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FACTORS ASSOCIATED WITH OBESITY IN SOUTH AFRICAN MOTHERS AND THEIR PRE-ADOLESCENT DAUGHTERS:

A cross - cultural validation and comparison study

By

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Dedication

This dissertation is dedicated to **my late parents Ntombi and Nzima**, and my sister who passed away at a very young age **Ntsiki**. “I love you”, you taught me to be a victor and not to quit even if things become most overwhelming.

I also give Glory to my **God**, for being there when I call on him.

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DECLARATION

I, **Zandile June – Rose Mciza**, Hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicated otherwise) and that neither the whole work nor any part of it has been, is being or is to be submitted for another degree in this or any other University.

I empower the University of Cape Town to produce for the purpose of research either the whole or any of the contents in any manner whatsoever.

Signature: **Date:**

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PREFACE

The thesis is comprised of seven chapters. The first chapter outlines the scope of the problem of obesity, with particular focus on the definition of obesity, as well as, a review of the studies which identify factors associated with obesity in South Africa and internationally. Further, this chapter establishes the gaps identified in South African scientific and medical literature regarding the determinants of obesity. Three of the next five chapters focus on the validation of instruments for measuring physical activity, health knowledge, body size attitudes and perception, self-efficacy, social support and environmental barriers associated with healthy eating and participation in physical activity in South African women and girls. The fourth study is written such that it highlights the factors associated with errors in reporting of food energy intake by adult South African women, using a previously validated instrument. The fifth and final study explores intra-familial and inter-ethnic variance in attitudes and perception towards body size status, in South African women and their daughters. The last chapter pulls together the most important findings, as well as the strengths and limitations of the current dissertation, and discusses the implications of the results of this body of work, in relation to the development of interventions aimed at preventing obesity in South African women and girls.

Figure 1 below outlines the structure of the dissertation starting from the scope of the problem of obesity and specific objectives of the research. This figure outlines that our first objective (study 1) was to validate instruments measuring the body image of both mothers and their daughters. In this regard, we compared body image questions to standard measures such as age-adjusted

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silhouettes and the women's actual body size status. The hypothesis was that body image influences the body status of women. For the second objective, we examined factors associated with food energy intake under-reporting in women using their reported energy intake (EI) divided by the estimated resting metabolic rate (BMR_{est}) ($EI:BMR_{est}$). The hypothesis was that body size status (obesity) and body image influence women to under-report their food energy intake. In objective 3 we validated an instrument to measure physical activity in South African children by comparing the energy expenditure (EE) and inactivity generated using the physical activity questionnaire (PAQ) with EE and inactivity generated using standard measures such as the ACTIVITYGRAM and Television List. The hypothesis was that physical activity influences body size status of children. For the fourth objective we assessed the inter-item reliability of the constructs measuring health knowledge, self-efficacy, social support and environmental barriers in children. The hypothesis was that health knowledge, self-efficacy, social support and environmental barriers influence children to eat healthily and exercise. The fifth objective was to assess family and ethnic group resemblance of mothers and their daughters regarding their body image attitudes and perception. The hypothesis was that body image attitudes and perception resemblances existed between mothers and their pre-adolescent daughters. Further, mothers influenced / modeled body image attitudes and perception to their daughters.

Our research suggested that our instruments were comparable to the standard measures used and we found internal reliability in most measures. As such, we have reached our main objectives of developing and validating instruments

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measuring determinants of obesity in South African women and their pre-adolescent daughters of different ethnic origin. The results of this research have implications in the health field in that there are age-adjusted and culturally-sensitive measures for intra- and inter-personal determinants of obesity in South African context.

Figure 1 Outline and structure of the dissertation

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LIST OF PUBLICATIONS RESULTING FROM THIS DISSERTATION

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Zandile Mciza, Julia H Goedecke, Nelia P Steyn, Karen Charlton, Thandi Puoane, Shelly Meltzer, Naomi S Levitt and Estelle V Lambert. Development and validation of instruments measuring body image and body weight dissatisfaction in South African mothers and their daughters. *Public Health Nutrition*: 2005: 8(5), 509–519

ZJ Mciza, JH Goedecke, EV Lambert. Validity and reliability of a physical activity / inactivity questionnaire in South African primary schoolgirls. *SAJSM*: 2007: 19(4):80-87

PEER-REVIEWED PUBLISHED ABSTRACTS:

Mciza Z, Goedecke JH, Steyn NP, van der Merwe, L, Lambert EV. Assessing Knowledge and Self-Efficacy for Healthy Eating and Exercise, Self-Perception and Cultural Identity in South African Girls: A Validation Study. *10 International Congress of Obesity*: and 2nd edition of the Community-Based Obesity. Geelong and Sydney Australia 31october –08 November 2006

Zandile J. Mciza, Julia H. Goedecke, Estelle V. Lambert. Accuracy of reporting food energy intake: influence of ethnicity and body weight status in urban South African women. *Medical Research Council (MRC) of South Africa Research Day*. 18 October 2007

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List of abbreviations

ANOVA - Analysis of Variance

AR- adequate reporting

BMI- Body Mass Index

BMR – Basal Metabolic Rate

BMR_{cal}- Calculated Basal Metabolic Rate

BMR_{est-} Estimated Basal Metabolic Rate

BRISK- Black Risk Study

CATCH- Children Cardiovascular Health

CBF- central body fat

CDC- Center for Chronic Diseases

ChEAT- Children's Eating Attitudes Test

cm- centimeters

CORIS- Coloured Risk Study

DLW- Doubly Labelled Water

EAT- Eating Attitudes Test

EDI - Eating Disorder Inventory

EE- Energy Expenditure

EI – Energy Intake

EPAQ- European Physical Activity Questionnaire

EPAQ2- 2nd European Physical Activity Questionnaire

EPIC- European Prospective Investigation into Cancer

FFQ- food frequency questionnaire

FID index– Feel Ideal Difference index

FPPB- food portion picture book

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FYFS- First Year Food Survey

GPAQ- global physical activity questionnaire

HEPA- health enhancing physical activity

HIV- Human Immuno-defficient Virus

SADOH – South African Department of Health

BSQ- Body Shape Questionnaire

HSRC- Human Science Research Council

IDECG- International Dietary Energy Consultative Group

IPAQ – International physical activity questionnaire

kcal - Kilocalories

Min- minutes

MRC- Medical Research Council

NCD - Non communicable disease

NFCS- National Food Consumption Survey

NHANES- National Health and Nutrition Examination Survey

OR- over-reporting

PAEE- Physical Activity Energy Expenditure

PAJMG- Physical Activity Joint Monitoring Group

PAL- Physical Activity Levels

PAQ- Physical Activity Questionnaire

PAQ-A- physical activity questionnaire for adolescents

PAQ-C- physical activity questionnaire for children

PDPAR- previous day physical activity recall

QFFQ- quantified food frequency questionnaire

s/t- subscapular / triceps

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SA - South Africa

SADHS- South African Demographic and Health Survey

TEE- Thermal Energy Expenditure

THUSA – Transition and Health during Urbanization of South Africans

UCT- University of Cape Town

UR- under-reporting

USA- United Status of America

WHO-World Health Organization

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Abstract

Background

Obesity is a worldwide problem and has escalated rapidly to epidemic proportions even in low income countries undergoing demographic, epidemiologic and nutrition transition such as South Africa (Ono, 2005). South African evidence suggests that like other developing countries, obesity affects the most vulnerable groups (women and the poor), some higher socioeconomic classes and those that live in urban communities (Puoane et al., 2002; Gopalan et al., 1998; al Shammari et al., 1994; Mokhtar et al., 2001). Further, in South Africa, evidence suggests that there are gender disparities, with the highest prevalence of overweight and obesity shown in adult women compared to adult men (i.e. 56.6% versus 29.2%%, Puoane et al., 2002; Ono, 2005). Although the obesity prevalence in South African children is still lower than in South African adults, they seem to follow the same gender trend in that, the prevalence is higher in girls between the ages 9 and 13 years (17.9% of overweight and 4.9% of obesity) than in boys of the same age (14% of overweight and 3.2% of obesity, Armstrong et al., 2006). Similarly, adolescent South African children have shown the same gender trend with 25% of girls overweight and 5.3 % obese in comparison to boys, 6.9% of whom were overweight and 2.2% of whom were obese, Reddy et al., 2003).

The aetiology of obesity is complex, and in addition to intrinsic factors such as the biology of individuals (presented as genetics, age, gender) that contribute to the high obesity epidemic, there are behavioural determinants, along with

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economic, socio-cultural and environmental factors which are largely extrinsic, that either directly or indirectly influence the development of obesity, therefore are called "obesogenic" (Swinburn et al., 2005; Egger and Swinburn, 1997). In South Africa, these "obesogenic" factors have been only partially explored, and as such, there are gaps in our knowledge. We are also not certain of the extent to which the language, culture and age influence these afore-mentioned factors. As such, this dissertation focused on finding and adapting culturally-sensitive and age-appropriate instruments to better understand these obesogenic factors in South African women and girls.

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Aims and objectives

The main aim of this dissertation was to determine the validity and reliability of instruments measuring "obesogenic" factors such as dietary and physical activity knowledge, attitudes, beliefs, and health behaviours of South African mothers and their pre-adolescent girls from different ethnic origins.

The specific objectives were: i) to develop and validate instruments measuring the body image of South African mothers of different ethnic origins and their pre-adolescent daughters; ii) to identify factors related to food energy intake mis-reporting in different ethnic groups of adult South African women, iii) to validate a physical activity questionnaire to quantify physical activity / inactivity of pre-adolescent South African children; and iv) to adapt and validate a questionnaire measuring cultural identity, health knowledge, self-efficacy, self-perception, social support and environmental barriers to healthy eating and physical activity in South African children. Secondary to this, and after having

established the validity of the various instruments, we formulated a hypothesis of the secondary objective suggesting that maternal body image attitudes and perception impact on the body image of their daughters, and this effect remains, even after adjusted for between group differences in ethnicity. Thus, mothers influenced / modeled body image attitudes and perception to their daughters. In this regard, we undertook identifying the respective contributions of intra-familial factors, on attitudinal and perceptual body image of South African women and their pre-adolescent daughters. As such, the specific objectives / questions of the secondary objective which were: i) to compare mothers and their daughters' data regarding their body image attitudes and perception and ii) to compared black versus mixed ancestry and white families' data regarding body image attitudes and perception.

Methods

Research design and participants

A validation study was undertaken in which energy intake, physical activity, health knowledge, attitudinal and perceptual body image, self-efficacy, social support and environmental barriers of 333 multi-ethnic pre-adolescent South African girls and 204 of their mothers from divergent socio-economic statuses (presented by low, middle and high socioeconomic statuses) were evaluated. Ethical approvals were obtained from the Western Cape Department of Education as well as the University of Cape Town Research Ethics Committee. All participants completed informed consent forms, with girls given informed consent by their parents or caregivers and assent, individually.

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Procedures

Measurements

Body composition was calculated as the WHO BMI (percentiles) for girls and as the BMI (kg/m^2) for their mothers. The percentage body fatness was calculated using 4 skinfold measurements (biceps, triceps, subscapular and suprailliac)] for all participants. Further, body fat centralization was determined based on the subscapular / triceps (s/t) ratio for girls (van Lenthe et al., 1996) and waist / hip circumferences (waist-to-hip) ratio for their mothers.

Questionnaires

Participants were asked to answer questions characterizing socio-demographic factors. For example, girls answered questions regarding their age, ethnicity, school grade, as well as their caregiver's marital status, employment status and level of education. Their mothers answered questions regarding their age, ethnicity, marital and employment status, level of education, household density (number of people residing / sleeping in the same household for at least five days a week) and asset index (total number of appliances they had in their household).

Further, in the first study all participants completed questions concerning their body image derived from focus groups comprised of black women from the Cape Town Metropole Area (Puoane et al., 2005). They were also asked to select silhouettes adapted from the Pathways study (Stevens et al., 1999) for girls and Stunkard figures (Stunkard et al., 1983) for their mothers. Using the

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selected silhouettes, a Feel-Ideal Difference (FID) index score (Fitzgibbon et al., 2000; Caradas et al., 2001) was created for each participant by subtracting the score of the silhouette selected as the participants' *"Ideal"* from the one selected as most closely representing their current appearance *"Feel"*. We hypothesized that a higher FID Index score would be associated with greater body size dissatisfaction. The body image outcome scores were further compared to the participants' measured BMI and the body shape questions (BSQ, Cooper et al., 1987) in adult women.

In the second study the food energy intake of adult women was quantified using a previously validated quantitative food frequency questionnaire (QFFQ, MacIntyre et al., 2001) for energy intake over a period of 1 month. Energy and macronutrient intake were then calculated and averaged to generate food EI over 1 day period. The outcomes were compared to the women's estimated basal metabolic rate (BMR_{est}) derived from standard equations (Schofield et al., 1985). The ratio ($EI:BMR_{est}$) for each individual was compared to the cut-off values of <1.05 for under-reporters, 1.05-2.28 for adequate-reporters, and >2.28 for over-reporters. Further, the outcomes were compared to the FID Index scores, BSQ scores as well as socio-economic status (based on household density and asset index score).

In the third study, girls only answered questions concerning their physical activity (yielding results in the form of MET $min.week^{-1}$) and inactivity (in the form of minutes spent watching television and working on a computer) over a period of seven days using a physical activity questionnaire (PAQ) adapted

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from the Second European Physical Activity Questionnaire (EPAQ2, Wareham et al., 2002) To validate the PAQ, the energy expenditure derived from PAQ was compared to the energy expenditure derived from the ACTIVITYGRAM (Welk et al., 2004). Further, PAQ- derived minutes of inactivity were compared to the number of television programmes watched from a television programme list. The television programme list included the most commonly watched programmes by South African children. To measure indirect validity of the PAQ, the energy expenditure and inactivity derived from the PAQ was compared to the actual body composition of the girls.

In the fourth study a questionnaire consisting of 5 different constructs eliciting questions on (a) cultural identity, (b) knowledge related to healthy eating and participation in physical activity, (c) self-efficacy to eat healthily and engage in physical activity, (d) body size status self-perception, as well as (e) social support and environmental barriers influencing children to eat healthily and engage in physical activity, was administered to the girls. Further, a total score was also assigned for each construct and the inter-item reliability of each of the constructs was further explored.

Lastly, for the fifth study the mother- daughter resemblances on the attitudinal and perceptual body image of women participating in our research were explored.

Results

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Results of the first study suggested that the girls' WHO BMI-percentiles ($r = 0.46$, $P < 0.05$) and the mothers' BMI ($r = 0.68$, $P < 0.05$) were positively correlated to the selected silhouettes based on size. Participants who reported feelings of being "fat" and those who perceived that their family and friends were more dissatisfied with their body size had significantly higher FID Index scores. Scores were lower in black compared to white girls (all $p<0.05$). No differences were found in FID Index scores between ethnic groups of mothers. Internal reliability of the "thin" and "fat" belief constructs for girls was demonstrated by standardized Cronbach's α values ≥ 0.7. However, for mothers, only the "fat" belief construct demonstrated good internal reliability (a Cronbach's $\alpha \geq 0.7$)

Results of the second study suggested that the 26% of women in our study who under-reported their food energy intake had higher BMI ($P<0.01$) and % body fat ($P<0.05$) than the adequate- (64%) or over-reporters (10%). A greater proportion of under-reporters were black (38% vs. 21% and 20% for mixed ancestry and white, respectively, $P<0.01$). Eighty three percent black under-reporters were also obese, however, only 63% mixed ancestry under-reporters were overweight and 50% of white under-reporters were normal weight. Under-reporters reported lower dietary fat (28.1±1.2% vs. 31.7±7.7% and 32.9±9.1%, $P<0.01$) and higher protein intakes (13.9±3.9% vs. 12.6±2.7% and 11.8±2.7%, $P<0.01$) than the adequate- or over-reporters, respectively. However, EI:BMR_{est} was not associated with socio-economic status or body image.

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Further, the results of the third study suggested weak, but significant associations between the girls' body composition and PAQ-derived total energy expenditure ($r=-0.18$; $p<0.05$ for percentage body fat; $r=-0.17$; $p<0.01$ for WHO BMI-percentiles) and inactivity ($r=0.35$; $p<0.001$ for percentage body fat; $r=0.23$; $p<0.001$ for WHO BMI-percentiles). Further, positive associations were found between moderate and vigorous energy expenditure by PAQ and the same intensity activities by ACTIVITYGRAM ($r=0.19$; $P<0.001$ and $r=0.26$; $P< 0.001$, respectively). Moreover, the television viewing time reported by PAQ was significantly positively related to the number of programmes noted from the television programme list. However, only total energy expended while partaking in structured school sports showed good test-retest reliability ($r=0.80$; $P<0.05$).

In the fourth study we found that the 9-item self-efficacy construct, the 6-item body size status self-perception construct and the 12-item environmental factor construct showed good inter-item reliability (they yielded Cronbach's α values of 0.74, 0.70 and 0.90, respectively), whereas, the rest of the constructs yielded lower Cronbach's α values (<0.70). The girls' WHO BMI-percentile increased with an increase in the social support score ($r=0.14$, $P<0.05$) as well as self efficacy score ($r=0.11$, $P<0.05$), whereas the overall physical activity energy expenditure increased with an increase in body size status self-perception score ($r=0.20$, $P<0.01$), while it decreased with an increase in self-efficacy score ($r=-1.4$, $P<0.01$). The total number of fruit and vegetables the girls consumed increased with an increase in the social support score ($r=0.19$, $P<0.001$). Further, those girls who reported walking to and from school had lower environmental barrier scores than those who relied on motorized vehicles

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for transport (4.0±2.3 vs 9.8±3.2, P<0.001). The above relationships were not affected by the girls' ethnicity.

Lastly, the results of the fifth study suggested that some resemblances existed between mothers and their primary school aged daughters. For example, in this analysis, girls and their mothers chose similarly weighted figures representing their perceptual and ideal body image. Further, body size figures showing thinness, fatness and also engendering feelings of beauty, respect and happiness chosen by the girls were similar to those chosen by their mothers. However, in this analysis girls only demonstrated similar body size dissatisfaction to their mothers when the confounding effects of ethnicity were removed.

Conclusion

In conclusion, this research suggested that the South African version of silhouettes, FID Index scores, "fat" belief constructs are age-appropriate, culturally sensitive and can be used in further intervention studies to understand body image in multi-ethnic South African girls and their mothers. Further, a significant proportion of adult South African women under-report their food energy intake, and food EI reporting in adult South African women is influenced by body size status, is ethnic-specific, and also alters macronutrient reporting. Moreover, the South African version of a children's PAQ may provide some reasonable insights into levels of physical activity and inactivity of South African primary school aged children, based on indirect measures of validity such as body composition, with structured and higher intensity activities having

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better recall. However other objective measures such as accelerometers still need to be included during intervention procedures.

Furthermore, the South African version of self-efficacy, self-perception, social support and environmental barrier constructs were valid in this group of girls however, more studies are still to be done to improve the cultural identity and dietary knowledge constructs for both the girls and their mothers. Lastly, our South African validated body image constructs suggest that resemblances exist between primary school aged girls and their mothers on issues related to perceptual and attitudinal body image. However, mothers and their daughters seem to only demonstrate similar body size status dissatisfaction if the confounding effects of ethnicity are removed. Researchers, therefore, have a challenge to consider the effects ethnic or cultural group and family status may have on the problem of obesity in South African women, when developing targeted interventions to promote healthy eating and participation in physical activity.

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CHAPTER 1

LITERATURE REVIEW

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Chapter 1

Literature Review

1. 1 Introduction: Scope of the problem

Overweight and obesity are on the rise and are becoming global problems, with increasing significance in women of all age groups (Ono et al., 2005). Developing countries like South Africa are no exception, for example, with over 56% of adult South African women either overweight or obese compared to 29% of men (Puoane et al., 2002). The highest prevalence of obesity in women has been shown to occur in adult black women, who are also socioeconomically disadvantaged (Puoane et al., 2002). Further, in the same study urbanization differentiated obesity prevalence in black women, with those residing in urban areas presenting with a higher prevalence than those from rural areas.

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Moreover, obesity in South African children and adolescents follows a similar pattern. For example, the National Youth Risk Behaviour Survey conducted in 2002 on 9054 adolescent children showed that 17.2% were overweight and 4.0% were obese. In this group overweight and obesity prevalence was higher in girls (25% for overweight and 5.3 for obesity) than in boys (6.9 for overweight and 2.2% for obesity) (Reddy et al., 2003). Further, a national study done on 10195 pre-adolescent children also suggested a prevalence of overweight and obesity of about 17.9% and 4.9% in girls, higher than the 14.0% of boys who were overweight and 3.2% of whom were obese, between the ages of 6 and 13 years (Armstrong et al., 2006).

High prevalence of obesity is associated with high morbidity and disease burden, along with obesity-associated costs (Wang and Dietz, 2002; Stein et al., 2004; Katzmarzyk, 2001). These diseases include: diabetes mellitus, hypertension, cardiovascular disease, gall stones and cholecystisis, respiratory dysfunction, sleep apnoea and certain types of cancers (Mokdad et al., 2003; Canoy, 2004; Billington 2002; Wolk et al., 2001). These diseases may also present differently in groups of different ethnic origin, and in men and women (Joubert et al., 2007; Steyn et al., 1989).

Studies performed on small, local and regional samples of South African populations suggest the cultural, social, and economic factors to encourage unhealthy eating and sedentary behaviours (Steyn et al., 2003; Bourne et al., 1996; Puoane et al., 2005; Puoane et al., 2006; Kruger et al., 2002; Charlton and Rose, 2002). This situation therefore calls for more active and more comprehensive prevention strategies in South African women who also present with the high prevalence of obesity. Unfortunately, there is a lack of validated instruments to explore these predisposing cultural, social and economic factors in South Africa, with a focus on developing targeted interventions to prevent or manage the problem of overweight and obesity.

This dissertation therefore undertakes a multidisciplinary approach in finding and adapting self-report instruments that are feasible to administer and capable of eliciting information concerning these cultural, social, demographic and intra-personal factors influencing weight and health of South African mothers and their pre-adolescent daughters. The first part of the literature review deals with the problem and determinants of obesity itself, and the second part deals

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specifically with issues of validation of instruments to capture these determinants and the potential modulating factors of obesity.

1.1.1 Definition of overweight and obesity

Firstly we may define overweight as the weight that is greater than what is considered healthy for a given height (CDC, 2007), and obesity as an over-accumulation of body fat (Valdez and Williamson, 2002). The problem of overweight and obesity may occur in both children and adults. In clinical studies dual energy X-ray absorptiometry (DXA, Novotny et al., 2007) and computerized tomography (Mitsiopoulos et al., 1998) scans have been used as direct measures of adiposity. However, these procedures can be very expensive and impractical. Anthropometric techniques, generating prediction equations from the sum of various skinfolds, or from circumferences, have also been used to estimate levels of adiposity (Durnin and Womersley, 1973; Lohman et al, 1999). However, these techniques need well-skilled manpower, and as such, make them less suitable as an epidemiological tool to use in national studies.

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Therefore, for epidemiological purposes, body mass index (BMI) has been widely adopted, and the World Health Organization (WHO) cut-points for overweight and obesity are routinely applied. Thus, overweight adults may be defined as persons with a BMI [weight in relation to height squared (kg/m^2)] > 25, and obesity in adults with a BMI that is ≥ 30 (WHO, 1995). BMI has been shown to be strongly associated with percentage body fat in adults (such that, the correlation is about 0.75 and 0.76 in adult men and women, respectively, Deurenberg et al., 1991). Whereas, in the whole group of children the

relationship is lower, and is found to be about 0.43 and 0.53 (Deurenberg et al., 1991). Further, BMI correlates well with health complications in the adult population worldwide (WHO, 2003; Janssen et al., 2002) and as such, it may serve as a relevant reference standard for obesity in adulthood (WHO, 2003). In children, overweight and obesity may be defined as BMI ≥ 85th and 95th age-related percentile, respectively, for research and epidemiological purposes (Kuczmarski et al., 2000; Cole, 2000; WHO, 1995; WHO, 2003).

Additionally, body fat centralization in adults is determined by measuring the waist circumferences in centimeters (cm, Janssen et al., 2002). A waist circumference in excess of 88cm for women and 102 for men, places the individual at increased risk for chronic, non-communicable diseases (WHO, 1995). Moreover, the waist circumference reading may also be divided by the reading obtained from measuring the hip circumference also in cm to determine the waist-to-hip ratio. A result greater than 0.8 in adult women suggests an increased body fat centralization (Singh, 1993; Buss, 1994; Mohammed et al., 2008). However, in children body fat centralization is based on the sub-scapular measurement divided by the triceps (s/t) ratio (van Lenthe et al., 1996). Body fat centralization and accumulation of visceral adipose fat has been regarded as a determinant of chronic diseases (Janssen et al., 2002; Després, 1993; Novotny et al., 2007).

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1.1.2 Determinants of obesity:

We can use the epidemiological triad (Egger and Swinburn, 1997) to view the causes of obesity at population level in South Africa. The triad was initially used as a model for combating infectious diseases, and was later applied to injuries

and some non-communicable diseases, and is eminently applicable to obesity. It helps to define the different nature of the determinants of obesity and potential strategies for action. Figure 1.1 provides a schematic overview of the triad, and the inter-relationships between its various components. Firstly, there is the “host”, made up of biological, behavioral, attitudinal and physiological factors - unique to the individual or groups at risk. We can call these intra-personal factors or determinants. Secondly, we have vectors of energy imbalance – which include energy density of food, portion sizes and frequency of eating. These may be considered as health or risk behaviours which reflect intra-personal (namely, knowledge, attitudes, beliefs, etc.) determinants of obesity, and are measurable. Finally, we have environmental determinants which include the physical, legislative, policy and socio-cultural factors playing a role in the development of obesity. The first part of this literature review will focus on the obesity-associated behavioral, biological, attitudinal and psychosocial factors unique to the host, with specific reference to South Africa, using the epidemiological triad.

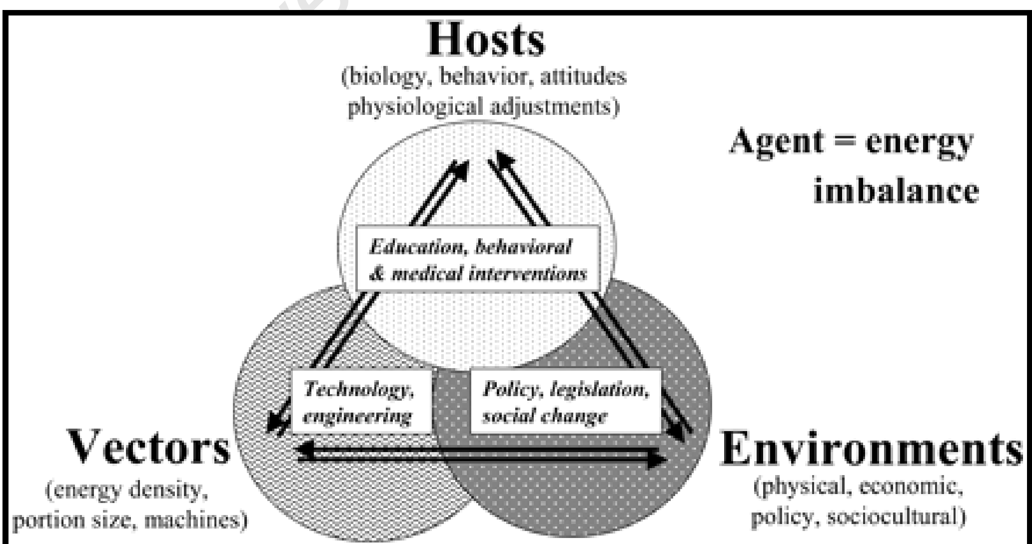

Figure 1.1 Epidemiological Triad, hosts, vectors and environments interconnected and interventions can be targeted at any corner of the triad (Egger and Swinburn, 1997)

1.1.2.1 Nutrition

1.1.2.1.1 Chronic over-nutrition

The problem of obesity is intrinsically linked to energy balance, and in particular, chronic, positive energy balance. This positive energy balance is associated with food energy intake that is higher than daily energy requirements (Griera et al., 2007). For example, body mass and body energy stores are balanced by the amount of energy or kilojoules obtained from food and drinks equaling the energy lost in resting metabolism, the work of breathing and digestion and the energy expenditure associated with being physically active (thermic effect of exercise and thermic effect of food intake, Greira et al., 2007).

The high prevalence of obesity has been linked to energy imbalance, and a more Westernized diet characterized by dietary fat >30%, dietary carbohydrates <55% as well as added sugar greater than 10% of the total energy consumed (McDowell et al., 1994; Kennedy et al., 1999; Steyn et al., 2001; Popkin and Nielsen, 2003). South Africa has a diversity of cultures and ethnicities that are characterized by different eating patterns. For example, white and mixed ancestry ethnic groups of South Africans typically consume a westernized diet (Wolmarans et al., 1989; Steyn et al., 2001). The traditional diet consumed by the black population is generally lower in dietary fat (<25% of energy), higher in carbohydrates (>60% of energy) and lower in added sugar (<10% of total energy) than a Western diet (Steyn et al., 2001).

In South Africa there is body of evidence suggesting high fat food intake (Kruger et al., 2002, Bourne et al., 1996), added sugar intake (Steyn et al.,

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2003), food portion sizes above the normal recommended daily allowances (Steyn et al., 1997; Steyn et al., 2003), and lower physical activity level, sedentary lifestyles or inactivity (McVeigh et al., 2004; Kruger et al., 2002) to be the promoters (vehicles / drivers) of overnutrition (the agent). For example, black South Africans are becoming increasingly urbanized, and adopting a more Westernized diet (Bourne, 1996), which may partly explain the higher prevalence of obesity in black women residing in urban areas than those from rural areas (Puoane et al., 2002; Steyn et al., 2001).

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Indeed, local evidence suggests that black South Africans between the ages 19 to 44 years who experienced migration from their traditional to urban areas showed an increased mean fat intake from 23% to 30%, while their mean carbohydrate intake decreased from 69% to 59% after a period of ten years (Wolmarans et al., 1988; Bourne, 1996). Similarly, the mean dietary fat intake of South African children between the ages of 1 to 9 years has increased from 17% to 26%, while their mean carbohydrate intake has decreased from 72% to 66% (Bourne, 1996; Labadarios et al., 2001). Even in rural populations, portion sizes above the recommended daily allowances have been reported (Steyn et al., 2001). These findings pertain in particular to the staple foods (maize) consumed (Steyn et al., 2001).

1.1.2.1.2 Under-nutrition followed by chronic over-nutrition

In conjunction with the shifts that have occurred in the diets of black South Africans, there are apparent inter-relationships between early life programming, environment and subsequent obesity (Mamabolo et al., 2005). For example, children from the rural Limpopo region in South Africa who were underweight at

birth and demonstrated a rapid weight gain within the first year of life, had a 2.39 fold increased risk of becoming overweight at the age of three years (Mamabolo et al., 2005).

In the longitudinal cohort (N=3273) of 9-10 yr olds in the Birth-to-Twenty study (BT20), Griffiths et al. (2008) reported that early life factors influenced body composition. Their results suggested that while higher socioeconomic status at birth was shown to be more important for shaping lean tissue of these children, a high socioeconomic status at ages 9 and 10 years was associated with high fat tissue (Griffiths et al., 2008).

Furthermore, Mvo and associates found that in households dominated by food insecurity, it is very common to see malnutrition presented as both obesity in adult women and under-nutrition (presenting as stunting) in children (Mvo et al., 1999). Even more concerning is data from the South African National Household Food Consumption Survey in which it was suggested that 17% of children under the age of 9 years were overweight or obese. Stunting was present in 19% of these children (Steyn et al., 2005). The odds of obesity in stunted children were 1.8 (95%CI: 1.48-2.20), with potentially long term negative health consequences (Steyn et al., 2005).

These long-term health consequences may be reflected in early markers for non-communicable disease such as raised blood pressure, glucose intolerance or insulin resistance. Levitt et al., (1999) found an inverse association between birthweight and systolic blood pressure in black South African children as young as 5 yrs old, as part of a birth cohort (BT20) in an urban township

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setting. This relationship was independent of current weight, height or socio-economic status of the children.

In the same BT20 study, Crowther et al. (1998) found that lower birth weight was associated with greater insulin production and higher glucose concentration at age 7. In the same study Crowther et al. (1998) found both the insulin concentrations and insulin resistance to increase with the rapid increase in children's weight.

Moreover, Levitt and associates in their study of 137 urban twenty year old South Africans of mixed ancestry found low birth weight to be associated with increased cardiovascular and metabolic disorders in adult life (Levitt et al., 1999). Moreover, Mukkudem-Petersen and associates found stunting to be associated with increased centralization of body fat and deposition of subcutaneous fat in 10-15 years olds participating in the Transition and Health during Urbanization Study of South Africa (THUSA; Mukkudem-Petersen et al., 2004). Body fat centralization and accumulation of subcutaneous fat are determinants for chronic diseases such as diabetes mellitus and cardiovascular disease (Janssen et al., 2002; Novotny et al., 2007).

Research from other developing countries has also shown low birth weight and early life undernutrition to be associated with body fat accumulation and obesity –related co-morbidities (Hemachandra et al., 2006; Ong and Dunger, 2002). Further, Doak and associates in their study of Brazilians, Chinese and Russians living in urban areas, found underweight (in children and older adults)

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and overweight (in adults) to coexist within the same households (Doak et al., 2000).

1.1.2.2 Physical activity and sedentary behaviours

In Section 1.1.2.1 of the current dissertation we have mentioned that energy balance is defined as the balance between energy taken in and the energy expended. However, the role of physical activity in the prevention and management of obesity is not only linked to energy expenditure itself, but also to the associated changes in body composition, substrate oxidation and metabolism (Griera et al., 2007; Donnelly et al., 2003). As such, studies suggest physical activity, combined with nutrition-related interventions, is the best means of preventing and managing obesity and its co-morbidities (Hance et al., 2007; Baranowski et al., 2002). However, researchers have shown that the promotion of physical activity is difficult due to poor adherence, influenced by social physique anxiety (disapproval of body shape) and unrealistic activity messages (where individuals are promised weight loss resulting from activity to be visible over a short period of time, Hemmingsson et al., 2001); as well as low motivation and inadequate access to safe recreation places (Amosun et al., 2007).

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Until recently, there has been little available data on the prevalence of physical activity / inactivity in South Africa. The few national studies that have recently been undertaken measured self-reported physical activity and inactivity of South Africans, and showed that both adolescent children and adults are insufficiently active (Amosun et al., 2007; WHO 2005). The prevalence data for physical in / activity in South African adolescents are presented in Figure 1.2 (Amosun et al., 2007). In this sample of 9054 adolescent children of different

ethnicities, more than 40% were reportedly inactive (Amosun et al., 2007). In the same study, ethnicity differentiated levels of inactivity, such that girls of mixed ancestry had the highest prevalence, when compared to black and white girls (57% vs 42% and 37%, P<0.05). This same pattern was present in boys, with the mixed ancestry boys more inactive than black and white boys (46% vs 37% and 29%).

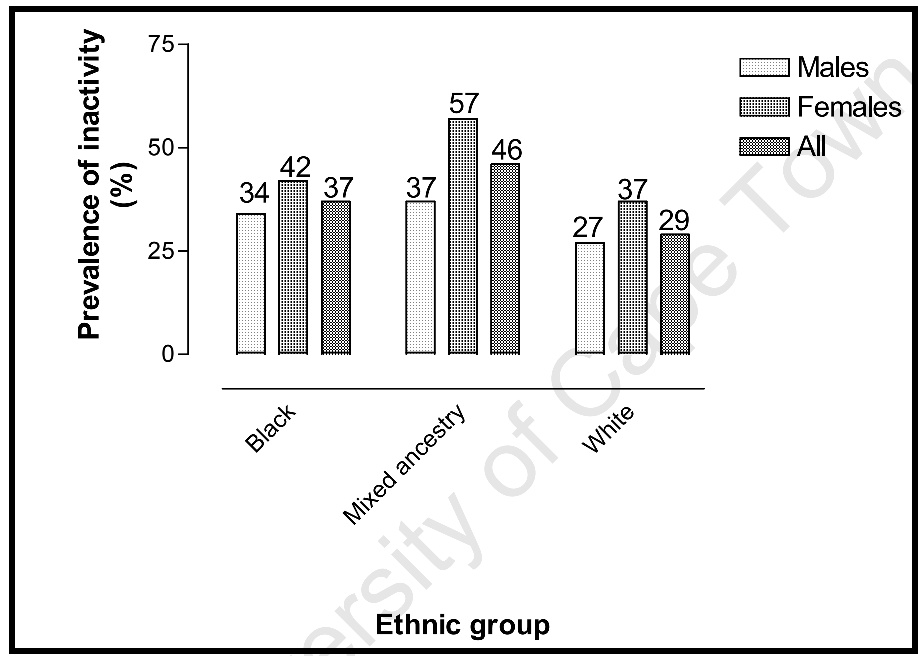

Figure 1.2 Prevalence of inactivity in South African adolescents of different ethnic origin.

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Further, in a local study including 381 black and white adolescent South African children from Gauteng, McVeigh et al. (2004) found that black children watched more television than their white counterparts. This study also found that black children were less likely to partake in physical education classes than white children. Those children who were highly active and who watched less television had greater lean tissue, possibly explaining why they weighed more than those with lower levels of activity and watched more television.

Socioeconomic status differentiated participation of children in physical activity in this study, and is likely confounding, with respect to apparent ethnic differences, as all the white children were of a high socioeconomic stratum, making interpretation of the findings difficult.

Similar to the findings in adolescents, the prevalence of inactivity in South Africa is also high in adults. An international study including a representative sample of South African adults (n=986), found that 46% of the study population were inactive and only 30% of the population were sufficiently active to be protective for non-communicable disease, with men being more active than women (Table 1.1, WHO World Health Survey, 2005). These findings were based on whether the participants in this study were doing no or very little physical activity at work, at home, while walking to- and from- places, or during discretional time. Small studies have also shown that South African adults have low levels of physical activity during work and leisure time (Kruger et al., 2002; Levitt et al., 1999). Further, physical inactivity has been found to be a major determinant of obesity in black women according to a local study done on black South African women in the North West Province (Kruger et al., 2002). In this study Kruger and associates found that physical activity was negatively correlated to the BMI and waist circumference, and those participants in the highest tertile of physical activity were less likely to be obese than those who were inactive (OR: 0.38, Kruger et al., 2002).

In summary, sections 1.1.2 of this dissertation reviewed studies supporting the role of intrapersonal risk factors for obesity in South African communities. However, the South African data are fragmented, with national prevalence data on the physical activity levels of pre-adolescent children lacking.

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Table 1.1 Prevalence (95% CI) of physical activity in a representative sample of adult South Africans (World Health Survey; World Health Organization)

	Men	Women	All
Inactive (<600 MET min/wk)	43 (38; 49)	49 (43; 54)	46 (42; 51)
Minimally Active (≥600 MET min/wk)	20 (16; 23)	27 (23; 30)	24 (21; 27)
Sufficiently active (HEPA)	37 (32;42)	25 (20; 29)	30 (26; 34)

HEPA (Health enhancing physical activity; ≥ 7 days of any combination of moderate and vigorous activity ≥ 3000 MET min/week)

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What is concerning is that, as previously mentioned in Section 1.1 obesity prevalence is high even in this group of children. For example, in their national study of 10195 primary school aged children of ages 6 to13 years done in 2001-2004, Armstrong et al. (2006) found that according to the curves developed by Cole et al. (2000) 13.0% girls were overweight and 4.9% were obese compared to 10.8% boys who were overweight and 3.2% who were obese (data presented in Figure 1.3, Armstrong et al., 2006). Prevalence of overweight and obesity in South African children was similar to that of children in North America, between 1976 and 1980.

Moreover, in the same study ethnicity differentiated overweight and obesity prevalence, such that white children had the highest overweight and obesity prevalence compared to black and mixed ancestry children (Armstrong et al., 2006).

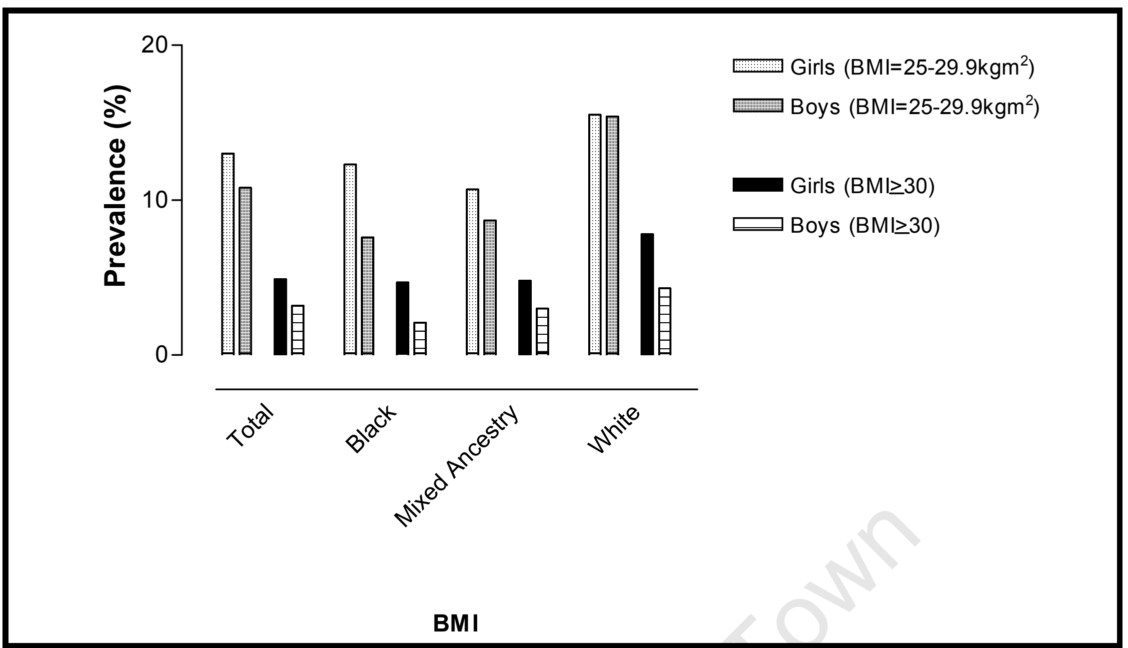

Figure 1.3 Prevelance of overweight and obesity in South African pre-adolescent children (6-13 years) based on the curves developed by Cole et al., 2000 (derived from Armstrong et al., 2006)

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Thus, adult black South African women and white pre-adolescent girls seem to be at increased risk for obesity. As such, local researchers and practitioners need to better understand factors that influence the development of obesity in these individuals, moving away from a linear predictive model and towards a a more integrated aetiological model. This integrated model considers multiple factors, some of which are non-modifiable (host characteristics, such as age, gender, ethnicity and heritability) as well as those that are modifiable (such as social, cultural, economic and physical environments) and that are thought to discourage healthy eating and participation in physical activity. The following section of the literature review will outline the non-modifiable factors associated with the development of obesity.

1.1.2.3 Non-modifiable risk factors for obesity

1.1.2. 3.1 Heritability

International studies suggest that obesity is highly heritable (Bouchard et al., 1991; Boesgaard et al., 2007; Rakinen et al., 2002) and tends to run in families (Treuth et al., 2001; Price et al., 1991). The chances of being overweight are greater if one or both parents are overweight or obese (Crawford et al., 2002; Maes et al., 1997). Genes may not only affect total adiposity, but also body fat distribution (Bouchard et al., 1991; Mohammed et al., 2008; Maes et al., 1997; Siffert et al., 1999). Moreover, it is likely that genetic factors contribute significantly to ethnic differences in body composition, fitness levels and obesity related co-morbidities (Siffert et al., 1999; Farooqi and Rahilly, 2005; Perusse et al., 2005; Fuemmeler et al., 2008). The specific genetic factors associated with obesity are beyond the scope of this dissertation, but have recently been reviewed in the South African context by van der Merwe and Pepper (2006).

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1.1.2.3.2 Age and gender distribution of obesity

It is well accepted that body fat increases from childhood to adulthood (Fujita and Volpi, 2006; Hedley et al., 2004; Puoane et al., 2002), but then declines in older adulthood (Puoane et al., 2002; Joubert 2007). Indeed, the National Health and Nutrition Examination Survey (NHANES, 1999-2002) data including children, adolescents and adults demonstrated that the chances of becoming obese increased, along with the risk for co-morbidities, as participants in the study got older (Hedley et al., 2004). Moreover, there is some recent evidence to suggest that being overweight at childhood results in an 11-30-fold increased risk for being obese in young adulthood (Thompson et al., 2007).

The increase in BMI in the NHANES example was attributed, in part, to a decline in physical activity with age (Hedley et al., 2004). Similarly, data from a recent World Health Survey (2003) also demonstrated that physical inactivity of South Africans increased with age (from adolescence to adulthood; World Health Survey, 2003). Corwyn and Benda (1999) showed that participation in any form of physical activity tends to decline with increasing age.

Furthermore, in South Africa, like many other developing countries, such as Saudi Arabia and Tunisia, adult women are the most vulnerable group, with a markedly higher prevalence of obesity than men (Puoane et al., 2002; al Shammari et al., 1994; Mokhtar et al., 2001; Ono et al., 2005). For example, Figure 1.4 presents that in Tunisia 30.2% of women are obese compared with only 7.7% of men (Ono et al., 2005).

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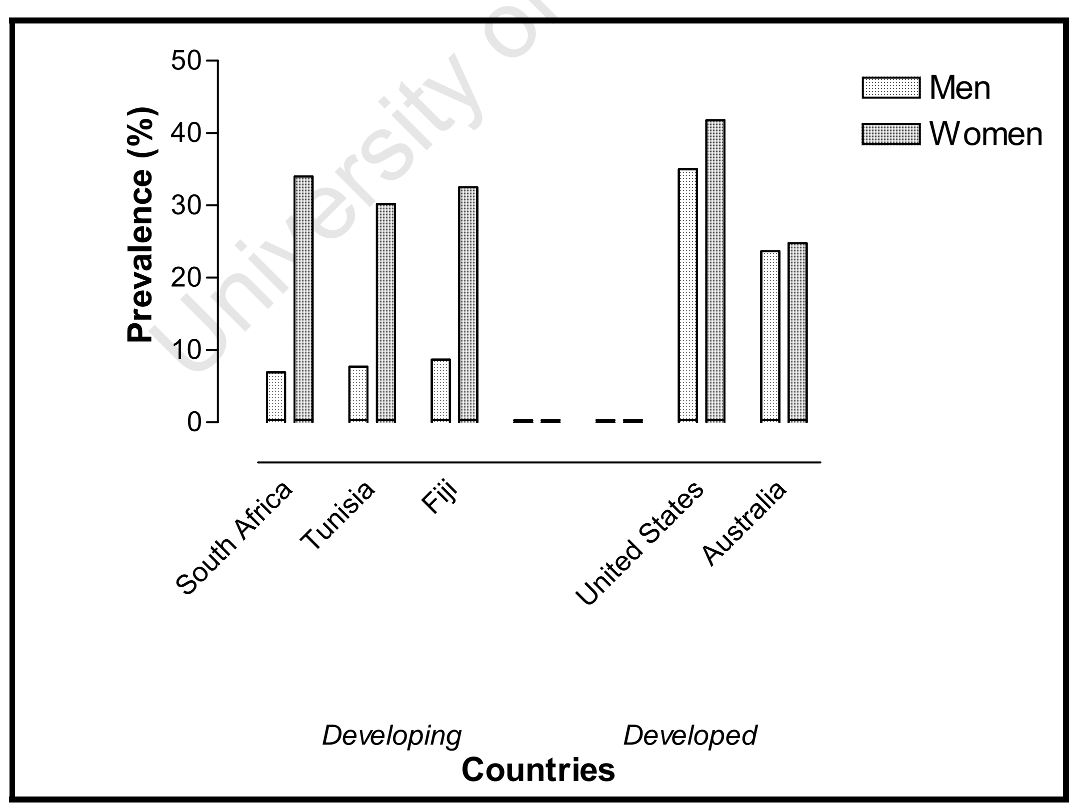

FIG 1.4 Gender difference in obesity (BMI ≥ 30, derived from Ono et al., 2005)

Similarly, in Fiji 32.5% women and only 8.7% of men are obese (Ono et al., 2005). This contrasts to developed countries, in which the gender disparities for obesity tend to narrow (Ono et al., 2005, Figure 1.4). For example, in Australia, 24.8% of women and 23.7% of men are obese. Similarly, in the United States of America, 41.8% of adult women and 35% of adult men are obese (Ono et al., 2005, Figure 1.4). Gender disparities in obesity observed in developing countries suggest that other important intra-personal factors, unique to those countries, may be driving the higher prevalence of obesity in women in comparison to men. These intra-personal factors have been identified as the 'environment' in the epidemiological triad and are known to be modifiable. These modifiable factors are the economic, social, cultural and physical environmental factors. However, these factors have not been widely explored in South Africa. In this regard, the following section of this review will focus on identifying these important factors that are assumed to play a major role in the development of obesity.

1.1.2.4 Modifiable risk factors for obesity

1.1.2.4.1 Socioeconomic status

Apart from the gender disparities in obesity in developing countries, obesity is also influenced by socio-economic status, with higher levels of obesity being observed in the lower socio-economic groups (WHO, 2005). However, this finding is not always consistent as, for example, Gopalan (1998) showed the prevalence of obesity to be higher in men within the highest social class than men in the middle and low social classes.

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Similarly, in South Africa socioeconomic status impacts significantly on obesity (Mvo et al., 1999; Mamabolo et al., 2005; Steyn et al., 2005). Despite the recent economic growth, large discrepancies in income between different ethnic groups of South Africans are still prevalent (May, 2004; Human Sciences Research Council, HSRC, 2003). In South Africa, 57% of individuals still live below the poverty index line (meaning that they spend some days in the week without food, Human Sciences Research Council, HSRC, 2003). Moreover, majority of these individuals, have less education and are termed to be disadvantaged with respect to their living conditions and overall wellbeing (Temple et al., 2003; Richter et al., 2006). The majority of these disadvantaged individuals are black and of mixed ancestry and reside in informal settlements, with no food security (Rose and Charlton, 2002; Mvo et al., 1999, Temple et al., 2001; HSRC, 2003). These individuals also experienced higher prevalences of both under- and over-nutrition (Temple et al., 2001; Puoane et al., 2002; Mvo et al., 1999; Rose and Charlton et al., 2002). However, on the other hand, the majority of South African white men still present with a higher socio-economic status and are also more likely to be overweight than black South African men (Puoane et al., 2002). Besides the fact that socioeconomic disparities in South Africa may play a role in the prevalence of obesity, interaction effects between social class and other factors such as the individual's culture and attitudes may also play a role in the development of obesity.

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For example, a study done in a poor urban informal settlement in South Africa (Khayelitsha) suggested that in households dominated by food insecurity, mothers presented with obesity while their children presented with wasting and stunting (Mvo et al., 1999). Obesity in these households was associated with

prosperity and health, whereas, underweight was associated with a person that is poor or having HIV/AIDS.

Moreover, we have previously presented that Mamabolo et al. (2006) found that early family life programing and subsequent obesity were related in a study involving 162 rural South African children that were followed from birth. In this study the children who were underweight at birth and had rapid weight gain within the first year of life had a 2.4 fold increased risk of becoming overweight when they were three years of age. The other determinants of being overweight at three years of age included having a young mother (<20 years), and a working mother who is also a primary / main caregiver (Mamabolo et al., 2005). Similarly, in other developing countries, additional to genetic influences, early life influences also appear to have a major influence on the development of obesity. For example, Ong and Dunger also found an association between low birth weight and body fat accumulation (Ong and Dunger, 2002). This paradox may be an important effect modifier on the presentation of the obese phenotype in South African women, which requires a more in-depth understanding.

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1.1.2.4.2 Social and cultural norms

Culture in South Africa is often used interchangeably with ethnicity. In this regard, it is important to understand proper definitions of these two terms (ethnicity and culture). For example, Hesse-Biber et al. (2004) suggested ethnic identity to refer to the integration of ethnicity or race into one's self-concept or self-image. In their study they also suggested that it is the full recognition of one's ethnicity, and the subsequent self-identity that shapes the values, ways,

and styles of an individual. The results of the study by Hesse-Biber and associates are corroborated by those of Rosenthal & Feldman (1992), suggesting the family environment provides children with their first experience as members of a particular ethnic group. In this regard, it is more likely that ethnic-identity develops from within the family, instead of an image that is imposed by societal stereotypes.

Culture, on the other hand, is defined as a system of shared beliefs, values, customs, behaviours and artefacts that the members of society adopts, and are transmitted from generation to generation (Bodley, 1994). International studies suggest that humans may be acculturated as they may need to receive social and cultural acceptance of the community for their behaviour (Cachelin et al., 2002; Spencer & Markstrom-Adams, 1990). In obesity the process of acculturation involves the adoption of dominant lifestyles such as overeating and sedentary behaviours. For example, studies examining habits of American refugees have indeed identified acculturation as a strong determinant of refugees adopting dominant eating and physical activity behaviours outside of their ethnic beliefs (Elias and Blanton, 1987; Matute-Bianchi, 1986).

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In South Africa, the role played by culture in the development of obesity is complex. For example, In South Africa cultural diversity is a consequence of different traditional beliefs and attitudes. In Section 1.1.2.1 we have presented results to suggest urban black South Africans to be acculturated, such that they have adopted popular Westernized eating behaviours practised in the urban areas. In this regard, it seems as if acculturation may partly explain the the high

prevalence of obesity of urbanized black South Africans compared to rural black South Africans.

However, in the same South African black and mixed ancestry communities, urbanization has been found to be a modifier of the social class within households (Temple et al., 2001; Puoane et al., 2002). As such, socioeconomic status influences both the living conditions and the wellbeing of individuals in these households. For example, Richter et al. (2006) found that the im-migrant black South African children (known as adolescent children moving from rural areas to urban areas) participating in the BT20 study were i) more likely to live in informal settlements (shacks), ii) less likely to have electricity in their homes and iii) less likely to have basic household appliances (such as a refrigerator, a television, a microwave, a motor vehicle etc.) than the long-term resident children in Greater Johannesburg and Soweto areas. Moreover, in the same BT20 study childhood social class was associated with high adulthood BMI, cardiovascular diseases as well as risk factors for type II diabetes (Richter et al., 2007).

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Temple et al. (2001) also found the increasing trend of obesity in the mixed ancestry adult South Africans residing in Mamre to be related to rural-urban transition, including electrification within households, reduced physical activity and energy-dense food. Despite some evidence of the role played by acculturation and urbanization on the weight status of black and mixed ancestry South Africans, we do not have data linking both these obesity correlates to the development of obesity in the white ethnic groups of South Africans. However,

obesity is also high in these ethnic groups. As such, the impact of culture on the development of obesity in these groups still needs closer exploration.

11.2.4.3 Body image, body size status acceptance

Considering the effects acculturation and urbanization have on the adoption of certain health behaviours, it is important to examine the role of these obesity correlates with respect to the body image of South Africans. For example, there is local evidence to suggest South African men and women of different ethnicities have different perceptions about their body size status (Puoane et al., 2002). Puoane and associates (2002) found that only 9.7% of men and 22.1% of women of all races perceived themselves as being overweight, whereas 29.2% of men and 56.6% of women interviewed were actually classified as overweight and obese. Ethnicity influenced these findings in that only 16% of black women perceived themselves to be overweight compared to 34% of mixed ancestry and 54% of white women. However, in actuality, 58.5% of black women were overweight and obese compared to 52.2% of mixed ancestry and 49.2% of white women (Puoane et al., 2002).

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A similar study done involving urban black South African adult women suggested that high self-esteem and positive body image were related to perceptual body image (Puoane et al., 2005). Similarly, Elias and Blanton (1987) and Matute-Bianchi (1986) in their studies found that refugees with strong ethnic-identity and high self-esteem had a reduced tendency to adopt the dominant lifestyle and social stereotypes outside of their ethnic beliefs. However, the role played by ethnic-identity on the adoption of health behaviour in South Africans still needs to be explored.

Despite the dearth of data associating body image to obesity in other adult ethnic groups of South African women, Puoane et al. (2005) and Mvo et al. (1999) suggested that overweight is viewed as a sign of beauty, wealth and health by black South African women. This may be the modifier of the increased self-esteem and positive body image found in black South African women. Indeed, Caradas et al. (2001) in their study of urban South African adolescent girls also suggested that black girls were less dissatisfied with their body size and shape, and were also less likely to desire a smaller body size than mixed ancestry and white girls. Similar results have been observed by Stevens et al. (1994), in their study comparing overweight, white and black American women. They found black women to be 40% less likely to feel guilty after eating, 2.5 times more likely to be satisfied with their weight and 2.7 times more likely to consider themselves attractive than white women. In the same study, Stevens and associates also found that among those women who were not overweight, white American women perceived themselves to be larger in body size and reported lower ideal body weight when compared to the black American women (Stevens et al., 1994). Moreover, Altabe (1998) found black American adolescent women to have less weight-related body image concerns than white American adolescent women.

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Considering the data suggesting high tolerance of a larger body size status in both young and adult black women presented above, it may appear as if family environment rather than community environment plays a role in body image of these women. Indeed, international studies have previously shown that the family environment, particularly the mother-child relationship, has an influence on obesity risk (Elfhag and Linne', 2005; Ogden and Elder, 1998; Cutting et al.,

1999). In these studies, the relationship between mothers and their children was found to be the strongest between mothers and their daughters compared to mothers and sons. Further, in these studies, the mother-daughter relationship was related to body image. For example, in some of these studies, it has also been found that mothers unintentionally model both positive and negative body image to their daughters (Elfhag and Linne', 2005; Cutting et al., 1999).

To our knowledge, there is little research directed at exploring the mother-child relationship in relation to obesity in South Africa. The only study of which we are aware, investigated the body size status of the women and their offspring (Mvo et al., 1999). In this study, mothers presented with larger body size status, whereas their offsprings presented with undernutrition. As such, in South Africa the mother-daughter resemblance is worth exploring. However, we also need to take into consideration other important obesity intrapersonal factors that are assumed to influence individuals eating healthily and engaging in physical activity such as self-efficacy.

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1.1.2.4.4 Self-efficacy to eat healthily and engage in physical activity:

The concept of perceived self-efficacy was initially introduced by Bandura (Bandura, 1977) and was later found to play an important role in behaviour modification. Self-efficacy may be defined as an individual's perceived capabilities to produce results and to attain designated types of performance (Bandura, 1977; Ormrod, 2006). Further, self-efficacy reflects the individual's confidence that they will be able to implement behaviour change and not lapse into a previous unhealthy behaviour (Bandura, 1977). There is strong evidence

to support the relationship between self-efficacy and better health (Ajzen, 1991; Schwarzer and Fuchs, 1995; Giles et al., 2004; Locke and Latham, 1990). A number of international studies have shown that self-efficacy has a direct effect on the adoption of health behaviours that include smoking cessation, behaviours of eating healthily, physical activity and adherence to prescribed health care regimens, in patients following myocardial infarction (Parcel et al., 1997; Thompson et al., 2007; Giles et al., 2004).

Self-efficacy has also been shown to be one of the strongest determinants of an individual's exercise behaviour (Nigg, 2001). Further, in an educational intervention study designed to increase self-efficacy for healthy eating in adolescent children conducted by Long and Stevens (2004), it was found that self-efficacy scores for fruits and vegetable intake of the experiment group were higher than those of the control group. In the same study self-efficacy was also significantly associated with dietary knowledge of lower fat intake, and knowledge of usual healthy food choices (Long and Stevens, 2004). Similarly, self-efficacy has been found to be a determinant of eating behaviour and was predictive of usual food choices in school-aged children participating in the Child and Adolescent Trial for Cardiovascular Health (CATCH) study (Frenn et al., 2003). A positive body image may also be associated with a greater self-efficacy to eat healthily (Locke and Latham, 1990).

To our knowledge, there are no studies that have attempted to explore the impact of self-efficacy on obesity in South Africa. However, a number of South African researchers have found that self–efficacy plays a role in influencing other behaviours such as: i) sexual behaviour of individuals in the prevention of

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HIV (MacPhail et al., 2004); ii) behaviour of women participating in computer activities (Galpin et al., 2005); and iii) alcohol use and the prevention of HIV infections in adolescents (Karnell et al., 2006).

1.1.2.4.5 Health knowledge (dietary and physical activity knowledge)

For individuals to have high self-efficacy for particular health behaviour, studies suggest that they need to understand the behaviour and its role in the improvement of health (Gotlieb and Chen, 1985; Azjen, 1991). Indeed, Gotlieb and Chen, in a study examining the psychosocial correlates of childhood sporting activities, showed that those learners who had more knowledge on the role of aerobic exercise on heart function were more likely to participate in activities with high aerobic potential (Gotlieb and Chen, 1985).

There is evidence to suggest that the lack of health knowledge may contribute in part, to the development of obesity in South Africa (Steyn et al., 2000, Kruger et al., 2002). For example, Kruger and associates investigated obesity determinants and health knowledge of South African black adults residing in the North West Province (Kruger et al., 2002; Kruger et al., 1994). They found that physical activity and the knowledge regarding obesity-related health consequences were negatively associated to both men and women's BMI. These results suggest that health knowledge of South Africans remains a potential target to improve self-efficacy and the adoption of healthy behaviours in an attempt to combat obesity and its co-morbidities. However, physical and social environments cannot be discounted when increasing health knowledge of individuals (Hughes et al., 2006; Bourne et al., 1996; Puoane et al., 2006).

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1.1.2.4.6 Physical, social and political environments

Like any other developing country, South African environments are constantly changing as a consequence of urbanization (Gopalan, 1998; Bourne et al., 1996). Environments can be broadly categorized as macro- (of the wider population, including food service and fitness industries, as well as policies) and micro- (in close proximity to the individual, including family environment, neighbourhood surroundings, and school and workplace environments, as well as local supermarkets and shops where food is purchased) (Egger and Swinburn, 1997; Swinburn et al., 2005). The macro- and micro- environments together with the biological and behavioural influences, determine whether an individual will be obese (Egger and Swinburn, 1997). In general, the environment influences the amount and type of food eaten by an individual, as well as the amount and type of physical activity an individual engages in (Swinburn et al., 2005). This section of literature review will only focus on the micro-environments. Discussion of the macro-environments is beyond the scope of this dissertation, but has been partially reviewed in the Healthy Active Kids South Africa Report Card, in conjunction with the South African Medical Research Council (SA MRC, 2007).

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There is well established evidence to link micro-environments (such as family, home and neighbourhood) to children's activity levels and eating behaviour (Adkins et al., 2004; Hume et al., 2005). For example, Adkins et al (2004) showed that parental support (presented as family environment) was the major influence for girls between the ages 8-10yrs to engage in physical activity. Further, Fisher et al. (2004) demonstrated that girls who saw their mothers

drinking milk in their homes were more likely to make the same choice themselves.

Environmental influences for healthy eating and physical activity in pre-school children were described by Ward et al. (2007), in the form of physical environment (preschool play grounds, and providing physical activity equipment), social support (preschool staff members) and policies. These environments were considered important in promoting free play and improving health knowledge of preschool staff in an effort to boost children's behaviours of healthy eating healthy and physical activity.

In South Africa, a few studies have attempted to understand the impact of environment on health behaviours (Temple et al., 2006; SA MRC, 2007; Reddy et al., 2003; Bradley and Pouane, 2007). For example, Temple et al. (2006) found school environment (school stores, tuck shops) to contribute the most on food items consumed by pre-adolescent and adolescent learners attending schools falling within different social classes in South Africa. For example, in their study they found that 69.3% of the so called "unhealthy foods" was purchased from the tuck shops when compared to food brought from home to school (of which was between 41%-56%).

Moreover, in a focus group study including 21 black community health workers, Bradley and Puoane (2007) identified built environments, and the reliance on motorized vehicles as mediators of obesity in a black community. Overcrowding led to built communities with fewer sidewalks, which has been shown to influence a persons' decision to walk, jog or cycle in international studies

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(Prezza et al., 2001; Tudor-Locke et al., 2001). Moreover, Bradley and Puoane (2007), Reddy et al. (2003) and SA MRC (2007) reported that community parks in the black townships were crime-ridden; with crime being identified as one of the major barriers to South African adolescent children partaking in physical activity. Further, high proliferation of "shebeens" (liquor stores) and local street vendors were identified as facilitators to over-consumption of energy dense food and alcohol (Bradley and Puoane, 2007). Moreover, Hughes et al. (2006) suggested that social engagements promote overeating, in that food is often used to show love in social gatherings. In this study, food showed acceptance and humanity in the black ethnic culture (Hughes et al., 2006).

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1.1.3 Summary

Based on the model of the epidemiological triad, an overview of the potential determinants of obesity, explored from South African perspective is presented in Figure 1.5. In this figure, we have identified 'hosts' as being women and girls, in whom the prevalence of overweight and obesity is very high. We further identified an 'obesity agent' as chronic positive energy balance. In South Africa, an agent is mediated by 'vectors' such as chronic energy intake, under-nutrition followed by over-nutrition, as well as lower levels of physical activity, sedentary lifestyle or inactivity. Factors that influence these vectors may be non-modifiable (i.e. they include the hosts' characteristics) or modifiable (i.e. environments).

However, in South Africa, data related to these obesity-associated factors are fragmented. We are also not certain to what extent language, culture, age and urbanization influence the interpretation of existing evidence on the

determinants of obesity. As such, culturally-sensitive and age-appropriate instruments are needed to better understand the determinants of obesity in South Africa.

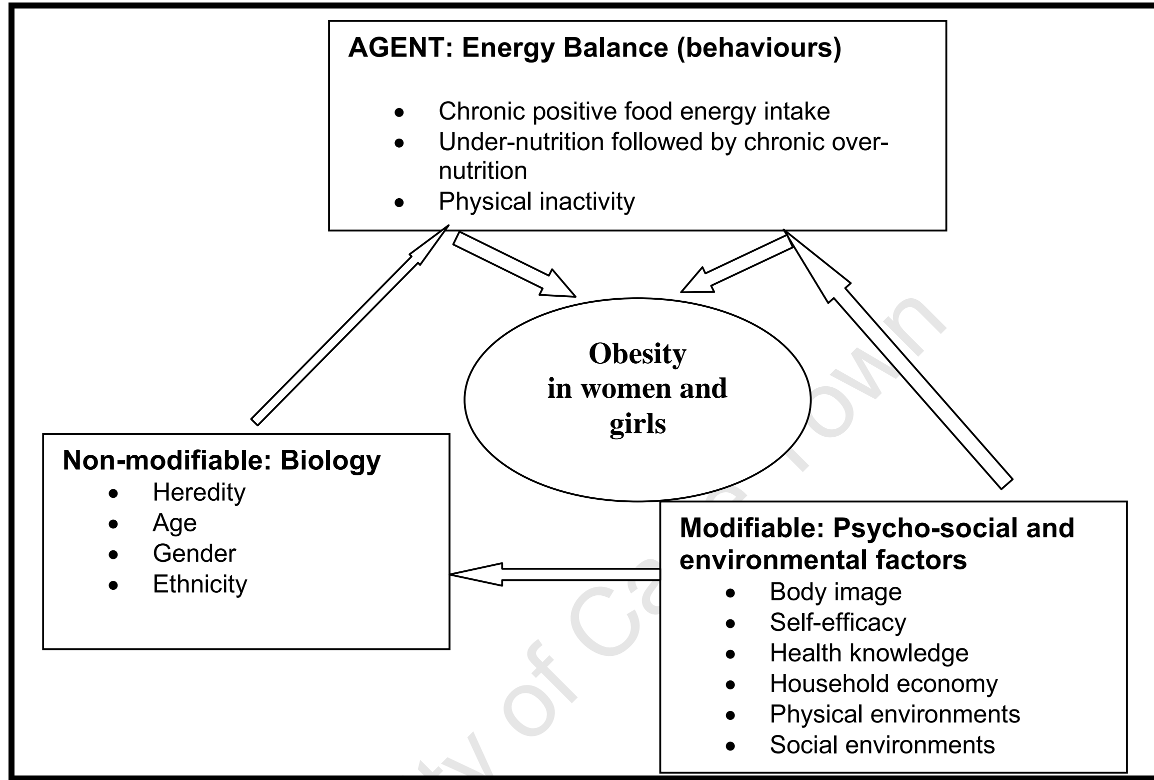

FIG 1.5 Determinants of obesity from a South African perspective, based on the epidemiological triad (Egger and Swinburn, 1997)

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In this regard, the second part of the literature review will focus on the instruments used to measure these determinants, highlighting the challenges of the validation process. But prior to this discussion, we will present the objectives of the current dissertation to provide a context for the second part of the literature review.

1.2 THE AIM OF THE CURRENT RESEARCH

This dissertation focused on the development/adaption, validation, and application of culturally-sensitive and age-appropriate instruments designed to

gain a better understanding of the aetiology of obesity in South African mothers and their pre-adolescent girls.

1.2.1 The primary objectives were:

1. To develop and validate instruments assessing body image in South African mothers and their pre-adolescent girls;
2. To identify factors related to food energy intake under-reporting in different ethnic group of South African women;
3. To test the validity and reliability of physical activity / inactivity questionnaires used to quantify physical activity and inactivity in South African pre-adolescent children of different ethnic origin;
4. To validate a questionnaire measuring cultural identity, health knowledge, self-efficacy, social support and environmental barriers to adopt health behaviours in South African pre-adolescent children of different ethnic origin;

1.2.2 The secondary objective was:

To use those instruments shown to be valid to assess the role played by family status (mother- daughter resemblance) and ethnic group on the body image of South African women.

1.3 VALIDATION OF SELF-REPORT INSTRUMENTS

As mentioned previously, this section of the literature review will focus on the exploration of the international and South African scientific literature to identify instruments designed for measuring dietary energy intake, physical activity energy expenditure, and factors associated with health knowledge and self-

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efficacy for engaging in these behaviours. Further, different validation procedures will be outlined.

1.3.1 Methodology of validating self-report instruments

Validity is defined as the degree to which the instrument measures what it is intended or was designed to measure (Pennington, 2003; Veltro et al., 2007). A validated design refers to the degree to which a study supports the intended conclusion drawn from the results (Pennington, 2003). There are three forms of validity that can be related to self-report instruments: namely: i) construct validity, referring to whether the instrument measures the traits it purports to measure (Pennington, 2003); ii) concurrent and criterion validity, measures of how well one variable predicts an outcome based on the information from other variables, or whether an instrument correlates well with another instrument of similar characteristics, namely, a gold standard (Veltro et al., 2007; Hu et al., 2004; Iqbal et al., 2006); as well as iii) finding the reliability of the instrument by determining whether the instrument generates similar results when applied at two different points (Veltro et al., 2007; Sallis and Saelens, 2000, Ridley et al., 2006).

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1.3.1.1 Validity

1.3.1.1.1 Construct

Construct validity refers to the totality of evidence about whether a particular construct adequately represent what it is intended to measure. For example, the newly developed construct's outcome measure may be compared to the outcome measure of an already existing and previously validated construct seeking the same information, however asked in the different version or form

(Pennington, 2003). Construct validity may also mean the judgment based on the accumulation of correlations from numerous studies using the instrument being evaluated. An example of construct validity in the context of this dissertation is when the outcome measure of a self-report instrument eliciting psychosocial information (such as body image attitudes) is compared to the outcomes generated using similar measures investigating body shape or image attitudes (such as the body shape questions, BSQ, Cooper et al., 1987). Construct-related validity may be established for non-parametric measures using Spearman's correlation, alternatively, Pearson's rank order correlation for parametric data.

1.3.1.1.2 Criterion and concurrent validity

Criterion-related validity reflects the success of an instrument in measuring what it is intended to measure (Pennington, 2003). Whereas, concurrent validity refers to the degree to which the outcome of the newly developed instrument correlates with the outcome of another similar instrument that is a comparative measure (Veltro et al., 2007; Pennington, 2003). For example, these types of validation may be used when measuring behavioural outcomes such as finding validity of a newly developed physical activity self-report questionnaire. The energy expenditure (EE) generated using this newly developed physical activity self-report may be compared to data generated using an already established and previously validated standard measure. A standard measure may be a subjective or an objective measure that has been previously validated in the group to be studied (Veltro et al., 2007; Baranowski, 1988). For example, a self-report physical activity generated outcome measure may be compared to objective measures such as body composition (Hu et al.,

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2004) and/or fitness outcome (Baranowski, 1988; Morrow and Freedson, 1994; McCormack et al., 2003). It can also be compared using a subjective measure such as another behavioural outcome i.e. self-reported food energy intake (Andersen et al., 1998), or number of steps taken per day or motion counts per day (pedometry; Basset et al., 2000).

1.3.1.2 Finding the reliability of an instrument

Reliability refers to the consistency of an instrument to give the same measurement or score over repeated tests in the same subject under identical conditions (test-retest, Veltro et al., 2007; Pennington, 2003). Reliability may be estimated through administering the same instrument more than once (test-retest) and analyzing the outcome using the Pearson product moment correlation coefficient between two administrations of the same measure. However, in the case of administrating the instrument once, the reliability may be assessed using inter-item reliability. Inter-item reliability is a standard technique to investigate the internal consistency of the multiple items / questions within a construct (Pennington, 2003; Veltro et al., 2007). Another technique used to investigate internal consistency is the measure of split-half reliability. Internal consistency outcome measures are the Cronbach's α value and the correlation coefficient (r- value, Cortina, 1993).

In the case of administering the instrument more than once, studies recommend choosing the optimal time period between measures carefully (Rudner and Shafer, 2001; Veltro et al., 2007). Veltro and associates further argue that when the time between test and retest administration is short; subjects may be simply remembering what they reported earlier. However, when subjects are asked to recall a number of days after the first test, reliability

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coefficients may reflect their memory that will depend on the age of the subjects, as well as the type of the information being measured (Matthews et al., 2001; Mota et al., 1994).

For example, if the time delay between the event and measurement is too long memory decay may reduce the reliability of the findings, especially in children younger than the age of 10 years (Matthews et al., 2001). Further, for a behaviour such as eating, food intake might have changed due to seasonal changes, or school holidays in the case of school-aged children (Beaton, 1994).

International studies suggest that children can recall and report participation in structured school sports well, compared to other unstructured game sports played at home and at school or in sports clubs (Matthews et al., 2001; Wallace et al., 1985; Argiropoulou et al., 2004). This is because unstructured activities may vary from day-to-day or month-to-month due to the school term (such as writing exams, school vacation, weather or seasonal changes). Moreover, if the instrument is used to elicit information regarding the usual behaviour, the administrations should cater for both the weekday and the weekend behaviour (Beaton, 1994).

In summary, this section defined procedures that can be used to validate self-report instruments. The defined procedures are the construct validity mainly used to validate psychosocial factors. This validating procedure refers to whether the instrument measures the traits it was designed to measure. Other validating procedures identified are the concurrent and the criterion validity. These refer to whether the outcome (total score) of an instrument correlates well with the score generated using another instrument (namely a gold

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standard). These validation procedures may be used to validate instruments measuring the behaviour of individuals.

Lastly, we reported on the issues relating to measuring the reliability of the instrument. This refers to either finding the internal consistency of the construct in case of administering the instrument once. However, if the instrument is administered more than once test-retest reliability is investigated. This refers to finding whether the instrument generates similar results when applied at two different points in time. In this case, it is recommended that researchers find an optimal time between measurements to ensure getting a true representative picture of information they seek to find at different points of administering the instrument. The next section will focus on identifying and outlining challenges of validating self-report instruments.

1.3.2 Body image instruments: challenges for validation

In section 1.1.2 we have presented that obesity is an epidemic that affects certain population groups more than the others (Ono et al. 2005; Gopalan et al., 1998; Puoane et al., 2002). In South Africa women and girls are most affected (Ono et al., 2005; Armstrong et al., 2006; Reddy et al., 2003; Puoane et al., 2002). In section 1.1.2.4.3 we also presented evidence to suggest different ethnic groups of South Africans have different perceptions about their body size status. There is well established international research to implicate body image, by its effects on weight control and dietary intake, as a contributing factor for weight gain in women (Henriques and Galhoun, 1999; Garner et al., 2000; Van der Wal and Thelen, 2000; Moya et al., 2006; Horner et al., 2002).

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Body image is defined as the way women see their bodies and also how they feel about their body size status (Dawson, 1988; Madrigal et al., 2000). Various international studies suggest body image to be multidimensional (Brewis et al., 1998; Bulik et al., 2001; Fitzgibbon et al., 2000; Markovic et al., 1998; Cooper et al., 1987). The dimensions of body image include the perception of body size status, the attitudes and dissatisfaction regarding body size status, the level and direction of body size dissatisfaction, as well as body shape concerns. These dimensions are thought to determine an individual's preference for thinness or fatness, and also determine their intentions to adopt health lifestyle behaviours (namely, behaviours of eating healthily or engaging in physical activity).

Firstly, we may define the term "perception of body size" as the accuracy of an individual's judgment of their size brought about by the way they see themselves (Cash et al., 1992; Dawson et al., 1988; Madrigal et al., 2000). Perception of body size is used interchangeably with "perceptual body image" (al Shammari et al., 1994; Cash et al., 1992). To measure perceptual body image accurately studies suggest using different methodologies such as written constructs (whereby individuals report their body size status or BMI) as well as using visual images that may be figural stimuli, such as sets of silhouettes ranging from the very thin to very heavy (Stunkard et al., 1983, for adults and Stevens et al., 1999 for children), from which individuals can select a figure that closely resembles their body size status (representing their 'Feel'). To validate perceptual body image the scores obtained from written constructs or silhouettes chosen for 'Feel' need to be compared to the individual's actual (measured) BMI. The results obtained from the comparison will indicate

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whether an individual accurately identify their body size status (Bulik et al., 2001; Brewis et al., 1998).

Secondly, the phrase “attitudes related to body size” is defined as the way an individual feels and reacts after judging their body size status (Altabe et al., 1998; Caradas et al., 2001; Henriques and Galhoun, 1999). This phrase “attitudes related to body size” is also used interchangeably with “attitudinal body image” (Cash et al., 1992). To assess attitudinal body image accurately, studies suggest using visual stimuli, whereby individuals select the silhouettes representing their ’Feel’. The score assigned to the silhouette selected for ‘feel’ will then be compared to the score assigned to the silhouette selected as the one that the individual will most want to look like (representing the desired body size status, *’Ideal’* silhouette). The difference between the ’Feel’ and the ’Ideal’ scores will be determined as the Feel-Ideal Difference (FID) index score, also regarded as the body size status dissatisfaction score. This score is, regarded as a good indicator of an individual’s attitudinal body image (Fitzgibbon et al., 2000). Moreover, the attitudinal body image score may be compared to the individual’s actual or measured BMI, to identify the level of BMI at which an individual becomes dissatisfied about their body size status (Fitzgibbon et al., 2000).

To validate body size dissatisfaction and find body size preferences of individuals, various researchers compared body size dissatisfaction scores to other scores generated using the Eating Attitude Test (EAT), designed to determine eating attitudes of individuals, and the Body Shape Questionnaire (BSQ), designed to determine body shape dissatisfaction of individuals

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(Markovic et al., 1998; Anton et al., 2006; Garner et al., 1982). The EAT is a 26-item self-report measure that has previously shown good internal reliability for measuring pathology of eating in children (Markovic et al., 1998). For example, Markovic et al. (1998) compared the scores for body image generated using the seven silhouettes to the scores generated using the EAT and found that, out of 109 adolescent girls participating in their study, those girls who were dissatisfied about their body size status presented with eating disorders and also preferred to be thinner (Markovic et al., 1998).

The BSQ was developed by Cooper and associates in 1987, and concurrent validity was previously evaluated using different scales including the Eating Disorder Inventory (EDI, Garner and Olmsted, 1984; Garner et al., 1983) and the EAT (Garner and Garfinkel, 1982). When compared to the EDI and EAT, the BSQ yielded Rho values that were greater than 0.7(Cooper et al, 1987). Further, in order to evaluate the accuracy of body shape questions included in the BSQ, tests of internal consistency (determined using Cronbach's alpha) were performed. The results showed the Cronbach's $\alpha = 0.95$, with a correlation coefficient of 0.93. Out of the 34 BSQ items, a BSQ score < 123 indicates lower body shape and size acceptance, whereas a BSQ score ≥ 123 indicates, greater body shape and size acceptance (Cooper et al., 1987).

Several small, local studies have attempted assessing different dimensions of body image in South African women (Matoti-Mvalo, 2007; Caradas et al., 2001; Mvo et al., 1999; Puoane et al., 2002; Bradley and Puoane, 2007; Puoane et al., 2005). In these studies, researchers used similar above - mentioned procedures to directly and indirectly measure perceptual and attitudinal body

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images of adult women and adolescent children. For example, Table 1.2 presents the results of a study in which perceptual body image was measured in 43 South African black community health workers from an under-resourced township (Khayelitsha) in Cape Town South Africa (Puoane et al., 2005).

Table 1.2 Perceptions about body weight of community workers in Khayelitsha Township in Cape Town, South Africa

How do you feel at your current weight?	**Perceived body weight (%)**	BMI (kg/m²)	% Overweight according to BMI
Very thin	0	< 18.5	0
Somewhat thin	4.8	18.5 - 19.9	0
Not thin nor overweight	47.6	20.0 - 24.9	4.7
Somewhat overweight	28.6	25.0 - 29.9	4.7
Extremely overweight	19.0	> 30	90.7

Source: Puoane et al., 2005

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In this study, the scores derived from figural stimuli (a set of nine silhouettes ranging from the thinnest to the heaviest figure, Stunkard 1985) were compared to the women's measured BMI to determine perceptual body image. Only 47.6 percent of the women in this study perceived themselves as overweight and obese, despite the fact that 95.4% had BMI $\geq$25 kg/m^2. These results further provided indirect evidence for a greater tolerance for a larger body size status in black South African women compared to other ethnic groups.

Similarly, Caradas and associates used silhouettes to assess attitudinal body size dissatisfaction of multi-ethnic urban South African adolescent schoolgirls (Caradas et al., 2001). In their study the scores selected for "*Feel*" and the ones selected for "*Ideal*" of their participants were compared to yield the Feel-Ideal Difference (FID) index (also presented as the body size status dissatisfaction). Dissatisfaction with body size status was significantly lower in black girls compared to mixed ancestry and white girls (Caradas, et al., 2001). Further, using the BSQ (Cooper et al., 1987) and the EAT (Markovic et al., 1999) questionnaires Caradas and associates found that body shape concerns were lower in black girls compared to those of mixed ancestry and white girls, but the prevalence of abnormal eating attitudes was equally common in South African schoolgirls from different ethnic backgrounds

Despite the acceptability of the results regarding perceptual and attitudinal body image of South African women obtained from these studies, data on the body image of pre-adolescent children and mixed ancestry and white ethnic groups of adult women are not presented. As such, we may not be certain that the instruments used to measure body image in these studies are valid for use in pre-adolescent girls as well as in different ethnic groups of adult women. Finding age-appropriate and ethnic-specific instruments measuring body image of South African women still remains important to the better understanding of obesity in South Africa.

In summary, in this section we have presented a definition of the body image using references from international studies. Validation procedures of body image instruments used in these studies have been presented. We have also

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presented examples in which South African researchers have measured different dimensions of body image, however, it is still not clear whether the these instruments are valid for use in assessing body image of both pre-adolescent and adult South African women of different ethnic origins. In this regard, a challenge that age – appropriate and culture-sensitive instruments measuring body image of women still need to be either developed and/or validated.

1.3.3 Dietary intake instruments: errors in reporting

In the previous section, we have presented that body image may affect women's responses to weight changes, attitudes towards weight control and their dietary intake. Accordingly, the current section will focus on exploring dietary intake reporting and the factors associated with energy intake reporting status of South African women. Due to the multi-cultural nature of South Africa, divergent traditional eating patterns have emerged (Wolmarans et al., 1989; Steyn et al., 2001; Bourne et al., 1996). These eating patterns are influenced by urbanization and socioeconomic status (Rose and Charlton, 2002; HSRC, 2003). For example, urbanization has resulted in black South Africans changing their food intake, such that they consume food portion sizes bigger than their daily recommended allowances, as well as foods that are high in fat and added sugar (MacIntyre et al., 2001; Kruger et al., 2002; Steyn et al., 2003). At the same time, socioeconomic status has been associated with food insecurity within households (Mvo et al., 1999). This has become a public health concern as food insecurity has been found to contribute, in part, to the development of obesity in South Africa.

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In this regard, instruments used to measure dietary intake of South Africans need to be sensitive in capturing different food items in their respective quantities consumed by different ethnic groups. These instruments include: the previous day recall (such as the 24-hr recall), seven day recall, as well as one month / one year recall. Multiple 24hr-recalls, have been found to be the most accurate means to measure dietary intake of individuals (Mannisto et al., 1996). However, a single 24hr-recall shouldn't be used to test population-based hypotheses, as they do not represent the usual dietary intake of individuals.

Various researchers prefer using dietary records (e.g. seven day dietary record) such that, individuals record their dietary intake over a specified period of time. However, collecting dietary data using this method have been shown to interfere with the study participant's usual way of eating, and as such results obtained are not representative of an individual's usual way of eating (Nusser et al., 1995).

Food frequency questionnaires (FFQ) may also be used, but may be limited in interpretation and should be specific to the study hypotheses (Nusser et al., 1995; Matthews et al., 2001; Mota et al., 1994). However, instruments that require individuals to remember what they ate over a long period of time (such as the, FFQ) have been shown to produce respondent burden and thereby, may increase the chances of obtaining errors in the food intake reporting. However, there is evidence to suggest that if FFQ are designed properly, such that they include the majority of food items consumed by the population under study, the accuracy with which they measure dietary data is improved (Nusser et al., 1995; Matthews et al., 2001; Mota et al., 1994). FFQ are designed not

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only to quantify the frequency of eating a particular food item, but also the amount (quantity) of food consumed by the individual, thus they are called quantified food frequency questionnaires (QFFQ). To facilitate recall of the types, quantities and amount of food items eaten, South African study participants are often presented with food models or pictures in conjunction with the QFFQ (food portion photograph book, FPPB, Venter et al., 2000).

Further, to improve precision, QFFQ have been validated by comparing their outcome measures to the outcome of another previously validated questionnaire (such as physical activity questionnaire, Goulet et al., 2004), a biomarker- urinary nitrogen (Bedard et al., 2003; Tooze et al., 2004), or an objective measure of energy expenditure, such as accelerometers or doubly-labeled water (Samuel-Hodge et al., 2004; Trabulsi and Schoeller, 2001; Bedard et al., 2004). Similar procedures have been employed in South Africa by Steyn et al. (2001) and MacIntyre et al. (2001). For example, MacIntyre and associates validated the QFFQ in multi-ethnic adult South Africans between the ages of 15-65 years while Steyn and associates validated a QFFQ in children between the ages of 1-9 years of age and adults 18 years and above. These QFFQ were designed such that they consisted of food items consumed by different ethnic groups of young and adult South Africans. Food items included in these QFFQ were obtained from local published studies on dietary intake within South Africa. These studies included: The National Food Consumption Survey (NFCS, Labadarios et al., 2000); Dikgale Study (Steyn et al., 1998; Steyn et al., 2001), Black Risk Factors Study (BRISK, Bourne et al., 1993; Bourne et al., 1994); Transition, Health and Urbanization Study (THUSA, Venter et al., 2000; Vorster., 2000; MacIntyre et al., 2000; MacIntyre et al.,

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2002; Kruger et al., 2002); First Year Female Students (FYFS, Steyn et al., 2000; Senekal et al., 2001), Weight and Risk Factor Study (WRFS, Senekal and Steyn, 1997; Senekal et al., 2003); and the Coronary Risk Factor Study (CORIS, Wolmarans et al., 1989; Steyn et al., 1997)).

The procedures used to validate these instruments are presented in Table 1.3. Steyn et al. (2003) used the 24 hour recall and a Food Procurement and Household Inventory Questionnaire (FP HIQ) to validate the QFFQ in children. For adults, they compared QFFQ to the Food Balance Sheets (FBSs) and the energy intake of participants generated using the 7-day records and a biomarker (i.e. 24-hour urinary nitrogen). The comparisons were favourable for both children and adults in this study, however, the FBSs had higher overall energy intake per capita of between 22-28%. MacIntyre et al. (2002) also validated the 122-food item QFFQ used in multi-ethnic adult South Africans between the ages of 15-65 years by comparing it to 7-day weighed food records (in 74 participants), and urinary nitrogen (1-24 hr urine output in 104 participants). In this study the QFFQ underestimated EI compared to food records, and the QFFQ was not significantly correlated to the urinary nitrogen. In this study, 43% of participants under-reported EI from the information generated by the QFFQ, whereas 28% under-reported their EI from the dietary information generated using 7-day food records. Despite the proper design and validation, QFFQs do have weaknesses in that bias in reporting (overestimation or underestimation) the amount of food consumed by individuals has been described. The most prevalent bias in reporting identified has been under-reporting of food energy intake (EI).

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1.3 QFFQs adopted to quantify energy intake and macronutrient intake of South African mothers and theirs daughters

ry ence	Name of the Study	Age (yrs)	Sample size (N)	Validation Method	Correlation	Validity
Africa n et al.,	South African National Food Consumption Survey (SA NFCS)	1-9 and ≥ 15	3120	QFFQ completed by mothers for their pre-adolescent children was compared to a 24 hour recall and a FP HIQ. Also adults completed the questionnaire and the kilojoules generated from the analyses were compared to FBSs	Dietary intake values generated using the FBS compared favourably with data generated by the FFQ for adults. FBS values were higher with respect to consumption of milk, pork and oils, maize-meal, rice and added sugar. However, beef and offal, eggs, oats, potatoes and fruit consumption values generated using FFQ were similar to vales generated using FBS.	The comparisons favourable for bot and adults, howe FBSs had higher energy intake per between 22-28%
Africa tyre et 00)	A culture-sensitive QFFQ used in African population: Transition,	15-65	178	122-food item QFFQ compared to 7-day weighed food records (in 74 participants), and urinary nitrogen (1-24 hr urine output in 104	QFFQ and weighed food records resulted in Spearman rank correlations - R =0.14 for fibre and milk, r=0.21 for fat, 0.25 (bread), 0.35 (meat), 0.38 (fruit), 0.41 vegetable, 0.56 (maize-meal and added sugar), and 0.59	QFFQ underestim than food records QFFQ was not sig correlated to the u nitrogen 43% participants

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Health development for specific adult population of South Africa (THUSA)	participants)	(vitamin C). For complete collection of urine. The mean calculated urinary protein (70.0±28.2g) was lower, and not significantly correlated to the mean reported protein intake (80.0±27.0g) (95%CI – 21.8 to 5.8)	reported EI from t information gener the QFFQ, where under-reported th the dietary inform generated using 7 records

Q- food frequency questionnaire, EI- energy intake, FP HIQ- Food Procurement and Household Inventory Questionnaire, F
Balance Sheets (MacIntyre et al., 2002 and Steyn et al.,2003)

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Under-reporting of EI occurs when individuals report implausibly low EI that are inconsistent with biological viability (Huang et al., 2005; Ferro-Luzzi, 1990). The International Dietary Energy Consultative Group (IDECG) suggested that total energy expenditure can be measured with good accuracy using the doubly labeled water (DLW) method (Coward et al., 1986; Trabulsi and Schoeller, 2001), and that, cut-off points for survival for adults have been estimated using a physical activity level (PAL) of 1.27 in developing countries (i.e. Total energy expenditure (TEE)=1.27XBMR (Basal Metabolic Rate), by the FAO/WHO/UNU, 1985), and using the PAL of 1.40 (TEE=1.40XBMR by the IDECG, used in developed countries, Coward, 1990). These levels are regarded as the minimum acceptable maintenance levels for EI in populations to sustain reasonable health. However, for men and women presenting with light occupational work / activity the PAL is estimated at 1.55 (TEE=1.55XBMR by the FAO/WHO/UNU, 1985; Black, 2000). Any levels less than this TEE calculated estimate are regarded as implausible EI reporting.

Based on the fundamental principles of energy physiology, Goldberg and associates also derived cut-off limits to identify under-reporting of EI (Goldberg et al., 1991), below which a person of a given sex, age and body weight could not live a normal life-style. They therefore used several external markers to identify the problem of underestimating self-reported energy intake. Under-reporting was calculated using the ratio of EI to basal metabolic rate (BMR) (Goldberg et al., 1991), which was estimated by comparing the reported food EI with an individual's resting energy expenditure measured using an objective measure such as indirect calorimetry (ventilated hood technique) and DLW. If

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these measures were not available, BMR was estimated using well-established equations (Schofield, 1985). Goldberg and associates found the average EI:BMR ratio of 1.35 for studies of whole-body calorimetry and 1.67 for studies using DLW. As such, in their study Goldberg and associates concluded that EI:BMR ratio below this range (1.37-1.67) was regarded as under-reporting of energy intake.

Following on Goldberg's research, Black (2000) explored the specificity and sensitivity of the Goldberg cut-off for EI:BMR to identify diet reports of poor validity (Black, 2000). Black used results from 22 studies, in which the total energy expenditure was measured using DLW and also using estimated BMR. She observed that failing to use each individual's PAL affected the number of under-reporters (sensitivity) or adequate-reporters (specificity) detected when using the Goldberg cut-off points for EI:BMR (results presented in Table 1.4). For example in this table it is stated that, in studies where an estimated blanketed PAL of 1.55 derived from FAO/WHO/UNU in 1985 was used, a lower sensitivity of 0.52 and a higher specificity of 0.99 resulted. However, using a higher PAL cut-off point of 1.95, the sensitivity increased to 0.85 while the specificity decreased to 0.78.

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Further, Black observed that using different measured PAL's for each individual in the studies resulted in an improved sensitivity without compromising the specificity. Consequently, Black concluded that to best identify diet reports of poor validity using the Goldberg cut-off for EI:BMR, PAL of each individual in each study was recommended (Table 1.4, Black, 2000).

1.4 the numbers of UR[a], AR[a] and OR[a] as derived by the gold standard EI:EE and as a classified by EI:BMR_{est} using cut-o g PAL (extracted from Black et al., 2000)

			Baseline classification by EI:EE									
			UR		AR			OR				
			Classification by EI_{rep}:BMR									
PAL	Lower cut-off [b]	Upper cut-off [b]	UR	AR	UR	AR	OR	AR	OR	Mis-classified %	Sensitivity	Specificity
	1.05	2.28	23	(23)	0	108	(3)	(7)	1	20	0.50	1.00
	1.12	2.43	27	(19)	(1)	110	0	(8)	0	17	0.59	0.99
	1.19	2.57	31	(15)	(4)	107	0	(8)	0	14	0.67	0.97
	1.26	2.72	33	(13)	(9)	102	0	(8)	0	18	0.72	0.92
	1.33	2.87	35	(11)	(16)	95	0	(8)	0	21	0.76	0.87
n												
	1.05	2.28	51	(48)	(2)	152	(1)	(8)	2	22	0.52	0.99
	1.12	2.43	64	(35)	(8)	147	0	(9)	1	20	0.65	0.95
	1.19	2.57	69	(28)	(13)	142	0	(9)	1	19	0.72	0.92
	1.26	2.72	77	(22)	(21)	134	0	(10)	0	20	0.78	0.87
	1.33	2.87	84	(15)	(36)	119	0	(10)	0	23	0.85	0.78

under-reporters defined as EI:EE < 0.76, AR=Acceptable reporters defined as EI:EE 0.76 – 1.24, OR=Over-reporters defin > 1.24. [b]Calculated using CV_{wB} 8.5%. CV_{wEI} 23%, CV_{tP} 15% and assuming 7-day records.

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Various international researchers have used Goldberg's cut-off points and demonstrated that dietary EI misreporting increases with age (Bandini et al., 1997; Bedard et al., 2003; Johansson et al., 2001), differs in relation to gender (Johansson et al., 2001; Bedard et al., 2003), body composition (Ventura et al., 2006; Johansson et al., 2001) and body image (Horner et al., 2002). For example, there is strong evidence suggesting that more women than men tend to misreport their EI (Ventura et al., 2006; Horner et al., 2002; Johansson et al., 2000; Tooze et al., 2004). Misreporting in women is associated with psychosocial parameters such as body image, weight concerns, social desirability and dietary restraint (Ventura et al., 2006; Tooze et al., 2004; Horner et al., 2002). Further, misreporting affects adult women, as well as younger girls (Bandini et al., 1997). However, dietary intake reporting tends to be more accurate in young girls (preadolescents) than older adolescents (Bandini et al., 1997).

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More recently, Bedard and associates studied correlates of food EI misreporting in Canadian adults (Bedard et al., 2004) and found that 54% of men under-reported their energy intake compared to 35% of women. The majority (22%) of men in this study were heavier in terms of BMI (BMI>30 kg/m^2) than women (11%). Further, in this study the main determinants for under-reporting in men were social desirability, adequate financial status and lower education level. Similarly, Tooze et al. (2004) showed that social desirability, as well as dieting history, BMI and education level to be the best predictors of under-reporting in men (Tooze et al., 2004).

Additionally, ethnicity and/or culture have been identified as important risk factors for misreporting dietary energy intake (Kimm et al., 2006; Harrison et al., 2000). Kimm et al. (2006) found ethnic differences in the energy intake reporting status of adolescent girls in the USA, with white girls under-reporting their energy intake to a greater extent than black girls. In this study, BMI was also a strong predictor of under-reporting, with the majority of black girls under-reporting at a higher BMI than white girls (Kimm et al., 2006). In a study of adult American and Egyptian women, Harrison et al. (2000) also observed that more than a third of American women reported intakes <0.92 BMR compared to only 10% of Egyptian women. Culture and food supply within different ethnic groups were found to affect the reporting status of the women in this study (Harrison et al., 2000). Furthermore, procurement of food, food preparation, gender-defined roles and family responsibility were highlighted as other major factors associated with under-report of food energy intake in the Egyptian women.

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Dietary energy intake (EI) misreporting not only affects the absolute energy intake reported, but also affects the reporting of individual macronutrients. Studies have shown that individuals, who are concerned about their weight status, and those who have been advised to change their diet, may have an increased awareness of their food intake and consequently under-report foods considered unhealthy such as foods high in fat and added sugar (Harnack et al., 2004; Johansson et al., 2001). Macronutrient misreporting can therefore impact our understanding of the relationship between diet and health (Venter et al., 2000; Briefel et al., 1997; Lafay et al., 2000). Macronutrient reporting is also influenced by socioeconomic status of individuals (Lafay et al., 2000). For

example, food items rich in fat and/or added sugar (i.e. cakes, pastries, candy and confectionary) are reported less frequently in individuals of lower socioeconomic status due to the expense of these items.

Researchers, therefore, have a challenge to determine whether they capture a truely representative picture of an individuals' dietary intake. To our knowledge only one study has considered the problem of dietary under-reporting in South Africans of different ethnic origin (MacIntyre et al., 2001). As previously mentioned above, using a semiquantative food frequency questionnaire, MacIntyre and associates found that quantifying dietary EI using QFFQ resulted in 43% of their participants under-reporting their dietary EI. They did not, however, attempt to determine factors that influenced EI under-reporting, the gender of the partcipants who under-reported, as well as whether under-reporting was altered by ethnicity.

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In summary, in this section we have provided evidence for the validity of FFQ in South African adults and children. However, errors may still arise despite the age- and ethnic-appropriateness of the dietary intake measure. The main error identified in quantifying dietary EI, is mis-reporting, in particular, under-reporting of EI and certain macronutrient intake. Although the prevalence of mis-reporting has been documented in the South African literature, the impact of ethnicity and the specific determinants of under- or mis-reporting were not explored. We have presented evidence that in other international studies, body composition, age, gender, and social determinants influence food EI misreporting. As such, there is a need to identify the determinants of misreporting in the South African

context, particularly in groups most vulnerable to overweight and obesity. This information is important for future research exploring the dietary determinants of obesity, as well as intervention studies aimed at targeting these vulnerable groups.

1.3.4 Measurement of Physical activity: challenges for validation

Similar to the requirements for validated instruments to quantify dietary intake, valid instruments for the estimation of physical activity are also required. The current public health recommendations for physical activity suggest that, individuals engage in 30 minutes of any combination of moderate-to-vigorous activity, on most, preferably all days of the week (Pate et al., 1995; Hesketh et at., 2006). However, the dose-response relationship between physical activity and health may be influenced by the perception of moderate-to-vigorous intensity, as well as different types of physical activities undertaken between and within communities. These may vary by socioeconomic status, education level, occupation, and other demographic factors such as age and gender. Moreover, the importance and necessity of physical activity is viewed differently in different cultural groups. It is because of these differences that age-appropriate and culture–specific instruments measuring physical activity should be carefully selected.

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Several researchers have developed instruments to capture habitual physical activity, patterns of activity as well as intensity of physical activity. Objective measures of physical activity include DLW, heart rate monitors and motion sensors (pedometers and accelerometers). The DLW technique is applicable

for use in both children and adults as a measure of total energy expenditure over a long period of time, and can can be used in both laboratory and field studies (IDECG, 1986; Montoya et al., 1996; Racette et al., 1995). DLW has been regarded as a gold standard for assessing total energy expenditure (IDECG, 1990), and as such, has been used in several studies to validate other tools designed to measure energy expenditure under conditions of daily living. However, DLW is very expensive, requires great expertise, and is not able to quantify differences in the mode and intensity of activity (Trabulsi and Schoeller, 2001; Schoeller, 1999)

Moreover, researchers have used heart rate monitoring to indirectly measure physical activity (Ceesay et al., 1989; Sallis et al., 1993). This technique has been based on the linear relationship between the individual's oxygen uptake and their heart rate ($r>0.9$) (Trowbridge et al., 1997; Dugas et al., 2005). This technique has also been proven to be applicable in both children and adults (Ceesay et al., 1989; Sallis et al., 1993). However, this technique is limited in larger population studies, particularly in developing countries due to the costs and logistical issues regarding measuring oxygen consumption and access to sufficient heart rate monitors (Trowbridge et al., 1997; Dugas et al., 2005).

Motion sensors, including pedometers (that count the number of times a limb or trunk of individual moves) and accelerometers (that monitor the acceleration of the body through space during activity) are also accepted measures of physical activity, which are applicable for use in both children and adults in field and laboratory studies (Ainsworth et al., 2000; Basset et al., 2000; Moller et al.,

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2007; Kruger et al., 2006; Cook et al., 2000). Despite the feasibility (practicability) of these motion sensors/detectors in a larger population group, they have major limitations in that they often fail to quantify physical activity involving the use of the upper body, gliding or riding and activities done in water (e.g. swimming). Moreover, despite the fact that they detect times of inactivity, they do not identify whether the time of inactivity was due to the individual using technology based equipment such as motor car, computer or television. Further, they do not differentiate between different domains of physical activity.

Following the limitation observed when using physical activity objective measures, various researchers have devised physical activity questionnaires (PAQ) to estimate physical activity and inactivity in children and adults globally and in South Africa, which have taken cognisance of the importance of domains of physical activity. For example, the International Physical Activity Questionnaire (IPAQ) and the Global Physical Activity Questionnaires (GPAQ) (Craig et al., 2003; Tshabangu et al., personal communication) have been validated in both international and local populations. The results of validation of these instruments will be presented in Table 1.5. The IPAQ was validated in adults between 18-65 years from 12 different countries across 6 continents, and overall showed moderate criterion validity (Rho=0.3) and good to very good reliability (Rho=0.5 to 0.8) (Craig et al., 2003). The GPAQ was developed for use as a part of the WHO STEPwise approach to non communicable disease (NCD) surveillance, assessing total physical activity and sedentary behaviours (time spent sitting). The GPAQ was validated in a sample of 215 South African men and women and found to be reliable (r=0.74, r=0.74 and

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r=0.71 for occupational, transport and leisure time physical activity, respectively, p<0.005 (Tshabangu et al., 2007, unpublished data), with reasonable concurrent and criterion validity (Table 1.5). Both the GPAQ and IPAQ are designed to quantify physical activity across four domains, namely work, domestic, transport and leisure time (WHO, 2005).

Differentiation between domains of physical activity (WHO, 2004; Ezzati et al., 2004) is essential to our understanding of physical activity in various settings. Typically, work, domestic and transport physical activities contribute very little to physical activity energy expenditure in developed country settings (Figure 1.6, Ezzati et al., 2004).

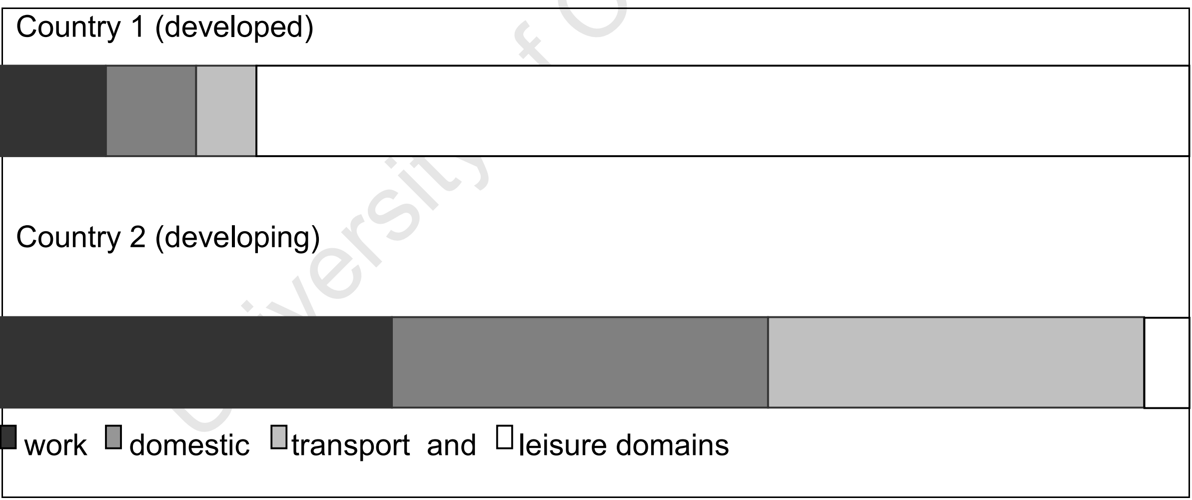

Figure 1.6 Relative importance of domains of physical in (activity) in two hypothetical countries (derived from Ezzati et al., 2004)

As such, individuals in developed countries rely on leisure time physical activity to increase their total physical activity energy expenditure. In contrast, in developing countries the domain ratio is reversed in that, work, domestic, and transport domains contribute the most to an individuals' physical activity due to

high levels of manual labour, walking for transport, as well as increased high activity domestic activities such as fetching water, making fire for food preparation. In this regard, little opportunity arises for individuals to be physically active during their leisure time in these countries (Figure 1.6, Ezzati et al., 2004).

In the urban areas of South Africa the domain ratio resembles that of the developed countries whereby work, domestic, and transport domains contribute very little to an individual's PAEE (Tshabangu et al., 2007, unpublished). Indeed, excessive use of technology-based equipment (television and computer, in particular), reliance on motorized vehicles for transport, as well as the increase in socioeconomic status within households are among the factors that have also been found to contribute to low levels of activity of South Africans including children (Bourne, 1996; McVeigh et al., 2004; Caradas et al., 2001).

Although the IPAQ and GPAQ instruments are available, there are only a few studies that have examined physical activity levels of multi-ethnic groups of South Africans. A better understanding of the physical activity patterns of South Africans is important for our understanding of the link between physical activity and obesity, which can be used to drive interventions to reduce the incidence of obesity and its associated morbidities, particularly in high risk populations in South Africa. As the validation of adult instruments for measuring physical activity was not part of this dissertation, we will now focus the discussion on measures of physical activity in children. The importance of increasing physical

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activity in children is highlighted by studies that demonstrate that being active from childhood and adolescence to early adulthood (i.e. from 13 to 20 years of age) contributes to lean body composition, improved weight control and has a protective effect against the development of obesity and other chronic diseases such as cardiovascular diseases, diabetes, and some forms of cancers (Telama et al., 2005; McVeigh et al., 2004; Raitakari et al., 1997; ACSM, 1998). Importantly, physical activity in childhood appears to track into adulthood (Kuh and Cooper, 1992; Telama et al., 1997). However, given the nature of physical activity in children, it is difficult to quantify and hence know when and how to intervene. However, in order to better understand these relationships, harmonisation of physical activity "dose" in children is needed.

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One of the challenges concerning the measurement of physical activity in children is that unlike physical activity performed by adults, physical activity of children is sporadic (Ridley, 2005) and as such, careful consideration is to be given to the choice of the self-report measure used in children. Moreover, it is impossible to use instruments designed for adults to quantify physical activity in children, as the domains of activity for children differ from those of adults. Children spend most of their time doing structured and unstructured activities at school, out of school, in gyms and in the playgrounds and do little, if any, work or house activities. McCormack and Giles-Corti have proposed that instruments used to capture physical activity in children should include these domains and also capture physical activity done on weekdays and weekend days (McCormack and Giles-Corti, 2002).

Self-report instruments for children, such as PAQ-C (for children, Kowalski et al., 1997; Croker et al., 1997) and PAQ-A (for adolescents, Kowalski et al., 1997) have been devised and found to be very useful and simple means of gathering information on the physical levels of children in uncontrolled environments (data presented in Tables 1.6). These self-report instruments have demonstrated high reliability and moderate validity in children between the ages of 9 and 18 years of age (Table 1.6). These questionnaires also quantify different domains and intensities of activities (Kowalski et al., 1997; Croker et al., 1997; Sallis et al., 1993; PAJMG, 2001) performed by children of different age groups. Further, they are able to cater for physical activity/inactivity done on weekdays and weekends, at school and out of school (Kowalski et al., 1997; Croker et al., 1997). However, these instruments do not cater for the time spent on sedentary behaviours, such as the use of technology-based equipment and the use of motor vehicles for transportation (Wolf et al., 1994; Sternfeld et al., 1999).

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Wareham et al. (2002) developed the second European physical activity questionnaire (EPAQ2) that includes most of the items/questions proposed by McCormack and Giles-Corti, which also quantifies physical inactivity of children (presented in Table 1.6). The EPAQ2 was validated by comparing the outcome to heart rate (objective measure, Wareham et al., 2002), the results of which are presented in Table 1.6. The EE generated by EPAQ2 was comparable to that obtained from heart rate monitoring (Spearman’s Rho=0.73, showing high validity). The EPAQ2 has been successfully used to assess physical activity of European adolescents, measuring the intensity of different activities (ranging

from low, moderate and vigorous activities), catering for structured and unstructured activities done at school, and out of school.

Although not previously validated in a South African setting, a modified version of the EPAQ2 has been used to quantify physical activity/inactivity in a younger group of South African children (Micklesfield et al., 2006). Other researchers such as Weston et al. (1997) suggest comparing the EE generated using the PAQ to EE generated using different objective measures (such as heart rate monitors, pedometry and Caltrac counts) as methods of finding indirect validity of PAQ for children between the ages 7 to 18. The correlations between PAQ – generated EE and EE generated by these objective measures has been found to range from moderate to high (r=0.53; r=0.88 and r=0.77 for heart rate monitors, pedometry or Caltrac counts respectively).

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Moreover, other researchers have used concurrent validity to validate self-report questionnaires. They compared the EE generated from the PAQ to another validated questionnaire (such as an ACTIVITYGRAM, Welk et al., 2002; Welk et al 2004). An ACTIVITYGRAM has been previously validated to quantify physical activity and inactivity in children (Welk, 2002). It is a very useful instrument that recalls the previous day's activities done by children within 30-minute intervals, and also captures the time of inactivity (time spent sitting down) during a typical day.

1.5 Physical Activity questionnaires (PAQs) adapted for use to quantify energy expenditure in South African adults

	Age group (yrs)	Sample size (N)	Validation method	Validity	Reliability
ational physical y questionnaire): 12-country ility and validity ,2005)	18-65	12-Countries	IPAQ administered for 3-7 days and compared to the CSA monitors worn for 1 week	Criterion validity: Mean Rho=0.3 comparable to other self report	Rho=0.8
l physical activity ionnaire (GPAQ 2) bangu et al., blished)	≥18	215 men and women	GPAQ administered to measure occupational, transport and leisure time physical activity and was compared to the CSA monitors worn for 1 week	Reasonable concurrent and criterion validity (Spearman's Rho>0.5 for occupational, transport and leisure time physical activity	r=0.74; r=0.74; r=0.71 for occupational, transport and leisure time physical activity respectively at p<0.005

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1.6 Physical Activity questionnaires (PAQs) adapted for use to quantify energy expenditure in South African children

	Age group (yrs)	Sample size (N)	Validation method	Validity	Reliability
C (Kowalski et al., Croker et al.,	9-18 years (grades ± 4, préadolescents and adolescents)	N=84	Self-administered 7-day recall, Activities were presented on 5-point Likert Scale to allow the total score of physical activity. Frequency in participation of different types of physical activities was identified. Catering for activities done on weekdays and weekends.	The PAQ-C was validated against the seven day recall. Results showed moderate overall validity (r=0.46). The Leisure time activity showed moderate validity (r=0.41). When the PAQ-C generated energy expenditure were compared to the caltrac accelerometer generated EE validity of r=0.39 was produced.	The test retest reliability performed by administration o the PAQ-C 1 we apart showed hi reliability in both males (r=0.75) a females (r=0.82)
A (Kowalski et al.,	13-18 years	N=85	Self-administered 7-day recall, Activities were presented on 5-point Likkert Scale. Frequency	PAQ-A generated leisure time activity (question 1) showed good validity (r=0.57) and	The test retest reliability done b having

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			in participation of different types of physical activities was identified. Catering for activities done on weekdays and weekends.	question 2 showed good validity (r=0.62). When the PAQ-A- generated EE was compared to the caltrac accelerometer generated moderate EE validity of r=0.33 was produced.	administration o the PAQ-C that were 1 week apa high reliability wa produced for bot males (r=0.75) a females (r=0.82)
2 (Wareham et 02)	Adolescents 12-18yrs (and successfully used in 109, 7-9yrs old SA children)	173	MET h per week generated by EPAQ2 compared to those generated by 4-day heart-rate	Recreational vs occupational activities (r=28, P<0.001); vigorous activity time vs cardio-respiration fitness (r=0.16, P<0.05)	Recreational vs occupational activities Rho=0

C, physical activity for children, PAQ-A, physical activity for adolescents, EPAQ 2, second European physical activity question

ergy expenditure

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It also aids children to recall the domains of activities and also classifies them as moderate or vigorous, using the picture-sort method (silhouettes) included in it. To validate the ACTIVITYGRAM, Welk and associates then compared its EE data to the previous day physical activity-recall (PDPAR). The results of this study yielded a high correlation between the two questionnaires (rho=0.72, Welk et al., 2004).

Lastly, other researchers suggest finding indirect validity of PAQ by comparing its self-reported PAEE to objective measures such as physical fitness, body composition, and dietary energy intake (Andersen et al., 1998; Bouchard, 2001; IDECG, 1989). These validation procedures are based on the premise that physical activity alters body composition, substrate oxidation and metabolism (Kimm et al., 2005; Griera et al., 2007; Donnelly et al., 2004; IDECG, 1989). Indeed, McVeigh et al. (2004) have done a similar study that compared body composition of adolescent South African children to levels of activity. Their results showed positive correlations between physical activity and participants' lean tissue mass (McVeigh et al., 2004).

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Despite the apparent validity of the questionnaires, these tools are still prone to errors, which depend on the kind of information the questionnaire is intended to elicit (Beaton, 1994; Sallis et al., 1985). Information elicited from questionnaires include: i) the behaviour of individuals (e.g. use of technology-based equipment or motorized vehicles instead of walking, Hesketh et al., 2006; Sallis et al., 1985); ii) the psychosocial correlates of physical activity (e.g. factors predisposing children to physical activity such as efficacy, enjoyment,

competence and parental encouragement, Welk et al., 2002); as well as iii) the relationship between physical activity and health-related quality of life (Vuillemin et al., 2005). In this regard, the type of error yielded by each self-report instrument is likely to differ.

For example, according to Beaton (1994), when measuring the behaviour of individuals; "asking them what they usually eat and how much, will never be measured without an error". In this regard, Ridley (2005) also argued that "asking individuals what they usually do to stay physically active, with what precision will never be interpreted without error". Beaton further argued that the usual intake of each individual may differ in the way each individual perceives it. Similarly, with activity, the averaged number of days/weeks may be a poor estimate of usual activity. Moreover, the precision of the activity may also be over- or under- estimated. In this regard, correct probing by trained interviewers may help minimize errors.

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As in dietary intake reporting (Beaton, 1994) if individuals systematically over- or under- estimate their physical activity, and these biases are randomly distributed, the errors act like random error. Random error produces bias by increasing the total variance while decreasing the statistical power of the physical activity outcome measure. This type of error does not result in a serious problem of interpretation, as variance can be decreased by either increasing the number of days measured for each individual or by increasing the number of subjects/participants (Beaton, 1994). However, if the regression or correlation analyses are performed, a random error may cause a more

serious problem (Beaton, 1994). For example, this type of error has been assumed to occur when there is large within-individual, day-to-day physical activity estimate variation. Random error of this type may result in either attenuation or an overestimation of the correlation between estimated PAEE and some explanatory variables. Beaton (1994) states that "there is no recognised way to estimate or adjust for these errors in an isolated individual…making valid assessment logistically impossible".

Despite the errors that may arise when using physical activity self-report questionnaires, they may have a number of appealing characteristics. They are non-invasive and relatively inexpensive for use in a larger group of individuals. They are generally reliable and valid especially when used in older children and teenagers (Matthews et al., 2001). They can be administered in a number or ways, either as printed versions or accessed via computer, depending on the education and social class of the group under study. They are also able to quantify different domains of activity such as leisure time activities, activities done at the gym, as well as activities done during and after school. They also include items/questions quantifying the time spent in sedentary activities (Weston et al., 1997). These advantages may not be possible to quantify when using objective measures such as accelerometers (Ainsworth et al., 2000) and pedometers (Basset et al., 2000).

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Given these advantages PAQ's can be used to quantify physical activity in developing countries in which resources are limited and objective measures of PA are not available. These questionnaires can be modified to account for

diversity in culture and social class. Prior to use, these questionnaires should be validated to ascertain if they are appropriate for the given age group and the muti-cultural nature of the sample being studied.

In summary, in this section we have highlighted the benefits physical activity can have on health. Although objective measures of physical activity are the 'gold standard, we have shown the advantages of using physical activity questionnaires to quantify physical activity in both adults and children. There is however a lack of validated self-report measures to quantify physical activity/inactivity in the South African context. The EPAQ is however, a potential tool to quantify physical activity/inactivity in pre-adolescent South African children. The EPAQ includes physical activity performed at school, out of school, on weekend and weekdays, as well as time spent on sedentary activities.

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1.3.5 Measuring cultural identity, health knowledge, self-efficacy, and environments: challenges for validation

In the previous sections 1.3.3 and 1.3.4 we have presented public health recommendations for individuals to eat healthily and engage in physical activity for at least 30 minutes of any combination of moderate-to-vigorous activity, on most, preferably all days of the week. However, meeting these recommendations has been found to be difficult. Extrinsic factors such as social, cultural, economic and environmental factors have been found to influence individuals eating healthily and engaging in physical activity.

For example, South Africa is recognized for its diversity in culture, traditional beliefs and attitudes. However, with increasing urbanization and urban migration, the majority of the population has adopted a Westernized lifestyle (Steyn et al., 2001). However, Elias and Blanton (1987) and Matute-Bianchi (1986) have suggested that individuals with strong ethnic-identity and high self-esteem have reduced tendencies to adopt the dominant lifestyle outside of their ethnic beliefs.

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Indeed, in South Africa, despite the influence urbanization on some dietary habits, it appears as if some body image - and food - attitudes and beliefs that were internalized by black individuals during early socialization within families are still adhered to (Puoane et al., 2006; Hughes et al., 2006). Attitudes, beliefs and behaviours identified to resist change include the individuals' general perceptions about food, the meaning of food in relation to health, the relationship of food to body size and image, the social meaning of food, the values attached to food, as well as food portion sizes (Puoane et al., 2006; Hughes et al., 2006; Steyn et al., 2001). However, in these South African studies, ethnic identity and self esteem in relation to the stability of these food-related attitudes, beliefs and behaviours were not explored. It therefore, remains important to explore the role of social, cultural and ethnic-identity in the attitudes, beliefs and behaviours of South Africans.

Besides the social and cultural norms, behavioural adoption may also be facilitated by an individual's perceived self-efficacy, as presented in Section

1.1.2.4.4. Moreover, studies in South Africa have shown a clear association between a lack of knowledge regarding healthy food choices, food preparation, and acceptable portion sizes and BMI (Kruger et al., 2002; Steyn et al., 2000).

Studies have also shown that social and physical environmental factors drive unhealthy behaviours of individuals (Schneider et al., 2007; Steyn et al., 2001; Reddy et al., 2003; McVeigh et al., 2004) via various mechanisms including: i) the abundance of energy dense food that is used as a means of socialising (Hughes et al., 2005), ii) the proliferation of fast food outlets and vendors that serve high fat cuts of meats (Bradley and Puoane, 2007), iii) the over-use of technology-based equipment (television in particular, Reddy et al., 2003; McVeigh et al., 2004), as well as iv) reliance on automobiles for transportation, overcrowding and crime that reduces participation in physical activities (Prista et al., 2005; Bradley and Puoane, 2007; SA MRC, 2007). It is, therefore, essential that resources are directed at understanding these so-called social-, and physical- environments that discourage South Africans from adopting health behaviours.

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We have previously mentioned that Bower et al. (2008) identified environmental factors which impacted on health behaviour of very young children as preschool play grounds, physical activity equipment, preschool staff members and policies. These environmental factors were considered important because they had the potential to promote free play amongst the children and improve health knowledge of preschool staff. However, in order to characterise these environmental factors, valid instruments were required. In this regard, Ward

and associates developed an instrument to assess these environmental factors (known as the "environment, policy assessment and observation", EPAO) at child care centers. Their results showed 87% and 79% mean agreement between the data collected from 17 pairs of direct observers placed at the child care centers using the EPAO and the data obtained by reviewing policy documents within the centers, respectively. Further, in the same study, items that were less reproducible included: staff behaviour, policy classification and the observation of children's daily or weekly activities. Nevertheless, they were able to recommend the use of EPAO as a valid measure to assess nutrition and physical activity environments at childhood day care centers.

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There is a need for validated instruments that will also characterize the cultural, social and environmental factors of obesity in underserved communities of preadolescent children. Stevens and associates (1999) in their Pathways study developed an instrument (questionnaire) to assess these socio-cultural and environmental correlates of obesity in American Indian children in grades 3-5 from different cultural backgrounds. From an initial draft of 248 questions, 170 questions were selected through a standardised review process to assess factors that were more likely to influence children's levels of activity and eating healthily, or their likelihood that they will become active and eat healthily if exposed to appropriate interventions, examples of which are presented in Table 1.7.

1.7 Inter-item analysis of constructs included in a questionnaire to assess knowledge, attitudes, and behaviours in 693 girl
oys American Indian Children (Stevens et al., 1999)

uct	Items included in a construct	No. of Items	Average K	Final items	Average K	Cronbach's α
l identity						
	Can you speak your tribal language	6	0.43	4	0.44	0.41
al Activity						
cacy	I can play hard during most of recess	5	0.30	3	0.31	0.61
upport	My friends play hard	12	0.23	9	0.18	0.78
	The weather is too bad to play sports and active games	10	0.21	10	0.22	0.56
ception	Some kids wish they could feel better about themselves physically	4	0.29	4	0.25	0.02
dge of high fat						
	Which has more fat?	10	0.30	6	0.29	0.56
cacy	I can put less butter on my tortilla bread	15	0.26	12	0.26	0.76
upport	The adults in my house eat fruits and vegetables	7	0.26	7	0.26	0.19
ns	Which would you pick for a snack?	10	0.45	8	0.43	0.76

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These questions elicited information on i) psychological factors such as self-efficacy (e.g. “I can play hard during most recess”); ii) social support (e.g. “my friends play hard”); iii) barriers (e.g. “the route is to long to walk to and from school”); iv) self perception (e.g. “some kids feel better about their bodies”). Furthermore, dietary intake items eliciting information on i) dietary knowledge (e.g. “Which has more fat”); ii) psychological factors such as self-efficacy (e.g. “I can put less butter on my tortilla bread”); iii) social support (e.g. “adults in my house eat fruits and vegetables”); iv) barriers (e.g. “fruits are too expensive for me to buy everyday”); and v) self perception (e.g. “do you think you are fat or thin”). Furthermore, Stevens et al. (year) developed an ethnic identity scale/construct used to gain insight into the impact of cultural issues on the effectiveness of the intervention in children who identified more or less strongly with their American Indian culture.

To determine the validity of the questionnaire, the internal consistency of the subscales within the main questionnaire were assessed using test-retest reliability. A summary of the validation procedure is presented in Table 1.7. Results of this study suggested that the physical activity social support construct, the dietary self-efficacy and dietary intention construct were valid in this group of children (all yielded Cronbach’s α values that were greater than 0.70) (Stevens et al., 1999). Despite the other constructs in the questionnaire yielding Cronbach’s α values of less than 0.70, the questionnaire was able to identify different social, attitudinal and environmental factors influencing multi-cultural American Indian pre-adolescent children’s levels of activity and eating healthily, or their likelihood that they will become active and eat healthily if

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exposed to appropriate interventions. Further the k Statistics was calculated for each of the study questions as an estimate of repeatability.

As ethnicity, cultural identity, health knowledge, self-efficacy, social stereotypes and environmental factors contribute in part to the adoption of health behaviours, it is important to characterize these factors in the South African context. However, no validated instruments are available in South Africa to characterise these specific factors. The Pathways American Indian questionnaire provides a strong basis for a questionnaire designed to elicit information on the cultural identity, health knowledge, self-efficacy to eat healthily and engage in physical activity, as well as explore environments that are more likely to influence South African pre-adolescent children of different ethnic origin. Furthermore, a similar validation procedure to that used this study can be used within the South African context.

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1.3.6 Overall Summary

In the first section of the current literature review we outlined the potential determinants of and/or modulating factors in the development of obesity in South Africa (namely, behaviour, host characteristics, as well as the economic, social, cultural and environmental factors outlined in Figure 1.5). We however, acknowledged that data in these determinants is fragmented, with reasons being the lack of validated instruments measuring these determinants.

In the second section we reviewed literature to explore the international and South African scientific literature to identify instruments designed for measuring

these determinants. Figure 1.7A outlines available age-adjusted and culturally-sensitive instruments designed to measure determinants of obesity in the South African literature, such as the QFFQs (Steyn et al., 2003; McIntyre et al., 2000), the IPAQ (Craig et al., 2003), as well as the GPAQ (Tshabangu et al., unpublished).

Dietary intake measurements
- Validated FFQ (McIntyre et al., 2000)
- Validated FFQ (Steyn et al., 2003)

Physical activity measurements
- Validated IPAQ (Craig et al., 2003);
- Validated GPAQ (WHO, 2005)

Psycho-social measurements
- Body image
- Self-efficacy
- Dietary knowledge

Environmental bariers
- Social support
- Environmental barriers

Figure 1.7 A Available age-adjusted and culturally-sensitive instruments designed to measure determinants of obesity in the South African literature

Errors in dietary EI
- Identifying misreporting groups in South Africa
- Determinants for misreporting EI
- Nutrients affected by misreporting EI

Physical activity measurement for children
- Adapted EPAQ (Wareham et al., 2002) previously used in young South African children (Micklesfield et al., 2006) however, not previously validated

Psycho-social factor measurements
- Perceptual body image questions (Puoane et al., 2005) and
- Attitudinal body image questions (Caradas et al., 2002), however not previously validated

Environmental barriers
- No available measures in South Africa

Figure 1.7 B Gaps in South African literature

Further, different validation procedures of these instruments have been outlined in Tables 1.4 and 1.6. However, In Figure 1.7B we also acknowledged that instruments measuring physical activity energy expenditure of South African children, and factors associated with health knowledge, body image self-perception, self-efficacy and environmental factors influencing engaging in health behaviours still need validation. We therefore outlined various validation processes of these instruments used by international researchers and highlighted the challenges experienced in these validation procedures.

The following Chapters 2 to 5 we will present in detail the process whereby we attempted to assess validity and internal reliability of various self-report methods adopted from the international studies, or factors affecting validity and reliability. Further, the validated instruments were then used to measure the contribution of familial factors to obesity and body image percentiopn and the results are presented in Chapter 6.

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CHAPTER 2

DEVELOPMENT AND VALIDATION OF INSTRUMENTS MEASURING BODY IMAGE AND BODY SIZE DISSATISFACTION IN SOUTH AFRICAN MOTHERS AND THEIR PRE-ADOLESCENT DAUGHTERS

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Chapter 2: Development and validation of instruments measuring body image and body size dissatisfaction in South African mothers and their pre-adolescent daughters.

2.1 Introduction

In Chapter 1 we presented evidence that South African women are at increased risk of becoming overweight and obese, and that black South African women and adolescent girls are particularly vulnerable (Puoane et al., 2002; Armstrong et al., 2006; Reddy et al., 2003). However, adult South African women appear to have misperceptions regarding their body size status (Puoane et al., 2002). In the same study, ethnicity influenced womens' body image perception. Further, we presented indirect evidence supporting a greater tolerance for larger body size status in urban black adult South African women (Puoane et al., 2005). Similarly, Caradas et al. (2001) in their study of urban South African adolescent girls, also found dissatisfaction with body size status and body shape to be significantly lower in black girls compared to white girls and those of mixed ancestry.

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International studies have suggested that ethnic differences in obesity prevalence may be partly related to differences in body image and body size dissatisfaction between groups (Altabe, 1998; Dawson, 1988; Caradas et al., 2001; Henriques and Galhoun, 1999). These studies further suggest that body image differences are manifested by the manner in which women see their bodies (perceptual body image, Dawson, 1988; Madrigal et al., 2000), and how they feel about their body size status (attitudinal body image, Altabe 1998;

Caradas et al., 2001; Henriques and Galhoun, 1999). In this regard, body image may affect one's response to weight changes and attitudes towards weight control (Henriques and Galhoun, 1999).

Culture and ethnicity have also been shown to influence body image and body size dissatisfaction in black and white American women (Fitzgibbon et al., 2000). Fitzgibbon et al. (2000) and others (Cachelin et al., 2002; Miller et al., 2000; Paeratakul et al., 2002; Sanchez-Johnsen et al., 2004) showed that white women experience more body size dissatisfaction and higher body image discrepancy levels than black American women after controlling for age, education, socio-economic status, and body weight. Additionally, Cash and colleagues found that black college women had body size ideals that were larger and more congruent with their current body weight compared with white college women (Cash et al., 1992). These studies also suggest that black American women generally have higher tolerances for a bigger body size, such that they are more likely to associate obesity with attractiveness than their white counterparts when age, education, and body weight are controlled (Cachelin et al., 2002; Sanchez-Johnsen et al., 2004).

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Similar findings of body image acceptance have been observed in some developing countries, such that, in certain traditions and cultures, obesity is portrayed as a sign of wealth, beauty and fertility (al Shammari et al., 1994; Wang et al., 1999). For example, the high prevalence of obesity in the Pacific Islands (i.e. Nauru and Tahiti), may be partially attributed to the use of rituals designed to fatten women, as obese women are still regarded by some as

sexually attractive, high-spirited, beautiful and fertile (Brewis et al., 1998). Similarly, there is a cultural preference for obesity among the traditional Saudi Arabian community, who consider a bigger body size status as a sign of beauty, good health and wealth (Rasheed, 1998). As a result, women from these cultural groups have less dissatisfaction with their bodies than women from more 'Westernized' communities (Wang et al., 1999; Rasheed, 1998).

These studies are consistent with previous work undertaken in small samples of South African women, in which body image differences were found to be highly driven by cultural norms (Caradas et al., 2001; Cachelin et al., 2002; Mvo et al., 1999), urbanization (Young et al., 2002; Senekal et al., 2001) and socio-economic status (Mvo et al., 1999). We have previously presented that in South Africa, a larger body size has many positive connotations in black rural communities and in some groups of urban black women. In these cultures a bigger body size is associated with affluence, health, attractiveness and happiness, as well as an indication that someone is not HIV-positive (Mvo et al., 1999; Puoane et al., 2005). In a recent study of South African female college students, those from urban backgrounds had greater body size dissatisfaction and were more likely to have attempted weight reduction compared to those from rural backgrounds (Senekal et al., 2001).

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Although cultural and ethnic differences in body image have been previously investigated in South African populations, few studies have provided evidence of cultural sensitivity and equivalence of the various instruments used to measure these constructs. To understand differences in body image constructs

within different ethnic groups, a culturally-sensitive and age-appropriate questionnaire is required. The aims of the first chapter of this dissertation were, therefore, to develop (adapting existing instruments to suit the multi-ethnic community of South African women) and validate (determine their cultural sensitivity) instruments for assessing body image constructs in South African women and pre-adolescent schoolgirls.

2.2 Methods and procedures

2.2.1 Study population

2.2.1.1 Sample size and participant recruitment

Three hundred and thirty three girls and their 204 mothers were included in this research. To recruite participants, fifteen primary schools in the Cape Town Metropole Area were randomly selected and sampled on the basis of divergent socio-economic status (ranging from low, middle to high socioeconomic status). Ethical approval was obtained from the UCT Research Ethics Committee (see Appendix 2.1), as well as the Western Cape Department of Education (see Appendix 2.2). All girls (ages 9-12 yrs, grades 4-5) and their mothers were invited to take part in the study. Girls were given informed consent forms (see Appendix 3) to be signed by their parents or caregivers. The response rate was 89% for girls and 61% for mothers, such that 30% of girls interviewed were from schools within the highest socioeconomic stratum, 49% from the middle socioeconomic stratum and 21% from the lowest socioeconomic stratum.

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2.2.1.2 Participant inclusion criteria

To control for the potential confounding effects of diverging stages in sexual maturation on body weight, body fatness and body image, girls were also asked to estimate their pubertal stage. Self-rating has been found to be the reliable way to identify pubertal development in South African children (Norris and Richter, 2005). Self-rating was done using diagrammatic sketches of Tanner (1962) classifications of breast development and pubic hair growth as presented in Appendix 4. Participants did this individually with privacy ensured by the interviewer. We classified the girls' developmental stage based on self-staging of both breast and hair development. Of the 372 girls who participated, 89% were found to be in Tanner Stages 1 and 2% in Stage 3 and 7% in Stage 4. Four percent of the girls could not correctly identify their stage of development. Only girls who were in Tanner Stages 1 and 2, and who returned to school with the signed consent forms (n=333) were included in the final analysi. For example, these 333 girls reported having no breasts at all or were within the Tanner stage 1 of breast development. Further, 98% of these girls reported being in Tanner stage 1 of pubic hair development and only 2% (n=7) reported being within Tanner Stage 2 of pubic hair development. Six of these 7 girls were 9 to 11 years old. As such, we included all the 333 girls in our final analysis as it seemed unlikely that this would have impacted on the results or interpretation of our research. The final sample comprised of 333 primary schoolgirls, of whom 32% were black, 34% were of mixed ancestry and 34% were white. Of the 204 mothers and caregivers to the girls who responded, 31% were black, 37% were of mixed ancestry and 32% were white.

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2.2.2 Body composition

Body weight was assessed in light clothing, without shoes, and recorded to the nearest 0.5kg using a calibrated electronic scale (TANITA HD-309, Tanita Corporation of America Inc, USA). Height was measured without shoes to the nearest 0.5cm using a calibrated height meter. BMI was calculated as weight (in kg) divided by the square of height (in m) for mothers and World Health Organization (WHO) BMI percentiles were determined for girls. Triceps, biceps, subscapular and suprailiac skinfold thicknesses were measured using calibrated Harpenden calipers, and recorded to the nearest 0.1mm. Percentage body fat measurements were calculated using standard equations for mothers (Durnin and Womersely, 1973) and for schoolgirls (Lohman, 1992). Additionally, body fat centralization was determined based on the [subscapular / triceps (s/t)] ratio for both mothers and daughters (van Lenthe et al., 1996).

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2.2.3 Questionnaire development and validation

Two questionnaires, one for mothers (presented in Appendix 5.1) and one for daughters (presented in Appendix 5.2), examining body image perception, body size dissatisfaction, body shape concerns (using of 34-item Body Shape Questionnaire (BSQ), Cooper et al., 1987), as well as weight-related beliefs and attitudes, were adapted and modified from the American Indian Pathways study for girls (Stevens et al., 1999), and questions derived from focus groups in black women from the Cape Town Metropole Area (Puoane et al., 2005) for both mothers and daughters. The constructs measured by each instrument and the process for determining construct validity (comparing similar questions

seeking the same response within the same construct or questionnaire) and concurrent validity (comparison of different constructs seeking the same response) are presented in Table 2.1. Additionally, the questionnaires characterized socio-demographic factors such as age, ethnicity, employment status, education level (the highest grade category passed: Category: 1<grade 8; 2=grades 9-11; 3=grade 12; 4=college / university), household density (total number of people residing in the same household five or more days a week) and asset index (total number of appliances in one household out of a list of 9 appliances). Questionnaires were administered by trained fieldworkers using a field worker resource manual.

The figural stimuli that were used to identify body size and shape status of the girls and their mothers are presented in Figure 2.1 a and b. For girls, a set of eight silhouettes ranging from the very thin to very heavy derived from the Pathways Study (Stevens et al., 1999, Figure 2.1a) were redrawn and modified to represent ethnic diversity in South Africa, with permission obtained. These changes did not affect the original body sizes and shapes.

Table 2.1 Body Image Constructs and validation procedure

Construct	**Validation Procedure**	
	GIRLS	**MOTHERS**
1. Perceptual body image: questions about the way participants see their body size status	Silhouettes (Figure 2.1a) representing a participant's current weight *"Feel"* (selection from the adapted American Indian pathways silhouettes) *compared with* body fat percentages and WHO BMI percentile	Silhouettes (Figure 2.1b) representing a participant's current weight *"Feel"* (selection from the Stunkard body image figures) *compared with* body fat percentages and BMI
	Locally adapted body weight status questions from the focus groups with black women from Cape Town Metropole Area about perpetual body image. The participants' response percentages are plotted against ethnicity	Locally adapted body weight status questions from the focus groups with black women from Cape Town Metropole Area about perpetual body image. The participants' response percentages are plotted against ethnicity

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	Non-parametric (Spearman's) rank-order correlation, Pearson product-moment correlation and chi-square test	
2. Attitudinal body image: questions about the way participants feel about their body size status (body size dissatisfaction)	FID Index score *compared with* locally adapted questions about the girls' body weight status from the focus groups with black women from Cape Town	FID Index score *compared with* locally adapted questions about the women's body weight status from the focus groups with black women from Cape Town. FID Index score compared to BSQ score
	Two-way analysis of variance as well as Pearson product-moment correlation	
3. Weight-related constructs: questions about attitudes towards thinness and fatness	"Thin" and "Fat" belief constructs derived from locally-adapted weight-related belief questions about a thin or fat girl being unhappy	"Thin" and "Fat" belief constructs derived from locally-adapted weight-related belief questions about a thin or fat woman being unhappy
	Internal consistency / item analysis: testing for internal reliability of the scales using Cronbach's α	

WHO, World Health Organization; BMI, body mass index; FID, feel-ideal difference; BSQ, body shape questionnaire

Stunkard's body image figures (Stunkard et al., 1983) a set of eight silhouettes also ranging from the very thin to very heavy were used for mothers (Figure 2.1b). These silhouettes were allocated numbers 1 to 8 from left to right and the numbers were used for comparative analyses.

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2.2.3.1 Body Image Perception

Each participant was shown the respective silhouettes and was required to select the number of a silhouette which she felt best represented her current weight. The silhouette selected indicated how she saw herself "Feel". The selected silhouette was compared with the actual BMI (for mothers) or actual WHO BMI – percentiles (for girls), using Spearman's correlation coefficients. The silhouettes were also compared to the actual body fat percentage and the ratio of body fat centralization for both mothers and daughters using Pearson-product moment correlation. In addition, each participant was asked to select whether she saw herself as being thin, normal weight or overweight. Lastly,

participants were asked to choose the silhouettes that they thought were thin, normal-weight or fat.

2.2.3.2 Body image attitude (body size dissatisfaction)

To assess for body image attitudes, Feel Ideal Difference (FID) Index scores (Caradas et al., 2001) were calculated using a procedure similar to Body Image Discrepancy scores created in the Bulik and Fitzgibbon studies for assessing body size dissatisfaction (Bulik et al., 2001; Fitzgibbon et al., 2000). The FID Index scores were created by determining the difference in the number of silhouette selected which best represented their current appearance 'Feel', and the one they thought was their 'Ideal' (the silhouettes they would want to look like). A higher FID Index score represented greater body size dissatisfaction, whereas a FID Index score that approaches zero, represented less body size dissatisfaction. Moreover, a BSQ score < 1.23 indicated lower body shape and size acceptance, whereas a BSQ score ≥123 indicated higher body shape and size acceptance (Cooper et al., 1987).

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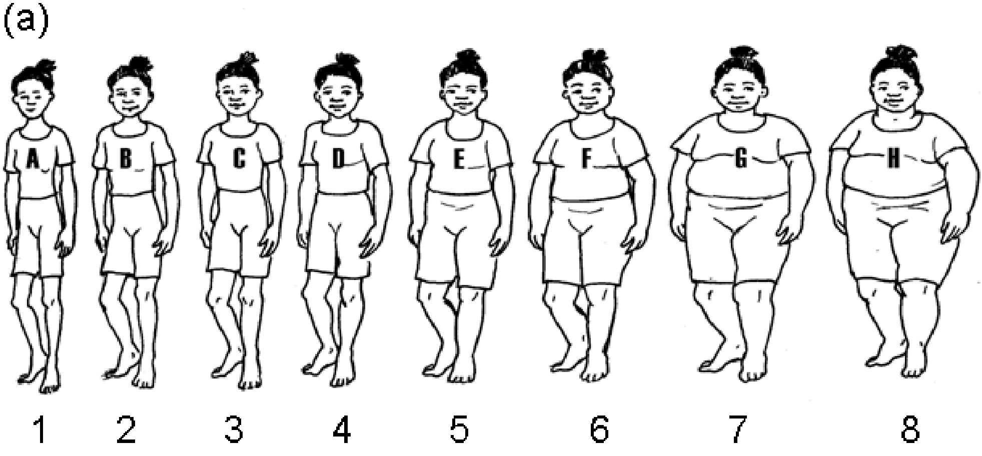

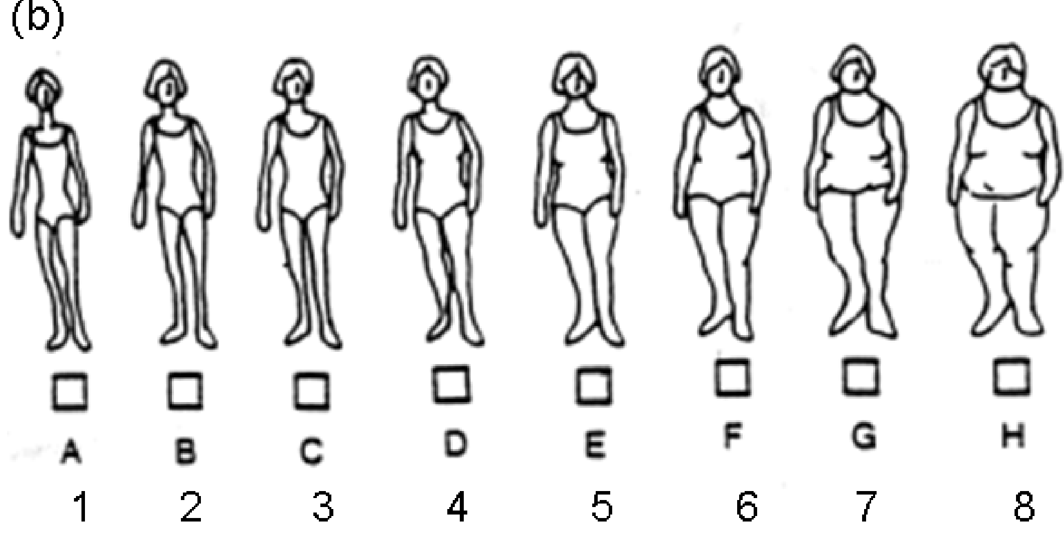

Fig. 2.1 Sets of silhouettes designed for use by (a) the girls and (b) the mothers. In both cases, body size is arranged in an increasing order from left to right

Subsequently, the body size dissatisfaction of girls and of mothers was also determined based on questions, modified from focus groups in black women from the Cape Town Metropole Area (Puoane et al., 2005). The modified questions included asking participants whether they ever considered themselves to be 'thin' or 'fat'. In addition, they were asked how their families, friends, partners, children perceived their body size. Responses to these questions were compared to the FID Index scores, to determine construct validity. Furthermore, the FID Index scores were compared to BSQ scores to determine concurrent validity (in mothers only).

2.2.3.3 Weight-related belief constructs

For both mothers and daughters, a written construct asking whether a 'thin' or 'fat' woman or girl was likely to feel better about herself, to feel 'more like a women or girl', to be happier, to have more friends and to be healthier, were modified from questions adapted from focus groups in black women from the

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Cape Town Metropole Area (Puoane et al., 2005). These constructs determined the 'thin belief' and 'fat belief' constructs. Internal reliability of these constructs was measured using item analysis by means of Cronbach's α.

2.2.4 Sample size determination and Statistical analysis

Sample size was calculated using a power of 80% (1-β) and an α-level of 0.05, referring to studies by Stevens et al. (1999) for body image, Caradas et al. (2001) for Feel-Ideal Difference (FID) index and body shape dissatisfaction (BSQ). Details are presented in Table 2.2. In summary, for body image an estimated 73 subjects were needed from each ethnic group, whereas for both the FID index and BSQ score n=30 and n=49 for each ethnic group were needed.

Table 2.2 Sample size determination using a power of 80% (1-β) and an α-level of 0.05. Comparisons reflect differences between black and white overweight women.

Parameter	Smallest Odds Ratio to detect	Smallest proportion	N per group	Study
Body image	OR = 2.5	Smallest proportion = 37%	73	Stevens et al., 1999
Feel-ideal difference (FID) index	0.6	0.9	30 per group	Caradas et al., 2001
Body shape questionnaire (BSQ)	20	35	49 per group	Caradas et al., 2001

All data were analyzed using Statistica version 7.0 (StatSoft Inc, Tulsa, OK, USA). For continuous variables, data were expressed as means ± standard deviations. Pearson-product moment correlations, as well as multivariate regression analysis were used to determine factors associated with scores, and also to describe relationships between continuous variables. Spearman's rank

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order correlations were used similarly for data that were ordinal. In addition, two-way analyses of variance were used to compare FID Index Scores, and morphological characteristics between and across different main effects. These main effects included; ethnicity and dichotomous categories based on, for example, whether or not the girl or her mother considered herself to be ‘fat’ (yes or no). For variables where overall differences were found, Scheffe’s post-hoc tests were used to evaluate between group differences. Where appropriate, we adjusted for the effect of socio-economic status (represented by the asset index and employment status), as the majority of the black participants were unemployed or received disability grants, compared to the other groups, who were employed and/or self employed. Chi-square analysis was used to determine ethnic differences in the silhouettes most frequently selected to represent a ‘thin’, ‘normal’ or ‘fat’ body type. In addition, item analysis was conducted to evaluate the internal consistency of the constructs of ‘fat belief’ and ‘thin belief’, and a series of attributes associated with being fat or thin.

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2.3 Results

2.3.1 Body composition and demographic characteristics

Black girls were significantly older compared to girls of mixed ancestry and white girls, whereas the white girls were significantly heavier, in terms of BMI-percentiles, than the other ethnic groups (Table 2.3). Girls of mixed ancestry had significantly greater centralization of body compared with white girls.

Table 2.3 Characteristics of mothers and their daughters according to ethnicity

GIRLS (N=333)				MOTHERS (N=204)			
	Black (n=105)	Mixed Ancestry (n=113)	White (n=114)		Black (n=63)	Mixed Ancestry (n=76)	Whi (n=6
Age (months)	130.7±11.1*º	127.3±7.4*	126.1±9.5* º	Age (yrs)	39.5 ± 10.7	38.0 ± 4.5**	41.5 ±
Weight (kg)	38.9 ± 10.6	38.2 ± 8.7	38.5 ± 9.4	Weight (kg)	84.0 ± 22.2*	66.6 ± 12.3*	68.5 ±
Height (m)	1.42 ± 0.08	1.42 ± 0.07	1.42 ± 0.08	Height (m)	1.57 ± 0.05*	1.59 ± 0.05*	1.64 ±
BMI percentiles	57.3 ± 31.1†	58.9 ± 29.8	60.7 ± 28.3†	BMI (kgm^{-2})	33.6 ± 7.8*	26.5 ± 4.7*	25.4 ±
Body fat (%)	24.1 ± 4.9	24.7 ± 4.6	25.3 ± 4.9	Body Fat (%)	34.5 ± 6.3 †	32.2 ± 4.8	31.8 ±
CBF (s/t)	0.41 ± 0.07	0.42 ± 0.07**	0.39 ± 0.08**	CBF (s/t)	0.04 ± 0.02†	0.05 ± 0.02	0.05 ±

Values are expressed in mean ± Standard Deviation. BMI- body mass index; s/t - ratio of subscapular / triceps skinfold thick
CBF - centralization of body fat. Matching superscripts represent groups that are different from each other: *ºP<0.001, **P
†P<0.05

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Moreover, black mothers had lower levels of education, with fewer having completed Matric (Grade 12) and fewer black mothers were employed compared to mixed ancestry and white mothers (Table 2.4).

Table 2.4 Socio-demographic characteristics of mothers according to ethnicity

	Black (n=63)	**Mixed Ancestry (n=76)**	**White (n=65)**
Household density (persons/room)	$1.9 \pm 1.3^{*o}$	$0.8 \pm 0.3^{*}$	0.6 ± 0.2^{o}
Asset index	$5.4 \pm 2.2^{*o}$	$8.5 \pm 0.8^{*}$	8.8 ± 0.5^{o}
Education level less than grade 12	54% ‡	5%‡	1%‡
Employed	36%‡	63%‡	72%‡

Values are expressed as Means ± Standard Deviations or percentages. Household density, number of people sleeping in the same house for 5 days or more; Asset index, total number of appliances in the house out of a total of 9 appliances. Matching superscripts represent groups that are different from each other: $^{*o}P<0.001$, ‡$P<0.05$

2.3.2 Body Image Perception

Despite a similar proportion of girls and their mothers from different ethnic groups being equally happy with their weight, white girls and their mothers were significantly more inclined to consider themselves to be fat compared to the black girls and their mothers.

In addition, the mean BMI of black mothers who considered themselves to be fat was significantly higher than the white and mixed ancestry women who also considered themselves to be fat (Table 2.5). A positive correlation was found between the girls' actual percentage body fat, centralization of body fat and WHO BMI–percentiles when compared to the silhouettes they selected as representing the way they saw themselves ('Feel', r=0.43; r=0.41 and r=0.46, respectively, all $P<0.05$).

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Table 2.5 Participants who responded by saying 'yes' to questions about personal feelings on perceptual body image

	GIRLS (N=333)			MOTHERS (N=204)		
	Black (n=58)	**Mixed Ancestry (n=65)**	**White (n=67)**	**Black (n=43)**	**Mixed Ancestry (n=60)**	**White (n=53)**
Happy feelings about body weight (%)	65%	65%	65%	89%	87%	88%
Thoughts of being fat they were fat (%)	17% * º	13%*	21% º	38% †	65%	64%†
Calculated mean BMI (kgm^{-2}) and WHO BMI (%) of subjects who thought they were fat	65±30	67±29	70±23	35 ± 7* º	27±5*	25±4 º

Values are expressed in mean ± standard deviation or percentages. Matching superscripts represent groups that are different from each other: * º P<0.001, † P<0.02

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In addition, the mean BMI of black mothers who considered themselves to be fat was significantly higher than the white and mixed ancestry women who also considered themselves to be fat (Table 2.5). A positive correlation was found between the girls' actual percentage body fat, centralization of body fat and WHO BMI–percentiles when compared to the silhouettes they selected as representing the way they saw themselves ('Feel', r=0.43; r=0.41 and r=0.46, respectively, all P<0.05). There was also a positive correlation between their BMI-percentiles and their FID Index scores (r=0.46, P<0.05). For the mothers, a positive correlation between actual body fat percentage, centralization of body fat, BMI and the silhouettes they selected as representing the way they saw themselves ('Feel', r=0.13; r=0.53 and r=0.68, respectively, all p<0.05). A significant positive correlation between BMI and FID Index scores of mothers was also found. As far as ethnic differences in perceptual body image are concerned, the majority of girls and their mothers recognized the first silhouette as the "thin" girl or woman. Furthermore, participants of mixed ancestry and white participants largely recognized the fourth silhouette from the left as "normal" in weight, whereas the majority of black participants recognized the fifth silhouette from left as "normal" in weight. Thus, the selection of the "normal" weight silhouette was significantly different between the three ethnic groups of mothers and daughters. Moreover, most participants selected the seventh or the eighth silhouette from the left as the "fat" girl or woman. There were no significant differences in the silhouettes chosen as "fat" by the three ethnic groups of girls, whereas a significant difference was found between mothers of different ethnic origin (p<0.001). More white mothers recognized

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silhouettes marked 5, 6 and 7 as 'fat' compared to the black and mixed ancestry mothers who regarded silhouette 7 as 'fat'.

2.3.3 Body size dissatisfaction

Table 2.6 presents the girls' mean FID Index for perception of their own body size, as well as their perception of what their family and friends think about their body size. FID Index scores varied significantly by ethnicity in the girls. White girls had significantly higher FID Index scores, representing higher body size dissatisfaction, irrespective of whether or not they considered themselves to be "thin" or "fat".

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Table 2.6 Girls body size dissatisfaction (FID Index scores) compared to thoughts of being "thin" or "fat"

FID Index compared to	Response	Black		Mixed Ancestry		White	
		n	FID Index	n	FID Index	n	FID Index
Girl reported she thought she was thin	No	51	0.6 ± 2.0	51	0.7 ± 1.1	55	1.3 ± 1.2
	Yes	38	-0.6 ± 1.9 †	60	0.2 ± 1.4	54	0.3 ± 1.3†
Girl reported she thought she was fat	No	39	-0.2 ± 2.1	46	0.2 ± 1.1	42	0.3 ± 1.3
	Yes	50	0.3 ± 2.0 †	65	0.5 ± 1.4°	67	0.9 ± 1.4$^{\dagger\circ}$
Family has told her that she was thin	No	57	-0.2 ± 2.5	48	0.2 ± 1.3	27	0.4 ± 1.1
	Yes	31	-0.9 ± 2.4 †	62	-0.1 ± 1.3°	79	0.5 ± 1.4$^{\dagger\circ}$
Family has told her that she was fat	No	41	-0.7 ± 2.6	82	0.0 ± 1.3	87	0.4 ± 1.2
	Yes	47	-0.2 ± 2.4 †	28	0.3 ± 1.2°	19	1.3 ± 1.6$^{\dagger\circ}$
Friends have told her that she was thin	No	57	0.2 ± 1.8	53	0.5 ± 1.4	27	1.1 ± 1.5
	Yes	30	-0.3 ± 2.3 †	57	0.1 ± 1.6°	75	0.6 ± 1.3$^{\dagger\circ}$
Friends have told her that she was fat	No	48	0.2 ± 2.2	87	0.2 ± 1.6	91	0.3 ± 1.3
	Yes	39	0.1 ± 1.7 †	23	0.9 ± 1.3°	11	2.0 ± 1.3†

Values are expressed as Means ± Standard Deviations. Matching superscripts represent groups that are different from each other: † $P<0.05$

In addition, compared with black girls, white girls perceived that their family and friends were significantly more dissatisfied with their body size regardless of whether they were “thin” or “fat”. Table 2.7 presents the mothers’ mean FID Index for perception of their own body size, as well as their perception of what their partners, friends and children thought about their body size.

Table 2.7 Mothers body size status dissatisfaction (FID Index scores) compared to thoughts of being “thin” or “fat”

FID Index compared to	Response	Black		Mixed Ancestry		White	
		n	FID Index	n	FID Index	n	FID Index
Mothers reported she thought she was thin	**No**	38	1.8 ± 2.3	49	1.4 ± 1.1	45	1.4 ±1.1
	Yes	22	0.2 ± 1.7	26	0.7 ± 1.6	20	0.8 ± 0.9
Mothers reported she thought she was fat	**No**	19	1.2 ± 1.3	15	1.1 ± 1.5	11	0.6 ± 0.7
	Yes	41	1.7 ± 2.4	60	1.5 ± 1.2	54	1.4 ± 1.1
Partner has told her that she was thin	**No**	37	1.5 ± 2.1	49	1.4 ± 1.4	41	1.4 ± 1.3
	Yes	14	1.1 ± 2.7	21	0.5 ±1.0	20	0.7 ± 1.1
Partner has told her she was fat	**No**	18	0.9 ± 2.4	41	0.8 ± 1.4	35	0.8 ± 1.0
	Yes	33	1.6 ± 2.2	29	1.6 ± 1.1	26	1.7 ± 1.4
Friends have told her that she was thin	**No**	46	1.4 ± 2.3	28	1.8 ± 1.3	28	1.6 ± 1.2
	Yes	14	0.7 ± 2.2	45	0.6 ± 1.3	33	0.6 ± 0.9
Friends have told her that she was fat	**No**	18	0.8 ± 2.3	46	0.9 ± 1.6	45	0.9 ± 1.1
	Yes	42	1.5 ± 2.3	27	1.3 ± 1.1	16	1.4 ± 1.3
Children have told her that she was thin	**No**	49	2.0 ± 2.6	50	1.3 ± 1.5	38	1.3 ± 1.2
	Yes	11	0.5 ± 2.3	25	0.8 ± 1.4	26	0.7 ± 1.0
Children have told her that she was fat	**No**	20	1.0 ± 3.1	30	0.4 ± 1.6	37	0.8 ± 1.1
	Yes	40	2.1 ± 2.2	45	1.6 ± 1.1	27	1.4 ± 1.2

Values are expressed ias Means ± Standard Deviations.

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FID Index was not altered by ethnicity in the mothers. All the three groups of mothers had similar higher FID Index representing body size dissatisfaction, irrespective of whether or not they considered themselves to be 'thin' or 'fat'. In addition, the three groups of mothers had similar perceptions of what their partners, friends and children thought about their body size. The relationships between the actual BMI, BSQ scores as well as FID Index scores of mothers are represented in Table 2.8. As previously presented in Table 2.3 black women presented with higher BMI than the mixed ancestry and white mothers. However, no ethnic differences were found in their FID Index and BSQ scores. Positive relationships were found between their actual BMI when compared to their BSQ and FID Index scores.

Table 2.8 Mothers BMI, FID Index and BSQ scores (presented in mean ± SD), as well as their correlation (Pearson product-moment coefficient, r)

	Ethnicity				**Correlation**	
	Black (n=63)	**Mixed Ancestry (n=76)**	**White (n=65)**	**Relationship**	**r**	**p**
BMI	33.6 ± 7.8*	26.5 ± 4.7	25.4± 4.1*	**BMI vs FID Index**	0.54	<0.05
FID Index	1.2 ± 2.2	1.2 ± 1.3	1.2 ± 1.1	**BMI vs BSQ**	0.27	<0.05
BSQ	81 ± 35	82± 28	87 ± 24	**FID vs BSQ**	0.29	<0.05

BMI - body mass index (kgm^{-2}), FID Index - Feel – Ideal Difference Index score, BSQ- body shape questions score. Matching superscripts represent groups that differ from each other: * P<0.05

Only 6.9% of mothers in this analysis exhibited BSQ scores greater that 123 (suggesting higher body shape and size acceptance). Further, a weak but positive relationship was found between the FID Index and BSQ scores of the mothers.

2.9 Reliability / Inter-item analysis of "thin" and "fat" belief constructs

ruct	GIRLS				MOTHERS			
	Number of questions	**Mean inter-item correlation**	**Cronbach's α**	**Standardized α**	**Number of questions**	**Mean inter-item correlation**	**Cronbach's α**	**Standard α**
elief	5	0.39	0.8*	0.8	3	0.16	0.4	0.7
belief	5	0.29	0.7*	0.7	5	0.17	0.4	0.5

nbach's α greater than or equal to 0.7 shows reliability

Table 2.10 Percentages of participants who responded "yes" in the "Thin" and "Fat" belief constructs

	GIRLS (N=333)			MOTHERS (N=204)		
	Black	**Mixed Ancestry**	**White**	**Black**	**Mixed Ancestry**	**White**
Participants who thought a thin girl / woman was going to be unhappy (%)	80	95	95	44	44	44
Participants who thought a fat girl / woman was going to be unhappy (%)	84 *º	98*	100 º	42 *º	82*	90º

Values are expressed in percentages. Matching superscripts represent groups that are different from each other:
*º P<0.05

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To control for potential confounding effects of socio- economic status and BMI on FID Index, education status, asset index, household density as well as actual BMI (in mothers only) were adjusted for using the analysis of covariance and multiple linear regression. The results indicate that body size dissatisfaction was unaffected by socio-economic status, BMI, age or education level of the participants.

2.3.4 Weight-related belief constructs

Table 2.9 presents the results of the “fat” and “thin” belief constructs, which were found to be internally reliable for girls (All p values <0.001). However, the “thin belief” and the “fat belief” constructs were not as internally reliable for the mothers.

Furthermore, Table 2.10 presents ethnic differences in perceptions regarding body size status of the daughter's actual body size. There were no differences between the three ethnic groups with regards to the physical or morphological attributes associated with being happy. However, black girls and their mothers were significantly less likely to associate overweight with being unhappy.

2.4 Discussion

In this Chapter, we sought to develop and validate instruments to explore body image constructs, one for South African women and the other for their daughters. We demonstrated that written constructs and visual images (silhouettes) yield comparable results (show construct and concurrent validity)

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in terms of body image, and that the constructs reflecting attributes of fatness and thinness can be used in culturally diverse groups of South African women and their primary school aged daughters. These findings are similar to those previously described in groups of black, Hispanic, Indian and white American men, women and children in which evaluation of body image and body shape differences have been investigated (Bulik et al., 2001; Fitzgibbon et al., 2000; Stevens et al., 1999).

The silhouettes were found to provide a rapid and accessible means to understand the perceptual body image in South African women and their daughters. We also determined the extent to which these silhouettes corresponded to the participants' (mothers and their primary school-aged. We found that the silhouettes selected as *"Feel"* by both mothers and their daughters correlated with their body size (actual BMI or BMI-percentiles, body fat percentage as well as centralization of body fat). Moreover, the perceptual body image of these participants was not affected by culture, and participants recognized larger and smaller body size in themselves. These results are in agreement with the studies of Bulik and associates (Bulik et al., 2001) as well as Stunkard and associates (Stunkard et al., 1983) in whom figural stimuli were correctly chosen to reflect current BMI in a sample of white American men and women.

Despite the association between BMI levels and silhouettes, the results of this study also demonstrated certain ethnic and cultural differences in attitudinal body image. The presence of ethnic and cultural differences in identifying a

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"fat" body size status, indicate the sensitivity of our constructs in highlighting body image concerns in the participants. For example, the actual mean BMI of black mothers who thought they were fat was higher compared to white mothers. These findings are consistent with those of Fitzgibbon and associates, in which black American women were found to perceive themselves as overweight at a BMI higher than 25 kgm^{-2} (Fitzgibbon et al., 2000). Additionally, a larger number of black mothers and their daughters generally selected larger silhouettes as having 'normal weight' compared to their white counterparts, suggesting a preference for larger body size in the black women (Fitzgibbon et al., 2000). Moreover, black girls and their mothers were less likely to see themselves as overweight, despite the fact that black girls were smaller while their mothers were larger, than those from other ethnic groups. Thus, it would appear as if there are still greater tolerances for increased body size in the black South African community.

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The silhouettes also provide a useful and sensitive measure to identify body size dissatisfaction in women through the derived FID index scores (Bulik et al., 2001; Fitzgibbon et al., 2000; Sands et al., 2000), in that values approaching zero reflect less body size dissatisfaction, while values greater than zero reflect more body size dissatisfaction. In our study, the FID index scores were found to be above zero for the participants regardless of whether they saw themselves as "thin" or "fat". When the FID index scores were compared to the written constructs regarding attitudinal perception of thinness and fatness, the direction of body size dissatisfaction was similar for both FID Index and construct regarding thinness and fatness across the three ethnic groups of participants.

Moreover, those participants who scored above 123 on the BSQ scores (showing increased dissatisfaction about body image and size) were described as having high scores exhibiting body size dissatisfaction (Caradas et al., 2001). Furthermore, the positive relationship found between the BSQ scores and FID Index scores in our study clearly suggests that FID Index is valid as an instrument to determine body size dissatisfaction in South African women.

Interestingly, the body size dissatisfaction (as reflected by FID index and BSQ) in our study was unaffected by ethnicity in mothers, however there were ethnic differences in the FID index in girls. Black girls had lower FID index scores compared to their white counterparts. These findings were similar to a South African study previously undertaken in adolescent schoolgirls (Caradas et al., 2001) in which black girls were found to exhibit less body image concerns and body image dissatisfaction compared to their white counterparts. In our study, the lower body size dissatisfaction in black girls may be explained by the fact that black girls were smaller in terms of BMI percentiles and body fat percentage compared to the white girls, suggesting that body size dissatisfaction is affected by a person's body size status. However, ethnic differences in social and cultural acceptance of a larger body size cannot be discounted.

Other international studies have found that body image concerns might be perpetuated by additional sources of influence. These sources of influence may be regarded as social acceptability that allow black women in South Africa or women from more traditional settings women to feel attractive and satisfied with

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their appearance compared to 'Westernized' and white women, even when they have larger body size (Fitzgibbon et al., 2000; al Shammari et al., 1994; Sands et al., 2001). These additional sources of influence were also observed in our own study, where black girls perceived less body size dissatisfaction from their family and friends regarding their body size, regardless of whether they were "thin" or "fat", compared to the other groups.

Furthermore, white girls in our study were larger in terms of body fat percentage and BMI-percentiles than their black counterparts, and had greater body size dissatisfaction, whereas their mothers were thinner in terms of body fat percentage and BMI than their black counterparts, but still had greater body size dissatisfaction similar to their daughters. This may suggest that a larger body size early in life is associated with greater body size dissatisfaction, and may thereby promote the adoption of thinner body size by these young women later in life. Indeed, Schwartz and Puhl (2003) found that the onset of obesity at an early age increases the durability of poor body image followed by weight loss later in life (Schwartz and Puhl, 2003). Perhaps, the differences in body size dissatisfaction among different ethnic groups may explain, in part, differences in obesity prevalence between black and white South African women.

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Finally, our study has shown the reliability of written constructs regarding attributes given to thin and overweight girls. However, reliability was found only on written constructs regarding an overweight woman but not regarding a thin woman. Indeed, other studies have shown that, questions generating negative

thinking about body size status are inappropriate in certain age groups and cultures (al Shammari et al., 1994; Brewis et al., 1998; Mvo et al., 1999; Puoane et al., 2005; Stevens et al., 1999; Sands, 2000). While still using these "thin" and "fat" belief constructs, we also found that fewer black women and their daughters perceived an overweight woman or a girl to be unhappy compared to either their mixed ancestry or white counterparts (Puoane et al., 2005).

In summary we have derived a set of validated instruments measuring body image in mothers and their daughters in a cross-cultural setting. The instruments include visual images, which are sets of age adjusted silhouettes, equivalent in highlighting perceptual body image by showing a general recognition of a larger or a smaller body size by pre-adolescent daughters and their mothers of varying BMI levels. The FID Index scores, also derived from the silhouettes, are useful in highlighting the attitudinal body image by showing the direction of dissatisfaction with body size in urban women of different ethnic groups and ages. Moreover, the FID Index scores also highlight the perception of family and friends on women of different cultures and age groups about their body size status, regardless of whether they regard themselves as "thin" or "fat". Furthermore, written constructs in the form of "fat" and "thin" belief constructs are also satisfactory in highlighting attitudinal body image in South African girls.

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In conclusion, we have reached our primary objective of finding construct validity as well as concurrent validity of two instruments measuring perceptual and attitudinal body image, one for mothers and one for their daughters. These instruments are culturally sensitive in multi-ethnic groups of South African women. These instruments can be used in future intervention studies and in cross-cultural research settings, as they provide information about the relationships between body image and obesity. Furthermore, they can be used to identify attitudes which may impact on the adoption of healthy lifestyles, and health beliefs in South African women and girls.

These instruments appear in different forms. As visual images they seek ordinal response, reduce respondent burden, can be used without supervision (self administered) and also trigger interest in the respondent. As written constructs, they seek nominal response, may increase the respondents' concentration burden thus require supervision, but are also rapid.

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CHAPTER 3

THE INFLUENCE OF ETHNICITY AND BODY WEIGHT STATUS ON THE ACCURACY OF REPORTING FOOD ENERGY INTAKE IN SOUTH AFRICAN WOMEN

The abstract of the current chapter has been presented and is published in Medical Research Council (MRC) of South Africa Research Day. Book of Abstracts

REF: Zandile J. Mciza, Julia H. Goedecke, Estelle V. Lambert. Accuracy of reporting food energy intake: influence of ethnicity and body weight status in urban South African women. *Medical Research Council (MRC) of South Africa Research Day*. 18 October 2007

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Chapter 3: The influence of ethnicity and body weight status on the accuracy of reporting food energy intake in South African women.

3.1 Introduction

In Chapter 2 we demonstrated that South African women experience body size dissatisfaction with increasing body size, but the BMI at which this occurs varies according to ethnic group. Body size dissatisfaction is associated with body image, and there is substantiative evidence that body image may affect women's response to weight changes, attitudes towards weight control and dietary intake reporting (Kant, 2003; Henriques and Galhoun, 1999; Garner et al., 1982; Vander Wal and Thelen, 2000; Moya et al., 2006; Horner et al., 2002). Therefore, ethnic differences in body image in South African women may, in fact, be associated with differences in dietary intake reporting. Further, this may have important implications for population-based estimates of dietary intake, and at an individual level, targeted dietary advice for the purpose of intervention.

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Food intake misreporting has been previously identified in 43% of South Africans from a multi-ethnic sample of 178 men and women (MacIntyre et al., 2001), however, the extent of misreporting and the factors associated with over- and under-reporting have not previously been studied in South African populations. International researchers have highlighted other factors including age (Bandini et al., 2003; Johnson et al., 1996), socio-economic status and education level (Ferro-Luzzi, 1990; Lafay et al., 2000; Bedard et al., 2004; Tooze et al., 2004), gender (Bedard et al., 2004; Tooze et al., 2004; Voss et al.,

1998; Carter and Whiting, 1998), body composition (Huang et al., 2005; Rosell et al., 2003; Tomoyasu et al., 2000), ethnicity or culture (Kimm et al., 2006; Harrison et al., 2000; Tomoyasu et al., 2000) and social desirability (Bedard et al., 2004; Tooze et al., 2004; Horner et al., 2002) that may influence food intake misreporting.

Bias in energy intake reporting can be measured by the ratio between reported energy intake (EI) and estimated energy expenditure (presented as the BMR) using Schofield equations ($EI:BMR_{est}$, Schofield et al., 1985), or measured BMR ($EI:BMR_{meas}$) using indirect calorimetry (Schoeller, 1998) or doubly labeled water (DLW, IDECG, 1990). However, measuring energy expenditure using indirect calorimetry or DLW in a large group of individuals is costly.

Various consultative groups and researchers have proposed guidelines for determining EI:BMR ratio which may be used to represent under- or over-reporting. For example in 1985, the FAO/WHO/UNU proposed that an energy intake of 1.27 x BMR was adequate for adults to sustain reasonable health and activity. In contrast, Goldberg et al. (1991) and others have recommended a range of energy intakes from 1.35-1.67 x BMR, as plausible, for adults in affluent societies to maintain health and lower level of activity (Coward, 1990; Goldberg et al., 1991; IDECG, 1990).

Subsequently, Black (2000) reviewed the evidence supporting various proposed cut-off points, in terms of the method used for measuring dietary intake, whether or not resting energy expenditure was measured or estimated,

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and the means by which physical activity levels were determined. In this analysis, she determined the specificity and sensitivity of various cut-off points in identifying under- and over-reporting. As such, she proposed a strategy that employed the 95% confidence intervals around the EI:BMR ratio under various conditions to reflect under- and over-reporting. The selection of criteria for classifying misreporting of food energy intake, is therefore informed by one's ability to estimate or measure resting and physical activity energy expenditure and the method used for collecting dietary intake data.

Finally, studies suggest that if bias in reporting is not evenly distributed in the population and affects certain nutrients, then the interpretation of the relationship between diet and diseases in that population may be altered (Johansson et al., 1998, Beaton, 1994). As such identifying the group or groups likely to underreport their energy intake and reasons for misreporting may help in the understanding of the relationship between diet and obesity in the South African women. Therefore, the aims of this chapter were to identify the extent and determinants of factors associated with misreporting of food intake in a sample of South African women of mixed ethnic origin.

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3.2 Methods

3.2.1 Study population.

The sample size of participants used in this analysis was set according to the sample size calculated in Chapter 2. Further, details of the participants' recruitment and selection are presented in Chapter 2. Only the mothers were included in this analysis and any woman who, at the time of the study, was

involved in any weight change intervention strategy was excluded. As a result, the final sample of 198 women was included in this analysis.

3.2.2 Physical characteristics, socio-demographic and psychosocial variables:

Physical characteristics, demographic characteristics and the body image of the women is presented in detail in Chapter 2. In brief, body composition (BMI and % body fat), age, ethnic group, education level and socioeconomic status (determined by asset index score and the house-hold density) of the women were determined.

3.2.3 Dietary intake

In this study, we employed a quantified food frequency questionnaire (QFFQ, MacIntryre et al., 2001), which has been previously validated in a sample of South African adult men and women of mixed ethnic origin. Detailed information about the development and the validation of the QFFQ has been presented in Chapter 1 section *1.4.2* of this dissertation. In brief, the QFFQ is a 122-item questionnaire consisting of food items commonly consumed by the general adult South African population (15-65 years old). The QFFQ is presented such that participants are able to choose the food items that they regularly consume, along with the quantity and frequency of consumption of these items, within the preceding month.

The questionnaire was administered by registered dietitians. To aid participants in estimating their food portion sizes, a food portion photograph book (FPPB, Venter et al., 2000) was used. The food energy intake generated by the QFFQ

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was analyzed using the South African Medical Research Council (MRC) Foodfinder 3 software programme (WAMTechnology © and MRC RISD, 2001). The energy and macronutrient intake generated from the analysis was then calculated and averaged and expressed per day.

3.2.4 Energy reporting status (EI:BMR$_{est}$):

Basal metabolic rate (BMR) was estimated using Schofield standard equations, based on age, weight and gender (Schofield et al., 1985). Reported EI in relation to estimated BMR was calculated for each individual to determine reporting status of the women (EI:BMR$_{est}$ ratio). Based on evidence from South African studies that suggest that urban South African women engage in light occupational activity (Kruger et al., 2001; WHO et al., 2005), we estimated that these women had an average of physical activity level (PAL) of 1.55. As such, 95% CI for Goldberg cut-off points have a sensitivity of 0.52 and a specificity of 0.99 for under-reporting energy intake (Black, 2000, Goldberg et al., 1991). Therefore, in the current study any EI:BMR$_{est}$ value below a cut-off point of 1.05 represented underreporting (UR, Lafay et al., 2000, Black, 2000). In addition, any EI:BMR$_{est}$ value above 2.28 represented over-reporting (OR) (Black, 2000). All other participants were considered adequate reporters (AR).

3.2.5 Statistical analysis

All data were analyzed using Statistica version 7.0, (StatSoft Inc, Tulsa, OK, USA). Values are presented as means ± standard deviation. Chi squared analysis was used to assess the frequency of EI reporting status according to ethnicity and BMI groups and presented as a percentage. In addition,

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GraphPad Instat t_m Dos Programme (Copyright © 1990-1994, Lambert M, University of Cape Town), was used to calculate Chi squared test for trend of the adequate-reporters EI according to ethnic group and BMI categories. Two-way analysis of variance (ANOVA) was used to compare body composition, macronutrient intake, body image and socio-economic status between the ethnic and EI-reporting groups. Furthermore, advanced general linear model analysis was used to adjust for confounding factors of age and BMI on EI-reporting status between different ethnic groups.

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3.3 Results

3.3.1 Participants' characteristics

Detailed characteristics of the main 204 sample are presented in Chapter 2, Table 2.2. In brief, of the198 women who participated in this analysis 31% were black, 38% were of mixed ancestry and 31% were white. The average ages of the women were 42±5, 38±5 and 40±11 years for the white, mixed ancestry and black women, respectively, with the white women being significantly older than the mixed ancestry women (P=0.02). Black women were significantly shorter (1.57±0.1 vs. 1.59±0.1 and 1.64±0.1 m, P<0.05), heavier (84.0±22.0 vs. 66.6±12.3 and 68.5±10.8 kg, P<0.05), had higher BMI (33.6±7.8 vs 26.5±4.7 and 25.4±4.1 kg.m^{-2}, P<0.05) and percentage body fat (34.5±6.3 vs 32.2±4.8 and 31.8±4.9 %, P<0.05) than the mixed and white women, respectively. They also had significantly lower levels of education and also presented with significantly lower socioeconomic status, on the basis of asset index and household density than the other groups of women (all P values <0.001). In addition, when adjusting for age and BMI, white women

scored significantly higher on the BSQ, indicating higher body shape dissatisfaction, than the mixed ancestry and black women (86.7±24.1 vs. 81.7±28.1 and 80.8±35.0, $P<0.05$, respectively), whereas mixed ancestry women scored significantly higher on the body size dissatisfaction questions (FID index), indicating greater body size dissatisfaction, than black and white women (1.7±1.1 vs. 1.5±1.3 and 1.2±2.2, $P<0.05$, respectively).

3.3.2 Misreporting of food energy intake (EI)

Using the cut-off points of 1.05-2.28 for EI-reporting, we found that overall 26% of women under-reported, 64% adequately-reported and 10% over-reported their EI ($P<0.05$). When comparing the EI reporting status of the three ethnic groups of women, we found that black women under-reported EI to a greater extent than mixed ancestry and white women (45% vs. 31% and 24%, $P<0.01$, respectively).

EI-reporting status according to BMI category and ethnicity is presented in Figures 3A and 3B. Figure 3A shows that, of the 45% (n=23) of black women who under-reported EI, only 4% (n=1) were within the normal range of BMI, 13% (n=3) were overweight and 83% (n=19) were obese. Of the 31% (n=16) mixed ancestry women who under-reported EI, 13% (n=2) were within the normal range of BMI, 63% (n=10) were overweight and 24% (n=4) were obese. Of the 24% (n=12) of white women who under-reported EI, 50% (n=6) were within the normal range of BMI, 25% (n=3) were overweight and 25% (n=3) were obese.

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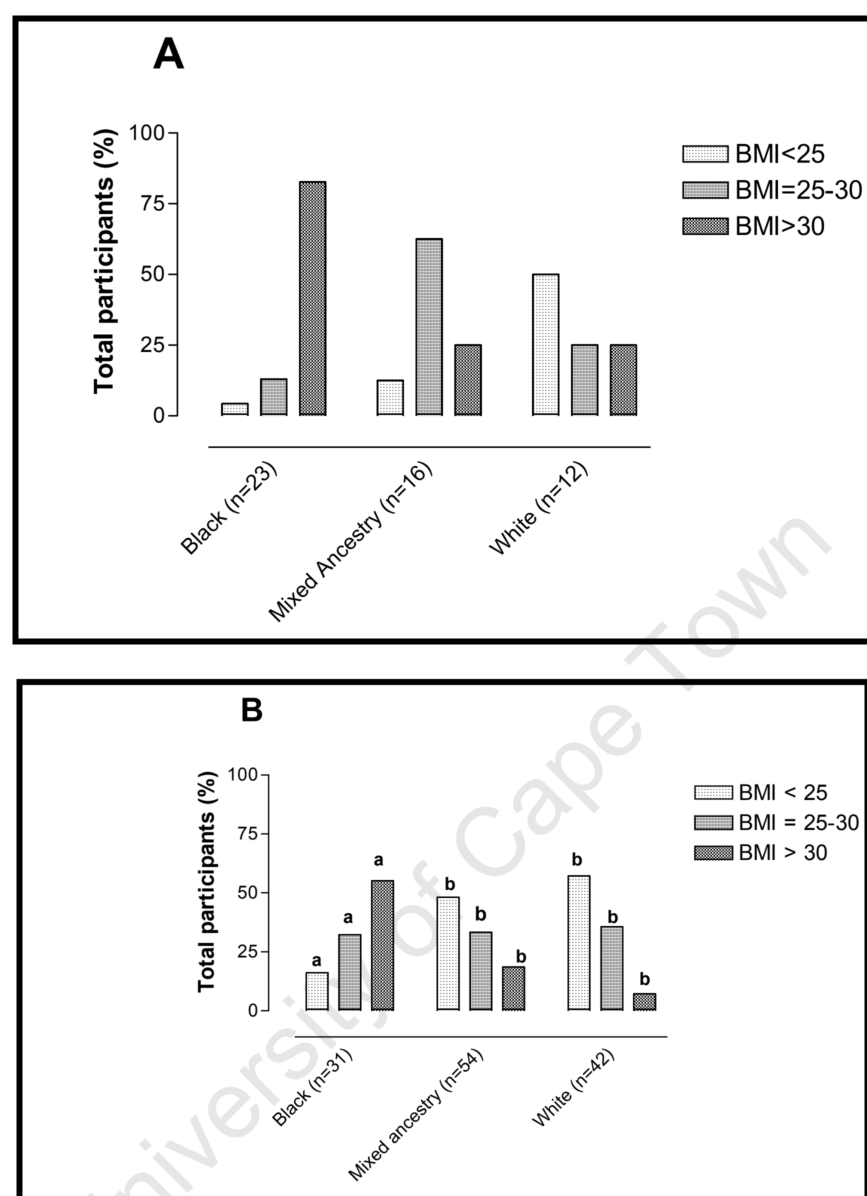

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Figure 3.1 Frequency of (A) Under-reporting and (B) Adequate-reporting of food EI according to body mass index (BMI) category and ethnicity in South African women. Matching superscripts represent groups that are different from each other, [a](χ^2=8.782, P<0.01); [b](χ^2=10.667, P <0.01 and χ^2=18.910, P<=0.001, for black, mixed ancestry and white, respectively).

A greater than expected proportion of mixed ancestry women reported adequate EI, compared to their white and black counterparts (71% (n=54) vs. 69% (n=42) and 51% (n=31), P<0.05, respectively) (Figure 3B). The frequency of adequate-reporters increased linearly with increasing BMI category in the black women (Chi square (χ^2) =8.782 and P<0.01), whereas the frequency of

adequate-reporters decreased linearly with increasing BMI category in the mixed ancestry (χ^2 =10.667 and P<0.01) and white women (χ^2 =18.910 and P<0.001). There were no significant differences in over-reporting between ethnic groups across BMI categories.

The characteristics of the women according to ethnicity and EI-reporting status are presented in Table 3.1. Those women who under-reported EI were significantly heavier (P<0.05), had a higher BMI (P<0.01) and % body fat (P<0.05) than those that adequately-reported EI. Although the black women were significantly heavier (P<0.001) and had higher BMI (P<0.001) than the mixed ancestry and white women, there was no interaction effect between ethnicity and EI-reporting (P=0.20). Despite the fact that black women presented with lower education levels and lower SES status (characterized by lower asset index and higher household density scores, all P values <0.001), these characteristics did not influence EI-reporting status. Similarly, EI-reporting status was not influenced by body image (characterized by FID Index and BSQ scores).

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Reported macronutrient intake according to ethnicity and EI-reporting status is presented in Table 3.2. Irrespective of EI-reporting status, black women had a higher reported carbohydrate intake and a lower dietary fat than the other groups of women (P<0.001), which was independent of age and BMI. However, no significant ethnic differences were observed in reported protein intake and added sugar intake.

haracteristics of South African women according to ethnicity and EI-reporting status

	Black 31%(n=61)			Mixed Ancestry 38%(n=76)			White 31%(n=61)		
	UR(n=23)	AR(n=31)	OR(n=7)	UR(n=16)	AR(n=54)	OR(n=6)	UR(n=12)	AR(42)	OR
haracteristics									
	40.6±11.6*	39.2±10.9	36.6±7.6	37.1±4.7*	38.0±4.5	40.8±3.4	42.7±5.8*	41.0±4.1	43.
	92.2±20.5$^{\dagger *}$	79.5±22.5*	78.7±21.2	70.0±10.1†	65.0±11.8	71.6±19.3	67.5±15.4†	68.5±9.5	68.
	36.6±7.1$^{\dagger \#}$	31.9±7.8$^{\#}$	31.3±8.5	28.1±4.3†	25.8±4.6	28.5±5.7	26.2±5.8†	25.2±3.8	24.
)	36.4±6.2*	34.1±5.6*	29.8±9.7	33.9±4.0	31.2±4.9	36.1±4.9	33.4±5.3	31.5±4.9	30.
ographic Characteristics									
tatus	3.2±1.2†	3.3±1.1	3.6±0.8	4.1±0.3†	4.4±0.6	4.2±0.8	4.4±0.7†	4.7±0.5	4.9
	5.5±2.4†	5.3±2.0	6.1±1.8	8.6±0.6†	8.4±0.9	8.5±0.8	8.8±0.4†	8.7±0.6	9.0
density	3.1±1.4†	3.2±1.8	3.7±2.4	1.5±0.6†	1.6±0.5	1.4±0.4	1.4±0.0†	1.3±0.4	1.1
e									
	79.6±39.2 ^{a}	78.5±34.9	85.0±17.3	91.8±27.7	80.5±28.4	64.8±18.9	92.3±31.3 ^{a}	83.8±22.5	83.9
	1.5±1.9	1.3±2.4	0.3±2.8	1.7±0.8 ^{a}	1.0±1.4	1.5±.5	1.5±1.5 ^{a}	1.1±1.0	0.6

es are Means ± Standard Deviations: UR= under-reporters EI: RMR_{est} < 1.05); AR= adequate-reporters (EI: RMR_{est} between 1
); OR= over-reporters (EI: RMR_{est} >2.28). Socio-demographic Characteristics: Asset Index , total number of appliance in
sehold out of 9 appliances; Household density, total number of people sleeping in the same household five or more days a
cation status, highest grade category passed (category: 1<grade 8; 2= grades 9-11; 3= grade 12; 4=College / University).
pe: BSQ, Body Shape Questions total score, measuring body shape dissatisfaction; FID, Feel Ideal Difference Index s
suring body size dissatisfaction. Matching superscripts represent groups that are significantly different to each other: * =P<0
0.001, $^{\#}$ =P<0.01. **After adjusting for BMI and age:** ^{a} P<0.05

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3.2 Reported macronutrient intake of South African women according to ethnicity and EI-reporting status

	Black 31%(n=61)			**Mixed Ancestry 38%(n=76)**			**White 31%(n=61)**	
	UR(n=23)	**AR(n=31)**	**OR(n=7)**	**UR(n=16)**	**AR(n=54)**	**OR(n=6)**	**UR(n=12)**	**AR(42)**
ohydrates (%)	64.4±9.2†	59.3±9.5	57.9±6.5	52.5±9.6†	55.2±7.5	53.9±9.0	55.9±10.4†	53.6±7.6
%)	22.9±8.6$^{\dagger\#}$	28.4±8.3$^{\#}$	29.3±7.7$^{\#}$	30.9±7.6†	31.7±6.9	34.7±9.6	29.7±8.5†	32.8±6.6
n (%)	12.9±3.1^{a}	12.2±3.2^{a}	12.8±3.0^{a}	16.2±4.5$^{\# a}$	12.9±2.4$^{\# a}$	11.3±2.6$^{\# a}$	13.6±3.4^{a}	13.1±3.0^{a}
d Sugar (%)	15.5±6.9‡	17.5±6.7‡	19.7±5.5‡	19.2±8.3‡	16.0±7.2	11.5±8.5‡	20.6±12.8‡	16.4±6.6

s are Means ± Standard Deviations: UR= under-reporters (EI: RMR_{est} < 1.05); AR= adequate-reporters (EI: RMR_{est} between 1.
OR= over-reporters (EI: RMR_{est} >2.28). Matching superscripts represent groups that are significantly different to each other: $^{\#}$
01, † =P<0.001, ‡ =P<0.05 **After adjusting for BMI and age:** ^{a} P<0.05

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Under-reporters had a lower reported dietary fat and a higher dietary protein intake compared to the adequate- and over-reporters (both P values <0.01). The differences in protein intake were not independent of age and BMI. There was a significant interaction effect for ethnicity and EI-reporting status for reported added sugar intake (P<0.05). The black women reported a consistently higher added sugar intake in both adequate- and over-reporters EI-reporting groups. Whereas the white and mixed ancestry women reported a significantly lower added sugar intake in the over-reporters compared to the under-reporters. However, these effects were not independent of age and BMI.

3.4 Discussion

Our main aims of this chapter were to identify characteristics in urban South African women which may be associated with misreporting of food EI, including ethnicity, socioeconomic status, body composition, body image, and macronutrient intake. The main findings of this study were that 26% of women under-reported their food EI, with a greater proportion of under-reporters being black and obese.

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In contrast, more overweight women of mixed ancestry and more normal weight white women under-reported EI. Under-reporters also reported lower dietary fat intakes and higher dietary protein intakes than the adequate- and over-reporters. However, $EI:BMR_{est}$ was not associated with socioeconomic status or the body image of women.

Our findings highlight a significant problem in terms of estimating dietary intake as 26% of women in our study reported implausible food EI, which is higher than that reported in a similar study done in another developing country (Harrison et al., 2000). For example, only 10% of the Egyptian women in Harrison's study under-reported their energy intake. However, the proportion of under-reporters in our study is closer to that found in one-third of American women (Harrison et al., 2000). As such, the role of dietary factors in the aetiology of obesity in South African studies should be interpreted with caution due to the influence of this bias (Johansson et al., 1998). However, knowledge of the factors that influence EI reporting will enhance the dietary assessment instruments and possibly the design of studies evaluating diet-disease relationships (Johansson et al., 1998; Johansson et al., 2000).

In the current study, ethnic background appeared to play a role in the bias of EI reporting, in that black women were more likely to under-report their food EI than mixed ancestry and white women. An explanation to these findings may be that the majority of black South African women in this analysis were obese compared to other ethnic groups of women. There is well established international evidence suggesting that obese women are more likely to under-report their EI than lighter women (Ferro-Luzzi, 1990; Harnack et al., 2004). As such, it may seem as if under-reporting is not culture-bound, but only relates to body composition. However, the ethnic differences in EI reporting in this study contrast to those of Kimm et al. (2006), who found that white adolescent American girls under–reported their EI to a greater extent than their black

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counterparts (Kimm et al., 2006). Differences in the findings of these studies may relate to age difference between the two study groups.

Nonetheless, both our results and Kimm's results highlight that BMI is one of the most consistent factors in predicting EI-under-reporting in women of different ethnic origin. Moreover, in our study, only 4% black women in the lowest BMI category under-reported EI compared to 13% mixed ancestry and 50% white women. Similarly, Kimm et al. (2006) found that black girls in the highest tertile of BMI under-reported EI to a greater extent than white girls, while within the lowest BMI tertile black girls under-reported EI somewhat less than white girls.

The differences in the BMI level at which black and white adult women in our analysis under-reported their EI might be explained, in part, by ethnic differences in body image discussed in Chapter 2. These results suggest that black adult women experience dissatisfaction about their body size status at a higher level of BMI (BMI>30kgm^2) than the white women who experience body size dissatisfaction even if they are not overweight (BMI<25kgm^2). However, in our analysis, body image parameters such as body size dissatisfaction (presented by the FID Index scores) and body shape acceptance (presented by the BSQ scores) were not specifically associated with EI reporting status.

Previous studies have suggested that social class is an important risk factor for under-reporting (Tooze et al., 2004; Lafay et al., 2001; Bedard et al., 2004). In our study, the majority of black women were of a lower socioeconomic status

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(based on educational level, household density and asset index scores) than the majority of mixed ancestry and white women. However, we did not find that the women's educational level and socioeconomic status influenced food EI reporting status in this study. Similarly, Harrison et al. (2000) observed no relationship between EI reporting status and formal education in Egyptian women.

Misreporting not only influenced total energy intake, but also biased the reporting of macronutrient intake in that under-reporters reported lower dietary fat and a higher dietary protein intake than adequate- and over-reporters. Similar results have been reported in other international studies (Briefel et al., 1997; Cook et al., 2000; Voss et al., 1998). In these studies, a social-desirability bias in women with higher BMI tended to drive under-reporting of foods considered unhealthy, in particular fat, due to guilt associated with consumption of this particular food (Lafay, 2000; Rosell et al., 2003). From our data, we are not able to ascertain if social desirability influenced macronutrient reporting. However, all participants who were actively dieting or through self-report, were attempting to lose weight were excluded from the analysis, reducing the likelihood of this confounding the results. However, future research should explore whether social desirability does influence macronutrient reporting in the South African context, and whether this is influenced by different cultural and social norms. .

In conclusion, we identified a group of women who misreport their energy intake, based on the cut-off range of 1.05-2.28 EI:BMR_{est}. Food EI under-

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reporting status in these women was influenced by body size status and differed according to ethnicity. Further, dietary EI reporting influenced macronutrient reporting. As such, studies designed to explore the relationship between dietary intake and obesity might be confounded by bias in EI and macronutrient reporting, compromising interventions aimed at preventing and managing obesity in South African women.

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CHAPTER 4

VALIDITY AND RELIABILITY OF A PHYSICAL ACTIVITY / INACTIVITY QUESTIONNAIRE IN SOUTH AFRICAN PRIMARY SCHOOLGIRLS

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Chapter 4. Validity and reliability of a physical activity / inactivity questionnaire in South African primary schoolgirls.

4.1 Introduction

In section 1.2.2.2 of this dissertation, we presented evidence that there is a relatively low proportion of South African adults and adolescent women who regularly participate in physical activity, and those who are active are not getting sufficient amount of physical activity (Amosun et al., 2007; Craig et al., 2003). This has become a public health concern, particularly in light of the high prevalence of obesity in women. In addition to chronic positive energy intake, obesity has also been regarded as a by-product of low levels of activity. Further, studies emphasize the importance of increasing physical activity in preventing and managing obesity (Donnelly et al., 2004; Fitzgibbon et al., 2006).

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In South African pre-adolescent children, the prevalence of overweight and obesity is 17.9% and 4.9% in girls, higher than that found in boys of the same age (6 to 13 years old) (Armstrong et al., 2006). Although there is a lack of national data on physical activity levels of South African pre-adolescent children, recent small local studies suggest lower levels of physical activity in these children (SA MRC, 2007; Kruger et al., 2003). Low habitual physical activity levels have been found to be associated with the increased reliance on motorized transport, television viewing and computer use (SA MRC, 2007;

Amosun et al., 2007, Reddy et al., 2003; McVeigh et al., 2004; Prista et al., 2005).

International evidence suggests that children with lower levels of lean body mass and higher BMI are spending more time watching television or using computers, instead of engaging in physical activity, sports or play (Andersen et al., 1998; Eisenmann et al., 2002; Hu et al., 2001; McVeigh et al., 2004; Salmon et al., 2005; Yackel, 2003). Moreover, a national study undertaken in South African adolescents suggests that only 54.3% of children have scheduled physical education classes at school and only 52% engage in vigorous physical activity during class (Reddy et al., 2003). Physical activity in childhood tracks into adulthood, thereby emphasizing the need to address the lack of physical activity in children and youth (Dennison et al., 1998; Kuh et al., 1992; Telama et al., 2005; Vanreusel et al., 1997).

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An accurate measurement of physical activity is fundamental to our understanding of the relationships between physical activity, obesity and health (Hu et al., 2001; Shephard, 2003). Further, in Chapter 3 of this dissertation, we emphasized that measuring physical activity levels of individuals may aid in the identification of diets of poor validity (Black, 2000). There are a numerous international studies that have used self report questionnaires (including both previous-day and seven-day physical activity recalls) in children in which construct and criterion validity, and reliability have been tested (Aaron et al., 1995; Argiropoulou et al., 2004; Janz, 1994; Sallis and Saelens 2000; Sarkin et al., 2000; Stevens et al., 2004; Treuth et al., 2003; Weston et al., 1997). Ideally, an instrument should capture all aspects of physical activity, including physical

activity during and after school, as well as sedentary behavior, and be able to differentiate between weekday and weekend physical activity (McCormack and Giles Corti, 2002). However, there is a lack of locally validated instruments for this purpose in South Africa, and as a result, there is a paucity of data concerning the prevalence of physical activity in South African children.

As the International and Global Physical Activity Questionnaires (IPAQ and GPAQ) have been validated in adult populations, including South African cohorts, this dissertation only focused on validating a physical acitivity instrument for South African children. Therefore, the main aim of this study was to validate a self-report method for estimating physical activity/inactivity levels in South African children. The method needed to be culturally sensitive, cost-effective, and convenient to administer in larger groups of children, as part of formative assessment for intervention studies to increase physical activity.

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For the purpose of this study, a physical activity questionnaire (EPAQ2), used to assess physical activity in European adolescents (Wareham et al., 2002) was modified and adapted to estimate physical activity/inactivity in a group of pre-adolescent South African children of different ethnic origin (Micklesfield et al., 2006). Although this instrument has been validated previously in European adolescents (Table 1.7) the main aim of the current analysis was to find construct validity and reliability of this modified and adapted physical activity questionnaire (PAQ) by comparing it with an ACTIVITYGRAM and the

television viewing habits in South African children. Body composition was also used as an indirect measure of validity of the PAQ.

4.2 Methods

4.2.1 Study population

Details of the participants' recruitment and selection procedure are presented in Chapter 2 of the current dissertation. Only the school girls were included in this analysis following the fact that a previously validated PAQ in South African adults was already available to quantify physical activity energy expenditure in adult women (WHO, 2005). A sample of 332 girls was included in this analysis, of which 32% were black, 34% were of mixed ancestry and 34% were white (one girl was excluded from the analysis due to incomplete data). In addition, a convenient sample of 14 girls with similar characteristics to the main sample was randomly selected, and the PAQ was re-administered one week later to find the test-retest analysis (reliability) of the questionnaire.

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4.2.2 Body composition measures

As an indirect measure of validity of the PAQ, body composition was measured using BMI, World Health Organization body mass index (WHO BMI)-percentiles, as well as percentage body fat (Andersen et al., 1998; Hu et al., 2004; Iqbal et al., 2006), as described in Chapter 2.

4.2.3 Instruments for the measurement of physical activity / inactivity

Physical activity/inactivity over a period of seven days was assessed using a physical activity questionnaire adapted from the EPAQ2 (Wareham et al., 2002), which had previously been successfully used in a younger group of South African children (7-9 years old) (Micklesfield et al., 2006). The PAQ included questions on physical education classes, formal and informal activities, activities performed at school, activities performed out of school in sports clubs or gyms, as well as just playing games at home. The girls were also required to report hours spent walking to and from school, or just simply sitting and using a computer or watching television. The PAQ was administered by trained interviewers, who conducted the interviews using the language of choice of each of the 332 girls. The PAQ was then re-administered a week later on a convenience sample of 14 girls.

The total minutes spent engaging in physical activity, as quantified using the PAQ, were converted to energy expenditure in the form of MET min.week^{-1}, by multiplying the minutes per week by different levels of intensities. These levels of intensity were defined as: resting (1 METs), light (3.0 METs), moderate (4.5 METs) and vigorous (7.5 METs) (Ainsworth et al., 1993; Lohman, 1992). Physical inactivity was quantified on the basis of television or computer time per week.

The girls also completed the ACTIVITYGRAM developed by the Cooper Institute, (Dallas, Texas, United States, Welk et al., 2004) in which they were

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required to rate the intensity of their activitiesin a day. An ACTIVITYGRAM recalls the previous days' physical activity and inactivity of children within 30-minute intervals. In so doing, it captures the time when the child does activity, highlighting the domain of activity as well as inactivity (whether low, moderate or vigorous) using a picture sort method (silhouettes). Further it also captures the child's time of inactivity. In our research the time intervals of activity of the children was captured using this method and then converted into EE by multiplying the time interval with the MET/minutes assigned to each domain of activity (whether moderate, vigorous etc). In this regard, total energy in the form of MET outcome were obtained and then compared with the total energy outcome generated using our South African version of PAQ.

Further, girls were asked to mark the television programmes watched from a pre-prepared list, as well as the frequency and duration of watching television in an average week. These results were based on a television programme list, which included the most commonly watched programmes by South African children. For example, the television list compiled most of the TV programs watched by South African children. Girls were asked to choose all the programs they watch in a week and the frequency of watching these programs. Because our TV list also containd time intervals of the programs each day we were able to quantify the time spent by the children watching these programs. The total time per week spent by children watching TV each child was converted to total time per day by dividing the total time with 7. The total time per day obtained by this method was then compared to the total time per day of inactivity (TV watching) generated by our South African version of PAQ.

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4.2.4 Statistical Analysis

All data were analyzed using Statistica version 7.0 (StatSoft Inc, Tulsa, OK, USA). Data were reported as means ± standard deviations and $P<0.05$ was considered Statistically significant. Where data were not normally distributed, medians, 25th and 75th quartiles were reported and non-parametric analyses were performed. Construct validity was determined using Spearman's rank-order correlations comparing results of the ACTIVITYGRAM with those of the self-report PAQ. The test-retest reliability of the energy expenditure and inactivity quantified using the PAQ were also evaluated using Spearman's rank correlation. Analyses of variance or Kruskal Wallis tests were performed to determine the differences in physical activity/inactivity between the three ethnic groups of girls. Where appropriate, Scheffe's post-hoc tests were used to evaluate between group differences. In addition, between group differences of moderate and vigorous physical activity as well as inactivity of the girls quantified by the PAQ were adjusted for differences in socioeconomic status on the basis of housing density and asset index, using analysis of covariance. Chi-square analysis was used to determine ethnic differences in socio-demographic characteristics of the girls, as well as the categorical variables relating to physical activity derived from the PAQ.

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4.3 Results

4.3.1 Participants' characteristics

Detailed characteristics of the participants have been reported previously in Chapter 2, Table 2.4. In brief, 332 girls participated in this study. The average age of the girls was 10.5±0.9, 10.1±0.7 and 10.0±0.8 years, P<0.001, for black, mixed ancestry and white girls, respectively. Mean WHO BMI-percentile was significantly higher in the white girls, compared to those of mixed ancestry and of black girls (61±28 vs. 59±30 and 57±31 percentile, P<0.05, respectively). However, there were no significant differences in the body weight, height and body fatness between the girls. Black girls presented with significantly lower socioeconomic status based on the housing density and asset index, than the other groups of girls (P<0.001). In addition, fewer black girls reported having television (77 vs. 99 and 98 %, P<0.001, respectively) or computers (16 vs. 77 and 87 %, P<0.001, respectively) in their households, as well as having physical education offered at their schools (63 vs. 88 and 93 %, P<0.001, respectively) compared to mixed ancestry and white girls. The characteristics of the sub-group sampled for test-retest reliability (n=14) were not significantly different than those of the larger group (n=332) (data shown in Appendix 4.1).

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4.3.2 Body composition as an indirect measure of PAQ validity

Body composition (WHO BMI-percentiles and percentage body fatness) of the girls was used as an indirect measure of the validity of PAQ-derived measures of energy expenditure and inactivity (Table 4.1). Weak, but significant inverse associations were found between the girls' percentage body fat and total

energy expenditure and inactivity by PAQ. Furthermore, there was an inverse association between girls' WHO BMI-percentiles and moderate energy expenditure derived from walking to and from school.

Table 4.1 Indirect validity of the physical activity questionnaire (PAQ)-derived measures of energy expenditure and inactivity against body composition of the girls

	Spearman's ρ	P
WHO BMI-percentiles vs. overall energy expenditure	-0.18	<0.05
Percentage body fat vs. overall energy expenditure	-0.17	<0.01
WHO BMI-percentiles vs. moderate energy expenditure (walking to and from school)	-0.17	<0.01
WHO BMI-percentiles vs. overall television time	0.23	<0.001
Percentage body fat vs. overall television time	0.35	<0.001

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4.3.3 Construct validity of PAQ against the ACTIVITYGRAM and television programme list

Construct validity of the PAQ-derived measures of energy expenditure and inactivity against energy expenditure derived from the ACTIVITYGRAM and from the television programme list are presented in Table 4.2. A significant positive association was found between the time spent watching television, recorded in the PAQ, and the number of television programmes selected from the television list. Weak, but significant positive associations were also found between moderate and vigorous energy expenditure by the PAQ and the same intensity activities recorded using the ACTIVITYGRAM. However, no significant associations were observed in overall PAQ-derived energy expenditure and total energy expenditure estimated using an ACTIVITYGRAM.

Table 4.2 Construct validity of the physical activity questionnaire (PAQ)-derived measures of energy expenditure and inactivity against the ACTIVITYGRAM and television programme list.

	Spearman's ρ	P
MEE by the PAQ vs. MEE by an ACTIVITYGRAM	0.19	<0.001
VEE by the PAQ vs. VEE by an ACTIVITYGRAM	0.26	<0.001
OEE by the PAQ vs. OEE by an ACTIVITYGRAM	0.02	0.78
TV time by the PAQ vs. number of PW by the TV PL	0.19	<0.001

MEE-moderate energy expenditure, PAQ-physical activity questionnaire, VEE-vigorous energy expenditure, OEE-overall energy expenditure, TV-television, PW-programmes watched, PL-programme list

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4.3.4 Test-retest reliability of the PAQ

We were only able to demonstrate significant test-retest reliability for total energy expenditure (MET min.week^{-1}) for the structured school sports (r=0.79, P<0.05). The remainder of the PAQ physical activity constructs did not show good test-retest reliability over a period of 7 days (Table 4.3). In fact, PAQ was less reliable for use in younger children (<10 years old) as yielded coefficient of 0.62, whereas the instrument had a better reliability in older children (≥10 years i.e. it yielded a coefficient of 0.79).

4.3.5 Ethnic differences in energy expenditure

Ethnic differences in energy expenditure estimated using the PAQ and ACTIVITYGRAM are presented in Table 4.4. Although none of the black girls participated in physical activity outside of school in sports clubs, they reported expending more overall energy per week than white and mixed ancestry girls (P<0.001). Most of this energy was expended while partaking in moderate

physical activity at school ($P<0.001$) and informal game activities at home ($P<0.001$).

Table 4.3 Test-retest reliability of the energy expenditure and inactivity measured by the physical activity questionnaire (PAQ)

	Spearman's ρ	P
School sports (min/week)	0.79	<0.05
Home games (min/week)	-0.50	0.67
Club/gym sport (min/week)	-0.37	0.30
Television time (min/week)	0.27	0.35
Moderate activity (MET min/day)	0.06	0.27
Vigorous activity (MET min/day)	-0.33	0.63
Overall activity (MET min/day)	-0.20	0.30

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There was an inverse association between socioeconomic status (presented by housing density and asset index) and energy expenditure ($r=-0.18$, $P<0.05$ and $r=-0.26$, $P<0.05$ respectively). Black girls expended more total energy than mixed ancestry and white girls, even after adjusting for the confounding factors of socioeconomic status based on both housing density and asset index (both P values <0.05) (Data not shown).

In addition, the majority of black girls reported expending more energy by walking to and from school than mixed ancestry and white girls (73 vs. 16 and 11 %, respectively, $P<0.001$). However, no significant ethnic differences were found in energy expenditure-generated using the ACTIVITYGRAM, even after

adjusting for socioeconomic status. Few of the black girls reported partaking in vigorous activities, thus the median is equal to zero. Consequently, the ethnic difference in vigorous activities tended towards significance (P=0.057).

Table 4.4 Girls' energy expenditure according to ethnicity measured by the physical activity questionnaire (PAQ) and the ACTIVITYGRAM

	Black	**Mixed ancestry**	**White**
Level of Activity	**32%(n=105)**	**34%(n=113)**	**34%(n=114)**
PAQ School (MET min/week)			
Moderate	360(0;1800)*	0(0;720)* †	720(0;1080)†
Vigorous	0(0;0)*	0(0;0)†	0(0;480)* †
Total	720(0;1800)* †	480(0;1080)*	810(420;1620)†
PAQ Overall (MET min/week)			
Moderate	720(0;2520)*	540(0;1080)*	720(360;1440)
Vigorous	0(0;960)*	120(0;960)	480(0;1440)*
Total	2528(1080;4950)**	1295(660;2400)** †	2106(1040;3100)†
ACTIVITYGRAM (MET min/week)			
Moderate	3360(840;4200)	1680(0;5040)	0(2520;5040)
Vigorous	0(0;3360)	0(0;0)	0(0;0)
Total	7560(4830;10500)	6300(3360;9660)	6720(3360;11130)

Values are expressed as medians (inter-quartile range). Moderate (≤ 6 MET min / week), Vigorous (≥ 6 MET min / week). Matching superscript symbols represent groups that are significantly different to each other: *, † = P<0.05 and ** = P<0.001

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4.3.6 Ethnic differences in inactivity

Table 4.5 presents the time spent by the girls using technology-based entertainment (watching television and using a computer) each day. Using the PAQ, we found that overall, mixed ancestry girls were more likely to use technology-based entertainment (television and computers) than white and black girls ($P<0.05$). However, when the computer time and the television time were separated, white girls spent significantly more time watching television than mixed ancestry and black girls ($P<0.05$). White girls spent most of this television time on weekends ($P<0.05$). Ethnic differences in television time remained the same even after adjusting for socioeconomic status based on asset index and housing density.

Table 4.5 Girls' physical inactivity according to ethnicity measured by the physical activity questionnaire (PAQ) and the television programme list

Levels of Inactivity	Black	Mixed Ancestry	White
PAQ television time (min/day)			
Weekday	80(0;120)*	100(15;180)	120(25;200)*
Weekend	160(0;260)*	180(35;300)†	240(30;350)*†
Total	240(0;380)*	210(30;420)$^{*\,**}$	270(30;450)**
PAQ technology-based entertainment (Sum of television and computer time, min/day)			
Total	240(180;480)*	480(300;600)$^{*\,**}$	300(180;540)**
Television programme list (television time, min/ day)			
Total	36(18;81)$^{*\,**}$	75(78;105)*‡	78(51;129)**‡

Values are expressed as medians (inter-quartile range). Matching superscript symbols represent groups that are different to each other: *, $\dagger$ = $P<0.05$ and **, $\ddagger$ = $P<0.001$

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Further, the girls who watched 3 or more hours of television each day had greater mean WHO BMI-percentiles than those who watched less than 3 hours of television per day (61.2±29.0 vs. 54.4±30.5, percentiles, P< 0.05, Figure 4.1) however, no ethnic differences were found. The relationship between WHO BMI-percentiles and television hours was unaltered by socioeconomic status (based on both the housing density and asset index scores).

The time spent watching television each day decreased with a decrease in socioeconomic status based on the housing density (r=-0.12, P<0.05), but no relationships were found on television time and the asset index of the girls. Significant ethnic differences in sedentary activities generated using the television programme list are also presented in Table 4.5 (P<0.05). These differences also remained unaltered even after adjusting for socioeconomic status (P<0.057).

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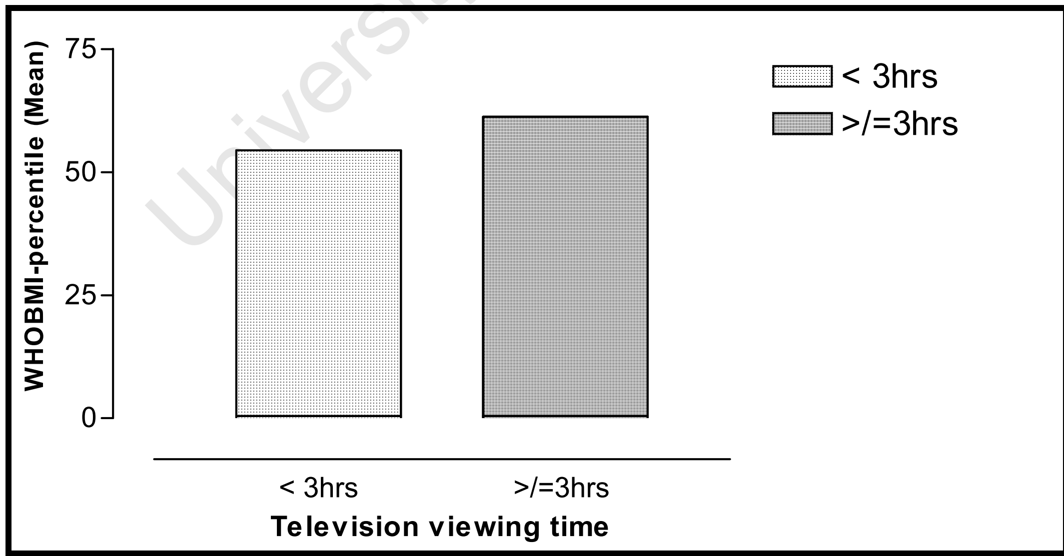

Figure 4.1 The WHO BMI-percentiles of the girls who reported watching less than 3 hours of television compared to those who reported watching 3 or more hours of television each day. Mean WHO BMI-percentile of girls who reported watching ≥3 hours of television was higher than those girls who watched <3 hours of television each day (P<0.05)

4.4 Discussion

Energy expenditure in the form of physical activity is associated with well-established health benefits (Goran et al., 1999; McGinnis, 1992; Pate et al., 1995), which increase with an increase in frequency, duration and intensity of exercise (Wallace et al., 1985). However, a more detailed understanding of the required exercise dosage and the extent of resulting health benefits is required, particularly in children where inactivity and the prevalence of obesity are increasing at an alarming rate (Armstrong et al., 2006). In order to achieve this, standardized instruments that record the low intensity activities, typical of sedentary societies, and ascribe consistent biological meaning to terms such as light, moderate, and heavy exercise, are required (Shephard, 2003; Vanreusel et al., 1997). However, there are few validated instruments that measure physical activity and inactivity that are pertinent to multi-cultural and developing countries such as South Africa, where there is a high prevalence of overweight and obesity in children (Armstrong et al., 2006).

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In the present study, an adapted version of a PAQ previously used in South African children (Micklesfield et al., 2006) and European adolescents (Wareham et al., 2002) demonstrated only modest indirect criterion validity, concurrent and construct validity in South African primary school girls. Based on evidence suggesting an association between body composition and physical activity/inactivity (Andersen et al., 1998; Hu et al., 2004; Iqbal et al., 2006), we used measures of body fatness and WHO BMI-percentiles as indirect measures of validity for PAQ-derived energy expenditure and inactivity. In this study, body fatness and WHO BMI-percentiles were lower in those girls with

higher overall energy expenditure (generated by partaking in sports or play, and walking to and from school), and those girls who spent less time watching television. These results are in agreement with other local and international studies (McVeigh et al., 2004; Rennie et al., 2005; Stevens et al., 2004).

Indeed, we found that watching television for 3 hours per day was associated with increased WHO BMI-percentiles levels, in agreement with other studies undertaken on local samples of South African children (Bourne et al., 2002; Lambert et al., 2001; McVeigh et al., 2004). Further, in the current study, the majority of black girls reported expending more energy by walking to and from school than those of mixed ancestry and white girls. The reliance on motorized vehicles for transport has been associated with a decline in physical activity, linked to weight gain (Andersen et al., 1998; Eisenmann et al., 2002; Hu et al., 2001; Salmon et al., 2005; Yackel, 2003).

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The PAQ also showed comparable construct validity for levels of inactivity with those generated by the television programme list. However, the total time spent by the girls watching television each day generated by the PAQ, was more than three times that estimated using the television programme list. The use of the television programme list might have underestimated inactivity as it may have overlooked other programmes watched in conjunction with adults. Moreover, due to programmes constantly changing, some of the programmes in the list were no longer featured on television.

Conversely, systemic error (or bias) may have resulted in an over-estimation of minutes spent watching television per day when television watching was recalled over the past week using the PAQ. Indeed, Ridley (2005) demonstrated that asking “How many minutes of television did you watch the previous week?” (Ridley, 2005), resulted in an over-estimation of the total time of inactivity compared to when television watching was capped within a 24-hour time frame. Ridley suggested that such an error can be reduced by rephrasing the question and making them simpler. Indeed, the television programme list was simpler and possibly made recalling easier.

Nonetheless, both the PAQ and the television programme list managed to identify significant ethnic differences in inactivity, such that black girls spent less time watching television than girls of mixed ancestry and white girls. These ethnic differences remained significant, even after adjusting for housing density, which was also a significant correlate of television watching time. In contrast, McVeigh and associates found that white children were more active and watched less television than black children (McVeigh et al., 2004). However, in their study, they found no differences in socioeconomic status between ethnic groups, whereas the black participants in the current study presented with lower socioeconomic status compared to mixed ancestry and white girls, which may explain the differences.

Further, the PAQ showed comparable construct validity for moderate and vigorous activities compared to the ACTIVITYGRAM. However, the total

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ACTIVITYGRAM energy expenditure was almost double that of the PAQ. A possible explanation for these differences can be the underestimation of energy expenditure by PAQ brought about by memory decay when asking the children to recall their activities over the past 12 months, which may lead to systemic error or bias in reporting. Indeed, Ridley et al. (2005, 2006) demonstrated that children might have difficulty in recalling activities that they participated in within the time-frame of 12 months (Ridley, 2005; Ridley et al., 2006). Thus rephrasing and simplifying the questionnaire to ask the children about the minutes they spent in activity on the previous day, on a number of occasions, is generally recommended. In contrast, the ACTIVITYGRAM asked the girls to recall their activities the previous day from the time they woke up in the morning, until the time they went to bed (from 7am to 10:30 pm) (Warburton et al., 2006).

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Despite differences in absolute energy expenditure, we found a weak, but significant positive relationship between the two measures, which is in agreement with other similar international studies (Sallis and Saelens, 2000; Sallis et al., 2000; Vuillemin et al., 2005; Weiss et al., 1990; Welk et al., 2004). These studies argue that when using complex and lengthy questionnaires children become bored, which may negatively impact the instrument's validity, yielding weak Spearman's ρ. This validation study was undertaken in conjunction with other studies in the current theses, during which the girls were also asked questions on their diet and physical activity knowledge, attitudes, beliefs and health behaviors. This may have contributed to the respondent

burden, thereby increasing fatigue and boredom during the interviews, which may have impacted on the quality of the relationships we obtained.

In this study we further observed significant ethnic differences in PAQ energy expenditure and a trend for ethnic differences in energy expenditure using the ACTIVITYGRAM. Black girls had the highest energy expenditure, followed by white girls and lastly the girls of mixed ancestry. Higher levels of activity in the black girls could possibly be attributed to their lower socioeconomic status, measured by the asset index and household density. Indeed, Monyeki and associates found that where space is limited and there is over-crowding, children will spend more of their time playing unstructured and informal activities away from home (Monyeki et al., 2000). Participation in play sport has previously been associated with increased energy expenditure (Salmon et al., 2005; Yackel, 2003).

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Finally, this study showed reasonable test-retest reliability of the PAQ only for structured school sports. This can be explained by the fact that girls of this age (9-12 years) can recall and report participation in structured school sports well, compared to other unstructured game sports played at home and at school or in sports clubs. These unstructured activities may vary from time to time due to the school term (such as writing exams, weather or seasonal changes) (Argiropoulou et al., 2004; Matthews et al., 2001; Plasqui and Westerterp, 2004; Wallace et al., 1985). Furthermore, memory decay has been reported in other international studies in children, where it was found that children under

the age of 10 could with reasonable accuracy recall the activity from the previous day, but had great difficulty with days further back in time (Argiropoulou et al., 2004; Baranowski, 1988; Wallace et al., 1985). The majority (69%) of our participants were 10 years and younger, a factor that would therefore influence the reliability of the activity recall after 7 days.

We can conclude that, despite the relatively weak associations between the PAQ-derived energy expenditure and inactivity, against those derived from the ACTIVITYGRAM-derived energy expenditure and television-derived time spent in sedentary behaviour, the PAQ may be useful in characterizing the physical activity levels and patterns of South African children of varying socioeconomic background. The PAQ shows a potential in highlighting health benefits associated with adoption of physical activity, such as reduced body fatness and BMI levels. Further, its usefulness in quantifying energy expenditure has been highlighted, such that it is able to distinguish between the intensity levels of the activity, by identifying moderate and vigorous energy expenditure in South African school girls.

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It also enables us to quantify and distinguish energy expenditure generated by activities performed at school, out of school, formal and informal, with the more formal activities showing good reliability. Further, it quantifies time spent in sedentary behaviors such as watching television, using computers, relying on motorized vehicles for transport, and identifies whether physical education is included in the school curriculum and if children are participating. Indeed, the

strength of association is comparable to those observed in similar studies where validation of self-administered questionnaires was tested in children (Janz, 1994; Ridley, 2005; Sallis and Saelens, 2000; Welk et al., 2004).

Studies suggest that validity may be improved by making questionnaires simpler and only asking about children's activity over a 24 hour period. Alternatively, researchers may make use of objective physical activity measures instead of questionnaires. Further, evidence suggests that choosing a suitable measure of physical activity/inactivity for children is often a trade-off between accuracy, depth of information gathered, cost, and subject and researcher burden. Alternatively, measuring physical activity objectively may provide sufficiently accurate information regarding inactivity/activity and specific growth and health outcomes in children (Montoye et al., 1996; Sallis et al., 1993, Ainsworth et al., 2000; Kruger et al., 2003; Cook et al., 2006).

Information provided by such questionnaires is relevant for South Africa where inactivity and the prevalence of obesity in children are becoming an important public health issue. However, additional studies are required using objective measures of physical activity, such a pedometry or accelerometry, to better understand the utility of the PAQ for children.

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CHAPTER 5

ASSESSING CULTURAL IDENTITY, HEALTH KNOWLEDGE, SELF-EFFICACY, SOCIAL BARRIERS AND SUPPORT IN SOUTH AFRICAN PRE-ADOLESCENT GIRLS: A VALIDATION STUDY

The abstract of the current chapter has previously been presented at the 10th International Congress of Obesity, in Geelong Australia:

REF: Mciza Z, Goedecke JH, Steyn NP, van der Merwe, L, Lambert EV. Assessing Knowledge and Self-Efficacy for Healthy Eating and Exercise, Self-Perception and Cultural Identity in South African Girls: A Validation Study. *10 International Congress of Obesity*: and 2nd edition of the Community-Based Obesity. Geelong and Sydney Australia 31October –08 November 2006)

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Chapter 5: Assessing cultural identity, health knowledge, self-efficacy, social barriers and support in South African pre-adolescent girls: A validation study

5.1 Introduction

As presented in Chapter 1 section 1.2.1 of this dissertation, chronic positive energy intake and low levels of activity have been identified as vectors / drivers of positive energy balance, associated with obesity. In this regard, the importance of including both physical activity and dietary modification in intervention strategies designed to prevent and / or treat obesity and its co-morbidities has been highlighted (Hance et al., 2007). However, the promotion of these behaviours is challenging, and as such, results of intervention studies designed to treat obesity are discouraging (Hemmingsson et al., 2001; Baranowski et al., 2003; Stevens et al., 1994).

There is evidence to suggest unhealthy behaviours to be more detrimental in middle- and older age groups of individuals (NHLBI, 1998; Kumanyika et al., 2001). However, implementation of health behaviour modification interventions at these age groups have been shown to produce short-term benefits (NHLBI, 1998; Hemmingsson et al., 2001). In the longer term, interventions implemented early in life may improve individuals' adaptation to health behavious (Nelson et al., 2005; Van Horn et al., 2005) and have a potential to prevent and reduce the health complications (i.e. obesity and its co-morbidities) later in life (Stevens et al., 1994). Moreover, adopting these health behaviours early in life have a tendency to track into adulthood (Nelson et al., 2005; Telama et al., 2005; Dennison et al., 1998; Kuh et al., 1992).

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Various studies have attempted to characterize the psychosocial factors which may influence the adoption of healthy lifestyle behaviours in children (Barr-Anderson et al., 2008; Saksvig et al., 2005; Felton and Parson, 1994; Harter, 1985; Stevens et al., 1999). One such study is the Pathways Study (Stevens et al., 1999), which investigated the validity of the cultural identity, self-efficacy, self-perception, social support and barrier constructs eliciting information on factors influencing American Indian children to eat healthily and engage in physical activity. The results of this study suggested that the physical activity social support, dietary intake self-efficacy and intentions constructs yielded good internal reliability (Cronbach's α values of 0.78, 0.76, 0.76, respectively), whereas the cultural identity, physical activity barriers and body status self-perception constructs still needed more revision (Details of results presented in Table 1.8).

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Despite the relatively low internal reliability obtained in some of the constructs, Stevens et al. (2003) included these constructs to the questionnaire examining the impact of the Pathways intervention conducted by Caballero et al. (1998) assessing the psychosocial variables related to physical activity and diet of American Indian children. Their results suggested positive impact of the intervention to the girl's self-efficacy to be physically active. Further, participating in physical activity behaviour increased in both boys and girls, with the intentions to eat healthily being shown to have also increased in both genders (Stevens et al., 2003).

Small studies in South Africa have shown that cultural, social and economic factors appear to contribute, in part, to overeating and sedentary behaviours

associated with obesity (Steyn et al., 2001; Mvo et al., 1999; Bourne et al., 1996; Puoane et al., 2005; Puoane et al., 2006; Kruger et al., 2003). However, there is limited information on these factors in South Africa and little is known about how they are altered by ethnicity and age. A lack of locally validated instruments to measure these behaviour modifying factors is partly responsible for this incomplete understanding.

Hence, the focus of this chapter was to use the knowledge gained from the Pathways and similar studies to develop an instrument designed to capture psycho-social factors influencing South African pre-adolescent school children from different ethnic origins to adopt specific health behaviours. As such, this chapter will focus on adapting the Pathways instrument for constructs measuring (i) cultural identity; (ii) knowledge to eat healthily and partake in physical activity; (iii) self-efficacy; (iv) body size status self-perception; and (v) environmental factors such as barriers and support for healthy eating and participation in physical activity in children. Further, the questionnaire's validity and reliability for use in South African primary school-aged children of different ethnic origins were tested.

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5.2 Methods

5.2.1 Study population

Details of the participants' recruitment and selection are presented in Chapter 2 of this dissertation. Only girls were included in this analysis. In brief, 332 girls participated in the study of which 32% were black, 34% were mixed ancestry and 34% were white (1 girl was excluded in the analysis due to incomplete information in her questionnaire).

5.2.2 Questionnaire development and validation

The 50-item questionnaire was designed such that it formed 5 different constructs with questions eliciting information on (i) cultural identity, (ii) health (eating healthily and engaging in physical activity) knowledge, (iii) self-efficacy to eat healthily and engage in physical activity, (iv) body size status self-perception, (v) environments including social support and barriers to the adoption of health behaviours. Questions were adapted and modified from the American Indian Pathways study for girls (presented in Chapter 1 section 1.4.6 of the current dissertation, Stevens et al., 1999).

A pilot study was undertaken including 30 multi-ethnic girls, having the same characteristics as the main sample (data not presented). Extensive revision of the questions was undertaken such that negatively worded questions were rephrased and made positive or simply removed from each construct due to their inapplicability to the South African context. This was done in consultation with South African Medical Research Council and other academic experts in obesity and nutrition following the completion of the pilot study. The constructs were designed such that they were administrable in the classroom setting over a ± 20 minutes time interval, during the physical education classes or free periods. Table 5.1 presents items that were included in each construct. The 7-item construct was designed and scored based on the strength of the girls' cultural identity. Each girl had to answer 7 questions presented in Table 5.1. The responses were scored such that a "yes" answer was given a point and a "no" answer given a zero.

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Table 5.1 Questions included in each of the 5 constructs forming the questionnaire

Construct	Example of questions included in a construct	Items
Cultural identity		
	• Who looks after you most of the time?	7
	• Do you stay with your grandparents	
	• To which ethnic group do most of your neighbours belong?	
	• Do you go to school in the same neighbourhood in which you live	
	• Which language is spoken at home	
	• Dou you understand your home language	
	• Do the adults at home teach you about your culture	
Physical Activity		
Knowledge of good physical activity	• Which is the best way to make sure you exercise at least minutes each day?	5
	• How does your body feel when you are doing exercise that is good for you?	
Self-efficacy	• I can play hard during most of my physical education classes	4
	• I can run and play harder for a longer time	
	• I can take stairs instead of a lift or accelerators to upper floors	
Social support	• Do your teachers encourage you to play hard during physical education classes?	3
	• Do you and your friends play hard games that make you sweat?	
	• Do adults at your home talk about ways of staying physically fit and active?	
Barriers	• The weather is too bad to play sports and active games	3
	• The route to school is to dangerous to walk	
Self-perception	• Some kids feel better about their bodies	6
	• Some kids feel they have more muscles than other kids	
	• Some kids feel they have strong bodies compared to others of their age	
	• Some kids have a lot of energy for hard physical activity	
Eating healthy		
Knowledge of high fat foods	• Which of the following food items contains no fat?	11
	• Which part of the food label identifies the fat content of food?	
	• Which snack item has more fat?	
Self-efficacy	• I can ask for an ice lolly instead of ice cream	5
	• I can eat fruit everyday	
	• I can put less butter or margarine on my bread	
Social support	• Do the adults at home eat fruits and vegetables?	3
	• Do you and you friends encourage each other to buy fruit instead of crisps	

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Barriers	• Do you have classes where you talk about eating healthy at school • Fruits are too expensive for me to eat everyday • Low fat or skim milk does not taste as good as full cream milk • Our vendor / tuckshop does not sell fruit but crisps	3

5.2.2.1 Construct 1: Cultural identity

For example, to score the questions a point was given if: i) the girl's care giver was a grandparent, ii) the girl stayed with her grandparents, iii) the majority of the girl's neighbours were of the same ethnicity as the girl, iv) the school she attended was in the area where she lived, v) the language spoken at the girl's home was similar to the language she understood well, and vi) the girl was being taught about the culture of the people speaking the same language as the one she spoke at home. A score closer to 1 represented the least cultural identity and the score closer to 7 represented the strongest cultural identity.

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5.2.2.3 Construct 2: Health (physical activity and healthy eating) knowledge

The health knowledge construct was a 16-item scale designed to elicit information on knowledge regarding physical activity and eating healthily (also presented in table 5.1). Eleven questions regarding food considered as healthy elicited information on the fat and energy content of food, fruit and vegetables, healthy snack choices, a healthy lunchbox, as well as reading labels. In addition, 5 questions on physical activity elicited information on the knowledge of the recommended daily duration of physical activity for children, as well as types of physical activities that are known to benefit health. Girls were asked to choose the answers that they knew as correct from a list of 3 answers. Each correct answer was given a point (or a score) and each wrong answer was

given a zero. The total responses were scored such that the total score closer to 0 represented the least health knowledge and the total score closer to 16 represented the greatest health knowledge.

5.2.2.4 Construct 3: Self-efficacy

Self-efficacy to eat healthily and participate in physical activity was assessed using a 9-item construct (also presented in table 5.1). Five items included questions eliciting information on individual psychological factors influencing them to eat healthily. Further, 4 items included questions concerning self-efficacy to participate in physical activity. Girls were asked to choose 1 answer that suited them best from a list of 3 answers. These included questions such as: (i) I am not sure I can (ii) I think I can; and (iii) I know I can (also presented in table 5.1). Each response was given a score according to the question number selected (1-3). A total score closer or equal to 1 denoted the lowest self-efficacy and a total score closer or equal to 27 represented the highest self-efficacy.

5.2.2.5 Construct 4: Self-perception

The scale included 6 items/questions on body size and self-confidence, from which a girl was asked to choose the response from a list of 4 answers. These ranged from: (i) not at all like me; (ii) not much like me; (iii) a little like me; and (iv) just like me. Each response was given a score from 1-4. A total score closer or equal to 1 represented the lowest body self-perception (also represented a greater body size dissatisfaction) and the total score closer or

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equal to 24 represented the highest body self-perception (also represented a lower body size dissatisfaction).

Furthermore, each girl was asked to answer a question that represented her body size status "*Feel*" by categorizing her body size status as underweight (BMI<50th centile), normal weight (BMI=50th-85th centile) or above the recommended weight (BMI>85th centile).

5.2.2.6 Construct 5: Environmental (social support and barriers) factors

The 12-item environmental factors construct included questions relating to the social support and barriers influencing the girls to eat healthily and to participate in physical activity (also presented in Table 5.1). Six items in the construct elicited information on the social support given by educators, peers and family in assisting the girls to eat healthily and to participate in physical activity. The remaining 6-items elicited information on environmental barriers to healthy eating and partaking in physical activity, such as the weather, crime (dangerous route to school), distance (school far from home), money constraints, and availability of healthy food at the school tuck-shop and/or venders.

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Both the social support and the environmental barrier scores were summed together to give a 12-item total environmental factor scale. A total score closer to 1 represented the least environmental support and the greatest number of environmental barriers, while a total score closer or equal to 48 represented the most environmental support and least environmental barriers.

The internal reliability/item analysis for each construct was explored. Furthermore, indirect validity of the construct was ascertained by comparing each construct score to the body composition, energy intake and physical activity energy expenditure of the girls.

5.2.3 Body composition measures

As an indirect measure of validity of the questionnaire, body composition was measured using the World Health Organization (WHO) BMI-percentiles, as well as percentage body fat, as described in Chapter 2.

5.2.4 Physical activity / inactivity

The PAQ (described in depth in Chapter 4) provided an indirect measure of the validity of the questionnaire. In brief, the total minutes spent doing physical activity, assessed using the PAQ, were converted to energy expenditure in the form of MET min.week^{-1}, by multiplying the minutes per week by different levels of intensities. The total energy expenditure generated by the PAQ each week was then averaged to yield a daily physical activity measure for each girl.

5.2.5 Dietary intake

Daily energy intakes, as well as the total number of fruit and vegetable servings were assessed using the previously validated QFFQ for children (Steyn et al, 2003). The questionnaire was administered by registered dieticians and a food portion photograph book (FPPB, Venter et al., 2000) was used to assist recalling of portion sizes of participants. The energy and total fruit and

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vegetable outcomes generated using the QFFQ were used as indirect measures of validity of the social support to eat healthily construct.

5.2.6 *Statistical analysis:*

All data were analyzed using Statistica version 7.0 (StatSoft, Tulsa, OK, USA). Internal reliability/item analyses were used to assess reliability of each construct. To improve the validity of each scale, frequency distribution of the answers, as well as the variance between answers given for each question was tested. Questions that showed no variance were then removed from each construct, and internal reliability/item analysis was retested to assess better reliability for each construct. Using only the validated constructs, indirect validity of the questionnaire was determined using Spearman's rank-order correlations comparing the total scores assigned to each validated construct with the body composition (presented by the WHO BMI-percentile and percentage body fat), as well as comparing validated constructs with the total energy intake and physical activity energy expenditure for each girl. Data are presented as means ± standard deviations, and $P<0.05$ was considered statistically significant.

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5.3 Results

5.3.1 Participants' characteristics

Detailed characteristics of the participants are presented in Chapters 2 and 4 of this dissertation.

5.3.2 Internal reliability of the constructs

Table 5.2 presents the internal reliability of all the constructs within the questionnaire. The 9-item self-efficacy construct, the 6-item self-perception construct and the 12-item environmental factor construct were found to be reliable in this group of girls, yielding standardised Cronbach's α values of 0.74, 0.71 and 0.94, respectively). However, the 7-item cultural identity and the 16-item dietary knowledge construct showed lower internal reliability in this group of girls (adjusted Cronbach's α = 0.40 and 0.55, respectively).

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Table 5.2 Reliability / inter-item analysis of the constructs within the questionnaire

Construct	Total items	Final items	Inter-item Correlation (r)	Cronbach's α	Standardized α
Cultural identity	**7**	6	0.10	0.40	0.41
Health knowledge	**16**	12	0.12	0.55	0.58
Self-efficacy	**9**	9	0.25	0.74*	0.74
Self-perception	**6**	6	0.16	0.70*	0.71
Environmental factors	**12**	12	0.20	0.90*	0.94

* Cronbach's α ≥ 0.7, shows reliability

To improve the inter-item reliability of the 7-item cultural identity construct, one question which correlated poorly with the rest of the items in the construct was removed. The question related to whether or not the girl was taught about her home language culture. When this item was removed, however, internal reliability of the now 6-item cultural identity construct did not improve. The construct was also not found to be more or less valid in girls from the different ethnic groups.

To improve the inter-item reliability of the 16-item health knowledge construct, four questions which correlated poorly with the rest of the items in the construct were removed. These questions interrogated 1) the extent to which children could read a food label identifying the quantity of fat in the item; 2) whether crisps or fruit were healthier snacks; 3) whether or not an English breakfast or a continental breakfast was a healthier breakfast, and 4) whether a normal burger or a double burger consisted of more energy. The Cronbach's α value of the 12-item health knowledge construct only improved slightly from 0.52 to 0.55, with an inter-item correlation of 0.12, however, still showing low reliability in this group of girls.

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5.3.2.1 Ethnic differences in constructs scores

Ethnic differences in construct scores are presented in Table 5.3. The cultural identity scores were lower in girls of mixed ancestry than black and white girls ($P<0.001$). However, total health (healthy eating and physical activity) knowledge scores and self-efficacy total scores were lower in black girls than the mixed ancestry and white girls (all $P<0.001$). These differences were unaltered by socioeconomic status, based on household density and asset index.

5.3.3 Indirect measure of validity of the constructs based on body composition:

Table 5.4 presents results on the relationship between body composition of the girls (presented by WHO BMI-percentile and percentage body fat) and the validated constructs namely: self-perception, body size self-perception, and the environmental factor constructs. No associations were found between the body

size status self-perception and the girls' body composition. However, weak associations were found between the girls' WHO BMI-percentile and their self-efficacy scores, as well as WHO BMI-percentiles and their total environmental factor score (ρ=0.11 and ρ=0.14, respectively all P<0.05).

Table 5.3 Ethnic differences in construct scores for the girls

	Black	**Mixed Ancestry**	**White**
Construct score			
Cultural identity	5.2±1.3*	4.6±1.1*†	5.1±0.9†
Health knowledge	9.4±2.9*†	11.8±2.1*	12.2±2.4†
Self-efficacy	14.8±7.1*†	19.0±5.9*	20.2±6.5†
Self-perception	17.1±6.3	15.9±3.8	15.5±4.1
Social support	15.5±4.3	15.7±4.1	15.8±4.1
Social barriers	15.8±4.3	15.7±3.5	15.6±3.5

Values are in means ± standard deviations, matching superscripts symbols represent groups that are different to each other, * † = P<0.001.

Based on girls' body size status *"Feel"*, 66.9% of the girls categorized their body size status to be within the normal range of weight (BMI=50th -85th WHO BMI-percentile) compared to 16.1% who categorized their body size status to be underweight (BMI<50th WHO BMI-percentile) and 17% who categorized their body size status to be overweight (BMI>85th WHO BMI-percentile). Further, those girls who categorized themselves as overweight scored lower on self-perception for body size status (this means that they had increased body size dissatisfaction) than those who thought they were within the normal range of weight and those who thought they were underweight (their mean self-perception scores were 14.7±4.3 vs 16.7± 4.7 and 16.2±4.2, P<0.05

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respectively). These differences were not altered by the girls' actual / measured BMI and their socioeconomic status based on housing density and asset index.

Table 5.4 Indirect validity of the questionnaire assessed by comparing the constructs within the questionnaire with the body composition of the girls

Constructs	WHO BMI-percentile		% body fat	
	ρ	**P**	**ρ**	**P**
Self-efficacy	0.11	<0.05	0.07	0.19
Self-perception	0.06	0.30	0.03	0.90
Environmental factors	0.14	<0.05	0.10	0.08

5.3.4 Ethnic differences in behavioural outcomes

Black girls presented with higher total PAEE than their mixed ancestry and white counterparts [2528(1080;4950) vs 1295(660;2400) and 2106(1040;3100) P<0.001, respectively], even after adjusting for socioeconomic status. However, no significant ethnic differences were found in the energy intake between the girls.

5.3.4.1 Indirect measures for validity of constructs based on physical activity behaviour:

The relationships between the validated constructs namely, self-efficacy, self-perception, and the environmental factors (social support and barriers) constructs compared to physical activity for the girls are presented in Table 5.5. Total physical activity energy expenditure was only positively associated with girls' self-perception (ρ=0.20, P<0.01). Furthermore, those girls who had lower total environmental barrier scores (4.0±2.3 vs 9.8±3.2, P<0.001) reported walking more to and from school than those who scored more on environmental barriers.

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5.3.4.2 Indirect measures for validity of constructs based on eating behaviour:

The relationship between the validated constructs and the total energy intake of the girls is presented in Table 5.5. The only weak but significant relationship found was between reported total number of fruit and vegetables consumed by the girls and the total social support score (to eat healthily) (ρ=0.19, P<0.001).

Table 5.5 Indirect validity of the questionnaire assessed by comparing the total score of the constructs with the total energy intake and physical activity energy expenditure

Construct	Total energy intake		Total physical activity	
	ρ	**P**	**ρ**	**P**
Self-efficacy	0.01	0.09	-0.14	<0.01
Self-perception	0.02	0.07	0.20	<0.01
Social support	0.01	0.08	0.05	0.06
	Fruit and vegetable score			
Social support	0.19	0.001		

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5.4 Discussion

The main aim of this chapter was to determine, the validity and internal reliability of the questionnaire assessing cultural identity, health knowledge, self-efficacy, self-perception, social support and environmental barriers influencing South African pre-adolescent girls of different ethnic origins, with particular focus on healthy eating and participation in physical activity. We found that the 9-item self-efficacy, the 6-item self-perception and the 12-item social support and environmental barrier construct were valid in this group of

girls. However, the 7-item cultural identity construct and the 16-item health knowledge constructs showed less internal reliability.

Despite the low correlation of items within our self-efficacy and self-perception constructs (demonstrated by the r values of 0.25 and 0.16), we obtained good reliability as demonstrated by the Cronbach's α values that were greater than 0.70. These results corroborate those of the Pathways study by Stevens et al. (1999) suggesting the Cronbach's α value of their 12-item self-efficacy scale to be 0.76. Stevens and associates results were also similar to the results obtained in the CATCH Study, where they also found the Cronbach's α value of 0.84 to be for the 14-item self-efficacy scale (Stevens et al., 1999; Parcel et al., 1996). Moreover, the Pathways self-efficacy and self-perception constructs were previously derived from the 36-item Self-Perception Profile for Children (SPPC) developed by Harter (1985) and validated by Eapen et al. (2000) on 8-16 year old United Arab Emirates children. Questions included in the SPPC elicited information on children judging their athletic competence and their physical appearance perception. Items in the SPPC generated good internal reliability ranging from 0.86 - 0.92 and correlations ranging from low to reasonable r values (0.14-0.57) in United Arab Emirates pre-adolescent to adolescent children (Eapen et al., 2000).

Further, our social support and environmental barrier construct demonstrated good reliability with a standardized Cronbach's α = 0.90. This construct was also derived from the Pathways Study of 9-item social support scale for physical activity and the 7-item social support scale for healthy eating. These

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scales were based on whether the children received support from friends and family to eat healthily, partake in physical activity and play (Stevens et al., 1999). In their study, Stevens et al. (1999) found a good internal reliability of 0.78 in their social support scale for physical activity, but their social support scale for healthy eating did not have similar levels of internal reliability (Cronbach's α was <0.7) and thus needed further revision (Stevens et al., 1999).

There is substantial evidence that psychosocial factors such as social support and higher self-efficacy are positively associated with the adoption of health behaviours including healthy eating and participation in physical activity (Barr-Anderson et al., 2008; Saksvig et al., 2005; Felton and Parsons, 1994; Adkins et al., 2004; Strauss et al., 1985). Adoption of these behaviours is therefore expected to be associated with a lower BMI and fat mass in children (Saksvig et al., 2005; Felton and Parsons, 1994; Adkins et al., 2004; Strauss et al., 1985). However, when we used our participants' actual measured body composition to assess indirect validity of the social support and self-efficacy constructs, we found that those girls who scored higher on the self-efficacy construct and those who had more support from friends, family and educators (white in particular), actually had higher BMI's. Our results are in direct contrast with the afore-mentioned evidence suggesting lower BMI to be found in children with higher social support and higher self-efficacy (Saksvig et al., 2005; Felton and Parsons, 1994; Adkins et al., 2004; Strauss et al., 1985). Moreover, fat mass of our participants was associated with neither the social support nor self-efficacy outcomes. However, we have local evidence

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suggesting South African children who participate in more physical activity have higher BMI's (i.e weighed more) associated with greater lean mass (McVeigh et al., 2004), which may partially explain the differences found in the present study.

In our research we further explored the relationship between the self-perception and the girls' perceptual BMI. We found that those girls who thought that they were above the normal range of weight (>85th percentile) obtained lower scores from the self-perception construct (suggesting increased body size status dissatisfaction) than those who categorized themselves to be within or below the normal range of weight (<85th percentile). Similarly, Rosseau et al. (2005) found that adolescent children who had greater mean BMI (99.9±23.6 percentiles), scored higher on body size status dissatisfaction than the subjects within normal mean BMI (74.1±27.9%) and underweight children (63.2±23.6%).

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In Chapter 1 of this dissertation we also presented evidence that self-efficacy positively associates with the adoption of health behaviours that include eating healthily and participation in physical activity (Thompson et al., 2007; Giles et al., 2004). We then used the behavioural measures of activity and food EI of our participants generated using the PAQ and the structured 24 hour recall to assess the indirect validity of the self-efficacy construct. We found that those girls who had higher self-efficacy participated in less physical activity and self-efficacy was not related to food EI. These results are surprising given the afore-mentioned evidence (suggesting an increase in participation in health behaviours with an increase in self-efficacy). Moreover, self-efficacy has been

defined as an individual's perceived capabilities to produce results and attain designated types of performance (Bandura, 1977; Ormrod, 2006). However, Baranowski et al. (1999) have previously observed similar results when reviewing various international intervention studies to improve health behaviours of children. They observed that environmental factors were often more influential in children adopting health behaviours than psychological factors.

Indeed, our results did suggest that children who had fewer environmental barriers participated in more physical activity. Moreover, we found that higher self-perception was positively associated with children participating in more physical activity. Various international studies have also provided evidence to suggest a positive link between positive body image and micro - environments (such as family, home, school and neighborhood) to children's increased activity levels and healthy eating behaviours (Gordon-Larsen et al., 2005; Meshreki and Hansen 2004; Strauss et al., 2001; Fisher et al., 2004; Adkins et al., 2004; Hume et al., 2005; Perry et al., 1994). Moreover, Fisher et al. (2004 and 2002) have suggested that those children, who were exposed to healthy eating in their homes, were more likely to make the same choices themselves. Commensurate with these findings, we found that those girls, who reported that their family consumed fruit and vegetables and those who experienced more social support to eat healthily from friends and family, reported consuming more fruits and vegetables in a day, compared to those who experienced less social support from friends and family.

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Despite the importance of culture and ethnicity in the development of obesity (Hughes et al., 2006; Kimm et al., 1997; Kimm et al., 2002), the questionnaires designed to elicit information on cultural identity were not valid in this group of girls (Cronbach's alpha = 0.40). A possible explanation for the poor performance of our cultural identity construct may be that, statistically, too few questions were included in this construct to obtain sufficient reliability (Veltro et al., 2007). As such, this construct needs to be revised to yield adequate internal validity for use in future studies. Similarly, in the Pathways Study, the cultural identity construct did not produce reliability (i.e. yielded a Cronbach's α of 0.41, Stevens et al., 1999). In their study Stevens and associates suggested that rating children culturally (in terms of tribe) was socially and culturally unacceptable. We are not certain whether this was a case in our study; but diversity of cultural beliefs and ethnicity are strongly linked in South Africa.

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Our 16-item health knowledge construct also yielded insufficient inter-item reliability and validity (the results yielded a Cronbach's α that was <0.70). Stevens et al. (1999) also found less validity in their construct regarding the knowledge of high fat food of American Indian food as demonstrated by a Cronbach's α value of 0.56. Moreover, statistically our health knowledge construct needed more items to produce good reliability (Veltro et al., 2007). The majority of girls in our study also scored poorly on the questions included in this construct. We anticipated that an environmental barrier (such as the absence of physical education (PE) in the school curriculum) to be one of the factors which may have contributed to the generally low level of health knowledge in our participants. However, more than 80% of our participants

reported having these classes offered at their schools, and more than 60% of these children participated in them. As such, environmental barriers may not be the cause of the girls' poor health knowledge. In this regard, health knowledge in South African children still needed closer attention.

In conclusion, self-efficacy, self-perception and environmental factor (social support and barrier) constructs showed good internal reliability as well as selective indirect validity when compared to body composition and behaviours of South African pre-adolescent girls. South African researchers should be encouraged to include these instruments/constructs in their studies examining the determinants of obesity or the effectiveness of intervention strategies designed to prevent and treat obesity. However, further research is required to improve the equally important cultural identity and a health knowledge constructs before they are used in future studies examining the impact of these factors on obesity and its outcomes.

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CHAPTER 6

INTER-FAMILIAL INFLUENCES ON ATTITUDINAL AND PERCEPTUAL BODY IMAGE OF SOUTH AFRICAN MOTHERS AND THEIR DAUGHTERS

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Chapter 6: Inter-familial influences on attitudinal and perceptual body image of South African mothers and their daughters.

6.1 Introduction

In Chapter 1 we provided evidence to suggest that gaps existed in the South African literature on some of the instruments measuring the socio-cultural and environmental factors of obesity. We undertook to adapt and provide valid measures of behavioural, environmental and socio-cultural factors which may impact on prevalence of obesity in women and girls. In chapters 2, 4 and 5 we presented results suggesting that the South African version of PAQ, the self-efficacy, the self-perception, the environmental construct, the age-adjusted silhouettes, the FID-index scores and the 'fat' belief construct were successful in measuring these sociocultural and environmental factors related to obesity in South African women and girls of different age groups. However, the body image constructs were the only age-adjusted constructs that included similar items and scales, for the purposes of comparison between mothers and their pre-adolescent girls.

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We then undertook to apply these validated body image constructs to understand the role played by different dimensions of body image in the development of obesity in South African women of different ethnic groups (results are presented in Chapter 2 of the current dissertation). In brief, we found some ethnic influences on different dimensions of body image in urban South African women. For example, women of different age groups in this

research were able to see larger body size status in themselves. Black girls had a higher tolerance of a larger body size status, and also perceived their family and friends to be more tolerant of their body size status. White girls on the other hand were more dissatisfied about their body size status, and also experienced more dissatisfaction from their family and friends about their body size status.

In the same analysis, despite adult women of different ethnicities not showing significant differences in body size status dissatisfaction, majority of black women were more dissatisfied about their body size status when they were obese (BMI>30kg/m^2). On the contrary, the majority of adult white women experienced more dissatisfaction about their body size status even when they were not overweight (BMI<25), while the majority of mixed ancestry women became dissatisfied about their body size status when they were overweight (BMI=25-30). In this regard, it may appear as if body size tolerance in South Africa differs within families and is affected by ethnicity. Moreover, the tolarence of body size status in these families may be a consequence of mother modeling their body image to their pre-adolescent daughters.

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Indeed, international studies have demonstrated that children of overweight parents are more likely to be overweight themselves (Davison and Birch, 2002; Treuth et al., 2001; Price et al., 2000). In Chapter 1 we provided evidence to suggest that in addition to genes and environment (Price et al., 2000), obesity in children may be partly related to parental modeling (Cutting et al., 1999). Parental modeling commonly exists in the presence of the mother-child bond

which is the first primary relationship children experience (Birch and Davison, 2001; Cutting et al., 1999; Birch and Fisher, 2000). The mother-child bond appears to be stronger between mothers and their daughters than mothers and their sons (Elfhag and Linne', 2005; Cutting et al., 2006), and is dependent on the age of the child (Ogden and Elder, 1998; Hill and Bhatti, 1995; Cutting et al., 1999).

Cutting et al. (1999) studied boys and girls of ages 3-6 years and found that during early years, a girl child is more likely to learn a great deal about weight concerns from her mother. Moreover, Hill and Bhatti (1995) found resemblances in the body image to exist between mothers and their daughters when younger (preadolescent) daughters were examined within families (Hill and Bhatti, 1995). However, Ogden and Elder (1998) when they studied adolescent girls (mean age = 20.21±1.76 years) they found no mother-daughter resemblances in issues related to body image.

To our knowledge, no studies have investigated the mother-child bond in relation to body image in South Africa. As such, we formulated a hypothesis of the secondary objective suggesting that maternal body image attitudes and perception impact on the body image of their daughters, and this effect remains, even after adjusted for between group differences in ethnicity. Thus, mothers influenced / modeled body image attitudes and perception to their daughters. In this regard, we undertook identifying the respective contributions of intra-familial factors, on attitudinal and perceptual body image of South African women and their pre-adolescent daughters. The specific objectives /

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questions of this secondary objective were: i) to compare mothers and their daughters' data regarding their body image attitudes and perception and ii) to compared black versus mixed ancestry and white families' data regarding body image attitudes and perception.

6.2 Methods

6.2.1 Study population.

Details of the participant recruitment, selection and their physical characteristics (such as age and body composition) are presented in Chapter 2 of this dissertation. Only girls whose mothers agreed to participate in the study, and who were of the same ethnicity as the girls were included, resulting in a final sample of 201 mother–daughter pairs (31% black, 37% mixed ancestry and 32% white) in this analysis.

6.2.2 Body image

Moreover, details of the methods used in assessing body image attitudes (feelings about body size status) and body image perception (the way women see their body size status and thoughts about a smaller or bigger body size status) for both girls and their mothers are also presented in Chapter 2 of the current dissertation.

6.2.3 Statistical analysis

All data were analyzed using Statistica (StatSoft, Tulsa, OK, USA version 7.0). Data were expressed as means ± standard deviations. To describe the participants' characteristics results were analyzed using analysis of variance

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(ANOVA). To match mothers and daughters' body image, repeated measures ANOVA were used. In this regard, measures of the effects of family status that was also adjusted for effects of ethnic group on attitudinal and perceptual body image of participants were calculated. Family status (mother vs. daughter) was used as the within-subject factor. The Tukey HSD post hoc test was used to evaluate the within ethnic group family status. This analysis method chosen was based on that used by Lupinski (2003) on his doctoral thesis regarding the cultural differences in body image of European American, African American and Asian American college women.

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6.3 Results

6.3.1 Participants' characteristics.

A total of 201 mother-daughter pairs were included in the current analysis, and results are presented in Table 6.1. The black girls were significantly older than the white girls however; there were no ethnic differences in body composition between the girls. However, the white adult women were significantly older than the mixed ancestry adult women, whereas the black adult women had a significantly higher BMI and percentage body fat than the mixed ancestry and white adult women.

Table 6.1 Physical characteristics of the mothers and their daughters according to ethnicity

	Black (n=44)		**Mixed ancestry** (n=64)		**White** (n=60)	
	Mothers	**Girls**	**Mothers**	**Girls**	**Mothers**	**Girls**

Age (years)	38.5±9.0	10.5±0.9[b]	38.4±4.7[a]	10.1±0.7	41.5±4.6[a]	9.9±0.8[b]
BMI (kg/m^2)	32.1±7.1[cd]	56.7±32.8	26.1±4.5[c]	58.8±29.2	25.2±4.0[d]	60.9±25.5
Body fat (%)	34.7±6.3[ab]	24.7±5.3	32.4±4.9[a]	24.3±4.7	31.6±4.8[b]	24.9±4.4

Values are expressed as Means ± Standard Deviations: Matching superscripts present significant differences between groups: [ab] $P<0.05$, [c] $P<0.001$,

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Silhouettes chosen by mothers and their daughters to represent different attributes / dimensions of body image

es	Mother-Daughter relationship	Ethnicity					
		Black (n=44)		Mixed Ancestry (n=64)		White (n=6	
		Mother	Girl	Mother	Girl	Mother	
al	5.0±1.5 vs 4.2±1.2$^{\#}$	5.5±1.9^{1}	4.7±1.5^{1}	5.0±1.3	4.0±1.0	4.7±1.2	4
y size	3.9±1.0 vs 3.7±1.4*	4.4±1.2^{1}	4.5±1.8^{1}	3.8±0.7	3.5±1.1	3.5±0.8^{2}	3.
FID	1.2±1.4 vs 0.5±1.4$^{\#}$	1.1±2.0	0.0±2.1	1.2±1.3	0.5±1.1	1.2±1.1^{2}	0.
D	1.2±1.6 vs 0.5±1.6$^{\#}$	1.4±2.2	0.03±2.2	1.1±1.4	0.5±1.4	1.1±1.2^{2}	0.
e	1.3±0.7 vs 1.3±0.9*	1.2±0.7	1.5±1.4	1.2±0.5^{3}	1.1±0.4^{3}	1.5±0.8	1
gure	3.9±0.7 vs 4.5±1.2	4.2±1.2	5.2±1.6	3.9±0.6	4.2±0.7	3.6±0.6	4
	8.1±1.4 vs 7.8±0.8$^{\#}$	8.9±0.4	7.6±1.0	8.1±1.3^{3}	7.9±0.3^{3}	7.3±1.7	7
figure	3.7±0.9 vs 3.7±1.4°	4.0±1.3^{1}	4.3±1.8^{1}	3.8±0.7^{3}	3.5±0.9^{3}	3.4±0.8^{2}	3.
d	4.4±1.8 vs 4.5±2.0*	5.4±2.4^{1}	5.3±1.9^{1}	4.0±1.5^{3}	4.1±2.1^{3}	3.7±1.0	4
owing s	4.1±1.9 vs 4.1±1.6°	4.6±1.9^{1}	4.2±2.2^{1}	4.1±1.8^{3}	4.2±1.4^{3}	3.7±1.8^{2}	3.

ughter resemblance which did not change even after removing the confounding factors of ethnicity, # mother-daughter resemblance that on esent after removing the confounding factors of ethnicity, ° mother-daughter resemblance that disappeared after removing the confounding thnicity. Matching superscripts represent resemblances between groups: $^{1, 2, 3}$ P>0.05

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6.3.2 Family status influences on body image:

Table 6.2 presents the scores of silhouettes selected by both mothers and their daughters as representing different dimensions of body image.

6.3.2.1 Perceptual body size:

When selecting the silhouette that most closely resembled their current body size (perceptual body image), irrespective of ethnicity, girls chose a leaner figure compared to their mothers (P<0.001). The differences were significantly shown between black girls and their mothers (noting that majority of black mothers were obese, while their daughters were within the normal range of weight). However, after adjusting for the differences in ethnicity and mothers' maternal BMI there were mother-daughter resemblances across all ethnic groups (P=0.576), suggesting that mothers and daughters chose similarly weighted silhouettes as presenting their perceptual body image.

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6.3.2.2 Ideal body size:

When selecting the silhouette that most represented their "Ideal" body size status, there were no differences in the silhouettes selected by mother-daughter pairs (P=0.308), suggesting that there was a family resemblance which did not change even after adjusting for ethnicity for the so-called "ideal" body size. The mother-daughter similarities were most apparent between black and white families.

6.3.2.3 Attitudinal body image (feel-ideal index):

Based on the Feel-Ideal index (FID index), derived from the difference between the scores of silhouettes selected as "ideal" and the participants' current body size, girls were generally more satisfied with their body sizes, with significantly lower FID index score than their mothers (0.5±1.4 vs. 1.2±1.4, P<0.001). However, the FID index scores were similar after adjusting for the ethnicity of the participants (P=0.557), suggesting mother-daughter resemblance for the so-called body size dissatisfaction presented by the FID index scores. Similarly, the FID index scores for friends became similar in mother-daughter pairs after adjusting for ethnicity (P=0.948). These similarities were more visible within the white families which also presented with higher FID index scores than the black families.

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6.3.2.4 Attitudinal body image (attitudes towards a fat body size status):

A 'fat belief' construct was formulated from the participants' association of fatness with certain attributes such as beauty, happiness, popularity, prosperity and health. Girls had higher regard or associated a largest number of positive attributes to body fatness than their mothers (4.5±3.7 vs 1.7±1.0, P<0.001, results not presented in table 6.2). The interpretation did not change even after adjusting for ethnicity. However, the differences were narrow within the black families.

6.3.2.5 Attitudinal body image (different body size statuses)

When participants were asked to identify figures that they regarded as thin, normal and fat from set of 8 age-adjusted silhouettes ranging from very thin to

very heavy, mothers selected similar weighted figures as showing thinness with those selected by their daughters (P=0.960). These similarities were more visible in the mixed ancestry families. However, girls across all ethnic groups identified a larger figure as normal (4.5±1.2 vs 3.9±0.9, P<0.001) and regarded a smaller figure as fat than their mothers (7.8±0.8 vs. 8.1±1.4, P<0.01). Adjusting for ethnicity did not change the interpretation of the figure selected for thin and normal, however, mothers and their daughters selected similar weighted figures as showing fatness (P=0.342). The similarities for figures selected as showing fatness were more visible in the mixed ancestry families.

Lastly, participants were asked to identify figures that they regarded as beautiful, showing respect and happiness from the set of 8 age-adjusted silhouettes. Girls across all ethnic groups identified similar weighted figures to those identified by their mothers as beautiful, showing respect and happiness (P=0.813, P=0.615 and P=0.693, respectively). However, the interpretation changed with regards the figures selected as showing beauty and happiness after adjusting for ethnicity (both P values <0.001). These differences were visible within the black and white families, whereas, the similarities still remained within the mixed ancestry families.

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6.4 Discussion

In this chapter we sought to find the effects of family status (presented as mother-daughter resemblance) on different dimensions of body image of South African women. We found that mother-daughter resemblances existed on perceptual and attitudinal body image. For example, mothers and their

daughters had similar ideal body size, saw similar figures as showing thinness, beauty, respect and happiness. However, these resemblances were no longer there for chosen silhouettes representing beauty and happiness when the confounding effects of ethnicity were removed. Furthermore, mother-daughter resemblances with regards to dissatisfaction about body size status and percieved friends' dissatisfaction became visible only after removing the confounding effects of ethnicity. Lastly, mothers and their daughters only selected similar weighted figures to show their perceptual body size, and also saw a similar figure as showing fatness, when the confounding effects of ethnicity were removed.

These results are of great interest as they highlight the role played ethnicity of South African women on the way they see and feel about their body size status, as well as the beliefs and attitudes they have regarding a certain body size status. For example, despite the majority of black mothers in this analysis being obese while their daughters were mostly within the normal range of weight, resemblances with regards perceptual body size were most notable in these black families when compared to other families. Further, black families appeared to have larger body size ideals compared to the other families. This marks greater tolerance of larger body size within the urban black South African families than in other families. Indeed, greater body size tolerance in black South Africans has been presented beautifully in the studies of Mvo et al. (1999) and Puoane et al. (2005) and more details on these studies have been presented in Chapter 1 of this dissertation.

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In this analysis, it appears as if girls are generally more satisfied with their body size status and perceive that their friends are more tolerant of their body size status than their mothers. However, if the confounding effects of ethnicity are removed, mother-daughter resemblances become most visible. These resemblances are more visible within the white families. In these white families dissatisfaction with body size and perceived body size dissatisfaction from friends appeared to be high. Indeed, in Chapter 1 of this dissertation we have previously presented studies of Caradas et al. (2001) and other international studies (Stevens et al., 1994; Fitzgibbon et al., 2000) suggesting white women of different age groups to be more dissatisfied about their body size status than black women.

Moreover, in this analysis it appears as if black families only see fatness in the fattest figures and also have an overall higher regard towards a larger body size. In these black mother-daughter pairs, a larger body size is associated with positive attributes, such as showing beauty, happiness and respect. On the other hand, mixed ancestry and white families participating in this study see fatness even in smaller figures and associate leaner figures with beauty, happiness and respect. Association of larger body size with positive attributes within the black ethnic groups have also been presented in previous similar South African studies (Puoane et al., 2002; Mvo et al., 1999; Matoti-Mvalo, 2006) also presented in Chapter 1 of this dissertation. In this regard, our results may be of great importance as they highlight that In South Africa body image runs within the families, and mothers model both positive and negative body image to their pre-adolescent daughters. Our results are corroborated by

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those of Birch and Davison (2001) as well as Hill and Bhatti (1995), suggesting resemblances regarding different dimensions of body image to be present in mothers and their pre-adolescent daughters (Elfhag and Linne', 2005; Cutting et al., 2006). Moreover, in Birch and Fisher (2000), Cutting et al. (1999) and Davison and Birch (2002) studies, it has also been shown that family environment also impacts strongly on children's health behaviours (such as eating healthily and participating in physical activity). In these studies, family environment includes mothers' i) feeding practices, ii) BMI status, ii) dietary restraint and disinhibition, iii) dietary patterns and iii) physical activity.

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Therefore, we conducted an *a posteriori* analysis, to determine the extent to which family status impacted on health behaviours, such as fruit and vegetable intake, or dietary fat intake, which have been shown to play a role in the development of obesity. The specific behaviours we examined were: overconsumption of energy-dense foods (specifically, fat intake that is ≥30% of total food EI) and added sugar (≥20g each day), as well as a low intake of fruits and vegetables (< 3 serves per day). Using the McNemar Chi Squared Test, we compared mother and daughter pairs to determine the extent to which these specific behaviours matched. Food and energy intake of mothers was quantified using the validated QFFQ (MacIntyre et al., 2001) presented in detail in Chapter 3, and for girls, it was quantified using the structured 24-hr recall derived from the a previously validated QFFQ (Steyn et al., 2001), also presented in Chapters 1 and 5 of the current dissertation.

Although we only collected one structured 24-hour recall from the girls (derived from a previously validated QFFQ for children, Steyn et al., 2003 also presented in Chapter 1 section 1.3.3 and Table 1.5 of the current dissertation), reported energy and macronutrient intake were similar to that reported in children who participated in the BT20 study (Norris et al., 2008) and the NFCS (Steyn et al., 2003).

In this analysis, mother-daughter pairs were similar with respect to the amount of fat consumed each day (P=0.912). Our results are in line with those of Lee and Birch (2002), in which they found mothers of girls who consumed more fat to have a higher fat intake themselves. Moreover, they found that fat intake influenced the intake of other nutrients. For example, in their study of 192 white girls and their mothers, Lee and Birch (2002) found that families who consumed more fat in their diet also had lower intakes of fibre and certain micronutrients (such as Vitamins A,C,B_6, folate and riboflavin). In fact, children who consumed high fat diets consumed fewer fruits, more meat, more sweets and also presented with lower Healthy Eating Index scores (scores presenting a degree to which a child's diet conformed to the Food Guide Pyramid serving recommendations of the US Department of Agriculture for 5 major food groups) than did children with low fat diets. In this regard, fat may be one of the most important macronutrients to be targeted in the interventions designed for the treatment and management of obesity.

Conversely, we did not find any significant mother-daughter relationships with respect to added sugar or for fruit and vegetable consumption (as dichotomous variables). in the present study, 34% adult women compared to 17% girls

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consumed fewer than 3 fruits and vegetables in a day, with black adult women consuming the lowest number of fruits and vegetables each day (3.4±0.9 vs 3.4±0.9 and 3.8±0.9 servings per day, compared to women of mixed ancestry and white women, respectively). These results may be similar to those of Boutelle et al. (2007) suggesting children's perceptions of their mothers' attitudes towards healthful eating to strongly impact children's behaviour of healthful eating, than their mothers' actual eating behaviours. However, in the current research we didn't investigate children's thoughts regarding their mothers' eating behaviour and attitudes. Our results are in contrast to those of Galloway et al. (2005) who found that fruit and vegetable intake in mothers was associated with fruit and vegetable intake of their daughters (2002).

Family environment and parental modelling have also been shown to influence children's consumption of fruits and vegetables in other international studies. For example, Wardle et al. (2002) demonstrated that 2-6 year old children across all social classes who were exposed to fruits and vegetables by parents in their homes showed an increase in preference for vegetables compared those who were not exposed. Differences in the results from the present study and those of Galloway et al. (2005) as well as Wardle et al. (2002) may be related, in part, to the overall low intake of fruits and vegetables in the Galloway study, as well as differences in ages between study sample populationsin Wardle's study and our study. For example Wardle studied younger children of 2-6 years, whereas we studied pre-adolescent children (9-12 years).

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With respect to added dietary sugar intake, our results were also in contrast to studies in which the parent's intake was a major predictor of healthy and unhealthy (high fat/sugar, carbonated beverages, candies, cookies) snack intake in primary school-aged children (Hang et al., 2007), and the most important factor associated with food intake in children (Elfhag et al., 2008). For example, Elfhag et al. (2008) found that mothers modelled the consumption of sweets in association with emotional eating. Differences between the study by Elfhag et al. (2008) and the present study may be attributed, in part, to the fact that father's intake was taken into consideration, and that the context for eating (psychological dimensions of eating behaviour) was also measured. Another possible difference is that the proportion of mothers whose added sugar intake was in excess of 20g per day was more than 65% of the current sample. This is in contrast to only 10% of the girls. Black adult women in our analysis presented with the highest amount of sugar (97.7±80 vs 80.4±41.4 and 86.5±47.0 grams) added in their diet (mainly in hot beverages such as tea and coffee, and maize porridge) than mixed ancestry and white women. Their daughters, on the other hand, did not consume hot beverages, and as such took in the least amount of added sugar (39.7±28.3 vs 47.4±36.9 and 41.7±22.34 grams) compared to their mixed ancestry and white counterparts.

The intake of sugar-sweetened beverages in a study of Dutch adolescents was inversely associated with a moderately strict parenting style and involvement, and influenced by parental modelling (van der Horst et al., 2007). However, estimates of added sugar intake for girls in the present study may also have

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been influenced by the single, QFFQ completed by the girls, and the fact that the girls in the present study were younger.

In summary, in the current chapter we have presented that black families still have a high regard towards a bigger body size status, have larger body size ideals, and also recognize larger figures as symbolizing fatness, beauty and respect than other ethnic groups. Further, we presented that some intra-familial resemblance exists between mothers and their primary school-aged daughters for body image dissatisfaction. Moreover, it seems as if black mothers may also be modelling unhealthy behaviours that include overconsumption of fat. These results have implications on the development of obesity in South Africa following the high prevalence of obesity in women that also differs between ethnic groups. Researchers have a challenge to consider the family effect on body image dimensions and dietary behaviours when developing intra-personal and targeted interventions for the prevention and management of obesity.

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CHAPTER 7

SUMMARY AND CONLUSIONS

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Chapter 7: Summary and Conclusions

Obesity in South Africa is on the rise (Puoane et al., 2002; Ono, 2005), with the highest prevalence of overweight and obesity being in adult women (i.e. 56.6% versus 29.2% compared to men, Puoane et al., 2002; Ono, 2005). What is of concern is that, although the obesity prevalence in South African children is still lower than in South African adults, they seem to follow the same gender trend in that, the prevalence is higher in girls between the ages of 9 and 13 years (17.9% of overweight and 4.9% of obesity) than in boys of the same age (14% of overweight and 3.2% of obesity, Armstrong et al., 2006). Similarly, South African adolescent children show a similar gender trend to adults with 25% of girls being classified as overweight and 5.3 % as obese in comparison to boys, of whom 6.9% were classified as overweight and 2.2% were obese (Reddy et al., 2003).

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International researchers have shown that the aetiology of obesity is complex, and in addition to intrinsic factors such as the biology of individuals (presented as genetics, age, gender), there are behavioural determinants, along with economic, socio-cultural and environmental factors which are largely extrinsic, that either directly or indirectly influence the development of obesity. These define what has been referred to as an “obesogenic” environment (Swinburn et al., 2005; Egger and Swinburn, 1997). Popkin and associates have suggested that these extrinsic factors may be particularly important in countries and settings which are undergoing the nutrition transition, including South Africa (Popkin, 2006; Popkin and Gordon-Larsen, 2004). However, in South Africa,

these extrinsic factors have only been partially explored, and as such, there are gaps in our knowledge.

We are also not certain of the extent to which language, culture and age influence these afore-mentioned factors. As such, this dissertation focused on finding and adapting culturally-sensitive and age-appropriate instruments that elicited information regarding individual factors associated with obesity in South African women and girls. More specifically, the aim of the study was to adapt, validate and find the reliability of already existing instruments measuring dietary and physical activity knowledge, attitudes and beliefs in South African women and their pre-adolescent daughters of different ethnic origins. Having validated these instruments, and several of these constructs, we then explored the mother - daughter relationship (effects of family status) on different dimensions of body image of urban South African women and girls.

The first part of the dissertation involved the development or adaptation of already existing body image instruments to better understand the role played by body image in the development of obesity in different ethnic groups of South African women of different age groups. Some of these instruments were derived from focus groups comprised of black women from Cape Town in South Africa (Puoane et al., 2005). Further, silhouettes from the Pathways Study (Stevens et al., 1999) and the Stunkard Figures (Stunkard et al., 1983) were adapted, and subjects were asked to select figures based on their actual and ideal body size, which represented their perceptual and attitudinal body image. These instruments were shown to be sensitive to the adult women's

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measured BMI, and were internally reliable. Our results suggested that there was a general recognition of a larger or a smaller body size by pre-adolescent daughters and their mothers of varying BMI levels. The FID Index scores, also derived from the silhouettes, were useful in highlighting the attitudinal body image by showing the direction of dissatisfaction with body size in urban women of different ethnic groups and ages (as presented in Tables 2.5 and 2.6). Moreover, the FID Index scores also highlighted the perceived body size tolerance of family and friends, for both women and girls, and the interaction with differences in culture or ethnic background on these perceptions. Furthermore, written constructs in the form of “fat” and “thin” belief constructs also produced good internal reliability, and as such, highlighted that through this battery of tests, it was possible to assess the attitudinal body image of urban South African women and the regard they give towards a thin or fat body size status (as presented in Table 2.8).

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Visual images (silhouettes in particular) and written constructs have been previously found to be responsive in highlighting the body image of women in other international studies (Stunkard et al., 1985; Fitzgibbon et al., 2000; Caradas et al., 2001). As such, the outcomes of this dissertation add value for South African obesity researchers and practitioners, as a local set of validated instruments for assessing body image are now available. This is especially important as there is urgency for interventions to treat and manage obesity in both young and adult South Africans of underserved communities (black, in particular), with particular focus on their body image. Stevens et al., (1994) and Kumanyika and Orbazanek, (2003) have highlighted the challenges that are

faced by health service providers who are investigating the aetiology of obesity, or developing interventions for obese persons, when relevant body image issues, cultural issues and environmental issues are not considered. The pictorial scale may be particularly useful for children, in cross-cultural settings and for large groups, as it is not bound by differences in literacy and first language, and has a low respondent burden.

In the second chapter of this dissertation, I used an existing and validated food frequency instrument, and identified factors which contributed to the problem of under- and over-reporting of food intake in adult South African women. On the basis of the reported energy intake in relation to estimated resting metabolic rate (EI:BMR_{est}), I found that 26 % of women in this analysis under-reported their intake (using the cut-off range of 1.05-2.28 EI:BMR_{est}, proposed by Black in 2000) In this group, under-reporting was influenced by body size status and differed according to ethnicity, such that a greater proportion of under-reporters were black and obese, compared to mixed ancestry women who were overweight, and white women who were within the normal range of weight. Clearly, this would make dietary intervention challenging for those obese under-reporters, as they are either under-reporting as a result of social desirability bias, or because they are not aware of their food energy intake. Either way, the intervention strategy for these individuals is likely going to be different than for those who adequately report food energy intake. Despite these differences, EI:BMR_{est} was not influenced by either socioeconomic status or body image, which was somewhat surprising.

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In this regard, under-reporters also tended to report less dietary fat and higher dietary protein intake than the adequate- and over-reporters. The results of this section are very critical in a country such as South Africa that is still undergoing nutrition transition [a transition presented as an increase in fat, added sugar intake and processed foods by Popkin and Gordon-Larsen (2004) in their schematic drawing regarding "Stages of the Nutrition Transition"]. As such, there is likelihood that micronutrient reporting in South African women is also affected. In this regard, results of South African studies aimed at determining the association between certain chronic diseases and nutrient intake may need to be adjusted for food energy intake misreporting. As such, dietary intake data obtained from under-reporters need to be interpreted with caution bearing in mind that nutrient intake of these individuals may not be representative. However, future research should also focus on undertaking longitudinal studies that use laboratory-based methods of assessing dietary intake of individuals, as a means of identifying implausible nutrient intake reporting (Schofield et al., 1985).

The third chapter of this dissertation explored the validity and reliability of a physical activity / inactivity questionnaire PAQ derived from the EPAQ 2 (Wareham et al., 2002) quantifying physical activity and inactivity levels in South African pre-adolescent school girls. Adults were excluded from this section of the thesis, as there has been extensive validation of physical activity instruments in South African adults (Craig et al. 2003). However, we were unaware of any available and validated questionnaires on physical activity, for use in children. Like many other developing countries, South African children

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are becoming increasingly overweight and obese (Armstrong et al., 2006; Reddy et al., 2003), and physical inactivity may be one of the contributing factors.

In the current research, energy expenditure derived from South African version of the PAQ was compared to the EE derived from the ACTIVITYGRAM. Further, minutes of inactivity derived from PAQ were compared to number of programmes watched selected from a television programme list. Finally, PAQ - generated EE and minutes of inactivity were compared to the participants' body composition to measure the indirect validity of the PAQ. Our results suggested that like any international questionnaire as mentioned above, the South African version of a PAQ only demonstrated modest indirect criterion validity, concurrent and construct validity in South African primary school girls. Despite the relatively weak associations between the PAQ-derived EE and inactivity, against EE derived from the ACTIVITYGRAM and television time, the PAQ was useful in characterizing the physical activity levels and patterns of South African children of varying socioeconomic background. The PAQ also highlighted health benefits associated with adoption of physical activity, such as reduced body fatness and BMI levels. It also distinguished between the intensity levels of the activity, such that it identified moderate and vigorous energy expenditure in South African school girls. It also enabled us to quantify and distinguish energy expenditure generated using different domains of activities such as activities performed at school, out of school, formal and informal, with the more formal activities showing good reliability. Further, it quantified time spent on sedentary behaviors such as watching television, using computers, relying on

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motorized vehicles for transport, and identified whether physical education was included in the school curriculum, and whether children did attend these classes. Moreover, the weak associations regarding the outcomes of PAQ and the outcomes of the standard measures (such as the body composition of our participants, the ACTIVITYGRAM and the TV list) we observed were comparable to outcomes of other similar studies where validation of self-administered questionnaires was tested in children (Janz, 1994; Ridley, 2005; Sallis and Saelens, 2000; Welk et al., 2004).

Despite the usefulness of the results of this study, we observed some limitations. First, we needed to collect more than one previous day's records (i.e. the ACTIVITYGRAM needed to be administered more than once) in-order to be sure that the outcomes we got regarding the EE of our participants provided a truly representative picture of energy expenditure of South African children. Further, if we only collected one previous day recall of energy expenditure, we ideally would have liked to include a larger sample size. As such, further improvement of methods quantifying the energy expenditure of subjects is recommended. Moreover, objectively measuring physical activity in children should be done on top of measuring it using this South African version of PAQ.

The fourth chapter of the dissertation adapted a questionnaire derived to measure health behaviours of American Indian preadolescent children (Pathways study, Stevens et al., 1999) to measure the cultural identity, health knowledge, self-efficacy, social support and environmental barriers that

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influence South African children to eat healthily and exercise. For example, in our introduction we have shown that social and cultural norms as well as health knowledge impacted the adoption of health behaviours of South Africans (Kruger et al., 2002; Steyn et al., 2000). Consequently, we measured the indirect validity of the South African constructs measuring dietary and physical activity knowledge, self-efficacy, social support and environmental barriers in South African children by comparing them with the same children's body composition, EE and EI. We found that the 9-item self-efficacy, the 6-item self-perception, and the 12-item social support and barrier constructs were valid in this group of girls. They yielded Cronbach's α values of 0.74, 0.71 and 0.94 for self-efficacy, self-perception and environmental factor constructs respectively.

These results implied that self-efficacy, self-perception and environmental (social support and barrier) constructs were understood by South African pre-adolescent children and gave valid information regarding psychosocial factors of obesity in children. However, the 7-item cultural identity construct and the 16-item health knowledge construct showed less reliability (their Cronbach's α values were 0.35 and 0.55). In this regard, we recommend that the cultural identity and health knowledge constructs be improved before they are used in obesity research.

Following these recommendations, the questionnaires were modified by the Chronic Diseases of Lifestyle Unit of the Medical Research Council (MRC) of South Africa, currently involved in a school-based nutrition and physical activity intervention, called Health Kick. The newest version of health knowledge

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constructs is presented as the HealthKick and copies are available on the MRC website (http//www.mrc.ac.za). The HealthKick questionnaire includes more items (25 questions) eliciting information regarding children eating healthily (presented as recommended food items to be eaten, individual food preferences, different types of fruits and vegetables to be consumed, food low in added sugar and fat, as well as healthy food choices that are mostly consumed before and after school by respondents). Further, 19 questions eliciting information regarding different domains of physical activity, duration and intensity of activities, as well as sedentary activities South African children engage in are included. However, this improved health knowledge questionnaire still needs to be tested for its validity and internal reliability in South African school aged children.

Moreover, the findings of the current research regarding the cultural identity construct suggested that future research may also be needed to measure ethnic/ racial identity. In fact, although each South African ethnic group has its own unique history, values and traditions, as well as sense of identification, there might be an overlap in these different values and tradition, judging from the results of this dissertation. In this regard, it may be more appropriate to also include questions eliciting information on acculturation when measuring issues relating to culture and ethnicity in children. Following these suggestions, we reviewed a study by Phinney (1992) and compared questions derived from his Multi-group Ethnic Identity Measure [MEIM, a measure that was developed to measure ethnic identity of adolescents and young adults by Phinney (1992)] to those in our cultural identity construct. We found that questions 1, 3, 8 and 13

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in the MEIM are similar to our cultural identity construct questions. However, we have identified a few questions (i.e. questions 2, 5, 7, 10, 14 and 15) in the MEIM that provide information on the child's cultural identity that may be incorporated into future questionnaires to improve the inter-item reliability of this construct (See Appendix 6). However, any changes to the South African version of a cultural identity measure (CIDM) would still need to be tested for its equivalence in measuring cultural and ethnic identity development of South African pre-adolescent children of different ethnicities.

The last part of this dissertation assessed the role played by family status (mother - daughter resemblance) on different dimensions of body image of South African women. We found that some resemblances existed between mothers and their primary school aged daughters on issues relating to body image, such as the desired (ideal) body size status, perceptual body image, the recognition of thin, fat and beautiful figures, figures showing happiness and respect, as well as body image dissatisfaction. Moreover, in South Africa it became likely that the family also provides its children with behaviours of eating healthily. However, an opportunity still presents itself that the role played by family status on the health knowledge, health behaviours (presented as physical activity EE) and dietary dis-inhibition in this country still needs further exploration.

In conclusion, despite some limitations of our research mentioned above, we have reached our main objectives of developing, adapting, validating and finding the reliability of already existing instruments measuring obesity

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determinants. These obesity determinants are thought to influence dietary and physical activity knowledge, attitudes, beliefs, and health behaviours of South African women and their pre-adolescent daughters from different ethnic origin. These results have an implication on the development of obesity in South Africa following the evidence showing growing obesity prevalence in children, as well as the high prevalence of obesity in women that also differs within ethnicities. As such researchers are encouraged to always consider these determinants when developing specific targeted weight management strategies for women. Further, the results of this research have an implication in the South African policy that the government has to endorse or provide support to several obesity studies to come, and also fund targeted interventions for the prevention and treatment of obesity in South African women of different ages and ethnicities at family level. More focus is to be directed to the underserved and vulnerable communities such as young South African black (pre-adolescent) girls, who are at risk of developing to be overweight adults as shown by South African literature (i.e. the results of the current study, Puoane et al., 2002 and 2005; Kruger et a., 2001; Mvo et al., 1999 and Matoti-Mvalo, 2006).

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Table 2 Outlines the limitations as well as the strengths of this research

Limitations	Strengths
Study 2: 1. Only 1 structure 24 –hr recall of children's dietary intake data was collected. As such, it was impossible including mother-daughter dietary data to achieve our secondary objective	3. This research used a large sample size, even above the number suggested in the calculated power for each study 4. We used random selection of our participants 5. In addition to the validated

2. EE of women was estimated as opposed to measuring it, thus no results for RMR

Study 3:

1. Only 1 physical activity previous day recall using the ACTIVITYGRAM of children was collected, thus the EE generated by this method differed by nearly threefold of the EE generated using PAQ
2. Women's PA not measured, as such we could not include mother-daughter PA data in study 5 to achieve our secondary objective
3.

Study 4:

1. Lack of reliability of the children's health knowledge and cultural identity constructs
2. Health knowledge, self-efficacy and environmental factors that influence women to eat healthily and exercise are not included in this study, thus mother-daughter relationship regarding these questions was not included in study 5 to achieve our secondary objective

instruments produced by this research (that have been / or still to be adopted by other researchers to explore factors of obesity in South Africa), data on different psychosocial and behavioural factors of obesity are also provided

6. Further, data regarding the family and ethnic group effects on the body image of South African women is generated

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CHAPTER 8

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APPENDICES

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Appendix 1 Upgrade from MSc to PhD approval

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences
Adri Winckler
Deputy Faculty Office Manager
Barnard Fuller Building
Anzio Road
Observatory, 7925

05 October 2004

Ms Z J Mciza (MCZZAN001)
Sports Science Institute
Newlands
7700

Dear Ms Mciza

Upgrade proposal

Old degree	MSc(Med) in Nutrition and Dietetics (MEDM10)
New degree	PhD in Nutrition and Dietetics (MEDD01)
Old title	Validation of instruments that can be used for measuring nutrition knowledge, attitudes, beliefs, practices, physical activity and health behaviours in South African women and their daughters
New title	Measuring dietary and physical activity knowledge, attitudes and health behaviours in South African women and their daughters: A validation study
Supervisors for PhD	Main supervisor: Prof E V Lambert Co-supervisor 1: Dr Julia Goedecke

I am pleased to advise that Professor Charles Swanepoel, Chair of the Dissertations Committee, has approved your application to upgrade your degree on behalf of the Dissertations Committee. Formal approval will be obtained by publication in the next Dean's Circular (MED02/04).

Sincerely

Adri Winckler
Deputy Faculty Office Manager

FACULTY OF HEALTH SCIENCES
2004 -10- 05
DEPUTY FACULTY OFFICE MANAGER

☎: (021) 406-6327 E-✉: awinckle@curie.uct.ac.za FAX: (021) 406-6584

"OUR MISSION is to be an outstanding teaching and research university, educating for life and addressing the challenges facing our society."

Appendix 2.1 Ethics approval from the University of Cape Town

UNIVERSITY OF CAPE TOWN

Research Ethics Committee
Faculty of Health Sciences
E46- 26 Old Main Building, Groote Schuur Hospital, Observatory,7925
Queries : Xolile Fula
Tel : (021) 406-6492 Fax: 406-6411
E-mail : Xfula@curie.uct.ac.za

05 July 2002

REC REF: 185/2002

Dr. J. Goedecke
Human Biology

Dear Dr. Goedecke

INTER-ETHNIC DIFFERENCES IN ADIPOSITY AND ENERGY BALANCE MAY PARTLY BE EXPLAINED BY SOCIO-CULTURAL AND FAMILIAL FACTORS IN SOUTH AFRICAN WOMEN AND THEIR DAUGHTERS

Thank you very much for your letter to the Research Ethics Committee dated 1 July 2002.

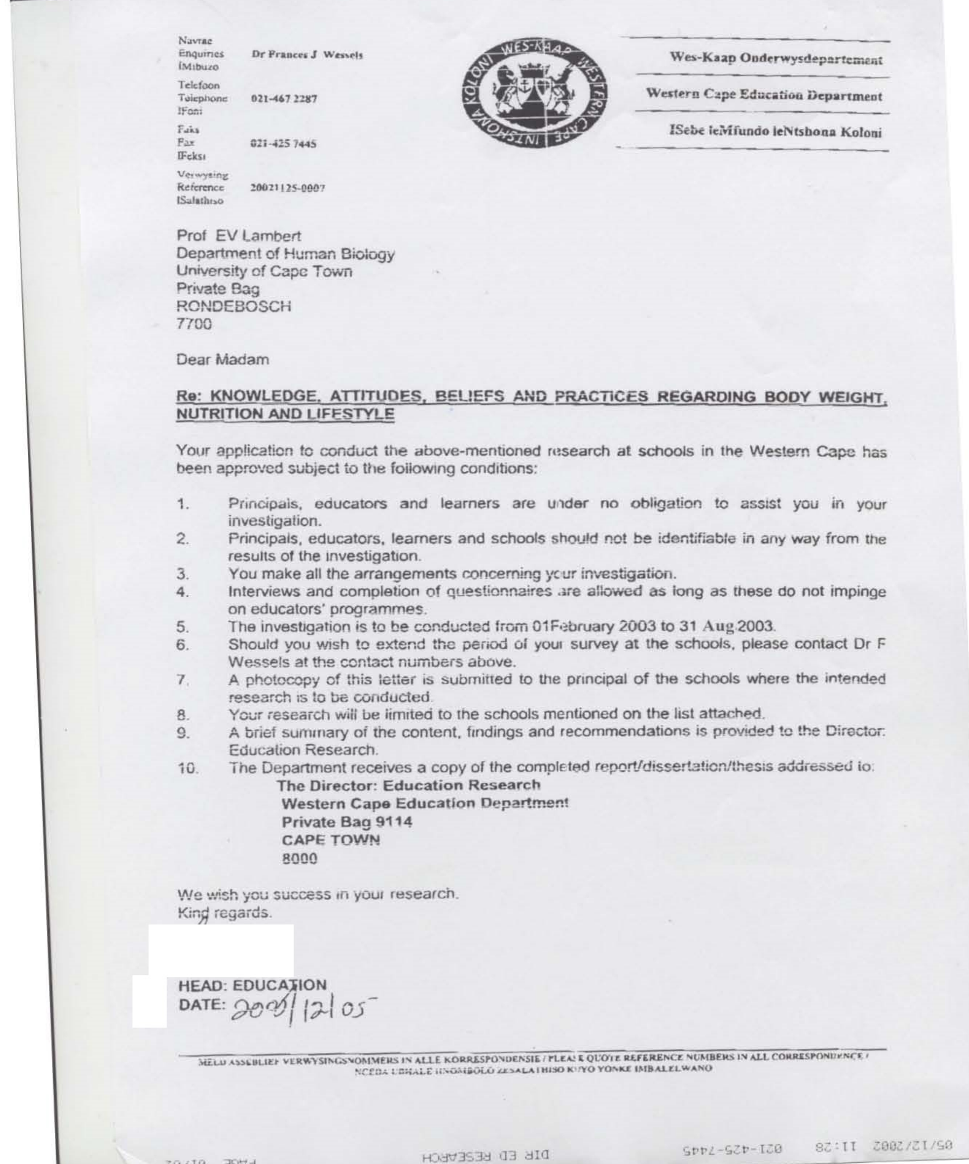
It is a pleasure to inform you that the Committee has formally approved your study.

Please quote the REC REF in all your correspondence

Yours sincerely

A/PROF. CR. SWANEPOEL
CHAIRPERSON

Appendix 2.2A Ethics approval from the Department of Education



Navrae / Enquiries / IMibuzo: Dr Frances J Wessels
Telefoon / Telephone / IFoni: 021-467 2287
Faks / Fax / IFeksi: 021-425 7445
Verwysing / Reference / ISalathiso: 20021125-0007

Wes-Kaap Onderwysdepartement
Western Cape Education Department
ISebe leMfundo leNtshona Koloni

Prof EV Lambert
Department of Human Biology
University of Cape Town
Private Bag
RONDEBOSCH
7700

Dear Madam

Re: KNOWLEDGE, ATTITUDES, BELIEFS AND PRACTICES REGARDING BODY WEIGHT, NUTRITION AND LIFESTYLE

Your application to conduct the above-mentioned research at schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Interviews and completion of questionnaires are allowed as long as these do not impinge on educators' programmes.
5. The investigation is to be conducted from 01February 2003 to 31 Aug 2003.
6. Should you wish to extend the period of your survey at the schools, please contact Dr F Wessels at the contact numbers above.
7. A photocopy of this letter is submitted to the principal of the schools where the intended research is to be conducted.
8. Your research will be limited to the schools mentioned on the list attached.
9. A brief summary of the content, findings and recommendations is provided to the Director: Education Research.
10. The Department receives a copy of the completed report/dissertation/thesis addressed to:
    The Director: Education Research
    Western Cape Education Department
    Private Bag 9114
    CAPE TOWN
    8000

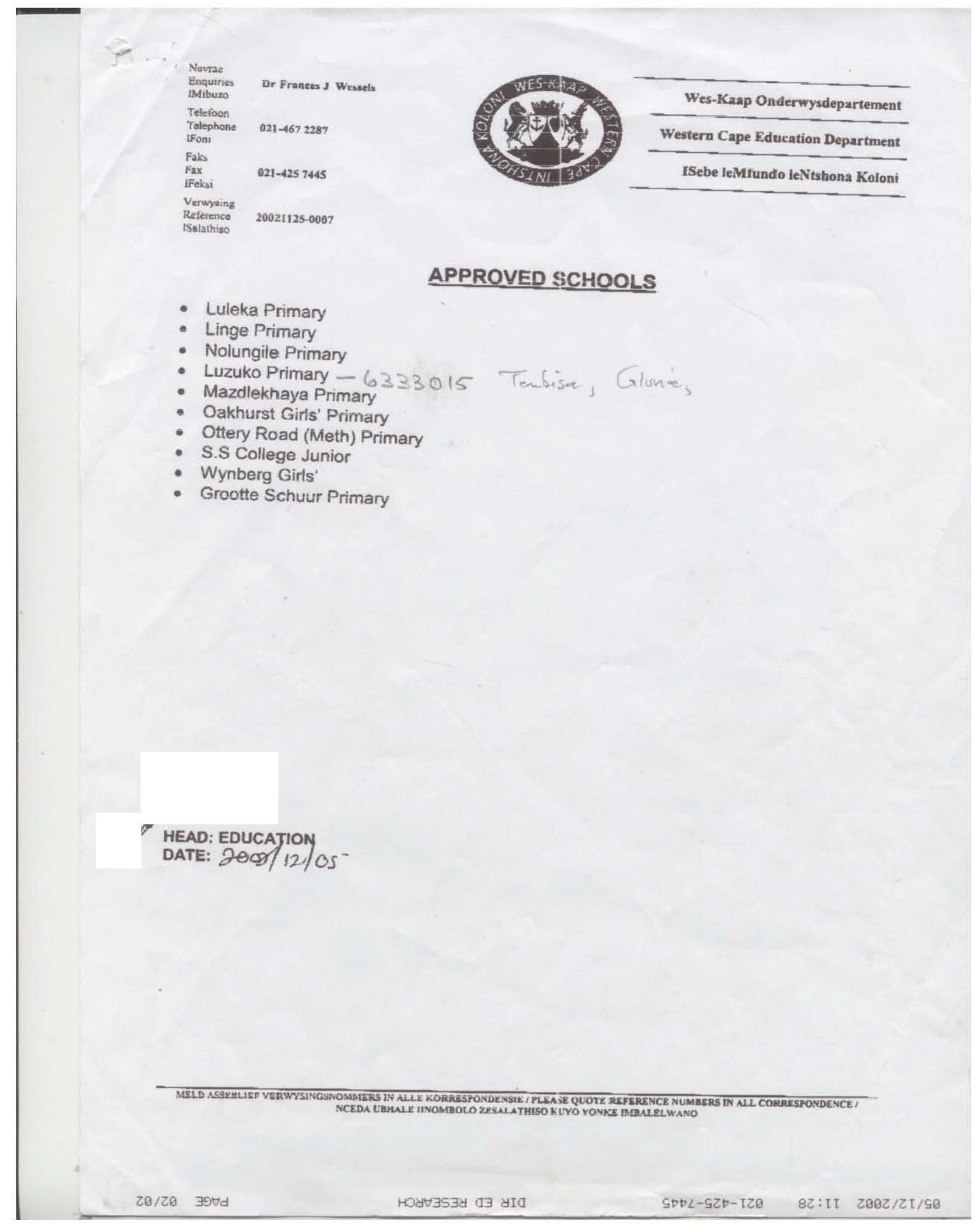
We wish you success in your research.
Kind regards.

HEAD: EDUCATION
DATE: 2002/12/05

MELD ASSEBLIEF VERWYSINGSNOMMERS IN ALLE KORRESPONDENSIE / PLEASE QUOTE REFERENCE NUMBERS IN ALL CORRESPONDENCE / NCEDA UBHALE IINOMBOLO ZESALATHISO KUYO YONKE IMBALELWANO

05/12/2002 11:28 021-425-7445 DIR ED RESEARCH PAGE 01/02

Appendix 2.2B Approved schools to partake in the research



Navrae / Enquiries / IMibuzo: Dr Frances J Wessels

Telefoon / Telephone / IFoni: 021-467 2287

Faks / Fax / IFeksi: 021-425 7445

Verwysing / Reference / ISalathiso: 20021125-0007

Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

APPROVED SCHOOLS

- Luleka Primary
- Linge Primary
- Nolungile Primary
- Luzuko Primary — 6333015 Tembisa, Gloria,
- Mazdlekhaya Primary
- Oakhurst Girls' Primary
- Ottery Road (Meth) Primary
- S.S College Junior
- Wynberg Girls'
- Grootte Schuur Primary

HEAD: EDUCATION

DATE: 2002/12/05

MELD ASSEBLIEF VERWYSINGSNOMMERS IN ALLE KORRESPONDENSIE / PLEASE QUOTE REFERENCE NUMBERS IN ALL CORRESPONDENCE / NCEDA UBHALE IINOMBOLO ZESALATHISO KUYO YONKE IMBALELWANO

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Appendix 3 Informed Consent for participants

<u>MOTHER AND DAUGHTER'S CONSENT FORM</u>

RE: Permission to interview schoolgirls in grades 4 and 5 and their mothers with regard to attitude, beliefs and practices regarding body weight, nutrition and lifestyle.

Dear parent / guardian

The University of Cape Town, and the Medical Research Council of Chronic Diseases of Lifestyle Unit is doing a study concerning the **"attitude, beliefs and practices regarding body weight, nutrition and lifestyle"** in South African schoolgirls (9-11 years old) and their mothers.

In this study, various schools reflecting different socio-economic and socio-cultural statuses in the Western Cape metro pole have been randomly selected. The reason we are contacting you specifically is that your school falls under the list of schools selected and we would like to invite you and your daughter to participate in our study.

We will be using trained field workers to interview the girls and their mothers with regard to their maturational status, dietary knowledge, practices, beliefs and attitudes toward body weight and health. In addition, we will be measuring weight, height and body fatness. Body fatness will be measured in a form of skin fold thickness where we will gently grasp the skin of the arm between the thumb and forefinger. These tests may all be conducted in ordinary PT clothes without shoes.

Subjects who are chosen to participate will be required to wear a uni-axial accelerometer over a period of 4 days (two weekdays and two weekend days). The accelerometers are of <u>dental-floss size</u>, attached to an adjustable belt and will be fitted around the waist of each subject. They are non-invasive devices, which have been previously used in research to measure movement patterns in individuals. The <u>battery-operated</u> accelerometers are user-friendly, can be worn securely underneath clothing when necessary, and will not prevent participation in everyday activities. They should, however, be removed when bathing or swimming.

No harm will be done to the subjects and all the information obtained will be highly confidential. The number on the completed form will identify the test subjects not their names.

All girls must have a written permission from parents or caregivers before they can participate, and interested mothers are also invited to take part during a "parents evening" or any other preferred time by the mother.

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If interested, we will like you to sign the form consenting for yourself and your daughter to participate in our study.

Thanking you

Prof. V.E. Lambert
UCT/MRC Research Unit
Department of Human Biology
University of Cape Town

Ms Zandile Mciza (Registered Dietitian)
UCT/MRC Research Unit
Department of Human Biology
University of Cape Town

Please sign (1) below to consent for your daughter and (2) below to consent for yourself (if you are a female above 18 years of age). Sign both (1) and (2) to consent for both you and your daughter

1) I ………………………………………………………………… **(name of parent or legal guardian)** give informed consent on behalf of my daughter …………………………………………….. **(name of the girl)** to participate in the above-mentioned study. I have read and fully understand the information about the study.

2) I ……………………………………………………………… **(name of the mother or female legal guardian)** am willing to participate in the above-mentioned study. I have read and fully understand the information about the study. Please indicate time and date preferred ……………………………

Be informed that you are free to withdraw at any time from the study, without prejudice, if you wish to do so.

Signature of Parent or guardian: **DATE:**

………………………………….
…………………………………..

Witness: **DATE:**

………………………………….
…………………………………

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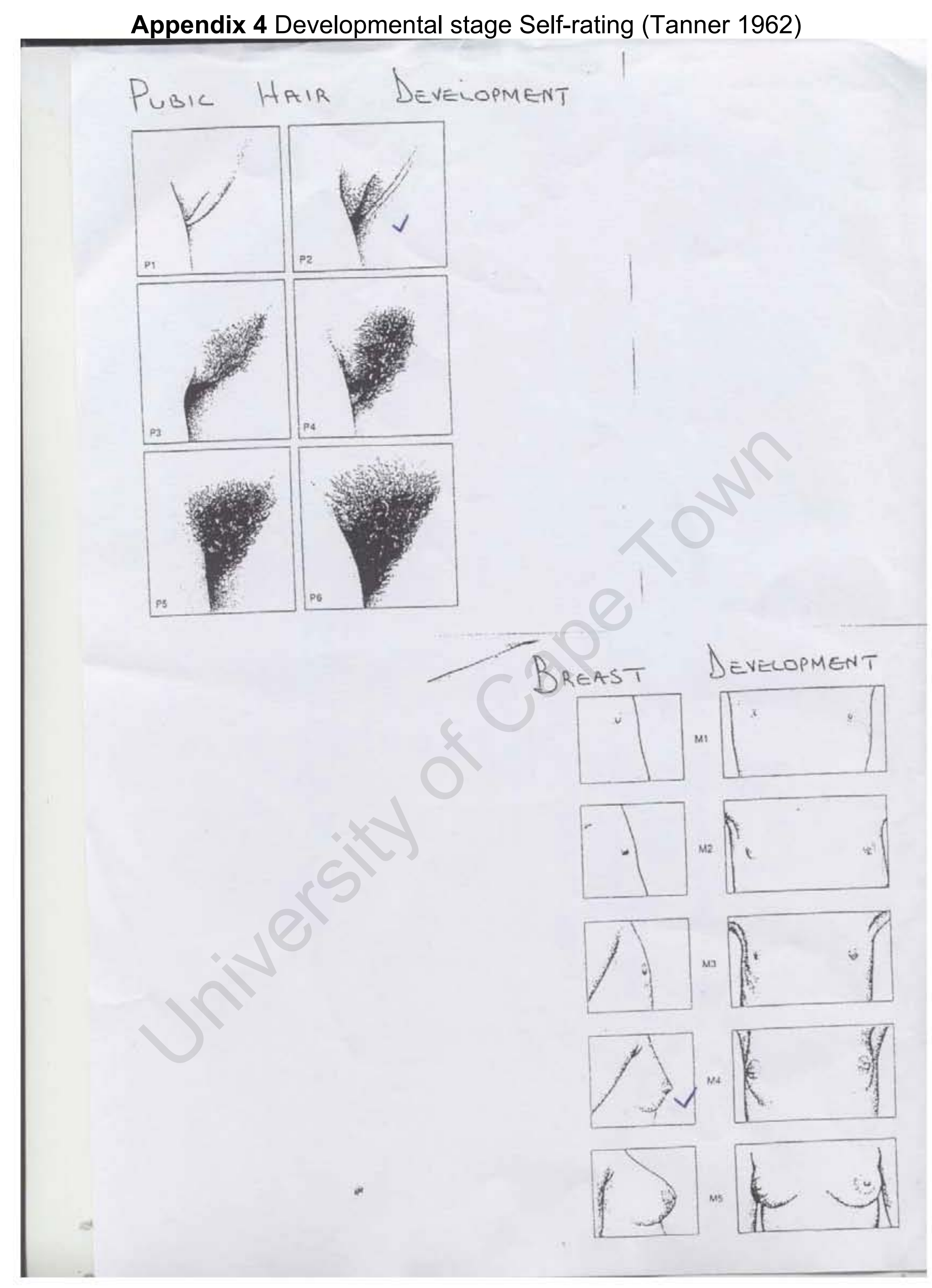
Appendix 4 Developmental stage Self-rating (Tanner 1962)



Appendix 5.1A Socio-demographics, dietary and physical activity knowledge, body image, self-efficacy, self-perception and environmental factor questionnaire for girls

QUESTIONNAIRE 2002		Office use	
I. ID. Nr of participant			3
2. Name of participant			
3. Home Address			
4 Home telephone number			
5. Name of School			
6. Grade of the participant			
7. Age on your last birthday	yrs		15
8. Date of birth:	D D M M Y Y Y Y / 1 9	1 9	23
9. Date of interview:	D D M M Y Y Y Y / 2 0 0	2 0 0	31

SOCIOECONOMIC STATUS

10. How many people live in your household, including you?

11. How many brothers and sisters do you have:

Brothers	
Sisters	

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12. Do your grandparents live with you?

Yes	1
No	2

13. Your position in your family:

First born	1
Second born	2
Third born	3
Fourth born	4
Other	5

14. Who looks after you most of the time:

Your mother	1
Your father	2
Your mother and father	3
Your sister / brother	4
Your grandmother	5
Your grandfather	6
Other	7

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15. Is the person looking after you:

Employed	1
Unemployed	2
A pensioner	3
On a disability grant	4
Do not know	5
Others:	6

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16. Is the person looking after you?

Married	1
Living with a boyfriend / girlfriend	2
Never married	3
Separated	4
Widowed	5
Divorced	6

17. What is the highest level of education did the person pass?

Never went to school	1
Std < 5	2
Std 5-7	3
Std 8-10	4
Do not know	5
Other:	6

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CULTURAL IDENTITY

18. To which ethnic group do you belong?

Black	1
Coloured	2
White	3
Indian	4
Other:	5

19. To which ethnic groups do most of your neighbors belong? (People on your street)

Black	1
Coloured	2
White	3
Indian	4
Other:	5

20. Do you go to school in the same area as you stay?

Yes	1
No	2

21. Which language is spoken at home?

Xhosa	1
English	2
Afrikaans	3
Other:	4

22. Do you understand Xhosa when someone else speaks it?

Yes	1
No	2

23. Do you understand English when someone else speaks it?

Yes	1
No	2

24. Do you understand Afrikaans when someone else speaks it?

Yes	1
No	2

25. Do the adults in your home teach you about Xhosa people?

Yes	1
No	2

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26. Do the adults in your home teach you about English people?

Yes	1
No	2

27. Do the adults in your home teach you about Afrikaans people?

Yes	1
No	2

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DIETARY AND PHYSICAL ACTIVITY KNOWLEDGE

1(a) Choose the food that has the lowest amount of fat

Fried potato chips	1
Donuts	2
Whole-wheat jam sandwich	3

(b) Which lets you know you are doing an exercise that is good for your body?

Breathing harder	1
Getting dizzy	2
Becoming sleepy	3

© Which of these foods contain no fat?

Fried potatoes	1
Potato chips	2
Baked potatoes	3

(d) Choose the kind of milk that has the lowest amount of fat

Whole milk	1
Skim	2
2% milk	3

(e) Which dairy product has the lowest amount of fat?

Cheddar cheese	1
Cottage cheese	2
Full cream milk	3

(g) Which will get rid of fat in meat before you eat it

Fry meat until well done	1
Add spice to meat	2
Remove all the fat that you can see before cooking it	3

(h) Which of these breakfasts has the lowest amount of fat

Cereal / porridge with 2% fat milk	1
Cereal with skim milk	2
Cereal with full cream milk	3

(i) Which of these is the healthiest snack to eat?

Peanuts and raisins	1
Fat cake	2
NikNaks	3

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(j) Which beverage has the lowest amount of sugar?

Diet coke	1
Regular coke	2
Drink'o pop	3

(k) Which is the healthiest to eat during snack time

Apple	1
Cheese curls	2
Candy	3

(l) Choose the one you think is a healthy snack?

Potato crisps	Apple
1	2

(m) Choose the one you think have no fat?

Ice sucker	Ice cream
1	2

(n) Select the food you would choose for breakfast?

Fried egg	Maize porridge
1	2

(o) Which one of these foods has the most fat?

Donut	Brown bread
1	2

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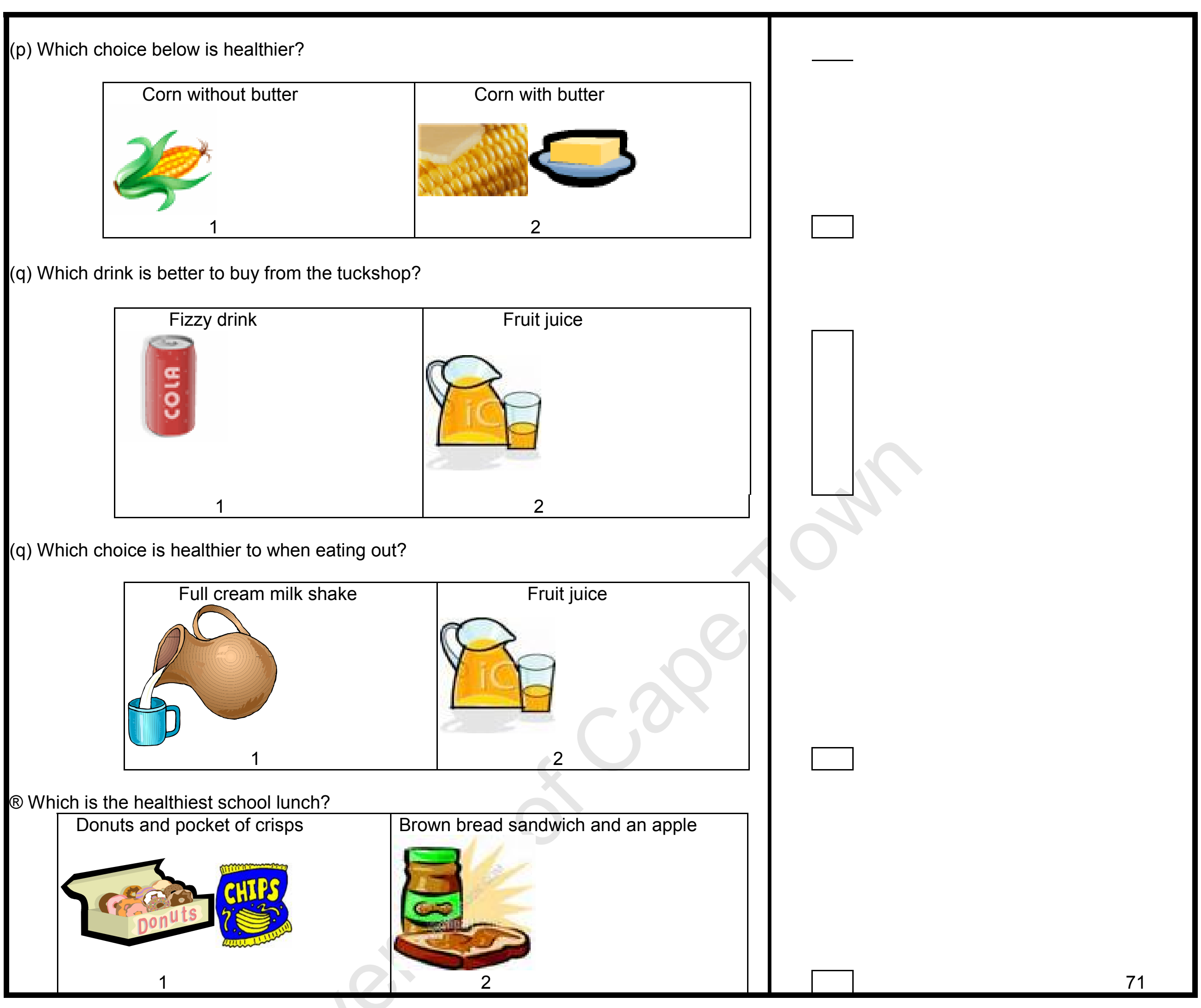

(p) Which choice below is healthier?

Corn without butter	Corn with butter
1	2

(q) Which drink is better to buy from the tuckshop?

Fizzy drink	Fruit juice
1	2

(q) Which choice is healthier to when eating out?

Full cream milk shake	Fruit juice
1	2

® Which is the healthiest school lunch?

Donuts and pocket of crisps	Brown bread sandwich and an apple
1	2

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BODY IMAGE SELF-ASSESSMENT, SIZE ACCEPTANCE AND SHAPE SATISFACTION

(a)

A B C D E F G H

1 2 3 4 5 6 7 8

2. Choose the girl that you think is:

Thin	
Normal weight	
Fat	

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3. Choose the girl that you think will:

Look best	
Be clumsy	
Have more respect from others	
Have less respect from others	
Be the strongest	
Be the weakest	
Be the happiest	
Be most unhappy	

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4. Choose the girl that:

You would want to look like	
Your mom / dad / grandma / grandpa / sister / brother will want you to look like	
Your friends will want you to look like	

5. Have you ever thought that you are thin:

Yes	1
No	2

6. Have your mom / dad / grandma / grandpa / sister / brother ever told you that you are thin

Yes	1
No	2

7. Have your friends ever told you that you are thin

Yes	1
No	2

8. Have you ever thought that you are fat:

Yes	1
No	2

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9. Have your mom / dad / grandma / grandpa / sister / brother ever told you that you are fat

Yes	1
No	2

10. Have your friends ever told you that you are fat

Yes	1
No	2

11. Which one of the pictures do you think you look the most like?

12. How happy are you with your present weight?

Happy	1
Not sure / somewhat happy	2
Unhappy	3

13. Do you think you are:

Underweight	1
Normal weight	2
Overweight	3

14. Do you worry about being thin?

Yes	1
No	2

15. Do you worry about being fat?

Yes	1
No	2

16. Have you ever tried to lose weight?

Yes	1
No	2

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17. Are you now trying to lose weight?

Yes	1
No	2

18. Have you ever tried to gain weight?

Yes	1
No	2

19. Are you now trying to gain weight?

Yes	1
No	2

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20. Choose one method you used / are using to lose weight: (Answer this if you said yes to 16 or 17)

Reduced the amounts of food I use to eat	
Exercise more	
Skip some meals	
Starve myself the whole day	
Use weight reducing medications	
Other:	

21. Choose one method you used / are using to gain weight: (Answer this if you said yes to 18 or 19)

Increased the amounts of food I used to eat	
Exercise more	
Eat more meals than I usually eat each day	
Take supplements to increase energy intake	
Other:	

22. If a girl of your age is thin she would:

a) Have more friends	Yes=1	No=2
b) Feel better about herself	Yes=1	No=2
c) Be prettier	Yes=1	No=2
d) Feel more like a girl	Yes=1	No=2
e) Be healthier	Yes=1	No=2

23. If a girl of your age is fat she would:

a) Have more friends	Yes=1	No=2
b) Feel better about herself	Yes=1	No=2
c) Be prettier	Yes=1	No=2
d) Feel more like a girl	Yes=1	No=2
e) Be healthier	Yes=1	No=2

SELF EFFICACY AND SELF- PERCEPTION FOR DIET AND PHYSICAL ACTIVITY

24. I can play hard during my break times:

I think I can	1
I know I can	2
I am not sure I can	3

25. I can ask for ice sucker instead of ice cream

I think I can	1
I know I can	2
I am not sure I can	3

26. I can play hard during most P.E classes

I think I can	1
I know I can	2
I am not sure I can	3

27. I can eat fruit everyday

I think I can	1
I know I can	2
I am not sure I can	3

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28. I can ask for water instead of fizzy drinks

I think I can	1
I know I can	2
I am not sure I can	3

29. I can keep on going for longer periods when doing activities like running

I think I can	1
I know I can	2
I am not sure I can	3

30. At the shop I can ask for fruit instead of NikNaks or chips

I think I can	1
I know I can	2
I am not sure I can	3

31. I can take stairs instead of a lift or escalators to the upper floors

I think I can	1
I know I can	2
I am not sure I can	3

32. I can put less butter on my bread

I think I can	1
I know I can	2
I am not sure I can	3

33. Some kids feel better about themselves physically

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

34. Some kids feel they are not strong compared to other kids

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

35. Some kids feel they are eating healthy

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

36. Some kids feel they have more muscles than other kids

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

37. Some kids feel they have beautiful and strong bodies compared to the others their own age:

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

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38. Some kids have a lot of energy for hard physical exercise

Just like me	1
A little like me	2
Not much like me	3
Not at all like me	4

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DIETARY AND PHYSICAL ACTIVITY SOCIAL SUPPORT AND BARRIERS

39. Do your teachers encourage you to play hard during P.E classes?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

40. Do you and your friends play hard games that make you sweat?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

41. Do the adults at home talk about ways of staying physically active?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

42. Do you have classes where you talk about healthy eating at school?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

43. Do the adults at home eat fruits and vegetables?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

44. Do you and your friends encourage each other to buy fruit instead of NikNaks?

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

45. Break times are too short to play hard games

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

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46. The route to school is too dangerous or too far to walk

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

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47. The weather is too bad to play sport or active games outside

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

48. Fruits are too expensive for me to eat everyday

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

49. Low fat or skim milk does not taste as good as full cream milk

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

50. Our vendor or cafeteria does not sell fruit but only NikNaks or chips

Never	1
Once in a while	2
Sometimes	3
Most of the time	4

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Appendix 5.1B Girls questionnaire for measuring dietary intake

A STRUCTURE 24-hr RECALL
QUICK LIST

Please tell me everything you had to eat and drink all day yesterday from the time you woke up to the time you went to sleep Include everything you ate and drank at home and away, even snacks, coffee, soft drinks and candies. I will ask you for the specific details and amounts of the foods in a few minutes.

	Food Items	Tick
Breakfast		
AM snack		
Lunch		
Midday snack		
Dinner		
Late night snack		

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In addition to the foods you have told me about, did you have any of these?

Food Items	Y	N
a. Coffee, tea, soft drinks, milk or juice?		
b. Cookies, candy, ice cream, or other sweets?		
c. Chips, crackers, popcorn, pretzels, nuts or other snack foods?		
d. Fruits, vegetables, or cheese?		
e. Breads, rolls, rice, pasta or porridge?		
f. Did you eat/drink anything else you have not already told me about?		

STRUCTURED 24 – H - RECALL	FOR OFFICE USE

1. CEREALS

FOOD ITEM	SERVING SIZE	No. of servings	Amount	Total Amt
Custard / Maizena	½ cup = 125ml			.
Maize porridge	½ cup = 125ml			.
Samp / mealie rice	½ cup = 125ml			.
White rice	½ cup = 125ml			.
White bread / rolls	1 slice / 1 roll = 30g			.
Brown bread / rolls	1 slice / 1 roll = 30g			.
Oats	½ cup = 125ml			.
Pasta	¾ cup = 125ml			.
				.
				.

2. SUGAR

FOOD ITEM	SERVING SIZE	No. of servings	Amount	Total Amt
White	1t = 5g			.
Brown	1t = 5g			.
Honey	1t = 15g			.
Syrup	1t = 15g			.

3. SPREADS

FOOD ITEM	SERVING SIZE	No. of serv.	Amt.	Total Amt
Peanut butter	1t = 12g			.
Margarine (soft)	1t = 5g			.
Margarine (hard)	1t = 5g			.
Butter	1t = 5g			.
Fish paste	Thin = 5g, medium = 7g, thick = 10g			.
Cheese spread	Medium = 12g, thick = 25g			.
Meat spread	Thin = 5g, medium = 7g, thick = 10g			.
Marmite	Thin = 2g, medium = 4g, thick = 7g			.
Jam	1t = 15g			.
Mayonnaise	1t = 15g			.
				.
				.

4. DAIRY: Milk in tea / coffee

FOOD ITEM	SERVING SIZE	No. of servings	Amount	Total Amt
Whole milk	¼ cup = 72.5ml			.
2% milk	¼ cup = 72.5ml			.
Condensed milk	1t = 15g			.
Cremora / Ellis Brown	Lt = 4g			.
				.

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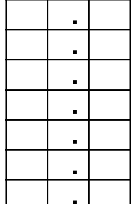
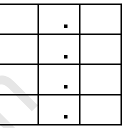
5. DAIRY: Milk to drink

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Whole milk	1cup = 250ml		
2% milk	1cup = 250ml		
Maas	1cup = 250ml		
Buttermilk (milk blend)	1cup = 250ml		
Yoghurt	½ cup = 125ml		
Flavoured milk	1cup = 250ml		



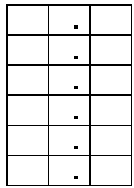
6. DAIRY PRODUCTS

FOOD ITEM	SERVING SIZE	No. of serv	Amt
Yellow cheese	1slice=8g,grated med=10g, thi=15g,cube = 30g		
White cheese	Medium = 20g, thick = 30g		



7. DRINKS

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Diet fizzy	Regular can = 340ml		
Regular fizzy	Regular can = 340ml		
Squashed – Oros	½ cup = 125ml		
Mix – a - drink	½ cup = 125ml		



8. MEAT & MEAT PRODUCTS

FOOD ITEM	SERVING SIZE	No. of serv.	Amt.
Beef stew	½ cup = 125g		
Beef steak	Match box size = 30g		
Beef offal	½ cup = 125g		
Beef liver	Deck of cards = 80g		
Beef mince	½ cup = 100g		
Mutton chops	Match box size = 30g		
Mutton stew	½ cup = 125g		
Chicken fried	W=30g,D=42g,T=80g,B+skin=125g		
Chicken heads and feet	1 foot / head = 30g		
Chicken livers	1T = 30g		
Chicken stew	½ cup = 125g		
Pork chops	Match box size = 30g		
Sausage / Russian	Thin x 200mm = 45g		
Polony	1 slice = 10g		
Viennas	100mm = 30g		
Bacon	1 slice = 10g		

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9. LEGUMES

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Split pea soup	½ cup = 125ml		
Baked beans	½ cup = 125ml		
Beans and Samp	½ cup = 125ml		
Dry bean soup / stew	1cup = 250ml		
Lentil soup	1 cup = 250ml		

10. FISH & SEAFOOD

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Pilchards	¼ cup = 50g		
Tuna in water	¼ cup = 50g		
Tuna in oil	¼ cup = 50g		
Fried fish in crumbs	Medium = 120g		
Baked fish	Medium = 100g		

11. FRUIT

FOOD ITEM	SERVING SIZE	No of servings	Amount
Guava	Medium = 95g		
Apple / Pear (fresh)	Medium = 120g		
Orange / Naartjies	Medium = 150g		
Grape	Medium (15) = 120g		
Banana	Medium = 75g		
Peach	Medium = 120g		
Fruit juice (unsweet)	1 cup =250ml		
Fruit juice (sweetened)	1 cup = 250ml		
Dried fruit (prunes)	1 handful = 27g		

12. VEGETABLES

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Boiled potatoes	½ cup = 90g		
Fried potato /chips	11 chips		
Baked potatoes	1 Medium = 90g		
Jacket potatoes	1 Medium = 90g		
Boiled potatoes	1 Medium = 90g		
Boiled carrots	½ cup = 85g		
Carrot salad	½ cup = 85g		
Pumpkin / squash	1T = 45g		
Cabbage	¼ cup = 80g		
Green beans	½ cup = 80g		
Spinach	¼ cup = 80g		

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13. EGGS

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Whole boiled / poached	1 egg = 50g		
Scrambled in oil	1T = 35g		
Fried	1 egg = 52g		

14. PASTRIES

FOOD ITEM	SERVING SIZE	No. o servings	Amount
Savoury tarts e.g. apple	1/6 = 1 slice		
Meat pie	1 pie		
Chicken pie	1 pie		
Samoosa	2 small		
Vetkoek	Medium = 60g		
Koeksister	Medium = 60g		
Chilibites	2 small		
Chocolate cake	1/16 = 1 slice		
Cake	1/16 = 1 slice		
Regular Rusks	1 rusk		
Health Rusks with bran	1 rusk		
Regular Biscuits	3 biscuits		
ProVita Biscuit	3 biscuits		

15. CRISPS

FOOD ITEM	SERVING SIZE	No. of servings	Amount
Potato crisps	1 small packet = 30g		
Peanuts & raisins	1 small packet = 30g		
Nicknaks / Cheese curls	1 small packet = 30g		
Savoury	1 small packet = 30g		
Fritos	1 small packet = 30g		
Popcorn	1 small packet = 30g		

16. SWEETS

FOOD ITEM	SERVING SIZE	No. of servigs	Amount
Soft sweets (Toffee)	3 sweets		
Chocolate	3 squares		
Ice cream	½ cup = 75g		
Ice lollies	1 lolly		
Hard boiled	3 sweets		

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17. CHOOSE ONE STATEMENT THAT SUITS YOU BEST

Had less than three meals the previous day	
Had only three meals the previous day	
Had three meals with snacking inbetween the previous day	
Had more than three meals with snacking inbetween the previous day	
Other: (please specify)	

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Appendix 5.1C Girls questionnaire for measuring physical activity / inactivity

ACTIVITY AT SCHOOL

1. Do you attend physical education (PE) / physical training (PT) / gym / games at school?

Yes	1
No	2

2. If Yes, how many classes do you have a week?

3. Using this cue card of school sports, over the last 12 months which 3 do you participate in the most?

ACTIVITY	Intensity Rating	Months	Minutes / day	Days / week	Minutes / week

Met / min / week

ACTIVITIES OUT OF SCHOOL

4. Using this cue card of out of school sports, which 3 do you participate in the most, in a sports club but not as your school sports?

ACTIVITY	Intensity Rating	Months	Minutes / day	Days / week	Minutes / week

Met / min / week

5. Using this cue card of out of school sports, which 3 do you participate in the most, but not in a sports club or as your school sports?

ACTIVITY	Intensity Rating	Months	Minutes / day	Days / week	Minutes / week

Met / min / week

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SEDENTARY ACTIVITIES:	
6. On an average night of the week, at what time do you go to sleep?	
[ ][ ] pm	[ ][ ]
7. And at what time do you wake up, the next morning?	
[ ][ ] am	[ ][ ]
8. Do you have a computer at home?	
Yes 1 No 2	[ ]
9. If the answer on 8 is Yes, during a normal weekday how many hours do you spend playing on your computer?	
[.][ ]	[.][ ]
10. If the answer on 8 is Yes, during a normal weekend how many hours do you spend playing on your computer?	
[.][ ]	[.][ ]
11. During a normal weekday, how many TV shows OR how many hours do you spend watching TV each day?	
Shows [ ][ ] Hours [.][ ]	[ ][ ] [.][ ]
12. During a normal weekend, how many TV shows OR how many hours do you spend watching TV each day?	
Shows [ ][ ] Hours [.][ ]	[ ][ ] [.][ ]

ACTIVITY FOR TRANSPORT	
13. How do you usually get to school / to the bus stop / taxi rank / train station? Choose one of the following:	

Walk to school	1
Walk to the taxi rank	2
Walk to the bus stop	3
Walk to the train station	4
Do not walk (driven on parents' car)	5
Other	6

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14. If you do walk to school / to the bus stop / taxi rank / train station, how many minutes does it take you to walk there?

Less than 15 minutes	**1**
15-30 minutes	**2**
30-60 minutes	**3**
More than 1 hour	**4**

15. If you do walk to school / to the bus stop / taxi rank / train station, how fast do you walk?

I walk slowly and there is no change in my breathing	**1**
I walk quickly which makes me breathe harder than normal	**2**
I walk very quickly, sweat a lot and breathe harder than normal	**3**

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Appendix 5.1D ACTIVITYGRAM

17. ACTIVITYGRAM

Select the activity you do on an average day during each 30minute interval from the list below

	REST	LIGHT	MODERATE	VIGOROUS
ACTIVITY				

TIME	REST	LIGHT	MOD	VIG	TIME	REST	LIGHT	MOD	VIG
06 : 00					14 : 30				
06 : 30					15 : 00				
07 : 00					15 : 30				
07 :30					16 : 00				
08 : 00					16 : 30				
08 : 30					17 : 00				
09 : 00					17 : 30				
09 : 30					18 : 00				
10 : 00					18 : 30				
10 : 30					19 : 00				
11 : 00					19 : 30				
11 : 30					20 : 00				
12 : 00					20 : 30				
12 : 30					21 : 00				
13 : 00					21 : 30				
13 : 30					22 : 00				
14 : 00					22 : 30				
14 : 30					23 : 00				

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Appendix 5.1E Television List

TV PROGRAM	Times/week	Tick	TV PROGRAM	Times/week	Tick
All my children			Rescue heroes		
Angela Anaconda			Reboot		
Back Stage			Sabrina		
Bart and Simpson			Safe Harbour		
Batman of the future			Secret files of the spy dogs		
Bold and the beautiful			Selimathunzi		
Bruno the kid friend			Seventh Heaven		
Bubblies			Sex in the City		
Cow and Chicken			Soccer zone		
Cleopatra			Soul Buddies		
Craze			Stanely		
Days of our lives			Star search		
DCC			Stunt dawgs		
Dilbert			Survivor		
Donald Dusc			Takalani Sesami		
Dracular 2000			Tarzan		
Ed – Eddy - Edy			Tazmania		
Eerie Indiana			Teletubbies		
Egoli			Timon and Pumba		
E news live at 7			Tube		
Fast and the forris			Weekenders		
Felicia			Winnie the Pooh		
Fresh prince of Bell Air			X- Attitude		
Generations			X Duck X		
Goof troop			Yeeow		
Gummy bear			Yo TV		
Hercules			Yowo		
Holy Man			You lucky fish		
Home made science			Zobomafoo		
House of mouse			Madam and Eve		
House of mouse			The kid		
Jam Alley			Quick Pack		
Jamie fox			Annie		
Jungle Cubs			Fun food ferenzy		
Jumanji			The Klumps		
Kind of Magic			WOW (women of restling)		
Kiss of the dragon			Who's line is it anyway		
Little monsters			Farm monsters		
Magic adventures of Mumfie			K-TV		
Mickey mouse			Even Steven		
Moesha			Digimon		
Molo Show			Little vampires		
MTN soccer zone			Pacific blue		
Once upon a time			Wayne Brady Show		
Pim			The Tham sawawa		

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Appendix 5.2A Socio-demography, dietary knowledge, body image, and body shape questionnaire for women

• QUESTIONNAIRE 2002 (WOMEN)		Office use
I. ID Nr of participant		
2. Name of participant		
3. Home Address:		
4. Home telephone number		
5. Age on your last birthday	yrs	
6. Date of birth:	D D M M Y Y Y Y 1 9	1 9
7. Date of interview:	D D M M Y Y Y Y 2 0 0	2 0 0 61

SOCIOECONOMIC STATUS

8. How many people live in your household, including you? — 63

9. How many rooms do you have in your house (including kitchen, lounge, dinning room and bedrooms?

10. How many rooms are there just for sleeping?

11. How would you describe your home?

Flat	1
Hostel	2
Shack	3
Brick House	4
Other:	5

12. What type of household water do you have access to?

Indoor water	1
Outside tap water	2
Other:	3

13. What type of toilet do you have?

Flush outside	1
Flush inside	2
Other:	3

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14. Which of the following do you have in your household at the present time?

Electricity	1
Television	2
Radio	3
Motor vehicle	4
Fridge	5
Stove	6
Microwave	7
Computer	8
Telephone	9

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15. What is your marital status:

Single	1
Married	2
Divorced	3
Widowed	4
Other	5

16. How many children do you have:

Boys		
Girls		

17. Do your in-laws stay with you?

Yes	1
No	2

18. Your position in your family:

Head	1
Wife	3
Other	2

19. Are you:

Employed	1
Unemployed	2
A pensioner	3
On a disability grant	4
Others:	5

20. Is your husband / partner:

Employed	1
Unemployed	2
A pensioner	3
On a disability grant	4
Others:	5

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21. What is the highest level of education did you pass?

Never went to school	1
Std < 5	2
Std 5-7	3
Std 8-10	4
Other:	5

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CULTURAL IDENTITY

22. To which ethnic group do you belong?

Black	1
Colored	2
White	3
Indian	4
Other:	5

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23. To which ethnic group do most of your neighbors belong? (people on your street)

Black	1
Colored	2
White	3
Indian	4
Other:	5

24. Which language do you speak at home?

Black	1
Colored	2
White	3
Indian	4
Other:	5

25. Do you understand Xhosa when someone speaks it?

Yes	1
No	2

26. Do you understand English when someone speaks it?

Yes	1
No	2

27. Do you understand Afrikaans when someone speaks it?

Yes	1
No	2

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DIETARY KNOWLEDGE

1. Based on your knowledge, choose each food that has more fat:

(a)

Peanuts	1
Popcorn	2

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(b)

Yoghurt	1
Sour cream	2

(c)

A piece of toffee	1
A boiled sweet	2

(d)

Small bran muffin	1
A slice of whole wheat bread	2

2. Do you agree with the following statements:

(a) Starchy food, like bread, potatoes and rice make people fat

Yes	1
No	2

(b). What you eat can make difference in your chance of becoming fat and getting diseases like heart disease or cancer

Yes	1
No	2

(c). The things I eat and drink now are healthy, so there is no reason for me to make changes

Yes	1
No	2

3. Compared to what is healthy, do you think your diet is:

(a) Energy (calories / kilojoules)

Too low	1
About right	2
Too high	3

(b) Protein (e.g. meat / chicken / fish / legumes)

Too low	1
About right	2
Too high	3

© Fat (e.g. butter / margarine / oil)

Too low	1
About right	2
Too high	3

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(d) Sugar and sweets

Too low	1
About right	2
Too high	3

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(e) Fruit

Too low	1
About right	2
Too high	3

(f) Vegetables

Too low	1
About right	2
Too high	3

(g) Breads, cereals, rice and pasta

Too low	1
About right	2
Too high	3

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MEASURES OF BODY IMAGE SELF-ASSESSMENT

A B C D E F G H I

1. Choose the picture of a woman that you think is:

Thin	
Normal weight	
Fat	

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2. Choose the picture of a woman that you think will:

Look best	
Be clumsy	
Have more respect than the others	
Have less respect than the others	
Be the strongest	
Be the weakest	
Be the happiest	
Be the most unhappy	

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3. Choose the woman that:

You would want to look like	
Your husband / partner will want you to look like	
Your friend will want you to look like	
Your children will want you to look like	

4. Which of the pictures do you think you look the most like:

5. How happy are you with your present weight?

Happy	1
Some what happy	2
Unhappy	3

6. Do you think you are:

Underweight	1
Normal weight	2
Overweight	3

7. Have you ever thought that you are thin:

Yes	1
No	2

8. Have you ever thought that you are fat:

Yes	1
No	2

9. Have your husband or partner ever told you that you are thin:

Yes	1
No	2

10. Have your friends ever told you that you are thin:

Yes	1
No	2

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11. Have your children ever told you that you are thin:

Yes	1
No	2

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12. Have your husband or partner ever told you that you are fat:

Yes	1
No	2

13. Have your friends ever told you that you are fat:

Yes	1
No	2

14. Have your children ever told you that you are fat:

Yes	1
No	2

15. Do you worry about being thin

Yes	1
No	2

16. Do you worry about being fat

Yes	1
No	2

17. Have you recently lost weight in the last 3-6 months without trying?

Yes	1
No	2

18. Have you recently gained weight in the last 3-6 months without trying?

Yes	1
No	2

19. Have you ever tried to lose / are now trying to lose weight

Yes	1
No	2

20. Have you ever tried to gain / are now trying to gain weight

Yes	1
No	2

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21. Choose the method that you used / are using to lose weight

Reduced the amount of food I eat	1
Exercise more	2
Skip some meals	3
Starve myself	4
Use weight reducing medications	5

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22. Choose the method that you used / are using to gain weight

Increased the amount of food I eat	1
Exercise more	2
Eat more meals than I usually eat each day	3
Take supplements to increase energy intake	4

23. If a woman of your age is thin, she would:

Have more friends	1
Feel better about herself	2
Be beautiful	3
Feel more like a woman	4
Be healthier	5

24. If a woman of your age is fat, she would:

Have more friends	1
Feel better about herself	2
Be beautiful	3
Feel more like a woman	4
Be healthier	5

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BODY SHAPE QUESTIONS

1. Has feeling bored made you to brood about your shape?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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2. Have you been so worried about your shape that you wanted to go on diet?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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3. Have you thought that your thighs, hips or bottom are too large for the rest of your body?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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4. Have you been afraid that you might become fat or fatter?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

5. Have you worried about your flesh not being firm enough?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

6. Has feeling full (e.g. after eating a large meal) made you feel fat?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

7. Have you felt so bad about your shape that you have cried

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

8. Have you avoided running because you flesh might wobble?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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9. Has being with thin women made you feel self-conscious about your shape?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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10. Have you worried about your thighs spreading out when sitting down?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

11. Has eating even small amount of food made you feel fat?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

12. Have you noticed the shape of other women and felt that your own shape compared unfavorably?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

13. Has thinking about your shape interfered with your ability to concentrate (e.g. while watching television, reading, and listening to conversations)?

Always	1
Often	3
Very often Sometimes	2 4
Rarely	5
Never	6

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14. Has being naked, such as when taking bath, made you feel fat?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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15. Have you avoided wearing clothes, which make you particularly aware of the shape of your body?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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16. Have you imagined cutting off fleshy areas of you body?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

17. Has eating sweets, cakes or other high calorie foods made you feel fat?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

18. Have you not gone out to social occasions (e.g. parties) because you have felt bad about your shape?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

19. Have you felt excessively large and rounded?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

20. Have you felt ashamed of your body?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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21. Has worrying about your body made you diet?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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22. Have you felt happiest about your shape when your stomach has been empty (e.g. in the morning?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

23. Have you felt that you are in the shape you are because of lack of self-control?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

24. Have you worried about other people seeing rolls of fat around your waist and stomach?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

25. Have you felt that it is not fair that other women are thinner than you?

Always	1
Very often	2
Often	3
Sometimes	4
Never	6
Rarely	5

26. Have you vomited in order to feel thinner?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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27. When in company, have you worried about too much of room (e.g. sitting on a sofa or bus seat)?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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28. Have you worried about your flesh being dimply?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

29. Has seeing your reflection (e.g. in a mirror or shop window) made you feel bad about your shape?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

30. Have you pinched areas of your body to see how much fat is there?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

☐

31. Have you avoided situations where people could see your body (e.g. communal changing rooms or swimming baths)?

Always	1
Often	3
Very often	2
Sometimes	4
Rarely	5
Never	6

☐

32. Have you taken laxatives in order to feel thinner?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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33. Have you been particular self-conscious about your shape when in the company of other people?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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34. Has worry about your shape made you feel you ought to exercise?

Always	1
Very often	2
Often	3
Sometimes	4
Rarely	5
Never	6

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Appendix 5.2B Women's questionnaire for measuring dietary intake (QFFQ)

NUTRITION SURVEY IN S.A. WOMEN

Subject Name: ______________________________

Subject Number:							Interview Date:							
Birth Date:							Interviewer:	______________						

QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE

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Thank you for giving up your time to participate in this study. We would like to find out what you usually eat and drink. This information is important to know, as it will tell us about the South African women's habitual intake and dietary habits.

Please think carefully about the food and drinks that you have consumed during the **PAST 1 MONTH**. I will now go through a list of foods and drinks with you and I would like you to tell me:

- if you have eaten these particular foods,
- how the food is prepared (by you or someone else)
- how much of the food is eaten at a time, and
- how many times a day you eat it and if the food is not eaten every day, how many times a week or a month it is eaten?

To help you to describe the amount of a food, I will show you photographs of different amounts of the food. Please say which photo is the closest to the amount eaten. Amounts can also be reported as cups (c), tablespoons (T), ladles (L) teaspoons (t) or some other household measure.

- THERE ARE NO RIGHT OR WRONG ANSWERS.
- EVERYTHING YOU TELL ME IS CONFIDENTIAL
- IS THERE ANYTHING YOU WANT TO ASK NOW?
- ARE YOU WILLING TO GO ON WITH THE QUESTIONS?

		DESCRIPTION					FREQUENCY

				(g/ml)	usually eaten (HHM)	usually eaten (g)	Per day	Days per week	Times per month	Seldom/ Never
	Maize-meal porridge	Stiff (Pap) – Plain	3400	1c stiff = 250g 1T = 75g						
		Enriched	4278							
		Soft(slappap)-Plain	3399	1c soft = 250g 1T = 75g						
		Enriched	4277							
		Crumbly(Phutu)-Plain	3401	1c crumbly=140g 1T = 30g						
		Enriched	4279							
	Sour porridge	Maize with Vinegar Maize Fermented Mabella with Vinegar Mabella fermented	P0001 P0002 P0003 P0004	½ c = 125g 1 c = 250g						
	Mabella porridge/ Cornrice	Stiff Soft	3437 3437	½ c = 125g						
	Maltabella Porridge	Stiff Soft	3241 3241	½ c = 125g						
	Oats Porridge	Brand Name:	3239	½ c = 125g						
	Other cooked cereals	Specify Type:								
	Milk on porridge (Circle type usually used)	None								
		Whole/Fresh	2718	Little = 30g Med. = 60g Much = 125g						
		Sour (Amasi)	2787							
		2%	2772							
		Fat free / Skim	2775							
		Milk Blend	2771							
		Soy Milk	2737							
		Condensed (Whole,sweet)	2714	1t = 10g						
		Condensed (Skim,sweet)	2744							
		Evaporated Whole	2715	1t = 3g						
		Evaporated Low Fat	2827							
		Non-Dairy Creamer (Cremora etc)	2751	1t = 4g						
	Is sugar added to porridge? (Circle type usually used)	None								
		White	3989	1t sugar = 6g						
		Brown	4005							
		Syrup	3988	1t honey/syrup = 15g						
		Honey	3984							
		Sweetener: Type								
	Is fat added to porridge? (Circle type usually used)	None								

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	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
	Is fat added to porridge? (Circle type usually used)	Animal Fat (Butter)	3479	1t marg/oil=5g						
		Hard Margarine	3484							
		Soft Margarine (PM)	3496							
		Soft Margarine (Med)	3531							
		Sunflower Oil	3507							
		Peanut Butter	3485	1t = 12g						
BREAKFAST CEREAL	Breakfast Cereal	Specify types usually eaten		(See manual)						
	Milk on Cereal	None								
		Whole/Fresh	2718	Little = 80g Med. = 125g Much = 180g						
		Sour (Amasi)	2787							
		2%	2772							
		Fat free / Skim	2775							
		Milk Blend	2771							
		Soy Milk	2737							
		Condensed (Whole,sweet)	2714	1t = 10g						
		Condensed (Skim,sweet)	2744							
		Evaporated Whole	2715	1t = 3g						
		Evaporated Low Fat	2827							
		Non-Dairy Creamer (Cremora etc)	2751	1t = 4g						
	Is sugar added to cereal? (Circle type usually used)	None								
		White	3989	1t sugar = 6g						
		Brown	4005							
		Syrup	3988	1t honey/syrup = 15g						
		Honey	3984							
		Sweetener: Type								
	Is fat added to cereal	Specify type:		(See Manual)						

I am now going to ask about starchy foods:

STARCHES	Samp/Maize Rice	Samp, White	3250	1T = 55g 1L = 125g; ½c = 125g						
		Maize Rice	3250							
	Samp & Beans	Specify Ratio:	3402	1T = 50g 1L = 125g ½c = 125g						
	Samp & Peanuts	Specify Ratio:	P0013							
	Rice: Specify Brands Names	White	3247	1T = 25g;						

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		DESCRIPTION	CODE	QUANTITY (g/ml)						
		Brown	3315	1L = 60g ½c = 65g						
	Stamped Wheat		3249	1T = 30g 1L = 80g ½c = 80g						

STARCHES	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
	Pastas	Macaroni	3262	1T = 35g 1L = 70g ½c = 90g						
		Spaghetti Plain	3262							
		Spaghetti & Tomato Sauce (Tinned)	3258	1T = 45g 1L = 80g ½c = 125g						
		Other : Specify								
	Do you add fat to any of these starchy foods	Yes______ No _______ If yes, specify types, amounts and to which food?		(See Manual)						

Now we come to bread and bread spreads:

BREADS AND SPREADS										
	Bread/Bread rolls	White	3210	Wh+Br = 30g (Shopcut)						
		Brown	3211	Wh+Br 20mm= 60g Wh+Br30mm=100g ½ loaf = 400g						
		Whole Wheat	3212	Ww = 35g (Shopcut)						
	Vetkoek	Other bread: Specify type:		8cm diam = 60g large – 235g						
	Provita		3235	1biscuit = 6g						
	Crackers	Cream Crackers	3230	1biscuit = 8g						
		Savoury (eg Tuc)	3331	1biscuit = 4g						
		Wholewheat	3391	1biscuit = 8g						
	Pizza	(Specify Toppings)		(See Manual)						
	Hotdogs	(Specify Sausage)		(See Manual)						
	Hamburger			(See Manual)						
	Are any of the following spreads used on your bread? Fat Spreads:	Butter	3479	1t = 5g						
		Butro	3523							
		Animal Fat (Beef Tallow)	3494							
		White fat (Holsum)	3495							
		Hard margarine	3484							
		Soft margarine (PM)	3496							
		Soft margarine (Med)	3531							
	PeanutButter		3485	1t = 12g						
	Sweet Spreads	Jam	3985	1t = 15g						
		Syrup	3988							

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		Honey	3984							
	Marmite / OXO	Marmite	4030	Thin = 2g ; med = 7g ; thick = 7g						
		Oxo	4029							

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
BREADS AND SPREADS	Paste	Fish Paste	3109	Thin = 2g; med = 4g; thick = 7g						
		Meat Paste	2917							
	Cheese (Specify types)	Cheddar	2722	Grated: med = 10g; thick = 15g; cubes=30g; slice = 8g; cheezi=20g						
		Gouda	2723							
		Cottage Low-fat Cheese	2760	Med = 20g; thick=30g						
		Cream Cheese	2725	Thin = 10g; med=20g						
		Other cheese, specify type								
	Cheese Spreads (Specify types)		2730	Med = 12g; thick=25g						
	Atchar		3117	1T = 14g; 1L=60g						
	Other Spreads (Specify types)									

You are being very helpful. Can I ask you about protein foods? These are: meat, beans, chicken, fish and eggs.

CHICKEN	Chicken	Boiled with skin	2926	Breast + skin = 125g Thigh = 80g Drumstick = 42g Foot = 30g Wing = 30g						
		Boiled without skin	2963							
		Fried in batter (Kentucky)	3018							
		Fried – not coated	2925							
		Roasted/grilled with skin	2925							
		Roasted/grilled without skin	2950							
	Chicken Bones Stew	(Specify ingredients)	P0048							
	Chicken Heads		2999							
	Chicken Stew	With vegetables	3005	1L = 90g ½ c = 125g						
		With tomato & onion	2985							
	Chicken feet		2997	Foot = 30g						
	Chicken offal	Giblets	2998	Stomach = 20g						
	Chicken liver		2970	Liver = 30g						
	Chicken pie	Commercial or homemade	2954	Med. = 150g						
BEEF	Beef	Roasted with fat	2944	Thin slice = 35g Thick slice = 70g						
		Roasted, fat trimmed	2960							
		Rump, fried with fat	2908	Small = 125g Large = 270g						
		Rump, fried, fat trimmed	2959							

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		Stewed/Boiled/with fat (Cabbage)	3006	1L = 105g ½ c = 125g						
		Stewed/Boiled without fat (Vegetables)	2909							

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
RED MEAT	Beef	Mince with tomato and onion	2987	1t = 40g; 1L= 85g; ½ c = 100g						
		Other preparation methods								
	Mutton	Fried/Grilled: with fat	2927	Loin chop = 60g Rib chop = 40g						
		Fried/Grilled without fat	2934							
		Stew: Plain	2974	1L = 105g ½ c = 125g						
		Stew: Irish (Vegetables)	2916							
		Stew: Curry	3039							
		Stew: Greenbean	3040							
		Other preparation methods								
	Pork	Fried/Grilled: with fat	2930	Chop: = 100g Schnitzel: = 110g Roast: slice = 30g 1L = 105g ½ c = 125g						
		Fried/Grilled: without fat	2977							
		Roast with fat	2958							
		Roast without fat	2978							
		Other preparation methods								
	Goat	Fried/Grilled: with fat	P0008	Thin slice = 35g Thick slice = 70g						
		Fried/Grilled: fat trimmed	P0009							
		Stewed (Plain)	4281	1L = 105g ½ c = 125g						
		Stewed (with vegetables)	4282							
		Other preparation methods:								
MEAT: GENERAL	Offal	"Vetderm" fried	P0023	1L = 105g ½ c = 125g						
		Liver: beef (fried)	2920	80g						
		Liver: Sheep (fried)	2955	55g						
		Kidney (Beef)	2923	85g						
		Kidney (Sheep)	2956	30g						
		Tripe, Beef,Cooked in Milk	2951	1L = 105g ½ c = 125g						
		Heart (Beef)	2968	60g						
		Heart (Sheep)	2969	60g						
		Lung (Beef)	3019	60g						
	Wors/Sausage	Fried	2931	Thinx200mm = 45g Thickx165mm = 90g						
	Bacon	Fat	2906	1 rasher = 10g						
		Lean	2915							
	Cold Meats	Polony	2919	Slice 5mm thick=8g Comm slice = 16g						
		Ham	2967	Med. Slice = 25g						

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		Viennas	2936	100mm = 30g; 150mm = 40g						
		Other								
	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
MEAT: GENERAL	Canned meats	Bully Beef	2940	1 slice = 20g ½ c = 100g						
		Other (Specify)								
	Meat pies	Bought (Steak & Kidney)	2957	120g						
		Other (Specify)								
	Legumes (Specify dried beans/peas/legumes)	Stews (Bean, Potato & Onion)	3178	1T = 60g; 1L = 120g ½ c = 125g						
		Soups: Commercial	3165	½ c = 125g 1T = 35g; 1L = 80g ½ c = 125g						
		Split Pea	3157							
		Lentil	3153							
		Beef & Vegetables	3159							
		Bean	3145							
		Bean Salad	3174	1T = 40g; 1L = 105g ½ c = 125g						
	Soya Products eg Toppers / Imana	(Specify)	3196	1L = 85g; ½ c = 120g						
FISH	Fried Fish (Fresh or Frozen, Fried in Sun Oil)	With Batter/Crumbs	3094	Small = 60g Med = 120g Large = 180g						
		Without Batter/Crumbs	3084							
	Canned Fish	Pilchards in Brine	3055	1 pilchard =75g						
		Pilchards in Tomato sauce	3102							
		Pilchards, mashed	3102	1L = 85g ½ c = 100g						
		Sardines in Oil	3104	Small = 7g; Large = 25g						
		Sardines in tomato sauce	3087							
		Tuna in Oil	3093	¼ c = 50g						
		Tuna in Brine	3054							
		Other (Specify)								
	Pickled Fish / Curried Fish		3076	1L = 95g; ½ c = 140g						
	Do you remove fish bones before eating canned fish? Yes:_________ No: ________									
	Fish Cakes	Fried: oil/butter/margarine	3098	50g						
	Fish Fingers	Fried: oil/butter/margarine	3081	35g						
EGGS	Eggs	Boiled/Poached	2867	1 egg = 50g						
		Scrambled in oil	2889	1T = 35g; 1L = 80g; ½ c = 115g (approx 2 eggs)						
		In butter	2886							
		In margarine	2887							
		Fried in oil	2869							

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		In butter	2868	1egg = 52g						
		In margarine	2877							
		In bacon fat	2870							
		Curried	2902	1 egg + sauce (1T) = 75g						

We now come to vegetables:

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
VEGETABLES	Cabbage	Boiled, nothing added	3756	1T = 30g; 1L = 55g; ½ c = 80g						
		Boiled with potato, onion and fat	3813	1T = 35g; 1L = 75g; ½ c = 80g						
		Fried, nothing added	3812	1T = 30g; 1L = 55g; ½ c = 80g						
		Boiled, then fried with potato, onion	3815	1T = 35g; 1L = 75g; ½ c = 80g						
		Other								
	Spinach/Marog/Imifino/Amaranth leaves. Other green leafy vegetables: List Names	Boiled, nothing added	3980	1T =40g; 1L =105g ; ½ c = 90g						
		Boiled, fat added	3898	1T =40g; 1L =105g ; ½ c = 90g						
		Boiled with onion, potato and fat	3901	1T =50g; 1L =105g ; ½ c = 110g						
		Other								
	Tomato and Onion "Gravy"/Relish/ Chow/Sheshebo	Homemade with sugar	3910	1T = 35g; 1L = 75g; ½ c = 140g						
		Homemade, no sugar	3925							
		Canned	4192							
	Pumpkin (Specify type)	Boiled, nothing added	4164	1T = 45g; 1L = 85g ½ c = 105g						
		Cooked in fat and sugar	3893							
		Other								
	Carrots	Boiled, sugar and fat	3818	1T = 25g; 1L = 50g ½ c = 85g						
		With potato/onion (HM)	3822	1T = 35g; 1L = 70g ½ c = 105g						
		Raw, Salad (plus sugar)	3721	1T = 25g						
		Chakalaka	P0046							
		Other								
	Mealies/sweet Corn	On Cob	3725	1T = 30g; 1L = 60g ½ c = 95g						
		Off cob – creamed, sweetcorn	3726	1T = 55g 1L = 125g ½ c = 135g						
		Off cob – Whole kernel canned	3942							
		Other								
	Beetroot	Cooked (no sugar)	3698	1T = 40g; 1L = 70g ½ c = 80g						
		Cooked (with sugar)	3699							
		Salad (grated)	3699	1T = 25g; 1L = 65g						
	Potatoes	Boiled/Baked with skin	4155							

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		Without skin	3737	Small = 60g; Med. = 90g; Large = 150g						
		Mashed (WM)	3876	1T=50g; 1L = 115g; ½ c = 125g						
		Roasted	3878	1 Med. = 70g						
		French fries/potato chips	3740	½ c = 50 Med. = 80g						
		Salad	3928	1T=45g; 1L = 105g ½ c = 120g						
		Other								

	FOOD	**DESCRIPTION**	**CODE**	**QUANTITY (g/ml)**	**Amount usually eaten (HHM)**	**Amount usually eaten (g)**	**FREQUENCY**			
							Per day	**Days per week**	**Times per month**	**Seldom / Never**
VEGETABLESE	Sweet potatoes	Boiled/Baked with skin	3748							
		Without skin	3903	1T = 50g 1L = 110g						
		Mashed (with sugar)	3749	½ c = 145g						
		Other								
	Green Beans	Green, frozen	4123	1T = 25g; 1L = 60g ½ c = 80g						
		Cooked, potato & onion (HM)	3792	1T = 40g; 1L = 75g ½ c = 120g						
		Other								
	Peas	Green, frozen, boiled	4146							
		Green, frozen with sugar, boiled	3720	1T = 30g; 1L = 65g ½ c = 85g						
		With sugar and butter	3859							
	Green Peppers	Raw	3733							
		Cooked	3775							
	Brinjal/Egg Plant	Cooked	3700							
		Fried in oil	3802	1 slice = 20g + batter = 30g						
		Stew (oil,onion,tomato)	3798	1T = 50g;1L = 100g ½ c = 130g						
	Mushrooms	Raw	3842							
		Sauteed in brick marg.	3839	1T = 30g 1L = 65g ½ c = 80g						
		Sautéed in oil	3841							
	Onions	Sauteed in Sun oil	3730	1T = 50g						

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	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	Per day	Days per week	Times per month	Seldom / Never
	Salad vegetables	Raw tomato	3750	Med. = 120g Slice = 15g						
		Lettuce	3723	1 med. Leaf = 30g						
		Cucumber	3718	Med. Slice = 10g Thick = 15g						
		Avocados	3656	¼ avo = 40g						
	Other vegetables: Specify									
	If you fry veg. Or add fat, specify type of fat used	Butter	3479	1t = 5g						
		Butro	3523							
		Animal fat (beef tallow)	3494							
		White fat (Holsum)	3495							
		Hard margarine (Brick)	3484							
		Soft margarine (tub)	3496							
		Soft margarine (med)	3531							

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
DRESSINGS	Mayonnaise/ Salad dressing	Mayonnaise – bought	3488	1t = 10g 1T = 40g						
		Homemade	3506							
		Cooked salad dressing	3503	1t = 5g; 1T = 15g						
		Salad Dressing, low-oil	3505							
		Salad Dressing, French	3487							
		Oli – Olive Oil	3509	1t = 5g; 1T = 15g						
		Sunflower oil	3507							
		Canola	4280							

I will now ask about fruit

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	Per day	Days per week	Times per month	Seldom / Never
FRUIT	Apples	Fresh	3532	1T = 60g; ½ c = 120g 1 med. = 150g						
		Canned, Pie, unsweetened	4216							
	Bananas		3540	1 med. = 75g						

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	Oranges/ Naartjies		3560	Med. = 180g						
	Grapes		3550	Med. Bunch = 230g ½ c = 90g						
	Peaches	Fresh	3565	1 med. = 150g						
		Canned in syrup	3567							
	Apricots	Fresh	3534	1 med. = 35g						
		Canned in syrup	3535							
	Mangoes	Fresh	3556	135mm = 350g						
		Canned in syrup	3633							
	Pawpaw		3563	Wedge 165x26x27 = 90g						
	Pineapple	Raw	3581	1 slice = 40g						
		Canned in syrup	3648							
	Guavas	Fresh	3551	Med. = 95g						
		Canned in syrup	3553							
	Pears	Fresh	3582	1 med. = 165g						
		Canned in syrup	3583							
	Dried Fruit (also as snacks)	Raisins	4232	1 handful = 27g						
		Prunes (Raw)	4230	1T = 50g ; ½ c = 110g 1 = 12g						
		Prunes (cooked with sugar)	3564							
		Peaches (Raw)	3568	1 med. = 150g (60x65)						
		Peache (Cooked with sugar	3569							
		Apples (Raw)	3600	1T=60g; ½ c = 120g ; 1med = 150g						
		Dried fruit sweets	3995	(See Manual)						
		Other								
	Other fruit									

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	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
DRINKS	Tea	Ceylon	4038	Teacup = 180ml; mug = 250ml						
		Rooibos	4054							
	Sugar per cup of tea	Specify type: white	3989	1t sugar = 6g						
		brown	4005							
	Milk per cup of tea	Fresh/long Life Whole	2718	20ml = tea in cup 35ml – tea in mug						
		Fresh/Long Life 2%	2772							
		Whole milk powder – reconstituted (Specify brand)	2831	1t = 4g						
		Skimmed milk powder, reconstituted (Specify brand)	2719	1t = 4g						
		Milk Blend, reconstituted (Specify Brand)	2771	20ml – tea in cup 35ml – tea in mug 40ml – coffee in cup 75ml – coffee in mug						
		Whitener/non-dairy creamer (Specify brand)	2751	1t = 4g						

		Condensed Milk (Whole)	2714	1t = 10g						
		Condensed Milk (Skim)	2744							
		Evaporated milk (Whole)	2715	1t = 3g						
		Evaporated milk (Low-fat)	2827							
		None								
	Coffee		4037	Teacup = 180ml; mug= 250ml						
	Sugar per cup of Coffee	Specify Type: White	3989	1t sugar = 6g						
		Brown	4005							
	Milk per cup of Coffee	Specify Type:		See above						
	Milk as such: What type of milk do you drink as such?	Fresh/Long Life/Whole	2718	To drink ½ c = 125ml						
		Fresh/Long Life 2%	2772							
		Fresh/Long Life/Fat Free	2775							
		Sour/Maas	2787							
		Brand: Infant Formulas (Specify)								
	Milk drinks, Specify Brands, including milk supplements and type of milk used.	Nestle Drinking Chocolate	4287	1t = 5g						
		Malted milk beverage, no sugar (eg Milo)	2735	1t = 5g						
		Flavoured Milk	2774	Carton = 250ml Plastic = 350ml or 500ml						
		Other								
	Yoghurt	Drinking Yoghurt	2756	Small = 175ml Yogisip = 350ml ½ c = 125g						
		Thick Yoghurt:Plain,Fat-free	2778							
		WM Plain	2757							
		Fruit,Low-fat	2732							
		Other								

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
DRINKS	Squash	Sweeto, Sixo	3982	Small glass = 150ml Med. Glass = 250ml Large glass = 500ml Small bottle = 350ml Large bottle = 500ml Small can = 350ml						
		Oros/Lecol with sugar	3982							
		Oros + Artificial sweetener	3990							
		Kool Aid	3982							
		Other								
	Fruit Juice	Fresh/Liquifruit/Ceres/ Purity	2866	1 small box = 250ml 1 large box = 1000ml small bottle = 350ml Large bottle = 500ml Small can = 350ml						
		Tropical/mixture with milk	2791							
	Fruit Syrups	Average	2865	1t = 5g						
		Guava Syrup	2864							
	Fizzy Drinks (e.g. coke, Fanta)	Sweetened	3981	Small bottle = 350ml Large bottle = 500ml Small can = 340ml						
		Diet	3990							
	Magou/Motogo		4056	1carton = 500ml						

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Please indicate what types and amounts of snacks, puddings and sweets you eat:

SNACKS	Potato Crisps		3417	(See Manual)						
	Peanuts	Roasted, unsalted	3452							
		Roasted, salted	3458							
	Cheese Curls (Nik Naks, etc)	Average	3267							
		Savoury	3418							
	Popcorn	Plain	3332							
		Sugar coated	3359							
	Peanuts & raisins	Roasted, salted	P0047							
	Chocolates	Specify types and names: Assorted	3992	(See Manual)						
	Sugary sweets	Sugus, gums, hard sweets (Specify)	3986							
	Other sweets	Toffee, fudge, caramels (Specify)	3991							
CAKES, BISCUITS AND COOKIES	Biscuits/ Cookies	Specify Type								
	Cakes & Tarts	Specify Type								
	Pancakes / Crumpets	Specify Type								
	Rusks	Specify Types								
	Scones	White, WM	3237	6cm diam. = 35g 8cm diam = 60g						
	Muffins	Plain	3408							
		Bran	3407							
	Koeksisters		3231	50g (85mm length) 60g(100mm length)						
	Savouries	Sausage Rolls	2935	Roll = 165g						
		Samoosas (Meat)	3355	Small = 42g						
		Biscuits eg Bacon kips	3331	4g						
		Other								

	FOOD	DESCRIPTION	CODE	QUANTITY (g/ml)	Amount usually eaten (HHM)	Amount usually eaten (g)	FREQUENCY			
							Per day	Days per week	Times per month	Seldom / Never
PUDDINGS	Jelly		3983	1T = 35g; 1L= 75g ; ½ c = 110g						
	Baked puddings	Specify Types		Med. Serving = 30g 30x65x65 = 50g						
	Instant puddings	Specify Types		1T = 45g; 1L = 95g; ½ c = 145g						
	Ice Cream	Commercial regular	3483	Scoop = 40g; 1L = 65g; ½ c = 75g						
		Commercial rich	3519							
		Soft serve	3518	Plain = 135g; + flake = 155g						
		Sorbet	3491	Scoop = 40g;						

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		Ice lolies	3982	1L = 65g ; ½ c = 75g						
		Chocolate coated individual ice creams (eg Magnum)	P0036							
	Custard	Homemade (WM)	2716	T = 13g; 1L = 40g						
		(SM)	2717							
	Other Puddings Specify									
SAUCES, GRAVIES, DONDIMENTS	Tomato Sauce		3139	1t = 6g; 1T = 25g						
	Worcester Sauce		P0037							
	Chutney	Fruit	3168	1t = 14g; 1T = 60g						
		Tomato	3114							
	Pickles		3866	1 = 10g						
	Packet Soups		3165	½ c = 125g						
	Others									

Are there any foods that you do not eat? Please list them and give reasons why you do not eat them (e.g. because of religious beliefs or health reasons)

FOODS NOT EATEN	CODES	REASON

EATING PATTERNS: (FREQUENCY OF EATING)

Please indicate which of the following best describes your usual eating pattern (mark only one)

More than three meals with eating between meals	1
Three meals with eating between meals	2
Three meals with no eating between meals	3
Two meals with eating between meals	4
Two meals with no eating between meals	5
One meal with eating between meals	6
One meal with no eating between meals	7
Nibble the whole day, no specific meals	8
Other (Please specify):	9

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Do you ever eat elsewhere, other than at home? YES NO

If yes, where?

(1) Luncheon Club	(2) Church meetings	(3) Eating out	(4) Eat with relatives or friends	(5) Other, specify

How often?

(1) >once a week	(2) weekly	(3) monthly	(4) < once a month

Thank you for your co-operation. We appreciate your contribution.

ABBREVIATIONS:

Measures:	**Bread:**	**Other:**
1t = 1 rounded teaspoon	Wh = white	Comm = commercial
1T = 1 rounded tablespoon (15ml)	Br = brown	Home = homemade
1L = 1 rounded ladel (30ml)	Ww = wholewheat	Pot = potato
c = measuring cup (250 ml)		Cab = cabbage
Milk:	**Oil/Fat**	Carr = carrot
SM = skim milk	B = butter	
WM = whole milk	HM = 1 hard margarine	HHM = household measure
BL = blend	Med = medium fat/light	
CON = condensed	PM = polyunsaturated	
Meat:	SO = sunflower oil	
F = with fat	WF = white fat	
FT = fat trimmed	PB = peanut butter	

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ALCOHOL CONSUMPTION

Yes No

Q. In your entire life, have you ever consumed 1 or more drinks of any type of alcoholic beverage?

Yes No

Q. in the past year, have you consumed 1 or more drinks of any type of alcoholic beverage, for example, beer, wine, spirit or cider?

Q. In the past year, counting all types of beverages combined, what was the largest number of drinks you consumed on a single day? ________

Q. During the **past week**, how many standard drinks did you have each day?

1 standard drink = 10g of alcohol equivalent, e.g.

1 glass/can/bottle (340ml) of regular beer
1 measure (40ml) of spirit
1 glass (120ml) of wine

	Beer	**Wine**	**Spirit**	**Other (specify)**		
Monday						
Tuesday						
Wednesday						
Tuesday						
Friday						
Saturday						
Sunday						

Number of standard drinks

C:\Karen\WHOquestionnaire

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Appendix 6 Multi Ethnic Identity Measure (MEIM, Derived from a study by Phinney (1992)

Table 1 Items include in the MEIM as well as our Cultural identity construct

Items in the MEIM	Items in Cultural Identity construct o research
1. Have you spent time trying to find out more abou ethnic group, such as its history, traditions customs.	1. To which ethnic group do you belong 2. To which ethnic group do most of your neighbors belong? (people on your 3. street)
2. Are you active in organizations or social group: include mostly members of your own ethnic grou	4. Do you go to school in the same ar you stay?
3. Do you have a clear sense of your ethnic backg and what it means for me.	5. Which language do you speak at hom
4. Do you think a lot about how my life will be affect my ethnic group membership.	6. Do you understand your language someone speaks it?
5. Are you happy that I am a member of the gr belong to.	7. Do the adults in your home teach you Xhosa people?
6. Do you have a strong sense of belonging to your ethnic group.	
7. Do you understand pretty well what your ethnic membership means to me.	
8. Do you often talk to other people about their group, in order to learn more about your background,.	
9. Do you a lot of pride in your ethnic group.	
10. Participate in cultural practices of your own such as special food, music, or customs.	
11. Do you feel a strong attachment towards you ethnic group.	
12. Do you feel good about your cultural or background.	
13. What is your ethnicity,	
14. Your mother and	
15. Your fathers's ethnicity	

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