Investigation of beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at South African Universities

Gabrielle Lana Lasker

Dissertation presented for the degree of

Masters in Medical Science in Nutrition

(MMedSci Nutrition)

University of Cape Town

2020

Supervisor: Professor Marjanne Senekal, PhD, RD (SA)

DECLARATION

I, Gabrielle Lana Lasker, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate 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 to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Signature: G. Lasker

Date: 08 February 2020

ACKNOWLEDGEMENTS

I hereby wish to acknowledge and thank the following individuals and organizations. Their expertise, input and dedication to this study was invaluable.

Professor Marjanne Senekal, University of Cape Town, my supervisor for her expertise, time, valuable insights and her expert guidance and support.

Sharmillah Booley and Janetta Harbron, University Of Cape Town, for their help in determining the most important beliefs and wording of beliefs to be used in the cross- sectional survey.

Hannelie Nel for her massive help with my statistical analysis.

Marieke Theron, University of Cape Town, for her assistance with the physical activity component of the quantitative analysis.

Friend and registered dietician, Anri Horne, as well as registered dietician, Ntokozo, for helping to conduct the in-depth interviews.

Registered dietician, Kinza Hussain for helping with transcribing the qualitative data before the electronic coding framework was developed.

Johanna Jacoba Adriana Visser, Stellenbosch University masters student, as well as dietician Kim Rutgers for helping me in handing out and supervision of cross-sectional surveys.

My sister in law, Kira Meltzer and third year medicine student at UCT for pilot testing the cross sectional survey as well as for her constant encouragement, love, support and understanding.

Friend and UWC student, Maria Cupido for pilot testing the in depth interview questions.

The University of Cape Town for funding the project.

To my husband, Benji Meltzer, for supporting me from the very beginning as my boyfriend and now as my husband. Your ongoing love, support, time, encouragement and patience kept me focused and helped me to face any challenge. I can't wait to have more time to dedicate to you now.

To my loving parents, Karen and Dave, my brother Josh, my mother-in-law and father-in-law-Shelly and Craig and my wonderful friends for their constant support, love and encouragement.

ABSTRACT

Introduction

International as well as South African research indicates that first year female students at tertiary institutions may be specifically prone to weight gain and that these students should be targeted for weight management interventions. To contribute to this field of research a self-help weight management manual was developed for South African first year female students and tested in a controlled trial. The manual was found to result significant lower weight gain in the intervention group. The research group followed on and posited that development of further elements to combine with the self-help manual should consider beliefs students hold regarding weight gain prevention behaviours and weight related constructs.

This research aimed to investigate the beliefs of first year female students from three universities in the Western Cape, South Africa regarding weight gain prevention behaviours and weight related constructs. The first objective was to elicit salient beliefs held by first year female students regarding weight gain prevention behaviours (dietary patterns, physical activity alcohol intake and sleep time) and weight related constructs (eating behaviour, body shape dissatisfaction, stress, self-esteem and depression/anxiety) using a qualitative research design (Phase 1). The second objective was to identify weight gain prevention belief patterns of first year female students, to investigate the association thereof with actual weight gain prevention behaviours and weight related constructs and identify significant predictors of the belief patterns using a quantitative cross-sectional research design (Phase 2).

Methods and results

The target population for both Phases was English speaking 18-20-year old first year female students who were registered for the first time for a qualification at University of Cape Town (UCT), Stellenbosch University (SU) or the University of the Western Cape (UWC) in South Africa. Students who were pregnant, breastfeeding,

elite athletes, following dietary restrictions for a medical condition, or had a disease that may influence their weight, were not eligible for participation.

For Phase 1 total of 28 in-depth interviews were conducted with participants with representation of living situation (university residence or private accommodation, those living at home were excluded) and race (black African, mixed ancestry or white) ensured in recruitment. Eighteen of the interviews were fully coded until data saturation was apparent. The additional 10 interviews were coded for new information only. Data analysis was conducted using the audio coding option on Nvivo Version 12. Core belief themes that emerged reflect awareness of recommendations of behaviours of weight gain prevention, awareness of benefits of performance of these behaviours, awareness of consequences of not meeting the requirements as well as non-concern relating to not performing the behaviours. Further beliefs focused mainly on barriers to and facilitators these behaviours.

Phase 2 comprised completion of a questionnaire that covered socio-demographics, self-reported weight and height, dietary (including alcohol intake), physical activity, sleep time, body shape satisfaction, eating behaviour, self-esteem, presence of depression/anxiety symptoms and belief statements (derived from Phase 1) by a convenience sample of 168 first year female students from the same three universities to identify weight gain prevention (WGP) belief patterns, associated factors and predictors thereof.

Four weight gain belief patterns (WGP Belief Patterns) were extracted using principal component analysis: WGP Belief Pattern 1: Barriers to weight management; WGP Belief Pattern 2: Facilitators for healthy eating and exercise; WGP Belief Pattern 3: Barriers to exercise; WGP Belief Pattern 4: Social barriers to healthy eating. Numerous associations between these belief patterns and dietary patterns including snacking after dinner, problematic eating behaviours (including a higher emotional eating, cognitive restraint and uncontrolled eating), body shape dissatisfaction, attempts to prevent weight gain during the study year, a higher or lower BMI, perception of overweight/obesity as a child/adolescent, higher stress and lower self-

esteem were evident. Regression analysis identified identified snacking after dinner, emotional eating, body shape dissatisfaction and attempts to prevent weight gain during the study year as predictors of a higher score, whereas a higher BMI and perception to have been thin as an adolescent as predictors of a lower score on WGB Belief Pattern 1; for WGP Belief Pattern 2: a higher BMI and a higher score for Dietary Pattern 2 (fruits, vegetables and legumes) were identified as predictors of a higher score, and a higher MET-minutes and a higher score for Dietary Pattern 1 (sugary foods/drinks, slap chips, take-outs) as predictors of a lower score; for WGP Belief Pattern 3: a higher BMI and uncontrolled eating were identified as being predictors of a higher score, and a higher self-esteem and weight gain prevention attempts in the study year as predictors of a lower score; and a higher level of body shape dissatisfaction and a higher level of cognitive restraint were identified as being predictors of a higher score, and a higher BMI, perception of being thin as a child, lower stress and a higher self-esteem as predictors of a lower score on WGP belief pattern 4.

Overarching conclusions

Results and conclusions of the in depth interviews conducted to assess the beliefs of first year female students from three universities in the Western Cape, South Africa, regarding weight gain prevention behaviours and weight related constructs show that a multicultural sample of students held numerous beliefs regarding potential barriers and facilitators to weight gain prevention.

Results of the quantitative assessment of these beliefs in a cross-sectional survey conducted amongst the same target group resulted in the extraction of three barrier WGP Belief Patterns, including barriers to weight management per se (feeling stressed/anxious or sad/depressed, mindless eating, being awake at night, experiencing lack of health food options at university, preparing one's own meals, feeling fat, having people around you who do not eat healthy and the difficulty of not overeating were barriers to weight management), barriers to exercise (feeling sad/depressed, feeling stressed/anxious, having poor body shape satisfaction and feeling fat were barriers to exercise) and social barriers to healthy eating (socialising,

judgement from peers when making healthy food choices and drinking alcohol were barriers to weight management). Specific predictors of these patterns, namely snacking patterns, cognitive restraint, uncontrolled eating, emotional eating, problematic eating behaviours, body shape dissatisfaction, overweight/obesity as a child/adolescent, higher stress levels and lower self-esteem have typically been reported to be associated with challenges to healthy weight management. A concern is that students who participated in the cross sectional survey were characterized by many of these predictors. Predictors of the single facilitator WGP Belief Pattern (facilitators of healthy eating and exercise: complying with a healthy diet plan, finding enjoyment in healthy eating, preparing vegetables in a tasty way, finding affordable ways to eat healthy, making time in the day for exercise, knowing how to prepare one's own meals, planning meals and snacks ahead and exercising) that was extracted from the quantitative data reflect factors that have typically been reported to be associated with improved weight management (healthy eating and higher physical activity levels), as well as factors that have typically been reported to be associated with weight management challenges (unhealthy eating and a higher BMI).

Overarching recommendations

Although the associations between the four weight gain prevention belief patterns and weight status of first year female students were not investigated in this study, factors found to be associated with and predictors of the three barrier patterns point to potential risk for the experience of weight gain prevention challenges by first year female students. Although this notion should ideally be confirmed in further research, addressing the focus of the beliefs included in the barrier belief patterns, as well as the characteristics of the students that have been reported to be associated with weight management challenges in the literature in weight gain prevention interventions for first year female students at tertiary institutions is recommended.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BSQ: Body shape questionnaire

BMI: Body mass index

FYFS: First year female students

UCT: University of Cape Town

UWC: University of the Western Cape

SU: Stellenbosch University

TPB: Theory of Planned Behaviour

USA: United States of America

US: United States

UK: United Kingdom

ASEAN: Association of Southeast Asian Nations

EB: Energy Balance

RMR: Resting metabolic rate

TEF: Thermic effect of food

AT: Adaptive thermogenesis

nREE: Non- resting energy expenditure

FFM: Fat-free mass

FM: Fat mass

WHO: World Health Organisation

AHA: American College Health Association

GI: Glycaemic index

GL: Glycaemic load

MUFA: Monounsaturated fats

PUFA: Polyunsaturated fats

SFA: Saturated fats

LA: Linoleic acid

ALA: alpha-linolenic acid

n-3: Omega-3

n-6: Omega-6

ACSM: American College of Sports Medicine

NIAAA: The National Institute on Alcohol Abuse and Alcoholism

SAMHSA: The Substance Abuse and Mental Health Services Administration

ACHA-NCHA: American College Health Association-National College Health Assessment

RCT: Randomized control trial

NQFFQ: Non Quantified Food Frequency Questionnaire

IPAQ: International Physical Activity Questionnaire

BSC-8C: 8-item Body Shape Questionnaire

TFEQ-R18: Three Factor Eating questionnaire-R18

PSS-14: Cohen 14-item Perceived Stress Scale

RSES: 10-item Rosenberg Self-Esteem Scale

K10: 10-item screening scale of psychological distress

SD: Standard deviation

IQR: Inter-quartile range

PCA: Principal component analysis

WGP: Weight gain prevention

MET: Metabolic equivalents

1. INTRODUCTION AND RESEARCH AIMS

1.1 Introduction

The prevalence of obesity worldwide is continuously rising and is a global public health concern (Machado et al., 2012; Adeboye et al., 2012; Jensen et al., 2014; De Vos et al, 2015; WHO, 2015; Chooi et al., 2019). The global prevalence of overweight and obesity has been increasing in the younger age groups, with young adults being no exception (Racette et al., 2005; Lloyd-Richardson et al., 2009; LaCaille et al, 2011; Wing et al., 2013; Grave et al., 2013; Quick and Byrd-Bredbenner; 2013; Flegal et al., 2016; Ogden et al., 2016; Swanson, 2016; Zheng et al., 2017; Dietz et al., 2017; Shi et al., 2018). The 2012 South African National Health and Nutrition and Examination Survey (SANHANES) showed that obesity among females aged 18 to 24 years was 21.7% and overweight 25.3%, while obesity among males in this age group was 4.2% and overweight 5.8% (Shisana et al., 2013). The 2016 South African Demographic and Health Survey (SADHS) showed that overweight among females aged 15 to 24 years was 24.4% and obesity 15.5%, while overweight among males in this age group was 8.9% and obesity 2.3% (National Department of Health et al., 2016). Furthermore, the SADHS showed that overweight among females aged 15 and older was 27% and obesity 41%, while overweight among males was 20% and obesity 11% (National Department of Health et al., 2016). Females are a specific target in this research given the higher prevalence of overweight and obesity compared to males in both younger and older age groups in South Africa.

Research shows that first year female students may be specifically prone to weight gain (Hovell et al., 1985, Megel et al., 1994; Senekal et al., 1988, & Senekal, 1994; Graham et al., 2002; Anderson et al, 2003; Malinauskas et al., 2006; Lloyd-Richardson et al., 2009; LaCaille et al., 2011; Fayet et al., 2012; Finlayson et al. 2012; Smith- Jackson & Reel, 2012; Vadeboncoeur et al, 2015; Nikolaou et al., 2015). “Freshman 15” is a term that evolved in the United States to describe the weight gain that occurs in first year university students based on the original claim that this

weight gain was on average 15lbs (6.8kg) (Graham & Jones, 2002; Smith-Jackson & Reel, 2012). However, a meta-analysis by Vella-Zarb and Elgar (2009) concluded that the mean weight gain in first year students of both genders was 1.75kg, which is far less than the reported 6.8kg, but still significant and higher than weight gain trends in the general population (Levitsky et al., 2004). A more recent meta-analysis showed that most (60.9%) first year male and female students gain weight in their first year and that most of this weight gain is in the first term (Vadeboncoeur et al., 2015). South African research confirms that female students, especially first years studying at tertiary education institutions in South Africa, are prone to gaining weight (Senekal et al., 1988; Senekal, 1994; Senekal et al., 2016; Senekal et al., 2018). Between 59% (Senekal et al., 1988) and 72% (Senekal et al., 1988) of female students at a South African university were found to have gained weight ranging from one to 25kg during their first year at university. The results of a four year longitudinal study conducted by Senekal (1994) supports this notion. It was evident that only 20.7% of the subjects who were followed up for four years were able to maintain a constant weight over the four year period, 31.6% continued to gain weight, 18% were clear weight cyclers and the weight of 29.7% was not constant. No information for South African male students was available at the time of the study.

Weight gain and poor lifestyle behaviours that develop during the young adult life stage may persist into later adulthood and increase rates of overweight and obesity in the longer term (Rothacker & Blackburn, 2000; Gillen & Lefkowitz, 2011; Wharton et al., 2008; Vadeboncouer et al., 2015; Walsh et al., 2018). Since excessive body weight is associated with serious health consequences, including a higher risk of premature mortality and diseases that can lead to a decreased quality of life and health (Tchernof and Després, 2013; Chooi et al., 2019), it is crucial to develop and implement weight gain prevention interventions for female students attending tertiary education institutions (Mendez-Hernandez et al., 2010; Wing et al., 2013; Laska et al., 2013; Vadeboncoeur et al., 2015; Walsh et al., 2018).

Weight gain is caused by a positive energy balance when dietary energy intake is greater than energy expenditure (Hall et al., 2011; Lysen & Israel, 2012; Hill et al.,

2013; Romieu et al., 2017; Chooi et al., 2019) that can result from an interaction between genotype and environment (including lifestyle patterns and psychosocial influences) (Lysen & Israel, 2012; Hill et al., 2013; Romieu et al., 2017; Hartmann-Boyce et al., 2017; Sogari et al., 2018; Chooi et al., 2019; Wilding et al., 2019; Chapelot & Charlot, 2019). First year female students may be specifically vulnerable due to their transition from school to a tertiary institution (Mueller et al., 2018; Sogari et al., 2018). This is known to be a difficult stage in adult development due to the need to adapt to a new environment that brings with it new social, psychological and academic challenges and pressures, change in routines, as well as a newly found sense of independence (Cilliers et al., 2006; Fayet et al., 2012; Vadeboncoeur et al., 2015; Crombie et al., 2009; Patrick et al., 2014).

It is evident from the literature that particular weight management related behaviours may characterize female students, including the following: low levels of physical activity, which may be lower than it was during the period before enrolment at the tertiary institution (Deliens et al., 2015; Plotnikoff et al., 2015; Yahia et al., 2016; Peltzer & Pengpid, 2017; Walsh et al., 2018); unhealthy eating patterns (Lazaverich et al., 2013; Brown et al., 2014; Gresse et al., 2015; Yahia et al., 2016), including low/inadequate intake of fruit, vegetables and dietary fiber combined with frequent intake of energy dense foods such as alcohol, sugar sweetened beverages and fast foods (Small et al., 2013; Nicolou et al., 2015; Yahia et al., 2016; Senekal et al., 2016; Mueller et al., 2018; Lazaverich et al., 2018); frequent binge drinking (Peltzer & Pengpid, 2016; Battista & Leatherdale, 2017; Yi et al., 2017; Nourse et al., 2017; Ajayi et al., 2019), with drinking having increased in female students over the years (White & Hingson, 2013; Govender et al., 2017; Ajayi et al., 2019); and not meeting the recommended hours of sleep (Buboltz et al., 2001; Buboltz et al., 2009; Sing & Wong, 2010; Vargas et al., 2014; Walsh et al., 2018; Wang et al., 2019). Further documented weight management related characteristics described for female students include having a distorted body image and being dissatisfied with their weight (Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018); dietary restraint, uncontrolled and emotional eating (Lazaverich et al, 2013; Crockett et al., 2015; Lazaverich et al., 2016; Bourdier et al.,

2018; Constant et al., 2018; Hootman et al., 2018); stress that may be linked to the early adult life stage as well as the challenges these students face during the transition from home to the tertiary institution (Serlachius et al., 2007; Hunt & Eisenberg, 2010; Fayet et al., 2012; Gardner et al., 2013; Haidar et al., 2018; Lyzwinski et al., 2019); depression/anxiety (Lazaverich et al., 2013; Peltzer & Pengpid, 2015; Asante & Andoh-Arthur, 2015; Mazurek Melnyk et al., 2016; Nourse et al., 2017; Lazaverich et al., 2018) and lower self-esteem (Senekal et al., 2001; Cillers et al., 2006; Cristiana, 2016). It follows that key behaviours to focus on for effective weight management in female students include dietary intake, alcohol, physical activity and sleep. Weight related constructs that may need attention include eating behaviours (dietary restraint, uncontrolled eating and emotional eating), body shape satisfaction, stress, self-esteem, depression and anxiety.

The growing obesity epidemic has led to a shift in focus from the clinical treatment of obesity towards the development of prevention strategies that address the economic, environmental, sociocultural, and lifestyle causes of weight gain (Wilmott et al., 2019). The reason for this shift is that it is both less challenging, as well as more cost-effective to prevent weight gain or to maintain a healthy weight on a population level than attempting to treat obesity once it is fully developed (Wilmott et al., 2019). It is well known that those who have lost weight struggle to maintain the weight loss and that people tend to defend the highest weights that they reach (Lowe et al., 2019). It would be more beneficial to achieve weight maintenance rather than having a series of weight cycling attempts, which may have a worse effect on health indicators (Metzgar & Nikols-Richardson, 2015).

Energy balance is achievable when the following factors/strategies are in place: setting of reasonable goals that are individualised, realistic, maintainable and that contribute to well-being (Jensen et al., 2014; Kushner, 2014; Lowe et al., 2015; Bhutani et al., 2017; Stefan et al., 2018; Berger et al., 2019); ensuring a healthy dietary pattern with energy intake tailored to the needs of individuals and their particular weight management needs (Sacks et al., 2017; Liu et al., 2017; Kahleova & Barnard, 2017; Yannakoulia et al., 2019; LaRose et al., 2019; Livesey et al., 2019);

controlling alcohol intake (Yeomans, 2010; Jacobs & Steyn, 2013; WHO, 2014; Kalinowsky & Humphreys, 2016; SADHS, 2016; Battista & Leatherdale, 2017); ensuring adequate levels of physical activity and limited time spent being sedentary (Botha et al., 2013; Grave et al., 2013; WHO, 2014; Piercy et al., 2018; Foright et al., 2018; Petridou et al., 2019); 5) achieving a healthy sleep pattern (Hirshkowitz et al., 2015; St-Onge, 2017; Ludy et al., 2018; Hayes et al., 2018; Yang et al., 2019; Rihm et al., 2019); healthy eating behaviours and psychological well-being (Hunt et al., 2017; Braden et al., 2018; Van Strien, 2018; Geiker et al., 2018; Konttinen et al., 2019); and avoiding unnecessary dieting as this may lead to more weight management problems (James, 2012; Denny et al., 2013; Sares-Jäske et al., 2019).

Senekal et al. (2018) and others (Gillen & Lefkowitz 2011; Webb et al. 2013; Das & Evans 2014; Vadeboncoeur; Foster & Townsend, 2016) point out that tertiary institutions should take some responsibility to address concerns students may have about weight gain during their first year on campus. Swanson (2016) and Das and Evans (2014) maintain that students actually desire assistance with weight management during their time on campus. Review of the literature revealed that a number of university based weight gain prevention interventions have been tested. These interventions included a one-semester nutrition education course (not successful) (Matvienko et al., 2001), a 10 week intensive intervention that covered 21 web-based mini-educational lessons combined with three e-mails (nudges), followed by 12 months of receiving four nudges per month (not successful) (Kattelmann, Bredbenner & White, 2014), a 14-week randomised controlled trial (RCT) with two arms: 1) improving outcome expectations and self-efficacy within a social cognitive theory framework and 2) targeting the same variables but focusing on explicit training in self-regulation skills (not successful) (Dennis et al., 2012), two interventions that focussed on using a tissue monitoring system algorithm for weight management [Caloric Titration Method (CTM)] (successful) (Levitsky et al., 2006, Bertsz et al., 2015), educational inputs on maintenance of a healthy lifestyle in the form of small group seminars over a two-year period (successful) (Hivert et al., 2007) and a combination of a 6-week online intervention with weight and energy intake feedback over a six week period (successful) (Gow et al., 2010).

Senekal et al. (2018) identified the need to reach large numbers of students in a short period of time during their first weeks on the campus of a tertiary institution to deliver any form of weight gain prevention intervention as a material challenge to success. As a result these researchers opted to develop a self-help intervention in the form of a self-help manual that could be handed out early in the year with students then being able to engage with the intervention at their leisure. The intervention was tested in a controlled trial and results showed that the intervention group gained a significant 0,9kg (30%) less weight at eight months after baseline than the control group (Senekal et al., 2018). Senekal et al. (2018) recommended that a combination of the self-help manual with intervention elements such as social media messaging may increase the intervention effect.

Following on the recommendation by Senekal et al. (2018) the research group posited that development of a further component such as social media messaging to combine with the weight gain prevention self-help manual (Senekal, 2005) should consider beliefs students hold regarding weight gain prevention behaviours and weight related constructs. Azjen (1991) explains that human behaviour is guided by salient beliefs (e.g. eating less fat will help me control my weight), normative beliefs (e.g. my friends think that I should eat less fat) and control beliefs (e.g. it is entirely up to me to eat less fat). Behaviour beliefs contribute to the development of a favourable or unfavourable attitude toward the behaviour, normative beliefs result in subjective norm and control beliefs give rise to perceived behavioral control (Azjen, 1991; Baranowski et al., 2003; Armitage & Conner, 2001; Schifter & Azjen, 1985). Attitude, subjective norm and perceived behavioral control determine intention to perform a behaviour (Azjen, 1991). The more favorable the attitude and the subjective norm and the higher the perceived behavioral control, the higher the intention and the more likely it is that the behaviour will be performed (Azjen, 1991).

There is a paucity of published research on beliefs held by female students or other young female adults on weight management in general, and more specifically on weight gain prevention. Understanding beliefs of students relating to perceived

barriers to and facilitators of a healthy lifestyle is essential in designing weight gain prevention interventions in this vulnerable group (Nikolaou et al., 2015).

The current research focused on conducting formative assessment of beliefs held by first year female students relating to weight gain prevention behaviours and weight related constructs to advise the development of further elements to combine with the self-help weight management manual by Senekal (2005).

1.2 Research Aim and Objectives

This research aimed to investigate the beliefs of first year female students from three universities in the Western Cape, South Africa regarding weight gain prevention behaviours and weight related constructs.

The first objective of this research was to elicit salient beliefs held by first year female students regarding weight gain prevention behaviours and weight related constructs using a qualitative research design (Phase 1).

The second objective of this research was to identify weight gain prevention belief patterns of first year female students, to investigate the association thereof with actual weight gain prevention behaviours and weight related constructs and identify significant predictors of the belief patterns using a quantitative research design (Phase 2).

1.3 Structure of the thesis

A comprehensive review of literature on weight management principles; personalised weight goals; healthy dietary patterns, alcohol use, physical activity and sleep time for weight gain prevention; eating behaviour, psychological well-being for

weight gain prevention; weight management profile of first year female students and belief patterns and behaviour change for weight gain prevention is presented in Chapter 2. Phase 1 of the research (qualitative design) is presented in Chapter 3 and Phase 2 (quantitative design) in Chapter 4. Both these chapters are presented in article format, thus with an introduction, methods, results, discussion and conclusion. Chapter 5 provides an overarching summary and integrative discussion and conclusions on the two phases of the research, as well as final recommendations.

1.4 Definition of Terms

Weight gain prevention behaviours

For the purposes of this research, weight gain prevention behaviours for first year female students refer to the following: dietary intake (Levitsky et al., 2004; Vella-Zarb and Elgar, 2009; Crombie et al., 2009; Wengreen and Moncur, 2009; Gillen & Lefkowitz, 2011; De Vos et al., 2015), alcohol intake (Vagstrand et al., 2007; Berkey et al., 2008; Croezen et al., 2009; Vella-Zarb and Elgar, 2009; Wengreen and Moncur, 2009; Farhat et al., 2010; De Vos et al., 2015), physical activity (Senekal et al., 1994; Bulter et al., 2004; Jung et al., 2008; Vella-Zarb and Elgar, 2009; Wengreen and Moncur, 2009; Crombie et al., 2009; Gillen & Lefkowitz, 2011) and sleep (Wengreen and Moncur, 2009; Vargus et al., 2014; Ludy et al., 2018).

Weight related constructs

For the purposes of this research weight related constructs for first year female students refer to the following: Eating behaviours (cognitive restraint, uncontrolled eating, emotional eating) (Crombie et al., 2009; Vella-Zarb and Elgar, 2009; Finlayson et al., 2012; Senekal et al., 2018), body shape dissatisfaction (Cristiana, 2016), stress (Vella-Zarb and Elgar, 2009; Gillen & Lefkowitz, 2011), self-esteem (Cilliers et al., 2006) and presence of anxiety and depression symptoms (Dyson & Renk, 2006).

(Senekal, 1994; Senekal., 2005; Vella-Zarb and Elgar, 2009; Crombie et al., 2009).

2. LITERATURE REVIEW

2.1 Weight management principles

2.1.1 Energy balance and weight management

The concept of energy balance (EB) is based on the thermodynamic principle that energy cannot be created or destroyed but can only be gained, lost, or stored (Hill et al., 2013). Energy balance is defined as the state achieved when energy intake equals energy expenditure. In this state of balance, weight stability and maintenance is achieved (Hill et al., 2013). The amount of food and drink consumed contributes to energy intake, while resting metabolic rate (RMR), thermic effect of food (TEF), adaptive thermogenesis (AT) and physical activity contribute towards total energy expenditure (Hill et al., 2013). The RMR is the energy required for maintaining normal body functions and homeostasis and is higher in those with a higher fat-free mass (Hill et al., 2013). TEF refers to the energy used to absorb, digest, and metabolise food consumed and accounts for 8 to 10 % of daily energy expenditure (Hill et al., 2013). AT refers to changes in resting energy expenditure (REE) and non-resting energy expenditure (nREE), which are independent from fat free mass (FFM) and FFM composition (Müller et al., 2016). AT differs in response to changes in energy balance and is considered an outcome of autoregulatory control that operates to limit weight loss and to restore body composition (Müller et al., 2016). The energy expended as a result of physical activity includes energy used in voluntary exercise, shivering, postural control, and voluntary movement and is the most variable component of energy expenditure (Hill et al., 2013).

Keesey and Hirvonen (1997) suggested that body weight in humans is typically regulated with great precision. The example provided by Keesey and Hirvonen (1997) to illustrate this concept is as follows: despite the fact that the energy flux (number of calories consumed and expended) experienced by an average-size human being over a 1-y period is roughly 700000 kcal, body weight usually varies very little over long periods of time. Weight stability, which can inherently be

achieved in the absence of conscious effort, indicates that a highly precise system of energy balance regulation is in place. Greater-than-average variability in body weight over time may be the result of biological or environmental influences that override or undermine the regulation system (Keesey & Hirvonen, 1997).
In essence, change in body weight occurs as a result of an imbalance between the amount of food consumed and the amount of energy expended by the body to maintain life and perform physical activity (Hall et al., 2011; Lysen & Israel, 2012; Hill et al., 2013; Romieu et al., 2017; Chooi et al., 2019). Lack of exercise and sedentary lifestyle compounded by chronic overeating and alcohol use, as well as inadequate sleep contribute to a positive energy balance, resulting in weight gain (Hill et al., 2013; Romieu et al., 2017; Sogari et al., 2018; Chooi et al., 2019). If the positive energy balance continues unchecked, obesity will ensue; on the other hand, if energy intake is less than the amount that is expended (negative energy balance), the result will be weight loss.

Chapelot and Charlot (2019) postulate that energy balance should not be represented by an input/output model and that it is far more complex. In order to maintain continuous energy expenditure with sporadic energy intake, the brain relies on various neuro- hormonal messages with glucose and insulin as modulators. Hedonic and reward systems also need to be considered since environmental exposure to constantly available highly palatable food would override homeostatic intake of food based on the body's needs (Chapelot & Charlot, 2019). Ultimately, what may seem to be a simple equation of energy balance is compounded by any combination of lifestyle patterns and psychosocial influences that could result in abnormal biological regulation, weight gain and obesity (Hartmann- Boyce et al., 2017; Wilding et al., 2019; Chapelot & Charlot, 2019).

2.1.2 Factors that influence energy balance

Key factors that determine biological functioning, energy balance, total fat deposition and variation in accumulation of visceral adipose tissue in response to a

prevailing energy balance include genenotype, epigenetics, the microbiome, gender, race/ethnicity and age (Tchernof & Després, 2013).

Heritability, syndromic, monogenic and polygenic studies illustrate that there is a gene-environment interaction in the development of obesity (Brandkvist et al. 2019; Rohde et al., 2019). According to Tchernof and Després (2013) family studies have shown that heritability rates of total body fat mass are around 50 percent. Polygenic obesity, where a large number of gene variants of which the effect of each individual gene is minimal, but the combined effect is greater, may increase the susceptibility to obesity via any pattern of gene-gene and gene-environment interaction, is also referred to as common obesity (Senekal, 2012; Brandkvist et al. 2019, Rohde et al., 2019; Stipanuk, 2019).

Stipanuk (2019 p. 573) states that "Obesity is most likely to occur when a genetically susceptible individual encounters an environment conducive to obesity." Dietary patterns, physical activity and socioeconomic status thus have the potential to alter the association between genetic predisposition and BMI. Results from a longitudinal study by Brandkvist et al. (2019) conducted in Norway in 959 participants aged 13-80 years showed that BMI increased substantially from the 1960s to 2000s in both genders, that the increase was more evident in people with a genetic predisposition to higher BMI, but that BMI also increased in those who were not genetically predisposed. This implies that the effect of obesogenic environments remains the main contributor to the development of a positive energy balance and obesity. These results need to be considered within the context of the fact that genome-wide association studies have to date identified genetic variants that explain only 2-5% of variation in BMI, leaving a large part of genetic variance in obesity unexplained (Brandkvist et al.,2019). It follows that evidence based application of gene screening in personalization of obesity prevention and management (precision nutrition) is not a possibility at this point in time (Senekal, 2012; Rohde et al., 2019).

Epigenetics refers to heritable changes in the genome that do not involve changes in deoxyribonucleic acid (DNA) sequence and are the result of molecular modifications

of DNA through methylation and histone (DNA packaging protein) modification (Kauwell 2008, van Dijk et al, 2015, Bell, 2017; Rohde et al., 2019). According to Gluckman et al. (2008) epigenetic modifications may take place during in utero exposure to under- and overnutrition that may affect obesity risk in later life. Van Dijk et al. (2015) indicated that epigenetic markers for obesity detectable at birth could potentially be modified by changing exposure in utero and by making lifestyle changes in adult life. These researchers predicted that screening for such markers could be utilized for predicting an individual's obesity risk at a young age to formulate personalised prevention strategies (precision nutrition) (Van Dijk et al., 2015). However, according to Bell (2017) more recent and more powerful studies do not corroborate the earlier findings from a limited number of small studies on epigenetic markers and potential to modulate obesity risk. Additional high quality research is required to accurately define the epigenome and interpret these findings for practice application (Bell, 2017).

The debate that the gut microbiome contributes to energy regulation originated from the fact that differences in microbiota composition were found between lean humans and those with obesity. The most consistent finding at this point in time is that an imbalance in microbiota (dysbiosis) may be associated with obesity due to a reduced richness or diversity, increased pathogens or a shift in metabolic capacities (Vangay et al., 2015, Le Chatelier et al., 2013). Loss of bacterial gene richness has also been linked to reduced sensitivity to weight loss following a restricted energy diet (Dao et al., 2016). However, although individuals with reduced microbial richness have been found to be more likely to have obesity, low richness does not typically characterize those with obesity (Le Chatelier et al., 2013). This may indicate that low richness potentially only contributes to obesity in a subset of individuals characterized by for example specific race/ethnicity profiles or correlates thereof, such as dietary patterns or socioeconomic status (Stanislawski et al, 2019).

There are clear indications that dietary factors interact with the gut microbiome (Kong et al., 2014). For example, lower intake of whole grains, fruit and fermented dairy products, as well as a lower total dietary quality score was found to be

associated with reduced abundance of potentially beneficial bacteria, but increased levels of potentially harmful bacteria in the colonic mucosa of endoscopically normal individuals (Lui et al., 2019). These researchers, however, point out that available evidence on diet-microbiome interactions has been derived from microbiome cohorts that are often too small to study complex interaction effects (Lui et al., 2019). More research is needed to validate the proposed mechanisms by which gut microbiota dysbiosis and loss of richness can promote energy imbalance and obesity (Romieu et al., 2017; Lui et al., 2019). Products marketed by commercial companies for screening the gut microbiota to personalize dietary intake for prevention and management of obesity (precision nutrition) are thus not evidence based at this point in time.

When considering gender as a determinant of biological functioning, energy balance, total fat deposition and variation in visceral adipose tissue accumulation are factors to consider. Men are more likely to accumulate adipose tissue in the upper body (trunk and abdomen; visceral fat), while premenopausal women are more likely to accumulate adipose tissue in the lower body (hips, thighs; subcutaneous fat) (Tchernof and Despres, 2013). These authors surmised from available literature that estrogens have a significant influence on adipose tissue function and metabolism and may explain the gender differences in body composition and body fat distribution to a lesser or greater extent.

According to Tchernof and Despres (2013) it is well know that there are racial/ethnic differences in body fat distribution profiles. Weight gain in some populations may result in increases in subcutaneous adipose tissue, whereas other populations may be more likely to experience increases in visceral adipose tissue. These differences may result in increased risk and earlier onset of obesity in some populations, and increased risk for greater visceral fat stores and higher body fat content at a lower body mass index (BMI) in others. These differences resulted in the contention that the general World Health Organization (WHO) obesity cut-off value of 30 kg/m^2 should not be applied without considering race/ethnicity (Tchernof & Despres 2013). Hypotheses regarding the physiological explanation of ethnicity/race-related

differences in body fat distribution have mainly focused on genetic and epigenetic programming (Tchernof & Despres, 2013).

Tchernof and Despres (2013) further explain that ageing contributes to accumulation of visceral fat mostly in males and menopausal and postmenopausal females, as reflected in a decreased ratio of subcutaneous to visceral fat stores predicted by waist circumference. The increase in visceral adipose tissue with ageing may be greater than the increase in total body fat (Tchernof and Despres, 2013). Furthermore, age related increases in total fat may be greater in African American than Caucasian women, but the increase in visceral adipose tissue may be lower in African American women (Lara-Castro et al. 2002)

Besides the effect of unhealthy dietary and physical activity behaviours and patterns, other factors that are common in the modern world such as inadequate sleep, demanding cognitive effort and chemical pollution may also promote a positive energy balance (Tremblay, 2018). However, Tremblay et al. (2018) point out that it may be very difficult to return to a more traditional type of lifestyle that is less obesogenic in today's society. The focus should rather be on promotion of the healthiest lifestyle possible within the context of the modern world.

2.1.3 Weight management continuum

Senekal et al. (1999) suggested that weight management exists on a continuum from prevention of weight loss in those who are under- or normal weight, prevention of weight gain in those who are normal weight, weight loss and maintenance thereof in individuals with overweight/obesity and prevention of further weight gain in individuals with overweight/obesity who are unable to lose weight successfully.

Underpinning all the mentioned points on the weight management continuum is the identification of a personalised weight goal (see detail in section 2.2), a healthy dietary pattern with energy intake tailored to the needs of individuals and their

particular weight management needs (see detail in section 2.3), controlled alcohol intake (see detail in section 2.4), adequate levels of physical activity and limited time spent being sedentary (see detail in section 2.5), adequate sleep time (see detail in section 2.6) and eating behaviours and psychological well-being (see detail in section 2.7).

2.2 Personalised weight goals

Weight goals are typically defined within the context of ensuring that metabolic health indicators such a blood lipid levels, insulin sensitivity, blood glucose levels and blood pressure remain within normal ranges or be improved if these indicators are not within normal ranges. According to Stefan et al. (2018) the process of defining a universally accepted definition of metabolic health for adults and for adolescents and children is ongoing. These authors write that a definition of having less than two indicators of metabolic syndrome might be the most appropriate approach in clinical settings, but that a different, more widely applicable definition might be agreed upon in future (Stefan et al., 2018). Evidence from the most extensive study to date with the most rigorous criteria to account for confounding factors confirmed that a BMI in the normal weight range, specifically a BMI of 20 to 25 kg/m², was associated with the lowest all-cause mortality"(Global BMI Collaboration, 2016). Maintaining BMI in this range or reducing an increased bodyweight to this range could thus effectively reduce the risk of early death (Stefan et al, 2018).

Any weight goal for health should be reasonable, achievable and maintainable (Senekal et al., 1999). To ensure that personalised weight goals meet these requirements the following should be considered: personal and family weight history (reflects genetics and family lifestyle environment), cultural norms, behaviour change demands to achieve and maintain the goal weight, the environmental support needed to maintain the required behaviour changes, as well as individuals' personal perceptions, goals, expectations, dieting history, stable weight point and

lifestyle (Senekal et al., 1999). For the person who aims to prevent weight gain, thus maintain a stable body weight, the aim would be to remain in energy balance and minimize variability in weight.

According to Bhutani et al. (2017) literature indicates that shorter term (several days to three weeks) fluctuations in body weight in individuals who are not making an effort to lose or gain weight (i.e. unrestricted free-living conditions) generally range from 1 to 2 kg. Literature also shows that factors that may explain these fluctuations include intestinal content, glycogen stores, labile protein stores and accompanying body water (Bhutani et al., 2017). These researchers found that the average mean (standard deviation) weight fluctuation in a sample of 46 free living adults over a two week period was 0.26 (1.2)kg. The change in body weight was largely composed of fat free mass (FFM), where the ratio of fat mass (FM) to FFM for weight loss over longer periods (> 8 weeks) typically is 75% FM to 25% FFM (Bhutani et al., 2017).

There is limited information on the level of variability in weight that would be acceptable within the definition of being in energy balance and having a stable weight. Jensen et al. (2014) defined stable weight as gaining less than or equal to 2kg and losing less than 2kg over time (Jensen et al., 2014). In the protocol for a pragmatic weight gain prevention trial for medically vulnerable patients Berger et al. (2019) formulated the outcome for prevention of weight gain as a gain of less than 3% of body weight. The latter should be interpreted against the backdrop of recommendations of a weight loss of 5% or more over a six month period to gain health benefits (Kruger et al., 2005; Jensen et al., 2014; Kushner, 2014).

Following research in a group of young women who had weight concerns, but were in a healthy weight range, Lowe et al. (2015) proposed that naturally occurring weight variability in normal weight individuals over long periods of time may reflect a weakening of the typically finely tuned ability of the body to automatically and accurately maintain energy balance and body weight. Individuals who find themselves in obesogenic environments may be specifically susceptible to degradation in this ability to maintain energy balance. Moreover, Lowe et al. (2015)

found in their research that higher weight variability predicted future weight gain. Preventing weight variability by addressing intra-personal, interpersonal, institutional, community level and policy level influences on weight management would thus be key to prevention of longer term weight gain in young adults. Lowe et al. (2015) mention that in addition to weight gain, weight variability could be increased by individuals' attempts to lose weight to limit or reverse weight gains, especially in young women who are particularly sensitive to changes in their weight irrespective of whether their weight is normal or not.

2.3 Healthy dietary patterns for weight gain prevention

2.3.1 Healthy eating recommendations

Many different dietary patterns for health have been proposed over the years. Unfortunately, as more competing diets emerge, the general public has become increasingly confused about healthy eating (Katz & Meller, 2014). In their review of diets promoted for weight loss and health, Katz and Meller (2014) found that the most consistent elements across these diets were limiting intake of refined starches, added sugars and processed foods, as well as limiting the intake of saturated and trans fats, while emphasizing intake of whole plant foods, with or without lean meats, fish, poultry and seafood (Katz & Meller, 2014). In their narrative review, Romieu et al. (2017) concluded that dietary patterns characterized by higher intakes of fruits and vegetables, legumes, whole grains, nuts and seeds and unsaturated fat, and lower intakes of refined starch, red meat, trans and saturated fat, and sugar-sweetened foods and beverages can contribute to long-term weight control. Limiting consumption of sugar- sweetened beverages has a particularly important role in weight control (Romieu et al., 2017). The South African Food Based Dietary Guidelines (SAFBDG) (Table 2.1) that form the basis for nutrition related health education in the country, reflect these elements of a healthy diet (Vorster et al., 2013).

Table 2.1: South African Food-Based Dietary Guidelines (2012)

1	Enjoy a variety of foods
2	Be active!
3	Make starchy foods part of most meals.
4	Eat plenty of vegetables and fruit every day.
5	Eat dry beans, split peas, lentils and soya regularly.
6	Have milk, *maas* or yoghurt every day.
7	Fish, chicken, lean meat or eggs can be eaten daily.
8	Drink lots of clean, safe water.
9	Use fats sparingly. Choose vegetable oils rather than hard fats.
10	Use sugar and foods and drinks high in sugar sparingly.
11	Use salt and food high in salt sparingly.

Energy requirements for maintaining a stable weight can be estimated using equations for either normal weight or individuals with overweight/obesity using the individuals height, weight, age, gender, current weight status and an appropriate activity factor as outlined by Ireton-Jones (2017) (Table 2.2).

Table 2.2. Estimated energy Expenditure Prediction Equations at Four Physical Activity Levels (Ireton-Jones, 2017)

Women with overweight or obesity 19 years and older (BMI ≥ 25kg/m^2)	**Normal weight women 19 years and older (BMI 18.5kg/m^2 to 25kg/m^2)**
TEE = 448 – 7.95 x Age (yr) x [11.4 x Weight (kg) + 619 x Height (m)]	EER = TEE EER = 354 – 6.91 x Age (yr) + PA x [9.36 x Weight (kg) + 726 x Height (m)]
where	In which
PA = physical activity coefficient:	PA = physical activity coefficient:
PA = 1 if PAL is estimated to be ≥ 1 < 1.4 (sedentary)	PA = 1 (sedentary)
PA = 1.6 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)	PA = 1 12 (Low active)
PA = 1.27 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)	PA = 1.27 (Active)
PA = 1.44 if PAL is estimated to be ≥ 1.9 < 2.5 (Very active)	PA = 1.45 (very active)

*BMI= body mass index; EER= estimated energy expenditure; PA= physical activity; TEE= total energy expenditure; PAL = physical activity level
PAL is the physical activity level that is the ratio of the total energy expenditure to the basal energy expenditure
TEE is the sum of the resting energy expenditure, energy expended in physical activity and the thermic effect of food
EER is the average dietary intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender, height, weight and level of physical activity consistent with good health.

Table 2.3. Physical Activity Level Categories and walking Equivalence*

PAL category	**PAL values**	**Walking Equivalence**
Sedentary	1-1.39	
Low Active	1.4-1.59	1.5, 2.2, 2.9 for PAL = 1.5
Active	1.6-1.89	3, 4.4, 5.8 for PAL = 1.6 5.3, 7.3, 9.9 for PAL = 1.75
Very Active	1.9-2.5	7.5, 10.3, 14 for PAL = 1.9 12.3, 16.7, 22.5 for PAL =2.2 17, 23, 31 for PAL = 2.5

*In addition to energy spent for the generally unscheduled activities that ae part of a normal daily life. The low, middle and high miles/day values apply to relatively heavy weight (120-kg), midweight (70-kg), and lightweight (44-kg) individuals, respectively.

Weight fluctuation <2kg either way (loss or gain) would indicate that energy intake is aligned with requirements (Jensen et al., 2014, Bhutani et al., 2017). In the event

that physical activity levels change (decrease/increase), energy intake should be adjusted accordingly. Wing et al. (2013) confirm that small changes in eating and exercise behaviour will contribute to maintenance of energy balance and prevention of weight gain.

Underpinning dietary patterns and guidelines are the recommendations relating to the macro- and micronutrient composition of the diet. Macronutrient recommendations for health have been formulated by the World Health Organisation and numerous countries (United States and Canada, Norway, New Zealand and Europe) and range from 40 to 75% for carbohydrates, 10 to 35% for protein and 20 to 35% for fat (WHO, 2003; Becker et al., 2004; Nordic Council of ministers, 2004; Institute of Medicine, Food and Nutrition Board, 2002/2005; Australian National Health and Medical research Council and the New Zealand Ministry of Health, 2006; EFSA, 2010). Research has shown that successful weight management is not dependant on specific proportions of carbohydrate, fat and protein in the diet (Hall et al., 2011; Yannakoulia et al., 2019). Hence the distribution of macronutrients should be individualized within the recommended ranges and based on the needs and preferences of individuals (Kushner, 2014; Grave et al., 2013). People are more likely to comply with an eating pattern if they are given choices of foods that they like (Kushner, 2014; Grave et al., 2013).

Carbohydrates provide the principal source of energy in the diet and good quality sources such as whole grains, legumes, fruit and vegetables provide an array of micronutrients and biologically active compounds, as well as oligosacharrides, resistant starch and dietary fibre (Vorster et al., 2013). A specific contribution dietary fibre could make to weight gain prevention is to increase the feeling of satiety (Vorster et al., 2013; Kahleova & Barnard, 2017). Fibre also adds to stool bulk and has beneficial effects on blood lipids and glucose (Vorster et al., 2013; Kahleova & Barnard, 2017). Sugar consumption, a potential risk factor for obesity and other metabolic conditions (Yannakoulia et al., 2019), should be limited to below 10% of total energy intake (WHO, 2015).

Good quality proteins such as lean meat, chicken without the skin, fish, eggs, low-fat or fat-free dairy products and a combination of plant proteins are important in the diet to provide essential amino acids necessary for protein synthesis (Schonfeldt et al., 2013). Proteins are also good sources of vitamins and minerals such as vitamin A, many of the B group vitamins, iron and zinc (Schonfeldt et al., 2013; Melina et al., 2016). Current evidence emphasises that protein from animal sources should be reduced, while the intake of plant proteins should be increased (Melina et al., 2016; Schwingshackl et al., 2017). Soy protein from soy beans or texturized plant proteins provide all the essential amino-acids, while other legumes such as beans, peas, chickpeas, lentils, nuts and seeds need to be combined (complemented) with grains such as rice, pasta, bread (Venter et al., 2013; Schonfeldt et al., 2013; Melina et al., 2016). Plant protein sources are also rich sources of phytoestrogens (biologically active compounds with antioxidant properties), are generally low in saturated fat and high in fibre and are typically more affordable than many animal protein sources (Venter et al., 2013; Melina et al., 2016).

It is essential to include a minimum amount of fat in the diet to ensure sufficient intake of total energy, essential fatty acids and absorption of fat soluble vitamins (Liu et al., 2017). Essential fatty acids cannot be synthesized in the body and have an important role in growth and development, as well as in cholesterol, lipoprotein and glucose metabolism and insulin sensitivity (Smuts & Wolmarans, 2013). The maximum amount of fat that should be consumed has been debated for many years and as indicated above, recommendations are currently given as a range. Smuts and Wolmarans (2013) and Liu et al. (2018) explain that the type of fat rather than the total amount of fat consumed should be the focus of dietary recommendations.

Trans-fatty acids found in partially hydrogenated oils in commercially available processed foods, baked goods and deep-fried foods increase risk for heart disease and should be limited to less than one percent of total energy intake (Smuts & Wolmarans, 2013; Sacks et al., 2017). Saturated fats are solid at room temperature and are from animal and vegetable oil sources such as palm and coconut oil. These fats should be limited to less than 10% of total energy intake (Smuts & Wolmarans,

2013; Dietary Guidelines for Americans, 2015; Liu et al., 2017). Saturated fats and trans fats should rather be replaced by polyunsaturated fats (PUFA) or monounsaturated fats (MUFA) which have been shown to decrease the risk for heart disease (Smuts & Wolmarans, 2013; Dietary Guidelines for Americans, 2015; Sacks et al., 2017; Liu et al., 2018). MUFAs include olive oil, avocado, nuts and canola oil (Smuts & Wolmarans, 2013; Sacks et al., 2017). Key sources of linoleic acid (LA) from the omega-6 PUFA family include soybean oil, corn oil, peanut oil and sunflower oil (Sacks et al., 2017). Key sources of alpha- linolenic acid (ALA) from the n-3 PUFA family are soybean and canola oil, flaxseeds and flaxseed oil, pumpkin seeds, walnuts and some green leafy vegetables (Sacks et al., 2017; Liu et al., 2017). Fish oil from salmon, mackarel, herring, anchovies and sardines is an important source of the very long chain n-3 PUFAs eicosapentaenoic acid, docosapentanoic acid and docosahexaenoic acid, which contribute to neurodevelopment and cardiovascular health (Smuts & Wolmarans, 2013; Sacks et al., 2017). A further consideration is the n-6 to n-3 ratio, where n-6 should provide 5-8% of total energy and n-3 should provide 1-2% of energy, with an optimal ratio between 2:1 to 3:1 respectively (Smuts & Wolmarans, 2013).

Micronutrients are compounds that are mostly not produced by the body and the small amounts needed must be obtained from food sources. They play a central role in metabolism and maintenance of tissue function and are vital for growth and development, disease prevention and wellbeing. Inadequate dietary intake of micronutrients will result in a specific deficiency syndrome or symptoms (Shenkin, 2006; Gallagher, 2012). Essential vitamins include fat soluble vitamin A (key sources: liver, kidney, egg yolk, yellow or orange fruit and vegetables and dark green leafy vegetables); vitamin D (key sources: fatty fish, egg yolk, beef liver and sunlight exposure (promotes production in the skin), vitamin E (key sources: wheat germ, vegetable oils, green leafy vegetables, egg yolk, nuts) and vitamin K obtained from key dietary sources such as liver, soybean oil, green leafy vegetables, wheat bran, as well as production by the gut microbes (Gallagher, 2012). The water soluble vitamins include the B vitamins (thiamine, riboflavin, niacin, pantothenic acid, biotin, vitamin B6, folic acid and vitamin B12) obtained from dietary sources such as whole grains,

legumes, vegetables, mushrooms, yeast, meat, fish, liver, eggs, dairy, enriched cereals and grains, oatmeal) and vitamin C obtained from dietary sources such as fruits and vegetables (including citrus fruit, tomato, peppers, guavas, strawberries, pineapple, potato, kiwi, raw cabbage, greens) (Gallagher, 2012).

Essential minerals include the macro minerals calcium (key sources: dairy, green leafy vegetables, sardines, clams, oysters, tofu), phosphorus (key sources: cheese, egg yolk, milk, meat, fish, poultry, whole-grain cereals), magnesium (key sources: whole-grain cerelas, tofu, nuts, meat, milk, green vegetables, legumes, chocolate), sulphur (key sources: meat, fish, poultry, eggs, milk, cheese, legumes, nuts), sodium (key sources: dairy products, meat, shellfish, table salt, smoked, cured or salted meats, canned foods, frozen meals, instant soups), potassium (key sources: bananas, oranges, canteloupe, grapefruit, apricots, dried fruit, spinach, broccoli, potatoes) and chloride (key sources: seaweed, rye, tomatoes, celery, lettuce, olives) (Gallagher, 2012). It has been suggested that calcium in dairy foods may help prevent excess weight gain, especially when consumed in adequate amounts (three or more servings per day) bearing in mind energy balance (Poddar et al., 2009). Essential trace minerals include iron (key sources: liver, meat, egg yolk, legumes, whole or enriched grains, dark green vegetables, dark molasses, shrimp, oysters), zinc (key sources: oysters, shellfish, herring, liver, milk, legumes, bran), iodine (key sources: iodized table salt, seafood), copper (key sources: liver, shellfish, grains, legumes, cherries, chocolate, nuts). Essential ultra-trace minerals include selenium (key sources: grains, onions, milk, meat), manganese, molybdenum, flouride, cobalt, and chromium (Gallagher, 2012).

2.3.2 Unhealthy and extreme weight management (loss) methods

An abundance of unhealthy weight loss methods and products, also termed “fad diets,” are marketed by the weight loss industry or are promoted by celebrities. These diets are typically followed for a distinct, often short period of time with exaggerated eagerness and expectation of quick weight loss with little or no real

effort (Neumark-Sztainer & Hannan, 2002, Van Horn, 2007; Pagoto & Appelhans, 2013; Ramage et al., 2014). Unhealthy and extreme weight loss diets may be very low energy in energy; limit or exclude entire food groups; promote fasting; and include a variety of weight loss products that claim to affect appetite, absorption and energy expenditure (Neumark-Sztainer & Hannan, 2002, Senekal et al., 2008). These options are especially attractive as dieters are inclined to want a quick and easy way to lose weight instead of changing their lifestyles i.e. eating healthily and increasing physical activity (Senekal et al., 2008; Ramage et al., 2014).

Adolescent and young females have been reported to be at risk of using extreme weight loss methods such as vomiting and use of diuretics and laxatives (Neumark-Sztainer & Hannan, 2002). These methods are deemed to be extreme as they may result in life threatening physical and mental damage to the body, as well as poor weight management (Reba et al., 2005, Roerig et al., 2010, Mascolo et al., 2011). Self-induced vomiting has also been shown to be associated with large lifelong weight fluctuations (Grave et al., 2009), while Roerig et al. (2010) reported that laxative abuse may lead to weight gain instead of weight loss due to the effect of fluid loss on the rennin-aldosterone system. Moreover, according to Mascolo et al. (2011) diuretic abuse results in volume depletion and increased aldosterone production, which causes oedema and weight fluctuations. These extreme weight loss methods may thus create more weight management issues than solutions and should be avoided (Reba et al., 2005; Roerig et al., 2010).

2.4 Alcohol use and weight gain prevention

According to the World Health Organisation (2018), South Africa has been identified as one of the nations with the highest absolute alcohol consumption per drinker in the world and as being one of the nations with the most harmful patterns of alcohol consumption. A sustained high alcohol intake can lead to many social and health problems, such as alcohol related crime, violence, car accidents, risky sexual

behaviour and increased risk of HIV, foetal alcohol syndrome, liver disease and malnutrition (Jacobs & Steyn, 2013).

Data on the general population in South Africa shows that one in four women (26%) over the age of 15 has ever drunk alcohol, while one in 10 has drunk alcohol in the past 7 days. Five percent of women report risky drinking (drinking five or more standard measures of alcohol on a single occasion in the past 30 days). Risky drinking was found to be most common among women in the 20-24 year age group.

There is significant variability in guidelines for low-risk drinking, with recommendations ranging from 10–42g per day for females and 10–56g per day for males (98–140g per week for females and 150–280g per week for males) (Kalinowsky & Humphreys, 2016). Most countries define 10g ethanol to be a standard alcohol serving, but the modal standard serving ranges from 8 to 20g in different countries (Kalinowsky & Humphreys, 2016). The National Institute on Alcohol Abuse and Alcoholism (NIAAA) in the USA defines low-risk drinking as no more than three drinks on any single day and no more than seven drinks per week for females, and no more than 4 drinks per day or 14 over the week for males. Although the 2002 SAFBDGs included a guideline that specified that adult females could consume up to one drink a day, the revised 2012 guidelines do not include an alcohol intake guideline (Jacobs & Steyn, 2013).

Various drinking patterns have been identified, including social, harmful and binge drinking. Social drinking is described as drinking for social facilitation, improvement of social gatherings, or to get in a party mood (Constant et al., 2018). The Substance Abuse and Mental Health Services Administration (SAMHSA) in the USA defines heavy drinking as more than 8 drinks per week for females and $\geq$15 drinks per week for males (Sacks et al., 2015). Harmful drinking is defined as alcohol consumption that results in adverse events (e.g., physical or psychological harm) (Pengpid & Peltzer, 2013). Binge drinking is defined as four or more drinks in an evening for females and five or more for males (National Institute on Alcohol Abuse and Alcoholism, 2005; SADHS, 2016).

Alcohol consumption should be limited not only for health and safety reasons, but also for energy intake control (Jacobs & Steyn, 2013; WHO, 2012). Alcoholic beverages provide a significant source of calories (7 kcal/g), while lacking in nutritional value (Suter et al., 1997; Yeomans, 2010; Battista & Leatherdale, 2017). There is evidence that alcohol consumption may be associated with weight gain or obesity risk among youth, especially among females (Vagstrand et al., 2007; Berkey et al., 2008; Croezen et al., 2009; Farhat et al., 2010). Binge drinkers are more likely to have overweight or obesity than those who consume the same amount of alcohol over multiple sessions (Yeomans, 2010). LaRose et al. (2019) for example found that binge drinking was associated with weight gain at the 4 month and 2 year follow ups of normal or overweight 18 to 35 year olds in a weight gain prevention intervention.

Of note is that obesity prevention largely focuses on food and sugar-sweetened beverage consumption, but may overlook the potential impact of energy from alcoholic beverages (Battista & Leatherdale, 2017). Compounding the energy contribution of alcohol is the fact that it has no satiety effect, with drinkers typically not compensating for the energy consumed in the form of alcohol by a reduction in food intake (Yeomans et al., 2010). It further stimulates appetite, peaking at 30 minutes after ingestion. This may result in greater total energy consumed from a meal and from alcohol if drinking commences prior to a meal (Yeomans, 2010).

Alcohol can form part of a healthy balanced diet, but it is not energy-free and it should not replace nutrient rich foods (Yeomans, 2010). Considering the substantial amount of energy provided by alcoholic beverages, as well as the potential link between alcohol intake and weight gain, weight gain prevention interventions should include a focus on controlling alcohol intake (Battista & Leatherdale, 2017).

2.5 Physical activity for weight gain prevention

2.5.1 Physical activity recommendations

Physical activity includes any bodily movements that are done on an everyday basis such as occupational activity, recreational activity, exercise and sporting activities (WHO, 2014). Occupational activity includes any activity taking place during the performance of work, including household tasks and recreational activity is any activity that takes place during leisure time; it can include walking or cycling specifically for transportation or commuting (Blackwell et al., 2018). Kushner (2014 p.466) defined exercise and sporting activities as any "planned, structured and repetitive body movement done to improve or maintain one or more components of physical fitness".

Muscle-strengthening activities include activities that increase skeletal muscle strength, power, endurance and mass, such as resistance training and weight lifting (Piercy et al., 2018). Aerobic activities include activities in which the body's large muscles move for a sustained amount of time, causing an increase in heart rate and improving cardiorespiratory fitness such as brisk walking, running or cycling (Piercy et al., 2018). Bone- strengthening activities include any activities that promote bone growth and strength, for example jumping rope or running (Piercy et al., 2018). Balance activities are designed to improve individuals' ability to resist forces within or outside of the body that cause falls while a person is moving or stationary, for example lunging or walking backwards (Piercy et al., 2018).

The WHO recommends 30 minutes of moderate intensity exercise, five days of the week, which can include any activities of daily living mentioned above (Lambert et al., 2001; NYRBS, 2002; Driskell et al., 2005; Marshall et al., 2009; Wen et al., 2011; Cook et al., 2011; WHO, 2014). This level of activity can have the same health benefits as high intensity exercise that is performed three times per week (WHO, 2014). These recommendations are in line with the most recent physical activity guidelines for Americans that suggest that adults should perform at least 150

minutes (2 hours 30 minutes) to 300 minutes (5 hours) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) to 150 minutes (2 hours and 30 minutes) a week of vigorous- intensity aerobic physical activity or an equivalent combination of moderate- and vigorous- intensity aerobic activity (Piercy et al., 2018). Additional health benefits can be gained from performing more than 300 minutes of moderate-intensity physical activity over the week (Piercy et al., 2018). Adults should also do muscle- strengthening activities of moderate- or greater intensity that involve all major muscle groups at least twice a week for added health benefits (Piercy et al., 2018).

Exercise plays an important role in increasing lean body mass in proportion to fat mass, which results in increased basal energy expenditure and maintenance of a stable weight (Kushner, 2014; Petridou et al., 2019). Physical activity is associated with long term successful weight maintenance as a result of both physical and emotional benefits, including greater energy expenditure and physical fitness, as well as a greater sense of well-being (Elfhag & Rossner, 2005; LaCaille et al., 2011; Foright et al., 2018; Petridou et al., 2019). Physical activity is thus an important factor to consider in weight management interventions (Elfhag & Rossner, 2005; LaCaille et al., 2011; Foright et al., 2018; Petridou et al., 2019).

The American College of Sports Medicine's (ACSM) position on appropriate physical activity for health and weight maintenance (weight gain prevention) for adults is that moderate-intensity physical activity of 150 to 250 minutes per week with an energy equivalent of 1200 to 2000 calories per week is sufficient to prevent weight gain greater than 3% in most adults and may also result in modest weight loss (Donelly et al., 2009). Lifestyle approaches for increasing physical activity have been consistently associated with less weight gain compared to inactivity (Donelly et al., 2009). More recent studies have also shown that physical activity levels in line with the ACSM recommendations could contribute to weight gain prevention (Petridou et al., 2019). Both aerobic activity and resistance exercise are important in weight management regimes (Kruger et al., 2005; Haskell et al., 2007; Schwingshackl et al., 2013; WHO, 2014). Aerobic exercise increases loss of fat and increases energy expenditure, while

resistance exercise is important for increasing the amount of energy expended and also for increasing lean body mass (Haskell et al., 2007; Schwingshackl et al., 2013).

Recommendations for maintaining a stable weight and prevent weight gain should thus focus on increasing daily living and recreational activities, as well as on fitness, strength and flexibility (Kruger et al., 2005; James, 2012). However, physical activity must be accompanied by a healthy, energy-controlled diet for long-term success (Botha et al., 2013).

2.5.2 Sedentary behaviour

Sedentary activity includes watching television, computer use and sitting for work or study purposes (Deliens et al., 2015). This type of behaviour has an important influence on weight and health status and higher sedentary activity is associated with a greater risk of obesity, independent of diet and physical activity (Deliens et al., 2015).

Sedentary behaviour may be promoted by physical environmental factors such as low walkability, unsafe neighbourhood environments, residential density and poor neighbourhood aesthetics (Owen et al., 2018). Some studies have found walkability features to be associated with higher levels of sedentary time (Van Dyck et al., 2010; Van Dyck et al., 2012), while others have observed associations with lower levels of television viewing time among women (Sugiyama et al., 2007). According to Owen et al. (2018) residential density may promote increased sedentary time due to smaller homes or dwelling. Smaller homes may provide less opportunity or means for incidental light exercise in comparison to larger homes.

In contrast, street connectivity, land use mix and pleasing aesthetics reduced sedentary time (Owen et al., 2018). Higher levels of perceived safety and the presence of street lighting have been associated with lower levels of television viewing among Belgian (Van Cauwenberg et al., 2014) and Hong Kong older adults

(Barnett et al., 2015). Owen et al. (2018) reported that aesthetics and safety from crime were related to less sedentary time in women only.

2.6 Sleep patterns for weight gain prevention

Although sleep is often not considered in the health equation, it is just as vital as healthy eating and physical activity for physical, cognitive and emotional health (Hirshkowitz et al., 2015). The National Sleep Foundation recommends that 18 to 25-year-olds get between seven to nine hours of sleep a night (Hirshkowitz et al., 2015). This expert panel suggests that anything less than six hours or more than 11 hours is not recommended (Hirshkowitz et al., 2015).

Inadequate sleep and poor quality sleep have been associated with obesity in various studies (Taheri et al., 2004; Gangwisch et al., 2005; Patel et al., 2006; Chaput et al., 2007; St-Onge, 2017; Ludy et al., 2018; Hayes et al., 2018; Yang et al., 2019; Rihm et al., 2019). A number of possible mechanisms for this association have been suggested. Research has shown that restricted sleep may lead to daytime fatigue and therefore reduced activity (Chaput et al., 2008; St-Onge, 2017; Hayes et al., 2018). Sleep deprivation may further increase appetite by causing alterations in serum leptin and grelin levels (Patel et al., 2006; St-Onge, 2017; Hayes et al., 2018). Sleep loss has also been linked to decreased glucose tolerance which is a risk factor for obesity (Gangwisch et al., 2005). Sleep restricted people have a 30% decrease in insulin response to glucose, which is similar in those with insulin resistance and prediabetes (Gangwisch et al., 2005).

Insufficient sleep is further associated with impulse control and risk-taking behaviours which could also contribute to weight gain (Roane et al., 2015). Inadequate sleep can also lead to higher hedonic eating (eating for pleasure) rather than eating when feeling hunger due to an increased desire for the rewarding properties of food (Benedict et al., 2012; St-Onge, 2017; Rihm et al., 2019). Later bedtimes allow for more opportunity to consume foods and drinks, with decreased

access to healthy food options at such late hours (Roane et al., 2015; St-Onge, 2017; Hayes et al., 2018). Sleep deprivation may further contribute to a positive energy balance as a result of decreased physical activity during awake time (St-Onge, 2017).

In a study of normal weight 18 to 55-year-old females who slept on average seven to nine hours per night, Yang et al. (2019) assigned participants to either a control group or restricted night sleep group. They found that participants experienced increased hunger and food cravings, had a food reward orientation and increased their food portion sizes after a night of modest sleep restriction. These maladaptive responses could lead to higher energy intake and, ultimately, weight gain.

2.7 Eating behaviour, psychological well-being and weight gain prevention

2.7.1 Eating behaviours

Eating behaviours that play a role in weight management include cognitive restraint, uncontrolled eating (disinhibition and perceived hunger) and emotional eating (Provencher et al., 2003; Lowe & Kral, 2006; Hays & Roberts, 2008; Bryant et al., 2012; Crocket et al., 2015; Hunt et al., 2017; Braden et al., 2018; Van Strien, 2018; Konttinen et al., 2019; Aoun et al., 2019).

Cognitive restraint

Restrained eaters restrict their food intake through cognitive control in order to better control their weight (Lowe & Kral, 2006; Bryant et al., 2012; Hunt et al., 2017; Aoun et al., 2019). Examples of restraint are to stop eating before feeling full, avoid eating high fat foods or consume small portions of food in order to limit food intake (Bryant et al., 2008).

Research on the association between cognitive restraint and weight status per se is controversial, with studies showing the association between weight or BMI and

cognitive restraint as being either positive (Banna et al., 2018) or negative (de Lauzon-Guillain et al, 2017; Singh et al., 2017). However, cognitive restraint seems to be clearly associated with weight loss attempts (Elfhag & Rossner, 2005). Individuals who lose weight successfully have been reported to have higher levels of restraint or control over eating. Higher levels of restraint have also been found to be associated with better weight maintenance (Elfhag & Rossner, 2005).

According to Hunt et al. (2017) if efforts to control dietary intake are unsuccessful and a lapse occurs, binge eating may result. This may be the result of the fact that high restraint levels increases the susceptibility to uncontrolled eating (Lowe & Kral, 2006; Lowe et al., 2013). Furthermore, there is also research that shows that when under stress, individuals with high restraint levels tend to increase their food intake (Lowe & Kral, 2006). For these reasons restraint may not be a sustainable and appropriate behaviour to promote for achieving successful weight gain prevention in the long term.

Uncontrolled eating (Disinhibition and perceived hunger)

Disinhibition is the tendency to over-eat in response to a number of stimuli and thereby increasing susceptibility for weight gain (Bryant et al., 2008; Finlayson et al., 2012). Stimuli trigger over-eating when in the presence of others who are eating, or in response to the palatability of food, as well as in response to emotional experiences (Bryant et al., 2012). High dietary restraint is associated with high disinhibition, thus the more individuals attempt to control/restrict their food intake, the higher the chance that a trigger will cause a lapse and therefore overeating (Fayet et al., 2012). It follows that both high restraint and high disinhibition are associated with adult weight gain (Fayet et al., 2012) and that lower levels of disinhibition would contribute to successful weight gain prevention.

Binge eating disorder (BED) is a clinical eating disorder related to overweight and obesity and is viewed as the extreme form of disinhibited/uncontrolled eating (Mustelin et al., 2018). The excess calories consumed during binge eating episodes

are likely to lead to weight gain (Mustelin et al., 2018). At this point it is inconclusive as to whether BED precedes weight gain or vice versa, but it has been proposed that there is a bidirectional association (Mustelin et al., 2018). BED is commonly seen from age 16 onwards and is associated with excess weight gain throughout adolescence and into early adulthood (Mustelin et al., 2018).

Perceived hunger refers to feeling hungry countless times in a day, feeling as if one never reaches satiety or having a 'bottomless pit' of a stomach (Bryant et al., 2008). Research has found that successful weight loss and maintenance is associated with lower perceived hunger (Bryant et al., 2012). Education on hunger and satiety cues and being able to stop eating once full would thus be important aspects of any weight management intervention (Denny et al., 2013). For example, the promotion of intuitive eating has been reported to be an effective strategy in dealing with issues of perceived hunger (Denny et al., 2013; Schaefer & Magnunson, 2014).

Emotional eating

Emotional eating is defined as eating in response to emotions including depression, anxiety, anger, boredom, but also positive emotions (Crockett et al., 2015; Braden et al., 2018; Van Strien, 2018; Konttinen et al., 2019). Emotional eating has been found to be a risk factor for eating disorders and a mediator between depression and obesity (Armitage, 2015; Crockett et al., 2015; Van Strien, 2018; Bourdier et al., 2018; Konttinen et al., 2019). One possible cause of emotional eating may be high dietary restraint (Van Strien, 2018). Boredom, depression, anxiety and anger have all been associated with poorer psychological well-being and difficulties with regulation of emotions (Braden et al., 2018).

Van Strien (2018) therefore cautions that weight management interventions should consider the emotional state of the target population. Strategies for those experiencing emotional challenges should focus more on emotion regulation skills than on energy restriction (Van Strien, 2018).

2.7.2 Psychological well-being

Psychological well-being, with specific reference to stress, body image, depression, anxiety, and self-esteem plays an important role in weight management (Senekal at al., 1999; Wardle et al., 2011; Cheung et al., 2011; Richard et al., 2016; Geiker et al., 2018).

Stress

Stress can be described as a feeling of being extremely challenged, overwhelmed or having lost control due to an emotional or physiological event or a cluster of events (Sinha & Jastreboff, 2013; Geiker et al., 2018). Health problems such as weight gain may result if individuals use maladaptive behaviours to cope with stress (Sinha & Jastreboff, 2013).

Stress management is important for successful weight loss and maintenance because detrimental changes in eating behaviours may be the result of higher stress levels (Geiker et al., 2018). Eating is often used as a stress coping mechanism and may thus contribute to poor weight management (Elfhag & Rossner, 2005; Lazaverich et al., 2018). Stress may further increase appetite and cravings for sweet foods, decrease motivation for doing physical activity and result in poor sleep patterns (Groesz et al., 2012; Geiker et al., 2018). Hence, high levels of stress may be a risk factor for weight gain (Wardle et al., 2011; Geiker et al., 2018).

Depression and anxiety

Depression is a medical illness that affects the way an individual feels, thinks and behaves (APA, 2013). Depression may cause persistent sadness and loss of interest in activities previously enjoyed (APA, 2013). It is a common mental disorder and one of the main causes of disability worldwide, with an estimated 264 million people being affected according to the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD 2017) (James et al., 2018).

Depression has been associated with increased appetite and weight gain or regain, as well as underweight, while lower levels of depression have been reported to be associated with greater weight loss success and maintenance (Wing & Phelan, 2005; Elfhag & Rossner, 2005; Privitera et al., 2013). A possible reason for this may be that individuals suffering from depression may overeat or use comfort foods including sweet tasting and high energy foods as a way of feeling good (Privitera, 2013; Lazaverich et al., 2018). In addition, dieters often experience major weight changes and struggle to maintain stable weights (Denny et al., 2013). This in turn may lead to depression and thus the use of unhealthy or extreme weight loss methods (Denny et al., 2013).

According to Dean (2016) "anxiety is the feeling of fear that occurs when faced with threatening or stressful situations. It is a normal response when confronted with danger, but, if it is overwhelming or the feeling persists, it could be regarded as an anxiety disorder." Symptoms may include excessive worry, avoidance, and fear about a number of situations or activities, fatigue, sweating, gastrointestinal disturbances, and difficulty concentrating (APA, 2013). There is evidence for a positive association between anxiety and weight status (Gariepy et al.,2010). This notion is confirmed by the results of prospective studies in adult populations that show that baseline depression and anxiety symptoms predicted weight gain at follow-up (Brumpton et al., 2013)

Choi et al. (2019) suggested that interventions for depression in young adults should focus on improving levels of social support, resilience and positive domains of personality.

Body image

Body image refers to how individuals perceive their weight or shape and their attitudes towards their weight status (Shisana et al, 2013; Richard et al., 2016). Body

image is one of the most important psychosocial factors that influence individuals' weight control behaviours (Cheung et al., 2011; Shisana et al., 2013; Cristiana, 2016; Richard et al., 2016; Lowe et al., 2019). Negative body image is typically measured as body shape dissatisfaction (Silva et al. 2019), which is attributable to a discrepancy between the perception of body image and body shape ideals (Lewer et al., 2017).

Females tend to be more likely to be dissatisfied with being overweight, less likely to be dissatisfied with being underweight and more worried about weight gain than males (del Mar Bibiloni et al., 2017; Woodruff et al., 2018). Cheung et al. (2011) found that body dissatisfaction was prevalent in three quarters of young adults aged 18 to 27 years in Hong Kong and that 30.9% of underweight females and 75.5% of normal weight females were dissatisfied with their body shape.

In a systematic review Haynes et al. (2018) found that perceived overweight was associated with greater disordered eating and increased likelihood of weight loss attempts (with healthy and unhealthy weight control strategies), while not being associated with physical activity or healthy eating. Evidence furthermore showed consistently that perceived overweight was predictive of increased weight gain over time (Haynes et al., 2018). Similarly, Robinson et al. (2018) found that adolescents and young adults who identify themselves as being overweight are more likely to attempt weight loss, which in turn creates a greater likelihood of weight gain due to failed weight loss attempts. One reason for this may be the reduction in metabolic rate associated with weight loss, or binge eating following a diet (Lowe et al., 2019).

A further concern is that body shape dissatisfaction has been found to be associated with depression (Tang et al., 2010; Minor et al., 2016; Richard et al., 2016), independent of BMI, age and sex. Minor et al. (2016) examined the relationship between weight perception and suicidal behaviours in female adolescents aged 11 to 18 years in the USA and found that both self-perceived and actual weight status (overweight or obesity) increased the probability of suicide ideation.

Self-esteem

Self-esteem is the evaluative component of self-concept and involves the general evaluation that individuals make of themselves (Pila et al., 2015; Bleidorn et al., 2016; Kiviruusu et al., 2016). According to Bleidorn et al. (2016) evidence from numerous cross-sectional, longitudinal, and cohort studies shows that men tend to have higher self-esteem than women and that self-esteem increases from late adolescence to middle adulthood in both genders.

Low self-esteem is commonly associated with vulnerability to eating disorders, depression or anxiety (Choi et al., 2019), as well as overweight and obesity in female samples (Pila et al., 2015). According to Kiviruusu et al. (2016) these associations may be bidirectional. Kiviruusu et al. (2016) investigated the developmental trajectories of self-esteem and BMI from adolescence to mid-adulthood during a 26-year follow-up in a Finnish cohort. Among females, higher and increasing BMI was found to be associated with lower and more slowly increasing self-esteem. This association was not restricted to adolescent years but persisted and strengthened in mid-adulthood. Moreover, body related shame or body shape dissatisfaction has been found to be a mediator between self- esteem and BMI (Pila et al., 2015). In addition, a higher self-esteem has been associated with a greater ability to control weight and being less prone to giving up on weight control (Elfhag & Rossner, 2005).

According to Soohinda et al. (2019) self-esteem has further been hypothesized to mediate internalization of culturally unattainable ideals i.e. internalization of perceived pressure by media and peers to comply with a particular body shape ideal is facilitated by a low self-esteem. This could lead to the development of harmful diet control measures. Weight management interventions should address the development of skills for controlling and regulating emotions as well as controlling environmental influences that cause poor self-esteem or body image by changing misperceptions of a westernized ideal beauty. Teaching individuals how to be more assertive and how to manage their mistakes are also important (Senekal et al., 1999; Wing & Phelan, 2005).

2.8 Weight management profile of female students

Information in this section is based not only on publications that focus on first year female students as there is a limited information on this specific group. Information from studies that investigate female students in general and those that cover male and female students was also used.

2.8.1 Developmental stage of first year students (late adolescents)

Late adolescence is the developmental stage that occurs between the ages of 18 to 21 years old (Newman et al., 2007; Newman et al., 2009; Strang & Larson, 2012). This developmental stage is a unique and important period for human development, during which brain regions involved in planning, decision-making, cognitive reasoning and control of impulses and emotions are refined (Tamura et al., 2012). This phase is a transitional period where adolescents mature and develop a core set of values and beliefs that guide moral, ethical and health decisions (Tamura et al., 2012). They further develop a sense of personal and social identity by overcoming social and emotional instabilities and through experimentation with different social settings (Erikson, 1994; Nelson et al., 2008; Tamura et al., 2012). Late adolescents develop social, emotional, financial and physical independence from their families as they leave home to engage with tertiary education or seek employment (Nelson et al., 2008; Strang & Larson, 2012). They also become more future oriented, developing a better understanding of the link between their current behaviours and chronic health risks (Strang & Larson, 2012). As a result, this stage may be particularly important for establishing long-term health behaviour patterns (Nelson et al., 2008).

Transition from adolescence to adulthood is challenging as it involves making new friends, aiming for academic success, seeking romantic relationships and exploring possible occupations (Tamura et al., 2012). Late adolescents may be more likely to engage in risk-taking behaviours as they revert to less complex thinking when they

are under stress (Tamura et al., 2012; Strang & Larson, 2012). It is thus important to understand the vulnerability of individuals in this life stage when considering weight gain prevention characteristics and initiatives.

2.8.2 Transition of late adolescents into tertiary education settings

In addition to the developmental transition experienced by late adolescents, many of them also undergo a transition from secondary school to tertiary education (Kantanis, 2000; Tamura et al., 2012; Deliens et al., 2015). The tertiary education environment provides students with experiences to learn about themselves and others through diverse perspectives, opinions and ways of living (Tamura et al., 2012). Some students view this transition as a challenge, while others are overwhelmed by the change and do not cope well (Kantanis et al., 2000). High numbers of students (e.g. up to 40% at some institutions) discontinue studies prematurely due to the unexpected stressful experience of university life (Bowles et al., 2011).

According to Kantanis (2000) students find it difficult to manage the level of autonomy and flexibility that they have in the tertiary education environment after being used to the supportive frameworks that they had at school. Further key challenges experienced during the transition include the sense of independence, loneliness and home- sickness (Kantanis, 2000; Bowles et al., 2011), the need for some students to earn money, the inability to integrate socially and the wrong choice of subject or degree (Kantanis, 2000).

The academic transition from school to tertiary education requires students to become more skilled in independent learning, as there is little feedback and guidance when compared to the school setting (Kantanis, 2000; Christie et al., 2008). Students also report being concerned with the style and pace of learning and the high volumes of reading required in a short time frame at tertiary education institutions (Kantanis, 2000; Christie et al; 2008). Assignments are generally reported

to be overwhelming in terms of weight of marks and hand in deadlines, creating difficulty with time management and increased stress (Kantanis, 2000). Students are also often afraid of letting themselves and their families down, especially if they are the first in the household to continue with tertiary education (Kantanis, 2000).

Initiation of tertiary education is often the first time that students live away from their parents, meaning that they need to create their own new routines and habits (Small et al., 2013). The transition from living with parents to campus living increases the risk for developing and adopting unhealthy lifestyle habits that may increase weight gain and obesity risk (Walsh et al., 2018). It is thus not surprising that research shows that campus living comes with changes in lifestyle factors including dietary intake, alcohol use, physical activity and sleep (Brunt & Rhee, 2008; Kapinos & Yakusheva, 2011; Small et al., 2013). For example, many students enrol in university residences that offer a dining plan with all-you-can eat access to food (Walsh et al., 2018). Besides the food offerings in campus dining halls, students tend to engage in more social eating and drinking (Walsh et al., 2018). They also tend to reduce their participation in sports or physical activity and experience a disrupted sleep pattern (Walsh et al., 2018). Therefore, it is important to address the lifestyle changes that come with moving away from home in weight gain prevention interventions.

Overall, research highlights the need for effective facilitation of and support for the transition process experienced by first year students. Tertiary education institutions need to have a clear understanding of the issues involved to institute appropriate interventions (Kantanis, 2000).

2.8.3 Weight status of female students attending tertiary education institutions in South Africa

The weight status and associated factors of tertiary students has been the focus of research in South Africa for more than three decades (see section 2.8.4). The

prevalence of overweight and obesity in South African female university students, as well as comparative age groups from the general population is presented in Table 2.4. Results show that in the early 2000s overweight or obesity among a sample of black female students was 21.8% (Senekal et al., 2001), and 10% among Caucasian first year female students (Cilliers et al 2006). In 2015 a study that included all the predominant race groups found that overweight or obesity among female students was 24.2% (Senekal et al., 2016). Comparative information from national surveys shows that overweight or obesity was 25% (18 year olds) and 35.7% (19 year olds) (SAHDS, 2003), 47% females aged 18 to 24 years (SANHANES, 2012), 39.9% females ages 15 to 24 years (SADHS, 2016) in the respective studies .

Table 2.4: Weight status of South African females from 2000-2016

Senekal (2001)	Black South African female tertiary students	Mean BMI 22.6 ± 3.8 kg/m^2	• 16.8% overweight • 5% obesity
Cilliers et al. (2006)	Caucasian South African first year female students		• 81.9% normal weight • 10% overweight • 0.8% obesity • 7.2% underweight
Senekal et al. (2016)	South African female tertiary students age 18 to 25 years	Mean BMI of 23.17 ± 3.8 kg/m^2	• 20.1% overweight • 4.11% obesity
SADHS (2003)	South African female adolescents	• Age 18 years: Mean BMI of 23.3 ± 0.47 kg/m^2 • Age 19 years: Mean BMI of 23.9 ± 0.52 kg/m^2	Age 18 years: • 12.9 % Underweight • 61.7 % Normal weight • 15.3% Overweight • 10.1 % Obesity Age 19 years: • 6.8% Underweight • 57.6% Normal • 28.1% Overweight • 7.6% Obesity
SANHANES (2012)	South African females aged 18 to 24 years	Average 26.2 kg/m^2	• 4.4% underweight • 48.5% normal weight • 25.3% overweight • 21.7% obesity
South African Demographic Health Survey (2016)	South African females age 15 to 24 years	Mean BMI 24.8 kg/m^2	• 54.3% normal weight • 24.4% overweight • 15.5% obesity
	South African females age 15 to 19 years	Mean BMI 23.7 kg/m^2	• 66.3% normal weight • 16.1% overweight • 10.9% obesity
	South African females age 20 to 24 years	Mean BMI 25.9 kg/m^2	• 42.2% normal weight • 32.8% overweight • 20.1% obesity
	South African Caucasian females	Mean BMI 28.3 kg/m^2	• 28.9% normal weight • 38.8% overweight • 30.6% obesity
	South African Indian/asian females	Mean BMI 29.1 kg/m^2	• 30% normal weight • 20.8% overweight • 49.2% obesity
	South African coloured females	Mean BMI 30.1 kg/m^2	• 27.9% normal weight • 21.8% overweight • 45.9% obesity
	South African black females	Mean BMI 29.2 kg/m^2	• 30% normal weight • 26.5% overweight • 40.9% obesity

The studies included in Table 2.4 show that the mean BMI has remained in the

normal range from 2000 to 2015, while the prevalence of overweight seemed to have increased and that of obesity seemed to have decreased (Senekal et al., 2001; Cilliers et al., 2006; Senekal et al., 2016). Despite the fact that the weight of the majority of female students (nationally and internationally) seems to be in the normal range, dieting is very common (Senekal et al., 2001; Hendricks et al., 2004; Cilliers et al., 2006; Malinauskas et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016).

2.8.4 Weight change experienced by females during their tertiary education time period

Research shows that first year female students may be specifically prone to weight gain problems and dieting (Hovell et al., 1985, Megel et al., 1994; Senekal et al., 1988, & Senekal, 1994; Graham et al., 2002; Anderson et al, 2003; Malinauskas et al., 2006; Lloyd-Richardson et al., 2009; LaCaille et al., 2011; Fayet et al., 2012; Finlayson et al. 2012; Smith- Jackson & Reel, 2012; Vadeboncoeur et al, 2015; Nikolaou et al., 2015).

“Freshman 15” is a term that evolved in the USA to describe the weight gain that occurs in first year university students based on the original claim that this weight gain was on average 15lbs (6.8kg) (Graham & Jones, 2002; Smith-Jackson & Reel, 2012). However, a meta-analysis by Vella-Zarb and Elgar (2009) found that mean weight gain in first year students of both genders was 1.75kg, which is far less than the reported 6.8kg, but still significant and higher than weight gain trends in the general population (Levitsky et al., 2004). A more recent meta-analysis showed that most (60.9%) first year male and female students gain weight in their first year and that most of this weight gain is in the first term (Vadeboncoeur et al., 2015).

South African research confirms that female students, especially first year students studying at tertiary education institutions in South Africa, are prone to gaining weight. Senekal et al. (1988) reported that 59% of non-first year female students reported that they had gained weight during their first year. Seventy two percent of

first year female students who participated in a longitudinal follow-up study were not able to maintain a stable weight (Senekal, 1994). The results of the four year longitudinal study further showed that only 20.7% of the students were able to maintain a constant weight over the four year period at university, whereas 31.6% continued to gain weight, 18% were weight cyclers and the weight of 29.7% was not stable. There is a paucity of recent published national and international studies that focus on the longitudinal follow-up of the weight status of female students.

Reported causes of weight gain during the transition from home to a tertiary education setting include change in living situation, increased alcohol consumption, homesickness, frustration, tension, lack of self-discipline, changes in eating patterns, increased socializing, increased availability of money to spend on food, unhealthy food choices, decreased physical activity, altered sleep pattern and poor body image (Vella-Zarb & Elgar, 2009; Crombie et al., 2009; Wengreen & Moncur, 2009; Gillen & Lefkowitz, 2011; Nikolaou et al., 2015; De Vos et al., 2015). All of these factors contribute to increased stress, anxiety and depression and decreased self-esteem (Cilliers et al., 2006; Fayet et al., 2012; Quick & Byrd-Bredbenner, 2013). This may result in an increased risk for using unhealthy or extreme weight management methods and unnecessary dieting (Cilliers et al., 2006; Quick & Byrd-Bredbenner, 2013).

Weight gain and poor lifestyle behaviours that develop during late adolescence may persist into adulthood and increase rates of overweight and obesity in the longer term (Braddon et al., 1986; Williamson et al., 1990; Rothacker & Blackburn, 2000; Nelson et al., 2008; Gillen & Lefkowitz, 2011; Wharton et al., 2008; Brown et al., 2014; Vadeboncouer et al., 2015). Therefore, education on healthy eating habits, managing stressful situations and lifestyle modification is vital in helping female students to maintain a healthy weight through this transition period or to achieve successful weight loss and prevent future weight regain and weight cycling (Cilliers et al., 2006). Senekal (1994) found that factors that may need specific attention in a targeted weight management intervention for female students include adapting to the university/residence environment, appropriate levels of energy intake and

physical activity, realistic body size perceptions and ideals, eating habits, eating behaviours and psychological well-being.

2.8.5 Weight perceptions, weight goals and weight loss patterns in tertiary level female students

Research shows that female students at tertiary institutions are very likely to have a distorted perception of their weight, that many are dissatisfied with their weight or body shape and that they generally overestimate their weight (Senekal et al., 2001; Hendricks et al., 2004; Malinauskas et al., 2006; Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018).

Cilliers et al. (2006) found that 85% of the first year female students (Caucasian) who participated in their research were dissatisfied with their weight, although the weight of 81.9% of the students was normal. Two thirds (67%) of the normal weight students correctly perceived their weight as normal, but 56.5% had attempted weight loss in the two years preceding the study (Cilliers et al., 2006). Students with a higher body mass index were more likely to exhibit weight dissatisfaction. Cilliers et al. (2006) found that students were mainly dissatisfied with their stomachs, buttocks and thighs, with those with a higher body mass index being more likely to be dissatisfied with these body parts. Weight satisfaction in the general population in this age group may be higher than in female student populations. Results from the SANHANES (2012) showed that 65.5% of South African females between the ages of 15 to 24 years were satisfied with their weight at the time of the survey; only 12.2% of these participants reported attempting to lose weight in the year prior to the survey (Shishana et al., 2013).

Underweight South African first year female students (Caucasian) were found to be mostly satisfied with their current weight; 88.5% of these students incorrectly perceived their weight to be normal (Cilliers et al. 2006). Similarly, in a study by Kim and Lee (2010) in female tertiary students in Korea, 64.1% of underweight students

perceived their weight to be higher than it actually was and 60.6% of underweight students had attempted weight loss. In a study of 160 female tertiary level students in China, 63.9% of the total group were found to be dissatisfied with their weight (63.27% of underweight; 63.2% of normal weight and 90% of students with overweight/obesity), 57.5% desired to lose weight (19.9% of underweight; 70.4% of normal weight and 100% of students with overweight/obesity) and 73.4% (including 30.6% of underweight students) had attempted weight loss in the past six months (Zang et al., 2018). Rodgers et al. (2018) found in a survey of 251 female tertiary level students in the USA that 83% perceived their weight to be higher than their actual weight, 83% reported a desire for thinness and 89% reported a fear of weight gain.

In the study by Cilliers et al. (2006) the proportion of overweight students who correctly perceived themselves as being overweight was 93%. More than two thirds (71.8%) of them had attempted to lose weight in the two years prior to the study. From these results it can be surmised that the overweight students were more realistic about weight loss goals i.e. wanting to lose weight when actually overweight. Malinauskas et al. (2006), however, mention that not all female students with overweight or obesity seem to want to lose weight, which may also be true within the South African context (Senekal et al., 2001; Cilliers et al., 2006; Senekal et al., 2016). In young black South African females this inclination may be linked to the finding that they are likely to underestimate being overweight and overestimate being underweight (NYRBS, 2008).

Female students' perceptions regarding healthy/attractive weight goals may be more realistic than their personal weight goals. For example, Malinauskas et al. (2006) reported that female students perceived a healthy weight to be lower than their current weight, with the mean perceived healthy weight being 13% lower than actual weight in overweight students, 23% lower in students with obesity and 5% lower in normal weight students. Similarly, normal weight students perceived a weight 6% lower than current weight to be attractive, overweight students a weight

15% lower than current weight in and students with obesity a weight 26% lower than current weight (Malinauskas et al., 2006).

Evidence further shows that ethnicity is a factor that can influence students' weight goals via culture linked body shape ideals. Black females have been reported to accept a larger ideal body size, have less body dissatisfaction, feel less pressure to lose weight, are less preoccupied with weight control, are more accepting of being overweight, are less likely to perceive themselves as overweight and see obesity as a normal state of health than their Caucasian counterparts (Senekal et al., 2001; Schembre et al., 2011; Annesi et al., 2014). On the other hand, Caucasian females have been reported to strive to achieve a westernized thin body ideal (Schembre et al., 2011). However, since acculturation to western norms is becoming more apparent, the gap in weight goals and weight management behaviours across different ethnicities may become narrower. Hence, healthy weight gain prevention education should be aimed at all females (Senekal et al., 2001).

It is evident from the reviewed literature that disparities in perceived and desired weight and actual weight are prevalent especially amongst normal weight female students. These findings support the notion that many young females have a distorted body image and are dissatisfied with their current weights. Evidence shows that this may result in unrealistic weight goals, preoccupation with weight, unnecessary weight loss attempts and possibly weight cycling (Senekal et al., 1999; Cilliers et al., 2006; Wharton et al., 2008; Mendez-Hernandez et al., 2010; Fayet et al., 2012; Senekal et al., 2016).

2.8.6 Dietary patterns of tertiary level female students

Food choices and meal patterns

Dietary quality has generally been shown to be poorer during the transition from adolescence into adulthood (Small et al., 2013; Nikolaou et al., 2015; Yahia et al.,

2016; Senekal et al., 2016; Lazaverich et al., 2018; Mueller et al., 2018). Tertiary level students in particular often do not follow recommended dietary guidelines and have poor eating habits (Deshpande et al., 2009; LaCaille et al., 2011; Small et al., 2013; Yahia et al., 2016; Senekal et al., 2016; Sogari et al., 2018; Mueller et al., 2018). Research shows that these students have a poor intake of fruit, vegetables and dietary fiber and a high intake of energy dense foods such as alcohol, sugar sweetened beverages and fast food (Huang et al., 2003; Racette et al., 2005, Vella-Zarb & Elgar, 2009; Small et al., 2013; Nikolaou et al., 2015; Senekal et al., 2016; Mueller et al., 2018). Small et al. (2013) found that only one third of college students consumed a healthy, balanced diet in line with national recommendations. Hendricks et al. (2004) found that the typical food pattern consumed by American female students consisted mostly of foods that are considered less healthful, including fast foods, refined grains, desserts, high fat dairy products, high fat snacks and French fries.

Fruit and vegetables: A recent report from the American College Health Association-National College Health Assessment (ACHA-NCHA) indicated that 93.7% of tertiary level students did not meet the recommendation of five or more fruit and vegetables per day (ACHA, 2013). Results from other research in tertiary level students in the USA is in line with this, with only 8% of males and 9% of females reporting consumption of more than four fruit and vegetable servings per day in a study by Yahia et al. (2016). Nikolaou et al. (2015) surveyed first year tertiary level students in the UK and found that 31% initially consumed five or more fruit and vegetables per day, but this decreased to 27% by the end of the first year. The majority (90.3%) of Belgian university students surveyed by Deliens et al. (2018) did not meet fruit and vegetable intake recommendations. Hilger et al. (2017) also found that there was room for improvement with regard to fruit and vegetable intake among German students recruited from 40 universities across the country.

Results for youth aged 15 to 24 years in South Africa showed that 27.8% met the recommended level of fruit and vegetable intake, with intakes increasing with age (SANHANES, 2013). Senekal et al. (2016) found much lower daily frequency of intake

of fruit and vegetables in female students from three South African universities, with only 4.5% of the sample consuming fruits and vegetables (combined) more than four times per day. Gresse et al. (2015) reported that 67% of students surveyed at another South African university consumed less than one fruit per day and 64% less than one vegetable per day. Van den Berg et al. (2013) found that 98.1% of a sample of students (mostly females) at yet another South African University consumed less than three servings of vegetables per day and 58.4% consumed less than two servings of fruit per day. The low fruit and vegetable intake of young South African females is in line with the findings in a review by Mchiza et al. (2015), namely that the fruit and vegetables group is one of the most likely food groups for which the requirements are not met in the South African adult population.

Hilger et al. (2017) recommended that making fruits and vegetables more accessible and appealing to students may be one strategy for increasing consumption. Deliens et al. (2018) concluded that interventions that aim amongst others to improve fruit and vegetable intake among tertiary students should specifically consider younger students from lower socioeconomic backgrounds. Interventions should also focus on improving students' subjective norm and behavioural control concerning healthy eating.

Carbohydrates: There is limited information in the literature on the type of carbohydrate sources other than fruit, vegetables and sugary foods that are consumed by tertiary level students. Lazaverich et al. (2018) found that 38.6% of first year tertiary level students in Mexico consumed white bread more than twice a week, while Hilger et al. (2017) reported that brown bread was consumed more regularly than white bread by German students. In the USA, Yahia et al. (2016) found that 74% of male and 84% of female tertiary level students consumed pasta/rice/bread/potatoes every day, with 49% consuming a total of one to two portions per day. Van den Berg et al. (2013) found that 43.7% of the students in their sample had a carbohydrate (bread, cereal, rice and pasta) intake below the FBDG recommendations (< 6 servings/day), 41.9% within the recommendations (6-11 servings/day) and 14.4% above the recommendation (> 11 servings/day). The most

commonly consumed carbohydrates were bread (type not specified), ready to eat cereals and cooked porridge.

Sugary foods: The consumption of sugary foods seems to be common among tertiary level students. Lazaverich et al. (2018) reported that 51.8% of their sample of Mexican students consumed sweet foods and 49% consumed sugary drinks more than twice a week. Forty one percent of female tertiary level students in the USA ate sweets and cakes more than twice a week (Yahia et al., 2016). In the UK, 16% of tertiary level students consumed sugary drinks on a daily basis (Nikolaou et al., 2015). Van den Berg et al. (2013) found that 57.1% of South African students used sugar daily, 77% drank soft drinks weekly (10.6% daily), 92.5% ate sweets and chocolates weekly (4.4% daily) and 87.6% ate cake and biscuits weekly (2.5% daily). Sweet consumption seemed to be lower at another South African University, with 52% of the sample of students eating sweet snacks (sweets) more than twice a week (Gresse et al., 2015). Sugar intake was found to be high in youth in general in South African (SANHANES, 2013).

Dairy: Although dairy seems to be consumed on a daily basis by tertiary level students, they do not necessarily meet country recommendations. In a survey conducted by Yahia et al. (2016) in the USA two thirds of the tertiary level students reported daily consumption of milk (66% of females), but only 16% of females reported consumption of at least three cups of milk/yogurt per day as is recommended (USDA, 2010). Nikolaou et al. (2015) found in their study of first year tertiary level students in the UK that 49% consumed the recommended two to three dairy servings per day. South African studies show that 82.6% (Van den Berg et al., 2013) and 92% (Gresse et al. 2015) of students surveyed had an intake below the recommended intake of two to three servings of dairy a day.

Other proteins: Eggs were the most commonly consumed protein by German students in the study by Hilger et al. (2017) (approximately 70% ate eggs 1-3 times a week), followed by poultry, sausages and ham, red meat and lastly fish (43.1% ate fish 1-3 times a week). Significantly more females (19.6%) in the German study than

males (7.1%) reported to be vegetarians. Eggs were also commonly eaten by South African students in the study by Van den Berg et al (2013) and 82.6% of these students ate meat, poultry or fish weekly and 16.2% daily. Soy mince or legumes were not consumed regularly by students in this study (36.7% consumed these foods weekly and 1.2% daily). Yahia et al (2016) found that the most frequently consumed proteins in a sample of students in the USA were meat and cheese (most students reported eating red meat and cheese three or more times per week), while eggs, processed meats, fish and legumes were eaten less frequently (1-2 times per week). Moreover, many students reported never eating fish or legumes (43% of females reported never eating fish and 3% reporting never eating legumes) (Yahia et al., 2016).

Fats: Fat intake is generally linked to intake of spreads, fatty foods and fatty snacks. Evidence shows that the latter may be a concern in tertiary level students. One study from the USA reported that 51% of students ate fried foods and 56% fast foods three or more times in the last week (Racette et al., 2005). A more recent study in the USA found that only 14% of male and 9% of female students reported eating fast foods and 18% of males and 8% of females reporting eating fried potatoes more than twice a week (Yahia et al.,2016). Results from the study by Lazaverich et al. (2018) in Mexico are similar, with 20.8% consuming fast foods and 30.3% fried foods more than twice a week. However, consumption of these types of foods was more common among South African students: 76% in the study by Gresse et al. (2015) ate fast foods more than three times a week an 88.2% in the study by Van den Berg et al. (2013) ate crisps weekly. Senekal et al. (2016) reported that high fat foods and energy dense drinks and snacks were consumed almost four times a week by female students from three South African universities. Data from the SANHANES (2013) showed that 24.3% of South African youth between the ages of 15 to 24 had a high fat intake.

Meal patterns: Irregular or unhealthy eating patterns seem to be characteristic of tertiary level students. It emerged from a study in Mexico that 17.2% of students

never kept to mealtimes and only 30.3% kept to mealtimes often or always; overall 82.2% reported having difficulty with eating regularly (Lazaverich et al., 2013). Evidence shows that breakfast appears to be a meal that may be frequently skipped. Forty three percent of students in a study by Brown et al. (2014) in the USA reported that they skipped breakfast either usually or often. In a further study in the USA by Yahia et al. (2016) it was found that only 53% of students reported eating breakfast daily (41% males; 58% females). In the South African study by Gresse et al. (2015) 51% reported having breakfast less than five times a week.

In contrast, it was evident from a further South African study that the meal pattern of female students from three universities was in line with the SAFBDG recommendation that meals should be spread throughout the day (Senekal et al., 2016). A similar profile was found in a study in Germany by Hilger et al. (2017); the majority of their sample of students (74.3%) reported eating breakfast regularly on weekdays (4-5 times). Most of these students (77.9%) had breakfast on their own. Lunch was eaten by 73.6% on weekdays, and 66.6% reported having lunch together with colleagues/friends, with 51.8% having their lunch at the university canteen. Reasons students mentioned for eating in the canteen included being with friends (78.4%), saving time (75.1%), proximity to university (74.8%), and wanting a warm meal (58.0%). Eighty four percent of these students ate dinner on four to five days during the week and 50.5% reported having dinner on their own.

Tertiary level students may also be inclined to eat meals out or away from their place of residence. Mueller et al. (2018) showed that 41.4% of first year tertiary level students in the USA reported eating out at restaurants or getting take-outs. Those who reported that they never ate out had a higher intake of plant-based foods and a lower intake of refined grains, processed meats and alcohol. According to SANHANES (2013) 22.9% of South African youth age 15 to 24 reported eating away from home more than once a week, and 31% reported doing this weekly. A higher frequency of eating meals away from home such as at restaurants, street foods or fast food take-out places was found to be positively associated with weight gain and obesity in this

national survey (Shisana et al, 2013). A possible reason for this is that many of these foods are energy but not nutrient dense (Mueller et al., 2018).

Barriers to and facilitators of healthy eating in female students

The obesogenic food environment that tertiary level students are exposed to may be a major contributor to their food choices, meal patterns and weight status (Metzgar & Nikols-Richardson, 2015, Shi et al., 2018; Shi et al., 2018). For students living at home or in university residences this includes foods available, prepared and consumed there. Further available food outlets on campus or vicinity of campus could include vending machines, take-away places, cafes, cafeterias, restaurants, supermarkets and convenience stores (Townshend & Lake, 2017).

Food environment related challenges students experience with making healthy food choices and control of energy intake include a perceived lack of healthy choices on campus, combined with easy access to energy dense drinks, snacks and meals, eating away from home, large portion sizes, "all-you-can-eat" buffet style meal offerings in university residences, unlimited availability of food in university residences, university residences with dining facilities that are open longer hours or on weekends, residences that offer students a variety of food choices that do not require preparation at a prepaid cost, making it an easy choice, social eating and alcohol use (Brunt & Rhee, 2008; LaCaille et al., 2011; Horaceck et al., 2013; Kapinos et al., 2014; Ashton et al., 2017; Munt et al., 2017; Shi et al., 2018; Walsh et al., 2018). Findings by Kapinos and Yakusheva (2011) show that tertiary students living in university residences with on-site dining halls gained more weight in their first year and exhibited more behaviours consistent with weight gain when compared with students living elsewhere. Further support for challenges posed by the campus food environment comes from work by Horaceck et al. (2013) who evaluated the restaurant and dining facilities on campus in close proximity of 15 tertiary institutions in the USA. They concluded that the campus dining environment provided limited support for healthy eating and obesity prevention. Munt et al.

(2017) noted that planning ahead would facilitate navigation of the various elements in the environments of students that impede healthy eating.

According to Shi et al. (2018) healthy snacks and beverages have become more available on tertiary education institutions campuses in the past few years, but that these efforts were still not sufficient to achieve a healthy food environment. These researchers investigated the offerings of food outlets and vending machines on Australian campuses and found that compliance with the 'Food and Drink Benchmark' was poor as vending machines on campuses were stocked with limited healthy options (Shi et al., 2018). Similarly, Park and Papadaki (2016) found that mostly unhealthy food choices were available on the UK campuses they investigated. Vending machine snacks were generally high in sugar, fat and saturated fat and most beverages were high in sugar (Park & Papadaki, 2016). The German university students who participated in the study by Hilger et al. (2017) identified a lack of healthy meals at university canteens as one of the two most important barriers to healthy eating.

Further factors that determine food choices include food cost, availability and preparation aspects (Brunt & Rhee, 2008; Ashton et al., 2017; Munt et al., 2017; Walsh et al., 2018). Brunt and Rhee (2008) found that students living on campus consumed a wider variety of fruit and vegetables, grains and dairy products than those living off campus. Consumption of fruit juice and milk was higher in students living on campus due to the availability of a wide variety of beverages at the dining centres (Brunt & Rhee, 2008). A possible barrier to eating fruit and vegetables when living off campus could be that when sharing food costs with roommates, students tend to buy foods that keep for longer, are more affordable and quick to prepare (Brunt & Rhee, 2008; Small et al., 2013). Since students living off-campus consume a smaller variety of nutrient dense foods, this may indicate that a larger percentage of their energy intake comes from higher fat, higher sugar, non-nutrient dense foods including alcohol (Brunt & Rhee, 2008).

Other food related barriers to healthy eating identified by tertiary level students are a perceived lack of time to cook, as well as poor access to cooking facilities in university residencies, with students eating out more often or choosing take-out options as a result (LaCaille et al., 2011, Ashton et al., 2017; Hilger et al. 2017; Munt et al., 2017). Students in a study by Sogari et al. (2018) in the USA reported that it was easier to eat healthy when cooking meals themselves, but that they cooked less and ate out more frequently during their transition to university. Moreover, access to grocery stores resulted in less weight gain by university students (Kapinos et al., 2014). The high cost of healthy food has also been reported as a barrier (Sogari et al., 2018), with students being of the opinion that unhealthy food is less expensive than healthy foods like fruit and vegetables. Furthermore, almost all students in the study by Sogari et al. (2018) reported not having enough time to go to the shops or prepare healthy meals. Lack of nutrition and food preparation knowledge has also been identified as barriers to healthy eating (Ashton et al., 2017).

The social environment and support can also act as barriers to or facilitators of healthy eating (Larson et al. 2018). Sogari et al. (2018) found that peer influence was a barrier to healthy eating for some tertiary students at a university in the USA, since meals eaten with friends were generally unhealthier. In contrast, some students in this study reported peer influence as being a facilitator for healthy eating, since they were exposed to the healthier eating habits of new peers (Sogari et al., 2018). Students indicated that parental influence on dietary habits can be positive or negative, depending on eating habits learnt at home. Some reported learning bad habits such as having to finish a plate of food before leaving the table, while others mentioned that their parents shaped their healthy eating habits (Sogari et al., 2018). Ashton et al. (2017) found that the expectation from others to eat healthy was a motivator, while poor diet of friends and family was a barrier to healthy eating.

Food preferences were reported to be a barrier to healthy eating in the study by Sogari et al. (2018). Students in this research reported that they chose foods based on preference and taste rather than based on health; they felt that unhealthy foods were tastier (Sogari et al., 2018). Ten point one percent of female German students

indicated that not enjoying eating healthy food and 10.7% the fact that healthy food did not taste good were important barriers to healthy eating (Hilger et al., 2017). Moreover, students have been found to be knowledgeable on healthy eating, the benefits of healthy eating and the consequences of having a poor diet, but this knowledge did not necessarily result in healthier eating (Sogari et al., 2018).

Students in the study by Sogari et al. (2018) specifically identified stress as a barrier to healthy eating, especially during studying or exam time when they are more likely to snack and use food to regulate mood. Munt et al. (2017) also concluded that stress may contribute to unhealthy eating in youth. Dieting (especially unnecessary and use of unhealthy/extreme methods) and binge eating have also been reported to compromise attempts to eat healthy (Metzgar & Nikols-Richardson, 2015; Munt et al., 2017). Possessing autonomous motivation to eat healthy and use of self-regulatory skills were reported by Hilger et al. (2017) and Munt et al. (2017) as important facilitators of healthy eating.

Facilitators of healthy eating that should be promoted for weight gain prevention include social support, accountability to self and others, self-motivation, planning food intake ahead, body shape satisfaction and nutrition and food preparation knowledge and skills (Metzgar & Nikols-Richardson, 2015; Munt et al., 2017; Ashton et al., 2017; Larson et al., 2018). Barriers that should be addressed include unnecessary dieting and use of unhealthy/extreme weight management methods, detrimental changes in health status such as stress, lack of nutrition and food preparation knowledge, life transitions and environmental pressures including eating away from home, social eating and drinking alcohol, unhealthy diet of friends and family, higher cost of healthy food (or perceived higher cost), lack of access to healthy foods, as well as easy access to unhealthy foods (take aways, university campus, university residences), lack of facilities for cooking and lack of time to cook due to university commitments (Metzgar & Nikols-Richardson, 2015; Munt et al., 2017; Ashton et al., 2017).

Interventions aimed at weight gain prevention in first year female students should thus broadly focus on changes in the food environment experienced by tertiary level students, establishment of support systems, ensuring physical and mental health, stress management, establishment of motivation, knowledge dissemination and improving body shape satisfaction. According to Kliemann et al. (2018) starting university with high eating self-regulatory skills protects students against unhealthy dietary intake and substantial weight gain over six months. Intervention strategies should thus also focus on establishment of such skills. Nutrition education should specifically focus on addressing the following three SAFBDGs: use fats sparingly and use food and drinks high in sugar sparingly, and eat plenty of vegetables and fruits every day (Shisana et al, 2013; Bleich & Wolfson, 2014).

Weight loss methods used by tertiary level female students

Evidence shows that tertiary level female students use a variety of weight loss methods to lose weight. The most commonly used methods are healthy dietary changes, including eating less high-fat foods (58.1% to 75.3%), eating less sweets (56.1% to 82.1%), eating more fruit and vegetables (64.9% to 82.1%), decreasing food portion sizes (45.63% to 83.9%), eating a balanced diet (36.8%), choosing sugar free options of foods (43%), decreasing intake of energy dense foods, choosing low-fat or fat free options of foods or drinks (41.4% to 59%) and increasing physical activity (40.63% to 89.5%) (Senekal et al., 2001; Neumark-Sztainer & Hannan, 2002; Malinauskas et al., 2006; Kim & Lee, 2010; James et al, 2012; Senekal et al., 2016; Zhang et al., 2018).

Use of healthy weight loss strategies may differ across weight categories. Malinauskas et al. (2006) found use of artificial sweeteners to lose weight was least common among female students with obesity in their study in the USA (5% versus 31 % in the normal weight and overweight groups). The same was true for eating or drinking sugar free versions of foods or drinks (29% among students with obesity versus 43% among normal weight and 49% overweight students) (Malinauskas et al., 2006). Use of low-fat or fat-free versions of foods or drinks was most common

among normal weight as a weight loss strategy (Malinauskas et al., 2006). Kim and Lee (2010) found that compared to normal weight Korean female tertiary level students, significantly more overweight students used dieting methods such as reducing meal size (83.9% versus 79.3%), increasing exercise (71.0% vs 63.9%), choosing lower-calorie foods (51.6% vs 41.4%) and skipping dinner (45.2% vs 32.5%).

The use of unhealthy or extreme weight loss methods, including certain weight loss products by students at tertiary institutions is a concern (Senekal et al., 2001; Neumark- Sztainer & Hannan, 2002, Senekal et al., 2016). Methods that have been used by tertiary level female students include eating little food (45.2% to 51%), skipping meals (4% to 46.2%) and fasting (4% to 37%) (Neumark- Sztainer & Hannan, 2002; Hendricks et al., 2004; Malinauskas et al., 2006; Kim & Lee, 2010; James, 2012; Senekal et al., 2016). Extreme weight loss methods used include using laxatives (1.6% to 15%), diuretics (1.7% to 2.3%) and vomiting (1.88% to 11.7%) (Senekal et al., 2001; Neumark- Sztainer & Hannan, 2002; Malinauskas et al., 2006; Mendez-Hernandez et al., 2010; Alvarenga et al., 2013; Senekal et al., 2016; Zhang et al., 2018).

Weight loss products that have been linked to weight loss attempts by female students include meal replacements such as Herbex, Herbalife, GI Lean products and meal replacement bars (0.4% to 35%) (Malinauskas et al., 2006; Fayet et al., 2012; Senekal et al., 2016). The following non-prescription drugs or supplements are reportedly also used by students: Hoodia, USN weight loss products, CLA products, Leanor, Simply Slim, Phentermine, Sibutramine, green tea, green tea pills, dieter's tea, chromium picolinate (0.6% to 11%) (Malinauskas et al., 2006; Senekal et al., 2016) and prescribed pills (Malinauskas et al., 2006).

2.8.7 Alcohol use by tertiary level students

Prevalence of alcohol use by tertiary level students

Heavy drinking, often in the form of binge drinking, is common on campuses of tertiary institutions (Brown et al., 2008; Boekeloo et al, 2009; White & Hingson, 2013; Merrill & Carey, 2016; Peltzer & Pengpid, 2016; Yi et al., 2017; Nourse et al., 2017; Battista & Leatherdale, 2017). The high drinking rate reported in tertiary level students can lead to health, safety, academic and social problems with peers, family, sexual partners and the community (Boekeloo et al., 2009; White & Hingson., 2013; Merrill & Carey, 2016; Nourse et al., 2017; Wilkinson & Ivsins, 2017; Govender et al., 2017).

Boekeloo et al. (2009) reported that 78.6% of first year tertiary students from a university in the USA drank and that 31.7% binge drank. This is in line with a review by White and Hingson (2013) on tertiary level students in the USA which concluded that approximately 65% of students drink alcohol in a given month and 44% of students binge drink. Peltzer and Pengpid (2016) found lower rates of alcohol consumption and binge drinking for undergraduate tertiary level students in 24 low-to-middle income and emerging economy countries across Asia, Africa and the Americas. These researchers reported that 71.6 % were non-drinkers, 17.1 % moderate and 11.3 % heavy alcohol drinkers (14.2 % in males and 9.2 % in females) in the two weeks prior to the study. Yi et al. (2017) investigated tertiary level students in the ASEAN (Association of Southeast Asian Nations) and found that 12.8% of students were infrequent (<once per month) and 6.4% frequent (≥ once per month) binge drinkers, which is lower than reported by Peltzer and Pengpid (2016) for Asian, African and American countries.

Alcohol use was reported to be at hazardous levels for 15.6% and harmful drinking for 4.1% for students at a South African university, while 5.6% showed alcohol dependence (van Zyl et al., 2015). Male students were significantly more likely to drink at these levels than female students (32.8% versus 18.9% respectively). Gresse

et al. (2015) reported that 83% of their sample of students at another university reported that they used alcohol. The majority used alcohol less than twice a month, 40% male and 28% females indicated that had experienced at least one episode of binge drinking in the last year and 22% of the total group indicated that they had passed out after binge drinking at least once. Females are biologically more vulnerable to the negative effects of alcohol and may suffer more biological and social risks as a consequence (Van Zyl et al., 2015).

Moreover, research among tertiary level students shows that alcohol use has been increasing especially in females (Govender et al., 2017; Ajayi et al., 2019). This trend was also noticed by Van Zyl et al. (2015) specifically for female students in the alcohol dependent category (Van Zyl et al., 2015). As is evident from the evidence mentioned above, male tertiary level students were traditionally more likely to drink, but evidence shows that females are catching up (Hendricks et al., 2004; White & Hingson, 2013; Ajayi et al., 2019). Female drinking now seems to be ingrained in the youth drinking culture (White & Hingson, 2013). One reason for this may be that female students engage in heavy drinking in order to elicit feelings of equality and power when behaving like their male peers (Wilkinson & Ivsins, 2017).

Factors contributing to alcohol use by students

Wicki et al. (2010) found that physical, university (campus), environmental, social and individual factors are associated with alcohol consumption behaviours. The campus environment has been identified as high risk for alcohol use, especially university residence environments (Wilkinson & Ivsins, 2017). Students may be specifically vulnerable to alcohol use as a result of the sense of freedom from parental monitoring and control they experience (Boekeloo et al., 2009; Wicki et al., 2010). Brunt and Rhee (2008) found that students in the USA living off campus in private accommodation were more likely to use alcohol than those living in university residences. This may be linked to enforcement of rules regarding alcohol use in university residences (Brunt & Rhee, 2008). Students who continue to live at home may be less affected by the concept of freedom of parental control (Boekeloo

et al., 2009; Wicki et al., 2010). Living at home and having adequate family support have been associated with lower alcohol use (Ayaji et al., 2019). Parental modelling is an important factor since students with parents who promote drinking may have a higher frequency of alcohol use compared to those from families that do not support drinking (Ajayi et al., 2019).

According to Cox et al (2019) students mostly drink alcohol for social and enhancement motives during social gatherings. Peer group approval and acceptance of drinking behaviours among peers encourages alcohol consumption (Wicki et al., 2010; Wilkinson & Ivsins, 2017; DiGuiseppi et al., 2018; Cox et al., 2019). DiGuiseppi et al. (2018) found that students with greater perceived norms and resistance to peer influence reported fewer episodes of binge drinking. Tertiary level students have been found to persistently overestimate the extent of their fellow students' alcohol consumption (Wicki et al. 2010, Cox et al., 2019). This is especially true for students with higher alcohol consumption levels; overestimation of peer heavy drinking was found to be associated with more frequent heavy drinking and higher drinking intentions in students themselves Cox et al. (2019).

Tertiary level students may binge drink in order to get away from feelings such as depression, anxiety or stress (Bulter et al. 2010; Deasy et al., 2014; Nourse et al., 2017). Nourse et al. (2017) found that 15.9% of students in their study in the USA felt that drinking lessened their feelings of depression and 18.9% of students reported that drinking lessened feelings of anxiety. Although some students reported these benefits, Nourse et al. (2017) found that students mostly seemed to drink for cultural reasons, in response to social norms and to enhance positive feelings, rather than drinking to 'self-medicate' or regulate mood. However, findings by Deasey et al. (2014) and Bulter et al. (2010) that distress experienced by tertiary level students is linked with hazardous drinking behaviours does support the notion of drinking to 'self-medicate.'

Further factors that have been associated with binge drinking among tertiary level students include being older, having a poorer family background, lack of knowledge

on alcohol-disease relationships, lack of conviction regarding the importance of limiting alcohol use, lower level of life satisfaction, use of other substances such as tobacco and illicit drugs, high levels of physical activity, willingness to endure effects of alcohol misuse, as well as alcohol use out of curiosity and for experimentation (Boekeloo et al., 2009; Wicki et al., 2010; White & Hingson, 2013; Deasey et al., 2014; Merrill & Carey, 2016; Peltzer & Pengpid, 2016; Yi et al., 2017; Govender et al., 2017).

Consequences of alcohol use by tertiary level students

Commonly reported consequences of drinking in tertiary level students include feelings of embarrassment, hangover symptoms (feeling tired, headaches, vomiting and an upset stomach) and drinking on nights they did not intend drinking (Nourse et al., 2017).

A number of researchers have reported that heavy episodic drinking is associated with weight gain among young females (Vagstrand et al., 2007; Berkey et al., 2008; Croezen et al., 2009; Farhat et al., 2010). However, Fazzino et al. (2019) did not find an association between weight gain and alcohol intake in first year university students in the USA. More research is necessary to determine whether alcohol possibly plays a more indirect role in weight gain via alcohol-induced eating, especially energy dense foods/snacks, rather than the additional energy from the alcohol itself being the primary problem (Fazzino et al., 2019). Despite the lack of solid evidence, weight gain prevention interventions should include a focus on the detrimental effects of alcohol in general and specifically the fact that it contributes to total energy intake and that it may be a potential facilitator of intake of energy dense foods and snacks (Fazzino et al., 2019).

2.8.8 Physical activity and sedentary behaviour of tertiary level students

Physical activity levels and time spent being sedentary in tertiary level students

The transition from secondary school to tertiary level education is often accompanied by a decrease in physical activity and an increase in sedentary behaviour. Yahia et al. (2016) found that half of the tertiary level students in their study in the USA were physically active, but only 33% reported physical activity of more than four hours per week. Females were less active than males. In a further study in the USA, only 48.8% of tertiary level students (52.8% males; 46.7% females) met the minimum recommended guideline of at least 30 minutes of physical activity on five days of the week (ACHA, 2013). Results from research by Peltzer and Pengpid (2017) in tertiary level students in the ASEAN shows that 49.9% of students had low levels of physical activity, 33.6% moderate levels and 16.6% high levels. In a study in the UK 73% of male and 79% of female tertiary level students did not meet physical activity guidelines (Plotnikoff et al., 2015).

Within the South African context low levels of physical activity in the youth age group also seems to be common. The 2002 and 2008 Youth Risk Behaviour Survey (YRBS) demonstrated that physical inactivity is a widespread problem among females, especially in the Western Cape Province. Similarly, according to SANHANES (2013) only 38% of young females aged 18 to 24 years were physically fit. Research among South African female tertiary level students has shown contradictory results for physical activity levels. Cilliers et al. (2006) reported that 27.2% of first year female students at a South African university did not partake in any physical activity for exercise purposes. Gresse et al. (2015) found that 79% of the students at another university were physically inactive (below the cut-off point of walking briskly ≥ 3 times/week). In contrast, Senekal et al. (2016) reported that female students at three South African universities seemed to meet the current WHO guidelines of doing a minimum of 150 minutes moderate intensity exercise per week or 75 minutes of vigorous exercise. Senekal et al. (2016) found that students with a dieting history engaged in much higher levels of vigorous activity than non-dieters.

Prioreschi et al. (2017) also found students in their study to be mostly active; 97% of rural and 77% of urban South African female tertiary students met the current WHO guidelines of doing a minimum of 150 minutes moderate intensity exercise per week or 75 minutes of vigorous exercise.

Research consistently shows that students spend a lot of time on study related sedentary activities (Deliens et al., 2015; Walsh et al., 2018). A study in tertiary level students in the UK revealed that students spent eight hours per day on sedentary activities such as studying, watching television, gaming, computer activities, sitting and talking, shopping and hanging out (Rouse & Biddle, 2010). Sedentary behaviour of eight hours or more was also reported by Peltzer and Pengpid (2017) in 31.5% of ASEAN tertiary level students. Gresse et al. (2015) used television watching for four or more times a week as a proxy for a sedentary lifestyle. They found that 55% of their sample of students watched television ≥ 4 times/week.

When considering the results on physical activity and sedentary time spent outlined above it needs to be borne in mind that the methods and instruments used for estimation of these variables varied substantially across studies.

Barriers to and facilitators of physical activity in tertiary level students

Factors that affect levels of physical activity in students include physical environment, social environment and personal/individual factors (Deliens et al., 2015).

Physical environmental factors such as the built environment (poor walkability), feeling unsafe to be active outdoors, poor weather and poor access to recreational facilities (availability, transport and cost factors) and easy access to televisions and other resources that enhance sedentary behaviours may be barriers to physical activity in young females (Papas et al., 2007; NYRBS, 2008; LaCaille et al., 2011; Kapinos & Yakusheva, 2011; Deliens et al., 2015; Blake et al., 2017; Lazaverich et al., 2018). Possible facilitators for physical activity that relate to the physical

environment include availability of physical activity options on campus and convenience of physical activity options (LaCaille et al., 2011). Living off campus has been reported as both a barrier and facilitator for physical activity (LaCaille et al., 2011; Kapinos and Yakusheva; 2011; Small et al., 2013; Kapinos, 2014). Kapinos and Yakusheva (2011) reported that female students living in university residences were less likely to be physically active, especially if the proximity to the gym was further away. In contrast, research by Small et al. (2013) showed that off-campus students experienced a greater decline in physical activity than those living on campus. This may also be explained by proximity, where exercise facilities may be even further away for students who do not live on campus. In line with this, Kapinos et al. (2014) found that first year female students in the USA who lived closer to a campus gym reported doing exercise more frequently over the course of the year.

Social environmental barriers to physical activity in tertiary level students include lack of parental control and social support (from society and friends), internet communication and technology, modelling of others and peer pressure (LaCaille et al., 2011; Deliens et al., 2015). Facilitators reported specifically by tertiary level students (LaCaille et al., 2011) include fast, easy websites that provide physical activity information or programmes to follow, as well as support from partners, doctors, family and friends, and an exercise companion (LaCaille et al., 2011; Deliens et al., 2015; Kelly et al., 2016).

Individual level barriers to physical activity reported for tertiary level students include values, norms and beliefs, state of mind (including stress and depression), lack of self-discipline, low self-efficacy, lack ofself-discipline and motivation, poor body image and low self-esteem, perceived lack of enjoyment of exercise, perceived lack of time and inconvenience, high workloads, lack of routine or structure, lack of physical activity knowledge, past sedentary habits, injuries or physical health problems (including metabolism, vitality and physical needs), fatigue, need for relaxation, partying, drinking and substance abuse (LaCaille et al., 2011; Kapinos & Yakusheva, 2011; Small et al., 2013; Deliens et al., 2015; Blake et al., 2017; Lazaverich et al., 2018; Walsh et al., 2018; Sogari et al., 2018).

Potential individual level facilitators of physical activity in tertiary level students include motivation (LaCaille et al., 2011); positive feelings about physical activity; perceived enjoyment thereof; self- discipline; positive values, norms and beliefs regarding physical activity (Deliens et al., 2015; Kelly et al., 2016); improved self-esteem and body image (Kelly et al., 2016); sense of wellbeing; weight loss (Kelly et al., 2016) and competitive exercise (Deliens et al., 2015).

Interventions aimed at weight gain prevention in first year female students should thus broadly focus on improving access to physical activity options in and around campuses and university residences, establishment of support systems, ensuring physical and mental health, stress management, promotion of motivation, knowledge dissemination and improving body shape satisfaction. Deliens et al. (2015) suggest offering more affordable or more flexible physical activity options such as including sports into the university curricula and providing bicycles that can be used for transport between university residences and campuses. LaCaille et al. (2011) also suggest providing a variety of options for physical activity on campus.

Exercise and weight management in tertiary level students

The role of physical activity in weight management by tertiary level students has been investigated by a few researchers (Senekal et al., 1994; Butler et al., 2004; Jung et al, 2008; Wengreen & Moncur, 2009). In a longitudinal follow up that stretched over four years (first to final year at university), female students who had maintained their baseline weight had also maintained the highest level of physical activity (Senekal, 1994). Conversely, those who gained weight over the four year period showed a decline in physical activity, which may have contributed to weight gain (Senekal, 1994).

Some studies showed that the amount of exercise done by students is associated with actual weight status. Kim and Lee (2010) reported that 51.6% of overweight students in their study in the USA exercised more than once a week in comparison to

2.4% of normal weight students. Furthermore, 74.2% of the overweight students exercised for longer than 30 minutes at a time in comparison to 52.9% of normal weight students. In contrast, Cilliers et al. (2006) found that normal weight South African first year female students had significantly higher scores for sport participation than students who were underweight or overweight, indicating that normal weight students were most likely to participate in sport. However, Malinauskas et al. (2006) found no association between physical activity levels and weight status in their sample of female students from the USA.

Use of exercise for weight loss purposes is common among tertiary level and was reported to be 80% in female students in the USA (Malinauskas et al., 2006), 30.8% in female tertiary level students aged 18 to 35 years in Australia (Fayet et al., 2012), 21.7% in black South African female students (Senekal et al., 2001) and 89.5% in a sample of mixed race South African female students (Senekal et al., 2016). It is, however, important to note that students who use physical activity for weight loss purposes may not necessarily be meeting physical activity goals for health (Malinauskas et al. 2006). Mendez-Hernandez et al. (2010) reported that solitary exercise or exercise at a gym were the most frequently forms of physical activity used for weight loss by their sample of Mexican female students. However, solitary exercise has been found to not result in successful and continued exercise as a part of a healthy lifestyle (Mendez- Hernandez et al., 2010).

2.8.9 Sleep behaviour of tertiary level students

As mentioned in section 2.6, sufficient and good quality sleep is important for physical and emotional well-being (Buboltz et al, 2009). According to Buboltz et al. (2009) the basic need for good quality sleep for physical and psychological health, weight gain prevention and academic performance may be overlooked by tertiary level students.

Sleep quality and time of tertiary level students

During the transition from high school to a tertiary institution, students report experiencing a significant reduction in sleep, a delayed onset of night time sleep, as well as reduced sleep quality (Buboltz et al., 2001; Buboltz et al., 2009; Sing & Wong, 2010; Vargas et al., 2014; Walsh et al., 2018; Wang et al., 2019).

A number of studies conducted among tertiary level students in the USA reported on sleep time. Vargas et al. (2014) indicated that only 30.1% of their sample achieved the recommended eight or more hours of sleep a night, while 40.6% slept six hours or less per night. Roane et al. (2015) found that the mean sleep duration among first year students was seven hours 15 minutes, which is in line with the seven hours during the week and seven hours 58 minutes per night on the weekends reported by Buboltz et al. (2009). Sleep difficulties were mentioned by 88.5% of these students and 74.3% believed that they did not get enough sleep (Buboltz et al., 2009). Similarly, Hendricks et al. (2004) found that 80% of a sample of first year female students got less than eight hours of sleep on week nights, although most slept longer on weekends.

Forty percent of the students included in the study by Hendricks et al. (2004) experienced difficulty sleeping more than one night per week. Most students in a study by Walsh et al. (2018) reported that they experienced some kind of sleep disturbance. Results of the study by Vargas et al. (2014) showed that 51% of students experienced poor and 19% extremely poor sleep quality. Fifty five percent reported waking up in the middle of the night or early in the morning at least once a week and 32.7% reported lacking enthusiasm to get things done at least once a week.

Work by Peltzer and Pengpid (2015) on sleep duration in university students from 26 low-, middle- and high-income countries across Asia, Africa and the Americas showed that the average number of self-reported hours of sleep per night was 7.1, with the prevalence of getting less or equal than six seven to eight or more or equal

than nine hours sleep per night being 39.2%, 46.9% and 13.9%, respectively. There is a paucity of information on sleep behaviours of South African tertiary level students. The one study that could be traced reported that 18% experienced poor quality sleep and 20% reported having ever fallen asleep while driving and 2% reported having had a fatigue-related accident (there were no gender differences) (Reid & Baker et al. 2008).

Barriers to and facilitators of sufficient, good quality sleep in students

Possible barriers to sufficient good quality sleep in students may include stress, increased freedom, late-night socializing, living in noisy conditions, disorganised lifestyle, variable schedules, lack of self-responsibility, late night studying and spending time surfing the web (Buboltz et al., 2009; Walsh et al., 2018; Wang et al., 2019). Walsh et al. (2018) found that almost all students in their study reported late night studying and very short sleep duration over the exam period. Those living in university residences reported noise as being a barrier, where many students reported broken-sleep as a result of others partying late and returning to the university residence late at night (Walsh et al., 2018). Vargas et al. (2014) found that the most common reason for sleep disturbance reported was “stress related” (e.g. stress, racing thoughts, worried) (Vargus et al., 2014).

Consequences of a lack of sleep

Only a few studies reported specifically on consequences of lack of sleep in tertiary level students. Peltzer and Pengpid (2015) found in multivariate logistic regression that irregular sleep duration was associated with severe depressive symptoms in a study on sleep duration in university students from 26 low-, middle- and high-income countries across Asia, Africa and the Americas. In a randomized cross-over trial in female tertiary level students in the USA by Tajiri et al. (2018), physical activity increased in those with shorter sleep duration (four hours per night) due to longer time spent awake, but sedentary time was also increased in these students. Increases in cortisol and insulin were found in those with shorter sleep duration.

However, no differences in energy intake between those with shorter sleep duration compared to controls (seven hours per night) were found (Tajiri et al., 2018). Reid and Baker (2008) found that poor sleep quality in South African students was associated with the following factors: night-time awakenings, late bed times, use of sleep medication, not getting enough sleep and low energy. These researchers suggested that doctors and healthcare workers should be better trained to support students with sleep problems.

In line with research that points to an association between sleep duration and weight status that was discussed in Section 2.6, Ludy et al. (2018) found that first year students living on campus in the USA who were classified as "major gainers" reported a sleep duration of approximately one hour less than students who maintained their weight after a follow up of four and a half months. Vargas et al. (2014) also indicated that it is clear from evidence that students with more variability in their sleep patterns are more likely to have a higher BMI.

Considering that current obesity therapies have not been adequate to reduce the burden of this disease, more attention should possibly be focused on sleep hygiene as a mechanism for slowing the epidemic of weight gain, especially in university students (Patel et al., 2006; Vargas et al., 2014). Buboltz et al. (2009) suggests including sleep education as an extracurricular activity or to offer it as part of an orientation programme to first year university students. Education should focus on helping students overcoming difficulties in getting enough sleep, fitting sleep into routines, promoting the benefits of getting enough good sleep, setting self-imposed limits and emphasizing students' responsibility for their health behaviours (Buboltz et al., 2009). Altering noise levels in university residences should also be a focus for improving sleep quality in university students (Walsh et al., 2018).

2.8.10 Eating behaviours in tertiary level students

As is mentioned in Section 2.7.1, eating behaviours may impact on energy intake from food and could therefore be predictors of weight gain prevention, weight gain and weight loss success in female students (Bryant et al., 2012; Finlayson et al., 2012; Bourdier et al., 2018).

Cognitive restraint

Fayet et al. (2012) found that approximately half of their sample of tertiary level female students in Australia (aged 18 to 35 years) were restrained eaters. Restraint levels were higher in those with a greater perceived weight, those who were actively attempting to lose weight, those who had lost weight over the previous year and those who had used weight loss methods such as exercise, organised programmes or "other" methods (Fayet et al., 2012). The lowest scores were found in students who did not diet in the three months prior to the study and could not recall any weight loss over the previous year (Fayet et al., 2012). Provencher et al. (2009) found in a cohort of first year students in Canada that high levels of dietary restraint were associated with both weight loss and weight gain.

In a study by Finlayson et al. (2012) in first year tertiary level students in the UK, lower restraint was associated with an increase in fat-free mass (lean mass), along with higher levels of physical activity and a higher drive to experience reward (hedonic responsiveness), but there was no association with an increase in fat mass. Hootman et al. (2018) found in a study of first year tertiary level students in the USA that restraint was associated with higher weight at the beginning of the first year of tertiary education, but there was little or no association between restraint and subsequent changes in weight or fat mass.

Uncontrolled eating (disinhibition and perceived hunger)

Fayet et al. (2012) found that almost half of the female tertiary level students in their study experienced high levels of disinhibition. Scores for this eating behaviour were higher in female students who reported weight gain and were actively trying to lose weight and lowest in participants who were trying to gain weight (Fayet et al., 2012). In a study by Finlayson et al. (2012) in first year tertiary level students in the UK, disinhibition and binge eating were associated with increases in fat mass at the 3 and 12 month follow-ups, which may have been due to overconsumption and opportunistic eating.

Hootman et al. (2018) found an association between disinhibition and higher weight at baseline (beginning of first year of tertiary education), but no longitudinal associations with weight, BMI or waist circumference. These researchers speculate that a possible explanation for this finding is that there is no true association, or that the instruments used to assess eating behaviours are not sensitive enough to capture the behaviours or attitudes that drive weight gain or body fat gain. Another possibility is that higher weight, BMI and waist circumference are predictors of more emotional and disinhibited eating, rather than the reverse relationship that has been studied (Hootman et al., 2018).

Further studies are needed to determine whether weight loss results in decreased disinhibition, or whether lower disinhibition promotes weight loss (Bryant et al., 2008; Hootman et al., 2018). However, there is no doubt that disinhibition is a factor to consider in weight management interventions (Fayet et al., 2012).

Perceived hunger was investigated by Lazaverich et al. (2013) in Mexican university students in a study that focused on eating behaviour, depression, anxiety and impulsiveness. Results showed that 32% of the participants reported feeling constant hunger sometimes, 8% often, and 1% always. Denny et al. (2013) emphasize that understanding hunger and satiety cues and the ability to stop eating once full, are important for successful weight management. Learning that it is

acceptable to enjoy all foods in moderation, and to enjoy extras such as sweets, chocolates, cakes, ice- cream, alcohol and other non- nutritious foods occasionally is important to prevent students from feeling restricted and deprived, which may result in binge-eating as a consequence (Hunt et al., 2017). This recommendation ties in with the concept of intuitive eating, which has been reported to be an effective strategy in dealing with these eating behaviour related challenges (Denny et al., 2013; Schaefer & Magnunson, 2014).

Emotional eating

Research has shown that tertiary level students may be susceptible to making unhealthy and more palatable food choices in order to cope with negative emotions or engaging in overeating episodes in response to emotional states (Lazaverich et al., 2016; Bourdier et al., 2018; Constant et al., 2018). In a sample of French students, Bourdier et al. (2018) found that emotional eating was a mediator between psychological distress and BMI, which is in line with findings by Lazaverich et al. (2016) in Mexican tertiary level students. Hootman et al. (2018) found an association between emotional eating and higher weight at baseline (beginning of first year of tertiary education), but no longitudinal associations.

Constant et al. (2018) studied 18 t0 24-year-old French female tertiary level students who had a healthy BMI and found that half of the students reported emotional eating on one to five days over a period of 28 days due to anxiety (51.3%), loneliness (45.1%), sadness (44.8%), happiness (43.6%), tiredness (27.4%) and anger (14.6%). These researchers found that overeating in response to psychological distress was positively associated with a loss of ability to resist emotional cues and a loss of control over food intake. Crockett et al. (2015) in a study of undergraduate tertiary students in the USA found that emotional eating as a result of being bored is common among students (especially females) and that it may result in weight management problems. Proneness to boredom and difficulty in regulating emotions independently predicted the likelihood of eating in response to negative emotions (Crockett et al., 2015).

It is evident that using food to regulate mood may be a risk factor for weight gain in students (Bourdier et al., 2018). Appropriate management of emotions should thus be an important focus in weight management interventions targeted at female students (Wing & Phelan, 2005, Crockett et al., 2015; Constant et al., 2018).

2.8.11 Psychological well-being of tertiary level students

Psychological factors such as stress, depression and anxiety, body shape dissatisfaction and self-esteem are important constructs that affect weight management behaviours of first year female students (Serlachius et al., 2007; Lazaverich et al., 2018; Lyzwinski et al., 2019).

Stress

Stress is commonly seen in university students and is linked to a lesser or greater extent to the life stage they are in, including transition to tertiary education setting. Globally 20 to 25% of students report being stressed at any given time (Haidar et al., 2018) and 80% of college students report experiencing some form of stress in their regular student lives (Lyzwinski et al., 2019). People tend to overeat or under eat in stressful times, leading to depression, overeating and poor weight management (Senekal et al., 1999; Elfhag & Rossner, 2005; Gardner et al., 2013).

Stressors tertiary education level students may experience include building new social relationships, keeping up with academics, time management, increased work load, planning for the future, transitioning into financial and emotional independence and trying to meet the expectations of their parents, friends as well as their own (Cilliers et al., 2006; Renk & Smith, 2007; Hunt & Eisenberg, 2010; Fayet et al., 2012; Gardner et al., 2013).

Research shows that there is a link between higher levels of stress, engagement in maladaptive weight-related behaviours such as binge eating before exams; increased consumption of unhealthy, more palatable food; physical inactivity and weight gain in tertiary level students (Lyzwinski et al., 2019). Serlachius et al. (2007) found in a sample of 18 to 25 year old UK students that increased stress levels was associated with both weight gain and weight loss, with this association being most pronounced in female students (Serlachius et al., 2007). The results of research by Boyce and Kuijer (2015) showed that students entering university with higher stress levels combined with a lower BMI were more likely to lose weight, whereas those entering university with a higher BMI were more likely to gain weight when stressed.

Kandiah et al. (2006) investigated the effect of stress on appetite and food choices in a sample of 17 to 26 year old female tertiary students in the USA . The majority (81%) of students reported experiencing a change in appetite when stressed, with 63% reporting an increase and 37% reporting a decrease. Under normal conditions 80% typically made healthy food choices, however only 33% reported eating healthy when stressed. Snacking was significantly higher in those reporting an increased appetite (Kandiah et al., 2006). When stressed the variety of foods selected by students from each category (mixed dishes, salty/crunchy foods, sweet foods, creamy foods, beverages) was significantly reduced (Kandiah et al., 2006). Students who experienced increased appetite when feeling stressed selected a significantly greater variety of sweet foods and mixed dishes than those with decreased appetite or with no change in appetite when feeling stressed (Kandiah et al., 2006).

After conducting a systematic review of available evidence Haidar et al. (2018) noted that there was insufficient quality evidence to draw firm conclusions about the role of stress in weight change in tertiary level students. These researchers recommend that longitudinal studies with adequate sample sizes will need to be conducted to confirm the relationship between stress and weight change among students. However, irrespective of the inconclusiveness of the evidence a number of researchers have recommended that weight management (weight gain prevention) interventions should include a focus on stress management (Senekal et al., 1999;

Cilliers et al., 2006; Fayet et al., 2012; Sinha & Jastreboff, 2013). Techniques such as mindfulness and yoga may be useful in reducing stress and preventing weight gain in this population (Halperin et al., 2019).

Depression and anxiety

The onset of depression and anxiety is typically in the age range of tertiary education level students (18 to 24 years). The prevalence seems to be increasing, with females reportedly being more susceptible than males (Eisenberg et al., 2009; Asante & Andoh-Arthur, 2015; Mazurek Melnyk et al., 2016; Lazaverich et al., 2018). A review by Ibrahim et al. (2013) showed that the global prevalence of depression among tertiary level students ranged between 10% and 85%, which was much higher than depression rates in the general population.

Peltzer and Pengpid (2015) reported a prevalence of 24% of moderate and 12.8% severe depression in undergraduate tertiary level students from 26 low, middle and high income countries across Asia, Africa and the Americas. Similarly, Nourse et al. (2017) reported that 58.7% of their sample of tertiary level students in the USA experienced mild symptoms of depression, 23.9% moderate symptoms and 17.4% severe symptoms. A further study among tertiary level students in the USA by Mazurek Melnyk et al. (2016) showed that 41% experienced symptoms of depression and 28% had elevated anxiety. Lazaverich et al. (2013) found that 24.2% of Mexican female tertiary level students experienced depression symptoms. In a subsequent study these researchers found that 27.5% of the first year female students experienced depression symptoms (Lazaverich et al., 2018). Asante and Andoh-Arthur (2015) reported the presence of mild to moderate depression in 31.1% and severe depressive symptoms in 8.1% tertiary level students in Ghana. The prevalence of depression was found to be lower (17.7%) in a sample of black female South African tertiary level students (Steyn et al., 2000).

Depression among university students has been positively associated with a number factors, including female gender, older age, lower socioeconomic status, stressful

and traumatic situations, higher addictive behaviours including alcohol and tobacco use, lack of social support, sedentary behaviour, irregular meal patterns, higher salt intake and irregular sleep hours (Ibrahim et al., 2013; Asante & Andoh-Arthur, 2015; Peltzer & Pengpid, 2015). More specifically, Mazurek Melnyk et al. (2016) showed that depression and anxiety were both significantly negatively associated with healthy lifestyle behaviours, and significantly positively associated with stress, as well as with one another. Lazaverich et al. (2018) found that a higher depression score was associated with a higher BMI, higher frequency of consumption of fast food, fried food and sugary food, as well as a lower frequency of physical exercise (< 75 min/week) in first year female students. Kim and Lee (2010) did not find an association between depression and weight status in their sample of female students in Korea. However, those who over-estimated their weights had a significantly higher score for “loser”, “punishment”, “hatred” and “fatigue” as well as for the total depression score.

Since individuals who are inclined to depression may use food as a means of comfort, a number of researchers have recommended that weight management (weight gain prevention) interventions should include a focus on depression management (Mazurek Melnyk et al., 2016; Lazaverich et al., 2018). Integrating mindfulness training and cognitive behavioural skills into academic programmes could be useful for improving psychological outcomes in students (Mazurek Melnyk et al., 2016).

Body Image

Poor body image, typically assessed in terms of body dissatisfaction, is a common problem seen in tertiary level females and may result in the use of unhealthy or extreme weight loss methods and unnecessary weight loss attempts (Senekal at al., 1999; Neumark-Sztainer & Hannan, 2002; Wharton et al., 2008; Cristiana, 2016; Rodgers et al., 2018).

Cristiana (2016) reported that the mean BMI of female students in their study in 19 to 21 year old Romanian female students was in the normal range and that 65% had a healthy weight. However, 79% had low levels of body satisfaction, primarily due to their weight, with 66% reporting wanting to lose weight and 13% wanting to gain weight. Results of this study also showed that 46% of underweight students were dissatisfied with their weight and still wanted to lose weight. Only 13% of normal weight students were happy with their weight (Cristiana, 2016). A similar profile was reported by Malinauskas et al. (2006) for their sample of female students in the USA. In a further study in the USA Rodgers et al. (2018) found that 96% female tertiary level students were dissatisfied with their body shape. These researchers found that desire for thinness and fear of gaining weight were associated with body shape satisfaction (Rodgers et al., 2018).

As mentioned in Section 2.7.2, social and cultural factors impact on body shape satisfaction. Mendez-Hernandez et al (2010) reported that the main reasons for weight loss attempts in their study of tertiary level students in Mexico were aesthetics and keeping up with appearance. In line with this, Malinauskas et al. (2006) reported that female university students in their study in the USA felt pressure to lose weight mainly from themselves, friends and media. Similarly, LaCaille et al. (2011) found in their sample that female tertiary level students in the USA were mainly concerned about what their peers thought of them in terms of their weight. A further study among first year female students in the USA suggests that the amount of weight gained by these students is negatively associated with the starting weight of their peers i.e. if a heavier peer feels that she needs to lose weight and engages in behaviours associated with weight loss, her behaviours could in turn cause a peer student to adopt some of the same behaviours and consequently gain less weight (Yakusheva et al., 2011).

Weight gain prevention interventions should thus include a focus on prevention of or addressing distorted body image, body shape dissatisfaction and ensuring the adoption of reasonable weight goals (Senekal at al., 1999; Neumark-Sztainer & Hannan, 2002; Wharton et al., 2008). Perspectives on cultural body shape ideals and

management of peer and social pressures in this regard should most probably be key to this focus.

Self-esteem

Research has shown that the transition from high school to tertiary level education is specifically associated with a decrease in self-esteem in female students (Cilliers et al., 2006). Cristiana (2016) found that the average self-esteem among Romanian female tertiary level students was normal to high and that only 1.9% reported a low self- esteem. This study also showed that there was a significant negative association between self-esteem and body dissatisfaction (Cristiana, 2016). In the study by Cilliers et al. (2006), 43.9% of the sample of Caucasian South African first year female students had a medium self-concept (Vrey & Venter, 1983), while 19.4% had a low self-concept. These researchers found that self-concept differed across BMI ranges, with 30.8% of overweight students having a low self-concept in comparison to 15.4% of underweight students and 18.3% of normal weight students (Cilliers et al., 2006). Senekal et al. (2001) reported similar results for a sample of black South African female students, with 65.5% of the students having a medium self-concept and 28.2% having a low self-concept.

Weight gain prevention interventions targeted at female students should thus include elements that would contribute to strengthening self-esteem (Cilliers et al., 2006). The bi-directional nature of the associations between self-esteem and numerous variables need to be considered in this regard. For example body related shame or body shape dissatisfaction has been found to be a mediator between self-esteem and BMI (Pila et al., 2015). Furthermore positive health behaviours including healthy dietary habits and patterns and physical activity have been demonstrated to be associated with higher self-esteem in tertiary level students (Crombie et al., 2009).

2.9 Belief patterns and behaviour change for weight gain prevention

2.9.1 Definition of a belief

Numerous definitions of the noun, belief, have been formulated (see examples in Table 2.5). Core elements that come to the fore include acceptance, confidence, convictions, being certain, attitudes and importantly, truth. It is evident that forming beliefs drive action (behaviour). This notion is in line with the core premise of the Theory of Planned Behaviour (TBP) (Azjen,1991) (Section 2.9.2).

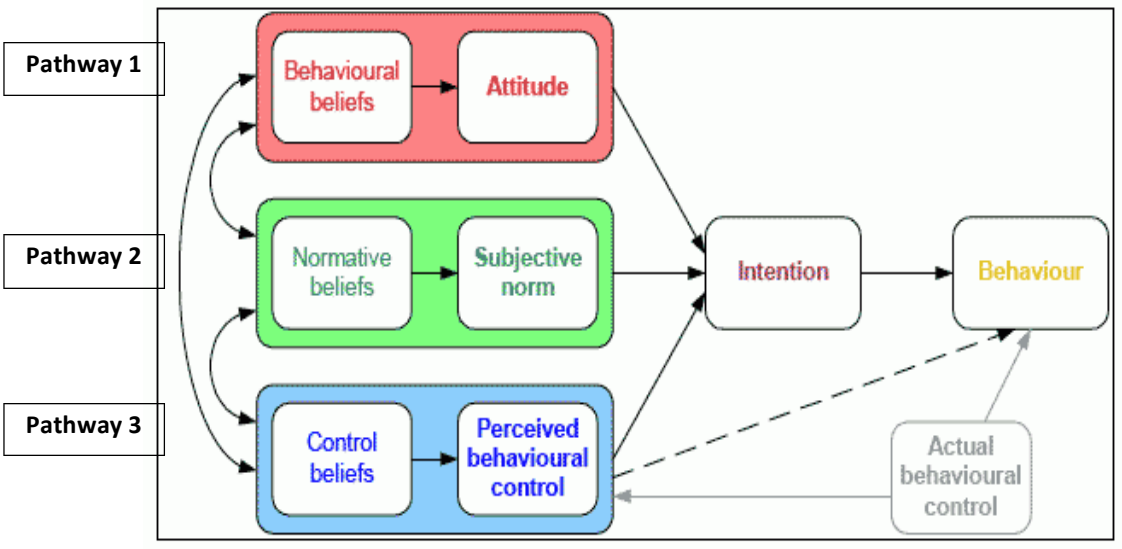
Table 2.5 Examples of definitions of beliefs

Definition (Quotes)	Reference
“an acceptance that something exists or is true, especially one without proof”	https://www.lexico.com/en/definition/belief
“a state or habit of mind in which trust or confidence is placed in some person or thing”	https://www.merriam-webster.com/dictionary/belief
“The definition of a belief is an opinion or something that a person holds to be true.”	https://www.yourdictionary.com/belief
“belief is an idea one usually holds with conviction and importance.”	https://www.vocabulary.com/dictionary/belief
“the feeling of being certain that something exists or is true.”	https://dictionary.cambridge.org/dictionary/english/belief
“In epistemology, philosophers use the term "belief" to refer to personal attitudes associated with true or false ideas and concepts.”	https://en.wikipedia.org/wiki/Belief
“Most people define beliefs as inward convictions, a feeling of certainty about what something means. They are what you hold dear and are rooted deeply within. A belief is both mental and emotional. It is imbedded in the mind and in the heart.”… “Beliefs drive us. They are at the root of all purpose and all action.”	https://tybennett.com/the-true-definition-of-belief/
“The topic of belief isolates the elementary mental act or state of accepting some proposition as true.”	Owen Egan (1986 p 315):
“A belief is a personal attitude associated with true or false ideas and concepts.”	Primmer (2018)
“Contemporary Anglophone philosophers of mind generally use the term “belief” to refer to the attitude we have, roughly, whenever we take something to be the case or regard it as true”… “Forming beliefs is thus one of the most basic and important features of the mind.”	https://plato.stanford.edu/entries/belief/Stanford Encyclopedia of Philosophy First published Mon Aug 14, 2006; substantive revision Mon Jun 3, 2019

2.9.2 Belief constructs in the theory of planned behaviour (TBP)

Belief constructs in the theory of planned behaviour include behavioural beliefs, normative beliefs, control beliefs, attitude toward the behaviour, subjective norm, perceived behavioural control, and intention to perform the behaviour (Azjen, 1991; Baranowski et al., 2003; Armitage & Conner, 2001; Schifter & Azjen, 1985) (Figure 1).

Figure 1: The Theory of Planned Behaviour



Adapted from: Azjen (2014)

Pathway 1

Behavioral beliefs involve an individual's belief about the consequences of a particular behaviour, thus the subjectively believed likelihood that the behaviour will result in a given outcome, which may be favourable or unfavourable e.g. 'eating less fat will help me prevent weight gain.' Behaviour beliefs influence the attitude to a particular behaviour (Azjen, 1991; Klama, 2013).

Pathway 2

Normative beliefs involve an individual's belief whether key people such as family and peers approve or disapprove of a particular behaviour, thus motivation to behave in a way that gains approval of others e.g. 'my friends think that I should eat less fat.' These beliefs influence subjective norm (Azjen, 1991; Klama, 2013)

Pathway 3

Control beliefs involve an individual's beliefs about the presence of factors that may facilitate or impede performance of the behavior, in other words, perceived barriers or facilitators for performing a specific behaviour e.g. It is entirely up to me to eat

less fat. Control beliefs influence perceived behavioral control (the belief that one has control over performing the behaviour) (Azjen, 1991; Klama, 2013).

All three pathways contribute to behavioural intent (willingness and motivation to perform the behaviour), which in turn contributes to increasing the possibility that the behaviour will be executed (Azjen, 1991; Klama, 2013).

Application of the TPB in weight management research has typically been in the form of application thereof in explaining cross-sectional associations or the outcome of weight loss interventions (Klama, 2013). Associations between perceived behavioural control, attitude and intentions of those with overweight/obesity regarding target behaviours may explain weight loss in particular interventions to a lesser or greater extent (Schifter & Ajzen, 1985; Palmeira et al., 2007; Chung and Fong, 2015). However, formative assessment of underlying beliefs is typically not conducted to inform the development of targeted intervention content and core messages in these studies (Klama, 2013).

2.9.3 Beliefs and belief patterns associated with weight management in tertiary level students

There is limited research on beliefs or belief patterns related to lifestyle behaviours for weight management (dietary intake, physical activity, alcohol use and sleep time aligned with recommendations) and associated constructs such as eating behaviour, body shape dissatisfaction, stress, self-esteem and symptoms of depression/anxiety in general, and specifically in tertiary level female students.

In a study in first year tertiary level male and female students in the UK, Nikolaou et al. (2015) found that students believed the transition to university had led to significant lifestyle changes and that weight gain, reported by 50% of the participants as a major concern, resulted. Increased alcohol consumption was the most commonly believed cause of the weight gain (Nikolaou et al., 2015). Although

students believed that consumption of fruit and vegetables and physical activity were protective against weight gain, these healthy lifestyle behaviours were not found to be associated with prevention of weight gain (Nikolaou et al., 2015). The three main themes that emerged regarding barriers to and facilitators of healthy lifestyles and weight management were budget, peer influence and time management (Nikolaou et al., 2015). Students believed that eating healthy is more expensive, that their peers' exercise and eating habits had a positive or negative impact on their own behaviours, that having someone to cook with or model healthy habits around them would facilitate a healthier lifestyle and that university coursework and lectures affect time management and stress (long days with no breaks) (Nikolaou et al., 2015).

Das and Evans (2014) performed nominal group technique (NGT) sessions with first year tertiary level male and female students in the USA to examine students' beliefs regarding barriers to and benefits of weight management. They found that students were most concerned with perceived susceptibility to and severity of physical inactivity and poor dietary intake. Students were further concerned about social life (e.g. making new friends and participating in social activities), as well as physical health (e.g. having a strong immune system) and mental health (e.g. being able to concentrate in class). Reported barriers included lack of motivation, lack of social support and the perception that healthy food options on campus and physical activity opportunities are limited. Lack of time for physical activity was the most commonly believed barrier to physical activity (Das & Evans, 2014). It emerged that students believed that effective weight management increased self-confidence due to physical attractiveness, as well as facilitating a better mental focus (Das & Evans, 2014).

Tertiary level (male and female) students in a study by Mazurek Melnyk et al. (2016) in the USA reported strong beliefs regarding healthy lifestyle behaviours. However, despite believing that engaging in regular physical activity, eating a healthy diet, maintaining a healthy weight, getting adequate sleep, and sustaining relationships are beneficial to one's health, they reported that establishing healthy lifestyle habits

was difficult. In this study healthy lifestyle beliefs were positively associated with healthy behaviours (assessed using the 15-item Healthy Lifestyle Behaviours Scale including for example, eating 5 or more fruit and vegetable servings per day, engaging in muscle-strengthening activities on 2 or more days of the week, doing healthy things to cope and deal with worries and stress). However only a third of students reported eating the recommended five fruits and vegetables per day and only 44% met the recommended physical activity guidelines for adults (Mazurek Melnyk et al., 2016).

Understanding beliefs of students relating to perceived barriers to and facilitators of a healthy lifestyle is essential in designing weight gain prevention interventions in this vulnerable group (Nikolaou et al., 2015).

3. PHASE 1: QUALITATIVE

Salient beliefs of first year female students concerning weight gain prevention behaviours and weight related constructs

3.1 Introduction

The prevalence of obesity worldwide is continuously rising and is a global public health concern (Machado et al., 2012; Adeboye et al., 2012; Jensen et al., 2014; De Vos et al, 2015; WHO, 2015; Chooi et al., 2019). The global prevalence of overweight and obesity has been increasing in the younger age groups, with young adults being no exception (Racette et al., 2005; Lloyd-Richardson et al., 2009; LaCaille et al, 2011; Wing et al., 2013; Grave et al., 2013; Quick and Byrd-Bredbenner; 2013; Flegal et al., 2016; Ogden et al., 2016; Swanson, 2016; Zheng et al., 2017; Dietz et al., 2017; Shi et al., 2018). The 2012 South African National Health and Nutrition and Examination Survey (SANHANES) showed that obesity among females aged 18 to 24 years was 21.7% and overweight 25.3%, while obesity among males in this age group was 4.2% and overweight 5.8% (Shisana et al., 2013). The 2016 South African Demographic and Health Survey (SADHS) showed that overweight among females aged 15 to 24 years was 24.4% and obesity 15.5%, while overweight among males in this age group was 8.9% and obesity 2.3% (National Department of Health et al., 2016). Furthermore, the SADHS showed that overweight among females aged 15 and older was 27% and obesity 41%, while overweight among males was 20% and obesity 11% (National Department of Health et al., 2016). Females are a specific target in this research given the higher prevalence of overweight and obesity compared to males in both younger and older age groups in South Africa.

Research has shown a prevalence of overweight (4.1 to 22.2%) and obesity (1 to 15.8%) in female tertiary level students both nationally (South Africa) and internationally (Senekal et al., 2001; Cilliers et al., 2006; Malinauskas et al., 2006;

Kim & Lee, 2010; Nikolaou et al., 2015; Senekal et al., 2016; Peltzer & Pengpid, 2017; Lazaverich et al, 2018).

International and national (South African) research conducted over decades has shown that first year female students may be specifically prone to weight gain (Hovell et al., 1985, Senekal et al., 1988; Megel et al., 1994; Senekal, 1994; Graham et al., 2002; Anderson et al., 2003; Malinauskas et al., 2006; Lloyd-Richardson et al., 2009; LaCaille et al., 2011; Fayet et al., 2012; Finlayson et al., 2012; Smith- Jackson & Reel, 2012; Vadeboncoeur et al., 2015; Nikolaou et al., 2015; Senekal et al., 2018).

Weight gain is caused by a positive energy balance when dietary energy intake is greater than energy expenditure (Hall et al., 2011; Hill et al., 2013; Romieu et al., 2017; Chooi et al., 2019). A positive energy balance results from an interaction between genotype and environment, including lifestyle patterns and psychosocial influences (Romieu et al., 2017; Hartmann- Boyce et al., 2017; Sogari et al., 2018; Chooi et al., 2019; Wilding et al., 2019; Chapelot & Charlot, 2019). First year female students may be specifically vulnerable due to their transition from school to a tertiary institution (Mueller et al., 2018; Sogari et al., 2018). This is known to be a difficult stage in development due to the need to adapt to a new environment. This environment brings with it new social, psychological and academic challenges and pressures, changes in routine, as well as a newly found sense of independence (Cilliers et al., 2006; Fayet et al., 2012; Crombie et al., 2009; Patrick et al., 2014; Vadeboncoeur et al., 2015).

It is evident from literature that particular weight management related behaviours may characterize female students, including the following: low levels of physical activity, which may be lower than it was during the period before enrolment at the tertiary institution (Deliens et al., 2015; Plotnikoff et al., 2015; Yahia et al., 2016; Peltzer & Pengpid, 2017; Walsh et al., 2018); unhealthy eating patterns (Lazaverich et al., 2013; Brown et al., 2014; Gresse et al., 2015; Yahia et al., 2016), including low/inadequate intake of fruit, vegetables and dietary fiber combined with frequent intake of energy dense foods such as alcohol, sugar sweetened beverages and fast

foods (Small et al., 2013; Nicolou et al., 2015; Yahia et al., 2016; Senekal et al., 2016; Mueller et al., 2018; Lazaverich et al., 2018); frequent binge drinking (Peltzer & Pengpid, 2016; Battista & Leatherdale, 2017; Yi et al., 2017; Nourse et al., 2017; Ajayi et al., 2019), with drinking having increased in female students over the years (White & Hingson, 2013; Govender et al., 2017; Ajayi et al., 2019); and not meeting the recommended hours of sleep (Buboltz et al., 2001; Buboltz et al., 2009; Sing & Wong, 2010; Vargas et al., 2014; Walsh et al., 2018; Wang et al., 2019). Further documented weight management related characteristics described for female students include having a distorted body image and being dissatisfied with their weight (Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018); dietary restraint, uncontrolled and emotional eating (Lazaverich et al, 2013; Crockett et al., 2015; Lazaverich et al., 2016; Bourdier et al., 2018; Constant et al., 2018; Hootman et al., 2018); stress that may be linked to the early adult life stage as well as the challenges these students face during the transition from home to the tertiary institution (Serlachius et al., 2007; Hunt & Eisenberg, 2010; Fayet et al., 2012; Gardner et al., 2013; Haidar et al., 2018; Lyzwinski et al., 2019); depression/anxiety (Lazaverich et al., 2013; Peltzer & Pengpid, 2015; Asante & Andoh-Arthur, 2015; Mazurek Melnyk et al., 2016; Nourse et al., 2017; Lazaverich et al., 2018) and lower self-esteem (Senekal et al., 2001; Cillers et al., 2006; Cristiana, 2016). It follows that key behaviours to focus on for effective weight management in female students include dietary intake, alcohol, physical activity and sleep.

Weight related constructs that may need attention include eating behaviours (dietary restraint, uncontrolled eating and emotional eating), body shape satisfaction, stress, self-esteem, depression and anxiety.

Weight gain and poor lifestyle behaviours that develop during the young adult life stage may persist into later adulthood and increase prevalence of overweight and obesity in the longer term (Braddon et al., 1986; Williamson et al., 1990; Rothacker & Blackburn, 2000; Gillen & Lefkowitz, 2011; Wharton et al., 2008; Vadeboncouer et al., 2015; Walsh et al., 2018). Since excessive body weight is associated with serious

health consequences, including a higher risk of premature mortality and diseases that can lead to a decreased quality of life and health (Tchernof & Després, 2013; Chooi et al., 2019), it is crucial to develop and implement weight gain prevention interventions for female students attending tertiary institutions (Cilliers et al., 2006; Deshpande et al., 2009; Mendez-Hernandez et al., 2010; Wing et al., 2013; Laska et al., 2013; Vadeboncoeur et al., 2015; Walsh et al., 2018).

Senekal et al. (2018) and others (Gillen & Lefkowitz 2011; Webb et al. 2013; Das & Evans 2014; Vadeboncoeur; Foster & Townsend, 2016) point out that tertiary institutions should take some responsibility for addressing concerns students may have about weight gain during their first year on campus. Swanson (2016) and Das and Evans (2014) maintain that students actually desire assistance with weight management during their time on campus. Review of the literature revealed that a number of university based weight gain prevention interventions have been tested. These interventions include a one-semester nutrition education course (not successful) (Matvienko et al., 2001), a 10-week intensive intervention that covered 21 web-based mini-educational lessons combined with three e-mails (nudges), followed by 12 months of receiving four nudges per month (not successful) (Kattelmann, Bredbenner & White, 2014), a 14-week randomised controlled trial (RCT) with two arms: 1) improving outcome expectations and self-efficacy within a social cognitive theory framework and 2) targeting the same variables but focusing on explicit training in self-regulation skills (not successful) (Dennis et al., 2012), two interventions that focussed on using a tissue monitoring system algorithm for weight management [Caloric Titration Method (CTM)] (successful) (Levitsky et al., 2006, Bertsz et al., 2015), educational inputs on maintenance of a healthy life style in the form of small group seminars over a two-year period (successful) (Hivert et al., 2007) and a combination of a 6-week online intervention with weight and energy intake feedback over a six week period (successful) (Gow et al., 2010).

Senekal et al. (2018) surmised that potential success of a tertiary institution based weight gain prevention intervention will depend on accessing large numbers of students in a short period of time during their first weeks on the campus.

Consequently these researchers opted to develop a self-help intervention in the form of a self-help manual that could be handed out to first year female students early in the academic year. The intervention was tested in a controlled trial and results showed that the intervention group had gained a significant 0.9kg (30%) less weight at eight months after baseline than the control group (Senekal et al., 2018). Senekal et al. (2018) recommended that combination of the self-help manual with additional elements, for example social media messaging, may increase the intervention effect.

According to the Theory of Planned Behaviour (TBP) changing beliefs that influence attitude, social norm and perceived behaviour control, which in turn influence intent to change behaviour, is critical to ensure behaviour change and intervention success (Azjen, 1991). The aim of this study was to elicit and describe salient beliefs of first year female students concerning weight gain prevention behaviours (dietary and alcohol intake, physical activity and sleep) and weight related constructs (body image and body dissatisfaction, stress, self-esteem and depression) to advise the development of further elements to combine with the self-help weight management manual for female students by Senekal (2005).

3.2 Methods and Procedures

3.2.1 Study design

Francis et al. (2004) recommend that elicitation studies should allow participants free format responses to a set of questions. They propose that focus groups or individual interviews, thus a qualitative design, should be used for these purposes. In this research in-depth semi-structured interviews were used for data collection since it allowed for detailed exploration of the beliefs of the first year female students. Boyce and Neale (2006) explain that in-depth interviews provide a relaxed atmosphere for collecting information and are useful when potential participants may feel more comfortable to talk openly in a one-on-one interview than in a focus group. This was deemed to be specifically relevant for discussions concerning the potentially sensitive issues of weight gain prevention behaviours and weight related constructs.

3.2.2 Target population and study sample

Target population

The target population for this qualitative study was first year female students attending the University of the Cape Town (UCT), Stellenbosch University (SU) and University of the Western Cape (UWC) in the Western Cape Province, South Africa.

Inclusion and exclusion criteria

First year female students between the ages of 18 and 20 years old registered for the first time for an undergraduate programme at UCT, SU or UWC were eligible for participation in this research. Students who resided at home while attending university, were pregnant or breastfeeding, were elite athletes, followed dietary restrictions for a medical condition, had an eating disorder or a disease or physical disability that may have influenced their weight, were not eligible for participation. Exclusion criteria were self-reported as part of the screening questions.

Sample size and sampling strategy

Francis et al. (2004) suggest that a sample size of 25 participants is ideal for belief elicitation studies. However, Marshall (1996) mentions that the number of subjects required usually becomes clear as the study progresses, as new themes, sub-themes or explanations stop emerging from the data (data saturation is achieved). Francis et al. (2009) propose that data saturation can be decided on by specifying a minimum sample size for initial analysis and then specifying how many more interviews will be conducted without new ideas emerging.

The sampling strategy applied in this research was purposeful; thus the most productive sample to answer the research question was selected as suggested by Marshall (1996). Based on literature (Shisana et al., 2013; Annesi et al., 2014; Senekal et al., 2016; SADHS, 2016; Munt et al., 2017; Senekal et al., 2018) and the researchers' expert insights in the target population, the following characteristics were considered in the sampling frame: abode during the students' first year at the tertiary institution, race and university attended.

Literature shows that abode during a student's first year on campus, whether at home, in a university residence or private accommodation, may influence weight management related lifestyle behaviours such as dietary intake, physical activity, alcohol use, sleep and psychological well-being of students (Brunt & Rhee, 2008; Boekeloo et al., 2009; Wicki et al., 2010; Kapinos & Yakusheva, 2011; Small et al., 2013; Deliens et al., 2015; Wilkinson & Ivsins, 2017; Walsh et al., 2018; Ajayi et al., 2019). Students who lived at home at the time of this study were excluded. It was assumed that the change in environment experienced by these students would be less prominent than the change experienced by students who moved away from home to either private or university residence accommodation.

As far as race is concerned, international and local literature shows that cultural perceptions may have a profound influence on body image and satisfaction measures, as well as weight loss practices (Senekal et al., 2001; Puoane et al. 2005,

Puoane et al. 2013; Cilliers et al. 2006; Annesi et al., 2014). It is for this reason that the sampling framework was structured to ensure representation of the main race groups in the country (African black, Caucasian, mixed ancestry and Indian) (Shisana et al., 2013; SADHS, 2016).

The three universities included in this research differ in that Stellenbosch University was historically an Afrikaans medium institution, although the language policy has recently changed to English as primary languages of instruction. The University of Cape Town was historically and remains an English medium institution. The University of the Western Cape was a historically disadvantaged institution and remains an English medium institution.

The final sampling frame is depicted in Table 3.1. The aim was to conduct a minimum of six interviews per accommodation category (private versus university residence) within each university category, with two participants per race category (African Black, Caucasian, Indian/Mixed Ancestry), thus a minimum total of 36 interviews.

Table 3.1 Sampling frame for in depth interviews

	Private (excluding those living at home with family or parents)	**University Residence**
UCT	African Black FYFS: 2	African Black FYFS: 2
	Indian/Mixed Ancestry: 2	Indian/Mixed Ancestry: 2
	Caucasian: 2	Caucasian: 2
UWC	African Black FYFS: 2	African Black FYFS: 2
	Indian/Mixed Ancestry: 2	Indian/Mixed Ancestry: 2
	Caucasian: 2	Caucasian: 2
SU	African Black FYFS: 2	African Black FYFS: 2
	Indian/Mixed Ancestry: 2	Indian/Mixed Ancestry: 2
	Caucasian: 2	Caucasian: 2

UCT: University of Cape Town; UWC: University of the Western Cape; SU: Stellenbosch University

Participant recruitment and sampling

Recruitment firstly involved compiling a list of potential volunteers.

Recruitment strategies for these purposes included the following:

A. An invitation to participate in this research was placed on the UCT, SU and UWC websites and was also sent to first year female students via e-mail. The relevant administrative staff member at each of the universities was sent a copy of the email for distribution which they then forwarded on to first year female students.
B. A link to an information sheet explaining the nature of the research and expectations of participants accompanied the invitation (see Addendum B). Students could indicate their willingness to be screened for participation in the study via a return e-mail.
C. Posters were put up in university residences and at strategic positions on campus (Addendum D). Interested students could contact the researchers (the candidate's contact details were included on the poster) to be included on the volunteer screening list.
D. The candidate put up a small stall at busy areas on each of the three campuses to hand out information sheets and field any questions of interested students. If they wished to do so, students added their names to the screening list.
E. Recruitment by word of mouth was also encouraged, thus requesting students who were approached on campus to inform their friends of the study who could then contact the candidate for inclusion on the screening list.

Volunteers from each university were then requested to disclose their race, contact details and living arrangements. Students on the potential volunteer list who met the inclusion criteria were contacted and invited to participate in the study. Forty three students consented and were subsequently interviewed. Table 3.2 in the data analysis section depicts alignment of the achieved sample with the sampling framework.

3.2.3 In-depth interview guide

The development of the guide for the in-depth interviews involved formulation of open-ended questions to elicit salient beliefs relating to weight gain prevention behaviours (dietary and alcohol intake, physical activity and sleep) and weight related constructs (body image and body dissatisfaction, stress, self-esteem, depression) bearing in mind the constructs of behavioural, normative and control beliefs, using the Theory of Planned Behaviour Manual by Francis et al. (2004) to guide the process. The elicitation questions were reviewed by four experts in weight management research and/or practice, and adapted as necessary, with the outcome being the first draft of the interview guide. The draft guide was subsequently pilot tested for comprehension of questions and quality of information generated with three first year female students who met the inclusion criteria of the study. The pilot testing sessions also served to train the study interviewers (a total of three, including the candidate). The final guide (Addendum A) covered beliefs concerning the following: 1) dietary intake (what should/should not be eaten on a daily basis; importance of healthy eating; facilitators of and barriers to healthy eating); 2) physical activity (how much and what type of physical activity should be performed; importance of physical activity; facilitators of and barriers to physical activity); 3) sleep (how much sleep a person should get on a daily basis; importance of getting enough sleep; facilitators of and barriers to getting enough sleep; consequences of a lack of sleep); 4) alcohol intake (how much alcohol a person should drink; benefits to drinking alcohol, barriers to reducing alcohol intake; consequences to drinking alcohol); 5) stress and depression (how stress and depression influence dietary intake, physical activity, sleep and alcohol intake); 6) body image (body shape dissatisfaction) and self-esteem (how body image and self-esteem influence dietary intake, physical activity, sleep and alcohol intake); and 7) weight loss and weight gain prevention strategies. Questions on the importance/benefits of weight gain prevention behaviours were formulated to elicit behavioural beliefs, while questions on facilitators and barriers to these behaviours were formulated to elicit normative and control beliefs. Questions on how weight related constructs affect these

behaviours were formulated to elicit control beliefs. Questions on what and how much to eat, level of alcohol use, amount and type of physical activity to do, hours of sleep, weight loss and weight gain prevention strategies did not speak to the three TBP belief categories, but were included to gain insights in students' beliefs regarding the execution of these behaviours and weight management strategies.

3.2.4 Data collection procedures

Following recruitment, selected students were invited for a face-to-face interview. A date and time that suited both the participant and interviewer was agreed on. Interviews were conducted in a private venue on the SU, UCT or UWC campuses or in the university residences as per the choice of the student. On arrival the students completed the informed consent procedure, after which the interview commenced in the language of their choice. Interviews took an hour on average to complete.

Three trained interviewers (registered dieticians) who were proficient in English, Afrikaans or isiXhosa conducted the in-depth interviews. The interview guide was used to facilitate the discussion, which was conducted in such a way that participants had sufficient time to think about each question before answering/commenting. The interviews were audio recorded for data analysis. None of the interviews were conducted in Xhosa, two were conducted in Afrikaans and the remaining 41 in English.

3.2.5 Data analysis

Data analysis process

The data was systematically analysed using the computer-assisted qualitative data analysis software Nvivo12 Pro (QSR International, 2018). This software was used for marking and coding the interview transcripts and recordings, allocation of themes, subthemes and sub-subthemes (referred to in the Nvivo software as nodes, subnodes and sub-subnodes).

The following steps were executed as part of the data analysis process:

1. Four of the interviews were transcribed verbatim into word documents; two of the 41 English interviews were transcribed by the candidate and the two Afrikaans interviews were transcribed and then translated to English by the Afrikaans speaking interviewer. These documents were read repeatedly by the candidate to gain insights and become familiar with the content.
2. The four transcribed documents were subsequently uploaded into Nvivo to be coded. This involved classification of a selected segment of textual data by means of a label (summary term) that expresses some essential quality of beliefs as reflected in the data segment. Codes were identified on a line- by- line and paragraph- by- paragraph basis as recommended by Rogerson et al. (2016). The theoretical framework of weight gain prevention behaviours and weight related constructs as reflected in the interview guide, underpinned the process of coding. The preliminary codes were confirmed in an interactive session with a senior researcher with experience in qualitative research methodology (supervisor) to generate the first draft of the coding list.
3. Further interviews were transcribed in the Nvivo programme using the "transcribe mode". This process involves playing and pausing the recording and transcribing while listening, with Nvivo automatically adding new rows and timestamps as the process continues. The interviews were coded as the transcription process proceeded, using the first draft of the code list to start with. The code list was updated as new codes emerged from the interviews. Coded interviews were continuously revisited with the updated code list. The coding was done by the candidate and a trained registered dietitian with research experience. For training purposes the registered dietitian was required to code one of the interviews that had been transcribed verbatim and coded by the candidate under her supervision. The candidate reviewed the interviews coded by the dietitian for quality control and updated the coding list as necessary. The audio-coding of interviews took between four to six hours per interview,

depending on the actual duration of the interview and the complexity/detail of the information provided.

4. The order of selection of interviews for coding was done in such a manner that cells in the sampling framework (by abode, race and university) were progressively covered (Table 3.2). Apparent data saturation was achieved after 18 of the 43 interviews had been coded. The candidate listened to the audio recordings of a further 10 interviews to check whether any clearly new information emerged; 35 codes were added to the 2347 codes derived from the 18 interviews. These 10 interviews were not visited with the full final code list used to code the 18 fully coded interviews. A summary of interviews conducted and analysed per participant category is presented in Table 3.2.

Table 3.2 Summary of interviews conducted and analysed

Living circumstances	**Private accommodation (not at home)**									**University residence**								
Race	African Black			Indian or Mixed Ancestry			Caucasian			African Black			Indian or Mixed Ancestry			Caucasian		
University	UCT	UWC	SU	UCT	UWC	SU	UCT	UWC	SU	UCT	UWC	SU	UCT	UWC	SU	UCT	UWC	SU
Tot number interviews	3	4				2	1		2	8	5	1			4	4		9
Fully coded interviews	2	1				2	1		1	2	2				4	1		2
Coded for new info only		3							1	2	1							3
Not coded	1									4	2	1				3		4

UCT: University of Cape Town; UWC: University of the Western Cape; SU: Stellenbosch University; Info: information

Although the proposed sample framework was not fully achieved, coverage of university, race and living circumstances was achieved in the total number of interviews conducted, the number of interviews that were fully coded (18) and the number of interviews coded for new information only (10). A total of 15 interviews were thus not considered for the purposes of this dissertation.

5. An inductive approach was followed to categorize codes into themes and subthemes, as recommended by Berg et al. (2004) and Thomas (2006). The theoretical framework of weight gain prevention behaviours and weight related constructs also guided this process. The first draft of the analysis framework that depicted the themes and subthemes was revisited by the candidate four times with inputs from the senior researcher. This resulted in further refinement of the framework by combining or rearranging themes and subthemes (The Excel version of the final framework is available on request).
6. The framework of themes and subthemes was uploaded in the Nvivo Framework Matrices tool to create matrices where each row represented an individual case. Data for each case and theme were then summarized in the matrices by referring back to the indexed data as recommended by Rogerson et al. (2016). The matrices were then exported from Nvivo into Microsoft Excel 2011 to generate tables for the results section for interpretation. As

recommended by Rogerson et al. (2016) the frequencies of mentions of each theme or subtheme or sub-subtheme were included in tables. Rows (cases or participants) and columns (frequency of mention of themes, sub-themes and sub-subthemes) were compared qualitatively, facilitated by the matrix structure and theoretical framework of weight gain prevention behaviours and weight related constructs, to identify patterns, similarities and differences (Rogerson et al., 2016).

7. Retrieval of quotations involved revisiting the data generated using the Framework matrices tool.

3.2.6 Ethics

There was minimal risk for the subjects participating in this research and their safety was not compromised. As the students were above the age of 18 years, they were able to give written consent to participate in the study without parental consent. The consent procedure involved a full written and verbal explanation of the research after which the subject signed the consent form (Addendum B). Ethical approval for the study was obtained from the University of Cape Town FHS-HREC (HREC-REF:324/2017) (Addendum G; renewal in Addendum H). Institutional approval was obtained from the three universities. The principles of the Declaration of Helsinki (2013), Good Clinical Practice (GCP) and the laws of South Africa were adhered to in this research.

3.3 Results

The overarching themes (nodes) and subthemes (subnodes) that emerged from the interview data are summarized in Table 3.3 The table also depicts the layout of the results section.

Table 3.3: Themes (Nodes) covered in the results section that emerged from the interview data

Weight gain prevention behaviour or weight related construct	Themes (Nodes)	Integration
Dietary intake	Beliefs regarding what should be eaten	Salient beliefs
	Beliefs regarding what should not be eaten	
	Beliefs regarding the benefits of healthy eating	
	Beliefs regarding facilitators of healthy eating	Salient beliefs
	Beliefs regarding barriers to healthy eating	
Alcohol use	Beliefs regarding how much alcohol students feel they should be drinking	Salient beliefs
	Beliefs regarding benefits of drinking alcohol	
	Beliefs regarding consequences of drinking alcohol	
	Beliefs regarding barriers to limiting alcohol intake	Salient beliefs
	Beliefs regarding facilitators to limiting alcohol intake	
Physical activity	Beliefs regarding how much physical activity students feel they should be doing	Salient beliefs
	Beliefs regarding what type of physical activity students feel they should be doing	
	Beliefs regarding barriers to doing physical activity	Salient Beliefs
	Beliefs regarding facilitators of doing physical activity	
Sleep	Beliefs regarding how much sleep students feel they should be getting	Salient beliefs
	Beliefs regarding the benefits of getting enough sleep	
	Beliefs regarding the consequences of a lack sleep	
	Beliefs regarding facilitators of getting enough sleep	Salient beliefs
	Beliefs regarding barriers to getting enough sleep	
Body shape satisfaction	Beliefs regarding factors that affect the way that students think about their bodies	Salient beliefs
	Beliefs regarding the way that students think about their bodies	
Self-esteem	Beliefs regarding factors that affect students' self-esteem	Salient beliefs
	Beliefs regarding the effects of having a low/high self-esteem	
Stress	Reflected in 1-6	N/A
Depression	Reflected in 1-6	N/A
Weight gain prevention and weight loss strategies	Beliefs regarding strategies that would work to prevent weight gain	Salient Beliefs
	Beliefs regarding strategies that would work to lose weight	
Experience of first year on campus	Beliefs regarding challenges they experience of their first year at university	Salient beliefs

3.3.1 Weight gain prevention behaviour: Dietary intake

Beliefs of first year female students regarding what should and should not be eaten and benefits of healthy eating

Data on beliefs students held regarding what a person should eat on a daily basis are presented in Table 3.4.

Table 3.4: Beliefs of first year female students regarding what a person should eat on a daily basis (BESE)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Carbohydrates	No sub-subtheme*	6
	Health	3
	Energy	2
	Low carbohydrate	1
	Total	12
Protein	No sub-subtheme*	9
	Energy	1
	Health	1
	Total	11
Fats	No sub-subtheme*	1
	Low fat	1
	Total	2
Fruit	No sub-subtheme*	3
	Advisor (who recommended)	1
	Energy	1
	Total	5
Vegetables	No sub-subtheme*	4
	Easy to cook	2
	Health	2
	Type	4
	Total	12
Liquids	Water	1
Ratios/combinations	Fruit and vegetables	2
	More veg and protein than fruit	3
	Vegetables, fruit and dairy	2
	Not vegan	2
	Total	9
Variety	Everything in moderation	33
	Balanced meal	4
	Total	37
Meal Pattern	One meal	5
	Three meals	3
	Between meals	4
	Breakfast	14
	Lunch	5
	Dinner	3
	Total	34
New information from interviews not fully coded (n=10)		
Meal pattern	Two meals	1
Liquids	Lots	1

*Participant mentioned the subtheme, but not a sub-subtheme

The most commonly mentioned items students believed they should eat were carbohydrates, proteins and vegetables. Quotes that illustrate these beliefs are as follows:

- Carbohydrates: [are] *"essential to being healthy and balanced";*
  "carbs [are] a good source of energy as well"; but
  [one should have a] "limited amount of unhealthy carbs".
- Protein: *"You need protein firstly for energy"* and *"to function properly".*
- Vegetables:*" You still need those veggies for immunity and for iron and for all those healthy minerals and things".*

Some students mentioned beliefs regarding fruits and vegetables: *"my mom says I have to eat fruit"* and "*even though I believe fruits and vegetables cannot have a negative impact on your body".* Liquid (water; lots) and fat (low fat) were not commonly mentioned.

A common belief that emerged related to the variety that a person needs to eat with some students also indicating that they believe that one should eat a balanced meal. Quotes that illustrate these beliefs are as follows:

- Everything in moderation: *"I don't think there's anything you should not eat" and "If you do, you can eat it but don't over indulge"*.
- Balanced meal: *"Just for your body to get its required energy and minerals and nutrients".*

A few beliefs regarding ratios or combinations of foods emerged as illustrated in the following quotes:

- More vegetables and protein than fruit: *"I feel* [that one should eat] *more vegetables and protein than of fruit".*
- Vegetables, fruit and dairy: *"So for me- veggies, fruit, yoghurt, cheese".*
- Not vegan: *"I could never be a vegan".*

Many beliefs around meal pattern emerged, with the belief that one needs to eat breakfast being the most prominent. Quotes that illustrate these beliefs are as follows:

- Breakfast: "*should be a big meal because I believe you will be burning the calories of the breakfast during the day";*
  "If you eat a filling breakfast you wouldn't eat a lot for lunch and dinner".
- One meal: *"I am not really for the three meal or six meals a day kind of thing. I personally think that is a bit too much food";*
  "You don't use it and that's how you end up gaining weight because there is just food that is left over".
- Three meals*: "* [You] *have to have breakfast, lunch, supper like your three basic meals".*

Data on beliefs regarding what a person should not eat are presented in Table 3.5.

Table 3.5: Beliefs of first year female students regarding what a person should not eat (BESNE)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
High fat	No sub-subtheme*	4
	Fast foods	3
	Trans fat	1
	Unhealthy	3
	Gain weight	3
	Total	14
Meat	Psychological	2
	Physical health	1
	Total	3
Carbohydrates	Sugar	22
	Too much	8
	Bread	12
	Advisor	2
	Feel better	2
	Weight loss	2
	Grains and cereals	6
	Total	54
Highly Processed foods	No sub-subtheme*	1
	Health	3
	Cravings	1
	Total	5
Excess		5
Allergens		1
Dislikes		1
Meal Pattern	One meal	2
Delicious food		1
New information from interviews not fully coded (n=10)		
High fat	Saturated fat	0
Too much Salt		2
Dairy	No health benefit	1
	Lose weight	1
	Total	2

*Participant mentioned the subtheme, but not a sub-subtheme

The most commonly mentioned items that students believed they should not eat were carbohydrates and high fat foods. Carbohydrates students believed that they

should avoid were sugar and bread. Quotes that illustrate these beliefs are as follows:

- Carbohydrates: *"They are the ones that make you chubby".*
- Sugar: *"It boosts your energy levels and then as soon as it has been used up it drops and you get tired";*
  "I find it very addictive and when I do eat it I crave it even more. Umm, so for me, sugar is the only thing really that I try avoid".
- Bread: *"Um because it's not filling actually";*
  "*I have 2 slices and I'm not filled and then I go back for more";*
  "I guess it's a lot of empty calories";
  "*I feel like I get bloated*";
  "*My body can't digest it*".
- High fat foods: *"makes you feel tired";*
  "makes you feel lazy";
  "Because they make you gain weight".

Highly processed foods were also mentioned by some as items they believed should not be consumed. The following quote illustrates this belief: *"I've noticed the change in my skin"* and "*my sleeping patterns*".

Beliefs relating to meat and dairy intake were only mentioned by a few students:;

- Meat*: "I think that meat for me personally/ it makes me feel sluggish".*
- Dairy: *"I just don't see any* [additional] *health benefits that we can't really get from anything else";*
  "It's like if I cut out dairy out, I'll lose weight".

Some students believed that they should not indulge in excessive eating: *"Too much of everything is bad for you".*

Other items that a few students believed they should not eat were salt, allergens, foods they disliked, delicious foods and one meal only.

Data on beliefs held by students regarding the benefits of healthy eating are presented in Table 3.6.

Table 3.6: Beliefs of first year female students regarding the benefits of healthy eating (BEBHE)

SUBTHEME	SUBSUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical health	Prevent lifestyle disease	24
	Body functions better	40
	Weight management	13
	Total	77
Financial	Healthy eating can be affordable	1
Knowledge/awareness	Prepping own food	5
Psychological	Feel happy	7
	More focused	11
	Less stressed	1
	Self-esteem	21
	Body shape satisfaction	7
	Total	47
Access	Healthy food is accessible	2
Appeals to senses	Taste	14
	Texture	1
	Total	15
Affects every sphere of my life		1
No benefit		2
New information from interviews not fully coded (n=10)		
Financial	Prevent disease	1
Psychological	More in control	1
Social		1

The most commonly mentioned beliefs on benefits of healthy eating related to physical health, psychological benefits and to some extent taste. Beliefs on physical health benefits of healthy eating included prevention of lifestyle disease, body functions better (most prominent) and weight management. Quotes that illustrate these beliefs are as follows:

- Prevent lifestyle disease: [If you are] *"obese you can become sick ";*

"And also even if you are small in weight and stuff you can still get sick because you are unhealthy";

"If you eat unhealthily you have a risk of like diabetes, cholesterol, high blood pressure. I eat healthily to lower those risks so you can live longer basically".

- Body functions better: *"Maybe my skin would look better";*
  "Maybe my sleeping patterns as well";
  "also helps with your digestive system";
  "You have more energy than when you just eat junk food all the time".
- Weight management: *"I wouldn't have a lot of fat"* and *"weight loss".*

Beliefs regarding psychological benefits of healthy eating focused on better self-esteem (most prominent), feeling more focused, feeling happy, less stressed and having a higher body shape satisfaction. Quotes that illustrate these beliefs are as follows:

- Self-esteem: "*'Because it is like I am trying to look after myself instead of like neglecting my body"*.
- More focused: *"Improve concentration"* and *"Being on top of my game"*
- Feeling happy: "*You are giving off life or positivity, positive energy".*
- Less stressed: *"If you eat foods that are good for your health I feel stress wouldn't be such a thing".*
- Body shape satisfaction: *"You would accept your body appearance".*

Beliefs relating to the benefit of healthy eating as being "appealing to senses' mostly focused on taste: *"Oh, I love fruit"; "It tastes nice"* and *"I love, I love, love the taste of salad and vegetables".*

The belief that knowledge or awareness is a benefit of healthy eating was mentioned by a few students: *"You kind of feel very much aware with what you are doing. You learn so many things".*

Two students mentioned beliefs relating to financial benefits of healthy eating: *"Healthy eating can be cheap"* and [you may] *"have more expenses if you are*

unhealthy. You need to go to the doctor and have more responsibilities if you have a health problem".

A belief regarding social benefits of healthy eating was mentioned by one student: *"…but like ever go to Kauai and get something, get a pretty meal and you just post- it looks nice".*

Other beliefs regarding benefits of healthy eating mentioned by single students related to access (healthy food is accessible), texture and that it affects every sphere of life. There was one student who believed that healthy eating held no benefit. She answered "*Nothing."* when asked the question about the benefits of healthy eating and continued: *"I guess because we are so used to the unhealthy eating that healthy eating just seems dreadful".*

Salient beliefs

It emerged that students believed that a variety of foods should be enjoyed in moderation and that no food groups should be cut out completely. Vegetables, carbohydrates (for energy) and protein (for energy and function) were believed to be important food groups. However, carbohydrates were also believed to be foods of which the portion size needed to be controlled or intake needed to be avoided to prevent weight gain (carbohydrates in general, as well as bread) and for health (sugar, bread). The beliefs that you need to eat fruits and drink water regularly were less common.

Other foods that students believed should be avoided include high fat foods (most prominent) and highly processed foods. Meat was mentioned as a food that may make one feel sluggish, while some students believed they should eat dairy and others believed that they do not need dairy as they believed that they could get the nutrients it provides from other food sources. It was also mentioned that cutting out dairy may help with weight loss.

Students held different beliefs regarding what a healthy meal pattern constitutes, with options ranging from one meal to three meals and snacks. A common belief regarding meal pattern was that breakfast is important and should be the biggest meal of the day.

Beliefs that emerged regarding benefits of healthy eating focused mainly on physical (prevention of lifestyle disease and improved body function) and psychological (improved self-esteem and improvement of social engagement) aspects. Although not prominent, the benefits that healthy eating promotes weight management, that it was affordable (if offset against lower medical costs) and that fruit and vegetables taste great emerged. The belief that healthy eating had no benefits also emerged.

Beliefs of first year female students regarding facilitators and challenges of healthy eating

Data on beliefs held by students regarding facilitators of healthy eating are presented in Table 3.7.

Table 3.7: Beliefs of first year female students regarding facilitators of healthy eating (BEFHE)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical	Exercise	2
	Understanding body	1
	Total	3
Support	No sub-subtheme*	2
	Peers	33
	Family	30
	Total	65
Psychological	Discipline	19
	Self-esteem	7
	Mood	1
	Body shape satisfaction	20
	Total	47
Meal preparation		17
Access	No sub-subtheme*	1
	Healthy food options	14
	Cooking facilities	2
	Money	3
	Total	20
Time		2
New information from interviews not fully coded (n=10)		
Behavioural	Goal setting	1
	Rewarding self	3
	Total	4

*Participant mentioned the subtheme, but not a sub-subtheme

The most commonly mentioned beliefs regarding facilitators of healthy eating focused on support from peers and family and psychological factors such as self-discipline, body shape satisfaction (most prominent), as well as self-esteem and mood. Quotes that illustrate these beliefs are as follows:

- Support (peers): *"friends that would do it with me so then we would motivate each other to be healthy together".*
- Support (family): *"because after my mum was diagnosed with diabetes she changed her pattern so she is totally there for me";*
  "My sister would support me… university weighted her hard".

- Discipline: *"You need to know that it is going to take a while for your body to get used to it so if you can just have the willpower";*
  "I think you have to be conscious about what it is you are eating and why you are eating it";
  " [You] *need to make sure that what you are putting into your body is slightly premeditated, to a certain extent".*
- Body shape satisfaction: *"* [If] *I think okay I am getting too big, you tend to eat the greener things".*
- Self-esteem: *"The better you feel about yourself the more you want to eat healthy".*
- Mood: [If I am in a] *"good mood I will want to like change the way that I look. I will be like okay I am going to have healthy food today".*

Beliefs regarding meal preparation and access, especially healthy food options, were also mentioned as facilitators of healthy eating. Quotes that illustrate these beliefs are as follows:

- Meal preparation: [You] *"need to be given a guideline. It is like okay, this is exactly what you need to eat morning, afternoon and dinner because…and not just like vaguely, I need a plan";*
  "Also with that, I will be able to prepare earlier and not be impulsive".
- Access to healthy food options: *"It can be easier if I can go to a self-catering res*[idence]*";*
  "Umm, but there are pretty healthy options available on campus and if you know where to find them then it's not hard to make certain adjustments".

Other beliefs regarding facilitators of healthy eating that were mentioned by only one or two students were physical factors (exercise; understanding one's own body), time and behavioural factors (goal setting and rewarding oneself). Quotes that illustrate these beliefs are as follows:

- Exercise: *"And when you exercise you tend to eat more healthily".*
- Understanding own body: "*Just understanding my own body and what I need and when I need it. Because there is no one sort of food clock you can follow.*

Breakfast, lunch, supper… that really doesn't work for somebody who has a day that starts in the afternoon because my days start rather late and what usually happens, I know in the first semester I had a breakfast option. Horrible idea. You end up waking up to eat only to go back to sleep again".

- Time: *"keeping busy does things".*
- Behavioural: *"Starting out slow. Not immediately cutting out all sugar and carbs otherwise you go for a week and then just collapse again and binge on a whole bag of biscuits"* and *"getting rid of the mentality of rewarding myself with fast food".*

Data on beliefs held by first year female students regarding the barriers to healthy eating are presented in Table 3.8

Table 3.8: Beliefs of first year female students regarding barriers to healthy eating (BECHE)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Affordability		13
Availability	Fast food	16
	Campus	7
	University Residence	11
	Total	34
Meal preparation	Lack of Knowledge	3
	Lack of time	12
	Living alone	4
	Laziness	2
	planning ahead	5
	Total	26
Restriction	Portion control	8
	Lifestyle	9
	Feel guilty if cheat	6
	Leads to bingeing	5
	Weight management	2
	Cravings	13
	Total	44
Psychological	Self-esteem	12
	Lack of control	1

	Stress	23
	Emotions	41
	Body shape satisfaction	20
	Thinking you are hungry	29
	Total	126
Environment	TV	1
	Food Smells	1
	Eating out	1
	Living away from home	2
	Eating schedule	5
	Total	10
Lack of support	Peers	42
	Family	15
	Total	57
Taste	Bland	2
	Picky eater	1
	Total	3
Vegetables		12
Physical	Menstrual cycle	5
Lack of knowledge		3
Routine	Difficult to stick to	1
	Not good at planning	1
	Total	2

Beliefs regarding psychological factors that constitute barriers to healthy eating were most prominent and focused mostly on emotions, thinking you are hungry, stress and body shape satisfaction. Beliefs regarding lack of support (peers and family) emerged prominantly. Beliefs relating to the concept of "restriction" were also prominent, with the focus being on cravings, portion control and lifestyle. Quotes that illustrate these beliefs are as follows:

- Emotions: "*Whenever I am sad or I am angry, the first thing I think about is just comfort food and junk specifically";*
  [It is] "*going to make you feel good for that moment";*
  "It's also something we grow up with especially in the African culture. If you start crying, they shove food in your mouth. It's more of like… ya, I guess our parents taught us like that. We were conditioned to be like that in a way... African cultures";

"If I'm bored then I look for a reason to eat". There's nothing better than lying in front of the TV and eating something".

- Stress: *"When I'm in a stressful or sad situation my appetite is just/I really, I have to force myself to sit down and eat something";*
  "You eat less because you are just like ahh I'm feeling so anxious and nervous and worried, let me just have a little nibble and continue living my life";
  "But it is also a natural trend or it makes sense that when you feel stressed you want something that will make you feel better. And you just want to go for your favourite foods".
- Body shape satisfaction: *"You are going to eat everything because you already feel big and you are going to carry on".*
- Thinking you are hungry: *"Because honestly, you can be full, you could have just eaten but you see something that is appetizing and you go eat again".*
- Self-esteem (high): *"If I feel confident and if people are complimenting me I end up liking my body and I eat more".*
- Lack of support (peers): *"If you go to gatherings, you are always the odd one out";*
  "Seeing our background, it is like are you going to try and be white";
  "So if we eat out at a restaurant and I have a salad, then they would make negative comments like: We're students, we only live once, have a pizza".
- Lack of support (family): *"No I really don't want any……but you've got to eat it you're skinny";*
  "You eat what is on your plate and ya".
- Restriction (portion control): *"I can eat a salad but it is not going to fill me like a burger or something";*
  "[I] just think the portions are too small".
- Restriction (lifestyle): "*You need to make an effort, it does not just happen naturally and eventually it becomes a habit".*
- Restriction (feel guilty if I cheat): *"If you do binge sometimes, [and] have something unhealthy, you feel extremely guilty".*

- Restriction (leads to bingeing): *"If you are super strict in what you restrict yourself from it just leads to you bingeing".*
- Restriction (cravings): *"You can't always eat what you want to eat, like the sweet things";*
  "It is too fattening".

Other beliefs regarding barriers to healthy eating that were mentioned by some were affordability, availability, meal preparation and environment. More insights in these beliefs are reflected in the quotes below:

- Affordability: "*You can have a lot of unhealthy [foods] for a smaller price but when you want to eat healthy food, it's expensive. For a small amount of food you have to pay a whole big amount of money".*
- Availability: *"Mostly less healthy, fast foods that you can give students. So it makes it difficult when you want to grab something quickly between classes. Then you will just buy fries or something";*
  "It can be hard, like for me, I live in res[idence] and if I decide to eat healthy then it means I just eat salads there. There aren't many options";
  "There is healthy food but it is all the same thing and you can get bored having the same thing every day";
  "I do not eat res[idence] food coz they have something called weight gain Wednesdays".
- Meal preparation: *"The fact that I can't cook";*
  "It takes time to prepare the food";
  "Time… you get back from class and then you still need to study".
- Environment (living away from home): *"When you were at home your mom made you a plate of food every night that was balanced and contained all the nutrition you need".*
- Environment (eating schedule): *"I get hungry at midnight because you have to eatan early dinner so most of the people at res[idence] will be like just go get a muffin";*

"The eating schedules... sometimes you are busy till midnight and at 01:00 you start getting hungry because you ate at 18:00";
"Because we have too many breaks and in between classes you don't know what to do";
"Because normally you set yourself a schedule right? Okay, because based from school, you know that by the time school ends then you go home and you do homework and you have tests, you see. So, because you are so used to that, varsity is a completely different game ball. There's a lecture and then you have like two hours break and then in those two hours you don't know what to do with yourself because you are not used to working during the day".

Beliefs regarding the taste of vegetables being a barrier to healthy eating also emerged as is illustrated in the quotes below:

- *"I feel like some vegetables have no taste"* and *"so it feels like I'm putting myself on a DIET by eating them".*
- *"Sometimes it's tasteless and I hate to eat it because I like my food salted and spiced"* and *"I am a very picky person when it comes to food".*

Beliefs regarding physical factors being barriers to healthy eating were mentioned by two students and these related to menstrual cycle: *"But it's during THAT time [of the month] that I really eat more"* and *"then you also crave unhealthy things".*

Routine (difficult to stick to; not good at planning) were also believed to be barriers to healthy eating by two students.

Only one student indicated that she believed that a lack of knowledge was a barrier to healthy eating: *"I have the knowledge of why it's important but I don't have the... I don't know how to structure into like my daily life".*

Salient beliefs

Beliefs relating to support (or lack thereof), both from parents and peers, emerged as a key focus across the barriers to and facilitators of healthy eating. The same is true for psychological factors, specifically relating to body shape satisfaction (high body shape satisfaction = facilitator; low body shape satisfaction= barrier), stress (barrier only) and emotions (feeling in a good mood= facilitator; feeling sad or angry that may result in comfort eating= barrier). Beliefs relating to self-esteem show that a high self-esteem may be a facilitator of or barrier to healthy eating. Other beliefs regarding psychological factors that emerged included thinking that you are hungry (perceived hunger) as a barrier, and having discipline (what is eaten and why, premeditated eating) as a facilitator.

Beliefs relating to physical factors also spanned both barriers to and facilitators of healthy eating (physical activity and understanding one's own body= facilitators; menstrual cycle= barrier).

Meal preparation (if you cook your own food) was believed to be a facilitator of and barrier to healthy eating (planning needed, lack of time and cooking skills needed). Beliefs regarding access to healthy food options and affordability emerged as facilitators of (know where to find on campus) and barriers to (expensive, mostly unhealthy options sold on campus and served in university residences and healthy options lack variety – gets boring) healthy eating. The belief that a lack of knowledge was a barrier for healthy eating was not common.

Further beliefs concerning facilitators of healthy eating involved behaviour change techniques such as setting goals, rewarding (not with food) and changing elements of an unhealthy diet slowly .

Further beliefs concerning barriers to healthy eating that emerged included that it is associated with having to restrict food portion size; that it needs to be made into a lifestyle; that one would need to stick to a routine and plan ahead; that it can lead to

feelings of guilt, bingeing and cravings; and that it can be bland/tasteless. Students also believed that living away from home was a barrier to healthy eating (used to cooked meals served at home).

3.3.2 Weight gain prevention behaviour: Alcohol use

Beliefs regarding how much alcohol first year female students felt they should be drinking and benefits and consequences of drinking alcohol.

Data on beliefs held by first year female students regarding how much alcohol they believed they should drink and at what point to stop drinking alcohol when socializing are presented in Table 3.9

Table 3.9: Beliefs of first year female students regarding how much alcohol they should drink and at what point to stop drinking alcohol when socializing (BEAlcSD)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Above recommendation	Feel good	3
	Party hard	3
	Still have control	44
	Total	50
Recommendation #	Calories	1
	Responsible	4
	Total	6
Below recommendation	No sub-subtheme*	1
	Health	3
	Don't enjoy it	3
	Total	7

#Recommendation: 1 drink for females
*Participant mentioned the subtheme, but not a sub-subtheme

It is evident that the level of alcohol intake at which students believe they should stop drinking was above the recommendation. They believed that they should still have control (most prominent), feel good and party hard at the point where they should stop drinking. The quotes below illustrate these beliefs:

- Still have control: "*Make sure you can walk, you can talk, can you feel yourself? Are you functioning well? The minute that you feel you are tipsy, you don't know how many fingers the other person has";*
  "You should probably stop when you can't remember how many glasses you have had, then maybe if you can't think how many drinks have I had, I have had two or three... No, no, no, if you can't remember what you have had then stop drinking";
  "But the moment you get up and you're feeling like you're a bit dizzy, just stop drinking. It's not going to be worth drinking another drink and ending up on the toilet";
  "As soon as you start doing things you would normally never do you should stop".
- Feel good: "*feel like they can do anything"; "just in a happy state"; "where you are on a buzz".*
- Party hard: *"if you want to go out clubbing and whatever it is okay to drink a bit more".*

A few students believed that their alcohol intake should be at the recommended level. The following quotes illustrate this belief:

- Calories: *"otherwise I am just drinking calories"*
- Responsible: *"Sometimes when you go out with people, they drink alcohol and they drink so much that they get drunk and you on the other hand don't drink so much so you kind of feel like you need to take responsibility for them".*

The belief that one should not drink alcohol was not common. Beliefs that emerged as to why a person should not drink are illustrated by the following quotes.

- Health: *"affects your organs"* and *"affects your veins".*
- Don't enjoy it: *"I just don't see the sense in drinking"; "It doesn't appeal to me at all"* and *"it is not nice".*

Data on beliefs held by first year female students regarding benefits of drinking alcohol are presented in Table 3.10.

Table 3.10. Beliefs of first year female students regarding the benefits of drinking alcohol (BEBenAlc)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical Health	Prevent disease	2
	Weight gain	1
	Total	3
Taste		5
Psychological	Feel happier	8
	Relieves stress	14
	Improves self-esteem	7
	Total	29
Social	Relax with friends	2
New information from interviews not fully coded (n=10)		
Physical health	Sleep better	1
Social	Celebrating	1

The most prominent focus of beliefs students held regarding the benefits of alcohol use was on psychological factors i.e. relieving stress, feeling happier and improving self-esteem, as is illustrated in the following quotes:

- Feel Happier: *"It takes me from being an 8 personality to 10";*
  "you are a little more fun".
- Relieves stress: *"You want to get away from all the feelings. I guess because I am a happy drunk. Well as soon as I get tipsy I just start laughing around and I am like no it's all fine and it is all going to be better, it is all okay";*
  "It is, to some extent, a relaxer".
- Improves self-esteem: *"I don't know, when you are in that tipsy mode and you just feel like you can just run up a wall. Sometimes you attempt to and then you break your nose".*

A few students mentioned beliefs relating to taste and physical health benefits of alcohol:

- Taste: "*I like red wine just as much as anybody else"….." I mean it is delicious".*
- Prevent disease: *"Sometimes alcohol is good for you like red wine"* .
- Weight gain: *"Maybe the slight weight gain that I will have for a while".*
- Sleep better: *"And actually alcohol makes me sleep".*

Beliefs that drinking alcohol was beneficial for relaxing with friends and celebrating were also mentioned by a few students.

Data on beliefs held by first year female students regarding consequences of drinking alcohol are presented in Table 3.11

Table 3.11: Beliefs of first year female students regarding the consequences of drinking alcohol (BEBarAlc)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Affordability	Expensive	3
Dietary intake	Eat unhealthy	2
Psychological	Lose control	23
Taste	Sour	1
Physical Health	Hangover	14
	Weight gain	13
	Don't feel well	4
	Disease	5
	Total	36
New information from interviews not fully coded (n=10)		
Affordability	Waste of money	1
Taste	Bitter	1

A prominent belief relating to consequences of alcohol use that emerged focused on the psychological aspect of losing control: *"Doing something wrong without thinking about it and having regrets afterwards or saying things you are going you regret afterwards"* and *"That's the one thing I don't like about it because it makes you vulnerable".*

A number of beliefs relating to physical health and dietary consequences of alcohol use emerged as is illustrated in the following quotes:

- Hangover: "*If you've been drinking, then you waste the entire next day"* .
- Weight Gain: *"There is a lot of sugar in alcohol";*
  "[It contains] calories…maybe I will get a beer belly";
  "You don't realise that that could be your entire day's worth [of calories] in like three beers you know. You shouldn't be drinking three loaves of bread like two hours before bed".
- Don't feel well: *"Sometimes you would feel sick or bloated";*
  "I realised it doesn't make me feel nice".
- Disease: [You are] *"killing yourself in a sense";*
  "Your insides like your liver or kidneys or something like that";
  "It's addictive";
  "I have heard of diabetes and stuff like that".
- Dietary intake: "*And also if you drink a lot, then you want to eat things like fries and what not at weird times. You find yourself walking down to McDonald's at three in the morning to get fries and you are like, in what sort of state would I be doing this?!"*

A few students believed that affordability (waste of money; expensive) and taste (sour; bitter) were consequences of alcohol use.

Salient beliefs

A prominent belief that emerged among students was that they could drink alcohol at levels that are above the recommended levels for health (1 drink a day for females), as long as they felt they still were in control (can walk, talk, count, not dizzy and not do abnormal things). Students believed that drinking this amount made them feel good (happy, can do anything) and allowed them to party hard. The few students who believed that drinking alcohol should be at levels that are in line with the recommendation believed that they needed to be responsible and to control

their energy intake. The few who believed their intake should below the recommendation believed that they did not enjoy it.

Beliefs relating to psychological factors emerged as a key focus of benefits of alcohol use. Students believed that alcohol use contributed to relieving stress, feeling happier and improving self-esteem. Some students, however, believed that alcohol use resulted in loss of control.

Beliefs relating to the effect of alcohol use on physical health spanned both benefits (prevention of disease, weight gain and better sleep) and consequences (hangover, weight gain, don't feel well, disease- killing yourself). Taste was believed to be a benefit (delicious) to and consequence of (sour, bitter) of alcohol use.

Some students believed that relaxing with friends and celebrating were other benefits of drinking alcohol. Further beliefs relating to consequences of alcohol use were dietary consequences (eating at 3:00 in the morning) and affordability (waste of money; expensive).

Beliefs of first year female students regarding facilitators of and barriers to limiting alcohol use

Data on beliefs held by first year female students regarding facilitators of drinking alcohol are presented in Table 3.12.

Table 3.12: Beliefs of first year female students regarding facilitators of limiting alcohol use (BEFLimAlc)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Support	No sub-subtheme*	1
	Peers	28
	Family	19
	Myself	5
	Total	53
Psychological	Less Stress	1
	Responsibility	7
	Self-esteem	6
	Total	14
Physical Health	Brain	1
	Liver	1
	Total	2
Access to alcohol	Less money	5
Enviroment	Avoid going out	7
	Safety	1
	Total	8
Academics		4
New information from interviews not fully coded (n=10)		
Access to alcohol	Be designated driver	1

*Participant mentioned the subtheme, but not a sub-subtheme

A strong belief that emerged was that support from peers, but also from family, was a facilitator of limiting alcohol use. Some students believed that they themselves were facilitators in this regard. Quotes that illustrate these beliefs are as follows:

- Peers: *"Avoiding people that consume a lot of alcohol because they will have an influence on me";*

  "I really don't know anyone that would want me not to limit [alcohol] ".
- Parent: *"My mom! (laughs). She is like, you kids drink way too much nowadays. Some of my friends they would, but most of them wouldn't!"*
- Myself: *"Limiting yourself. If you are going on a night out say this is what I am going to have and that is my limit I am not having anymore".*

Some students believed that taking responsibility and a good self-esteem would facilitate using less alcohol. The belief that reducing stress may limit alcohol intake was mentioned by one student. These beliefs are illustrated in the quotes below:

- Responsibility: *"priorities"* and *"I also think the older you become the less/ it sounds strange but in first year you go out with every opportunity and the older you get the less you go out. You outgrow it".*
- Self-esteem and responsibility: *"My self-esteem is kind of also what puts me on guard because I know I am cute I am not going to go out and drink ten shots and be vulnerable";*
  "I don't want to let go of my reality";
  "It doesn't make me want to be super extra".
- Less stressed: *"If I am not worked out about class and things".*

A few students believed that being selective of the environment they place themselves in could facilitate limiting alcohol use:

- Avoid going out*: "Not going to a pub where everyone is drinking";*
  "Probably go out less".
- Safety*: "Given the atmosphere that we are in, I am very cautious about how I drink".*

Some students believed that reduced access was a facilitator to limiting alcohol use:

- Less money: *"The less money you have the less you got out";*
  "Taking a certain amount of money with".
- Designated driver: *"Go with friends and be the driver for wine tasting".*

A few students believed that their academic programme may facilitate lower alcohol use: *"Yes, we all do it during exam time. You drink a lot less".*

Data on beliefs held by first year female students regarding barriers to limiting alcohol use are presented in Table 3.13.

Table 3.13: Beliefs of first year female students regarding barriers to limiting alcohol use (BEBarLimAlc)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Psychological	Poor self-esteem	9
	Emotions	4
	Stress	8
	Total	21
Environment	Going out	11
	A good meal	2
	Total	13
Lack of support	Peers	29
	Myself	2
	Family	2
	Total	33
New information from interviews not fully coded (n=10)		
Environment	Freedom	1

Beliefs regarding barriers of limiting alcohol use focused strongly on lack of support from peers, although lack of support from family and self were also mentioned by a few students. More insights in these beliefs can be gained from the following quotes:

- Peers: *"If friends want to go out and they want to drink it is difficult for you to say no";*

  "People give you positive opinions on what you did when you were drunk so you are going to keep doing it because it is like I am fitting in";

  " [There is] no family around"….. "so we can just chill and just be chilled";

  " *[Drinking alcohol is the] biggest aspect of approval while you're at varsity".*
- Myself: *"I just have to tell myself you [are] not drinking alcohol anymore".*
- Family: *"My mum would be like okay now I can do what I want [since I am old enough to drink]"… "she started [drinking] herself, like wine every once in a while, socially drinking".*

Beliefs regarding psychological barriers were also common and focused on poor self-esteem, stress and emotions as illustrated in the following quotes:

- Poor self-esteem: *"I think less confident people drink more alcohol to gain that social confidence or just you know, confidence in their opinions or if they're not feeling very assertive or very certain of what they want to say and how they want to say it, they might drink a bit more".*
- Stress: *"After I'm done with these exams and done studying, I am going to feel like I at least need a drink just to calm my nerves";*
  "Definitely plays a big role. I think it's easy to say ahh I'm stressed, I've had such a hard day, beers! (laughs) You know, or just, I need a release, let me have alcohol. Who does that? You know it's part of human nature I suppose to be like ah I'm so stressed I need some wine".
- Emotions: "*When you are sad, you want to get away from all the feelings. I guess because I am a happy drunk. Well as soon as I get tipsy I just start laughing around and I am like no it's all fine and it is all going to be better, It is all okay. When I am tipsy, I am right there, so it is trying to get to that buzz so that I am not down in the dumps".*

Beliefs relating to environment as a barrier to limiting alcohol use focused mainly on going out, while a few students believed that having a good meal and freedom were barriers. The following quotes illustrate these beliefs:

- Going out*: "There is like a pub here at school";*
  "Umm parties because most residence parties or any student place, they have this tag line of unlimited drinks or a lot of drinks for the cheapest and then I am just like okay well this is difficult. You can recognize a bargain and it is just natural when you see something that is a lower price than it should be you want it just because you tell yourself it is a bargain";
- Good meal*: "A really good meal without a glass of wine to go with it. Ya. That would be hard. Ya".*
- *"Freedom"*

Salient beliefs

Beliefs relating to support (or lack thereof) from peers (most prominent) from family, and oneself emerged across both the facilitators of and barriers to limiting alcohol use. Students believed that not one of their friends would not want them to limit their alcohol use. However, they also believed that they would need to avoid drinkers to be able to limit their alcohol use, which they believed could be difficult as a result of the need to fit in and family (mom) condoning drinking.

Beliefs relating to psychological factors also emerged as both facilitators of and barriers to limiting alcohol use. A high self-esteem and low levels of stress were believed to be facilitators of limiting alcohol use. Low self-esteem (need social confidence) and high levels of stress made limiting alcohol use difficult. Some students believed that taking responsibility (outgrowing it) would facilitate using less alcohol, while some believed that emotions (e.g. the need to get away from all feelings) made it difficult to limit alcohol use.
Beliefs relating to environmental factors that facilitate limiting alcohol use focused mainly on avoiding going out as alcohol is generally freely available and that having a good meal without alcohol is difficult. Further beliefs regarding facilitators of limiting alcohol intake related to reducing access to alcohol (having less money, being the designated driver and academics (exams), although completion of exams was believed to be cause for relaxation and celebration (drinking alcohol).

3.3.3. Weight gain prevention behaviour: Physical activity

Beliefs of first year female students regarding how much, what type, benefits and when and where physical activity should be done

Data on beliefs held by first year female students regarding how much physical activity should be done are presented in Table 3.14.

Table 3.14: Beliefs of first year female students regarding how much physical activity should be done (BETPA)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Above recommendation #	No sub-subtheme*	12
	Schedule	2
	Health	6
	Weight management	1
	Total	21
In line with recommendation	No sub-subtheme*	3
	Schedule	1
	Health	3
	Weight management	8
	Total	15
Below recommendation	No sub-subtheme*	6
	Health	2
	Total	8

#Recommendation =150 minutes per week
*Participant mentioned the subtheme, but not a sub-subtheme

The most common response to the question regarding how much physical activity students believed they should be doing was that exercise should be performed at levels above or in line with the recommendation for general health. Students believed that exercising at these levels is necessary for both physical and psychological health (most prominent), weight management and to benefit or fit into their schedule. More insights in these beliefs are reflected in the quotes below:

- Weight Management: *"Well from experience, that is only how I lost weight"; "If you eat a lot of food you have all this stored up energy that you don't end up using. Now if you find ways to use that energy, you are burning it away because if you are somebody that eats a lot and you want to lose weight, burn off all the food that you bring in, keep the nutrients but burn off like all the excess".*
- Health: *"It* [exercise] *is a stress reliever because I spend so much time looking at books and siting down, to me it feels like that is the minimum I could do"; "Not too much so that you are tired all the time"; "Maintain a healthy balanced life"*; *"To be fit. To keep fit"*;

"[recommended amount is enough]"

- Schedule: *"Because I feel like it occupies another hour of my time that won't be spent doing nothing";*
  "I feel like it is enough [recommended amounts of exercise] *to squeeze into my schedule".*

Some students mentioned that they believe they should be exercising at levels below the recommendation for health. These students believed that participating at this level of exercise was good for health.

Data on beliefs held by first year female students regarding the type of physical activity a person should do, as well as when and where it should be done are presented in Table 3.15.

Table 3.15: Beliefs of first year female students regarding the type of physical activity a person should do, as well as when and where it should be done (BEPAType)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Cardiovascular exercise	No sub-subtheme*	1
	Walk/run	2
	Burn off calories	1
	Total	4
Resistance exercise	Improve strength	2
	Abdominal workout	1
	After eating protein	1
	Muscle definition	1
	Total	5
Any form of exercise		6
Yoga		5
Morning exercise	No sub-subtheme*	2
	Energy	1
	Sets good tone	1
	Total	3
Outdoor exercise		7

*Participant mentioned the subtheme, but not a sub-subtheme

Overall the number of beliefs regarding the type of physical activity a person should do was limited. The belief that a person should do a combination of exercises was most common, followed by doing resistance exercise and yoga. Beliefs that one should do cardio type exercises were not common, but when mentioned, were linked to compensating for over eating. More insights in these beliefs are reflected in the quotes below:

- Combination: *"There is no bad exercise. There is no such thing. You can run, you can dance, yoga, that is also exercise".*
- Yoga*: "An hour that I give myself to be with my thoughts";*
  "Just be happy in that moment".
- Resistance exercise: *" I felt my strength improve a lot"*;
  "*It was just so fast and so effective"*.
- Cardiovascular exercise: *"If you have like a sandwich or a plate of chips try to fit in a run or dance session somewhere".*

A number of students believed that outdoor exercise is good: *"That is way more rewarding than being on the treadmill".*

One student believed that morning exercise should be performed for energy and because it sets a good tone for the day.

Data on beliefs held by first year female students regarding the benefits of physical activity are presented in Table 3.16.

Table 3.16: Beliefs of first year female students regarding the benefits of physical activity (BEPAB)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical health	No sub-subtheme*	1
	Prevent lifestyle disease	4
	Body functions better	36
	Weight management	13
	Total	54
Psychological well-being	No sub-subtheme*	3
	Feel happy	14
	More focused	20
	Less stressed	15
	Improved self-esteem	26
	Body shape satisfaction	15
	More motivated	2
	Total	95
Social benefits		2

*Participant mentioned the subtheme, but not a sub-subtheme

Beliefs regarding the benefits of physical activity mainly focussed on psychological health, including beliefs relating to improved self-esteem, being more focused, body shape satisfaction and feeling less stressed and being more motivated. More insights into these beliefs are reflected in the quotes below:

- Improves self-esteem: *"Makes you feel better about yourself".*
- More focused: *"I would find it easy to concentrate"* and *"helps your academics".*
- Body shape satisfaction: *"I will probably be like lean and firm"* and *"You can have that summer body you have always wanted".*
- Less stressed: *"stress reliever".*
- Feel happy: *"the feeling afterwards".*
- More motivated: *"And when you exercise you tend to eat more healthily".*

Beliefs regarding the benefits of physical activity also included a focus on physical health, namely better functioning of the body, weight management and prevention of lifestyle disease. More insights in these beliefs are reflected in the quotes below:

- Prevent lifestyle disease: *"[It] reduces your chances of getting lifestyle diseases maybe diabetes, heart diseases".*
- Body functions better*: "recover faster from injuries";*
  " [The] sleep you have will just be amazing";
  "Getting your blood flowing";
  "All your joints are nice and flexible".
- Weight management: *"[It] would maybe help burn fat in a different way like gain muscle"* and *"weight loss".*

Two students believed that exercise could be used as a social activity with friends: *"When you train with your friends it's always a bonus. It's a way to spend time with your girlfriends if you never see them".*

Salient beliefs:

It emerged that students believed that they should be performing physical activity at levels above or in line with the recommendation for general health. Students believed that this level of physical activity was good for health (both physical and psychological), weight management (most prominent, compensate for excess food intake - burn off all the food that you bring in) and that they could fit it into their schedules. Only a few students believed they should be participating in physical activity at levels below the recommendation for health, which they also believed was good for health.

The number of beliefs that emerged relating to the type of physical activity a person should do was limited. The belief that a person should do a combination of exercises (any form of exercise) was most common. Other types of exercise students believed they could do are yoga, resistance exercise and cardiovascular exercise (to compensate for eating too much). A few students believed that doing exercise outdoors and in the morning was preferable.

Beliefs relating to psychological health emerged as a key focus regarding the benefits of physical activity, more specifically improved self-esteem, being more focused, body shape satisfaction, feeling less stressed and being more motivated. Beliefs relating to physical health benefits included better functioning of the body, weight management and prevention of lifestyle disease. Another benefit that emerged was the belief that exercise could be used as a social activity with friends.

Beliefs of first year female students regarding barriers to and facilitators of physical activity

Data on beliefs held by first year female students regarding the barriers to physical activity are presented in Table 3.17.

Table 3.17: Beliefs of first year female students regarding barriers to physical activity (BEPABar)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical	Higher hunger	1
	Tired	31
	Health	7
	Total	39
Social	Less time with friends	1
Lack of knowledge		2
Access	Gym membership	6
	Transport	5
	Safety	6
	Total	17
Time	No sub-subtheme*	9
	Schedule	8
	Workload	10
	Travel	6
	Showering	1
	Sleep	6
	Total	40
Psychological	Self-esteem	15
	Don't enjoy it	4
	Stress	5
	Feeling sad	6
	Body shape dis/satisfaction	7
	Total	37
Environment	Gym	3
Lack of support	Peers	13
	Myself	2
	Family	15
	Total	30
Starting up		1

*Participant mentioned the subtheme, but not a sub-subtheme

The most commonly mentioned beliefs regarding barriers to physical activity involved physical barriers, specifically feeling tired; health was mentioned by a few and increased hunger by just one student. The following quotes illustrate these beliefs:

- Tired: *"Doing something when I am finding it difficult to do";*

"Being tired afterwards";

"After class, instead of me jogging, I just want to rest".

- Increased hunger: *"then you are eating more".*
- Health: *"If you do too much of it and you don't take in enough water"*;
  "*The only thing would be if you over train*";
  "*You end up with an injury".*

Beliefs that focused on psychological barriers were also commonly mentioned. These beliefs concerned self-esteem (most prominent), body shape dissatisfaction, stress, feeling sad and not enjoying it. The following quotes illustrate these beliefs:

- Self-esteem: *[You are] "not going to feel confident enough to walk in with your gym outfit or whatever or do anything so you are just going to give up while you are there already and then you are just going to leave";*
  "I may not go in as hard as I did before because I'm conscious of who is looking and at what".
- Body shape dissatisfaction: *"If you think that you are big you are not going to want to go to the gym because you feel like people are going to look at you and think you are already big, what are you doing type of thing. You are not going to be comfortable";*
  "When I feel fat and not good about myself then I won't go exercise. I would rather sleep and forget about it. I feel that it won't make a difference now".
- Feeling sad: *"Then you feel negative"* and *"you don't have energy".*
- Stress: *"Ya, but also it depends on what the stress is. If it's school work and the fact that maybe I am writing a test, then I can't really go out and waste forty five minutes you know, I have to stay in and actually study".*
- Don't enjoy it*: "But when you hate it, then you are going through torture yourself".*

Time and lack of support related beliefs were also common and involved workload, schedule and routine, travel, sleep and showering. Quotes that illustrate these beliefs are as follows:

- Lack of support (Family): *"My mum would not support me because it will be like you're wasting time in things that are not important in a way";*
- *"they are very concerned about my safety";*
- *"You're so skinny, you don't need to exercise".*
- Lack of support (Peers): *"*[Peers] *hold you back because it separates you from them. It's peer pressure"*
- Workload: *"You are forever studying, you have to go to the library and now you have to do so many things and assignments and so you really put it aside the fact that you have to eat healthy, you have to do exercise. You just put that aside because it is not as important as handing in that assignment and passing"*.
- Schedule: *"We finish classes around 5:00pm then to go back to res[idence], change into exercise clothes, go to the gym, work out, come back, study..it is too much".*
- Sleep: "*And it takes away from your rest and sleep time".*
- Travel: *"Situations that I am currently in like I don't have a car so it is like getting to gym and home again. I live kind of far".*
- Showering: *"Plus the shower and getting ready after because you are so sweaty you can't do anything".*

Further beliefs held by a few students regarding barriers to physical activity included access, the gym environment, knowledge, starting with exercise and social aspects. The quotes below illustrate these beliefs :

- Access (financial): *"Most of the students' parents won't necessarily pay for a gym contract, because they know they won't exercise!"*
- Access (safety): *"It is not safe if you are travelling alone";*
  "If I decide to jog there are going to be issues like if it is safe to jog alone".
- Gym environment: *"And I just felt like it was a superficial environment for me".*
- Lack of knowledge: *"Not being sure if you are doing it the right way".*
- Start up: *"Starting...like going from nothing to doing something".*

- Social: *"and all the opportunities, and tests, and when you would rather spend an afternoon with your girlfriends than going to exercise. So it's giving up opportunities".*

Data on beliefs held by first year female students regarding the facilitators of physical activity are presented in Table 3.18.

Table 3.18: Beliefs of first year female students regarding the facilitators of physical activity (BEFPA)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Dietary intake	Eating more	3
Support	Peers	38
	Family	13
	Total	51
Psychological	Stress	11
	Motivation	11
	Passion	5
	Emotions	11
	Self-esteem	21
	Body shape satisfaction	15
	Spiritual	1
	Total	75
Access	Transport	3
	Gym	5
	Outdoor exercise	1
	Safety	1
	Money	1
	Total	11
Available time	No sub-subtheme*	3
	Schedule	8
	Sleep	3
	Social	2
	Total	16
New information from interviews not fully coded (n=10)		
Physical Health		2

*Participant mentioned the subtheme, but not a sub-subtheme

The most commonly mentioned beliefs regarding facilitators of physical activity focused on psychological factors, including self-esteem (most prominent), body shape satisfaction, stress, motivation, emotions, passion and spiritual. Quotes that illustrate these beliefs include:

- Self-Esteem: *"The more you exercise, the better you feel about yourself"* and *"being able to be comfortable in whatever you are wearing".*
- Body shape satisfaction: "The more I like my body the more physical activity I would like to do because I would see what it does for me";
  "Trying to get the perfect body… If you think you're bigger, you're going to want to exercise more".
- Stress: *"Because I just feel as if I am literally kicking out all of the frustrations".*
- Motivation: *"like if you notice change like the same with eating if you notice change… because then you get more motivated".*
- Emotions: *"Once I am at gym, I love it. I feel great" and "afterwards I feel really good".*
- Passion: *"I feel like in order for me to exercise I actually need to enjoy it".*
- Spiritual: *"It's also a way of spending time with God... my way of worshipping".*

Beliefs relating to support from family and peers for doing physical activity were also common. The following quotes illustrate these beliefs:

- Support (peers): "*I love it, because I love the people I train with. It's not just good for me, it's a social gathering and everything's great".*
  " [Having a] gym buddy who stayed on campus. Then we could make arrangements, like let's wake up in the morning and jog together";
  "You need someone that is going to push you, someone to motivate you".
- Support (family): *"In the beginning of the year my sister and I, we were eating healthy. We were all about the fitness, we went to the gym".*

Beliefs concerning having time available focused on creating a schedule for exercise, managing sleep time and less socialising also emerged, as is illustrated in the following quotes:

- Schedule: *"Organize myself better to a point where I can just fit even if it is just half an hour of exercise it would benefit me";*
  "Going in between classes".
- Sleep: *"because I know that you need energy to do this";*
  "So, just waking up 30 minutes earlier".
- Social: *"Going out less".*

Beliefs that concern access to physical activity opportunities were mentioned by a few students, as is illustrated in the quotes below:

- Transport: *" If I had a car, like transport, then I wouldn't have to worry like how I am going to get home if I do go to gym".*
- Gym: *"To find easier ways to maybe do it in my room";*
  "I know it's not easy, but if they could give us a free gym".
- Outdoor exercise: *"I think walking around is the most important form of exercise because it's accessible to everyone".*
- Safety: [If I had a] "*better" [*sense of] *"security".*
- Money: *"Increase in allowance".*

A few students believed that dietary intake and physical health were facilitators of physical activity:

- Dietary intake: *"It increases my appetite" ….. "that is a good thing actually because sometimes I don't even eat".*
- Physical health: *"to be fit and healthy".*

<u>Salient beliefs:</u>

Key beliefs regarding barriers to physical activity that emerged focused on physical aspects (being tired), lack of time, a number of psychological factors and lack of

support from peers (they do not exercise, sets you aside) and family (mom thinks exercise is a waste of time). The focus of beliefs regarding facilitators was similar, including a number of psychological factors, support from peers and family (exercise buddy – family member or friend), time and access.

Beliefs relating to specific psychological factors that may act as both facilitators of or barriers to doing physical activity are as follows: self-esteem (most common; low= barrier/facilitator; high= facilitator/barrier), body shape satisfaction (high/low= facilitator; low= barrier), stress (high= barrier/facilitator), emotions (feeling sad= barrier; feeling happy= facilitator). Students further believed that not enjoying physical activity was a barrier, while further facilitators were believed to be motivation, passion and spiritual benefits.

Time beliefs that emerged as barriers to and facilitators of physical activity involved schedule and routine for exercise (lack of schedule= barrier; creating a schedule= facilitator), sleep time (promotes more sleep= facilitator; infringes on sleep time= barrier) and social (less socialising= facilitator; giving up on social opportunities= barrier). Other beliefs regarding time barriers to physical activity related to the high workload (for studies), travel (to exercise facility) and having to shower afterwards (sweaty).

Beliefs relating to access aspects spanned both facilitators and barriers to physical activity, including safety (a better sense of security= facilitator; unsafe to exercise outdoors/alone= barrier), money (increase in allowance= facilitator; paying for a gym contract= barrier), transport/travel (unsafe to travel to gym= barrier; having a car= facilitator). Further beliefs relating to access as a facilitators of physical activity were gym (free offering), exercise at home and exercise outdoors (mainly walking). Further beliefs relating to barriers to physical activity that emerged were the gym environment (superficial), lack of knowledge on what exercise to do and getting started.

Dietary intake was also the focus of beliefs relating to facilitators of and barriers to physical activity, with some believing that it increases appetite and promotes eating

in a poor eater, while others believed that it causes hunger and increases intake unnecessarily.

3.3.4. Weight gain prevention behaviour: Sleep

Beliefs regarding how much sleep first year female students feel they should be getting, the benefits of getting enough sleep and the consequences of lacking sleep

Data on beliefs held by first year female students regarding the amount of sleep a person needs are presented in Table 3.19.

Table 3.19: Beliefs of first year female students regarding the amount of sleep a person needs (BESS)?

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
In line with recommended hours #	No sub-subtheme*	15
	Body functions better	19
	Psychological aspects	1
	Experience	3
	Weight management	2
	Dietary intake	2
	Total	42
Below recommended hours	No sub-subtheme*	8
	Time	2
	Academics	1
	Age	1
	Meets body's needs	4
	Total	16
New information from interviews not fully coded (n=10)		
Above recommendation	Love sleeping	1
Below recommendation	Knowledge	1

#Recommended amount of sleep: 7-9 hours
*Participant mentioned the subtheme, but not a sub-subtheme

The amount of hours students believed they should sleep was mostly in line with the recommended hours. Students believed they needed this amount of sleep to ensure

that their bodies functions better. A few further beliefs as to why a person should sleep the recommended amount emerged, as illustrated in the quotes below:

- Body functions better: *"Because sleep links to everything. It links to your appetite and your energy levels. And I think it's important to fuel your brain and just give it enough time off otherwise it's not going to behave properly"; "And I also feel like digestion is really kick- started by a good night's rest".*
- Psychological: *"I love my sleep".*
- Experience: "*I've experienced it for myself" and "I have learnt it".*
- Weight management: *"If you under- sleep, your body needs more food to run off, it increases your appetite".*
- Dietary intake: "*And also for your eating patterns".*

Some students believed they should sleep less than the recommended amount. Beliefs as to why a person would/should sleep fewer hours are reflected in the quotes below:

- Time: *"There are a lot of things to do in life other than sleeping".*
- Academics: *"I think it is enough and being a student I feel having to sleep more hours is a risk sometimes"* [for falling behind in academics].
- Age: *"When you are at university, 6 hours is good enough versus when you are younger, it is 8 hours".*
- Meet's body's needs: *"Yeah sleep is not really an essential part of life".*
- Knowledge: *"from research and others".*

Only one student mentioned the belief that sleep should be at levels above the recommendation: *"Because I love to sleep and sleep makes me feel really good. I don't know. I really, really like to sleep. I know we are meant to only get like 8, at least 8, but at least 10 for me, 10 to 11 hours".*

Data on beliefs held by first year female students regarding the benefits of getting enough sleep are presented in Table 3.20.

Table 3.20: Beliefs of first year females students regarding the benefits of getting enough sleep (BEBenSleep)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical Health	Body functions better	11
	Weight management	3
	Total	14
Psychological	Feel positive	1
	Stable mood	1
	More focused	17
	Reduced stress	10
	Improved self-esteem	1
	More productive	12
	Total	42
Social	Interacting with others	2
New information from interviews not fully coded (n=10)		
Time	Meal preparation	2

Beliefs concerning psychological benefits of getting enough sleep were commonly mentioned and focused mainly on feeling more focused and being more productive, as well as reduced stress. These beliefs are illustrated by the following quotes:

- More focused: *"You are able to concentrate better".*
- More productive: *"In terms of academics it is helpful"*;
  "I think sleeping enough will help you to be able to do your daily duties. Do it in a way that is quite effective".
- Reduce stress: *"If you are overwhelmed or very stressed then sleep is a way to relax".*
- Feel positive: *"I wake up positive".*
- Stable mood: *"I know I can have a stable mood"*.
- Improved self-esteem: *"feeling better about yourself"*.

Beliefs concerning physical health (body functions better; weight management) and social benefits of getting enough sleep were also mentioned by some students:

- Body functions better: *"Because your body does need it. It's a process where body can repair itself";*

"[It] improves your energy".

- Weight management: *"Okay if you have enough sleep it kind of reduces your appetite. And then you don't eat as much which is important for weight management".*

One student believed that getting enough sleep would be beneficial for meal preparation. " *[I can] make a good breakfast and "prepare food" [it is less of a rush].*

Data on beliefs held by first year female students regarding the consequences of a lack of sleep are presented in Table 3.21.

Table 3.21: Beliefs of first year female students regarding consequences of a lack of sleep (BeCLSleep)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Physical	Lack of energy	11
	Messes up hormones	10
	Total	21
Psychological	Less productive	5
	Being moody	5
	Less focused	14
	More stressed	1
	Emotions	2
	Less motivated	7
	Total	34

Beliefs concerning psychological consequences of a lack of sleep were most commonly mentioned. These beliefs related to feeling less focused and productive, being less motivated and being moody and sad or depressed. Quotes that illustrate these beliefs are as follows:

- Less focused: *"I have realized that when I have not slept enough I don't concentrate as well".*
- Less motivated: *"If you don't sleep then you are going to not achieve what you want to achieve and to the best of your abilities".*

- Less productive: *" [It] Affects how much I am willing to work" and "I don't feel like doing anything".*
- Being moody: *"You are going to be this moody person".*
- Emotions: *"You are most likely to be depressed".*

Beliefs regarding physical consequences of a lack of sleep were also common and focused on lack of energy and effects on hormones. Quotes that illustrate these beliefs are as follows:

- Lack of energy: *"When I'm tired I can't exercise";*
  "And I don't feel like cooking";
  " [It] increases your appetite".
- Messes up hormones: *"And the thing is that if you haven't had enough sleep, the things that you crave are not really nutritional";*
  "It comes from being tired and your body feeling like it needs the sugar and what not".

Salient beliefs

It emerged that the number of hours students believed they should sleep was in line with the recommended 7-9 hours. Students believed that this amount of sleep was necessary for body functions (energy, brain and digestion), as well as psychological reasons (love sleeping), weight management and dietary intake (controls appetite). Some students believed they should sleep less than the recommended amount as they believed that it would impinge on time available for other activities and academics (falling behind with academics), that you need more sleep when you are younger, that it is sufficient to meet the body's needs and that they know this is enough. The belief that one should sleep more than the recommended amount was not common.

Psychological factors emerged as a key focus of beliefs regarding benefits of getting enough sleep, as well as consequences of a lack of sleep. These beliefs focused

mainly on feeling focused (more focused= benefit; less focused= consequence), being productive (more productive= benefit; less productive= consequence) and mood (stable mood= benefit; moody= consequence). Students also believed that reduced stress, feeling positive and improved self-esteem were benefits of getting enough sleep. Other beliefs that emerged regarding consequences of too little sleep involved being less motivated and feeling depressed.

Beliefs concerning physical health (body functions better; weight management) and social benefits of getting enough sleep were mentioned by some students. One student believed that getting enough sleep would be beneficial for meal preparation. Beliefs regarding physical consequences of a lack of sleep were also common, with beliefs focusing on lack of energy and effect on hormones.

Beliefs of first year female students regarding barriers and facilitators of getting enough sleep

Data on beliefs held by first year female students regarding barriers to getting enough sleep are presented in Table 3.22.

Table 3.22: Beliefs of first year female students regarding barriers to getting enough sleep (BEBarSleep)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Time	Routine	4
	Workload	27
	Exercise	1
	Procrastinator	3
	Chores	5
	Social	3
	Total	43
Psychological	Stress	20
	Poor self-esteem	1
	Feeling sad	3
	Total	24
Environment	Media	4
	Noise	6
	Total	10
Lack of support	Peers	22
	Myself	1
	Family	3
	Total	26
New information from interviews not fully coded (n=10)		
Lack of support	Lecturers	1

The beliefs that time is a barrier to getting enough sleep were common, specifically related to workload. A few beliefs regarding the following barriers also emerged: chores, change in routine, being a procrastinator, social activities and exercise. Quotes that illustrate these beliefs are as follows:

- Workload: *"And ya because that is the main thing you are here for. So you sacrifice a lot to be here";*

  "If you are going to sleep then you think about all those things like your parents and the money that they are paying and if you have bursary things and stuff";

  "Sometimes you feel as if, you know what, I am wasting time by sleeping, I could be finishing that essay. I could be completing that assignment, I could be studying for that test. So you just push your sleep back more and more".

- Routine: *“Once you start off from one night, it kind of affects you throughout the whole week”;*
  “Especially in first year you need to like get used to things so like you need to adapt and adjust because it is not like high school”.
- Procrastinator: *“I leave most things up until the last minute”;*
  “And also I have this mind-set that I work really well under pressure”.
- Social: *“Going out and coming back late”.*
- Chores: *“There are so many things to do”.*

Beliefs regarding psychological barriers to getting enough sleep were also common, focusing specifically on stress (most prominent), poor self-esteem and feeling sad. The following quotes illustrate these beliefs:

- Stress: “*my mind is just so active and I'm thinking about all the things I should have done and all the things I have to do and why I am thinking about all this stuff instead of sleeping”.*
- Poor self-esteem: *“I didn't sleep enough because I'm feeling fat”.*
- Feeling sad: *“but when you are sad, you are more affected by whatever you are thinking so you engage more with it and you think and then you have an afterthought of an afterthought and you just end up sitting there and it decreases the amount of time you sleep”.*

Students also mentioned beliefs that involved lack of support from peers (most prominent), family, themselves and lecturers as barriers to getting enough sleep.

- Peers: “*Friends. Because they are like no come on. Let's get out. You are like, no I am tired! Because friends just want to socialize and they want to see you in person. I feel like for some people phone calls and messages are not enough. They need to have in person contact with you”;*
  “Why are you sleeping when we have assignments?";
  "Shouldn’t you be studying?".
- Family: *“I think my mom would say I sleep too much”.*

- Lecturers: *" [They] say work is more important than sleep. One lecturer says to sleep for 2 hours".*
- Themselves: *"The only person* [to blame for the lack of sleep] *would be myself".*

A few students also believed that environmental factors (engaging with media and noise) acted as a barrier to sleeping enough:

- Engaging with media: *"instagram is very addictive when you start scrolling and double tapping. You can easily waste an hour of your time";*
  "Watching series late at night".
- Noise*: "My res[idence] is close to others' so if they're having a party or if our res[idence] is hosting a party";*
  "but people in the hallways don't really respect quiet time or that they need to be quiet while walking".

Data on beliefs held by first year female students regarding facilitators of getting enough sleep are presented in Table 3.23.

Table 3.23: Beliefs regarding facilitators of first year female students getting enough sleep (BEFSleep)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Dietary intake	Limit caffeine	1
Support	Peers	23
	Family	14
	Mentor	2
	Lecturers	2
	Total	41
Psychological	See a psychologist	1
	Meditation	3
	Total	4
Environment	Living situation	2
Time		6
New information from interviews not fully coded (n=10)		
Psychological	Feeling sad	1
Environment	Media	1

Beliefs relating to facilitators of sleep focused on support from peers (most prominent) and family, but lecturers were also mentioned.

- Peers: *"I feel like everyone understands how important sleep is in university".*
- Family: *"My mummy"…"she would want me to be well rested".*
- Lecturers: *"They definitely want you to live your healthiest life".*

Some students believed that making time available and the environment (abode and media) were facilitators to getting enough sleep as is illustrated by the following quotes:

- Time: *"Like do enough during the day. Put in enough energy during the day to get everything done and force yourself not to study after 11 at night. Then you could wake up early to study again. Like half an hour earlier".*
- Living situation: *"Get myself an apartment".*
- Media: *"if I could control myself from TV and Instagram".*

A few students mentioned beliefs relating to psychological facilitators of sleeping enough, which included seeing a psychologist, meditation and feeling sad: *"I sleep a*

lot when I am sad". One student mentioned limiting caffeine as being a facilitator: "You can't drink a red bull before you go to bed".

Salient beliefs

A lack of time, especially due to workload, emerged as a key belief regarding barriers to getting enough sleep. Making time to sleep by being more efficient during the day was believed to be a facilitator of getting enough sleep by some. Students also believed that chores, routine (different at university, need to adapt), being a procrastinator (leaving everything to the last minute), socialising and the need to do exercise were barriers to getting enough sleep.

Beliefs relating to environmental factors that influence the amount of sleep one gets spanned both barriers and facilitators, for example use of social media (instagram, watching television) resulted in a waste of time and less sleep, while control of use of such media was believed to be a facilitator of getting enough sleep. Students also believed that noise, especially in the university residences (parties at other residences, noisy people in corridors) was a barrier to sleeping enough, while they believed that living privately (not in a university residence) was a facilitator.

Psychological factors such as stress (most prominent), poor self-esteem and feeling sad were commonly believed by students to be barriers to getting enough sleep. Feeling sad was also believed to be a facilitator of sleeping by a few students, along with seeing a psychologist and meditation. One student mentioned limiting caffeine (Red Bull) intake as being a facilitator of getting enough sleep.

Students mentioned beliefs that involved lack of support from peers (most prominent, linked to need to socialise), family (e.g. parents who feel that time should be spent studying), themselves and lecturers (studying is the most important, more so than sleep) as barriers to getting enough sleep. Further beliefs relating to facilitators of sleep focused on support mostly from peers (understand how

important sleep is), family (want me to be well rested) and lecturers (want students to be healthy).

3.3.5. Weight related construct: Body shape satisfaction

Data on beliefs held by first year female students regarding factors that affect the way students think about their bodies are presented in Table 3.24.

Table 3.24: Beliefs of first year female students regarding factors that affect the way they think about their bodies (BEAThinkBody)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Environment	No sub-subtheme*	1
	Others	26
	Beach	1
	Social media	17
	Total	45
Psychological	Self-esteem	8
Weight	Underweight	3
	Weight gain	3
	Total	6

*Participant mentioned the subtheme, but not a sub-subtheme

Beliefs relating to what students believe affects the way they think about their bodies focused strongly on environmental factors, with many students mentioning beliefs regarding the role of others (people) (most prominent) and social media (promoting particular body shape ideals) and being on the beach (one student). Quotes that illustrate these beliefs are as follows:

- Others: *"And how other people look at my body"; "I am one person that I take other people's opinions into account too seriously";*
  "celebrities";
  "Maybe if I am around people who are in smaller size than myself".
- Social media: *" [The] kind of images are pushed out as what is a good body and what is a bad body".*

Students also believed that self-esteem affects the way they think about their bodies. *"And then I guess you just don't love yourself you know"*.

Some students believed that weight, either being underweight or gaining weight affected the way they think about their bodies negatively:

- Underweight: "*I weigh 38 and it really really...it puts me down".*
- Gaining weight: *"When I gain weight around my stomach area".*

Data on beliefs held by first year female students regarding their bodies as such are presented in Table 3.25.

Table 3.25: Beliefs of first year female students regarding their bodies as such (BEThinkBody)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Negative body image	Think overweight	10
	Anorexic	2
	Think underweight	2
	Think gained weight	8
	Feel bad about body	3
	Total	25
Positive body image	Think Look good	1
	Feel comfortable in clothes	3
	Healthy	6
	Total	10

Beliefs relating to students' perceptions of their bodies as such focused more prominently on negative than positive aspects of body shape satisfaction. Believing that one is overweight or has gained weight stood out, with only a few students believing that they were underweight or anorexic. The following quotes illustrate these beliefs:

- Think overweight: *"I think that I have a lot of fat in my body".*
- Anorexic: "*because I just feel like you know anorexic people? I think I have that".*
- Think underweight: *"I feel like I need to gain weight".*

- Feel bad about body: "*After winter I do not like how I look".*

Some students believed that their bodies were healthy and one student believed that she looked good irrespective of her weight. Some students believed that they would base what they think about their bodies on how comfortable they feel in their clothes. These beliefs are illustrated by the following quotes:

- Healthy: *"I don't want to look skinny, I want to look healthy".*
- Feel comfortable in clothes: "*If I feel they [my clothes] are still fitting then ya ….to my brain I'm like okay I'm alright".*
- Think Look good: "*I could look like I weigh 90kg and if I feel happy and I feel strong and confident and beautiful then that's all that matters to be one hundred percent honest"*;
  "*I'm still like happy inside my own skin and things like that… I'm still like happy with my body".*

Salient beliefs

Environmental factors emerged as a key focus of beliefs regarding what affects the way students think about their bodies, including other people (most common) and social media (promotion of body particular types), as well as being on the beach (mentioned by one student). The belief that self-esteem affects the way students think about their bodies also emerged (lower self-esteem=do not love yourself). Students also believed that their weight affected the way they think about their bodies (underweight and gaining weight= negative body thoughts) .

Beliefs relating to students' perceptions of their bodies as such focused more prominently on negative than positive aspects of body shape satisfaction. In terms of a negative body image, believing that one is overweight or has gained weight was more common, while only a few students believed that being underweight or anorexic would have a negative effect on their body shape satisfaction. In terms of a positive body image, the belief that wanting to look healthy (not skinny) was most

common), while one student believed that she looked good irrespective of her weight and some students believed that they would base what they think about their bodies on how comfortable they felt in their clothes.

3.3.6. Weight related construct: Self-Esteem

Data on beliefs held by first year female students regarding factors that affect students' self-esteem are presented in Table 3.26.

Table 3.26. Beliefs of first year female students regarding factors that affect students' self-esteem in general (BEASelfEsteem)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Environment	Others	16
	Media	8
	Total	24
Psychological	Body shape satisfaction	16
New information from interviews not fully coded (n=10)		
Physical	Skin	1
	Accent	1
	Total	2
Academics		2

The environment was the most frequently mentioned factor that students believed affects their self-esteem, focusing specifically on other people and media. Quotes that illustrate these beliefs are as follows:

- Others: *"what people say and the comments they make on my body"; "People who just like made you feel more like valued as a person".*
- Media: *"The portrayal of women on social media".*

Students also believed that body shape satisfaction affects students' self-esteem: "*The thinner you are the better you feel about yourself".*

Physical factors such as skin and accent were also mentioned by a few students as being issues they believed would affect self-esteem: "*My skin… I hate it… too much"* and *"maybe I don't speak right".*

A few students believed that academics affected self-esteem: *"not smart enough to interact with people"* and *"getting good marks".*

Data on beliefs held by first year female students regarding the effects of having a low/high self-esteem are presented in Table 3.27.

Table 3.27: Beliefs of first year female students regarding the effects of having a low/high self-esteem (BESelfEsteem)

SUBTHEME	**SUB-SUBTHEME 1**	**Total**
Information from fully coded interviews (n=18)		
Poor	No sub-subtheme*	1
	Others	3
	Weight management	13
	Body shape satisfaction	2
	Physical activity	1
	Total	20
High	Content with the person that I am	1
	Body shape satisfaction	4
	Weight management	3
	Others	3
	Health	1
	Total	12

*Participant mentioned the subtheme, but not a sub-subtheme

Beliefs relating to students' perceptions of how a low self-esteem may affect them focused on weight management (most prominent) (obsess about it), being susceptible to what other people think, body shape satisfaction (never satisfied) and physical activity (self-conscious). The following quotes illustrate these beliefs:

- Others: *"So, it's like a cycle. It's all a chain that's interlinked like this. Because if I had more self-esteem in myself I wouldn't care about what other people think. And I wouldn't eat as much or I would eat more because I am happy*

with who I am, but because I have low self-esteem, I carry too much and then my diet is based on other people's reactions to my physical body".

- Weight management: *"A lower self-esteem can make you not even want to think about losing weight sometimes because it's going to be the same thing";*
  "I am never going to reach the goal" or "you obsess about what you eat or don't eat" and "you obsess about how many calories you burn or don't burn".
- Body shape satisfaction: *"If [you have a] low self-esteem you will never be satisfied with your body".*
- Physical activity: *" [I am] very self-conscious to be in the gym".*

Beliefs relating to students' perceptions of how a high self-esteem may affect them focused mainly on body shape satisfaction, weight management (no need to lose weight), what others think (less vulnerable) and health (want to eat healthy). One student believed that she was content with the person that she is. Quotes that illustrate these beliefs are as follows:

- *"[If I have a] high self-esteem then I won't feel like I need to lose weight or gain weight".*
- *"So, having a good self-esteem also reduces the influence that other people can have on the opinions of yourself".*
- *"Umm, if you are feeling confident, you want to feed yourself good stuff and you want to do things that are good for your body".*

Salient beliefs

Beliefs of students about what affects their self-esteem focused mainly on environmental factors including others (people) and media (portrayal of women on social media). Students believed that a higher body shape satisfaction resulted in a higher self-esteem. Other factors that students believed would affect their self-esteem were physical factors such as skin and accent, as well as academic performance.

Beliefs relating to students' perceptions of how having a low self-esteem may affect them focused on weight management (most prominent) (obsess about it), as well as susceptibility to what other people say, body shape satisfaction (never satisfied) and physical activity (self-conscious). Beliefs relating to student's perceptions of how a high self-esteem may affect them focused on body shape satisfaction and weight management (no need to lose weight), being less vulnerable to what other people say, wanting to eat healthy and being content with the person that one is.

3.3.7. Weight management strategies: Beliefs of first year female students regarding weight gain prevention and weight loss strategies

Data on beliefs held by first year female students regarding strategies that would work for prevention of weight gain are presented in Table 3.28.

Table 3.28: Beliefs of first year female students regarding strategies that would work to prevent weight gain (BEPWG)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical activity	No sub-subtheme*	8
	Cardiovascular	2
	Resistance	4
	Enjoyable	1
	Schedule	1
	General health recommendation	3
	Total	19
Dietary intake	No sub-subtheme*	1
	Eating Pattern	8
	Eat healthy	12
	Knowledge	2
	Portion control	9
	Total	32
Psychological	Self-esteem	1
Advisor	Family	1
Access	Time	2
Behavioural	Self-monitoring	4
New information from interviews not fully coded (n=10)		
Psychological	Control	1
	Positive thoughts	1
	Total	2
Advisor	Seniors	1

*Participant mentioned the subtheme, but not a sub-subtheme

Beliefs relating to the role of dietary intake as a strategy in the prevention of weight gain were most common, with heathy eating, having an eating pattern and portion control emerging as prominent strategies. Knowledge of cooking also emerged as a strategy students believed was necessary for prevention of weight gain. These beliefs are illustrated in the quotes below:

- Eat healthy: *"Eat more home cooked things";*
  "Drinking enough water";
  "Having a balanced diet".
- Eating pattern: *"You eat regularly so you don't allow yourself to get hungry where I would overindulge";*

"Making sure that I stop this habit of mine of eating heavy meals later in the day. It is better to eat heavier meals during the day because then you can use the energy".

- Portion control: "*Wait after I eat".*
- Knowledge: "*I feel like I need to learn how to cook".*

Physical activity was also commonly believed to be a strategy to prevent weight gain, with some students believing that exercise should be at levels comparable with general health recommendations. Students believed that both cardiovascular and resistance exercise could contribute to weight gain prevention. Individual students believed that an exercise schedule should be created and that exercise should be enjoyable. These beliefs are illustrated in the quotes below:

- Resistance exercise: "*Strength training. Like a lot of strength training. That is good for preventing weight gain";*
  "*If I'm doing more heavy weights then I'm not hungry for about an hour afterwards".*
- General health recommendations: *"Exercise four times a week".*
- Cardiovascular exercise: *"Walking"*
- Enjoyable: *"Doing exercise that I enjoy or being physically active in a way which I enjoy".*
- Schedule: "*Make a schedule for exercising and how I'm gonna do it".*

Beliefs relating to psychological factors that play a role in weight gain prevention were mentioned by a few students and focused on self-esteem, control and positive thoughts:

- Self-esteem*: "good self-esteem… don't let other people affect your vision about your body".*
- Control: *"more conscious about what is in my fridge, taking control into [my] own hands. At home what my mom cooked I ate, now it is in my own control, [there is] no-one to blame but myself if I gain weight".*
- Positive thoughts*: "Affirm yourself" …. "positive thoughts".*

Family pressure or consulting a senior student and access (time: fitting it into one's schedule) were believed to be strategies to prevent weight gain by a few students as is illustrated in the following quotes:

- Advisor (Family): *"Family pressure to lose weight".*
- Advisor (senior): *"Speaking to a senior. Find out what made them gain weight and prevent it".*
- Access (time): *"I need to fill up my schedule to the way it was during school times".*

Beliefs relating to behavioural strategies for weight gain prevention focused on self-monitoring: Self-monitoring*: "Checking if I have picked up a kilo then I can work that day specifically to fix it".*

Data on beliefs held by first year female students regarding strategies that would work for weight loss are presented in Table 3.29.

Table 3.29: Beliefs of first year female students regarding strategies that would work for weight loss (BEWL)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical activity	No sub-subtheme*	9
	Cardio	6
	Schedule	2
	Above recommendation	2
	Burn off excess	1
	Total	20
Dietary intake	Eating Pattern	2
	Eat healthy	39
	Different diets	10
	Portion control	6
	Total	57
Psychological	Willpower	1
	Goal setting	3
	Total	4
Lifestyle	Balance	2
	Time	1
	Habits	3
	Total	6
Support		7
Education		2

*Participant mentioned the subtheme, but not a sub-subtheme

Beliefs relating to the role of dietary intake as a weight loss strategy were most prominent and focused mainly on aspects of eating healthy. Quotes that reflect these beliefs are as follows:

- *"Cut out all junk food".*
- *"More water".*
- *"Making sure that I don't overeat on the carbohydrate front".*
- *"Good fats"… "they make you feel so full".*
- *"Increase protein intake".*
- *"More greens than protein and carbs".*
- *"Cut off the gas cool drinks".*
- *"Alcohol intake, cut that also because I want to lose weight".*

Other dietary strategies a few students believed should be considered were having an eating pattern and portion size control. Some believed that different diets could be considered as is illustrated by the following codes:

- "*I like doing 1 day detox".*
- *"or the Mediterranean diet".*
- *"I think if I go to check my blood".*
- *"I think there is a certain thing that you might eat that if I come off, it will help me to lose weight".*
- *"Possibly go on a diet but on a diet that doesn't restrict me to eat when I should eat".*

Students also believed that physical activity (possibly above recommended levels) should be used for weight loss, specifically cardiovascular exercise: *"And I know it is not going to help for me to go sit and lift weights, that is not going to work for my body".* One student believed that physical activity was necessary to burn off excess calories.

Further believes regarding weight loss strategies held by a few students involved goal setting, having willpower, having the right lifestyle (balance; habits; time); support (no specific person mentioned) and education on weight loss.

Salient beliefs

The most prominent strategies students believed could work for weight gain prevention and weight loss related to dietary intake, including various aspects of heathy eating (most prominent) (cutting out unhealthy items such as junk food, fizzy drinks and alcohol, while increasing intake of water, protein, good fats and greens), having an eating pattern (eat regularly) and portion size control. Another belief that emerged was that different diets could be used as a strategy for weight loss (fad diets/healthy). Knowledge (how to cook) also emerged as a strategy students believed was necessary for prevention of weight gain.

Physical activity was also believed to be a strategy to prevent weight gain and for weight loss. For weight gain prevention students believed that exercise (cardiovascular and resistance) should be at levels comparable with general health recommendations. Some students believed that exercising above recommended levels, especially cardiovascular exercise, would be necessary for weight loss (burn off excess calories). Some students believed that an exercise schedule should be created for weight gain prevention and that enjoyable exercise should be performed.

Some students believed that a high self-esteem, self-control, self-monitoring and positive thoughts would contribute to weight gain prevention. Students also believed that goal setting and having willpower would contribute to successful weight loss.

One student believed that consulting a senior student and one that being able to fit activities in one's schedule would contribute to weight gain prevention. Other beliefs relating to weight gain prevention (mentioned by one or two students) linked to lifestyle (balance; habits; making time); support and education on weight gain prevention strategies.

3.3.8. Weight management problem: Experience of first year

Data on the beliefs first year female students held on challenges they experience of their first year at University are presented in Table 3.30.

Table 3.30: Beliefs of first year female students regarding challenges they experience of their first year at university (EXPFY)

SUBTHEME	SUB-SUBTHEME 1	Total
Information from fully coded interviews (n=18)		
Physical health	Weight management	12
Psychological	Self-esteem	1
	Body shape satisfaction	2
	Emotions	1
	Total	4
Challenge		3
New information from interviews not fully coded (n=10)		
Physical Health	Not priority	1

It emerged that a few students believed that the first year was a challenge in itself, while some students believed that the following were specific challenges they experienced during their first year: weight management (most prominent), self-esteem issues and emotional issues. One student believed that health was not a priority, all else is more important. The following quotes illustrate these beliefs:

- Weight management*: "It is so hard to prevent weight gain".*
- Emotions: *"It was like the worst time of my life".*
- Body shape satisfaction: *"As girls we are all under this pressure of how we should look or how we should feel";*
  "We shouldn't compare ourselves to other women".
- Self-esteem: *"Everyone is supposed to be happy in their own skin, like you just need to accept that not everyone can look a certain way you can't just let society shape how you should perceive yourself".*
- Challenge: *"new change, new life";*
  "People are not prepared for varsity".
- Not priority*: "Everything is different this year. My physical health took a back seat".*

Salient beliefs

A few students believed that the first year was a challenge in itself, while some students believed that the following were specific challenges they experienced during their first year: weight management (most prominent), self-esteem issues, emotional issues.

3.4 Discussion

This study set out to investigate the beliefs of first year female students at three South African universities regarding weight gain prevention behaviours and weight related constructs. Beliefs relating to the weight gain prevention behaviours are discussed in section 3.4.1 (behavioural and control beliefs) and beliefs relating to facilitators of and and barriers to these behaviours are discussed in section 3.4.2 (normative and control beliefs).

3.4.1 Beliefs relating to weight gain prevention behaviours

Lifestyle behaviours that are inherently linked to weight gain prevention include healthy eating (for this research in line with The South African Food Based Dietary Guidelines (SAFBDG)(Vorster et al., 2013), limiting alcohol intake (The guideline for low risk drinking is no more than one standard drink for females) (Jacobs & Steyn, 2013) and adequate physical activity (recommendation of at least 150 minutes per week of moderate-intensity activity)(WHO, 2014; Piercy et al., 2018) and sleep (recommendation of 7 to 9 hours per night)(Hirshkowitz et al., 2015). Meeting these recommendations is very likely to be promoted by having a good self-esteem, being satisfied with one's body shape and experiencing psychological well-being i.e. low levels of stress, depression and anxiety (Elfhag & Rossner, 2005; Wardle et al., 2011; Brumpton et al., 2013; Geiker et al., 2018). Research has shown that the potential of first year female students to meet healthy lifestyle recommendations is challenged

by the transition they experience from their home to the tertiary education institution environment (Cilliers et al., 2006; Fayet et al., 2012; Crombie et al., 2009; Patrick et al., 2014; Vadeboncoeur et al., 2015).

Eating patterns and food choices of female students, including South African students, have been described as unhealthy by a number of researchers over decades (Senekal, 1994, Huang et al., 2003; Racette et al., 2005; Deshpande et al., 2009; Vella-Zarb & Elgar, 2009; LaCaille et al., 2011; Small et al., 2013; Lazaverich et al., 2013; Brown et al; 2014; Nicolou et al., 2015; Senekal et al., 2016, Yahia et al., 2016; Mueller et al., 2018; Lazaverich et al., 2018). In contrast, the current research showed that the beliefs first year female students held regarding what one needs to eat to be healthy was mostly in line with the South African Food Based Dietary Guideline (SAFBDG) (Steyn, 2013), namely eating a variety of foods in moderation without excluding any one or more food groups completely (control belief). Similarly, Sogari et al. (2018) revealed that tertiary level students in their study in the USA believed that healthy eating involves following a balanced diet; they also believed that it is more important to eat the right foods than trying to eat less and controlling portions. These positive beliefs may be linked to the notion reported by Sogari et al. (2018), that students believed that their generation was more health conscious and understood the concept of being healthy better than previous generations. However, when considering the reported dietary patterns and food choices of tertiary level students (Senekal, 1994, Huang et al., 2003; Racette et al., 2005; Deshpande et al., 2009; Vella-Zarb & Elgar, 2009; LaCaille et al., 2011; Small et al., 2013; Lazaverich et al., 2013; Brown et al; 2014; Nicolou et al., 2015; Senekal et al., 2016, Yahia et al., 2016; Mueller et al., 2018; Lazaverich et al., 2018), it would seem that the positive beliefs do not necessarily translate into actual healthy eating behaviours.

Further beliefs students included in the current study held that were aligned with the SAFBDGs (Vorster et al., 2013) were that one should eat vegetables for immunity and for nutrients (behaviour beliefs), carbohydrates for energy and protein for body function (behaviour beliefs), while avoiding/limiting high fat and highly processed

foods. Beliefs regarding the fibre content of the diet or fibre rich foods e.g. whole grains and legumes were very uncommon, possibly reflecting lack of insights in the importance of fibre for health (control beliefs). The same may be true for fruits and drinking water, as beliefs regarding these items were also not common. Despite the increase in popularity of vegetarian and vegan diets (Dinu et al., 2017), no beliefs regarding these options emerged.

Limiting carbohydrate intake as part of a healthy diet emerged as a theme, more specifically that carbohydrate portion sizes needed to be controlled or that intake thereof needed to be avoided to prevent weight gain (carbohydrates in general, as well as bread) (control belief) and for health (sugar and bread) (behavioural belief). Although decreasing sugar intake is an important emphasis in dietary guidelines across the world (Temple & Steyn, 2013; WHO, 2015), the belief that carbohydrate intake per se should be reduced does seem to lean towards the notion of using low-carbohydrate diets for health and weight management (Hall et al., 2011; Ramage et al., 2014; Yannakoulia et al., 2019).

The belief held by some students that dairy is not important in a healthy diet is a concern, as it is a key source of calcium in omnivorous diets, while also contributing numerous other essential nutrients (Pereira, 2014). Awareness of alternative weight gain prevention or weight loss diets may be reflected in the belief that dairy intake contributes to weight management (behavioural belief). Other alternative diets students believed could work include the Meditteranean diet, the blood group diet and detox diets (unhealthy). A further concern is the belief that healthy eating is not important based on the premise that one's body is used to unhealthy eating (behavioural belief). Although mentioned by one student only, this notion may need to be considered in weight gain prevention messaging.

Literature shows that meal patterns of tertiary level students may be irregular (Lazaverich et al., 2013, Brown et al.,2014, Yahia et al. 2016) and that breakfast appears to be a meal that may be frequently skipped (Brown et al., 2014; Gresse et al., 2015; Yahia et al., 2016). In the current study students held different beliefs

regarding what a healthy meal pattern constitutes, with options ranging from one meal to three meals and snacks (control beliefs). This is reason for concern as following an irregular meal pattern may contribute to weight management problems (Timlin & Pereira, 2007; Berg et al., 2009; Fugelstad et al., 2012; Wang et al., 2014; Yannakoulia et al., 2019). However, the beliefs that breakfast is important and should be the biggest meal of the day (control belief) and that regular meals is a strategy for weight loss, is a positive finding (behavioural belief).

Beliefs students held about the benefits of healthy eating echo accepted theory that it is important for body function and prevention of lifestyle disease (WHO, 2003; Vorster et al., 2013), with students also believing that it would benefit their self-esteem and social engagement. Further benefits of healthy eating were evident from the belief that healthy eating is a strategy for prevention of weight gain and weight loss (behavioural belief), specifically also cutting out unhealthy food items such as junk food, fizzy drinks and controlling portion sizes (control beliefs).

Excessive use of alcohol in general, but specifically also binge drinking has been reported to characterize tertiary level students, with use in female students being on the increase (Brown et al., 2008; Boekeloo et al., 2009; Wicki et al., 2010; White & Hingson, 2013; Van Zyl et al., 2015; Peltzer & Pengpid, 2016; Battista & Leatherdale; Govender et al., 2017; Nourse et al., 2017; Yi et al., 2017; Ajayi et al., 2019).
This inclination to excessive alcohol consumption is reflected in the beliefs first year female students in the current study held about alcohol use. The amount of alcohol students believed they could consume was mostly above the recommended level of 1 drink a day for females (Jacobs & Steyn, 2013)(control beliefs). They believed that they could continue drinking as long as they felt they still were in control (can walk, talk, count, not dizzy and not do abnormal things)(behavioural belief). Of concern is that students believed that drinking alcohol at this level made them feel good (happy, can do anything), allowed them to party hard (behavioural belief), relieved stress (control belief) and improved self-esteem (control belief) and facilitated relaxing with friends, celebrations and better sleep (behavioural/control). These beliefs could contribute to justification of excessive alcohol use and further

entrenchment of this behaviour, despite (behavioural) beliefs that emerged regarding immediate consequences of alcohol intake such as a hangovers (frequently mentioned) and longer term consequences such as including addictions, lifestyle disease, as well as social problems such as risky sexual behaviours or landing up in unsafe situations (not frequently mentioned). Research by Nourse et al. (2017) in tertiary level students in the USA also showed that immediate consequences of alcohol use such as a hangover, vomiting, upset stomach and feeling more tired (along with feelings of embarrassment) were the most commonly mentioned consequences.

Beliefs relating to dietary consequences of using alcohol included that it resulted in eating at early hours of the morning and possibility weight gain (behavioural beliefs). According to Yeomans et al. (2010) weight gain associated with alcohol use could be due to the energy contributed by the foods eaten that at these late/early hours (usually junk food and take outs) and/or due to the calories provided by the alcohol itself when engaging in binge drinking. LaCaille et al. (2011) found that tertiary level students identified alcohol and unhealthy late night eating to be co-occurring behaviours and that the calories consumed could contribute to weight gain. However, numerous other researchers raised the concern that students may actually not be aware of the association of alcohol use, especially heavy episode drinking, with weight gain (Arif and Rohrer, 2005; Breslow and Smothers, 2005; Vagstrand et al., 2007; Berkey et al., 2008; Croezen et al., 2009; Farhat et al., 2010; Yeomans, 2010; Chakraborty, 2014; Fazzino et al., 2017). In support of this notion, Sogari et al. (2018) found that alcohol use was not mentioned as an unhealthy drinking habit by tertiary level students.

VanKim and Nelson (2013) argue that research shows that adolescents experience a substantial decrease in physical activity during their transition into adulthood. It is thus not surprising that physical activity levels of first year students, including South Africans, have generally been reported to be low (Cilliers et al., 2006; Kapinos & Yakusheva, 2011; Small et al., 2013; Deliens et al., 2015; Plotnikoff et al., 2015; Yahia et al., 2016; Peltzer & Pengpid, 2017; Walsh et al., 2018). The amount of physical

activity students in the current research believed that they should be performing was in line with or more than the recommendation of minimum of 150 minutes of moderate to vigorous activity per week (WHO, 2014; Piercy et al., 2018) (behavioural beliefs).

Beliefs regarding the type of physical activity a person should do were limited. It did emerge that students believed that exercise should be enjoyable and that any form of exercise (or a combination) is important and should be performed in a healthy and balanced way (behavioural beliefs). This is in line with the recommendation that all forms of physical activity should be encouraged for weight management purposes (WHO, 2014). Types of exercise students believed they could do are yoga (psychological benefit- time to be with own thoughts), resistance exercise (improves strength) and cardiovascular exercise (to compensate for eating too much) (behavioural beliefs). A few students believed that doing exercise outdoors and in the morning was preferable in terms of enjoyment and setting a good tone for the day (behavioural beliefs).

Research shows that physical activity can improve both emotional (better self-esteem and reduced anxiety and stress) and physical health i.e. prevent obesity and diseases such as diabetes, cancer, hypertension and high cholesterol) (NYRBS, 2002; Joubert et al., 2007; VanKim & Nelson (2013); WHO, 2014). Students seemed to be aware of these benefits since beliefs relating to psychological benefits of physical activity emerged strongly, specifically improved self-esteem, being more focused, improving body shape satisfaction, feeling less stressed and being more motivated (behavioural/control beliefs). Beliefs relating to physical health benefits were also frequently mentioned (behavioural). These included better functioning of the body (keeping fit, increasing flexibility, aiding in recovery and improved sleep), and prevention of lifestyle disease. Students also believed that exercise could be used as a social activity with friends (control belief). According to VanKim and Nelson (2013) positive benefits of vigorous physical activity on mental health and perceived stress occurs through a socializing pathway. Promotion of exercising with friends may thus be a valuable strategy to increase physical activity and psychological well-being of students.

Physical activity is widely promoted as an important strategy for weight management (Elfhag & Rossner, 2005; LaCaille et al., 2011; Foright et al., 2018; Petridou et al., 2019). In line with this sentiment, students in the current study believed that physical activity is strategy for prevention of weight gain and promotion of weight loss (behavioural belief). They believed that exercise resulted in gaining muscle mass and losing fat mass, while also burning calories (behavioural belief). These beliefs reflect research that shows that aerobic exercise increases loss of fat mass and increases energy expenditure, while resistance exercise increases lean body mass (Haskell et al., 2007; Schwingshackl et al., 2013). For weight gain prevention, students believed that exercise (cardiovascular and resistance) should be at levels comparable with general health recommendations. Some students believed that exercising above recommended levels, especially cardiovascular exercise, would be necessary for burning off calories and weight loss (behavioural). Exercising at this level will most probably not be sustainable and students may need to be educated in this regard. The belief of some students that exercise for weight gain prevention should be enjoyable should also be included in intervention messaging as it could contribute to establishment of a more sustainable active lifestyle in the long term.

Tertiary education level students are well known for not meeting the recommended hours of sleep (Buboltz et al., 2001; Buboltz et al., 2009; Sing & Wong, 2010; Vargas et al., 2014; Walsh et al., 2018; Wang et al., 2019). It is thus of note that the number of hours students mostly believed they should sleep was in line with the recommendation of seven to nine hours per night (Hirshkowitz, 2015) (behavioural). Students believed that this amount of sleep was necessary for body functions (energy, brain and digestion) and for psychological well-being, which is in line with research that has shown that good sleep quality is important for physical and emotional well-being (Buboltz et al, 2009) (behavioural beliefs). Specific beliefs regarding benefits of getting enough sleep included feeling more focused, being more productive, having a stable mood, feeling less stressed, feeling positive and having an improved self-esteem (behavioural/control). In addition, some held the

belief that it is easier to interact with others when they have had enough sleep (behavioural).

Some students also believed that a benefit of the right amount and quality of sleep is appetite control and weight management (behavioural). The importance of this belief is illustrated by results of a recent meta-analyses that shorter sleep duration is associated with a higher body mass index (Ludy et al., 2018). Possible explanations for this association have been put forward and include that lack of sleep may lead to fatigue and therefore reduced physical activity, an increase in appetite, increased eating for pleasure rather than based on hunger cues, and increased energy consumption due to later bedtimes and lack of access to nutritious foods at these hours (Patel et al., 2006; Chaput et al., 2008, Benedict et al., 2012; Roane et al., 2015). One student believed that getting enough sleep would be beneficial for meal preparation (control beliefs). A number of researchers have indicated meal preparation may result in improved eating patterns and therefore better weight management (Timlin & Pereira, 2007; Berg et al., 2009; Fugelstad et al., 2012; Wang et al., 2014; Yannakoulia et al., 2019).

Although not common, some students believed they should sleep less than the recommended amount. They believed that sleeping more would impinge on time available for other activities and academics (control). They also believed that sleep was more important for children (when you are younger), that the amount they believed they should sleep is sufficient to meet the body's needs and that they knew that it was enough for them (control beliefs). Although it is true that young adults require less sleep than teenagers or children (Hirschkowitz, 2015), the number of hours of sleep that an individual should get (seven to nine hours) may be undervalued by some. Beliefs regarding the consequences of a lack of sleep echo the beliefs regarding benefits to a great extent. These included feeling less focused, moody and depressed; being less productive and less motivated; lack of energy and a negative effect on hormones (behavioural beliefs). This is in line with evidence that shows that unhealthy sleep patterns may affect academic performance, as well as physical health and psychological wellbeing (Buboltz et al., 2009).

3.4.2 Facilitators of and barriers to healthy weight gain prevention behaviours

Barriers to and facilitators of the weight gain prevention behaviours that emerged related to body shape satisfaction, self-esteem, stress, emotions and depression; support from family, peers and friends; physical factors such as feeling tired, hungry, menstruation, how the body functions, health per se, taste of food, stimulant use and actual weight; lack of knowledge and skills relating to healthy eating and physical activity; time and planning; and physical environmental factors [mostly relating to access (to abode, physical activity opportunities, transport, finances, alcohol, healthy food options on campus or at university residences), social media, noise and eating out].

Poor body shape satisfaction i.e. the perception of, attitudes towards and concerns experienced by individuals regarding their weight or shape (Shisana et al, 2013; Richard et al., 2016) has been shown to affect weight management behaviours in the general population (Cheung et al., 2011; Richard et al., 2016; Biblioni et al., 2017) and specifically in female tertiary level students (Wharton et al., 2008; Rodgers et al., 2018). Some students in the current study believed that high body shape satisfaction would facilitate healthy eating as a weight gain prevention behaviour (control belief). Some believed that the thinner you are, the better you feel about yourself. However, high body shape satisfaction also emerged as a barrier to healthy eating as a weight gain prevention behaviour as some students believed that there is no need to worry about healthy eating when you are content with your body (control belief). As far as poor body shape satisfaction is concerned, some students believed that feeling heavier may facilitate healthy eating as a weight gain prevention behaviour as it may create a desire to feel and look healthier. This was also true for physical activity as some students believed that if you think you are too big you would want to exercise more (also found by Deliens et al., 2015 in female tertiary students) (control belief). On the other hand, some students believed that the more your body shape improves, the more you would be motivated to do exercise to see the result (also found by Kelly et al., 2016 in females) (control belief). Some students believed

that poor body shape satisfaction may cause a feeling of helplessness as you already feel so big that you may as well give up and eat whatever you like (control belief).

Self-esteem i.e. the evaluative component of self-concept that involves the general evaluation that individuals make of themselves (Pila et al., 2015; Bleidorn et al., 2016; Kiviruusu et al., 2016), has also been linked to successful weight management in tertiary level students (Crombie et al., 2009). Some students in this study believed that a high self-esteem could facilitate healthy eating as a weight gain prevention behaviour because feeling good about yourself would increase motivation to eat healthily (control belief). They further believed that having a high self-esteem would result in less drinking since they would not need to use alcohol to feel more confident or to be more fun and lively (control belief). The belief that a high self-esteem promoted physical activity was also mentioned (also found by Kelly et al., 2016 in females) (control belief). However, as was the case for body shape satisfaction, a high self-esteem was also believed to be a potential barrier to healthy eating and physical activity as weight gain prevention behaviours based on the premise that it is not necessary to eat healthy and be physically active when you already feel good about yourself (control belief).

A poor self-esteem (and feeling heavier) was believed by some to facilitate healthy eating and physical activity as weight gain prevention behaviours due to a desire to feel and look healthier (control belief). Deliens et al. (2015) also found an association between higher physical activity and poorer self- esteem, since students want to exercise more to lose weight. In contrast, some students believed that a poor self-esteem would be a barrier to healthy eating and physical activity as weight gain prevention behaviours as they would be inclined to compare their bodies to others exercising in e.g. the gym and feel embarrassed by what they may look like or how others may perceive them (normative belief). An association between being self-conscious and lower levels of physical activity has also been reported others (LaCaille et al., 2011; Deliens et al., 2015; Lazaverich et al., 2018). As far as alcohol use is concerned, students in this study believed that low self-esteem would promote drinking to increase social confidence (control belief). Wicki et al. (2010) also

reported that social enhancement motives were the main reasons reported by students for drinking and Govender et al. (2017) reported that female students use alcohol to boost self-esteem. Students in the current study also believed that having a poor self-esteem may be a barrier to getting enough sleep due to lying awake worrying about feeling fat (control belief).

Some students believed that having a low self-esteem may increase their sensitivity to negative comments others may make (normative belief). Conversely, some students believed that a high self-esteem may protect them against such comments and that they would worry less about weight management and more about being healthy (normative belief). Body shape ideals promoted on social media were also believed to affect self-esteem in a negative way (normative belief). Deliens et al. (2014) reported that students held beliefs that body- image was affected by the socio-cultural ideal image and that body image affected their eating behaviours (normative belief).

Stress i.e. a feeling of being extremely challenged, overwhelmed or having lost control due to an emotional or physiological event or a cluster of events (Steyn & Temple, 2008; Sinha & Jastreboff, 2013; Geiker et al., 2018), has been identified as a major factor in successful weight management in tertiary level students (Munt et al., 2017; Sogari et al., 2018). More specifically, weight gain may result if individuals use maladaptive behaviours such as overeating to cope with stress (Sinha & Jastreboff, 2013). The potential role of stress in weight gain prevention was evident from the beliefs of the students in the current study that stress is a barrier to healthy eating as a weight gain prevention behaviour; some students indicated that they believed they would eat less when stressed and some would eat more (control belief). In line with this, there is evidence that most people experience changes in appetite when feeling stressed, with some having an increase in appetite (11 to 55%) and others a decrease (32 to 70%) (Lazaverich et al., 2018).

Some students in this study further believed that a low stress level is a facilitator of limiting alcohol use and high levels of stress makes limiting alcohol use difficult

(control belief). This is in line with research in tertiary level students that showed that students may drink to get away from feelings of stress (Bulter et al. 2010; Deasy et al., 2014; Nourse et al., 2017). As was reported by other researchers, higher stress was believed to be both a barrier to physical activity (due to high workloads) (LaCaille et al, 2011; Deliens et al., 2015), as well as a facilitator (kick out frustrations) (Deliens et al., 2015). High stress also emerged as the most prominent barrier students believed contributed to difficulties in falling asleep due to having an active mind. Vargus et al (2014) and Walsh et al (2018) have also found associations between higher stress and poorer sleep in students.

Further psychological factors such as emotions e.g. feeling sad and depression have been reported to result in an increase or decrease in appetite (Wing & Phelan, 2005; Elfhag & Rossner, 2005; Privitera et al., 2013; Lazaverich et al., 2018). Students in this study seemed to link food intake with their emotional state, with some of them believing that emotions such as feeling sad or depressed may be a barrier to healthy eating as a weight gain prevention behaviour (control belief). They believed that these emotions may cause them to want to eat more comfort foods (also found by Lazaverich et al., 2018), while others believed they may respond to these emotions by not wanting to eat at all (behavioural belief). The emotion of feeling in a good mood on the other hand was believed by some to be a facilitator of healthy eating as a weight gain prevention behaviour due to a more positive attitude (control belief). Boredom (emotional eating) was also mentioned as a barrier to healthy eating as it may promote overeating (control belief). In line with this, Crockett et al. (2015) in a study of undergraduate tertiary students in the USA found that emotional eating as a result of being bored is common among students (especially females) and that it may result in weight management problems. Thinking you are hungry (perceived hunger) was another belief that emerged as a barrier to healthy eating as a weight gain prevention behaviour. In line with findings by Peltzer and Pengpid (2015) in tertiary level students, feeling sad (or depressive symptoms) was further believed by some students to be a barrier to getting enough sleep as they may be overthinking the reasons for this emotion and therefore struggle to fall asleep (control belief). However, feeling sad was also believed to be a facilitator of sleeping by a few

students based on the premise that they wanted to sleep more when they felt this way (control belief).

Some students believed that experiencing emotions made it difficult to limit alcohol intake (control belief). A reason for this may be that students drink alcohol in order to forget their problems and to lessen their symptoms of anxiety and depression (Nourse et al., 2017). Similarly, Deasey et al. (2014) and Bulter et al. (2010) reported that distress experienced by tertiary level students is linked with hazardous drinking behaviours. However, it needs to be borne in mind that research shows that the most common reason for students drinking alcohol is due to cultural or social norms or to enhance positive feelings, rather than drinking to self- medicate or regulate mood (Cox et al., 2019). Of note is that some students believed that taking responsibility and outgrowing the need to drink would facilitate using less alcohol (control belief). The research by Wicki et al. (2010) supports the notion that alcohol use decreases over the academic years at a tertiary institution, while other studies showed no change over the years (DiGrande et al., 2000; Underwood & Fox, 2000; Bullock, 2004) and others reported a peak in the middle of the tertiary education period (Engs et al., 1991). However, Yi et al. (2017) found the highest alcohol intake in older tertiary level students.

Emotions (feeling sad/depressed) were further believed by some to be both barriers to and facilitators for physical activity. Some students believed that feeling sad may be a barrier to exercising on the premise that they would not feel like it in this state of mind (control belief). In line with this, Lazaverich et al (2018) found that a higher depression score was associated with a lower physical activity in first year female students. A further barrier that emerged was not enjoying physical activity (control belief), which was also reported by Deliens et al. (2015). However, similar to findings by LaCaille et al (2011), the good feeling after completion of exercise was believed by a student to be a facilitator of doing it because it is rewarding to feel that way. Further facilitators of exercise were believed to be motivation (also found by LaCaille et al., 2011), passion and spiritual benefits. In turn, students believed that physical

activity would facilitate healthy eating as a weight gain prevention behaviour due to an increased motivation and better mind set (behavioural belief).

Support emerged as a key theme regarding barriers to and facilitators for weight gain prevention behaviours. From the beliefs it was evident that support (or lack thereof) from peers regarding healthy eating, physical activity, limiting alcohol use and getting enough sleep was an important consideration for students in this study relating to weight gain prevention. This reflects the notion that students feel a strong desire to fit in with their peers (Sogari et al., 2018). Students in the current study held beliefs that it is more difficult to make healthy food choices when socialising if their friends are making unhealthy food choices (normative belief), also mentioned by Sogari et al. (2018) as a concern. However, some students' dietary habits may be positively influenced by their peers (Sogari et al., 2018). For example, a belief that emerged in the current study was that healthy eating may be trendy (normative belief). Although some students believed that their friends would support them if they wanted to limit alcohol use (normative belief), research in tertiary level students has shown that alcohol use is associated with a higher level of peer group approval, which may encourage higher alcohol consumption (Wicki et al., 2010; Wilkinson & Ivsins, 2017; DiGuiseppi et al., 2018; Cox et al., 2019). This was clearly reflected in another belief that emerged, namely that drinking alcohol is the is the most important behaviour to gain approval while you are at a tertiary education institution (normative belief). In line with this sentiment, some students believed that they would need to set limitations for themselves and avoid surrounding themselves with heavy drinkers in order to limit alcohol use (behavioural belief). As far as sleep patterns is concerned, many students believed that in general peers would support them in getting enough sleep and that they would understand that sleep is important (normative belief). However, many mentioned feeling pressured to engage in social activities or work late to meet others' expectations (normative belief). In line with research reported by LaCaille et al. (2011) and Deliens et al. (2015), students believed that social support such as having an exercise buddy may facilitate performing more physical activity (normative belief). However, some believed that students may be less likely to engage in

physical activity if it is not accepted by or seen as being important by their peers (normative belief).

Family support beliefs related to all four of the weight gain prevention behaviours, namely healthy eating, physical activity, alcohol use and sleep. Students believed that unhealthy dietary habits learnt at home shaped current dietary behaviours such as the need to clean one's plate (also found by Sogari et al., 2018) (normative belief), with no learned healthy behaviours being mentioned. Some students believed that limiting alcohol intake is made difficult by family (mom) that condones drinking (normative belief). Some students further believed that family members would not support them to perform more physical activity based on the premise that it is a waste of time (normative belief). A similar notion emerged regarding sleep time, with a few students believing that their family felt that spending time on academics is more important than spending time sleeping (normative belief). However, more students believed that everyone in their lives would want them to get enough sleep and be well rested. Of note is that family support of physical activity and healthy eating may be influenced by cultural norms that focus on a larger body size (normative belief) (Senekal et al., 2001), which is a belief that did emerge in this study.

A further theme that emerged regarding barriers and facilitators relates to the influence of physical factors such as how the body functions, taste of food, health per se, feeling tired, hunger, menstruation and stimulant (caffeine) use on healthy eating, alcohol use, physical activity and sleep time. Some students believed that understanding one's own body with regards to what to eat and when to eat would facilitate healthy eating and limiting alcohol intake as weight gain prevention behaviours (control belief). A belief that emerged that may be important to consider in the promotion of healthy eating as a weight gain prevention strategy is that healthy eating can be bland/tasteless (control belief). Hilger et al. (2017) and Sogari et al. (2018) confirm that the perception by students that healthy foods do not taste good is common. Additionally, Munt et al. (2017) found that taste was the most important factor in food selection and that students had a preferred taste for

unhealthy foods. Only a few students believed that feeling fit and healthy is a facilitator for physical activity (control belief). Similarly reported by Walsh et al. (2018) in tertiary level students, feeling tired was believed by some students in the current research to be the most prominent barrier to physical activity (control belief). Although physical activity has been found to be beneficial in controlling appetite (Joseph et al., 2011), Dohle et al. (2015) indicate that some individuals perceive that hunger may be increased by physical activity, which also emerged as a belief in the current study and may hinder performing physical activity in those who are attempting to reduce their energy intake (control belief). Menstruation has been reported to be linked to cravings for chocolate and sweets (Michener et al., 1999; Hormes et al., 2017), which supports the belief of some students in this study that one's menstrual cycle could be a barrier to healthy eating as a weight gain prevention behaviour because it results in cravings for unhealthy foods/snacks/drinks at that time of the month (control belief). One student mentioned limiting caffeine (Red Bull) intake as being a facilitator of getting enough sleep, since caffeinated beverages may cause difficulty sleeping (Hershner & Chervin, 2014).

A further physical factor that students believed may be linked to weight gain prevention is their actual weight at any point in time. Students believed that being overweight or gaining weight, as well as being underweight was associated with a poorer body shape satisfaction (control belief). The belief that overweight or gaining weight would result in increased body shape dissatisfaction seemed to be more prominent than the belief that being underweight or anorexic would negatively affect body shape satisfaction. The positive link between body shape dissatisfaction and a higher BMI is well documented (Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018). The lower prominence of negative beliefs relating to being thin may be linked to the universal promotion of the "thin ideal" that female tertiary level students may be striving to attain (Malinauskas et al., 2006). On a positive note, some students believed that high body shape satisfaction was linked to wanting to look healthy, but not skinny. Further beliefs that may facilitate weight gain prevention include the belief of looking good

irrespective of actual weight and the belief of basing body shape satisfaction on how comfortable you feel in your clothes (control belief). These latter beliefs may reflect less focus on achieving an "ideal" body shape and more focus on looking healthy and feeling confident (normative belief). However, if these students have obesity, these beliefs could become barriers to healthy weight management.

Although knowledge of and the necessary skills to perform weight gain prevention behaviours is recognized as important for successful weight management (Metzgar & Nikols-Richardson, 2015; Munt et al., 2017; Ashton et al., 2017), only a few beliefs in relation to this theme emerged. A few students believed that they lacked knowledge on how to cook and what type of exercise to perform. The concept of knowledge not being translated into behaviour that has been acknowledged in the literature (Deliens et al., 2014) did emerge in the belief of a student that although she had the knowledge of why it is important to eat healthy, she did not know how to implement healthy eating as a weight gain prevention behaviour into her life (control belief). Beliefs that may reflect a possible lack of understanding of the concept of healthy eating are that healthy eating focuses on restrictions in portions and that it means needing to cut out certain foods, with students believing that this may result in feelings of guilt, bingeing and cravings (control belief).

Time and planning emerged as major themes regarding barriers to and facilitators of healthy eating, physical activity and sleep time as weight gain prevention behaviours (control belief). Meal preparation was commonly believed to be a barrier to healthy eating due to lack of time (also mentioned by LaCaille et al., 2011; Munt et al., 2017; Sogari et al., 2018). Students believed that having a guideline/plan, making healthy eating a part of one's lifestyle, sticking to a routine and creating a schedule for eating would help them to eat healthier and avoid impulsive decisions (control belief). Similarly, students believed that creating a schedule for exercise may help them to be more physically active (control belief) (also found by LaCaille et al., 2011; Deliens et al., 2015). Participation in physical activity was believed to be negatively impacted by not having a physical activity schedule or participation in organised sports, travel time to a gym (also mentioned by LaCaille et al., 2011), needing to shower after

exercise (feeling sweaty), high workloads (also mentioned by Deliens et al., 2015; Sogari et al., 2018), socialising and sleeping (control belief). Students believed that performing exercises at home and in shorter time periods, getting more sleep and socialising less could help address these time constraints (control belief). Sleep was also believed to be impacted by a lack of time due to factors such as workload, chores, adapting to a new routine, procrastinating, socialising, exercising and time spent on social media (as found by Buboltz et al., 2009) (control belief).

Environmental factors also emerged as a major theme regarding barriers and facilitators for healthy eating, alcohol use, physical activity and sleep as weight gain prevention behaviours. Research on the availability of healthy foods options on the campuses of tertiary education institutions has shown contradictory results (Park & Papadaki et al., 2016; Hilger et al., 2017; Shi et al., 2018), as is evident from this research. Some students held positive beliefs on the availability of healthy foods on campus. However, many students believed that healthy food choices at university residences and on campus are limited and that it can get boring to choose from the limited options all the time (also found by LaCaille et al., 2011) (control belief). With regards to abode during a student's tertiary education students' beliefs focused on the effect on healthy eating and sleep time as weight gain prevention behaviours (control belief). Some students believed that living away from home was a barrier to healthy eating. They believed that it was easier to eat healthy when they lived at home since healthy, balanced meals would be provided and no decision or plan had to be made to eat healthily (control belief). Some believed that barriers to healthy eating on campus included large portions and all-you-can-eat offerings served at university residence dining halls (also found by LaCaille et al., 2011) (control belief). Some students furthermore believed that it would be easier to eat healthier if they were in control of what they were eating (i.e. self-catering university residence) (also found by LaCaille et al., 2011). Other researchers have found that living away from home may lead to a higher intake of convenience foods (LaCaille et al., 2011) and eating out more often (Sogari et al., 2018). Availability of alcohol on or close to a tertiary education institution campus has been confirmed to be an important factor in determining drinking patterns of students (Wilkinson & Ivsins, 2017). Some

students in the current study believed that limiting access to alcohol would help them to drink less, for example by being the designated driver and avoiding going out to parties (especially where free alcohol is offered) (control belief). Some students further believed that environmental factors such as celebrations or when eating out makes it difficult to limit alcohol intake (normative belief). Although not evident from the current research, Ajayi et al. (2019) mention that growing up in home environments where family members enjoy drinking wine may have promoted higher alcohol use in their children.

In line with findings by Walsh et al. (2018), some students believed that noise, especially in the university residences (parties at other residences, noisy people in corridors) was a barrier to sleeping enough, while some believed that living privately (not in a university residence) may be a facilitator for getting enough sleep (control belief). Beliefs that access to social media and watching series (available technology) may be barriers to getting enough sleep also emerged (also mentioned by Buboltz et al., 2009), while control of use of such media was believed by some to be a facilitator of getting enough sleep (control belief). Social media, with the ever present promotion of the thin beauty ideal for women, was also believed to impact on body shape satisfaction (normative belief). Malinauskas et al. (2006) also reported that female tertiary level students reported feeling pressure to lose weight as a result of media (as well as themselves).

Physical environmental factors such as lack of actual facilities, lack of transport to facilities, cost, safety considerations and weather have been found to be barriers to performing physical activity in research in tertiary level students (LaCaille et al., 2011; Deliens et al., 2015). In line with this, some students in the current research believed that not having transport to a gym, the superficial atmosphere in gyms that affect body shape satisfaction negatively, exercising outdoors or exercising alone may be barriers to exercising (control belief). Some students believed that having access to a car would make it easier to get to gym since it is safer than walking, especially if they have to travel far to get to gym (control belief). Some students believed that walking outdoors is the best form of exercise since anyone can do it

with or without having access to a gym. However, this belief should be considered within the context of the weather and safety concerns (control belief). These may be well be factors that contribute to low levels of physical activity in young females, specifically in South Africans due to poor walkability, feeling unsafe to be active outdoors or poor access to recreational facilities (Papas et al., 2007; NYRBS, 2008).

Financial concerns emerged as a final theme regarding environmental barriers to and facilitators for healthy eating, alcohol use and physical activity as weight gain prevention behaviours. Students believed that affordability of healthy food, specifically the high cost of fruit and vegetables, may be a barrier to health eating (also found by Munt et al., 2017; Sogari et al., 2018); some believed that it was more affordable to buy convenience foods (also found by LaCaille et al., 2011; Sogari et al., 2018) (control belief). Only one student believed that healthy eating can be affordable. A further belief that emerged related to having to pay for a gym contract being a barrier to physical activity (control belief). Some believed that offering a free gym membership or an increase in allowance would facilitate physical activity (control). Of note is that one student believed that certain exercises could even just be done at home if students do not have access to a gym membership, a sentiment that may become an important message in physical activity interventions. One positive of limited finances that emerged is the belief that it would be helpful in limiting alcohol use (control belief).

Responses to questions that involved beliefs relating to the overarching experiences of the first year at the tertiary institution as such showed that a few students believed that the first year was a challenge in itself, which has been well reported in the literature as a difficult transition (Kantanis, 2000; Nourse et al., 2017; Lazaverich et al., 2018; Haidar et al., 2018; Lyzwinski et al., 2019). Beliefs relating to specific challenges that first year female students may experience involved weight management problems (most prominent), self-esteem issues and emotional issues (behavioural belief). One student believed that health was no longer a priority (considering all the other challenges that they were facing) (behavioural belief). The focus of beliefs on weight management problems comes as no surprise as a

substantial body of evidence shows that tertiary level students, specifically first year female students, are prone to weight management problems (Hovell et al., 1985; Senekal et al., 1988; Senekal, 1994; Megel et al., 1994; Graham et al., 2002; Anderson et al, 2003; Malinauskas et al., 2006; Lloyd-Richardson et al., 2009; LaCaille et al., 2011; Fayet et al., 2012; Smith- Jackson & Reel, 2012; Nikolaou et al., 2015; Vadeboncoeur et al, 2015; Senekal et al., 2016; Sogari et al., 2018).

Finally, responses to questions on appropriate weight gain prevention and weight loss strategies showed that beliefs focused on promotion of psychological well-being (specifically self-esteem, self-control, willpower and positive thoughts), healthy behaviours by making use of behaviour change strategies (specifically self-monitoring and goal setting), support (specifically from family, peers and senior students who have gone through the first year experience themselves), knowledge (specifically how to cook and weight loss information), planning and time management skills (specifically creating a schedule for exercise), eating regularly to prevent hunger, considering second servings carefully, having things to do if you have free time on your hands and controlling spending on unnecessary foods (leaving wallet at home to avoid the temptation). All the options mentioned as part of the beliefs can be considered healthy options. Extreme methods such as detox diets or cutting out specific foods completely only emerged as beliefs relating to weight loss options. Results from previous research in South African tertiarly level students also shows that students mostly used healthy options when they attempted weight loss, including increasing exercise, increasing fruit and vegetables, decreasing high fat foods, decreasing sugary foods and fizzy drinks (Senekal et al. 2001, Senekal et al. 2016).

3.5 Limitations of the study

The findings of this research need to be viewed within the context of the study limitations. Qualitative research is inherently structured in such a way that

representation of a target sample is not a consideration. The sampling strategy applied in this research was purposeful, thus the most productive sample to answer the research question was selected as suggested by Marshall (1996). It is therefore important to interpret the results as qualitative insights and not as representative of characteristics of first year female students at the three universities. A further consideration is that the purposive sampling might have drawn students who were interested in the research topic and selection bias may thus be present. The greater representation of university residence students in the sample may have impacted on the number of mentions of barriers and facilitators specifically related to university residence life, but as qualitative investigation does not assign importance to frequency of mentions per se, and interviews were analyzed until data saturation was achieved, this is not deemed to be a concern.

3.6 Conclusions

Key conclusions of this research are that beliefs held by a multicultural sample of first year female students from three South African universities about weight gain prevention behaviours and weight related constructs show that the students have some awareness of the recommendations, benefits and importance of healthy eating, adequate physical activity and sleep time. They also have an awareness of the negative consequences of unhealthy eating, low levels of physical activity and lack of sleep. However, beliefs that reflected lack of concern regarding unhealthy eating and inadequate sleep were also evident. Although beliefs relating to consequences of excessive alcohol use emerged, it is clear that the amount of alcohol students believed they could drink was above recommendations (at levels where they were already inebriated), the benefit of this seemingly believed to be improved self-esteem, stress relief and socialising. Lack of concerns about unhealthy lifestyle behaviours could contribute to justification for and further entrenchment thereof, compromising potential weight gain prevention actions during a female student's first year at a tertiary institution.

It is also concluded that numerous potential facilitators of meeting weight gain prevention lifestyle recommendations emerged from the students' beliefs. These include having a high or low self-esteem; body shape dissatisfaction or satisfaction; low or high stress levels; low levels of depression and anxiety; at times negative emotions; feeling in a good mood; being responsible, disciplined, motivated and having passion; having sufficient time and being able to plan ahead; having access to healthy food options on campus and in university residences (physical and financial access); having access to cooking facilities; having access to easy, affordable, safe and enjoyable exercise options; being physically active; having sufficient finances; living privately, in a self-catering university residence or at home with parents; understanding the functioning of your body; having support from family, friends and peers; and making use of behavioural change strategies such as self-monitoring, goal setting and self-rewarding.

It is further concluded that numerous potential barriers to meeting weight gain prevention lifestyle recommendations emerged from the students' beliefs. These barriers include both body shape dissatisfaction or satisfaction; both high or low self-esteem; high stress levels; anxiety, sadness and depression; boredom; physical factors such as feeling tired, hungry, menstruating, unawareness of how the body functions, poor health per se, bland taste of healthy food, stimulant use and actual weight (mostly being overweight but also underweight); lack of knowledge and skills relating to healthy eating and physical activity; lack of time and no/poor planning relating to physical activity, healthy eating and sleep time; no/poor access to motorized transport, physical activity opportunities and sufficient finances; unhealthy food options on campus or at university residences; easy access to alcohol (on campus and when socialising); social media use (time consuming and increased exposure to promotion of stereotyped beauty ideals); noise, especially in university residences, and lack of support from family, peers and friends.

Bearing in mind the potential barriers and facilitators to weight gain prevention that emerged from the in-depth interviews with first year female students it is

recommended that the following should be emphasized in further elements to be combined with the self-help weight management manual for female students by Senekal (2005): promotion of body shape satisfaction and self-esteem; stress management; prevention/management of depression/anxiety and negative emotions; engendering support, specifically from family, peers and senior students who have gone through the first year experience themselves; and knowledge and skills relating to healthy alcohol use recommendations, cooking affordable healthy food, exercise options (easy, affordable and enjoyable), planning and time management skills and finally making use of behaviour change strategies such as self-monitoring and goal setting.

4. PHASE 2: QUANTITATIVE

Weight gain prevention belief patterns, associated factors and predictors in first year female students at three South African universities

4.1 Introduction

The prevalence of obesity worldwide is continuously rising and is a global public health concern (Machado et al., 2012; Adeboye et al., 2012; Jensen et al., 2014; De Vos et al, 2015; WHO, 2015; Chooi et al., 2019). The global prevalence of overweight and obesity has been increasing in the younger age groups, with young adults being no exception (Racette et al., 2005; Lloyd-Richardson et al., 2009; LaCaille et al, 2011; Wing et al., 2013; Grave et al., 2013; Quick and Byrd-Bredbenner; 2013; Flegal et al., 2016; Ogden et al., 2016; Swanson, 2016; Zheng et al., 2017; Dietz et al., 2017; Shi et al., 2018). The 2012 South African National Health and Nutrition and Examination Survey (SANHANES) showed that obesity among females aged 18 to 24 years was 21.7% and overweight 25.3%, while obesity among males in this age group was 4.2% and overweight 5.8% (Shisana et al., 2013). The 2016 South African Demographic and Health Survey (SADHS) showed that overweight among females aged 15 to 24 years was 24.4% and obesity 15.5%, while overweight among males in this age group was 8.9% and obesity 2.3% (National Department of Health et al., 2016). Furthermore, the SADHS showed that overweight among females aged 15 and older was 27% and obesity 41%, while overweight among males was 20% and obesity 11% (National Department of Health et al., 2016). Females are a specific target in this research given the higher prevalence of overweight and obesity compared to males in both younger and older age groups in South Africa.

Research has shown a prevalence of overweight (4.1 to 22.2%) and obesity (1 to 15.8%) in female tertiary level students both nationally (South Africa) and internationally (Senekal et al., 2001; Cilliers et al., 2006; Malinauskas et al., 2006;

Kim & Lee, 2010; Nikolaou et al., 2015; Senekal et al., 2016; Peltzer & Pengpid, 2017; Lazaverich et al, 2018).

Research published over more than three decades shows that globally female students, specifically first year students, were, and still are prone to weight gain during the time they spend at a tertiary education institution (Hovell et al., 1985; Megel et al., 1994; Graham et al., 2002; Anderson et al, 2003; Malinauskas et al., 2006; Lloyd-Richardson et al., 2009; LaCaille et al., 2011; Fayet et al., 2012; Smith-Jackson & Reel, 2012; Nikolaou et al., 2015; Vadeboncoeur et al, 2015). A similar pattern has been documented in South Africa (Senekal et al., 1986; Senekal et al., 1988; Senekal, 1994; Senekal et al. 2018).

Weight gain is caused by a positive energy balance when dietary energy intake is greater than energy expenditure (Hall et al., 2011; Lysen & Israel, 2012; Hill et al., 2013; Romieu et al., 2017; Chooi et al., 2019), which can result from an interaction between genotype and environment, including lifestyle patterns and psychosocial influences (Hill et al., 2013; Romieu et al., 2017; Hartmann- Boyce et al., 2017; Sogari et al., 2018; Chooi et al., 2019; Wilding et al., 2019; Chapelot & Charlot, 2019). First year female students may be specifically vulnerable to weight gain as a result of their transition from school to a tertiary institution (Mueller et al., 2018; Sogari et al., 2018). This is known to be a difficult stage in adult development as students need to adapt to a new environment that brings with it new social, psychological and academic challenges and pressures, changes in routine, as well as a newly found sense of independence (Cilliers et al., 2006; Fayet et al., 2012; Vadeboncoeur et al., 2015; Crombie et al., 2009; Patrick et al., 2014).

It is evident from published research that particular weight management behaviours may characterize female students, including low levels of physical activity (Deliens et al., 2015; Plotnikoff et al., 2015; Yahia et al., 2016; Peltzer & Pengpid, 2017; Walsh et al., 2018); unhealthy eating patterns (Lazaverich et al., 2013; Brown et al; 2014; Yahia et al., 2016; Mueller et al., 2018; Lazaverich et al., 2018), frequent binge drinking (Peltzer & Pengpid, 2016; Battista & Leatherdale, 2017; Yi et al., 2017;

Nourse et al., 2017; Ajayi et al., 2019); and inadequate sleep (Buboltz et al., 2001; Buboltz et al., 2009; Sing & Wong, 2010; Vargas et al., 2014; Walsh et al., 2018; Wang et al., 2019). Female students have also been characterized by distorted body image and being dissatisfied with their weight (Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018) dietary restraint, uncontrolled and emotional eating (Lazaverich et al, 2013; Crockett et al., 2015; Lazaverich et al., 2016; Bourdier et al., 2018; Constant et al., 2018; Hootman et al., 2018); stress (Serlachius et al., 2007; Hunt & Eisenberg, 2010; Fayet et al., 2012; Gardner et al., 2013; Haidar et al., 2018; Lyzwinski et al., 2019); depression/anxiety (Lazaverich et al., 2013; Peltzer & Pengpid, 2015; Asante & Andoh-Arthur, 2015; Mazurek Melnyk et al., 2016; Nourse et al., 2017; Lazaverich et al., 2018) and low self-esteem (Senekal et al., 2001; Cillers et al., 2006; Cristiana, 2016).

Numerous potential barriers to implementing healthy weight gain prevention behaviours by female students i.e. meeting recommendations for healthy eating, physical activity, alcohol use and sleep, as well as managing one's psychological well-being, have been reported. In line with the socio-ecological model proposed by McLeroy et al. (1988) these barriers include intrapersonal, interpersonal, institutional and community level factors. Intra-individual factors that contribute to poor lifestyle behaviours in female students include lack of relevant knowledge and skills (Ashton et al., 2017, Sogari et al., 2018); preference for the taste of unhealthy foods (Hilger et al., 2017; Sogari et al, 2018); fatigue and physical health problems that prevent performance of healthy behaviours (Buboltz et al., 2009); partying and substance abuse (Butler et al., 2010; Deasey et al., 2014; Cox et al., 2019); psychological and behaviour problems such as low self-esteem, poor body-image, stress, depression, anxiety, lack of self-responsibility, lack of motivation, lack of a set routine (disorganized lifestyle) and perceived lack of enjoyment of healthy behaviours (Munt et al., 2017; Nourse et al., 2017; Sogari et al., 2018; Lazaverich et al., 2018). Inter-individual level barriers to weight gain prevention behaviours mainly focus on negative support or modelling from peers/friends (Ashton et al., 2017; Wilkinson & Ivsins, 2017; DiGuiseppi et al., 2018; Sogari et al., 2018; Cox et al., 2019) and parents (Deliens et al., 2015; Sogari et al., 2018; Ajayi et al., 2019), as well as

socialising activities (Buboltz et al., 2009; Walsh et al., 2018; Wang et al., 2019; Cox et al., 2019). The freedom from parental monitoring and control is also reported by many students as a barrier to having a healthy lifestyle when away from home (Boekeloo et al., 2009; Wicki et al., 2010).

Various aspects of the university residence environment constitute institutional (tertiary institution) level barriers to healthy lifestyle behaviours. These include the type of meals served, perceived unlimited availability of food (Ashton et al., 2017; Munt et al., 2017; Shi et al., 2018; Walsh et al., 2018), poor access to cooking facilities (Sogari et al., 2018) and easy access to alcohol (Wilkinson & Ivsins, 2017) in university residences. The noisiness in university residences as a result of others partying late and returning to university residence late at night is also a common barrier (Walsh et al., 2018). However, Brunt et al. (2008) mention that living off campus may also increase risk for alcohol use as a result of more freedom. Further barriers that arise from the tertiary education setting involves academic actives and schedules that are seen to be time consuming and stressful, resulting in poor eating patterns, reduced physical activity and lack of sleep (Buboltz et al., 2009; Small et al., 2013; Deliens et al., 2015; Blake et al., 2017; Walsh et al., 2018; Sogari et al., 2018).

Community level barriers evident from the literature include perceived lack of healthy food options and high cost of healthy foods per se versus the easy accessibility and affordability of energy dense drinks, snacks and meals (Munt et al., 2017; Shi et al., 2018; Sogari et al., 2018; Walsh et al., 2018). Physical environmental factors that may constitute barriers to a healthy lifestyle include poor walkability (built environment), feeling unsafe to be active outdoors, poor weather and poor access to recreational facilities (availability, transport and cost factors)(Deliens et al., 2015; Blake et al., 2017; Lazaverich et al., 2018). Easy internet access and technology (Deliens et al., 2015) on and around campus settings promote spending time surfing the web, reducing sleep time and other essential activities to ensure academic performance and health (Buboltz et al., 2009; Walsh et al., 2018; Wang et al., 2019).

Numerous weight gain prevention related beliefs emerged from the in-depth interviews with first year female students conducted by Lasker (Chapter 3 of this dissertation). The aim of this study was to generate belief patterns held by first year female students on weight gain prevention; to investigate the association thereof with weight gain prevention behaviours (dietary patterns, physical activity, alcohol intake and sleep time), weight gain related constructs (eating behaviour, body shape dissatisfaction, stress, self-esteem and symptoms of depression/anxiety), as well as body mass index (BMI), past weight loss and gain prevention attempts, and perceived weight history; and to identify significant predictors of the belief patterns. The results will provide further insights for consideration to advise what an additional component to the self-help weight management manual by Senekal (2005) should focus on to enhance the weight gain prevention impact thereof.

4.2 Methods and Procedures

4.2.1 Target population and study sample

The target population for this study was English speaking 18-20-year old first year female students who were registered for the first time for a qualification at University of Cape Town (UCT), Stellenbosch University (SU) or the University of the Western Cape (UWC). Students who were pregnant, breastfeeding, elite athletes, following dietary restrictions for a medical condition, or had a disease that may influence their weight, were not eligible for participation.

The study sample size was determined using the proportion option of the OpenEpi Calculator. The proportion of students who were found to have high levels of body shape concerns, namely 11.9% (Cilliers et al. 2006) and a precision of 5% resulted in an estimated sample of 162 at a confidence level of 95% . The aim was to recruit 60 students from each of the three universities, thus oversampling with 10%. The convenience sampling technique was applied. This sampling technique limits external validity and may favour those who are interested in weight related

information/issues. A final convenience sample of 168 students who met the inclusion criteria was attained.

Recruitment actions that were rolled out included the following:

1. Fieldworkers approached female students in busy areas on campus to hand out information sheets (See Addendum C) and field any questions of interested FYFS.
2. Posters providing information on the study were put up in university residences and on campus (see Addendum E).
3. Recruitment by word of mouth was also encouraged, thus requesting students who were approached on campus to inform their friends of the study to distribute the information sheet to their friends.
4. Interested students were provided with more information about the study (See Addendum C). Volunteers proceeded with the completion of the consent forms, questionnaires and anthropometric measures.

4.2.2 Measures

A self-administered questionnaire was developed for the purposes of this research. The process that was followed in the development of the questionnaire firstly involved constructing a theoretical framework starting with the core concepts of the study (weight management related behaviours and constructs). The theoretical framework was reviewed by nutrition experts (M candidate and two senior researchers with PhDs) to ensure construct and content validity. The second step involved the identification of validated instruments for the assessment of select concepts and the development of questions to cover the remaining concepts. The third step involved construction of a draft questionnaire. The draft questionnaire was reviewed by the two senior research experts for content and face validity. An outline of the sections included in the questionnaire is presented in Table 4.1 and the full questionnaire is included in Addendum F:

Table 4.1 Outline of questions included in the questionnaire

Questionnaire section	Published instrument/ questions used	Reference
Personal information and health history	Questions	Senekal et al. (2016)
Weight and weight loss history	Questions	Senekal et al. (2016)
Dietary and meal patterns	Non Quantified Food Frequency (NQFFQ) Meal pattern question	Seme et al. (2017) Senekal et al (2016)
Physical activity	International Physical Activity Questionnaire (IPAQ)	Craig et al. (2003)
Sleep	Behaviour Risk Factor Survey	CDC (2009)
Body shape	8-item Body Shape Questionnaire (BSQ-8C)	Evans & Dolan (1993)
Eating Behaviour	Three Factor Eating questionnaire-R18 (TFEQ-R18)	Karlsson et al. (2000).
Stress	Cohen 14-item Perceived Stress Scale (PSS-14)	Cohen et al, 1983
Self-esteem	10-item Rosenberg Self-Esteem Scale (RSES)	Rosenberg (1965)
Depression and anxiety	10-item screening scale of psychological distress (K10)	Kessler et al. (2002).
Beliefs on weight gain prevention behaviours and weight-related constructs	31 statements derived from in depth interviews	Chapter 3 in this dissertation

Personal information and health history

This section in the questionnaire included age (date of birth); ethnicity (black, white, mixed ancestry, Indian, other); home language (English, Afrikaans, Xhosa, other), current living situation (private residence, university residence, other); mother's and father's education (no formal education, primary school, secondary school, university degree/technical university degree, technical university/college diploma, post-graduate degree); previous pregnancies (yes, no); and number of previous pregnancies.

Weight and weight loss history

This section in the questionnaire included self-reported current weight and height for calculation of current BMI for classification as underweight (BMI < 18.5 kg/m^2), normal weight (BMI ≥18.5; <25 kg/m^2), overweight (BMI ≥25;<30 kg/m^2) and obesity (BMI ≥30 kg/m^2) (WHO, 2005). Research shows that self-reported weight, height and BMI are generally strongly correlated with actual weight, height and BMI (r>0.9). However, researchers warn that subjects do tend to underestimate their weight,

with being female and heavier increasing the risk for underestimation. This may result in underestimation and misclassification of BMI (Niedhammer et al.,2000; Rossouw et al., 2000; Spencer et al., 2002; Gunnare et al., 2013; Yoong et al., 2013). Results of the classification of individuals according to BMI should therefore be interpreted with caution (Niedhammer et al., 2000; Rossouw et al., 2000; Spencer et al., 2002; Yoong et al., 2013). In this research that focused on identifying belief patterns relating to weight gain prevention behaviours and constructs and possible predictors, it was deemed that the advantage of using self-reported weight and height, namely increased willingness of students from all weight categories to participate if they were not being physically weighed as part of the research, outweighed the mentioned disadvantages. Furthermore, BMI was not used as a dependant variable in association analysis, as the focus was on identifying predictors of belief patterns.

Also covered in this section of the questionnaire were perception of own weight as a child, as an adolescent and at present (too thin, just about the right weight, too chubby/ fat, very overweight); weight loss attempt(s) in the year preceding the study, as well as during the year of the study and attempt(s) to prevent weight gain during the study year.

Dietary and meal patterns

Questions considered in decision making regarding the dietary intake methodology for identification of dietary patterns are depicted in Table 4.2.

Table 4.2. Information considered for decision making on dietary intake methodology for identification of dietary patterns

Question	Answer for this study
What is the aim of the dietary intake assessment (role in the study)	To identify dietary patterns and investigate associations with weight gain prevention belief patterns
What type of dietary data is needed	Data that can be used to generate usual dietary patterns during the students' time on campus using principal component analysis, thus the data must be food item based
Who is the respondent	It was assumed that FYFS have an advanced level of education
Respondent burden	The total questionnaire needed to be completed in a limited time period (no more than 20-30 minutes) to ensure sufficient participation; the dietary intake component thus needed to be as brief as possible

The non-quantified food frequency questionnaire (NQFFQ) developed by Seme et al. (2017) for primary school educators and adapted by Senekal et al. (2016) for use in female students was further adapted for the purposes of this study. The food list in the original questionnaire that focused mainly on healthy choices (fruit, vegetables and other fibre rich foods) and poor food choices (high fat foods and energy dense foods/snacks) was adapted to be more reflective of frequency of intake from all five food groups as outlined in the South African Food Based Dietary Guidelines (SAFBDG) (Vorster et al., 2013). Food items included in the NQFFQ questionnaire were: oranges, naartjies, grapefruit, guavas, strawberries; peach, apricot, mangoes, paw paw, melon; orange or yellow vegetables like sweet potato, pumpkin, butternut, carrots; green vegetables like spinach, peas, beans, broccoli; mixed vegetables including fresh, tinned or frozen; cabbage, cauliflower, lettuce; tomato; legumes like sugar beans, bake beans or lentils; white bread, rolls, pita bread, wraps; brown, whole wheat or rye bread or rolls; breakfast cereals like All Bran, Weetbix, whole wheat Pronutro; oats porridge; rice, pasta, samp, couscous, potato (mash/boiled); maize porridge; red meat like beef, mutton, pork, sausage or ostrich; processed and tinned meats like polony, viennas, Russians or bully beef; chicken; fresh, tinned or smoked fish; milk, sour milk or yoghurt; yellow cheese, spreads, cream cheese, cottage cheese; margarine, butter, lard or oil; peanut butter or peanuts, nuts or seeds; fried potatoes or slap chips; other fried foods like fat cakes,

fried fish, fried chicken; pies, sausage rolls, samoosas; take outs; sugar; chocolate; sweets e.g. boiled, lollipops, jelly; cake, biscuits, doughnuts; fizzy drinks like Coke, Cream Soda (not diet drinks) or sweetened fruit juice; crisps like Lays, Nik-Niks, papas, pretzels; jams, syrups, honey; and alcohol. Participants were required to indicate their frequency of intake of each food item during the preceding week.

Meal pattern was derived from a question on the frequency per week particular meals (breakfast, lunch and supper) and snacks (pre-breakfast snack, mid-morning snack, late afternoon snack and after dinner snack) were consumed.

Physical activity

The International Physical Activity Questionnaire (IPAQ) was selected to assess physical activity levels of students in this research as it measures habitual physical activity in minutes per week at three intensity levels i.e. mild (walking), moderate and vigorous activity (Craig et al., 2003). The questionnaire has demonstrated reliability, validity and sensitivity to change when compared to objective measures (Godin & Shephard, 1985) and has been used in a similar population of university students (Kattelman et al., 2014). The IPAQ questionnaire lists activities and requests estimates of durations and frequencies for each activity engaged in over the past week (Kattelman et al., 2014). The standard scoring protocol was used to convert this data into metabolic equivalents (MET-minutes) per week to generate total, inactivity (<=599), moderate activity (600-2999) and vigorous activity (>=3000) (Craig et al, 2003).

Sleep time

Sleep was assessed using one question from the Behaviour Risk Factor Survey (CDC, 2009) that has been used previously in a similar population of university students (Kattelman et al., 2014). The question was as follows: ‘‘Think about the time you actually spend sleeping or napping, not just the amount of sleep you think you should get. On average, how many hours of sleep do you get in a 24-hour period?’’ (CDC, 2009). Answers were recorded as daily hours of sleep.

Eating behaviour

Eating behaviour was assessed using the Three Factor Eating questionnaire-R18 (TFEQ-R18) developed by Karlsson et al. (2000). This is a shortened and revised derived from the 51-item eating inventory developed by Stunkard and Messick (1985). This revised short version was selected for this research as it is a validated instrument with a lower respondent burden than the 51-item TFEQ (Karlsson et al., 2000). The TFEQ-R18 has been shown to be valid in a student population (Hyland et al., 1989), as well as in a general population without obesity (De Lauzon et al., 2004). The questionnaire covers three dimensions of eating behaviour, namely cognitive restraint, uncontrolled eating, and emotional eating (De Lauzon et al., 2004). The TFEQ-R18 consists of 18 items on a 4-point response scale and is scored as follows: definitely true: 4; mostly true: 3; mostly false: 2 and definitely false: 1. Scores were summated into scale scores for cognitive restraint, uncontrolled eating, and emotional eating. The raw scale scores were transformed to a 0–100 scale [(raw score − lowest possible raw score)/possible raw score range) × 100]. Higher scores in the respective scales are indicative of greater cognitive restraint, uncontrolled, or emotional eating (De Lauzon et al., 2004). The Cronbach Alpha Coefficient for the TFEQ-R18 was 0.82 for the study sample.

Body shape satisfaction

The 8-item Body Shape Questionnaire (BSQ-8C) developed by Evans and Dolan (1993) was selected for this research to measure first tear female students' concerns about body shape. The BSQ-8C is a shortened version of the original 34-item body shape questionnaire (BSQ) developed by Rosen et al. (2006) with a reduced respondent burden. The BSQ-8C has shown good test-retest reliability and validity and is considered to be a valuable instrument for measuring body dissatisfaction among young adult women (Welch et al., 2012). The questions refer to the subject's state over the past four weeks and are answered on a 6-point scale, from "never" to "always," scored incrementally from 1 to 6 (Welch et al., 2012). A higher score indicates more body dissatisfaction. The highest possible score on the BSQ-8C is 48 (Welch et al., 2012). For data analysis, the mild and moderate concern with body shape categories were collapsed. A score below 19 indicates no concern with body

shape, a score less than or equal to 33 indicates mild to moderate concern, and a score above 33 indicates major concern with body shape. The Cronbach Alpha Coefficient for the BSQ-8C was 0.93 for the study sample.

Self- esteem

The 10-item Rosenberg Self-Esteem Scale (RSES) was selected for this research as it and has been used to in a similar population of university students (Robins et al., 2001). This instrument is a valid and reliable and the most widely used measure of global self-esteem (Gray-Little et al., 1997). The scale measures both positive and negative feelings about the self. All items were answered using a 4-point Likert scale format (strongly agree, agree, disagree, strongly disagree), (Rosenberg, 1965). A score $\leq$ 15 indicated a low self-esteem, 15 to 25 an average self-esteem, and 25 to 30 a high self-esteem (Psychological Science 2011). The Cronbach Alpha Coefficient for the 10-item Rosenberg Self-Esteem Scale was 0.88 for the study sample.

Stress

The Cohen 14-item Perceived Stress Scale (PSS-14) was selected for this research as it has been shown to have substantial reliability and validity (Cohen et al., 1983) and has been used previously in a similar population of university students (Kattelman et al., 2014). This scale assesses the extent to which individuals consider their situations to be stressful (Mikolajczyk et al., 2009). The items in the questionnaire query how unpredictable, uncontrollable and overloaded respondents find their lives using a 5-point Likert scale (ranging from 0- never to 4-very often) (Mikolajczyk et al., 2009). A score of 0 to 13 indicated low stress, 14 to 26 moderate stress and 27 to 40 high stress (Mikolajczyk et al., 2009). The Cronbach Alpha Coefficient for the PSS-14 was 0.83 for the study sample.

Presence of symptoms of depression and anxiety

The presence of anxiety and depressive symptoms was assessed using a 10-item questionnaire developed by Kessler et al. (2002) (K10). This questionnaire was selected for this research as it is a reliable, widely used scale with consistent

psychometric properties across major sociodemographic subsamples (Kessler et al, 2002). It has also been used previously in a sample of university students (Stallman, 2010). This questionnaire measured the distress of students by asking questions about anxiety and depressive symptoms experienced in the last month (Kessler et al., 2002). Each question was scored as prescribed and summed to generate a total score that could range from 10 to 50. The final scores were classified using criteria set by Andrews and Slade (2001): Score < 20: likely to be well; 20-24: likely to have a mild mental disorder; 25-29: likely to have a moderate mental disorder, >= 30: likely to have a severe mental disorder. The Cronbach Alpha Coefficient for the K10 was 0.89 for the study sample.

Beliefs on weight gain prevention behaviours and weight-related constructs

Belief statements relating to weight gain prevention behaviours and weight related constructs were generated from the data obtained in the qualitative component of this research (Chapter 3). The following steps were executed to identify the beliefs that to be included in the cross-sectional questionnaire:

- Key salient beliefs that emerged from the in-depth interviews were listed.
- An expert panel of four dietitians experienced in weight management and behaviour change research and the candidate considered the listed beliefs in terms of focus (weight management prevention behaviour and/or construct related) and the number of times it was mentioned. In line with the recommendation by Kreuger and Casey (2009:121), namely "Although we pay attention to how frequently something is said, it is a mistake to assume that what is said most frequently is most important. Sometimes a key insight might have been said only once in a series of groups. You have to know enough about what you are studying to know a gem when it comes along. One person may be a visionary thinker and identify something that no one else has spotted or thought about yet", the number of times a belief was cited was considered, but was not the definitive factor in selection of beliefs to be included in the cross-sectional questionnaire.

The mentioned expert panel in collaboration with two female students who were in their first year at the time of the study developed a belief statement for each belief on the final list (Table 4.3). The guidelines published by Azjen (2014) for formulation of belief statements were applied in this process. This process contributed towards ensuring content and face validity of the statements. The belief statements were pilot tested on five first year female students to assess readability, understanding and interpretation (also contributed face-validity).

Table 4.3: Final list of belief statements included in the cross-sectional questionnaire:

	Belief statement	**TBP belief category**
1	Eating less carbohydrates would help me to manage my weight.	Behaviour
2	Carbohydrates should be part of a balanced, healthy diet.	Control
3	Eating less fruit would help me to manage my weight.	Behaviour
4	Eating more protein would help me to manage my weight .	Behaviour
5	Skipping meals would help me to manage my weight.	Behaviour
6	Planning my meals and snacks ahead would help me to manage my weight.	Behaviour
7	Vegetables can be tasty.	Control
8	Sticking to a healthy diet plan would be easy for me.	Control
9	There are no forbidden foods.	Control
10	Healthy eating can be enjoyable.	Behaviour
11	It is difficult not to overeat.	Control
12	Being awake at night may increase how much I eat.	Control
13	The lack of healthy food options at university makes it difficult for me to manage my weight.	Control
14	My peers would judge me if I made healthy food choices when socializing.	Normative
15	Socializing makes it difficult for me to manage my weight.	Control
16	It would be easier for me to manage my weight if the people around me also eat healthy.	Normative
17	Healthy eating can be affordable.	Control
18	Knowing how to prepare my own meals would help me to manage my weight.	Control
19	Preparing my own meals would take a lot of time.	Control
20	Feeling fat makes it difficult for me to manage my weight.	Control
21	Feeling stressed/anxious makes it difficult for me to manage my weight.	Control
23	Mindless eating makes it difficult for me to manage my weight.	Control
24	Counting calories would help me to manage my weight.	Behaviour
25	Exercise is important for weight management.	Behaviour
26	Feeling fat would cause me to feel less comfortable to exercise.	Control
27	I can make time in my day for exercise.	Control
28	Feeling stressed/anxious reduces my desire to exercise.	Control
29	Feeling sad/depressed reduces my desire to exercise.	Control
30	Drinking alcohol would make it difficult for me to manage my weight.	Behaviour
31	Having a poor self-image makes it difficult to manage my weight.	Control

TBP: theory of Planned Behaviour (Azjen, 1991)
Behaviour belief: contributes to the development of a favourable or unfavourable attitude toward the behaviour
Normative belief: results in subjective norm
Control belief: gives rise to perceived behavioral control

Participants were requested to rate each belief statement on a five-point Likert scale i.e. strongly disagree, disagree, neutral, agree and strongly agree.

The complete questionnaire (Addendum F) was pilot tested on two first year female students for face validity and duration of completion, which was found to be approximately 30 minutes.

4.2.3 Data collection procedures

MMedSci in Nutrition students and registered dietitians were trained to conduct the fieldwork. Recruited participants could either complete the consent procedure and questionnaire immediately following recruitment, or at a time and place that was convenient for them. On completion of the informed consent procedure students were given a hard copy of the questionnaire to fill out in the presence of the fieldworker. On completion of the questionnaire the fieldworker checked it and clarified any points with the participant before she left. All questionnaires were checked again by the candidate and any questions that arose were resolved with the fieldworkers.

4.2.4 Statistical analysis

The data was captured in an Excel spreadsheet, cleaned and descriptive analysis conducted using Statistica Version 13.5 for Windows (TIBCO Software Inc., USA)

The following data analysis steps were conducted:
Descriptive statistics included frequencies for categorical variables and means ± SD or medians and inter quartile range (IQR) for continuous variables depending on the normality of the data (tested using the Kolmogorov-Smirnov statistic).

The Pearson's Chi Square test was used to compare the categorical variable of self reported BMI and the categorical variables of current weight perception, weight loss and weight gain prevention attempts.

Dietary patterns were derived using principal component analysis (PCA) in SAS Version 9.4, SAS for Windows (SAS Institute, Cary, NC, USA). The principal axis method was used to extract the components, which was then followed by varimax rotation. The number of components (patterns) retained was determined by visual inspection of the screen plot; the eigenvalue (>1) and the dietary pattern interpretability as was done by Sprake et al. (2018) to identify dietary patterns of university students in the United Kingdom. In the current research food items with a factor loading >0.33 were used to interpret each retained dietary pattern. There is no universally accepted cut-off for factor loading. Marques-Vidal et al. (2018) for example used> 0.30 as cut-off eto characterize items loading on the dietary patterns of French speaking adults in Switzerland. A score for each retained dietary pattern was calculated for each participant for use in association analyses. These scores were estimated by creating linear composites of the observed variables, in this case the food items included in each dietary pattern, i.e. adding optimally weighted scores for each variable included in a pattern. This score represents the participant's position on the underlying pattern (O'Rourke & Hatcher, 2014).

All continuous variables, including BMI (kg/m^2) derived from self-reported weight and height, weekly frequency of intake of meals and snacks, dietary pattern scores, physical activity (total MET-minutes per week), time spent being sedentary (hours per day) sleep time (hours per night), TFEQ-R18 cognitive restraint score, TFEQ-R18 uncontrolled eating score, TFEQ-R18 emotional eating score, BSQ-8C score, PSS-14 score, RSES score and K10 score, were subsequently included in a Spearman correlation matric to investigate associations (Statistics Version 13.5).

Weight Gain Prevention (WGP) Belief patterns were also derived using principal component analysis (PCA). Beliefs with a factor loading of > 0.33 were used to interpret each retained belief pattern. A score for each retained belief pattern was

calculated for each participant as described above. The belief pattern scores were used as dependant variables in association and regression analyses.

A Spearman correlation matrix was constructed with the belief pattern scores and all the continuous variables mentioned above to investigate associations. These analyses were done using Statistica version 13.5. Comparison of WGP Belief Pattern scores for five categorical variables (tried to lose weight last year, tried to lose weight this year and tried to prevent weight gain this year; and perception of weight as child and as adolescent) were conducted using the Bonferroni Dunn-t test (two response options) or Bonferroni multi-comparison test (three response options) for normally distributed Belief Pattern scores and the Mann-Whitney U test (two response or Kruskall Wallis test for non-normally distributed Belief Pattern scores. These analyses were done using SAS version 9.4.

Predictors of each individual belief pattern score (dependant variables) were identified with logistic regression analyses using SAS version 9.4. Backward elimination was used to find the most appropriate model for each belief pattern. Independent variables included in the regression analysis included all the mentioned continuous variables, as well as the five categorical variables. Backward elimination addresses potential collinearity i.e. independent variables which are highly correlated e.g. with a correlation coefficient of 0.9 or above (Tabachnik & Fidell, 2014).

A p-value of <0.05 denoted significance for all analyses.

4.2.5 Ethical considerations

There was minimal risk for the subjects participating in this research and their safety was not compromised.

As the students were above the age of 18 years, they were able to give written consent to participate in the study without parental consent. The consent procedure involved a full written and verbal explanation of the research after which the subject signed the consent form (Addendum C). Ethical approval for the study was obtained from the University of Cape Town FHS-HREC (HREC-REF 324/2017) (Addendum G; renewal in Addendum H) . The principles of the Declaration of Helsinki (2013), Good Clinical Practice (GCP) and the laws of South Africa were adhered to in this research.

4.3 Results

4.3.1 Socio-demographic profile of first year female students

The mean±SD age of the sample (n=168) was 18.91±0.60. Only two students reported having been pregnant prior to the study. Almost half of the sample was black, with of the balance being either white or coloured (Table 4.4). More than half of the students' mothers and fathers had tertiary level education and only a few students had parents with no formal education. The majority (72%) of students in the sample lived in university residences at the time of the study (Table 4.4).

Table 4.4 Sociodemographic profile of the first year female students

Variable	Total group		Variable	Total group	
	n*			n*	
Race (Column %)	**168**		**Living situation (column %)**	**168**	
Black	82	48.8	Private	47	28.0
White	31	18.5	University Residence	121	72.0
Coloured	39	23.2			
% Indian	14	8.3			
% Other	2	1.2			
Mother's education (Column %)	**167**		**Father's education (Column %)**	**162**	
No formal education	1	0.6	No formal education	1	0.6
Primary school	2	1.2	Primary school	2	1.2
Secondary school	22	13.2	Secondary school	17	10.5
Matric	57	34.1	Matric	47	29.0
University degree/diploma	62	37.1	University degree/diploma	65	40.1
Post-graduate degree	23	13.8	Post-graduate degree	30	18.5

SD= Standard Deviation
*n varies due to missing values

4.3.2 Self-reported weight status, weight history and recent weight management attempts of first year female students

The mean±SD self-reported current weight was 64.3±14.9, height was 162.8±9.1 and BMI was 24.3±5.5 kg/m^2 (n=167). BMI categorization according to the WHO (2015) criteria showed that 10.2% of the students were underweight, 54.2% normal weight, 21.7% overweight and obesity was 13.9% . Total overweight and obesity was thus 35.6%. .

There was a shift in the proportion of students who perceived themselves to have been underweight by ten percent from childhood to adolescence and by a further ten percent by the time of the study (not necessarily the same students) (Table 4.5). About two thirds of the total group perceived their weight to be just about right

during childhood, adolescence and at the time of the study (Table 4.5). There was a shift in the proportion of students who perceived themselves to have overweight or obesity. This proportion was similar during childhood and adolescence, but had doubled by the time of the study (37%) (not necessarily the same students) (Table 4.5).

Table 4.5 Weight history of the first year female students

Variable	**Childhood weight perception**		**Adolescent weight perception**		**Current weight perception**	
	n		**n**		**n**	
Column %	**168**		**168**		**168**	
Too thin	36	21.4	19	11.3	5	3.0
Just about right	107	63.7	120	71.4	101	60.1
Too chubby	22	13.1	26	15.5	53	31.6
Very overweight	3	1.8	3	1.8	9	5.4

Of those students that were underweight, one fifth correctly perceived themselves to be underweight but the balance perceived their weight to be normal. Of those students that were normal weight, almost three quarters perceived their weight to be normal, one quarter percieved themselves to be too chubby and a few perceived themselves to be underweight. Of those that were overweight, just over half correctly perceived themselves to be too chubby, but just over a third underestimated their weight. Of those that were obese, just over one quarter perceived themselves to be very overweight, almost half perceived themselves to be too chubby and just over a quarter thought they were normal weight (Table 4.6).

Table 4.6 Current weight perception by BMI categories based on self-reported weight and height

BMI category	Underweight		Normal		Overweight		Obese		P value*
	n		n		n		n		
Current weight perception (Column %)	**17**		**90**		**36**		**23**		
Too Thin	3	17.7	2	2.2	0	0.0	0	0.0	0.000
Just about Right	14	82.4	66	73.3	13	36.1	6	26.1	
Too chubby	0	0.0	22	24.4	20	55.6	11	47.8	
Very Overweight	0	0.0	0	0.0	3	8.3	6	26.1	

* Pearson Chi Square

*n varies due to missing variables

Almost half of the students attempted to lose weight in the year preceding the study, just over half attempted to lose weight in the study year and half attempted to prevent weight gain in the study year (Table 4.7). Of those that were underweight, almost one fifth attempted to lose weight in the year preceding the study as well as in the study year and almost one third attempted to prevent weight gain in the study year. Of those who were normal weight, forty percent attempted to lose weight in the year preceding the study, just over half attempted to lose weight in the study year and just under half attempted o prevent weight gain in the study year. Of those that were overweight, three quarters attempted to lose weight in the year prior to the study as well as in the study year and just more than half attempted to prevent weight gain during the study year. Of those that were obese, just over half attempted to lose weight in the year prior to the study, just over two thirds attempted to lose weight in the study year and almost three quarters attempted to prevent weight gain in the study year (Table 4.7).

Table 4.7 Weight loss and weight gain prevention attempts by self-reported BMI categories (% yes)

BMI Category	Total		Underweight		Normal weight		Overweight		Obese		*P value
	n	%	n	%	n	%	n	%	n	%	
Weight loss attempts last year (Column %)	**166**		**17**		**90**		**36**		**23**		0.000
Yes	78	47.0	3	17.7	36	40.0	27	75.0	12	52.2	
Weight loss attempts this year (Column %)	**166**		**17**		**90**		**36**		**23**		0.001
Yes	92	55.4	3	17.7	47	52.2	26	72.2	16	69.6	
Weight gain prevention this year (Column %)	**166**		**17**		**90**		**36**		**23**		0.042
Yes	85	51.2	5	29.4	44	48.9	19	52.8	17	73.9	

*Pearson Chi Square
*n varies due to missing variables

4.3.4 Dietary and meal patterns

Four dietary patterns were retrieved from the NQFFQ data, including: Pattern 1: Sugary foods/drinks-'slap chips'-take-outs; Pattern 2: Fruits-vegetables-legumes; Pattern 3: Alcohol-fatty foods-fatty snacks-maize pap; and Pattern 4: Breakfast foods. The loading of individual food items on the four dietary patterns is depicted in Table 4.6. Combined, the four patterns accounted for 10.9% of the total variance.

Table 4.8 Loading of individual food items in the non-quantified food frequency questionnaire on the four dietary patterns

Food item	Pattern1: Sugary foods/drinks-'slap chips'[1]-take-outs	Pattern 2: Fruits-vegetables-legumes	Pattern 3: Alcohol-fatty foods-fatty snacks-maize pap	Pattern 4: Breakfast foods
Sweets e.g. boiled, lollipops, jelly	**0.73847**	0.02229	0.10877	0.06935
Crisps like lays, Nik-Naks, papas, pretzels	**0.71664**	-0.02346	0.28343	-0.04496
Cake, biscuits , doughnuts	**0.59566**	-0.07716	0.01393	0.16637
Fizzy drinks like Coke, Cream Soda (not diet drinks) or sweeteend fruit juice	**0.58377**	-0.03533	0.34112	-0.04716
Chocolate	**0.53661**	-0.00895	0.02835	0.10067
Fried potatoes or slap chips	**0.49927**	-0.03913	0.49729	-0.01808
Take outs (KFC, McDonalds)	**0.44695**	-0.02390	0.23696	0.11716
Sugar	**0.34550**	0.09319	0.03695	0.05237
Green vegetables like spinach, peas, beans, broccoli	-0.05252	**0.78319**	-0.24571	0.04624
Orange/yellow vegetables: sweet potato, pumpkin, butternut, carrots	-0.01243	**0.65785**	0.16693	0.07902
Mixed vegetables (fresh, tinned or frozen)	-0.00774	**0.61450**	-0.20356	0.05283
Tomato (raw or cooked)	0.07163	**0.51438**	0.23085	-0.05999
Cabbage, cauliflower, lettuce	0.06647	**0.47332**	-0.06577	-0.02658
Peach, apricot, mangoes, paw paw, melon	-0.02985	**0.46089**	0.03687	0.28088
Oranges, naartjies, grapefruit, guavas, strawberries	-0.10606	**0.44928**	0.14965	0.17580
Legumes like sugar beans, baked beans, lentils or chickpeas	0.00923	**0.35486**	0.02986	0.12566
Maize (pap)[2]	0.24066	0.14578	**0.66769**	0.13000
Alcohol	0.12103	0.13099	**0.60242**	-0.04175
Pies, sausage rlls, samoosas	0.22096	-0.11788	**0.54389**	0.02761
Other fried foods: fat cakes, fried fish, fried chicken	0.12744	-0.03965	**0.52777**	-0.01729
Margarine, butter, lard or oil	0.12232	0.30246	**0.37527**	0.29710
Cheese (yellow, spreads, cream cheese, cottage cheese)	0.13561	0.06003	-0.02330	**0.53232**
Milk, sour milk or yoghurt	0.06250	0.10921	-0.20021	**0.52913**
Breakfast cereals like All Bran, Weetbix, Wholewheat, Pronutro	0.23603	-0.01827	-0.22477	**0.52703**
Processed and tinned meats like polony, viennas, russians or bully beef	0.06700	0.06429	0.20832	**0.50063**
Breakfast cereals like cornflakes, rice crispies, muesli	0.25123	-0.02583	-0.21778	**0.41390**
Peanut butter or peanuts, nuts or seeds	0.00675	0.39584	0.20510	**0.40192**
Oats porridge	-0.06360	0.18281	0.12071	**0.39336**
Fish (fresh, tinned or smoked)	-0.04347	0.08411	0.26245	**0.38774**
Brown, wholewheat or rye bread, rolls, pita or wraps	-0.01112	0.32146	0.24565	**0.36813**
White bread, rolls, pita bread, wraps	0.25772	0.07328	0.33532	**0.33752**

[1]Slap chips= deep fried potato chips

[2]Maize pap = mealie meal (staple food in South Africa)

Lunch and dinner were the meals most commonly consumed by the students (Table 4.9). Breakfast was consumed by 80.5% at a median frequency of four times a week. Snacking between meals increased from early morning (34.5%) to late afternoon (84.5%) and then decreased slightly after dinner (78.6%). The median frequency of snacking followed the same pattern, increasing from morning to afternoon and then decreasing after dinner.

Table 4.9 Meal pattern of the first year female students (n=168)

(Column %)	% yes	Median(IQR) frequency/week
Pre-breakfast drink/snack	34.5	0 (0;2)
Breakfast	82.1	5 (2;7)
Mid- morning snack	64.9	2 (0;4)
Lunch	97.0	7 (5;7)
Late afternoon snack	84.5	4 (2;5)
Dinner	100	7 (7;7)
After Dinner snack	78.6	3 (1;6)

IQR: Inter quartile range

4.3.5 Eating behaviour, body shape concerns, stress, self-esteem and depression/anxiety of first year female students

The median(IQR) cognitive restraint score on the TFEQ-R18 was 44.4(33.3; 55.6), the mean±SD uncontrolled eating score was 49.2±20.7 and the mean±SD emotional score was 49.2±20.7 (n=163). The mean±SD BSQ-8C score was 25.05±11.06 (n=168), with 32.7% having no concerns with their body shape, 22.6% mild concerns, 23.2% moderate concerns and 21.4% marked concerns. The mean±SD PSS-14 score was 23.6±6.3 (n=167), with 30.5% having high stress, 65.3% moderate stress and 4.2% low stress levels. The mean±SD self-esteem score on the RSES was 19.01±5.61 (n=167), with 11.4% having a high self-esteem, 67.1% a moderate self-esteem and 21.6% a low self-esteem. The mean±SD K10 score was 27.33±7.86 (n=167), with 13.8% having been likely to be well, 29.9% to have a mild mental disorder, 23.4% to

have a moderate mental disorder and 32.9% to have a severe mental disorder (n varies due to missing values).

4.3.6 Physical activity, sedentary and sleep time of first year female students

The median MET-minutes score of the total group of students was in the minimally active range, with the majority of students being either minimally active or inactive (Table 4.10). The median vigorous activity score was zero minutes per day, with less than half meeting the recommendations for vigorous activity. Less than a third of students met the recommendations for general health in terms of moderate activity. The median time spent being sedentary was 7 hours and students slept a median of 7 hours per night.

Table 4.10 Physical activity and sleep by total group

Variable	**Total**	
Median IQR	**n**	
Sleep	165	7 (6;8)
Sedentary activity (hrs/day)	102	7 (5;10)
Minutes vigorous activity/day	130	0 (0;60)
Minutes moderate activity/day	118	0 (0;30)
Minutes walking/day	111	60 (30;120)
Minutes moderate + walking activity/day	142	60 (15;150)
Meets recommendation for moderate activity for health [1]	142	
% Yes	38	26.8
Meets recommendation for vigorous activity for health[2]	62	
% Yes	26	41.9
Total MET-minutes/week (Median IQR)	148	1640 (620;3630)
MET-minutes Score (Column %)	148	
Active (>=3000)	49	33.1
Minimally active (600-2999)	64	43.2
Inactive (<=599)	35	23.7

IQR= interquartile range; MET- minutes= metabolic equivalents x minutes

[1] *Recommendation: ≥150 minutes moderate activity/day (includes walking and moderate activity)*

[2] *Recommendation ≥ 75 minutes vigorous activity/day*

4.3.7 Associations between weight status, meal and dietary patterns, physical activity, sleep time, body shape satisfaction, eating behaviours, stress, self-esteem and depression/anxiety

A Spearman correlation matrix that depicts associations between BMI (kg/m^2) derived from self-reported weight and height, weekly frequency of intake of meals (breakfast, lunch and supper) and all snacks combined, the four Dietary Pattern scores, physical activity (total MET-minutes per week), sleep time (hours per night), TFEQ-R18 cognitive restraint score, TFEQ-R18 uncontrolled eating score, TFEQ-R18 emotional eating score, BSQ-8C score, PSS-14 score, RSES score and K10 score is presented in Table A: Correlation matrix (Addendum I). Significant associations are as follows:

A higher BMI was associated with a higher BSQ-8C score (body shape concern score) ($r=0.42$; $p<0.001$), a higher TFEQ-R18 emotional eating score ($r=0.23$; $p=0.006$), as well as a higher score on the K10 (presence of anxiety/depression symptoms) ($r=0.21$; $p=0.012$).

A higher frequency of eating breakfast was associated with a higher score for Dietary Patterns 2 (fruits, vegetables, legumes) ($r=0.22$; $p=0.008$) and Dietary Pattern 4 (breakfast foods) ($r=0.26$; $p=0.002$). A lower frequency of eating breakfast was associated with a higher score for Dietary Pattern 3 (alcohol-fatty foods-fatty snacks-maize pap) ($r=-0.26$; $p=0.002$) and higher BSQ-8C score (body shape dissatisfaction) ($r=-0.21$; $p=0.014$) and K10 (presence of anxiety/depression symptoms) ($r=-0.17$; $p=0.048$) scores.

A higher frequency of snacking per week was associated with a higher score for Dietary Pattern 1 (sugary foods/drinks, 'slap chips', take-outs) ($r=0.21$; $p=0.013$), as well as higher scores for TFEQ-R18 emotional ($r=0.37$; $p<0.001$) and TFEQ-R18 uncontrolled eating ($r=0.44$; $p<0.001$).

A higher score on Dietary Pattern 1 (sugary foods/drinks, 'slap chips', take-outs) was further associated with higher TFEQ-R18 emotional eating (r=0.02; p=0.019) and K10 (presence of anxiety/depression symptoms) (r=0.17; p=0.041) scores.

A higher score for Dietary Pattern 2 (fruits, vegetables, legumes) was associated with higher MET-minutes (physical activity) (r=0.17; p=0.044) and TFEQ-R18 cognitive restraint score (r=0.17; p=0.043).

A higher score for Dietary Pattern 3 (alcohol, fatty foods, fatty snacks, maize pap) was associated with a higher TFEQ-R18 score uncontrolled eating (r=0.20; p0.015) and a higher score on the K10 (presence of depression/anxiety symptoms) (r=0.19; p=0.028).

A higher score for Dietary Pattern 4 (breakfast foods) was associated with a higher RSES score (r=0.18; p=0.036) and a lower PSS-14 score (r=-0.17; p=0.046).

A higher total MET-minutes was associated with a higher RSES score (r=0.17; p=0.040).

A higher BSQ-8C score was associated with higher TFEQ-R18 cognitive restraint (r=0.30; p<0.001), TFEQ-R18 uncontrolled eating (r=0.28; p=0.001), TFEQ-R18 emotional eating (r=0.41; p<0.001), PSS-14 (r=0.46; p<0.001) and K10 (presence of anxiety/depression symptoms) (r=0.50; p<0.001) scores.

A lower RSES score was associated with higher scores on the BSQ-8C (r=-0.57; p<0.001), TFEQ-R18 cognitive restraint (r=-0.20; p=0.020), TFEQ-R18 uncontrolled eating (r=-0.24; p=0.004), TFEQ-R18 emotional eating (r=-0.33; p<0.001), PSS-14 (r=-0.54; p<0.001) and K10 (presence of anxiety /depression symptoms) (r=-0.67; p<0.001) scores.

A higher TFEQ-R18 uncontrolled eating score was associated with higher scores for TFEQ-R18 emotional eating (r=0.60; p<0.001), PSS-14 (r=0.20; p0.019) and K10 (presence of anxiety and depression symptoms) (r=0.29; p<0.001) scores.

A higher TFEQ-R18 emotional eating score was associated with higher PSS-14 (r=0.33; p<0.001) and K10 (presence of anxiety and depression symptoms) (r=0.35; p<0.001) scores.

A higher PSS-14 score was strongly associated with a higher K10 (presence of anxiety/depression symptoms) score (r=0.73; p<0.001).

4.3.8 Weight Gain Prevention Belief Patterns of first year female students

Four Weight Gain Prevention (WGP) Belief Patterns were retrieved from the belief data: Pattern 1: Barriers to weight management; Pattern 2: Facilitators of healthy eating and exercise, Pattern 3: Barriers to exercise, and Pattern 4: Social barriers to healthy eating. The loading of beliefs on the four dietary patterns is depicted in Table 4.9. Combined, the four patterns accounted for 35% of the total variance.

Table 4.11 Loading of beliefs on the four WGP Belief Patterns retrieved from the belief data

Belief statement included in the questionnaire	Pattern1: Barriers to weight management	Pattern 2: Facilitators of healthy eating & exercise	Pattern 3: Barriers to exercise	Pattern 4: Social barriers to healthy eating
21. Feeling stressed/anxious makes it difficult for me to manage my weight.	**0.64015**	0.21067	0.35428	-0.06962
22. Feeling sad/depressed makes it difficult for me to manage my weight.	**0.61961**	0.19068	0.30220	-0.08531
23. Mindless eating makes it difficult for me to manage my weight	**0.58114**	0.03930	0.28531	0.17073
12. Being awake at night may increase how much I eat.	**0.54141**	0.10663	-0.02381	0.04185
13. The lack of healthy food options at university makes it	**0.45565**	-0.05839	-0.02686	0.17019

difficult for me to manage my weight.				
19. Preparing my own meals would take a lot of time.	**0.43690**	-0.16466	0.10677	0.09648
20. Feeling fat makes it difficult for me to manage my weight.	**0.41684**	-0.05097	0.30325	0.20402
16. It would be easier for me to manage my weight if the people around me also eat healthy.	**0.38684**	0.16278	0.06511	0.33373
11. It is difficult not to overeat.	**0.35444**	-0.01250	0.10094	0.04767
8. Sticking to a healthy diet plan would be easy for me.	-0.24181	**0.63451**	-0.09200	-0.04618
10. Healthy eating can be enjoyable.	0.02096	**0.61811**	-0.16740	-0.06662
7. Vegetables can be tasty.	0.10149	**0.56544**	-0.04304	0.10904
17. Healthy eating can be affordable.	-0.17352	**0.50175**	0.18730	-0.08708
27. I can make time in my day for exercise.	-0.03194	**0.48555**	-0.09787	-0.10442
18. Knowing how to prepare my own meals would help me to manage my weight.	0.05468	**0.44675**	-0.03380	-0.04490
6. Planning my meals and snacks ahead would help me to manage my weight.	0.09876	**0.36764**	0.11206	0.12336
25. Exercise is important for weight management.	0.15591	**0.33211**	-0.03681	-0.02970
29. Feeling sad/depressed reduces my desire to exercise.	0.18353	-0.13177	**0.78465**	0.14279
28. Feeling stressed/anxious reduces my desire to exercise.	0.16541	-0.13047	**0.73459**	0.05528
31. Having a poor self- image makes it difficult for me to manage my weight.	0.13855	0.10492	**0.47510**	0.31921
26. Feeling fat would cause me to feel less comfortable to exercise.	0.27666	-0.12431	**0.45076**	0.16170
15. Socialising makes it difficult for me to manage my weight.	0.13220	-0.06690	0.08505	**0.65055**
14. My peers would judge me if I made healthy food choices when socializing.	0.03256	-0.15389	0.07763	**0.60797**
30. Drinking alcohol would make it difficult for me to manage my weight.	0.13804	0.04786	0.21529	**0.47365**

Beliefs that did not load on any factor: 1. Eating less carbohydrates would help me to manage my weight; 2. Carbohydrates should be part of a balanced, healthy diet; 3. Eating less fruit would help me to manage my weight; 4. Eating more protein would help me to manage my weight; 5. Skipping meals would help me to manage my weight; 9. There are no forbidden foods; 24. Counting calories would help me to manage my weight.

4.3.9 Predictors of WGP belief patterns of first year female students FYFS

Significant associations between the four WGP belief patterns and BMI (kg/m^2) derived from self-reported weight and height, weekly frequency of intake of meals (breakfast, lunch and supper) and all snacks combined, the four Dietary Pattern scores, physical activity (total MET-minutes per week), TFEQ-R18 cognitive restraint score, TFEQ-R18 uncontrolled eating score, TFEQ-R18 emotional eating score, BSQ-8C score, PSS-14 score, RSES score and K10 score is presented in Table 4.10.

A higher score for WGP Belief Pattern 1 (Barriers to weight management) was associated with a higher frequency of snack consumption, a higher score for Dietary Pattern 1 (Sugary foods/drinks-'slap chips'-take-outs), as well as higher BSQ-8C, TFEQ-R18 cognitive restraint, TFEQ-R18 uncontrolled eating, TFEQ-R18 emotional eating, PSS-14 and K10 scores. A higher score was also associated with a lower RSES score.

A higher score for WGP Belief Pattern 2 (Facilitators of healthy eating and exercise) was associated with a lower score for Dietary Pattern 1 (Sugary foods/drinks-'slap chips'-take-outs), a higher score for Dietary pattern 2 (fruits-vegetables-legumes), as well as higher Total MET-minutes and TFEQ-R18 cognitive restraint scores.

A higher score for WGP Belief Pattern 3 (Barriers to exercise) was associated with a higher BMI, a higher frequency of snack consumption, a higher score for Dietary Patterns 1 (Sugary foods/drinks, 'slap chips', take-outs) and 3 (alcohol, fatty foods, fatty snacks, maize pap), as well as higher BSQ-8C, TFEQ-R18 uncontrolled eating, TFEQ-R18 emotional eating, PSS-14 and K10. A higher score was also associated with a lower RSES score.

A higher score for WGP Belief Pattern 4 (Social barriers to healthy eating) was associated with higher BSQ-8C, TFEQ-R18 cognitive restraint and K10 scores. A higher score was also associated with a lower RSES score.

Table 4.12 Spearman's Rank correlation matrix for WGP Belief Patterns and BMI, meal pattern, dietary patterns, physical activity, eating behaviours, stress, self-esteem and depression/anxiety symptoms in first year female students

Variable*	Belief Pattern 1[1]	Belief Pattern 2[2]	Belief Pattern 3[3]	Belief Pattern 4[4]
BMI (kg/m^2)	r=0.1551 p=0.069	r=0.0926 p=0.280	**r=0.1832** **p=0.032**	r=-0.0466 p=0.587
Breakfast (times per week)	r=-0.1254 p=0.143	r=0.1396 p=0.103	r=-0.0057 p=0.947	r=0.0640 p=0.456
Snacks combined (times per week)	**r=0.2511** **p=0.003**	r=-0.0383 p=0.656	**r=0.1833** **p=0.031**	r=0.1075 p=0.210
Dietary Pattern 1	**r=0.1745** **p=0.041**	**r=-0.2134** **p=0.012**	**r=0.1816** **p=0.033**	r=-0.0720 p=0.402
Dietary Pattern 2	r=-0.0772 p=0.368	**r=0.3266** **p=0.000**	r=-0.1024 p=0.232	r=0.1226 p=0.152
Dietary Pattern 3	r=0.0630 p=0.463	r=-0.0908 p=0.290	**r=0.2136** **p=0.012**	r=-0.0600 p=0.485
Dietary Pattern 4	r=0.1050 p=0.220	r=-0.0461 p=0.591	r=-0.0206 p=0.811	r=-0.0203 p=0.813
Sleep (hrs/night)	r=-0.0348 p=0.685	r=0.0653 p=0.446	r=-0.0925 p=0.281	r=-0.0328 p=0.703
Total METS	r=-0.1622 p=0.057	**r=0.2629** **p=0.002**	**r=-0.1792** **p=0.035**	r=-0.1621 p=0.057
Body shape score[5]	**r=0.5516** **p=0.000**	r=0.0039 p=0.964	**r=0.3103** **p=0.000**	**r=0.2947** **p=0.000**
Cognitive restraint score[6]	**r=0.1708** **p=0.045**	**r=0.1993** **p=0.019**	r=-0.0830 p=0.333	**r=0.2785** **p=0.001**
Uncontrolled eating score[7]	**r=0.3459** **p=0.000**	r=-0.1253 p=0.143	**r=0.2642** **p=0.002**	r=0.1507 p=0.078
Emotional eating score[8]	**r=0.5180** **p=0.000**	r=0.0065 p=0.940	**r=0.2930** **p=0.000**	r=0.1083 p=0.206
Stress score[9]	**r=0.3195** **p=0.000**	r=-0.0896 p=0.296	**r=0.2888** **p=0.001**	r=0.0736 p=0.391
Self-esteem score[10]	**r=-0.4016** **p=0.000**	r=0.1193 p=0.163	**r=-0.3490** **p=0.000**	**r=-0.3431** **p=0.000**
Depress/anxiety score[11]	**r=0.3773** **p=0.000**	r=-0.0943 p=0.271	**r=0.3680** **p=0.000**	**r=0.2078** **p=0.014**

WGP= Weight Gain Belief Pattern; BMI=body mass index; MET= metabollic equivalent, Depress= depression

*There were no associations between any one of the Belief Patterns and time spent sleeping and time spent being sedentary

[1] WGP Belief Pattern 1: Barriers to weight management

[2] WGP Belief Pattern 2: Facilitators of healthy eating and exercise

[3] WGP Belief Pattern 3: Barriers to exercise

[4] WGP Belief Pattern 4: Social barriers to healthy eating

[5] 8-item Body Shape Questionnaire (BSQ-8C)

[6] Three Factor Eating questionnaire-R18 (TFEQ-R18)

[7] Cohen 14-item Perceived Stress Scale (PSS-14)

[8] 10-item Rosenberg Self-Esteem Scale (RSES)

[9] 10-item Kendall Questionnaire on presence of anxiety and symptoms of depression (K10)

Comparison of belief pattern scores between response options for weight gain prevention attempts this year, weight loss attempts this year and last year and perception of weight as a child and as an adolescent are presented in Table 4.13.

Students who tried to prevent weight gain and tried to lose weight in the year of the study had a significantly higher score for WGP Belief Patterns 1 and 2. There were no differences for WGP Belief Patterns 3 or 4. Students who tried to lose weight in the year preceding the study had a significantly higher score for WGP Belief Patterns 1, 3 and 4.

Students who perceived themselves to have obesity as adolescents had a significantly higher score for WGP Belief Pattern 1 than those who perceived themselves to have been normal weight or thin as adolescents. Students who perceived themselves to have obesity as children had a significantly higher score for WGP Belief pattern 1 than those who perceived themselves to have been thin as children. There were no differences in the scores for WGP Belief Patterns 2, 3 and 4 between the response options for perception of weight as a child or an adolescent.

Table 4.13 Comparison of Belief Pattern scores between response options for weight gain prevention attempts, weight loss attempts and weight perceptions in first year female students

Variable	Belief Pattern 1[1] Normal Mean±SD		Belief Pattern 2[2] Normal Mean±SD		Belief Pattern 3[3] Non-normal Median(IQR)		Belief Pattern 4[4] Non-normal Median(IQR)	
Weight gain prevention attempts this year								
1 Yes	0.19±0.92	A	0.18±0.92	A	0.16(-0.93;0.71)	A	-0.11(-0.56;0.71)	A
2 No	-0.19±0.79	B	-0.18±0.80	B	0.22(-0.29; 0.54)	A	-0.12(-0.53;0.42)	A
P value	<0.05[5]		<0.05[5]		≥0.05[6]		≥0.05[6]	
Weight loss attempts last year								
1 Yes	0.19±0.80	A	0.11±0.89	A	0.45(-0.09;0.84)	A	0.06(-0.51;0.72)	A
2 No	-0.16±0.90	B	-0.09±0.87	A	-0.09(-0.67;0.38)	B	-0.20(-0.56;0.27)	B
P value	<0.05[5]		≥0.05[5]		≥0.05[6]		≥0.05[6]	
Weight loss attempts this year								
1 Yes	0.28±0.80	A	0.16±0.89	A	0.26(-0.74;0.78)	A	-0.01(-0.53;0.71)	A
2 No	-0.34±0.84	B	-0.19±0.83	B	0.14((-0.50;0.43)	A	-0.20(-0.55;0.25)	A
P value	<0.05[5]		<0.05[5]		P value[6]		P value[6]	
Perceived weight as an adolescent								
1 Thin	-0.34±0.94	B	-0.11±0.91	A	0.06(-0.52;0.56)	A	-0.15(-0.50;0.27)	A
2 Normal	-0.02±0.82	B	-0.03±0.90	A	0.18(-0.69;0.64)	A	-0.12(-0.51;0.51)	A
3 Overweight	0.20±0.99	A;B	0.24±0.79	A	0.35(-0.21;0.80)	A	0.02(-0.59;0.85)	A
4 Obesity	1.08±0.57	A	0.11±0.58	A	0.47(-0.85:0.77)	A	-0.62(-1.31;-0.03)	A
P value	<0.05[7]		<0.05[7]		≥0.05[8]		≥0.05[8]	
Perceived weight as a child								
1 Thin	-0.49±0.99	B	-0.08±0.76	A	0.17(-0.50;0.41)	A	-0.18(-0.50;-0.14)	A
2 Normal	0.06±0.82	A;B	-0.08±0.86	A	0.12(-0.69;0.52)	A	0.03(-0.49;0.59)	A
3 Overweight	-0.04±0.88	A;B	0.18±0.91	A	0.22(-0.45;0.77)	A	-0.07(-0.51;0.45)	A
4 Obesity	0.26±0.89	A	0.16±0.99	A	0.55(-0.00;0.92)	A	-0.39(-0.79;0.30)	A
P value	<0.05[7]		≥0.05[7]		≥0.05[8]		≥0.05[8]	

[1] WGP Belief Pattern 1: Barriers to weight management
[2] WGP Belief Pattern 2: Facilitators of healthy eating and exercise
[3] WGP Belief Pattern 3: Barriers to exercise
[4] WGP Belief Pattern 4: Social barriers to healthy eating
[5] Bonferroni's Dunn t-test
[6] Mann Whitney U test
[7] ANOVA & Bonferroni Multiple comparison test
[8] Kruskall Wallis test

Significant predictors of WGP Belief Pattern 1 (barriers to weight management) are presented in Table 4.14. Predictors of a higher WGP Belief Pattern 1 score were a

higher BSQ8-C score, attempts to prevent weight gain during the study year, snacking after dinner and a higher TFEQ-R18 emotional eating score. Predictors of a lower WGP Belief Pattern 1 score were a higher BMI and perception to have been thin as an adolescent.

Table 4.14 Predictors[1] of WGP Belief Pattern 1: Barriers to weight management in first year female students (n= 159)

Variable	Coefficient	Standard deviation	P- value	Comments
BMI (kg/m^2)	-0.02	0.01	0.040	With each unit that BMI (kg/m^2) increases, WGP Belief Pattern 1 score decreases with 0.02.
BSQ-8C	0.18	0.07	0.009	With each unit that the BSQ8-C score increases, WGP Belief Pattern 1 score increases with 0.18.
Adolescent weight (thin)	-0.38	0.19	0.045	WGP Belief Pattern 1 score is 0.38 lower in students who perceived to have been thin as adolescents.
Weight gain prevention attempts (this year)	0.29	0.12	0.019	WGP Belief Pattern 1 score is 0.29 higher in those who attempted to prevent weight gain in the study year.
After dinner snack	0.05	0.02	0.038	With each unit (frequency per week) that after dinner snacking increases, WGP Belief Pattern 1 score increases with 0.05
TFEQ-R18 Emotional eating score	0.01	0.00	<0.001	With each unit the TFEQ-R18 emotional eating score increases, WGP Belief pattern 1 score increases with 0.01.

BMI= body mass index; BSQ-8C= Body Shape Questionnaire, TFEQ-R18= Three Factor Eating questionnaire-R18 Emotional eating score

[1] Logistic regression analyses, backward elimination to fit the most appropriate model

Significant predictors of WGP Belief Pattern 2 (facilitators of healthy eating and exercise) are presented in Table 4.15. Predictors of a higher WGP Belief Pattern 2 score were a higher BMI and a higher score for Dietary Pattern 2 (fruits, vegetables, legumes). Predictors of a lower WGP Belief Pattern 2 score were a higher MET-minutes and a higher score for Dietary Pattern 1 (sugary foods/drinks, 'slap chips' and take-outs).

Table 4.15 Predictors[1] of Belief Pattern 2: Facilitators of healthy eating and exercise in first year female students (n= 143)

Variable	Coefficient	Standard deviation	P- value	Comments
BMI (kg/m^2)	0.03	0.01	0.035	With each unit that BMI (kg/m^2) increases, WGP Belief Pattern 2 score increases with 0.03.
Dietary Pattern 1: Sugary foods/drinks-'slap chips'-take-outs	-0.16	0.07	0.035	With each unit that the score for Dietary Pattern increases, the WGP Belief Pattern 2 score decreases with 0.16.
Dietary pattern 2: Fruits-vegetables-legumes	0.28	0.08	<0.001	With each unit that the score for Dietary Pattern 2 increases, the WGP Belief Pattern 2 score increases with 0.28.
Total MET-minutes	-0.21	0.09	0.023	With each unit that total MET-minutes score increases, the WGP Belief Pattern 2 score decreases with 0.21.

BMI= body mass index; MET- minutes= metabolic equivalents
[1] Logistic regression analyses, backward elimination to find the most appropriate model

Significant predictors of WGP Belief Pattern 3 (barriers to exercise) are presented in Table 4.16. Predictors of a higher Belief Pattern 3 score were a higher BMI and a higher TFEQ-R18 uncontrolled eating score. Predictors of a lower Belief pattern 3 score were weight gain prevention attempts in the study year and a higher RSES score.

Table 4.16 Predictors[1] of Belief Pattern 3: Barriers to exercise in first year female students (n= 159)

Variable	Coefficient	Standard deviation	P- value	Comments
BMI (kg/m^2)	0.03	0.01	0.035	With each unit that BMI (kg/m^2) increases, the WGP Belief Pattern 3 score increases with 0.03.
Weight gain prevention (this year)	-0.33	0.13	0.015	WGP Belief Pattern 3 score is 0.33 lower in those who attempted to prevent weight gain in the study year.
TFEQ-R18 Uncontrolled eating score	0.01	0.00	0.035	With each unit that the score for the TFEQ-R18 uncontrolled eating increases, the WGP Belief Pattern 3 score increases with 0.01
RSES score	-0.04	0.01	<0.001	With each unit that the score for RSES increases, the WGP Belief Pattern 3 score decreases with 0.04.

BMI= body mass index; TFEQ-R18=Three factor eating questionnaire-R18; RSES= 10-item Rosenberg Self-esteem scale
[1] Logistic regression analyses, backward elimination to find the most appropriate model

Significant predictors of WGP Belief Pattern 4 (social barriers to healthy eating) are presented in Table 4.17. Predictors of a higher WGP Belief Pattern 4 score were a higher BSQ8-C score and a higher TFEQ-R18 cognitive restraint score. Predictors of a lower WGP Belief Pattern 4 score were a higher BMI, perception of having been thin as a child, a lower PSS-14 score and a higher RSES score.

Table 4.17 Predictors[1] of Belief Pattern 4: Social barriers to healthy eating in first year female students (n= 159)

Variable	Coefficient	Standard deviation	P- value	Comments
BMI (kg/m^2)	-0.03	0.01	0.005	With each unit that BMI (kg/m^2) increases, the WGP Belief Pattern 4 score decreases with 0.03.
BSQ-8C score	0.16	0.07	0.019	With each unit that the BSQ8-C score increases, the WGP Belief Pattern 4 score increases with 0.16.
Childhood weight (thin)	-0.30	0.15	0.045	WGP Belief Pattern 4 score is 0.30 lower in those who perceived to have been thin as a child.
TFEQ-R18 Cognitive restraint score	0.01	0.00	0.047	With each unit that the TFEQ-R18 cognitive restraint score increases, the WGP Belief Pattern 4 score increases with 0.01.
PSS-14 score	-0.02	0.01	0.036	With each unit that the stress score increases, the WGP Belief pattern 4 score decreases with 0.02.
RSES score	-0.04	0.01	0.004	With each unit that RSES increases, the WGP Belief pattern 4 score decreases with 0.04.

BSQ-8C= body shape questionnaire; BMI= body mass index; TFEQ-R18= Three Factor Eating Questionnare-R18; PSS-14= Cohen 14-item Perceived Stress scale; RSES= 10-item Rosenberg Self-esteem scale

[1] Logistic regression analyses, backward elimination to find the most appropriate model

4.4 Discussion

This study set out to identify belief patterns relating to weight gain prevention (WGP Belief Patterns), associated factors and predictors thereof in first year female students at three South African Universities. Numerous weight management related characteristics and associations that have been reported in the literature were confirmed in this study. Four WGP Belief Patterns were identified: barriers to weight management (Pattern 1), facilitators of healthy eating and exercise (Pattern 2), barriers to exercise (Pattern 3) and social barriers to healthy eating (Pattern 4).

Numerous associations between the four WGP Belief Patterns and dietary patterns, physical activity, body shape dissatisfaction, eating behaviours, stress, self-esteem and depression/anxiety symptoms and predictors of these patterns were identified.

The first year female students included in this study were mostly from homes where parents had a tertiary level education, which is in line with the profile reported by Senekal et al. (2016) for a sample of female students from the same three universities. The majority of the first year female students in this study were living in university residences (72%) while the balance lived in private accommodation (students living at home were excluded). Black African students made up 48.8% of the sample, 23.2% were coloured, 18.5% white, 8.3% Indian and 1.2% did not specify their race. The multicultural character of South African society and the different cultural perspectives relating to weight ideals, dietary and belief patterns as noted by Senekal et al. (2001), Puoane et al. (2005), Schembre et al. (2011), Puoane et al. (2013) and Annesi et al. (2014) were thus most likely represented in this research.

The BMI of the students (based on self-reported weight and height) was found to be in the normal range. However, when categorized according to the WHO cut-offs (WHO, 2015) it was found that 10.2% were underweight, 55.2% normal weight, 21.7% overweight and 13.9% had obesity at the time of the study. The proportion of students with overweight and obesity is substantially higher than the 10.8% reported for a sample of Caucasian first year female students (Cilliers et al. 2006), higher than the 24.2% reported for a sample of female students, including non-first year students, from the same three universities included in the in the current study, as well as the 22.9% reported for a sample of black African first year females (Steyn et al. 2000). The higher proportion of students with obesity found in the current study may reflect over-reporting of weight and/or underreporting of height, resulting in misclassification according to BMI. Interpretation of the self-reported weight and height (BMI) results and associations identified with other study variables should thus be interpreted with caution.

The self-perceived weight history results show that more students perceived themselves to have been underweight as a child and as and adolescent than at the time of the study. Conversely more students perceived themselves to have been overweight or have obesity at the time of the study than during their childhood or adolescence (37% versus 14.9% and 17.3% respectively) (35.6% were classified as overweight/ having obesity based on self-reported weight at the time of the study). This may reflect the nationally and internationally reported increase in overweight and obesity from childhood to young adulthood (Ogden et al., 2016; Flegal et al., 2016; SADHS, 2016; Dietz et al., 2017; Chooi et al., 2019). Fewer students perceived themselves to be underweight than reported (3% versus 10.2%) and less students percieved themselves to be obese than reported (5.4% versus 13.9% self-reported).

As was expected based on international and national research among female students (Senekal et al., 2001; Hendricks et al., 2004; Cilliers et al., 2006; Malinauskas et al., 2006; Kim & Lee; 2010; Yakusheva et al., 2011; Fayet et al., 2012; Senekal et al., 2016) weight loss attempts by students during the year preceding the current study, as well as during their first study year, were reported by half of the students, despite the fact that the majority of them were normal weight. Poor success with weight loss attempts by female students is reflected in the finding by Cilliers et al. (2006) that students with a higher BMI attempted to lose weight in the two years preceding the study, but had regained the weight. Half of the students in the current study attempted to prevent weight gain in the study year. This may point to awareness among first year female students of the weight gain risk they may face when starting their studies at a tertiary institution.

The results show that body shape dissatisfaction was rife among the first year female students who participated in the current study. Only a third of the students were classified as having no concern with their body shape, while almost half was characterized by moderate to marked concerns. Body image is one of the most important psychosocial factors that influence individuals' weight status (Shisana et al., 2013; Cristiana, 2016; Lowe et al., 2019). Poor body image is a common problem seen in tertiary level females and may result in unnecessary weight loss attempts

(Senekal at al., 1999; Neumark-Sztainer & Hannan, 2002; Wharton et al., 2008; Cristiana, 2016; Rodgers et al., 2018). In line with previous research in tertiary level students (Cilliers et al., 2006; Kim & Lee, 2010; Cristiana, 2016) the current study found that greater body dissatisfaction was associated with a higher BMI. Weight management attempts in those who are normal weight but perceive themselves to be overweight, may eventually result in weight gain and then further weight loss attempts (Lowe et al., 2019; Haynes et al., 2018; Robinson et al., 2019). Such weight gain could be the result of a reduction in metabolic rate associated with weight loss or binge eating following a diet (Lowe et al., 2019).

In the current study, as was reported by many others (Tang et al., 2010; Richard et al., 2016; Minor et al., 2016, Cristiana, 2016), body shape concern was associated with abnormal eating behaviours (cognitive restraint, uncontrolled eating and emotional eating), higher stress levels and symptoms of anxiety and depression and a lower self-esteem. Research has shown that abnormal eating behaviours, specifically emotional eating, may develop in order to cope with stress or symptoms of anxiety and depression, or as a result of low self-esteem (Lazaverich et al., 2016). In line with this, a higher emotional eating score was associated with a lower self-esteem, higher stress levels, as well as the presence of anxiety/depression symptoms in the current study. The positive association between uncontrolled eating and emotional eating that was also found confirms that emotional eaters may have difficulties controlling eating episodes as was also noted by Lazaverich et al. (2016). Moreover, abnormal eating behaviours may in turn result in poor weight management practices and as a consequence contribute to body shape dissatisfaction (Lowe & Kral, 2006; Lowe et al., 2013; Lazaverich et al., 16; Hunt et al., 2017).

Evidence shows that the transition from high school to a tertiary institution is associated with a decrease in self-esteem in female students (Senekal et al., 2001; Cillers et al., 2006; Cristiana, 2016). A fifth (21.6%) of students in this study had a low self-esteem. This is in line with previous research which found that 19.4% of Caucasian (Cilliers et al., 2006) and 28.2% of black South African female tertiary level

students (Senekal et al.,2001) had a low self-esteem. According to Soohinda et al. (2019) self-esteem has been hypothesized to mediate internalization of culturally unattainable ideals i.e. internalization of perceived pressure by media and peers to comply with a particular body shape ideal. In line with results published by APA (2007) and Chi et al. (2019), a lower self-esteem was associated with higher stress levels and the presence of symptoms of depression/anxiety in the current study. According to Kiviruusu et al. (2016) these associations may be bidirectional and could lead to the development of harmful diet control measures.

Results show that 30.5% of the students in this study experienced high stress levels, while 33% experienced severe symptoms of depression/anxiety. Globally 20-25% of students reported being stressed at any given time (Haidar et al., 2018) and 80% of university students reported experiencing some form of stress in their regular student lives (Lyzwinski et al., 2019). Strong positive associations between stress, symptoms of depression/anxiety and BMI were evident in this research, which has also been reported to be bidirectional (Lazaverich et al., 2016). Individuals tend to overeat or undereat as a result of stress and/or depression/anxiety leading to poor weight management outcomes (Senekal et al., 1999; Elfhag & Rossner, 2005; Gardner et al., 2013; Mazurek Melnyk et al., 2016).

Although many researchers have reported that the eating patterns of tertiary level students may be irregular and unhealthy (Lazaverich et al., 2013, Brown et al.,2014, Yahia et al. 2016), the meal pattern of first year female students who participated in this research did not seem to be irregular and was aligned with the SAFBDG recommendation of eating regular meals and snacks (Vorster et al., 2013). Breakfast was the meal most likely to be skipped, although the median intake was still five times a week, while snacking was most frequent during the late afternoon. A regular meal pattern and similar frequency of breakfast consumption and snacking pattern was also reported by Senekal et al. (2016) in a sample of female students from the same three South African universities. Fugelstad et al. (2012) suggested that individuals with more structured meal patterns may have greater success in weight management. Furthermore, Timlin and Pereira (2007) found that eating breakfast

was associated with a lower body weight, which may be due to a reduction in impulsive snacking and a lower dietary fat intake (Berg et al., 2009, Yahia et al., 2016). However, in this study no associations were found between BMI and any of the meal pattern indicators.

Four dietary patterns were retrieved from the non-quantified food frequency data, two of which were clearly unhealthy, namely Dietary Pattern 1 (sugary foods/drinks, 'slap chips', take-outs; strongest pattern) and Dietary Pattern 3 (alcohol, fatty foods, fatty snacks, maize pap). Dietary Pattern 2 (fruits, vegetables, legumes) was clearly healthy and Dietary Pattern 4 (breakfast foods) reflected healthy and unhealthy breakfast foods. The presence and composition of the two unhealthy dietary patterns indicate that although the students' meal pattern may have been in line with recommendations, their food and snack choices were not optimal. Poor food and snack choices may be the result of exposure to the obesogenic environment reported to characterize many tertiary education institution campuses, with energy dense, high fat-high sugar foods and alcohol being commonly available (LaCaille et al., 2011; Kapinos & Yakusheva, 2011; Small et al., 2013; Kapinos et al., 2014; Nikolaou et al., 2015; Yahia et al., 2016; Senekal et al., 2016; Townshend & Lake, 2017; Shi et al., 2018; Shi et al., 2018; Walsh et al., 2018; Sogari et al., 2018; Mueller et al., 2018).

The positive associations between Dietary Pattern 1 (Sugary foods/drinks, 'slap chips', take-outs) and frequency of snack consumption, as well as emotional eating and presence of depression/anxiety symptoms, combined with the positive association between uncontrolled eating and presence of depression/anxiety symptoms, suggest that students may choose these unhealthy foods/snacks when feeling emotional, possibly as a way to find comfort (Lazaverich et al., 2016; Lazaverich et al., 2008; Bourdier et al., 2018; Constant et al., 2018). In the same way, the positive association between Dietary Pattern 3 (alcohol, fatty foods, fatty snacks, maize pap) with uncontrolled eating and presence of depression/anxiety symptoms suggests that students were likely to make unhealthier food choices and use alcohol when feeling depressed/anxious as has also been reported by others (Wicki et al.,

2010; Lazaverich et al., 2016; Mazurek Melnyk et al., 2016; Nourse et al., 2017; Lazaverich et al., 2018).

The fact that a strong healthy dietary pattern emerged is encouraging, since previous research in tertiary level students internationally (ACHA, 2013; Nikolaou et al; 2015; Yahia et al., 2016) and in South Africa (Mchiza et al., 2015; Senekal et al., 2016) points to low fruit and vegetable consumption by students. The finding that Dietary Pattern 2 (fruits, vegetables, legumes) was associated with higher cognitive restraint may reflect some level of healthier food choices in those who engage in cognitive control over their eating, especially in the light of the finding that cognitive control was not associated with the two unhealthy dietary patterns.

The breakfast dietary pattern (Dietary Pattern 4: Breakfast foods) was positively associated with the weekly frequency of breakfast consumption, providing some confirmation of the validity of this dietary pattern. The food items included in the breakfast pattern show that not all foods consumed were necessarily healthy; foods such as white bread, sugary cereals and processed meats were for example consumed. Healthier choices included brown bread, milk/yoghurt/cheese, peanut butter, nuts and seeds and oats. Of note is that the healthy dietary pattern (Pattern 2: fruit, vegetables, legumes) was also positively associated with the frequency of breakfast consumption per week, providing support for the possibility that breakfast food choices included healthy options. Furthermore, Dietary Pattern 4 was positively associated with lower stress levels and a higher self-esteem. It is thus possible that regular consumption of breakfast foods (and thus breakfast) could be promoted by effective stress management and promotion of a strong self-esteem, or vice versa, that eating breakfast promotes contributes to decreasing stress levels and promoting self-esteem.

The obesogenic environment typically also promotes low levels of physical activity (NYRBS, 2008; Kelly et al., 2016; Uddin et al., 2018). Just under a quarter (23.7%) of the first year female students in this study were classified as being inactive. This is in line with results reported by Cilliers et al. (2006), namely that 27.2% of their sample

of first year female students did not partake in any physical activity, but less than the 40 to 79% of students at international tertiary institutions who were reported to be either physically inactive or did not meet physical activity guidelines (Plotnikoff et al., 2015; Deliens et al., 2015; Walsh et al., 2018; Yahia et al., 2016; Peltzer & Pengpid, 2017). In the current study a higher level of physical activity (MET-minutes) was associated with a higher self-esteem, suggesting that students with a higher self-esteem may be more likely to engage in physical activity (LaCaille et al., 2011), or on the other hand, would be less likely to engage in physical activity if they have a low self-esteem due to feelings of not being able to succeed in being active (Deliens et al., 2015). A higher level of physical activity was also associated with Dietary Pattern 2 (fruits, vegetables, legumes), suggesting that students with healthier food choices may be more likely to engage in other healthy lifestyle behaviours such as being physically active (Sogari et al., 2018), which may be linked to higher levels of motivation and self-regulation (LaCaille et al., 2011).

First year female students in this study reported being sedentary (studying, watching television, gaming, computer activities, sitting and talking, shopping and hanging out) for a median of 7 hours per day. In line with this, a systematic review and meta-analysis of levels of sedentary behaviour in university students by Castro et al. (2020) indicated that university students spend 7.29 hours per day being sedentary. Higher levels of sedentary activity have been associated with a greater risk of obesity, independent of dietary intake and physical activity (Deliens et al., 2015). Although also a sedentary activity, adequate sleep time of between seven to nine hours per night for young adults between 18 to 25 years old is essential for good health and weight management (Hirshkowitz, 2015). The first year female students who participated in this research slept a median of 7 hours per night, thus just meeting the recommendation, as was also found by Buboltz et al. (2009) and Roane et al. (2015) in tertiary level students in the USA. Insufficient sleep time needs to be prevented as it has been associated with poor weight management and obesity in many studies (Roane et al., 2015; St Onge, 2017; Hayes et al., 2018; Rihm et al., 2019).

As mentioned, four belief patterns relating to weight gain prevention behaviours (healthy eating, physical activity, alcohol and sleep) and constructs (body shape perception, self-esteem, eating behaviours, stress and depression/anxiety) were retrieved from the 31 belief statements included in the research questionnaire. Three out of the four patterns involved barriers (WGP Belief pattern 1,3 and 4) and are discussed first, followed by discussion of the facilitator belief pattern (WGP Belief Pattern 2).

Beliefs loading on WGP Belief Pattern 1, which is the strongest belief pattern that emerged, reflect that feeling stressed/anxious or sad/depressed, mindless eating, being awake at night, experiencing lack of health food options at university, preparing one's own meals, feeling fat, having people around you who do not eat healthy and the difficulty of not overeating are barriers to weight management. A high score on this pattern thus reflects an inclination to believe that a variety of factors act as barriers to weight management. Whether a high score on this pattern results in being a poorer weight manager during a female student's first year of tertiary education was not tested in this research. However, association and regression analysis provided insights in the characteristics and predictors of a high score that may provide some insights in potential weight management outcomes. Association analysis showed that students with a high score on this pattern may have been inclined to snack between meals; eat sugary foods/drinks, 'slap chips', take-outs (Dietary Pattern 1); be dissatisfied with their body shape; be restrictive (cognitive restraint), be uncontrolled and emotional eaters; be stressed; experience symptoms of depression/anxiety; have a low self-esteem; to try to lose weight in the year preceding the study and during the study year; to attempt to prevent weight gain during the study year; and to perceive themselves to have obesity during childhood and adolescence. Multiple regression analysis identified snacking after dinner, emotional eating, body shape dissatisfaction and attempts to prevent weight gain during the study year as predictors of a higher score on this belief pattern. Predictors of a lower score were a higher BMI and perception to have been thin as an adolescent. Published evidence supports the possibility that snacking and consumption of energy dense foods (Yahia et al., 2016; Senekal et al., 2016; Mueller

et al., 2018; Lazaverich et al., 2018), body shape dissatisfaction (Cilliers et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016; Rodgers et al., 2018), restrained eating (Fayet et al., 2012; Lowe et al., 2013; Hunt et al., 2017), uncontrolled eating (Fayet et al., 2012; Lowe et al., 2013), emotional eating (Van Strien, 2018), stress (Serlachius et al., 2007; Hunt & Eisenberg, 2010; Fayet et al., 2012; Gardner et al., 2013; Haidar et al., 2018; Lyzwinski et al., 2019), depression/anxiety (Lazaverich et al., 2013; Peltzer & Pengpid, 2015; Asante & Andoh-Arthur, 2015; Mazurek Melnyk et al., 2016; Nourse et al., 2017; Lazaverich et al., 2018), low self-esteem (Senekal et al., 2001; Cillers et al., 2006; Cristiana, 2016), weight loss attempts (Cilliers et al., 2006; Malinauskas et al., 2006; Kim & Lee; 2010; Fayet et al., 2012; Senekal et al., 2016) and a history of overweight/obesity (Cilliers et al., 2006) increases the risk of poor weight management that may include unnecessary dieting in those who are not overweight, weight gain and unsuccessful weight loss attempts.

Beliefs loading on WGP Belief Pattern 3 reflect that feeling sad/depressed, feeling stressed/anxious, having poor body shape satisfaction and feeling fat may be barriers to exercise. A high score on this pattern thus reflects a stronger inclination to believe that some factors act as barriers to exercise. Whether a high score on this pattern results in low physical activity levels during a female student's first year of tertiary education was not tested in this research. However, association and regression analysis provided insights in the characteristics and predictors of a high score that may provide some insights in potential physical activity outcomes. Association analysis showed that students with a high score on this pattern may have been inclined to have a higher BMI, snack frequently, eat sugary foods/drinks, 'slap chips' and take-outs (Dietary Pattern 1), as well as drink alcohol and eat fatty foods, fatty snacks and maize meal (Dietary Pattern 3), have body shape concerns, have problematic eating behaviours (uncontrolled eating and emotional eating), experience stress and anxiety/depression symptoms, have a low self-esteem and have tried to lose weight in the year preceding the study. Multiple regression analysis identified a higher BMI and uncontrolled eating as being predictors of a higher score on this belief pattern. Predictors of a lower score were a higher self-

esteem and weight gain prevention attempts in the study year. Published evidence supports the possibility that a higher BMI (More et al., 2017), alcohol use (Nelson et al., 2009), body shape dissatisfaction (LaCaille et al., 2011; Deliens et al., 2015), emotional eating (Konttinen et al., 2010), stress (LaCaille et al, 2011; Deliens et al., 2015), depression/anxiety (Lazaverich et al., 2018), low self-esteem (LaCaille et al., 2011; Deliens et al., 2015; Lazaverich et al., 2018) and weight loss attempts (Malinauskas et al., 2006; Fayet et al., 2012; Mendez-Hernandez et al., 2010; Senekal et al., 2016) may impact negatively on physical activity behaviours. Snacking, consumption of energy dense foods and uncontrolled eating have not been reported as potential barriers to exercise before.

Beliefs loading on WGP Belief Pattern 4 reflect that socialising, judgement from peers when making healthy food choices and drinking alcohol would make weight management more difficult. A high score on this pattern thus reflects a stronger inclination to believe that a variety of factors act as social barriers to weight management. Whether a high score on this pattern reflects the actual effect of social factors on a female student's weight management efforts during her first year of tertiary education was not tested in this research. However, association and regression analysis provided insights in the characteristics and predictors of a high score on this pattern that may provide some insights in this regard. Association analysis showed that students with a high score on this pattern may have body shape concerns, have problematic eating behaviours (cognitive restraint), experience anxiety/depression symptoms, have a low self-esteem and have tried to lose weight in the year preceding the study. Multiple regression analysis identified a higher level of body shape dissatisfaction and a higher level of cognitive restraint as being predictors of a higher score on this belief pattern. Predictors of a lower score included a higher BMI, perception of being thin as a child, lower stress and a higher self-esteem. Published evidence supports the possibility that body shape dissatisfaction (Sogari et al., 2018) and low self-esteem (Sogari et al., 2018; Cox et al., 2019) may be linked to poorer weight management behaviours due to perceived social barriers. A higher cognitive restraint, anxiety/depression and previous weight

loss attempts have not been reported as potential social barriers to weight management before.

Beliefs loading on WGP Belief Pattern 2 reflect that complying with a healthy diet plan, finding enjoyment in healthy eating, preparing vegetables in a tasty way, finding affordable ways to eat healthy, making time in the day for exercise, knowing how to prepare one's own meals, planning meals and snacks ahead and exercising may be facilitators for healthy eating and exercise as weight gain prevention behaviours. A high score on this pattern thus reflects a stronger inclination to believe that a variety of factors act as facilitators for healthy eating and exercise. Whether a high score on this pattern results in healthy eating and sufficient physical activity during female student's first year of tertiary education was not tested in this research. However, association and regression analysis provided insights in the characteristics and predictors of a high score on this pattern that may provide some insights in potential healthy eating and physical activity outcomes. Association analysis showed that students with a high score on this pattern may have been less inclined to eat sugary foods/drinks, 'slap chips' and take-outs (Dietary Pattern 1), and more inclined to eat fruits, vegetables and legumes (Dietary Pattern 2), have a higher cognitive restraint, as well as have a higher levels of physical activity. Multiple regression analysis identified a higher BMI and a higher score for Dietary Pattern 2 (fruits, vegetables and legumes) as predictors of a higher score on this belief pattern. Predictors of a lower score were higher MET-minutes and a higher score for Dietary Pattern 1 (sugary foods/drinks, slap chips, take-outs). Published evidence supports the possibility that a lower consumption of energy dense foods and a higher consumption of healthy foods including fruits, vegetables and legumes (Katz & Meller, 2014; Romieu et al., 2017), a higher cognitive restraint (Provencher et al., 2009; Fayet et al., 2012) and a higher level of exercise (Senekal et al., 1994) may facilitate healthy eating and physical activity.

4.5 Limitations

The findings of this research need to be viewed in the context of the study limitations. All data for this study was collected using a self-administered questionnaire, which leaves room for error and bias in the responses given by participants. The questionnaire included five published instruments, including the TFEQ-R18, BSQ- 8C, PSS-14, RSES and K10, which were not specifically developed for tertiary level female students. However, the high alpha-Cronbach values, 0.82, 0.93, 0.83, 0.88 and 0.89 respectively, confirm the appropriateness for use in the current study sample. It is important to bear in mind that these instruments cannot be applied to diagnose clinical conditions, but rather point to presence of risk that may need to be confirmed with further assessments. The NQFFQ is limited in that it only provides insights in frequency of food choices and dietary patterns. More in depth dietary intake analysis would need to be conducted to characterize actual energy, macro and micronutrient intake if required. However, the dietary pattern analysis based on the NQFFQ provided very meaningful insights that may contribute to identification of dietary aspects that need to be covered in further intervention planning.

As discussed, BMI derived from the self-reported weight and height may be prone to misclassification as a result of over or underestimation of either weight and/or height (Niedhammer et al., 2000; Rossouw et al., 2000; Spencer et al., 2002; Yoong et al., 2013). BMI results were thus interpreted with caution.

Due to the cross-sectional design of the study causality could not be investigated; all results therefore need be considered and interpreted bearing this in mind. Since the study included a convenience sample drawn from three selected South African universities in a particular geographical area, results do not represent first year female students at tertiary institutions in the country in general. However, as there is no published work on WGP Belief Patterns of first year female students or female students in general, the results of this study provide a good basis for further research in this regard.

Alcohol use was only assessed in terms of frequency per week/ per day and analysed as part of the extraction of dietary patterns. More detailed alcohol consumption questions would have made it possible to provide insights in actual quantities consumed as well as drinking patterns such as binge drinking versus moderate drinking.

4.6 Conclusions

The key conclusions of this research are that WGP Belief Patterns of a multicultural sample of first year female students focused mainly on barriers, specifically barriers to weight management (WGP Belief pattern 1) (strongest pattern), barriers to exercise (WGP Belief pattern 3) and social barriers to healthy eating (WGP Belief pattern 4). Predictors of these patterns included snacking after dinner, problematic eating behaviours (including a higher emotional eating, cognitive restraint and uncontrolled eating), body shape dissatisfaction, attempts to prevent weight gain during the study year, a higher or lower BMI, perception of overweight/obesity as a child/adolescent, higher stress and lower self-esteem. As these predictors have typically been reported to be associated with challenges to healthy weight management, it is plausible that a high score on these barrier belief patterns may contribute to poorer weight gain prevention by first year female students.

Some predictors of the facilitator belief pattern that emerged reflected factors that have typically been reported to be associated with improved weight management (Dietary Pattern 2: healthy and higher daily MET-minutes), while other predictors reflected factors that have typically been reported to be associated with weight management challenges (Dietary pattern 1: Unhealthy and a higher BMI). It thus seems less plausible that a high score on the facilitator belief pattern would promote weight gain prevention.

Further conclusions are that the first year female students included in this research were characterized by poor food choices (two strong unhealthy dietary patterns emerged versus one clearly healthy pattern and a fourth pattern that included both healthy and healthy food choices), inactivity, weight loss attempts in the year prior to the study and the study year despite the fact that the majority were normal weight, weight gain prevention attempts during the study year, body shape dissatisfaction, uncontrolled and emotional eating, high stress levels, low self-esteem and a high presence of depression/anxiety symptoms. Interrelationships between these characteristics show that first year female students' healthy behaviours (healthy eating pattern, eating breakfast and physical activity) may be associated with a higher self-esteem, lower stress levels and cognitive restraint; whereas unhealthy behaviours (the two unhealthy dietary patterns, snacking), body shape dissatisfaction, uncontrolled and emotional eating, stress and a low self-esteem may be associated.

Although the link between the weight gain prevention belief patterns and weight status during the students' first year at university were not investigated in this study, factors found to be associated with and predictors of the three barrier patterns point to potential risk for the experience of weight gain prevention challenges by first year female students. Although this notion should ideally be confirmed in further research, addressing the focus of the beliefs included in the barrier belief patterns in weight gain prevention interventions for first year female students is recommended.

5. OVERARCHING SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Overarching summary

Research shows that first year female students may be specifically prone to weight gain. A number of weight gain prevention interventions targeted at this very vulnerable group have been tested. In their attempt to address this problem Senekal et al. (2018) aimed to reach large numbers of students in a short period of time during their first weeks on the campus of a tertiary institution in South Africa. To make this possible the intervention they developed was in the form of a self-help manual that could be handed out early in the year, with students then being able to engage with the intervention at their leisure. This intervention was tested in a controlled trial and results showed that the intervention group gained a significant 0,9kg (30%) less weight at eight months after baseline than the control group (Senekal et al., 2018). Senekal et al. (2018) recommended that a combination of the self-help manual with further intervention elements such as social media messaging may increase the intervention effect.

The research group followed on and posited that development of further elements to combine with the self-help manual should consider beliefs students hold regarding weight gain prevention behaviours and weight related constructs. This notion is supported by Nikolaou et al. (2015) who stated that understanding beliefs of students relating to perceived barriers to and facilitators of a healthy lifestyle is essential in designing weight gain prevention interventions for first year students. However, there is a paucity of published research on beliefs held by female students or other young female adults on weight management in general, and more specifically on weight gain prevention.

This research aimed to investigate the beliefs of first year female students from three universities in the Western Cape, South Africa regarding weight gain prevention behaviours and weight related constructs.

The first objective was to elicit salient beliefs held by first year female students regarding weight gain prevention behaviours (dietary patterns, physical activity alcohol intake and sleep time) and weight related constructs (eating behaviour, body shape dissatisfaction, stress, self-esteem and depression/anxiety) using a qualitative research design (Phase 1: Chapter 3).

The second objective was to identify weight gain prevention belief patterns of first year female students, to investigate the association thereof with actual weight gain prevention behaviours and weight related constructs and identify significant predictors of the belief patterns using a quantitative cross-sectional research design (Phase 2: Chapter 4).

Phase 1 (Chapter 3) comprised 28 depth interviews with first year female students from three universities in the Western Cape, South Africa, with representation of living situation (university residence or private accommodation, those living at home were excluded) and race (black African, mixed ancestry or white) ensured. Eighteen of the interviews were fully coded until data saturation was apparent. The additional 10 interviews were coded for new information only. Data analysis was conducted using the audio coding option on Nvivo Version 12.

Key conclusions for Chapter 3 (qualitative component) include that beliefs held by a multicultural sample of first year female students from three South African universities (living either privately or in university residences) regarding weight gain prevention behaviours show that the students have some awareness of the recommendations, benefits and importance of healthy eating, adequate physical activity and sleep time. They also have some awareness of the negative consequences of unhealthy eating, low levels of physical activity and lack of sleep. However, beliefs that reflected lack of concern regarding unhealthy eating and inadequate sleep were also evident. Although beliefs relating to consequences of excessive alcohol use emerged, it is clear that the amount of alcohol students believed they could drink was above recommendations.

Potential facilitators of meeting weight gain prevention lifestyle recommendations that emerged from students' beliefs include having a high or low self-esteem; body shape dissatisfaction or satisfaction; low or high stress levels; low levels of depression/anxiety; at times negative emotions; feeling in a good mood; having responsibility, discipline, motivation and passion; having sufficient time and being able to plan ahead; having access to healthy food options on campus and in university residences (physical and financial access); having access to cooking facilities; having access to easy, affordable, safe and enjoyable exercise options; being physically active; having sufficient finances; living privately, in a self-catering university residence or at home with parents; understanding the functioning of your body; having support from family, friends and peers; and making use of behavioural change strategies such as self-monitoring, goal setting and self-rewarding.

Potential barriers to meeting weight gain prevention lifestyle recommendations that emerged from students' beliefs include both body shape dissatisfaction or satisfaction; both high or low self-esteem; high stress levels; anxiety, sadness and depression; boredom; physical factors such as feeling tired, hungry, menstruating, unawareness of how the body functions, poor health per se, bland taste of healthy food, stimulant use and actual weight (mostly being overweight but also underweight); lack of knowledge and skills relating to healthy eating and physical activity; lack of time and no/poor planning relating to physical activity, healthy eating and sleep time); no/poor access to motorized transport, physical activity opportunities, insufficient finances and sometimes sufficient finances, and unhealthy food options on campus or at university residences; easy access to alcohol (on campus and when socialising); social media use (time consuming and increased exposure to promotion of stereotyped beauty ideals); noise, especially in university residences, and lack of support from family, peers and friends.

Phase 2 (Chapter 4) comprised completion of a questionnaire that covered socio-demographics, self-reported weight and weight history, dietary history (including alcohol intake) and meal patterns, physical activity, sleep time, body shape satisfaction, eating behaviour, stress, self-esteem, presence of depression/anxiety

symptoms and belief statements (derived from Phase 1) by a convenience sample of 168 first year female students from the same three universities to identify weight gain prevention (WGP) belief patterns, associated factors and predictors thereof.

Key conclusions for 4 Chapter (quantitative component) include that WGP Belief Patterns of a multicultural sample of first year female students focused mainly on barriers, specifically barriers to weight management (WGP Belief pattern 1) (strongest pattern), barriers to exercise (WGP Belief pattern 3) and social barriers to healthy eating (WGP Belief pattern 4). Predictors of these patterns included snacking after dinner, problematic eating behaviours (including a higher emotional eating, cognitive restraint and uncontrolled eating), body shape dissatisfaction, attempts to prevent weight gain during the study year, a higher or lower BMI, perception of overweight/obesity as a child/adolescent, higher stress and lower self-esteem.

Predictors of the single facilitator belief pattern that emerged reflect factors that have typically been reported to be associated with improved weight management (healthy eating and higher physical activity levels), while other predictors reflected factors that have typically been reported to be associated with weight management challenges (unhealthy eating and a higher BMI).

Students included in the quantitative component of this research were characterized by poor food choices, inactivity, weight loss attempts in the year prior to the study and the study year despite the fact that the majority were normal weight, weight gain prevention attempts during the study year, body shape dissatisfaction, uncontrolled and emotional eating, high stress levels, low self-esteem and a high presence of depression/anxiety symptoms. Interrelationships between these characteristics show that healthy behaviours (healthy eating pattern, eating breakfast and physical activity), a higher self-esteem, lower stress levels and cognitive restraint may be associated, whereas unhealthy behaviours (the two unhealthy dietary patterns, snacking), body shape dissatisfaction, uncontrolled and emotional eating, stress and a low self-esteem may also be associated in first year female students.

5.2 Strengths and limitations

The key strength of this study is that beliefs students hold relating to weight gain prevention behaviours and weight management related constructs were first derived from a qualitative elicitations study after which a belief questionnaire was developed that was used in a quantitative survey to extract belief patterns, associated factors and potential predictors thereof.

Limitations of the qualitative component

Qualitative research is inherently structured in such a way that representation of a target sample is not a consideration. The sampling strategy applied in this research was purposeful, thus the most productive sample to answer the research question was selected as suggested by Marshall (1996). It is therefore important to interpret the results as qualitative insights and not as representative of characteristics of first year female students at the three universities. A further consideration is that the purposive sampling might have drawn students who were interested in the research topic and selection bias may thus be present. The greater representation of university residence students in the sample may have impacted on the number of mentions of barriers and facilitators specifically related to university residence life, but as qualitative investigation does not assign importance to frequency of mentions per se, and interviews were analyzed until data saturation was achieved, this is not deemed to be a concern.

Limitations of the quantitative component

All data for this study was collected using a self-administered questionnaire, which leaves room for error and bias in the responses given by participants. The questionnaire included five published instruments, including the TFEQ-R18, BSQ- 8C, PSS-14, RSES and K10, which were not specifically developed for tertiary level female students. However, the high alpha-Cronbach values, 0.82, 0.93, 0.83, 0.88 and 0.89

respectively, confirm the appropriateness for use in the current study sample. It is important to bear in mind that these instruments cannot be applied to diagnose clinical conditions, but rather point to presence of risk that may need to be confirmed with further assessments. The NQFFQ is limited in that it only provides insights in frequency of food choices and dietary patterns. More in depth dietary intake analysis would need to be conducted to characterize actual energy, macro and micronutrient intake if required. However, the dietary pattern analysis based on the NQFFQ provided very meaningful insights that may contribute to identification of dietary aspects that need to be covered in further intervention planning.

As discussed, BMI derived from the self-reported weight and height may be prone to misclassification as a result of over or underestimation of either weight and/or height (Niedhammer et al., 2000; Rossouw et al., 2000; Spencer et al., 2002; Yoong et al., 2013). BMI results were thus interpreted with caution.

Due to the cross-sectional design of the study causality could not be investigated; all results therefore need be considered and interpreted bearing this in mind. Since the study included a convenience sample drawn from three selected South African universities in a particular geographical area, results do not represent first year female students at tertiary institutions in the country in general. However, as there is no published work on WGP Belief Patterns of first year female students or female students in general, the results of this study provide a good basis for further research in this regard.

Alcohol use was only assessed in terms of frequency per week/ per day and analysed as part of the extraction of dietary patterns. More detailed alcohol consumption questions would have made it possible to provide insights in actual quantities consumed as well as drinking patterns such as binge drinking versus moderate drinking.

5.3 Overarching conclusions

Results and conclusions of the in depth interviews conducted to assess the beliefs of first year female students from three universities in the Western Cape, South Africa, regarding weight gain prevention behaviours and weight related constructs show that a multicultural sample of students held numerous beliefs regarding potential barriers and facilitators to weight gain prevention.

Results of the quantitative assessment of these beliefs in a cross-sectional survey conducted amongst the same target group resulted in the extraction of three barrier WGP Belief Patterns, including barriers to weight management per se (feeling stressed/anxious or sad/depressed, mindless eating, being awake at night, experiencing lack of health food options at university, preparing one's own meals, feeling fat, having people around you who do not eat healthy and the difficulty of not overeating were barriers to weight management), barriers to exercise (feeling sad/depressed, feeling stressed/anxious, having poor body shape satisfaction and feeling fat were barriers to exercise) and social barriers to healthy eating (socialising, judgement from peers when making healthy food choices and drinking alcohol were barriers to weight management). Specific predictors of these patterns, namely snacking patterns, cognitive restraint, uncontrolled eating, emotional eating, problematic eating behaviours, body shape dissatisfaction, overweight/obesity as a child/adolescent, higher stress levels and lower self-esteem have typically been reported to be associated with challenges to healthy weight management. It is thus plausible that a high score on these barrier belief patterns may contribute to poorer weight gain prevention by first year female students. A concern is that students who participated in the cross sectional survey were characterized by many of these predictors, as well as other factors that have been related to poor weight management in the literature. These include weight loss attempts despite being normal weight, unhealthy eating patterns, including unhealthy Dietary Pattern 1 (Sugary foods/drinks, 'slap chips', take-outs) and Dietary Pattern 3 (alcohol, fatty foods, fatty snacks, maize pap); low levels of physical activity, high stress levels, low self-esteem, body shape dissatisfaction and symptoms of depression/anxiety.

Predictors of the single facilitator WGP Belief Pattern (facilitators of healthy eating and exercise: complying with a healthy diet plan, finding enjoyment in healthy eating, preparing vegetables in a tasty way, finding affordable ways to eat healthy, making time in the day for exercise, knowing how to prepare one's own meals, planning meals and snacks ahead and exercising) that were extracted from the quantitative data reflect factors that have typically been reported to be associated with improved weight management (healthy eating and higher physical activity levels), as well as factors that have typically been reported to be associated with weight management challenges (unhealthy eating and a higher BMI). It thus seems less plausible that a high score on the facilitator belief pattern would promote weight gain prevention.

This work adds to the research in weight gain prevention in female tertiary level students by building on to beliefs regarding weight gain prevention found in previous research such as Das and Evans (2014) using the Health Belief model with a focus on diet and physical activity as weight management barriers. The current study focused not only on diet and physical activity but also on sleep and alcohol as weight gain prevention behaviours. It also had a focus specifically on sedentary behaviours, not only physical activity. We know that limiting sedentary time is important for weight management in addition to ensuring adequate levels of physical activity (Botha et al., 2013; Grave et al., 2013; WHO, 2014; Piercy et al., 2018; Foright et al., 2018; Petridou et al., 2019), as well as controlling alcohol intake (Yeomans, 2010; Jacobs & Steyn, 2013; WHO, 2014; Kalinowsky & Humphreys, 2016; SADHS, 2016; Battista & Leatherdale, 2017) and achieving a healthy sleep pattern (Hirshkowitz et al., 2015; St-Onge, 2017; Ludy et al., 2018; Hayes et al., 2018; Yang et al., 2019; Rihm et al., 2019). This study used Ajzen's TPB to elicit and describe the salient beliefs of first year female students concerning weight gain prevention behaviours and weight related constructs and took a step further in using these beliefs to generate belief patterns held by first year female students on weight gain prevention. In addition, the association of these belief patterns with weight gain prevention behaviours (dietary patterns, physical activity, alcohol intake and sleep time), weight gain related constructs (eating behaviour, body shape dissatisfaction, stress, self-esteem

and symptoms of depression/anxiety), as well as body mass index (BMI), past weight loss and gain prevention attempts, and perceived weight history were investigated and significant predictors of the belief patterns were identified. These results have provided further insights for consideration to enhance future weight gain prevention interventions in this target group.

5.4 Overarching recommendations

Although the associations between the four weight gain prevention belief patterns and weight status of first year female students were not investigated in this study, factors found to be associated with and predictors of the three barrier patterns point to potential risk for the experience of weight gain prevention challenges by first year female students. Although this notion should ideally be confirmed in further research, addressing the focus of the beliefs included in the barrier belief patterns, as well as the characteristics of the students that have been reported to be associated with weight management challenges in the literature in weight gain prevention interventions for first year female students at tertiary institutions is recommended.

Specific intervention strategies for consideration in development of elements to combine with the weight management manual for students by Senekal (2005) include the following:

- Education of students on selection (university residence students), purchasing of or preparation of healthy meals and snacks that are tasty and affordable.
- Development of advocacy skills to campaign for more affordable and tasty healthy food options on campus and restaurants and other food outlets frequented by students.
- Education on alcohol use control.

- Identification of accessible, affordable and enjoyable (personally and potentially socially) exercise options. This type of exercsie would be a sustainable activity.
- Development of time planning skills.
- Promotion of various aspects of psychological well-being: body image dissatisfaction, stress, self-esteem and depression/anxiety.
- Prevention and management of uncontrolled and emotional eating
- Engendering social support (senior students, peers, friends and family) in order to increase compliance with recommended weight prevention behaviours and optimize the various weight related constructs.
- Creating awareness and promotion of application of behaviour change techniques.

6. REFERENCE LIST

Adeboye, B., Bermano, G., Rolland, C. 2012. Obesity and its Health Impact in Africa: a Systematic Review. *Cardiovasc J Afr*. **23**:512-521.

Ajayi, A.I., Owolabi, E.O. and Olajire, O.O., 2019. Alcohol use among Nigerian university students: prevalence, correlates and frequency of use. *BMC public health*. **19(1)**:752.

Alvarenga, M.S., Lourenco, B.H., Philippi, S.T., Scagliusi, F.B. 2013. Disordered eating among Brazilian female college students. *Cad. Saude Publica, Rio de Janeiro*. **29(5)**:879-888.

American College Health Association, 2013. American college health association-national college health assessment II: Reference group executive summary spring 2014. *Hanover, MD: American College Health Association*.

American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. Arlington, VA: American Psychiatric Association, 2013.

Anderson, D.A, Shapiro, J.R, Lundgren, J.D. 2003. The Freshman Year of College as a Critical Period for Weight Gain: An Initial Evaluation. *Eating Behaviors*. **4(4):**363–367.

Andrews, G. & Slade, T. 2001. Interpreting scores on the Kessler psychological distress scale (K10). Australian and New Zealand Journal of Public Health. **25(6):** 494-497.

Annesi, J.J., Tennant, G.A., Mareno, N. 2014. Treatment-associated Changes in Body Composition, Health Behaviours, and Mood as Predictors of Change in Body satisfaction in Obese Women: Effects of Age and Race/Ethnicity. *Health Educ Behav*. DOI: 10.1177/1090198114531783.

Aoun, C., Nassar, L., Soumi, S., El Osta, N., Papazian, T. and Khabbaz, L.R., 2019. The Cognitive, Behavioral, and Emotional Aspects of Eating Habits and

Association With Impulsivity, Chronotype, Anxiety, and Depression: A Cross-Sectional Study. *Frontiers in Behavioral Neuroscience.*

Arif, A.A., Rohrer J.E. 2005. Patterns of alcohol drinking and its association with obesity: data from the Third National Health and Nutrition Examination Survey, 1988-1994. *BMC Public Health.* **5**:126.

Armitage, C.J. and Conner, M., 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. *British journal of social psychology*. **40(4)**:471-499.

Armitage, C.J., 2015. Randomized test of a brief psychological intervention to reduce and prevent emotional eating in a community sample. *Journal of Public Health*. **37(3)**:438-444.

Asante, K.O. and Andoh-Arthur, J., 2015. Prevalence and determinants of depressive symptoms among university students in Ghana. *Journal of affective disorders*. **171**:161-166.

Ashton, L.M., Hutchesson, M.J., Rollo, M.E., Morgan, P.J. and Collins, C.E., 2017. Motivators and barriers to engaging in healthy eating and physical activity: A cross-sectional survey in young adult men. *American journal of men's health*, **11(2)**:330-343.

Australian National Health and medical research Council and the New Zealand Ministry of Health. 2006. Nutrient reference values for Australia and New Zealand: Including Recommended Dietary Intakes. *Canberra: Australian National Health and Medical Research Council and the New Zealand Ministry of Health.*

Azjen, I. 1991. The Theory Of Planned Behaviour. *Organizational Behaviour and Human Decision Processe*s. **50**:179-211.

Ajzen, I. (2014) Diagram of Theory of Planned Behaviour. Available at: http://people.umass.edu/aizen/tpb.diag.html. Accessed 23 September, 2014.10.03

Banna, J., Panizza, C., Boushey, C., Delp, E. and Lim, E., 2018. Association

between Cognitive Restraint, Uncontrolled Eating, Emotional Eating and BMI and the Amount of Food Wasted in Early Adolescent Girls. *Nutrients*. **10(9)**:1279.

Baranowski, T., Cullen, K.W., Nicklas, T., Thompson, D., Baranowski, J. 2003. Are Current Health Behavioural Change Models Helpful in Guiding Prevention of Weight Gain Efforts? *Obes Res*. **11**:23S-43S.

Battista, K. and Leatherdale, S.T., 2017. Estimating how extra calories from alcohol consumption are likely an overlooked contributor to youth obesity. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice*. **37(6)**:194-200.

Becker, W., Lyhne, N., Pedersen, A.N., Aro, A., Fogelholm, M., Phorsdottir, I., et al. 2004. Nordic Nutrition Recommendations 2004- integrating nutrition and physical activity. *Scandinavian Journal of Nutrition*. **48(4)**:178-87.

Bell, C.G., 2017. The epigenomic analysis of human obesity. *Obesity*. **25(9)**:1471-1481.

Benedict, C., Brooks, S.J., O'Daly, O.G., Almen, M.S., Morell, A., Åberg, K., Gingnell, M., Schultes, B., Hallschmid, M., Broman, J.E. and Larsson, E.M., 2012. Acute sleep deprivation enhances the brain's response to hedonic food stimuli: an fMRI study. *The Journal of Clinical Endocrinology & Metabolism*. ***97(3)***:E443-E447.

Berg, B.L., Lune, H., Lune, H. 2004. Qualitative Research Methods for the Social Sciences. *Pearson*. Boston, MA, USA. Volume 5.

Berger, M.B., Steinberg, D.M., Askew, S., Gallis, J.A., Treadway, C.C., Egger, J.R., Kay, M.C., Batch, B.C., Finkelstein, E.A., DeVries, A. and Brewer, A., 2019. The Balance protocol: a pragmatic weight gain prevention randomized controlled trial for medically vulnerable patients within primary care. *BMC public health*, **19(1)**:596.

Berkey, C.S., Rockett, H.R. and Colditz, G.A., 2008. Weight gain in older

adolescent females: the internet, sleep, coffee, and alcohol. *The Journal of pediatrics*. **153(5)**:635-639.

Bertz, F., Pacanowski, C.R. and Levitsky, D.A., 2015. Frequent self-weighing with electronic graphic feedback to prevent age-related weight gain in young adults. *Obesity*. **23(10)**:2009-2014.

Bhutani, S., Kahn, E., Tasali, E. and Schoeller, D.A., 2017. Composition of two-week change in body weight under unrestricted free-living conditions. *Physiological reports*. **5(13)**:e13336.

Bleich, S.N. & Wolfson, J.A. 2014. Weight loss strategies: association with consumption of sugary beverages, snacks and values about food purchases. *Patient Educ Couns.* http://dx.doi.org/10.1016/j.pec.2014.04.008

del Mar Bibiloni, M., Coll, J.L., Pich, J., Pons, A. and Tur, J.A., 2017. Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC public health*. **17(1)**:39.

Blackwell, D.L. and Clarke, T.C., 2018. State Variation in Meeting the 2008 Federal Guidelines for Both Aerobic and Muscle-strengthening Activities Through Leisure-time Physical Activity Among Adults Aged 18-64: United States, 2010-2015. *National health statistics reports*. **(112)**:1-22.

Blake, H., Stanulewicz, N. and Mcgill, F., 2017. Predictors of physical activity and barriers to exercise in nursing and medical students. *Journal of Advanced Nursing*. **73(4)**:917-929.

Bleidorn, W., Arslan, R.C., Denissen, J.J., Rentfrow, P.J., Gebauer, J.E., Potter, J. and Gosling, S.D., 2016. Age and gender differences in self-esteem—A cross-cultural window. *Journal of personality and social psychology*. **111(3)**:396.

Braddon, F.E.M., Rodgers, B., Wadsworth, M.E.J., & Davies, J.M.C. 1986. Onset of obesity in a 36 year birth cohort study. *BMJ*. **293**: 299-303.

Brandkvist, M., Bjørngaard, J.H., Ødegård, R.A., Åsvold, B.O., Sund, E.R. and Vie, G.Å., 2019. Quantifying the impact of genes on body mass index during the obesity epidemic: longitudinal findings from the HUNT Study. *Bmj*. **366**:l4067.

Brown, S.A., McGue, M., Maggs, J., Schulenberg, J., Hingson, R., Swartzwelder, S., Martin, C., Chung, T., Tapert, S.F., Sher, K. and Winters, K.C., 2008. A developmental perspective on alcohol and youths 16 to 20 years of age. *Pediatrics*. **121(4)**:S290-S310.

Brown, O.N., O'Connor & L.E., Savaiano, D. 2014. Mobile MyPlate: A Pilot Study Using Text Messaging to Provide Nutrition Education and Promote Better Dietary Choices in College Students. *Journal of American College Health.* **10**:1080.

Brumpton, B., Langhammer, A., Romundstad, P., Chen, Y. and Mai, X.M., 2013. The associations of anxiety and depression symptoms with weight change and incident obesity: The HUNT Study. *International journal of obesity*. **37(9)**:1268.

Boekeloo, B.O., Bush, E.N. and Novik, M.G., 2009. Perceptions about residence hall wingmates and alcohol-related secondhand effects among college freshmen. *Journal of American College Health*. **57(6)**:619-628.

Botha, C.R., Moss, S.J. and Kolbe-Alexander, T.L., 2013. "Be active!" Revisiting the South African food-based dietary guideline for activity. *South African journal of clinical nutrition*. **26(3)**:S18-S27.

Bourdier, L., Orri, M., Carre, A., Gearhardt, A.N., Romo, L., Dantzer, C. and Berthoz, S., 2018. Are emotionally driven and addictive-like eating behaviors the missing links between psychological distress and greater body weight?. *Appetite*. **120**:536-546.

Bowles, A, Dobson, A. & Fisher, R. 2011. An Exploratory Investigation into First Year Student Transition to University. Conference: Proceedings of HERDSA 2011 Annual Conference, Australia.

Boyce, C. & Neale, P. 2006. Conducting In-depth Interviews: A Guide for Designing and Conducting In-depth Interviews for Evaluation Input. *Pathfinder International.* Monitoring and Evaluation-2.

Boyce, J. A., & Kuijer, R. G. 2015. Perceived stress and freshman weight change: The moderating role of baseline body mass index. *Physiology & Behaviour*, **139**:491–496.

Braden, A., Musher-Eizenman, D., Watford, T. and Emley, E., 2018. Eating when depressed, anxious, bored, or happy: Are emotional eating types associated with unique psychological and physical health correlates?. *Appetite*. **125**:410-417.

Breslow, R.A., Smothers, B.A. 2005. Drinking patterns and body mass index in never smokers: National Health Interview Survey, 1997-2001. *Am J Epidemiol* **161**:368–376.

Brown, O.N., O'Connor & L.E., Savaiano, D. 2014. Mobile MyPlate: A Pilot Study Using Text Messaging to Provide Nutrition Education and Promote Better Dietary Choices in College Students. *Journal of American College Health.* **10**:1080.

Brunt, A.R., Rhee, Y.S. 2008. Obesity and lifestyle in U.S. college students related to living arrangements. *Appetite*. **51**:615–621

Bryant, E.J., King, N.A. and Blundell, J.E., 2008. Disinhibition: its effects on appetite and weight regulation. *Obesity reviews*. **9(5)**:409-419.

Bryant, E.J., Caudewell, P., Hopkins, M.E., King, N.A., Blundell, J.E. 2012. Psycho-markers of weight loss. The roles of TFEQ Disinhibition and Restraint in exercise-induced weight management. *Appetite*. **58**:234-241.

Buboltz, W.C Jr, Brown, F., Soper, B. 2001. Sleep habits and Patterns of College Students: A Preliminary Study. *J Am Coll Health*. **50(3)**:131.

Buboltz Jr, W., Jenkins, S.M., Soper, B., Woller, K., Johnson, P. and Faes, T. 2009. Sleep habits and patterns of college students: an expanded study. *Journal of College Counseling*. **12(2)**:113-124.

Bullock, S., 2004. *Alcohol, drugs and student lifestyle: A study of the attitudes, beliefs and use of alcohol and drugs among Swedish university students*. Centrum för socialvetenskaplig alkohol-och drogforskning (SoRAD).

Butler, S.M., Black, D.R., Blue, C.L. and Gretebeck, R.J., 2004. Change in diet, physical activity, and body weight in female college freshman. *American journal of health behavior*. **28(1)**:24-32.

Butler, A. B., Dodge, K. D. and Faurote, E. J. (2010) College student employment and drinking: a daily study of work stressors, alcohol expectancies, and alcohol consumption. Journal of Occupational Health Psychology. **15**:291–303.

Castro, O., Bennie, J., Vergeer, I., Bosselut, G. and Biddle, S.J., 2020. How Sedentary Are University Students? A Systematic Review and Meta-Analysis. *Prevention Science*. **21(3)**:332-343.

Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System questionnaire. 2009. http://www.cdc.gov/brfss/questio nnaires/pdf-ques/2009brfss.pdf. [Accessed July 9, 2014].

Chakraborty, S. 2014. Analysis of NHANES 1999-2002 data reveals noteworthy association of alcohol consumption with obesity. *Ann Gastroenterol Q Publ Hell Soc Gastroenterol.* **27**:250–257.

Chapelot, D. and Charlot, K., 2019. Physiology of energy homeostasis: Models, actors, challenges and the glucoadipostatic loop. *Metabolism*. **92**:11-25.

Chaput, J.P., Depres, J.P, Bouchard, C. 2008. The Association Between Sleep Duration and Weight Gain in Adults: A 6- Year Prospective study from the Quebec Family Study. *SLEEP*. **31(4)**:517-523.

Cheung, Y.T.D., Lee, A.M., Ho, S.Y., Li, E.T.S., Lam, T.H., Fan, S.Y.S. and Yip, P.S.F., 2011. Who wants a slimmer body? The relationship between body weight status, education level and body shape dissatisfaction among young adults in Hong Kong. *BMC Public Health*. **11(1)**:835.

Choi, Y., Choi, S.H., Yun, J.Y., Lim, J.A., Kwon, Y., Lee, H.Y. and Jang, J.H., 2019. The relationship between levels of self-esteem and the development of depression in young adults with mild depressive symptoms. *Medicine*, *98*(42).

Chooi, Y.C. , Ding, C., Magkos, F. 2019. The Epidemiology of Obesity. *Metabolism Clinical and Experimental*. 92: 6-10.

Christie, H., Tett, L., Cree, V.E., Hounsell, J., McCune, V. 2008. 'A real rollercoaster of confidence and emotions': learning to be a university student, Studies in Higher Education. **33(5)**:567-581.

Chung, L.M.Y. and Fong, S.S.M., 2015. Predicting actual weight loss: A review of the determinants according to the theory of planned behaviour. *Health psychology open*. ***2*****(1)**:2055102914567972.

Cilliers, J., Senekal, M. & Kunneke, E. 2006. The Association Between the Body Mass Index of First-year Female University Students and their Weight-related Perceptions and Practices, Psychological health, Physical Activity and Other Physical Health Indicators. *Public Health Nutrition*. **9(2)**:234-243.

Cohen, S., Kamarck, T., Mermelstein, R. 1983. A Global Measure of Perceived Stress. *Journal of Health and Social Behavior*. **24(4)**:385-396.

Constant, A., Gautier, Y., Coquery, N., Thibault, R., Moirand, R. and Val-Laillet, D., 2018. Emotional overeating is common and negatively associated with alcohol use in normal-weight female university students. *Appetite*. **129**:186-191.

Cook, I., Alberts, M. & Lambert, E.V. 2011. Compliance with physical activity guidelines in rural, black South Africans in the Limpopo Province: an energy expenditure approach. *Br J Sports Med.* **45**:619-625.

Cox, M.J., DiBello, A.M., Meisel, M.K., Ott, M.Q., Kenney, S.R., Clark, M.A. and Barnett, N.P., 2019. Do misperceptions of peer drinking influence personal drinking behavior? Results from a complete social network of first-year college students. *Psychology of addictive behaviors*.

Craig, C.L., Marshall, A.L., Sjostrom, M., et al. 2003. International Physical Activity Questionnaire: 12-country Reliability and Validity. *Med Sci Sport Exerc.* **35**:1381-1395.

Cristiana, P.O.P., 2016. Self-esteem and body image perception in a sample of university students. *Eurasian Journal of Educational Research*. **16(64)**.

Crockett, A.C., Myhre, S.K. and Rokke, P.D., 2015. Boredom proneness and emotion regulation predict emotional eating. *Journal of Health Psychology*. **20(5)**:670-680.

Croezen, S., Visscher, T.L.S., Ter Bogt, N.C.W., Veling, M.L. and Haveman-Nies, A., 2009. Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: results of the E-MOVO project. *European Journal of Clinical Nutrition*. **63(3)**:405-412.

Crombie, A.P., Ilich, J.Z., Dutton, G.R,. Panton, L.B., Abood, D.A. 2009. The Freshman Weight Gain Phenomenon Revisited. *Nutr Rev*. **67**:83–94.

Dao, M.C., Everard, A., Aron-Wisnewsky, J., Sokolovska, N., Prifti, E., Verger, E.O., Kayser, B.D., Levenez, F., Chilloux, J., Hoyles, L. and Dumas, M.E., 2016. Akkermansia muciniphila and improved metabolic health during a dietary intervention in obesity: relationship with gut microbiome richness and ecology. *Gut*. **65(3)**:426-436.

Das, B.M. and Evans, E.M., 2014. Understanding weight management perceptions in first-year college students using the health belief model. *Journal of American College Health*. **62(7)**:488-497.

Dean, E. 2016. Anxiety. *Nurs Stand*. **30(46)**:15.

Deasy, C., Coughlan, B., Pironom, J., Jourdan, D. and Mcnamara, P.M., 2014. Psychological distress and lifestyle of students: implications for health promotion. *Health promotion international*. **30(1)**:77-87.

De Lauzon, B., Romon, M., Deschamps, V., Lafay, L., Borys, J.M., Karlsson, J.,

Ducimetière, P. and Charles, M.A., 2004. The Three-Factor Eating Questionnaire-R18 is able to distinguish among different eating patterns in a general population. *The Journal of nutrition*. **134(9)**:2372-2380.

de Lauzon-Guillain, B., Clifton, E.A., Day, F.R., Clément, K., Brage, S., Forouhi, N.G., Griffin, S.J., Koudou, Y.A., Pelloux, V., Wareham, N.J. and Charles, M.A., 2017. Mediation and modification of genetic susceptibility to obesity by eating behaviors. *The American journal of clinical nutrition*. **106(4)**:996-1004.

De Vos, P., Hanck, C., Neisingh, M., Prak, D., Groen, H., Faas, M.M. 2015. Weight Gain in Freshman College Students and Percieved Health. *Preventative Medicine Reports*. **2**:229-234.

Deliens, T., Clarys, P., De Bourdeaudhuij, I. and Deforche, B., 2014. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. *BMC public health*, *14*(1), pp.1-12.

Deliens, T., Deforche, B., De Bourdeaudhuij, I. and Clarys, P., 2015. Determinants of physical activity and sedentary behaviour in university students: a qualitative study using focus group discussions. *BMC public health*. **15(1)**:201.

Deliens, T., Verhoeven, H., De Bourdeaudhuij, I., Huybrechts, I., Mullie, P., Clarys, P. and Deforche, B., 2018. Factors associated with fruit and vegetable and total fat intake in university students: A cross-sectional explanatory study. *Nutrition & Dietetics*. ***75*(2)**:151-158.

del Mar Bibiloni, M., Coll, J.L., Pich, J., Pons, A. and Tur, J.A., 2017. Body image satisfaction and weight concerns among a Mediterranean adult population. *BMC public health*. **17(1)**:39.

Dennis, E.A., Potter, K.L., Estabrooks, P.A. and Davy, B.M., 2012. Weight gain prevention for college freshmen: comparing two social cognitive theory-based interventions with and without explicit self-regulation training. *Journal of obesity*. *2012*.

Denny, K.N., Loth, K., Eisenberg, M.E., Neumark-Sztainer, D. 2013. Intuitive eating in young adults: Who is doing it, and how is it related to disordered eating behaviours? *Appetite*. **60(1)**:13-19.

Department of Health, Medical Research Council, OrcMacro. 2007. South African Demographic and Health Survey 2003. Pretoria: Department of Health.

Deshpande, S., Basil, M.D. & Basil, D.Z. 2009. Factors Influencing Healthy Eating Habits Among College Students: An Application of the Health Belief Model. *Health Marketing Quarterly*. **26(2)**:145-164.

Dietz, W.H. 2017. Obesity and Excessive Weight Gain in Young Adults. New Targets for Prevention. *American Medical Association.* **318(3)**:241-242.

Dietary guidelines for Americans. 2015. US Dep. Health Hum. Serv, US Dep. Agric. 2015. e2020 https://health.gov/ dietaryguidelines/2015/guidelines/. [Accessed 31 October 2018].

DiGrande, L., Perrier, M.P., Lauro, M.G. and Contu, P., 2000. Alcohol use and correlates of binge drinking among university students on the Island of Sardinia, Italy. *Substance use & misuse*. **35(10)**:1471-1483.

DiGuiseppi, G.T., Meisel, M.K., Balestrieri, S.G., Ott, M.Q., Cox, M.J., Clark, M.A. and Barnett, N.P., 2018. Resistance to peer influence moderates the relationship between perceived (but not actual) peer norms and binge drinking in a college student social network. *Addictive behaviors*, **80**:47-52.

Dinu, M., Abbate, R., Gensini, G.F., Casini, A. and Sofi, F., 2017. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. *Critical reviews in food science and nutrition*, *57*(17), pp.3640-3649.

Dohle, S., Wansink, B. and Zehnder, L., 2015. Exercise and food compensation: exploring diet-related beliefs and behaviors of regular exercisers. *Journal of Physical Activity and Health*. **12(3)**:322-327.

Donnelly, J.E., Blair, S.N., Jakicic, J.M., Manore, M.M., Rankin, J.W. and Smith, B.K., 2009. Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine & Science in Sports & Exercise*. **41(2)**:459-471.

Driskell, J.A., Kim, Y.N., Goebel, K.J. 2005. Few Differences Found in the Typical Eating and Physical Activity Habits of Lower-Level and Upper-Level University Students. *J Am Diet assoc*. **105**:798-801.

Dyson, R. and Renk, K., 2006. Freshmen adaptation to university life: Depressive symptoms, stress, and coping. *Journal of clinical psychology*. **62(10)**:1231-1244.

EFSA Panel on Dietetic Products Nutrition and Allergies (NDA). 2010. Dietary Reference Values. *Parma: European Food Safety Authority (EFSA).*

Eisenberg, D., Golberstein, E. and Hunt, J.B., 2009. Mental health and academic success in college. *The BE Journal of Economic Analysis & Policy*. **9(1).**

Elfhag, K. & Rossner, S. 2005. Who succeeds in maintaining weight loss? A conceptual review of factors associated with weight loiss maintenance and weight regain. *Obesity reviews*. **6**:67-85.

Egan, O., 1986. The concept of belief in cognitive theory. In *Annals of theoretical psychology*. Springer, Boston, MA. 315-350.

Erikson, E. 1994. Identity and the life cycle. New York: Norton.

Erikson, E. 1994. Identity: youth and crisis. New York: Norton.

Engs, R.C., Slawinska, J.B. and Hanson, D.J., 1991. The drinking patterns of American and Polish university students: A cross-national study. *Drug and alcohol dependence*. **27(2)**:167-175.

Evans, C. and Dolan, B., 1993. Body Shape Questionnaire: derivation of shortened “alternate forms”. *International Journal of Eating Disorders*. **13(3)**:315-321.

Farhat, T., Iannotti, R.J. and Simons-Morton, B.G., 2010. Overweight, obesity, youth, and health-risk behaviors. *American journal of preventive medicine*. **38(3)**:258-267.

Fayet, F., Petocz, P. & Samman, S. 2012. Prevalence and Correlates of Dieting in College Women: a Cross Sectional Study. *International Journal of Women's Health.* **4**:405-411.

Fazzino, T.L., Fleming, K., Sher, K.J., Sullivan, D.K. and Befort, C., 2017. Heavy drinking in young adulthood increases risk of transitioning to obesity. *American journal of preventive medicine*. **53(2)**:169-175.

Fazzino, T.L., Forbush, K., Sullivan, D. and Befort, C.A., 2019. A Prospective Study of Alcohol Use Patterns and Short-Term Weight Change in College Freshmen. *Alcoholism: Clinical and Experimental Research*. **43(5)**:1016-1026.

Finlayson, G., Cecil, J., Higgs, S., Hill, A. and Hetherington, M., 2012. Susceptibility to weight gain. Eating behaviour traits and physical activity as predictors of weight gain during the first year of university. *Appetite*. **58(3)**:1091-1098.

Flegal, K.M., Kruszon-Moran, D., Carroll, M.D., Fryar, C.D. and Ogden, C.L., 2016. Trends in obesity among adults in the United States, 2005 to 2014. *Jama*. 315(21):2284-2291.

Foright, R.M., Presby, D.M., Sherk, V.D., Kahn, D., Checkley, L.A., Giles, E.D., Bergouignan, A., Higgins, J.A., Jackman, M.R., Hill, J.O. and MacLean, P.S., 2018. Is regular exercise an effective strategy for weight loss maintenance?. *Physiology & behavior*. **188**:86-93.

Francis, J., Eccles, M.P., Johnston, M., Walker, A.E., Grimshaw, J.M., Foy, R., Kaner, E.F., Smith, L. and Bonetti, D., 2004. Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers.Centre for Health Services Research, University of New Castle, United Kingdom.

Francis, J.J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M.P. and Grimshaw, J.M., 2010. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology and Health*. **25(10)**:1229-1245.

Gallagher, M.L. (2012). Intake: Nutrients and their Metabolism. Krause's Food and The Nutrition care Process. Edition 13. *Elsevier Inc.* Missouri, USA. 3:32-125.

Gangwisch, J.E., Malaspina, D., Boden-Albala, B. and Heymsfield, S.B., 2005. Inadequate sleep as a risk factor for obesity: analyses of the NHANES I. *Sleep*. **28(10)**:1289-1296.

Gardner, J., Kjolhaug, J., Linde, J.A., Sevcik, S. and Lytle, L.A., 2013. Teaching Goal-Setting for Weight-Gain Prevention in a College Population: Insights from the CHOICES Study. *Journal of health education teaching*. **4(1)**:39.

Gariepy, G., Nitka, D. and Schmitz, N., 2010. The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. *International journal of obesity*. **34(3)**:407.

Geiker, N.R.W., Astrup, A., Hjorth, M.F., Sjödin, A., Pijls, L. and Markus, C.R., 2018. Does stress influence sleep patterns, food intake, weight gain, abdominal obesity and weight loss interventions and vice versa?. *Obesity reviews*. ***19*(1)**:81-97.

Gillen, M.M. & Lefkowitz, E.S. 2011. The 'Freshman 15': Trends and Predictors in a sample of Multiethnic Men and Women. *Eat Behav*. **12(4)**:261-266.

Global BMI Mortality Collaboration. 2016. Body-mass index and all-cause mortality: individual-participant-data meta-analysis of 239 prospective studies in four continents. *Lancet*. **388**:776–86.

Gluckman, P.D.; Hanson, M.A.; Cooper, C., Thornburg, K.L. (2008). Effect of in utero and early-life conditions on adult health and disease. *N Engl J Med*. **359**:61-73.

Godin, G. & Shephard, R.J. 1985. "A Simple Method to Assess Exercise Behavior

in the Community," *Canadian Journal of Applied Sport Sciences*. **10(3)**:141–146.

Govender, I., Nel, K. and Sibuyi, X.M., 2017. An exploration of alcohol use amongst undergraduate female psychology students at a South African university. *South African journal of psychiatry*. **23(1).**

Gow, R.W., Trace, S.E., Mazzeo, S.E. 2010. Preventing Weight Gain in First Year College Students: An Online Intervention to Prevent the "Freshmen Fifteen" *Eat Behav*. **11(1):**33-39.

Graham, M.A. & Jones, A.L. 2002. Freshman 15: Valid Theory or Harmful Myth? *J Am Coll Health*. **50(4)**:171-173.

Grave, R.D.,Centis, E., Marzocchi, R., Ghoch, M.E., Marchesini, G. 2013. Major Factors for Facilitating Change in Behavioural Strategies to Reduce Obesity. *Psychology Research and Behaviour Management*. **6**:101-110.

Gray-Little, B., Williams, V.S.L. & Hancock, T.D. (1997). An Item Response Theory analysis of the Rosenberg Self-Esteem Scale. *Personality and Social Psychology Bulletin*. **23:**443-451.

Gresse, A., Steenkamp, L. and Pietersen, J., 2015. Eating, drinking and physical activity in Faculty of Health Science students compared to other students at a South African university. *South African Journal of Clinical Nutrition*. ***28*(4)**:154-159.

Groesz, L.M., McCoy, S., Carl, J., et al. 2012. What is eating you? Stress and the drive to eat. *Appetite*. **58(2)**:717-721.

Gunnare, N., Silliman, K. & Morris, M. 2013. Accuracy of self-reported weight and role of gender, body mass index, weight satisfaction, weighing behavior, and physical activity among rural college students. *Body Image*. **10**:406-410.

Haidar, S.A., De Vries, N.K., Karavetian, M. and El-Rassi, R., 2018. Stress, anxiety, and weight gain among university and college students: A systematic review. *Journal of the Academy of Nutrition and Dietetics*. **118(2)**:261-274.

Hall, K.D., Sacks, G., Chandramohan, D., Chow, C.C., Wang, Y.C., Gortmaker, S.L. and Swinburn, B.A., 2011. Quantification of the effect of energy imbalance on bodyweight. *The Lancet*. **378(9793)**:826-837.

Halperin, D.T., Laux, J., LeFranc-García, C., Araujo, C. and Palacios, C., 2019. Findings From a Randomized Trial of Weight Gain Prevention Among Overweight Puerto Rican Young Adults. *Journal of nutrition education and behavior*. **51(2)**:205-216.

Hartmann-Boyce, J., Boylan, A.M., Jebb, S.A., Fletcher, B. and Aveyard, P., 2017. Cognitive and behavioural strategies for self-directed weight loss: systematic review of qualitative studies. *Obesity Reviews*. **18(3)**:335-349.

Haskell, W.L., Lee, I.M., Pate, R.R., Powell, K.E., Blair, S.N., Franklin, B.A., Macera, C.A., Heath, G.W., Thompson, P.D. and Bauman, A., 2007. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine & science in sports & exercise*. **39(8)**:1423-1434.

Hayes, J.F., Balantekin, K.N., Altman, M., Wilfley, D.E., Taylor, C.B. and Williams, J., 2018. Sleep patterns and quality are associated with severity of obesity and weight-related behaviors in adolescents with overweight and obesity. *Childhood Obesity*. **14(1)**:11-17.

Haynes, A., Kersbergen, I., Sutin, A., Daly, M. and Robinson, E., 2018. A systematic review of the relationship between weight status perceptions and weight loss attempts, strategies, behaviours and outcomes. *Obesity Reviews*. **19(3)**:347-363.

Hays, N.P., & Roberts, S.B. 2008. Aspects of eating behaviors "disinhibition" and "restraint" are related to weight gain and BMI in women. *Obesity*. **16(1)**:52

Hendricks, K.M., Herbold, N. and Fung, T., 2004. Diet and other lifestyle behaviors in young college women. *Nutrition Research*. **24(12)**:981-991.

Hershner, S.D. and Chervin, R.D., 2014. Causes and consequences of sleepiness among college students. *Nature and science of sleep*. **6**:73.

Hill, J.O., Wyatt, H.R. and Peters, J.C., 2013. The importance of energy balance. *European endocrinology*. **9(2)**:111.

Hilger, J., Loerbroks, A. and Diehl, K., 2017. Eating behaviour of university students in Germany: Dietary intake, barriers to healthy eating and changes in eating behaviour since the time of matriculation. *Appetite*. **109**:100-107.

Hirshkowitz, M., Whiton, K., Albert, S.M, Alessi, C., Bruni, O., et al. (2015). The National Sleep Foundation's sleep time duration recommendations: methodology and results summary. *Sleep Health*. **1(1)**:40–43.

Hivert, M.F., Langlois, M.F., Berard, P., Cuerrier, J.P. and Carpentier, A.C., 2007. Prevention of weight gain in young adults through a seminar-based intervention program. *International journal of obesity*. **31(8)**:1262-1269.

Hootman, K.C., Guertin, K.A. and Cassano, P.A., 2018. Stress and psychological constructs related to eating behavior are associated with anthropometry and body composition in young adults. *Appetite*. **125**:287-294.

Horacek, T.M., Erdman, M.B., Byrd-Bredbenner, C., Carey, G., Colby, S.M., Greene, G.W., Guo, W., Kattelmann, K.K., Olfert, M., Walsh, J. and White, A.B., 2013. Assessment of the dining environment on and near the campuses of fifteen post-secondary institutions. *Public health nutrition*. **16(7)**:1186-1196.

Hormes, J.M. and Niemiec, M.A., 2017. Does culture create craving? Evidence from the case of menstrual chocolate craving. *PloS one*. **12(7)**:e0181445.

Hovell, M.F., Mewbor, C.R., Randle, Y. & Fowler-Johnson, S. 1985. Risk of Excess Weight Gain in University Women: A Three-year Community Controlled Analysis. *Addict Behav*. **10**:12-28.

Hunt, J. and Eisenberg, D., 2010. Mental health problems and help-seeking behavior among college students. *Journal of adolescent health*. **46(1)**:3-10.

Hunt, T.K., Forbush, K.T., Hagan, K.E. and Chapa, D.A., 2017. Do emotion regulation difficulties when upset influence the association between dietary restraint and weight gain among college students?. *Appetite*. **114**:101-109.

Huang, T.T.K., Harris, K.J., Lee, R.E., Nazir, N., Born, W. and Kaur, H., 2003. Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American College Health*. **52(2)**:83-86.

Hyland, M.E., Irvine, S.H., Thacker, C., Dann, P.L. and Dennis, I., 1989. Psychometric analysis of the Stunkard-Messick Eating Questionnaire (SMEQ) and comparison with the Dutch Eating Behavior Questionnaire (DEBQ). *Current Psychology*. **8(3)**:228-233.

Ibrahim, A.K., Kelly, S.J., Adams, C.E., Glazebrook, C., 2013. A systematic review of studies of depression prevalence in university students. *J. Psychiatr. Res*. **47(3)**:391–400.

Institute of Medicine Food and Nutrition Board. 2005. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). *Washington, DC: National academies Press.*

Ireton-Jones, C.S. 2017. Intake: Energy. Krause's Food and The Nutrition Care Process. Edition 14. *Elsevier Inc.* Missouri, USA**. 2**:24.

Jacobs, L. and Steyn, N.P., 2013. "If you drink alcohol, drink sensibly." Is this guideline still appropriate?. *South African Journal of Clinical Nutrition*. **26(3)**:114-S119.

James, D.C.S. 2012. Weight loss strategies used by African American women: possible implications for tailored messages. *J Hum Nutr Diet.* **26**:71-77.

James, S.L., Abate, D., Abate, K.H., Abay, S.M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A. and Abdollahpour, I., 2018. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–

2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*. ***392*(10159)**:1789-1858.

Jensen, M.D., Ryan, D.H., Apovian, C.M., Ard, J.D., Comuzzie, A.G. et al. 2014. 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults: A report of the American College of Cardiology/ American Heart Assocation Task Force on Practice Guidelines and the Obesity Society. *Circulation: J Amer Heart Assoc.* **00**:000-000.

Joseph, R.J., Alonso-Alonso, M., Bond, D.S., Pascual-Leone, A. and Blackburn, G.L., 2011. The neurocognitive connection between physical activity and eating behaviour. *obesity reviews*. **12(10)**:800-812.

Jung, M.E., Bray, S.R. and Ginis, K.A.M., 2008. Behavior change and the freshman 15: tracking physical activity and dietary patterns in 1st-year university women. *Journal of American College Health*. **56(5)**:523-530.

Kahleova, H., Levin, S. and Barnard, N., 2017. Cardio-metabolic benefits of plant-based diets. *Nutrients*. **9(8)**:848.

Kalinowski, A. and Humphreys, K., 2016. Governmental standard drink definitions and low-risk alcohol consumption guidelines in 37 countries. *Addiction*. **111(7)**:1293-1298.

Kandiah, J.; Yake, M; Jones, J, Meyer, M. 2006. Stress influences appetite and comfort food preferences in college women. *Nutr Res*. **26**:118–23.

Kantanis, T. 2000. The Role of Social Transition in Students' Adjustment to the First-Year of University. *Journal of Institutional Research*. **9**:100-110.

Kapinos ,K.A., Yakusheva, O. 2011. Environmental influences on young adult weight gain: Evidence from a natural experiment. *Journal of Adolescent Health*. **48**:52–58.

Kapinos, K.A., Yakusheva, O. and Eisenberg, D., 2014. Obesogenic environmental influences on young adults: Evidence from college dormitory assignments. *Economics & Human Biology*. **12**:98-109.

Karlsson, J., Persson, L. O., Sjostrom, L. & Sullivan, M. (2000) Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) study. *Int. J. Obes. Relat. Metab. Disord.* **24**:1715-1725.

Katz, D.L. & Meller, S. 2014. Can We Say What Diet Is Best For Health? *Public Health*. **35**:83-103.

Kattelmann, K.K., Byrd Bredbenner, C., White, A.A., Greene, G.W., Hoerr, S.L., et al. 2014. The Effect of Young Adults Eating and Active for Health (YEAH): A Theory-Based Web-Delivered Intervention. *Journal of Nutrition Education and Behaviour*. **46**:6*.*

Kauwell, G.P.A. 2008. Epigenetics: What it is and How it Can Affect Dietetics Practice. *J Am Diet Acc.* **108(6)**:1056-1059.

Keesey, R.E., Hirvonen, M.D. 1997. Body weight set-points: Determination and adjustment. *J Nutr*. **127**:1875S–83S.

Kelly, S., Martin, S., Kuhn, I., Cowan, A., Brayne, C. and Lafortune, L., 2016. Barriers and facilitators to the uptake and maintenance of healthy behaviours by people at mid-life: a rapid systematic review. *PloS one*. **11(1)**:e0145074.

Kessler, R.C., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S., Walters, E.E. & Zaslavsky, A.M. 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychological Medicine. **32(06):** 959-976.

Kliemann, N., Croker, H., Johnson, F. and Beeken, R.J., 2018. Starting university with high eating self-regulatory skills protects students against unhealthy dietary intake and substantial weight gain over 6 months. *Eating behaviors*. **31**:105-112.

Kim, M. and Lee, H., 2010. Overestimation of own body weights in female university students: associations with lifestyles, weight control behaviors and depression. *Nutrition Research and Practice*. **4(6)**:499-506.

Kiviruusu, O., Konttinen, H., Huurre, T., Aro, H., Marttunen, M. and Haukkala, A., 2016. Self-esteem and body mass index from adolescence to mid-adulthood. A 26-year follow-up. *International journal of behavioral medicine*. **23(3)**:355-363.

Klama, J., 2013. Predicting Fruit and Vegetable Intake with the Theory of Planned Behavior: A Literature Review.

Kong, L.C., Holmes, B.A., Cotillard, A., Habi-Rachedi, F., Brazeilles, R., Gougis, S., Gausserès, N., Cani, P.D., Fellahi, S., Bastard, J.P. and Kennedy, S.P., 2014. Dietary patterns differently associate with inflammation and gut microbiota in overweight and obese subjects. *PloS one*. ***9*(10)**.

Konttinen, H., Silventoinen, K., Sarlio-Lähteenkorva, S., Männistö, S. and Haukkala, A., 2010. Emotional eating and physical activity self-efficacy as pathways in the association between depressive symptoms and adiposity indicators. *The American journal of clinical nutrition*. **92(5)**:1031-1039.

Konttinen, H., Van Strien, T., Männistö, S., Jousilahti, P. and Haukkala, A., 2019. Depression, emotional eating and long-term weight changes: a population-based prospective study. *International Journal of Behavioral Nutrition and Physical Activity*. **16(1)**:28.

Krueger, R.A. & Casey, M.A. 2009. Focus Groups: A Practical Guide for Applied Research. 4th Ed. USA: *Sage Publications, Inc*.

Kruger, H.S., Puoane, T., Senekal, M., van der Merwe, M.T. 2005. Obesity in South Africa: challenges for government and health professionals. *Public Health nutrition*. **8(5)**:491-500.

Kushner, R.F., 2014. Weight loss strategies for treatment of obesity. *Progress in cardiovascular diseases*. **56(4)**:465-472.

LaCaille, L.J., Dauner, K.N., Krambeer, R.J., Pedersen, J. 2011. Psychosocial and Environmental Determinants of Eating Behaviours, Physical Activity, and Weight Change Among College Students: A Qualitative Analysis. *Journal of American College Health.* **59(6)**:531-538.

Lambert, E.V., Bohlmann, I., Kolbe-Alexander, T. 2001. Be active: physical activity for health in South Africa. *S Afr J Clin Nutr.* **14(3)**:S12-S15.

Lara-Castro, C., Weinsier, R.L., Hunter, G.R. and Desmond, R., 2002. Visceral adipose tissue in women: longitudinal study of the effects of fat gain, time, and race. *Obesity research*. **10(9)**:868-874.

LaRose, J.G., Neiberg, R.H., Evans, E.W., Tate, D.F., Espeland, M.A., Gorin, A.A., Perdue, L., Hatley, K., Lewis, C.E., Robichaud, E. and Wing, R.R., 2019. Dietary outcomes within the study of novel approaches to weight gain prevention (SNAP) randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*. **16(1)**:14.

Larson, N., Chen, Y., Wall, M., Winkler, M.R., Goldschmidt, A.B. and Neumark-Sztainer, D., 2018. Personal, behavioral, and environmental predictors of healthy weight maintenance during the transition to adulthood. *Preventive medicine*. **113**:80-90.

Laska, M.N., Pelletier, J.E., Larson, N.I., Story, M. 2013. Interventions for Weight Gain Prevention During the Transition to Young Adulthood: A Review of the Literature. *J Adolesc Health*. **50(4)**:324-333.

Lazarevich, I., Irigoyen-Camacho, M.E., Velázquez-Alva, M.C., Lara-Flores, N., Nájera-Medinaand, O. and Zepeda-Zepeda, M.A., 2018. Depression and food consumption in Mexican college students. *Nutricion hospitalaria*. ***35*(3)**:620-626.

Lazaverich, I., Irigoyen- Camacho, M.E. & Velazquez-Alva, M.C. 2013. Obesity, eating behaviour and mental health amoung university students in Mexico City. *Nutr Hosp*. **28(6)**:1892-1899.

Lazarevich, I., Camacho, M.E.I., del Consuelo Velázquez-Alva, M. and Zepeda, M.Z., 2016. Relationship among obesity, depression, and emotional eating in young adults. *Appetite*. **107**:639-644.

Le Chatelier, E., Nielsen, T., Qin, J., Prifti, E., Hildebrand, F., Falony, G., Almeida, M., Arumugam, M., Batto, J.M., Kennedy, S. and Leonard, P., 2013. Richness of

human gut microbiome correlates with metabolic markers. *Nature*. **500(7464)**:541-546.

Levitsky, D.A., Halbmaier, C.A., Mrdjenovic, G. 2004. The Freshman Weight Gain: A Model for the Study of the Epidemic of Obesity. *Int J Obes Relat Metab Disord*. **28**:1435–42.

Levitsky, D.A., Garay, J., Nausbaum, M., Neighbors, L., DellaValle, D.M. 2006. Monitoring Weight Daily Blocks the Freshman Weight Gain: a Model for Combating the Epidemic of Obesity. *Int J Obes*. **30:**1003–1010.

Lewer, M., Bauer, A., Hartmann, A.S. and Vocks, S., 2017. Different facets of body image disturbance in binge eating disorder: a review. *Nutrients*. **9(12)**:1294.

Liu, A.G., Ford, N.A., Hu, F.B., Zelman, K.M., Mozaffarian, D. and Kris-Etherton, P.M., 2017. A healthy approach to dietary fats: understanding the science and taking action to reduce consumer confusion. *Nutrition journal*. **16(1)**:53.

Liu, X., Li, Y., Tobias, D.K., Wang, D.D., Manson, J.E., Willett, W.C. and Hu, F.B., 2018. Changes in types of dietary fats influence long-term weight change in US women and men. *The Journal of nutrition*. **148(11)**:1821-1829.

Liu, Y., Ajami, N.J., El-Serag, H.B., Hair, C., Graham, D.Y., White, D.L., Chen, L., Wang, Z., Plew, S., Kramer, J. and Cole, R., 2019. Dietary quality and the colonic mucosa–associated gut microbiome in humans. *The American journal of clinical nutrition*. **110(3)**:701-712.

Livesey, G., Taylor, R., Livesey, H.F., Buyken, A.E., Jenkins, D.J., Augustin, L.S., Sievenpiper, J.L., Barclay, A.W., Liu, S., Wolever, T. and Willett, W.C., 2019. Dietary glycemic index and load and the risk of type 2 diabetes: a systematic review and updated meta-analyses of prospective cohort studies. *Nutrients*. **11(6)**:1280.

Lloyd-Richardson, E.E., Bailey, S., Fava, J.L., Wing, R. 2009. A Prospective Study of Weight Gain During The College Freshman and Sophomore Years. *Prev Med*.

48(3):256-261.

Lowe, M.R., Feig, E.H., Winter, S.R. and Stice, E., 2015. Short-term variability in body weight predicts long-term weight gain. *The American journal of clinical nutrition*. **102(5)**:995-999.

Lowe, M.R. & Kral, T.V.E. 2006. Stress- induced eating in restrained eaters may not be caused by stress or restraint. *Appetite*. **46**:16-21.

Lowe, M.R., Marti, C.N., Lesser, E.L. and Stice, E., 2019. Weight suppression uniquely predicts body fat gain in first-year female college students. *Eating behaviors*. **32**:60-64.

Ludy, M.J., Tan, S.Y., Leone, R.J., Morgan, A.L. and Tucker, R.M., 2018. Weight gain in first-semester university students: Positive sleep and diet practices associated with protective effects. *Physiology & behavior*. **194**:132-136.

Lysen, L.K & Israel, D.A. 2012. Nutrition in Weight Management. Krause's Food and The Nutrition care Process. Edition 13. **22**:462-488.

Lyzwinski, L.N., Caffery, L., Bambling, M. and Edirippulige, S., 2019. The Mindfulness App Trial for Weight, Weight-Related Behaviors, and Stress in University Students: Randomized Controlled Trial. *JMIR mHealth and uHealth*. ***7*(4)**:e12210-e12210.

Machado, E.C., Silviera, M.F., & Silviera, V.M.F. 2012. Prevalence of Weight-loss Strategies and Use of Substances for Weight-loss among Adults: a population study. *Cad. Saude Publica, Rio de Janeiro*. **28(8)**:1439-1449.

Malinauskas, B.M., Raedeke, T.D., Aeby, V.G., Smith, J.L. and Dallas, M.B., 2006. Dieting practices, weight perceptions, and body composition: a comparison of normal weight, overweight, and obese college females. *Nutrition Journal*. ***5*(1)**:11.

Marshall, M.N., 1996. Sampling for qualitative research. *Family practice*. **13(6)**:522-526.

Marshall, S.J., Levy, S.S, Tudor-Locke, C.E, Kolkhorst, F.W., Wooten, K.M., Ji, M., Macera, C.A., Ainsworth, B.A. Translating Physical Activity Recommendations into a Pedometer-Based Step Goal: 3000 Steps in 30 Minutes. *Am J Prev Med*. **36**:410-415.

Mascolo, M., Chu, E.S., Mehler, P.S. 2011. Abuse and Clinical Value of Diuretics in Eating Disorders Therapeutic Applications. *Int J Eat Disord*. **44**:200-202.

Matvienko, O., Lewis, D.S. and Schafer, E., 2001. A college nutrition science course as an intervention to prevent weight gain in female college freshmen. *Journal of Nutrition Education*. **33(2)**:95-101.

Mazurek Melnyk, B., Slevin, C., Militello, L., Hoying, J., Teall, A. and McGovern, C., 2016. Physical health, lifestyle beliefs and behaviors, and mental health of entering graduate health professional students: Evidence to support screening and early intervention. *Journal of the American Association of Nurse Practitioners*. **28(4)**:204-211.

Mchiza, Z.J., Steyn, N.P., Hill, J., Kruger, A., Schönfeldt, H., Nel, J. and Wentzel-Viljoen, E., 2015. A review of dietary surveys in the adult South African population from 2000 to 2015. *Nutrients*. **7(9)**:8227-8250.

McLeroy, K.R., Bibeau, D., Steckler, A. and Glanz, K., 1988. An ecological perspective on health promotion programs. *Health education quarterly*. **15(4)**:351-377.

Megel, M.E., Hawkins, P., Sandstrom, S., Hoefler, M.A. & Willrett, K. 1994. Health Promotion, Self-esteem, and Weight among Female College Freshmen. *Health Values*. **18(4)**:10-19.

Melina, V., Craig, W. and Levin, S., 2016. Position of the Academy of Nutrition and Dietetics: vegetarian diets. *Journal of the Academy of Nutrition and Dietetics*. **116(12)**:1970-1980.

Mendez-Hernandez, P., Dosamantes-Carrasco, D., Lamure, M., Lopez-Loyo, P., Hernandez-Palafox, C., Pineda-Perez, D., Flores, Y. & Salmeron, J. 2010. Weight-

loss Practices amoung University Students in Mexico. *Int J Public Health*. **55**:221-225.

Merrill, J.E. and Carey, K.B., 2016. Drinking over the lifespan: Focus on college ages. *Alcohol research: current reviews*.

Metzgar, C.J. and Nickols-Richardson, S.M., 2015. Effects of nutrition education on weight gain prevention: a randomized controlled trial. *Nutrition journal*. **15(1)**:31.

Michener, W., Rozin, P., Freeman, E. and Gale, L., 1999. The role of low progesterone and tension as triggers of perimenstrual chocolate and sweets craving: some negative experimental evidence. *Physiology & behavior*. **67(3)**:417-420.

Mikolajczyk, R.T., El Ansari, W., Maxwell, A.E. 2009. Food Consumption Frequency and Perceived Stress and Depressive Symptoms among Students in Three European Countries. *Nutrition*. **8**:31.

Mueller, M.P., Blondin, S.A., Korn, A.R., Bakun, P.J., Tucker, K.L., Economos, C.D. 2018. Behavioral Correlates of Empirically-Derived Dietary Patterns among University Students*. Nutrients.***10(6)**:E716.

Müller, M.J., Enderle, J. and Bosy-Westphal, A., 2016. Changes in energy expenditure with weight gain and weight loss in humans. *Current obesity reports*. **5(4)**:413-423.

Munt, A.E., Partridge, S.R. and Allman-Farinelli, M., 2017. The barriers and enablers of healthy eating among young adults: a missing piece of the obesity puzzle: a scoping review. *Obesity reviews*. **18(1)**:1-17.

Mustelin, L., Kaprio, J. and Keski-Rahkonen, A., 2018. Beyond the tip of the iceberg: Adolescent weight development of women and men with features of binge eating disorder. *Eating behaviors*. **30**:83-87.

National Institute on Alcohol Abuse and Alcoholism. 2005. Helping Patients Who

Drink Too Much: A Clinician's Guide. Available at: https://www.niaaa.nih.gov/guide. Accessed March 30, 2019.

Nelson, M.C., M. Story, M., Larson, N.I., Neumark-Sztainer, D., Lytle, L.A. 2008. Emerging Adulthood and College aged Youth: An Overlooked Age for Weight-related Behavior Change. *Obesity*. **16**:2205–2211.

Nelson, M.C., Lust, K., Story, M., Ehlinger, E. 2009. Alcohol use, eating patterns, and weight behaviors in a university population. *American Journal of Health Behavior*. **33**:227–237.

Neumark-Sztainer, D., and Hannan, P.J. 2002. Weight-Related Concerns and Behaviours Among Overweight and Nonoverweight Adolescents. *Arch Pediatr Adolesc*. **156**:171-178.

Newman, B.M, Newman, P.R. 2007. Theories of human development. Mahwah. NJ: Lawrence Erlbaum.

Newman, B.M, Newman, P.R. 2009. Development through life: A Psychosocial Approach. Belmont, California: Wadsworth.

Niedhammer, I., Bugel, I., Bonenfant, S., Goldberg, M. & Leclerc, A. 2000. Validity of self-reported weight and height in the French GAZEL cohort. *Int J Obes Relat Metab Disord.* 24:1111-1118.

Nikolaou, C.K., Hankey, C.R. and Lean, M.E.J., 2015. Weight changes in young adults: a mixed-methods study. *International journal of obesity*. **39(3)**:508.

Nordic Council of Ministers. 2004. Nordic nutrition recommendations 2004. Integrating nutrition and physical activity. *Arhus: Nordic Council of Ministers.*

Nourse, R., Adamshick, P. and Stoltzfus, J., 2017. College binge drinking and its association with depression and anxiety: a prospective observational study. *East Asian archives of psychiatry*. **27(1)**:18.

Ogden, C.L., Carroll, M.D., Lawman, H.G., Fryar, C.D., Kruszon-Moran, D., Kit, B.K.

and Flegal, K.M., 2016. Trends in obesity prevalence among children and adolescents in the United States, 1988-1994 through 2013-2014. *Jama*. **315(21)**:2292-2299.

Owen, N., Sugiyama, T., Koohsari, M.J., De Bourdeaudhuij, I., Hadgraft, N., Oyeyemi, A., Aguinaga-Ontoso, I., Mitáš, J., Troelsen, J., Davey, R. and Schofield, G., 2018. Associations of neighborhood environmental attributes with adults' objectively-assessed sedentary time: IPEN adult multi-country study. *Preventive medicine*. **115**:126-133.

Pagoto, S.L. and Appelhans, B.M., 2013. A call for an end to the diet debates. *Jama*. **310(7)**:687-688.

Palmeira, A.L., Teixeira, P.J., Branco, T.L., Martins, S.S., Minderico, C.S., Barata, J.T., Serpa, S.O. and Sardinha, L.B., 2007. Predicting short-term weight loss using four leading health behavior change theories. *International Journal of Behavioral Nutrition and Physical Activity*. **4(1)**:14.

Papas, M.A., Alberg, A.J., Ewing, R., Helzlsouer, K.J., Gary, T.L., Klassen, A.C. 2007. The built environment and obesity. *Epidemiologic reviews*. **29(1)**:129-143.

Park, H. and Papadaki, A., 2016. Nutritional value of foods sold in vending machines in a UK University: Formative, cross-sectional research to inform an environmental intervention. *Appetite*. **96**:517-525.

Patel, S.R., Malhotra, A., White, D.P., Gottlieb, D.J., Hu, F.B. 2006. Association Between Reduced Sleep and Weight Gain in Women. *Am J Epidemiol*. **164**:947-954.

Patrick, K., Marshall, S.J., Kolodziejczyk, J.K., Fowler, J.H., Calfas, K.J. et al. 2014. Design and Implementation of a Randomized Controlled Social and Mobile Weight Loss Trial for Young Adults (project SMART). *Contemporary Clinical Trials*. **37**:10-18.

Peltzer, K. and Pengpid, S., 2016. Sleep duration and health correlates among

university students in 26 countries. *Psychology, health & medicine*. **21(2)**:208-220.

Peltzer, K. and Pengpid, S., 2015. Trying to lose weight among non-overweight university students from 22 low, middle and emerging economy countries. *Asia Pacific journal of clinical nutrition*. ***24*(1):**177.

Peltzer, K. and Pengpid, S., 2017. The association of dietary behaviors and physical activity levels with general and central obesity among ASEAN university students. *AIMS public health*. ***4*(3):**301.

Pengpid, S., Peltzer, K., van der Heever, H. and Skaal, L., 2013. Screening and brief interventions for hazardous and harmful alcohol use among university students in South Africa: results from a randomized controlled trial. *International journal of environmental research and public health*. **10(5)**: 2043-2057.

Petridou, A., Siopi, A. and Mougios, V., 2019. Exercise in the management of obesity. *Metabolism*, **92**:163-169.

Piercy, K.L., Troiano, R.P., Ballard, R.M., Carlson, S.A., Fulton, J.E., Galuska, D.A., George, S.M. and Olson, R.D., 2018. The physical activity guidelines for Americans. *Jama*. **320(19)**: 2020-2028.

Pila, E., Sabiston, C.M., Brunet, J., Castonguay, A.L. and O'Loughlin, J., 2015. Do body-related shame and guilt mediate the association between weight status and self-esteem?. *Journal of health psychology*. **20(5)**:659-669.

Plotnikoff, R.C., Costigan, S.A., Williams, R.L., Hutchesson, M.J., Kennedy, S.G., Robards, S.L., Allen, J., Collins, C.E., Callister, R. and Germov, J., 2015. Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*. ***12*(1)**:45.

Poddar, K.H., Hosig, K.W., Nickols-Richardson, S.M., Anderson, E.S., Herbert,

W.G. and Duncan, S.E., 2009. Low-fat dairy intake and body weight and composition changes in college students. *Journal of the American Dietetic Association*. **109(8)**:1433-1438.

Primmer, J. 2018. "Belief", in Primmer, Justin (ed.), *The Stanford Encyclopedia of Philosophy*, Stanford, CA: The Metaphysics Research Lab, retrieved 19 September 2008.

Prioreschi, A., Wrottesley, S.V., Cohen, E., Reddy, A., Said-Mohamed, R., Twine, R., Tollman, S.M., Kahn, K., Dunger, D.B. and Norris, S.A., 2017. Examining the relationships between body image, eating attitudes, BMI, and physical activity in rural and urban South African young adult females using structural equation modeling. *PloS one*. **12(11).**

Privitera, G.J., Misenheimer, M.L., Doraiswamy, P.M. 2013. From weight loss to weight gain appetite changes in major depressive disorder as a mirror into brain-environment interactions. *Frontiers in Psychology*. **4(873)**:1-2.

Provencher, V., Polivy, J., Wintre, M.G., Pratt, M.W., Pancer, S.M., Birnie-Lefcovitch, S. and Adams, G.R., 2009. Who gains or who loses weight? Psychosocial factors among first-year university students. *Physiology & Behavior*. **96(1)**:135-141.

Provencher, V., Drapeau, V., Tremblay, A., Després, J.P. and Lemieux, S., 2003. Eating behaviors and indexes of body composition in men and women from the Quebec family study. *Obesity research*. **11(6)**:783-792.

Psychological Science (2011). Rosenberg's Self-esteem Scale. http://www.wwnorton.com/college/psych/psychsci/media/rosenberg.htm (Accessed 24 August 2019).

Puoane, T.R., Fourie, J.M., Tsolekile, L., Nel, J.H. and Temple, N.J., 2013. What do black South African adolescent girls think about their body size?. *Journal of hunger & environmental nutrition*, *8*(1), pp.85-94.

Puoane, T., Fourie, J.M., Shapiro, M., Rosling, L., Tshaka, N.C. and Oelefse, A., 2005. \'Big is beautiful\'-an exploration with urban black community health workers in a South African township. *South African Journal of Clinical Nutrition*, *18*(1), pp.6-15.

QSR International, 2018. NVivo Qualitative Data Analysis Software. Version 12 Pro.

Quick, V.M. & Bryd-Bredbenner, C. 2013. Disturbed eating behaviours and associated psychographic characteristics of college students. *J Hum Nutr Diet*. **26**:53-63.

Racette, S.B., Deusinger, S.S, Strube, M.J., Highstein, G.R., Deusinger, R.H. 2005. Weight Changes, Exercise, and Dietary Patterns During Freshman and Sophomore Years of College. *Journal of American College Health.* **53(6)**:245-251.

Ramage, S., Farmer, A., Apps Eccles, K., McCargar, L. 2014. Healthy strategies for successful weight loss and weight maintenance: a systematic review. *Appl Physiol Nutr Metab*. **39**:1-20.

Reba, L., Thornton, L., Tozzi, F., Klump, K.L., Brandt, H., Crawford, S., et al. 2005. Relationships between features associated with vomiting in purging-type eating disorders*. Int J Eat Disord*. **38**:287-294.

Reddy, S.P., Panday, S., Swart, D., Jinabhai, C.C., Amosun, S.L., James, S., Monyeki, K.D., Stevens, G., Morejele, N., Kambaran, N.S., Omardien, R.G., Van den Borne, H.W. Umthenthe Uhlaba Usamila: The South African Youth Risk Behaviour Survey 2002. *MRC, 2003*. Available at: http://www.doh.gov.za

Reddy, S.P., James, S., Sewpaul, R., Koopman, F., Funani, N.I., Sifunda, S., Josie, J., Masuka, P., Kambaran, N.S., Omardien, R.G. Umthente Uhlaba Usamila: The South African Youth Risk Behaviour Survey 2008. *MRC, 2010.* Cape Town: South Africa.

Reid, A. and Baker, F.C., 2008. Perceived sleep quality and sleepiness in South African university students. *South African journal of psychology*. **38(2)**:287-303.

Renk, K. and Smith, T., 2007. Predictors of academic-related stress in college students: An examination of coping, social support, parenting, and anxiety. *Naspa Journal*. **44(3)**:405-431.

Richard, A., Rohrmann, S., Lohse, T. and Eichholzer, M., 2016. Is body weight dissatisfaction a predictor of depression independent of body mass index, sex and age? Results of a cross-sectional study. *BMC public health*. **16(1)**:863.

Rihm, J.S., Menz, M.M., Schultz, H., Bruder, L., Schilbach, L., Schmid, S.M. and Peters, J., 2019. Sleep Deprivation Selectively Upregulates an Amygdala–Hypothalamic Circuit Involved in Food Reward. *Journal of Neuroscience*. **39(5)**:888-899.

Roane, B.M., Seifer, R., Sharkey, K.M., Van Reen, E., Bond, T.L., Raffray, T. and Carskadon, M.A., 2015. What role does sleep play in weight gain in the first semester of university?. *Behavioral sleep medicine*. **13(6)**:491-505.

Robins, R.W., Hendin, H.M, Trzesniewski, K.H. 2001. Measuring Global Self-Esteem: Construct Validation of a Single-Item Measure and the Rosenberg Self-Esteem Scale. *PSPB.* **27(2):**151-161.

Robinson, E., Sutin, A.R. and Daly, M., 2018. Self-perceived overweight, weight loss attempts, and weight gain: Evidence from two large, longitudinal cohorts. *Health Psychology*. **37(10)**:940.

Rodgers, R.F., DuBois, R., Frumkin, M.R. and Robinaugh, D.J., 2018. A network approach to eating disorder symptomatology: Do desire for thinness and fear of gaining weight play unique roles in the network? *Body image*. **27**:1-9.

Roerig, J.L., Steffen, K.J., Mitchell, J.E., Zunker, C. 2010. Laxative abuse. *Drugs*. **70(12)**:1487-1503.

Rogerson, D., Soltani, H. and Copeland, R., 2016. The weight-loss experience: a qualitative exploration. *BMC public health*. **16(1)**:371.

Rohde, K., Keller, M., la Cour Poulsen, L., Blüher, M., Kovacs, P. and Böttcher, Y., 2019. Genetics and epigenetics in obesity. *Metabolism*. **92**:37-50.

Romieu, I., Dossus, L., Barquera, S., Blottière, H.M., Franks, P.W., Gunter, M., Hwalla, N., Hursting, S.D., Leitzmann, M., Margetts, B. and Nishida, C., 2017. Energy balance and obesity: what are the main drivers?. *Cancer Causes & Control*. **28(3):**247-258.

Rosen, J.C, Jones, A., Ramirez, E., Waxman, S. 1996. Body Shape Questionnaire: studies of validity and reliability*. Int J Eat Disord*. **20**:315-9.

Rosenberg, M. 1965. Society and the Adolescent Self-Image. *Princeton University Press.*

Rossouw, K., Senekal, M. & Stander, I. 2000. The accuracy of self-reported weight by overweight and obese women in an outpatient setting. *Public Health Nutr*. 4:19-26.

Rothacker, D.Q. & Blackburn, G.L. 2000. Obesity prevalence by age group and 5-year changes in adults residing in rural Wisconsin. *J Am Diet Asso*. **100(7)**:784-790.

Rouse, P.C. and Biddle, S.J., 2010. An ecological momentary assessment of the physical activity and sedentary behaviour patterns of university students. *Health Education Journal*. **69(1)**:116-125.

Sacks, J.J., Gonzales, K.R., Bouchery, E.E., Tomedi, L.E. and Brewer, R.D., 2015. 2010 national and state costs of excessive alcohol consumption. *American journal of preventive medicine*. **49(5)**:e73-e79.

Sacks, F.M., Lichtenstein, A.H., Wu, J.H., Appel, L.J., Creager, M.A., Kris-Etherton, P.M., Miller, M., Rimm, E.B., Rudel, L.L., Robinson, J.G. and Stone, N.J., 2017. Dietary fats and cardiovascular disease: a presidential advisory from the American Heart Association. *Circulation*. **136(3)**:e1-e23.

Sares-Jäske, L., Knekt, P., Männistö, S., Lindfors, O. and Heliövaara, M., 2019. Self-Report Dieters: Who Are They?. *Nutrients*. **11(8)**:1789.

Schaefer, J.T. & Magnunson, A.B. 2014. A review of Interventions that Promote Eating by Internal Cues. *J Acad Nutr Diet*. **114(5)**:734-60.

Schembre, S.M., Nigg, C.R., Albright, C.L. 2011. Race/Ethnic Differences in Desired Body Mass Index and Dieting Practices Among Young Women Attending College in Hawai'i. *Hawai'i Med J*. **70**:1.

Schifter, D. & Azjen, I. 1985. Intention, Perceived control, and Weight Loss. An Application of the Theory of Planned Behaviour. *Journal of Personality and Social Psychology*. **49(3):**843-851.

Schonfeldt, H.C., Pretorius, B., Hall, N. 2013. "Fish, chicken, lean meat and eggs can be eaten daily": a food-based dietary guideline for South Africa*. S Afr J Clin Nutr*. **26(3)**:S66-S76.

Schwingshackl, L., Dias, S., Strasser, B. and Hoffmann, G., 2013. Impact of different training modalities on anthropometric and metabolic characteristics in overweight/obese subjects: a systematic review and network meta-analysis. *PloS one*. **8(12)**.

Schwingshackl, L., Schwedhelm, C., Hoffmann, G., Lampousi, A.M., Knüppel, S., Iqbal, K., Bechthold, A., Schlesinger, S. and Boeing, H., 2017. Food groups and risk of all-cause mortality: a systematic review and meta-analysis of prospective studies. *The American journal of clinical nutrition*. **105(6)**:1462-1473.

Seme, Z., de Villiers, A., Steyn, N.P. and Senekal, M., 2017. Food choices, physical activity levels and other factors associated with weight gain in primary school educators. *Journal of Consumer Sciences*.

Senekal, M. 1988. Factors related to weight gain experienced by first year female students in residence at the Univeristy of Stellenbosch. [Thesis] University of Stellenbosch, South Africa.

Senekal, M. 1994. Weight fluctuations experienced by first year female students at university and guidelines for long-term weight management. [Dissertation] Univeristy of Stellenbosch, South Africa.

Senekal, M., Albertse, E.C & Steyn, N.P. 1988. Weight change in first year female students in residence at a South African University. *J Diet Home Econ*. **16(3)**:83-87.

Senekal, M., Albertse, E.C., Momberg, D.J., Groenewald, C.J. and Visser, E.M., 1999. A multidimensional weight-management program for women. *Journal of the American Dietetic Association*. **99(10)**:1257-1264.

Senekal, M., 2005. *Love My Body Love Myself: A Self-help Weight Management Manual for Women*. M. Senekal.

Senekal, M., Mchiza, Z., Booley, S. 2008. Nutrition for Adults. Community Nutrition Textbook for South Africa: *A Rights-based Approach*. FAO/MRC: South Africa. **14**:479-546.

Senekal, M., 2012. Genotype-based personalised nutrition for obesity prevention and treatment: are we there yet?. *South African Journal of Clinical Nutrition*. **25(1)**:9-14.

Senekal, M., Lasker, G.L., van Velden, L., Laubscher, R. and Temple, N.J., 2016. Weight-loss strategies of South African female university students and comparison of weight management-related characteristics between dieters and non-dieters. *BMC public health*. **16(1)**:918.

Senekal, M., Lombard, C. and Harbron, J., 2018. A self-help weight-management manual limits weight gain in first-year female students living in university residences. *Journal of Consumer Sciences*.

Senekal, M., Steyn, N.P., Mashego, T.B., Nel, J.H. 2001. Evaluation of body shape, eating disorders and weight management related parameters in black female students of rural and urban origins. *S Afr J Psych*. **31(1)**.

Serlachius, A., Hamer, M. and Wardle, J., 2007. Stress and weight change in university students in the United Kingdom. *Physiology & Behavior*. **92(4)**:548-553.

Shenkin, A., 2006. Micronutrients in health and disease. *Postgraduate medical journal*. **82(971)**:559-567.

Shi, Y., Grech, A.L. and Allman-Farinelli, M., 2018. Changes in the nutritional quality of products sold in university vending machines since implementation of the health star rating in 2014; an environmental audit. *BMC public health*. ***18*(1)**:1255.

Shi, Y., Wang, Q., Norman, C., Allman-Farinelli, M. and Colagiuri, S., 2018. It Is Time to Make Policy for Healthier Food Environments in Australian Universities. *Nutrients*. **10(12)**:1909.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N.P., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M.G., Jacobs, L., Faber, M., & SANHANES-1 Team. 2013. South African National Health and Nutrition Examination Survey (SANHANES-1). *Cape Town: HSRC Press.*

Silva, D., Ferriani, L., Viana, M.C. 2019. Depression, anthropometric parameters, and body image in adults: a systematic review. *Rev Assoc Med Bras* (1992). **65(5)**:731-738.

Sing, C.Y.; Wong, W.S. 2010. Prevalence of Insomnia and its Psychosocial Correlates Among College Students in Hong Kong. *J Am Coll Health*. **59(3)**:174-82.

Singh, A., Bains, K. and Kaur, H., 2017. Relationship of eating behaviors with age, anthropometric measurements, and body composition parameters among professional Indian women. *Ecology of food and nutrition*. **56(5)**:411-423.

Sinha, R. and Jastreboff, A.M., 2013. Stress as a common risk factor for obesity and addiction. *Biological psychiatry*. **73(9)**:827-835.

Small, M., Bailey-Davis, L., Morgan, N. and Maggs, J., 2013. Changes in eating and physical activity behaviors across seven semesters of college: living on or off campus matters. *Health Education & Behavior*. **40(4)**:435-441.

Smith-Jackson, T & Reel, J.J. 2012. Freshmen Women and the “Freshman 15:: Perspectives on Prevalence and causes of College Weight Gain. *J Am Coll Health*. **60**:1.

Smuts, C.M. & Wolmarans, P. 2013. The importance of the quality or type of fat in the diet: a food-based dietary guideline for South Africa. *S Afr J Clin Nutr.* **26(3)**:S87-S99.

Sogari, G., Velez-Argumedo, C., Gómez, M. and Mora, C., 2018. College students and eating habits: A study using an ecological model for healthy behavior. *Nutrients*. **10(12)**:1823.

Soohinda, G., Mishra, D., Sampath, H. and Dutta, S., 2019. Body dissatisfaction and its relation to Big Five personality factors and self-esteem in young adult college women in India. *Indian Journal of Psychiatry*. **61(4)**:400.

South Africa Demographic and Health Survey 2016: Key Indicator Report, Statistics South Africa, 2017.

Spencer E.A.*, Appleby, P., Davey, G. & Key, T. 2002. Validity of self-reported height and weight in 4808 EPIC–Oxford participants. *Public Health Nutr*. 5:561-565.

Sprake, E.F., Russell, J.M., Cecil, J.E., Cooper, R.J., Grabowski, P., Pourshahidi, L.K. and Barker, M.E., 2018. Dietary patterns of university students in the UK: a cross-sectional study. *Nutrition journal*. **17(1)**:90.

Stallman, H.M. 2010. Psychological distress in university students: A comparison with general population data. *Australian Psychologist*. **45(4):**249-257.

Stanislawski, M.A., Dabelea, D., Lange, L.A., Wagner, B.D. and Lozupone, C.A., 2019. Gut microbiota phenotypes of obesity. *NPJ biofilms and microbiomes*. **5(1)**:1-9.

Stefan, N., Häring, H.U. and Schulze, M.B., 2018. Metabolically healthy obesity: the low-hanging fruit in obesity treatment?. *The lancet Diabetes & endocrinology*. **6(3)**:249-258.

Stipanuk, M & Caudill, M. 2019. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 4th Edition. *Saunders.* **4(20)**:573.

Steyn, N., Senekal, M., Brtis, S., Nel, J. (2000). Urban and rural differences in dietary intake, weight status and nutrition knowledge of black female students. DSc Asia Pacific *J Clin Nutr*. **9(1)**:53–59.

St-Onge, M.P., 2017. Sleep–obesity relation: Underlying mechanisms and consequences for treatment. *Obesity reviews*. **18**:34-39.

Strang, J.S. & Larson, N. 2012. Nutrition in Adolescence. Krause's Food and The Nutrition Care Process. Edition 13. **19**:410-430

Suter, P.M., Häsler, E. and Vetter, W., 1997. Effects of alcohol on energy metabolism and body weight regulation: is alcohol a risk factor for obesity?. *Nutrition Reviews*. **55(5)**:157-171.

Swanson, W.M., 2016. An opportunity to combat obesity lies in the at-risk college population. *Journal of the American Association of Nurse Practitioners*. **28(4)**:196-203.

Tabachnick, B. and Fidell, L., 2014. Using multivariate statistics (Pearson custom library). *Harlow: Pearson*.

Taheri, S., Lin, L., Austin, D., Young, T. and Mignot, E., 2004. Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PLoS medicine*. **1(3).**

Tajiri, E., Yoshimura, E., Hatamoto, Y., Tanaka, H. and Shimoda, S., 2018. Effect of sleep curtailment on dietary behavior and physical activity: a randomized crossover trial. *Physiology & behavior*. **184**:60-67.

Tamura, M., Moriguchi, Y., Higuchi, S., Hida, A., Enomoto, M., Umezawa, J. and Mishima, K., 2012. Neural network development in late adolescents during observation of risk-taking action. *PLoS One*, **7(6)**:e39527.

Tang, J., Yu, Y., Du, Y., Ma, Y., Zhu, H. and Liu, Z., 2010. Association between actual weight status, perceived weight and depressive, anxious symptoms in Chinese adolescents: a cross-sectional study. *BMC public health*. **10(1)**:594.

Tchernof, A. and Després, J.P., 2013. Pathophysiology of human visceral obesity: an update. *Physiological reviews*. **93(1)**:359-404.

Thomas, D. A. 2006. General Inductive Approach for Qualitative Data Analysis. *Am. J. Eval*. **27**:237–246.

Townshend, T. and Lake, A., 2017. Obesogenic environments: current evidence of the built and food environments. *Perspectives in Public Health*. **137(1)**:38-44.

Tremblay, A., 2018. Obesity management: what should we do if fat gain is necessary to maintain body homeostasis in a modern world?. *Frontiers in endocrinology*. **9**:285.

Uddin, R., Burton, N.W. and Khan, A., 2018. Perceived environmental barriers to physical activity in young adults in Dhaka City, Bangladesh—does gender matter?. *International health*. **10(1)**:40-46.

Underwood, B. and Fox, K., 2000. A survey of alcohol and drug use among UK based dental undergraduates. *British dental journal*. **189(6)**:314-317.

Vadeboncoeur, C., Townsend, N & Foster, C. 2015. A meta- analysis of weight gain in first year university students: is freshman 15 a myth? *BMC Obesity*. **2**:22.

Vadeboncoeur, C., Foster, C. and Townsend, N., 2016. Freshman 15 in England: a longitudinal evaluation of first year university student's weight change. *BMC obesity*. **3(1)**:45.

Vågstrand, K., Barkeling, B., Forslund, H.B., Elfhag, K., Linné, Y., Rössner, S. and Lindroos, A.K., 2007. Eating habits in relation to body fatness and gender in adolescents–results from the 'SWEDES'study. *European Journal of Clinical Nutrition*. **61(4)**:517-525.

Van den Berg, V.L., Abera, B.M.M., Nel, M. and Walsh, C.M., 2013. Nutritional

status of undergraduate healthcare students at the University of the Free State. *South African Family Practice*. **55(5)**:445-452.

van Dijk, S.J.; Molloy, P.L.; Varinli, H.; Morrison, J.L.; Muhlhausler, B.S. & members of EpiSCOPE. 2015. Epigenetics and Human Obesity. *International Journal of Obesity* **39**:85–97.

Van Dyck, D., Cardon, G., Deforche, B., Sallis, J.F., Owen, N. and De Bourdeaudhuij, I., 2010. Neighborhood SES and walkability are related to physical activity behavior in Belgian adults. *Preventive medicine*. **50**:S74-S79.

Van Dyck, D., Cardon, G., Deforche, B., Owen, N. and De Bourdeaudhuij, I., 2011. Relationships between neighborhood walkability and adults' physical activity: How important is residential self-selection?. *Health & place*. **17(4)**:1011-1014.

Vangay, P., Ward, T., Gerber J.S., Knights, D. 2015. Antibiotics, pediatric dysbiosis, and disease. *Cell Host Microbe. **17(5)***:553–564 82.

Van Horn, L. 2007. Nutritional research: The Power Behind the Fad-Free Diet. *J Amer Diet Assoc*. *Doi: 10.1016lj.jada.2007.01.020.*

Vankim, N.A. & Nelson, T.F. 2013. Vigorous Physical activity, Mental Health, Perceived Stress, and Socializing Among College Students. *Am J Health Promot*. **28(1)**:7-15.

Van Strien, T., 2018. Causes of emotional eating and matched treatment of obesity. *Current diabetes reports*. **18(6)**:35.

van Zyl, P., Botha, J., van Wyk, M., Breytenbach, J., Nel, C., van Niekerk, M. and Breytenbach, W., 2015. Hazardous, harmful and dependent drinking in hostel-dwelling students at the University of the Free State, Bloemfontein: a cross-sectional study. *Journal of Child & Adolescent Mental Health*. **27(2)**:125-133.

Vargas, P.A., Flores, M. and Robles, E., 2014. Sleep quality and body mass index in college students: the role of sleep disturbances. *Journal of American College Health*. **62(8)**:534-541.

Vella-Zarb, R.A., Elgar, F.J. 2009. The 'freshman 5': A Meta-analysis of Weight Gain in the Freshman Year of College. *J Am Coll Health*. **58**:161–6.

Venter, C.S., Vorster, H.H., Ochse, R., Swart, R. 2013. "Eat dry beans, split peas, lentils and soya regularly": a food-based dietary guideline. *S Afr J Clin Nutr*. **26(3)**:S36-S45.

Vorster, H.H., Bradham, J.B., Venter, C.S. 2013. An introduction to the revised food-based dietary guidelines for South Africa. *S Afr J Clin Nutr*. **26(3)**:S5-S12.

Vrey, J.D. and Venter, M.E., 1983. Manual to the adolescent self-concept scale. *Pretoria: University of South Africa*.

Walsh, A., Taylor, C. and Brennick, D., 2018. Factors that influence campus dwelling university students' facility to practice healthy living guidelines. *Canadian Journal of Nursing Research*. **50(2)**:57-63.

Wang, J., Chen, Y., Jin, Y., Zhu, L. and Yao, Y., 2019. Sleep quality is inversely related to body mass index among university students. *Revista da Associação Médica Brasileira*. **65(6)**:845-850.

Wardle, J., Chida, Y., Gibson, E.L, Whitaker, K.L., Steptoe, A. 2011. Stress and adiposity: A meta-analysis of longitudinal studies. *Obesity*. **19(4)**:771-778.

Webb, J.B., Butler-Ajibade, P., Robinson, S.A. and Lee, S.J., 2013. Weight-gain misperceptions and the third-person effect in Black and White college-bound females: Potential implications for healthy weight management. *Eating behaviors*. **14(3)**:245-248.

Welch, E., Lagerström, M. and Ghaderi, A., 2012. Body shape questionnaire: psychometric properties of the short version (BSQ-8C) and norms from the general Swedish population. *Body image*. **9(4)**:547-550.

Wen, C.P., Wai, J.P.M., Tsai, M.K., Yang, Y.C., Cheng, T.Y.D., Lee, M.C., Chan, H.T., Tsao, C.K., Tsai, S.P., Wu, X. 2011. Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study.

Lancet. **378**:1244-53.

Wengreen, H.J. & Moncur, C. 2009. Change in Diet, Physical Activity, and Body Weight Among Young-adults During the Transition from High School to College. *Nutrition Journal*. **8**:32.

Wharton, C.M., Adams, T., & Hampl, J.S. 2008. Weight Loss Practices and Body Weight Perceptions Among US College Students. *Journal of American College Health*. **56(5)**:579-584.

White, A. and Hingson, R., 2013. The burden of alcohol use: excessive alcohol consumption and related consequences among college students. *Alcohol Research: Current Reviews*. **35(2)**:201-219.

Wicki, M., Kuntsche, E. and Gmel, G., 2010. Drinking at European universities? A review of students' alcohol use. *Addictive behaviors*. **35(11)**:913-924.

Wilding, J.P., Mooney, V. and Pile, R., 2019. Should obesity be recognised as a disease?. *BMJ*. **366**:l4258.

Wilkinson, B. and Ivsins, A., 2017. Animal house: University risk environments and the regulation of students' alcohol use. *International Journal of Drug Policy*. **47**:18-25.

Williamson, D.F, Kahn, H.S., Remington, P.L. & Anda, R.F. 1990. The 10-year incidence of overweight and major weight gain in US adults. *Arch Intern Med*. **150**: 665-672.

Willmott, T.J., Pang, B., Rundle-Thiele, S. and Badejo, A., 2019. Weight management in young adults: Systematic review of electronic health intervention components and outcomes. *Journal of medical Internet research*. **21(2)**:e10265.

Wing, R.R., Tate, D., Espeland, M., Gorin, A., LaRose, J.G et al. 2013. Weight gain prevention in young adults: design of the study of novel approaches to weight gain prevention (SNAP) randomized controlled trial. *BMC Public Health.* **13**:300.

Wing, R.R. & Phelan, S. 2005. Long-term weight loss maintenance. *Am J Clin Nutr*. **82(suppl)**:222S-5S.

Woodruff, R.C., Raskind, I.G., Ballard, D., Battle, G., Haardörfer, R. and Kegler, M.C., 2018. Weight-related perceptions and experiences of young adult women in southwest Georgia. *Health promotion practice*. **19(1)**:125-133.

World Health Organisation/Food and Agricultural Organization. 2003. Diet, Nutrition and the Prevention of Chronic Disease. Report of a Joint WHO/FAO Expert Consultation. Chapter 5: Population nutrient intake goals for preventing chronic-diseases. *Geneva: World Health Organisation.*

World Health Organization, 2015. *Guideline: sugars intake for adults and children*. World Health Organization.

World Health Organization. 2012. Global Status Report on Alcohol and Health 2011. Management of substance abuse. Available from: who.int/substance_ abuse/publications/global_alcohol_report/en/ index.html

World Health Organisation (WHO). 2014. Global strategy on diet, physical activity and health. Accessed at: http://www.who.int/dietphysicalactivity/factsheet_adults/en/. On 15 April, 2014.

World Health Organisation. 2015. Obesity and Overweight. Available: http://www.who.int/mediacentre/factsheets/fs311/en/. Accessed 2016, 5 April.

World Health Organisation. 2018. Global Status Report on Alcohol and Health. Geneva. Available: https://www.who.int/substance_abuse/publications/alcohol/en/. Accessed 2020, 7 February.

Yahia, N., Wang, D., Rapley, M. and Dey, R., 2016. Assessment of weight status, dietary habits and beliefs, physical activity, and nutritional knowledge among university students. *Perspectives in public health*. ***136*(4)**:231-244.

Yakusheva, O., Kapinos, K. and Weiss, M., 2011. Peer effects and the freshman 15: evidence from a natural experiment. *Economics & Human Biology*. **9(2)**:119-132.

Yang, C.L., Schnepp, J. and Tucker, R.M., 2019. Increased Hunger, Food Cravings, Food Reward, and Portion Size Selection after Sleep Curtailment in Women Without Obesity. *Nutrients*. **11(3)**:663.

Yannakoulia, M., Poulimeneas, D., Mamalaki, E. and Anastasiou, C.A., 2019. Dietary modifications for weight loss and weight loss maintenance. *Metabolism*. **92**:153-162.

Yeomans, M.R., 2010. Alcohol, appetite and energy balance: is alcohol intake a risk factor for obesity?. *Physiology & behavior*. **100(1)**:82-89.

Yi, S., Ngin, C., Peltzer, K. and Pengpid, S., 2017. Health and behavioral factors associated with binge drinking among university students in nine ASEAN countries. *Substance abuse treatment, prevention, and policy*. **12(1)**: 32.

Yoong, S. L., Carey, M. L., D'Este, C. & Sanson-Fisher, R. W. 2013. Agreement between self- reported and measured weight and height collected in general practice patients: a prospective study. *BMC Med. Res. Methodology*. **13**:29-38.

Zhang, L., Qian, H. and Fu, H., 2018. To be thin but not healthy-The body-image dilemma may affect health among female university students in China. *PloS one*. **13(10).**

Zheng, Y., Manson, J.E., Yuan, C., Liang, M.H., Grodstein, F., Stampfer, M.J., Willett, W.C. and Hu, F.B., 2017. Associations of weight gain from early to middle adulthood with major health outcomes later in life. *Jama*. **318(3)**:255-269.

7. ADDENDA

Addendum A: Interview guide for semi-structured, in-depth interviews

Topic	**Discussion**
Introduction	Thank you for taking the time to meet with me today. Interviewer's name
Probes	Could you explain why? Would you give me an example? Can you elaborate on that? Would you explain that further? Is there anything else? I'm not sure I understand what you're saying
Interviewing techniques	Repeat what the person said – "so you say that….. " "just to make sure that I understand your point….." Nodding Yes…yes….
	Elicitation questions I will start with questions on your beliefs relating to dietary intake – could you tell me…..
Dietary intake	**What do you believe you should eat on a daily basis?** *Prompt: Could you explain why?* **What do you believe you should not eat?** *Prompt: Could you explain why?* **How important do you believe it is for you to eat healthy?** *Prompt: Could you explain the reasons for these beliefs?* **How do you believe you can benefit from eating healthy?** *Prompt: Could you explain why?* **What do you believe is nice about healthy eating?** *Prompt: Anything else…..? Why?* **What do you believe is not nice about healthy eating?** *Prompt: Anything else…? Why?* **Who do you believe would not support you if you tried to eat healthier while you are at university?** *Prompt: Why…..?* **Who do you believe would actually support you if you tried to eat healthier while you are at university?** *Prompt: Could you explain why?*

	What do you believe makes it difficult for you to eat healthy while you are at university? *Prompt: Could you explain why? Social eating – eating with and what friends eat?* **What do you believe is the most important change (thing/factor) that would make it easier for you to eat healthy while you are at university?** *Prompt: Anything else…? Why?* **To what extent do you believe consciously <u>restricting</u> what you eat plays a role in successful weight management?** *Prompt: Could you explain this a bit more?* **To what extent do you believe emotions and upsetting experiences would cause you to eat more than you would like to eat?** *Prompt: Could you explain this a bit more?* **To what extent do you believe <u>thinking</u> that you are hungry contributes to how much you eat?** *Prompt: Could you explain this a bit more?*
I am now going to move on to questions about physical activity; *please remember, physical activity includes walking to get to places, jogging, any sport, exercising at a gym, Pilates, yoga*	**How much physical activity do you believe you should be doing?** *Prompt: Could you explain why you believe this?* **How important do you believe it is for you to be physically active?** *Prompt: Could you explain the reasons for these beliefs?* **How do you believe you can benefit from being physically active?** *Prompt: Could you explain why?* **What do you believe is nice about being doing physical activity?** *Prompt: Anything else…..? Why? (possibility that they may say that they do not know as they have never been physically active* **What do you believe is not nice about doing physical activity?** *Prompt: Anything else…? Why?* **Who do you believe would not support you if you tried to be more active while you are at university?** *Prompt: Why?* **Who do you believe would support you if you tried to be more active while you are at university?** *Prompt: Why?* **What do you believe makes it difficult for you to be physically active while you are at university?** *Prompt: Why?* **What do you believe is the most important change (thing/factor) that would make it easier for you to be physically active while you are at university?** *Prompt: Anything else…? Why?*

I am now going to move on to questions about Sleeping time	**How much sleep do you believe you should get?** *Prompt: Could you explain why you believe this?* **How important do you believe it is for you to sleep enough?** *Prompt: Could you explain the reasons for these beliefs?* **How do you believe you can benefit from sleeping enough?** *Prompt: Could you explain why?* **Is there anybody you believe who would not support you if you tried to sleep as much as you need while you are at university?** *Prompt: Why?* **Is there anybody you believe who would support you if you tried to sleep as much as you need while you are at university?** *Prompt: Why?* **What do you believe makes it difficult for you to sleep enough while you are at university?** *Prompt: Why?* **What do you believe is the most important change (thing) that would make it easier for you sleep enough while you are at university?** *Prompt: Anything else…? Why?*
I am now going to move on to questions about Alcohol intake	**What are your beliefs about you personally drinking alcohol?** *Prompt: Why?* **What do you believe is nice about drinking alcohol?** *Prompt: Why?* **What do you believe is not nice about drinking alcohol?** *Prompt: Why?* **At what point do you believe you should stop drinking alcohol when you are out drinking?** *Prompt: Why?* **Who do you believe would support you if you tried to decrease/limit your alcohol intake while you are at university?** *Prompt: Why?* **Who do you believe would NOT support you if you tried to decrease/limit your alcohol intake while you are at university?** *Prompt: Why?* **What do you believe would make it difficult for you if you tried to decrease/limit your alcohol intake while you are at university?** *Prompt: Why?* **What is the most important change (thing/factor) that would make it easier for you if you tried to decrease/limit your alcohol intake while you are at university?**

	Prompt: Anything else…? Why?
I am now going to move on to questions about Stress and depression	**What role do you believe stress plays in what you eat?** *Prompt: Why?* **What role do you believe feeling sad/ depressed plays in what you eat?** *Prompt: Why?* **What role do you believe stress plays in how much physical activity you do?** *Prompt: Why?* **What role do you believe feeling sad/ depressed plays in how much physical activity you do?** *Prompt: Why?* **What role do you believe stress plays in how much you sleep?** *Prompt: Why?* **What role do you believe feeling sad/ depressed plays in how much you sleep?** *Prompt: Why?* **What role do you believe stress plays in how much alcohol you drink (only ask if she indicated that she drinks alcohol)?** *Prompt: Why?* **What role do you believe feeling sad/ depressed plays in how much alcohol you drink (only ask if she indicated that she drinks alcohol)?** *Prompt: Why?*
I am now going to move on to questions about believes you have about the size and shape of your body and self-esteem. I am going to refer to body size and shape as "your body" in the following questions.	**What do you believe has the biggest effect on what you think about your body?** *Prompt: Why?* **What do you believe has the biggest effect on your self-esteem?** *Prompt: Why?* **To what extent do you believe thoughts about your body affect what and how much you eat?** *Prompt: Why?* **To what extent do you believe your self-esteem affects what and how much you eat?** *Prompt: Why?* **To what extent do you believe thoughts about your body affect what and how much physical activity you do?** *Prompt: Why?* **To what extent do you believe your self-esteem affects what and how much physical activity you do?** *Prompt: Why?* **To what extent do you believe thoughts about your body affect decisions about your need to lose or gain weight?** *Prompt: They may allude to the one or the other in their answers (or say neither is*

	relevant), then explore further **To what extent do you believe your self-esteem affects decisions about your need to lose or gain weight?** **To what extent do you believe your self-esteem affects how much alcohol you use?** *Only ask if relevant* *Prompt: why?*
Weight management attempts	**What strategies do you believe would work for you to prevent weight gain if necessary?** *Prompt: Anything else?* **What strategies do you believe would work for you to lose weight if necessary?** *Prompt: Anything else?*
Closing points	Is there anything more you would like to add? Thank you for your time.

Addendum B: Participant Information and Informed Consent Form (Phase 1)

Investigation of beliefs relating to weight gain prevention behviours and weight related constructs in first year female students at three South African Universities

Investigators: Gabi Lasker, Prof M Senekal and Dr J Harbron
Division of Human Nutrition, Department of Human Biology, Faculty of Health Sciences
University of Cape Town (UCT).

Dear Study Participant
You are invited to take part in a study for research that is being conducted as part of a masters degree at UCT. The study will investigate beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities.

You can take part in this study if you are a registered first year female student at UCT, SU or UWC. You are unfortunately not eligible to take part if you are still living at home, are pregnant, breastfeeding, an elite athlete, follow dietary restrictions for a medical condition or have a disease that may influence your weight.

What will be expected of you?

You will be required to participate in a one-on-one interview. The interview will take place in a private location, at a time and place that suits you, and in your language of preference. We will also need to know your ethnicity as we want to make sure that we gain insights from all ethnic groups.

The one-on-one interview covers the following:

Your beliefs relating to weight gain prevention behaviours i.e.

- Dietary intake
- Alcohol intake
- Sleep time
- Physical activity

Your beliefs relating to weight related constructs

- Eating behaviours
- Stress
- Body shape perception
- Self-esteem
- Psychological well-being

- Weight management attempts

The interview should not take longer than 1 hour to complete and will be recorded in order for us to analyse the content.

Are there any benefits if you take part in this study?

You will receive no monetary benefits for partaking in this study but you will receive a copy of the student weight management manual by Senekal (2005) on completion of the interview. The results of this study may benefit future first year female students by gaining insights into beliefs relating to weight gain prevention behaviours and weight related constructs. These insights will be used in the development of a weight gain prevention intervention for first year female students.

Are there any risks involved in your taking part in this study?

There is no risk for your participation in this research and your safety will not be compromised in any way.

How will your confidentiality be protected?

A computer database will be used to store research data and each subject will be allocated a code to maintain anonymity and thus confidentiality. Your anonymity will also be ensured in publishing the data. Tape recordings of interviews will be kept under lock and key in the office of the research supervisor and will be destroyed on the completion and publication of the research.

Other important ethical considerations:

This study was approved by the Human Research Ethics Committee of UCT, which means that the study is ethical and safe. The principles of the Declaration of Helsinki (2013), Good Clinical Practice (GCP) and the laws of South Africa will be adhered to in this research. Participating in this study is your own free choice, and you have the right to withdraw from the study without stating a reason at any stage during the research.

Contact Information

If you have any complaints regarding the ethics of this study, or questions about your rights, please do not hesitate to call the Human Research Ethics Committee, on 021 406 6338.

For any other questions regarding this study, please contact:
Prof Marjanne Senekal on 021 406 6784
Gabi Lasker on 082 603 4689; glasker26@gmail.com

Declaration by Participant:

By signing below, I……. (write in your name and surname) agree to take part in this research study. I confirm that the exact procedures and nature of the study detailed in the information sheet have been explained to me. I have had the opportunity to ask questions about it and my questions have been answered to my satisfaction. The decision to take part in this study is my own. I have carefully read the accompanying Information Form and understand the nature, purpose and procedure of this study.

……
Your signature

…….
Date

Declaration by investigator:

I declare that I did not force the participant to take part in this study and that I will do no harm to the participant. I will ensure that their personal information is kept confidential and that their privacy will be protected.

……..
Investigator name (Print)

……
Investigator signature

……
Date

Addendum C: Participant Information and Informed Consent Form (Phase 2)

Investigation of beliefs relating to weight gain prevention behviours and weight related constructs in first year female students at three South African Universities

Investigators: Gabi Lasker, Prof M Senekal and Dr J Harbron
Division of Human Nutrition, Department of Human Biology, Faculty of Health Sciences
University of Cape Town (UCT).

Dear Study Participant
You are invited to take part in a study for research that is being conducted as part of a master's degree at UCT. The study will investigate beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities.

You can take part in this study if you are a registered first year female student at UCT, SU or UWC. You are unfortunately not eligible to take part if you are still living at home, are pregnant, breastfeeding, an elite athlete, follow dietary restrictions for a medical condition or have a disease that may influence your weight.

The following will be required of you:

- Having your weight and height measured without shoes in a private location on campus.
- Completion of a questionnaire to assess beliefs regarding weight gain prevention behaviours as well as weight related constructs and personal history and health information, weight history, body shape perception, current dietary intake, physical activity, sleep time, alcohol intake, self- esteem, eating behaviours, locus of control and psychological well-being .

The assessments should not take longer than 45 minutes to complete.

Are there any benefits if you take part in this study?

You will receive no monetary benefits for partaking in this study but you will receive a copy of the student weight management manual by Senekal (2005). The results of this study may benefit future first year female students by gaining insights into beliefs relating to weight gain prevention behaviours and weight related constructs. These insights will be used in the development of a weight gain prevention intervention for first year female students.

Are there any risks involved in your taking part in this study?

There is no risk for your participation in this research and your safety will not be compromised in any way.

How will your confidentiality be protected?

A computer database will be used to store research data and each subject will be allocated a code to maintain anonymity and thus confidentiality. Your anonymity will also be ensured in publishing the data.

Other important ethical considerations:

This study was approved by the Human Research Ethics Committee of UCT, which means that the study is ethical and safe. The principles of the Declaration of Helsinki (2013), Good Clinical Practice (GCP) and the laws of South Africa will be adhered to in this research. Participating in this study is your own free choice, and you have the right to withdraw from the study without stating a reason at any stage during the research.

Contact Information

If you have any complaints regarding the ethics of this study, or questions about your rights, please do not hesitate to call the Human Research Ethics Committee, on 021 406 6338.

For any other questions regarding this study, please contact:
Prof Marjanne Senekal on 021 406 6784
Gabi Lasker on 082 603 4689; glasker26@gmail.com

Declaration by Participant:

By signing below, I……. (write in your name and surname) agree to take part in this research study. I confirm that the exact procedures and nature of the study detailed in the information sheet have been explained to me. I have had the opportunity to ask questions about it and my questions have been answered to my satisfaction. The decision to take part in this study is my own. I have carefully read the accompanying Information Form and understand the nature, purpose and procedure of this study.

……
Your signature

……
Date

Declaration by investigator:

I declare that I did not force the participant to take part in this study and that I will do no harm to the participant. I will ensure that their personal information is kept confidential and that their privacy will be protected.

……..
Investigator name (Print)

……
Investigator signature

……
Date

Addendum D: Poster (Phase 1)

Investigation of beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities

Investigators: Gabi Lasker, Prof M Senekal, Dr J Harbron
Division of Human Nutrition, Department of Human Biology, Faculty of Health Sciences
University of Cape Town (UCT).

You are invited to take part in a study for research that is being conducted as part of a masters degree at UCT.

Can I take part?

Registered first year female student at UCT, SU or UWC

Still living at home, pregnant, breastfeeding, elite athlete, follow dietary restrictions for a medical condition, have a disease that may influence your weight

What will be expected of you? A 1 hr one-on-one interview

When and where? A private location, at a time and place that suits you.

The interview will cover the following:

Beliefs relating to weight gain prevention behaviours:

- Dietary intake
- Alcohol intake
- Sleeping time
- Physical activity

Benefits?

- Receive a copy of a student weight management manual by Senekal (2005)

If you are interested, please contact:

Gabi Lasker: (Cell) 082 603 4689 or (Email) glasker26@gmail.com

Addendum E:Poster (Phase 2)

Investigation of beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities

Investigators: Gabi Lasker, Prof M Senekal, Dr J Harbron
Division of Human Nutrition, Department of Human Biology, Faculty of Health Sciences
University of Cape Town (UCT).

You are invited to take part in a study for research that is being conducted as part of a masters degree at UCT.

Can I take part?

✓ Registered first year female student at UCT, SU or UWC

✗ Still living at home, pregnant, breastfeeding, elite athlete, follow dietary restrictions for a medical condition, have a disease that may influence your weight

What will be expected of you? Anthropometric measurements (weight & height) and a questionnaire that will take approximately 30 minutes to complete.

When and where? A private location on campus or at the university residence.

The questionnaire will cover the following:

- Personal information & health history
- Body shape perception
- Weight and weight loss history
- Food choices/dietary intake and meal pattern
- Physical activity
- Sleep time
- Eating behaviour
- Self- esteem
- Stress
- Psychological well-being
- Beliefs relating to weight gain prevention behaviours

Benefits?

- Receive a copy of the student weight management manual by Senekal (2005)

If you are interested, please contact:

Gabi Lasker: (Cell) 082 603 4689 or (Email) glasker26@gmail.com

Addendum F: Questionnaire

Investigation of beliefs relating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities

Write in/ place a cross (X) in the appropriate blocks.

Student code:

PERSONAL INFORMATION AND HEALTH HISTORY

1. Date of birth (DD/MM/YYYY)

2. What is your weight?

……. Kg

3. What is your height?

……..cm

4. Where do you live when you are at university?

Private residence without family or parents	University residence

5. To which one of the following groups do you belong?

Black (African)	White	Coloured	Indian	Other

6. What is your mother's highest level of education?

No formal education	Primary School	Secondary School but not matric	Matric	University or college degree/diploma	Post- graduate degree

7. What is your father's highest level of education?

No formal education	Primary School	Secondary School but not matric	Matric	University or college degree/diploma	Post- graduate degree

8. Have you been pregnant in the past?

Yes*	No

*If yes, how many previous pregnancies have you had?

…….

WEIGHT AND WEIGHT LOSS HISTORY

1. When you were a child you were (Primary school)…..

Too thin (underweight)	Just about the right weight (normal weight)	Too chubby/fat (overweight)	Very overweight (obese)

2. When you were an adolescent you were (High School)……

Too thin (underweight)	Just about the right weight (normal weight)	Too chubby/fat (overweight)	Very overweight (obese)

3. When you look at yourself now do you think you are….

Too thin (underweight)	Just about the right weight (normal weight)	Too chubby/fat (overweight)	Very overweight (obese)

4. Did you try to lose weight last year (2017)?

Yes	No

5. Did you try to lose weight this year (2018)?

Yes	No

6. Did you actively try to prevent gaining weight this year? (2018)

Yes	No

BELIEFS RELATING TO WEIGHT MANAGEMENT

Please answer each of the following statements by choosing/ placing a cross (X) over the block that best describes your belief. Please read each statement carefully.

1. Eating less carbohydrates would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

2. Carbohydrates should be part of a balanced, healthy diet.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

3. Eating less fruit would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

4. Eating more protein would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

5. Skipping meals would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

6. Planning my meals and snacks ahead would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

7. Vegetables can be tasty.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

8. Sticking to a healthy diet plan would be easy for me.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

9. There are no forbidden foods.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

10. Healthy eating can be enjoyable.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

11. It is difficult not to overeat.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

12. Being awake at night may increase how much I eat.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

13. The lack of healthy food options at university makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

14. My peers would judge me if I made healthy food choices when socializing.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

15. Socialising makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

16. It would be easier for me to manage my weight if the people around me also eat healthy.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

17. Healthy eating can be affordable.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

18. Knowing how to prepare my own meals would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

19. Preparing my own meals would take a lot of time.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

20. Feeling fat makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

21. Feeling stressed/anxious makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

22. Feeling sad/depressed makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

23. Mindless eating makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

24. Counting calories would help me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

25. Exercise is important for weight management.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

26. Feeling fat would cause me to feel less comfortable to exercise.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

27. I can make time in my day for exercise.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

28. Feeling stressed/anxious reduces my desire to exercise.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

29. Feeling sad/depressed reduces my desire to exercise.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

30. Drinking alcohol would make it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

31. Having a poor self- image makes it difficult for me to manage my weight.

Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree

MEAL PATTERN AND FOOD CHOICES

1. How often in a week do you eat the following meals/snacks?

Time of day	Number of times per week e.g. If NEVER, place a cross (X) at 0 times per week on the appropriate line; if EVERYDAY, place a cross (X) at 7 times per week on the appropriate line for each meal/snack time							
	Do not eat	1 time a week	2 times a week	3 times a week	4 times a week	5 times a week	6 times a week	7 times a week
Drink/Snack pre- breakfast								
Breakfast								
Mid Morning snack								
Lunch								
Late Afternoon snack								
Dinner								
After dinner								

2. To complete this questionnaire, please think very carefully about what you ate and drank for the whole of last week. If you **did not** eat or drink a specified food or drink in the last week, tick NOT AT ALL. If you **did** eat it in the last week, think carefully whether you ate or drank the item every day. If yes, think carefully how

many times a day (1 per day, 2 per day or 3 and more times per day) and tick the right block. If you did not eat the item every day, think carefully how many days during the last week (1-3 times or 4-6 times) you did eat it and place a cross (X) the right block.

Food or drink	How many times did you eat or drink the food or drink in the last week?				
	NOT AT ALL	1-3 times a week	4-6 times a week	1 time a day	≥2 times a day
Red meat like beef, mutton, pork, sausage, ostrich					
Processed and tinned meats like polony, viennas, russians or bully beef					
Chicken					
Fish (fresh, tined or smoked)					
Milk, sour milk or yoghurt					
Cheese (yellow, spreads, cream cheese, cottage cheese)					
Legumes like sugar beans, baked beans, lentils or chickpeas					
White bread, rolls, pita bread, wraps					
Brown, wholewheat or rye bread, rolls, pita or wraps					
Breakfast cereals like All Bran, Weetbix. Wholewheat, Pronutro					
Breakfast cereals like cornflakes, rice crispies, muesli					
Oats porridge					
Rice, pasta, samp, couscous, potato (mash/boiled)					
Maize (pap)					
Oranges, naartjies, grapefruit, guavas, strawberries					
Peach, apricot, mangoes, paw paw, melon					
Orange or yellow vegetables like sweet potato, pumpkin, butternut, carrots					
Green vegetables like spinach, peas, beans, broccoli					
Mixed vegetables (fresh, tinned or frozen)					

Food or drink	How many times did you eat or drink the food or drink in the last week?				
	NOT AT ALL	1-3 times a week	4-6 times a week	1 time a day	≥2 times a day
Cabbage, cauliflower, lettuce					
Tomato (raw or cooked)					
Margarine, butter, lard or oil					
Peanut butter or peanuts, nuts or seeds					
Fried potatoes or slap chips					
Other fried foods: fat cakes, fried fish, fried chicken					
Pies, sausage rolls, samoosas					
Sugar					
Chocolate					
Sweets e.g. boiled, lollipops, jelly					
Cake, biscuits, doughnuts					
Fizzy drinks like Coke, Cream Soda (not diet drinks) or sweetened fruit juice					
Crisps like Lays, Nik-Naks, papas, pretzels					
Take outs (KFC, McDonalds)					
Jams, Syrups, Honey					
Alcohol					

SLEEP

1. Think about the time you actually spend sleeping or napping, not just the amount of sleep you think you should get. On average, how many hours of sleep do you get in a 24-hour period?

……..	Hours per day

PHYSICAL ACTIVITY

The questions in this section are based on the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

……..	Days per week

* if 0 days per week (NO vigorous physical activities), Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

…… Hours per day	…… Minutes per day	Don't know/not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

……..	Days per week

*If O days (NO moderate physical activities), Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

…… Hours per day	…… Minutes per day	Don't know/not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

……	Days per week

* If 0 Days (NO walking), Skip to question 7

6. How much time did you usually spend walking on one of those days?

…… Hours per day	…… Minutes per day	Don't know/not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

…… Hours per day	…… Minutes per day	Don't know/not sure

BODY SHAPE

We would like to know how you have been feeling about your appearance over the PAST FOUR WEEKS. Please read each question and cross (X) the appropriate answer box. Please answer all the questions.

OVER THE PAST FOUR WEEKS:

1. Have you been afraid that you might become fat (or fatter)?	Never	Rarely	Some-times	Often	Very often	Always
2. Has feeling full (e.g. after eating a large meal) made you feel fat?	Never	Rarely	Some-times	Often	Very often	Always
3. Has thinking about your shape interfered with your ability to concentrate (e.g. while watching television, reading, listening to conversations)?	Never	Rarely	Some-times	Often	Very often	Always
4. Have you imagined cutting off fleshy areas of your body?	Never	Rarely	Some-times	Often	Very often	Always
5. Have you felt excessively large and rounded?	Never	Rarely	Some-times	Often	Very often	Always
6. Have you thought that you are in the shape you are because you lack self-control?	Never	Rarely	Some-times	Often	Very often	Always
7. Has seeing your reflection (e.g. in a mirror or shop window) made you feel bad about your shape?	Never	Rarely	Some-times	Often	Very often	Always
8. Have you been particularly self-conscious about your shape when in the company of other people?	Never	Rarely	Some-times	Often	Very often	Always

EATING BEHAVIOUR

Please read each statement and make a cross (X) over the box that indicates the frequency with which you find yourself feeling or experiencing what is being described in the statements below.

1. When I smell a delicious food, I find it very difficult to keep from eating, even if I have just finished a meal.	Definitely true	Mostly true	Mostly false	Definitely false
2. I deliberately take small helpings as a means of controlling my weight.	Definitely true	Mostly true	Mostly false	Definitely false
3. When I feel anxious, I find myself eating.	Definitely true	Mostly true	Mostly false	Definitely false
4. Sometimes when I start eating, I just can't seem to stop.	Definitely true	Mostly true	Mostly false	Definitely false
5. Being with someone who is eating often makes me hungry enough to eat also.	Definitely true	Mostly true	Mostly false	Definitely false
6. When I feel blue, I often overeat.	Definitely true	Mostly true	Mostly false	Definitely false
7. When I see a real delicacy, I often get so hungry that I have to eat right away.	Definitely true	Mostly true	Mostly false	Definitely false
8. I get so hungry that my stomach often seems like a bottomless pit.	Definitely true	Mostly true	Mostly false	Definitely false
9. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.	Definitely true	Mostly true	Mostly false	Definitely false
10. When I feel lonely, I console myself by eating.	Definitely true	Mostly true	Mostly false	Definitely false
11. I consciously hold back at meals in order not to weight gain.	Definitely true	Mostly true	Mostly false	Definitely false
12. I do not eat some foods because they make me fat.	Definitely true	Mostly true	Mostly false	Definitely false
13. I am always hungry enough to eat at any time.	Definitely true	Mostly true	Mostly false	Definitely false

14. How often do you feel hungry?

Only at mealtimes	Sometimes between meals	Often between meals	Almost always

15. How frequently do you avoid "stocking up" on tempting foods?

Almost never	Seldom	Moderately likely	Almost always

16. How likely are you to consciously eat less than you want?

Unlikely	Slightly likely	Moderately Likely	Very likely

17. Do you go on eating binges though you are not hungry?

Never	Rarely	Sometimes	At least once a week

18. On a scale of 1 to 8, where 1 means no restraint in eating (eating whatever you want, whenever you want it) and 8 means total restraint (constantly limiting food intake and never "giving in"), what number would you give yourself?

1	2	3	4	5	6	7	8

STRESS

Please answer each question by placing a cross (X) in the appropriate box based on how often you experience the following:

1. In the last month, how often have you been upset because of something that happened unexpectedly?	Never	Almost never	Some-times	Fairly often	Often
2. In the last month, how often have you felt that you were unable to control the important things in your life?	Never	Almost never	Some-times	Fairly often	Often
3. In the last month, how often have you felt nervous and "stressed"?	Never	Almost never	Some-times	Fairly often	Often
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	Never	Almost never	Some-times	Fairly often	Often
5. In the last month, how often have you felt that things were going your way?	Never	Almost never	Some-times	Fairly often	Often
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	Never	Almost never	Some-times	Fairly often	Often
7. In the last month, how often have you been able to control irritations in your life?	Never	Almost never	Some-times	Fairly often	Often
8. In the last month, how often have you felt that you were on top of things?	Never	Almost never	Some-times	Fairly often	Often
9. In the last month, how often have you been angered because of things that were	Never	Almost never	Some-times	Fairly often	Often

outside of your control?					
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	Never	Almost never	Some-times	Fairly often	Often

SELF-ESTEEM

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement by placing a cross (X) over the appropriate box.

1. On the whole, I am satisfied with myself.	Strongly Agree	Agree	Disagree	Strongly Disagree
2. At times I think I am no good at all.	Strongly Agree	Agree	Disagree	Strongly Disagree
3. I feel that I have a number of good qualities.	Strongly Agree	Agree	Disagree	Strongly Disagree
4. I am able to do things as well as most other people.	Strongly Agree	Agree	Disagree	Strongly Disagree
5. I feel I do not have much to be proud of.	Strongly Agree	Agree	Disagree	Strongly Disagree
6. I certainly feel useless at times.	Strongly Agree	Agree	Disagree	Strongly Disagree
7. I feel that I'm a person of worth, at least on an equal plane with others.	Strongly Agree	Agree	Disagree	Strongly Disagree
8. I wish I could have more respect for myself.	Strongly Agree	Agree	Disagree	Strongly Disagree
9. All in all, I am inclined to feel that I am a failure.	Strongly Agree	Agree	Disagree	Strongly Disagree
10. I take a positive attitude toward myself.	Strongly Agree	Agree	Disagree	Strongly Disagree

PSYCHOLOGICAL WELL-BEING

Below is a list of a few sentences about things that you may feel at times. Think back to which of these feelings you felt in the **past month**. For each line/question, make a cross (X) on the appropriate answer.

1. How often did you feel tired out for no good reason?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
2. How often did you feel nervous?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
3. How often did you feel so nervous that nothing could calm you down?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
4. How often did you feel hopeless?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
5. How often did you feel restless or fidgety?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
6. How often did you feel so restless you could not sit still?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
7. How often did you feel depressed?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
8. How often did you feel that everything was an effort?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
9. How often did you feel so sad that nothing could cheer you up?	None of the time	A little of the time	Some of the time	Most of the time	All of the time
10. How often did you feel worthless?	None of the time	A little of the time	Some of the time	Most of the time	All of the time

Addendum G: Ethics Approval

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.arieff@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

07 August 2017

HREC REF: 324/2017

Prof N Senekal
Human Nutrition
Anatomy Building-FHS

Dear Prof Senekal

PROJECT TITLE: INVESTIGATION OF BELIEFS RELATING TO WEIGHT GAIN PREVENTION BEHAVIOURS AND WEIGHT RELATED CONSTRUCTS IN FIRST YEAR FEMALE STUDENTS AT THREE SOUTH AFRICAN UNIVERSITIES (MMED CANDIDATE - MS G LASKER)

Thank you for your response letter dated 04 August 2017, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 August 2018.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: - Gabi Lasker will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval before the research may occur.

Yours sincerely

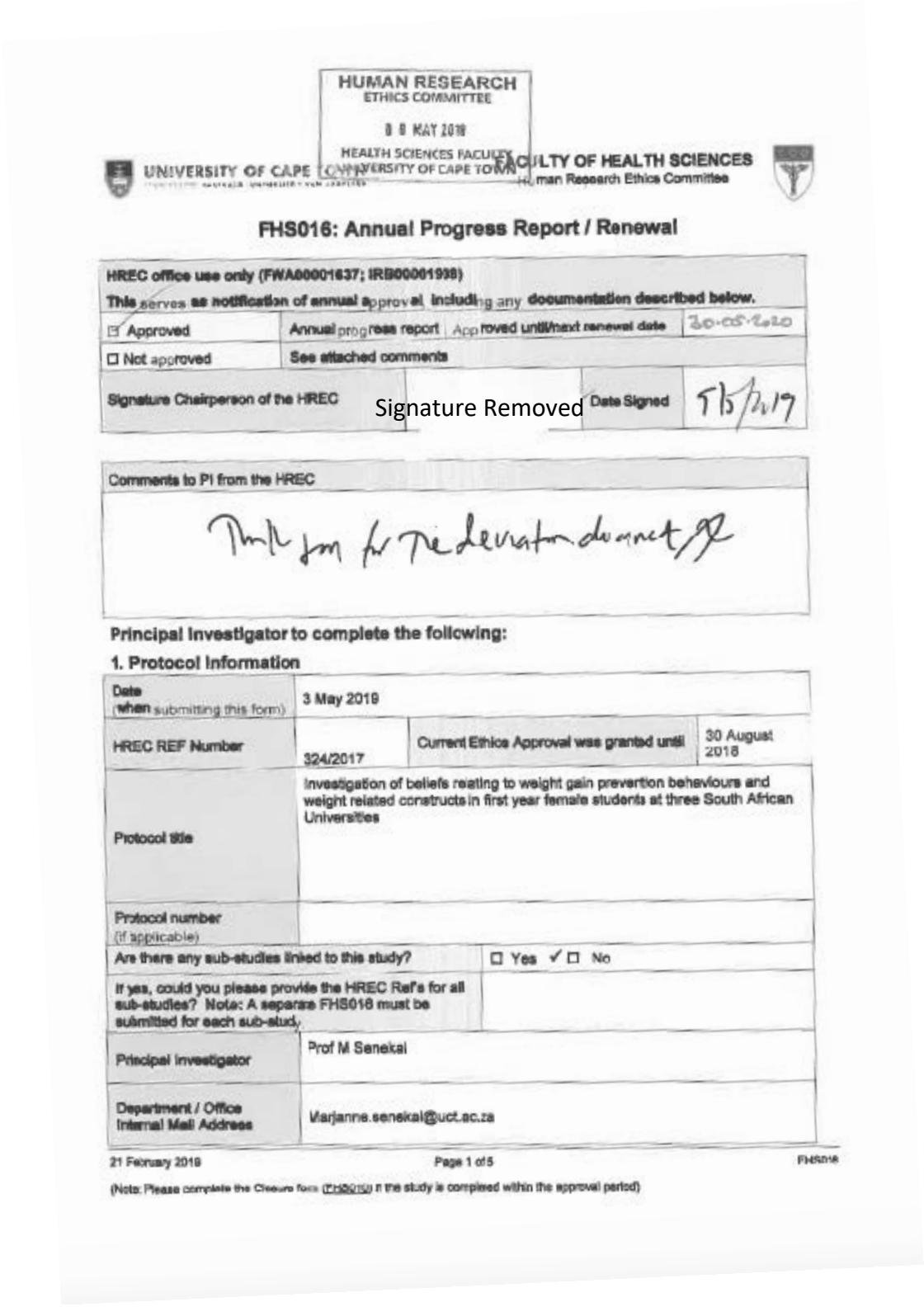
Signature Removed

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HREC 324/2017

Addendum H: Ethics Approval Renewal



HUMAN RESEARCH ETHICS COMMITTEE
0 8 MAY 2019
HEALTH SCIENCES FACULTY UNIVERSITY OF CAPE TOWN

UNIVERSITY OF CAPE TOWN
FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30-05-2020
☐ Not approved	See attached comments		
Signature Chairperson of the HREC	Signature Removed	Date Signed	7/5/2019

Comments to PI from the HREC
Thank you for the declaration document

Principal Investigator to complete the following:

1. Protocol Information

Date (when submitting this form)	3 May 2019		
HREC REF Number	324/2017	Current Ethics Approval was granted until	30 August 2018
Protocol title	Investigation of beliefs reating to weight gain prevention behaviours and weight related constructs in first year female students at three South African Universities		
Protocol number (if applicable)			
Are there any sub-studies linked to this study?	☐ Yes ✓ ☐ No		
If yes, could you please provide the HREC Ref's for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study			
Principal Investigator	Prof M Senekal		
Department / Office Internal Mail Address	Marjanne.senekal@uct.ac.za		

21 February 2019 Page 1 of 5 FHS016

(Note: Please complete the Closure form (FHS015) n the study is completed within the approval period)

Addendum I: Table A: Correlation Matrix

	BMI	Breakfast	Snacks	Dietary pattern 1	Dietary pattern 2	Dietary pattern 3	Dietary pattern 4	Total METS	BSQ[1]	Cognitive restraint[2]	Uncontr eating[2]	Emot eating[2]	Stress[3]	Self-esteem[4]
Breakfast	r=-0.12													
	p=0.151													
Snacks combined	r=0.03	r=0.15												
	p=0.689	p=0.069												
Dietary pattern 1	r=0.15	r=-0.08	**r=0.21**											
	p=0.083	p=0.0352	**p=0.013**											
Dietary pattern 2	r=-0.06	**r=0.22**	r=0.14	r=-0.07										
	p=0.453	**p=0.008**	p=0.095	p=0.413										
Dietary pattern 3	r=0.00	**r=-0.26**	r=0.12	r=0.06	r=-0.11									
	p=0.978	**p=0.002**	p=0.143	p=0.474	p=0.180									
Dietary pattern 4	r=-0.00	**r=0.26**	r=0.15	r=0.11	r=0.01	r=0.00								
	p=0.098	**p=0.002**	p=0.086	p=0.203	p=0.898	p=0.971								
Total METS	r=0.05	r=0.11	r=-0.11	r=-0.05	**r=0.17**	r=0.04	r=-0.04							
	p=0.534	p=0.203	p=0.186	p=0.584	**p=0.044**	p=.0676	p=0.672							
BSQ[1]	**r=0.42**	**r=-0.21**	r=0.14	r=0.10	r=-0.07	r=-0.02	r=-0.11	r=-0.04						
	p<0.001	**p=0.014**	p=0.094	p=0.219	p=0.405	p=0.775	p=0.204	p=0.649						
Cognitive restraint[2]	r=0.16	r=-0.01	r=-0.16	r=-0.07	**r=0.17**	r=0.01	r=-0.05	r=0.16	**r=0.30**					
	p=0.062	p=0.872	p=0.064	p=0.395	**p=0.043**	p=0.926	p=0.557	p=0.059	**p<0.001**					
Uncontr eating[2]	r=0.05	r=0.06	**r=0.44**	r=0.09	r=-0.02	**r=0.20**	r=0.10	r=-0.11	**r=0.28**	r=-0.03				
	p=0.529	p=0.460	**p<0.001**	p=0.272	p=0.832	**p=0.015**	p=0.224	p=0.203	**p=0.001**	p=0.742				
Emotional eating[2]	**r=0.23**	r=-0.04	**r=0.37**	**r=0.20**	r=-0.03	r=0.12	r=0.05	r=-0.12	**r=0.41**	r=0.13	**r=0.60**			
	p=0.006	p=0.612	**p<0.001**	**p=0.019**	p=0.729	p=0.151	p=0.559	p=0.159	**p<0.001**	p=0.132	**p<0.001**			
Stress[3]	r=0.16	r=-0.13	r=0.14	r=0.01	r=-0.07	r=0.07	**r=-0.17**	r=-0.04	**r=0.46**	r=0.05	**r=0.20**	**r=0.33**		
	p=0.062	p=0.129	p=0.091	p=0.882	p=0.441	p=0.389	**p=0.046**	p=0.599	**p<0.001**	p=0.571	**p=0.019**	**p<0.001**		
Self-esteem[4]	r=-0.13	r=0.15	r=0.01	r=-0.10	r=0.05	r=-0.04	**r=0.18**	**r=0.17**	**r=-0.57**	**r=-0.20**	**r=-0.24**	**r=-0.33**	**r=-0.54**	
	p=0.131	p=0.086	p=0.882	p=0.244	p=0.564	p=0.663	**p=0.036**	**p=0.040**	**p<0.001**	**p=0.020**	**p=0.004**	**p<0.001**	**p<0.001**	
K10[5]	**r=0.21**	**r=-0.17**	r=0.15	**r=0.17**	r=-0.05	**r=0.19**	r=-0.05	r=-0.05	**r=0.50**	r=0.11	**r=0.29**	**r=0.35**	**r=0.73**	**r=-0.67**
	p=0.012	**p=0.048**	p=0.071	**p=0.041**	p=0.567	**p=0.028**	p=0.580	p=0.557	**p<0.001**	p=0.201	**p<0.001**	**p<0.001**	**p<0.001**	**p<0.001**

BMI= body mass index; METS= metabollic equivalents; BSQ= body shape questionnaire; K10= 10-item Kendell

[1]8-item Body Shape Questionnaire (BSQ- 8C); [2]Three Factor Eating questionnaire-R18 (TFEQ-R18) REF; [3] Cohen 14-item Perceived Stress Scale; [4]10-item Rosenberg Self-Esteem Scale

[5]10-item Kendall Questionnaire on presence of anxiety and symptoms of depression.