a randomised sequence.            |
| <b>Allocation concealment.</b>   | Describe the method used to conceal the allocation sequence in sufficient detail to determine whether intervention allocations could have been foreseen in advance of, or during, enrolment.   | Selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment. |
| <i>Performance bias.</i>   |  |   |
| <b>Blinding of participants and personnel</b><br><i>Assessments should be made for each main outcome (or class of outcomes).</i> | Describe all measures used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective.  | Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.      |
| <i>Detection bias.</i>   |  |   |
| <b>Blinding of outcome assessment</b><br><i>Assessments should be made for each main outcome (or class of outcomes).</i>         | Describe all measures used, if any, to blind outcome assessors from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective.   | Detection bias due to knowledge of the allocated interventions by outcome assessors.                                  |
| <i>Attrition bias.</i>   |  |   |
| <b>Incomplete outcome data</b><br><i>Assessments should be made for each main outcome (or class of outcomes).</i>                | Describe the completeness of outcome data for each main outcome, including attrition and exclusions from the analysis. State whether attrition and exclusions were reported, the numbers in each intervention group (compared with total randomized participants), reasons for attrition/exclusions where reported, and any re-inclusions in analyses performed by the review authors. | Attrition bias due to amount, nature or handling of incomplete outcome data.  |

## Lifestyle intervention

| Domain                        | Support for judgement   | Review authors' judgement                               |
|-------------------------------|---|---|
| <i>Reporting bias.</i>        |   |   |
| <b>Selective reporting.</b>   | State how the possibility of selective outcome reporting was examined by the review authors, and what was found.  | Reporting bias due to selective outcome reporting.      |
| <i>Other bias.</i>            |   |   |
| <b>Other sources of bias.</b> | State any important concerns about bias not addressed in the other domains in the tool.<br><br>If particular questions/entries were pre-specified in the review's protocol, responses should be provided for each question/entry. | Bias due to problems not covered elsewhere in the table |

**Appendix 41: Cochrane Collaboration Risk of Bias Tool for evaluating RCTs**

| <b>Type of study</b>    | <b>Author</b>            | <b>Evaluation</b> |
|-------------------------|--------------------------|-------------------|
| RCT                     | Guagliano, et al. 2015   | Low bias          |
| Two-stage cluster trial | Levy, et al. 2012        | Low bias          |
| CRCT                    | Jemmott III, et al. 2011 | Low bias          |
| RCT                     | Singhal, et al. 2010     | Low bias          |
| RCT                     | Mihas, et al. 2009       | High bias         |
| CRCT                    | He, et al. 2009          | High bias         |
| RCT                     | Kaur, et al. 2007        | High bias         |
| CRCT                    | Kocken, et al. 2015      | Low bias          |
| RCT                     | Taymoori, et al. 2008    | High bias         |
| RCT                     | Pate, et al. 2005        | High bias         |