BODY MASS INDEX, BODY IMAGE AND POSSIBLE FACTORS RELATED TO WEIGHT LOSS PRACTICES OF FEMALE UNDERGRADUATE STUDENTS ON THE PIETERMARITZBURG CAMPUS, UNIVERSITY OF KWAZULU-NATAL

By

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Submitted in fulfilment of the

requirements for the degree of

Master of Science in Dietetics

Dietetics and Human Nutrition,

School of Agricultural, Earth and Environmental Sciences

College of Agriculture, Engineering and Science

University of KwaZulu-Natal

Pietermaritzburg

November 2019

DECLARATION

I, Zethembiso Desiree Lubisi (212539134) declare that the entirety of the work submitted to the University of KwaZulu-Natal, School of Agricultural, Earth and Environmental Sciences contained in this document is my own original work. Where other sources have been used they have not been copied and have been properly acknowledged

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ABSTRACT

Background

South Africa is undergoing epidemiological transition, characterized by an increasing prevalence of obesity, especially among women. Among those 15 to 24 years of age, the prevalence of overweight and obesity at 40.9% is cause for concern, as it is associated with the development of non-communicable diseases of lifestyle. However, 18.1% of women in the above age category, indicated that they are unhappy with their current weight. Body image is related to an individual's perception of the attractiveness of their own body, and has an impact on actual weight and weight management practices. Body image dissatisfaction refers to the negative perceptions and feelings a person has about their body and can be affected by factors such as body shape and appearance, body weight gain attitudes, and cultural norms regarding an ideal body size. In this respect, university students are of particular interest, as they are known to experience a number of stressors during the transition from secondary- to tertiary education that contributes to unhealthy eating habits, a decreased level of physical activity and subsequent weight gain.

Objectives

To determine the Body Mass Index (BMI), body image and factors related to weight loss practices among female undergraduate students on the Pietermaritzburg (PMB) campus of the University of KwaZulu-Natal (UKZN).

Methods

A cross sectional descriptive survey of conveniently sampled female undergraduate students on the PMB campus (N=316), UKZN was conducted. Weight and height were measured by trained fieldworkers for the calculation of BMI. Data was collected by means of a self-administered questionnaire to determine the socio-demographic characteristics, physical activity level, nutrition knowledge, body perceptions, weight management practices and dietary diversity of study participants.

Results

The majority of participants (86.7%), were black African and registered for study within the College of Agriculture, Engineering and Science (45.6 %). The mean age of the study

sample was 20 ± 2 years. Participants mainly resided in private accommodation (44.3%), followed by 38.6% living in university residences. The majority (72.7%) were funded by the National Student Financial Aid Scheme (NSFAS).

Participants who prepared their own meals, did so 3.7 ± 2.3 times per week, with 84.3% reporting that they prepared their own meals most days of the week. Most consumed take-aways (91.1%), with 61.2% doing so on a weekly basis. Nearly half (48.1%) of the participants had a normal BMI, followed by 19% being overweight. Furthermore, 13.3% were classified as obese class I, while 12.6% were classified as obese class II. Only 4.4% were underweight, while 2.5% were classified as obese class III. The majority (46.8%) could be classified as being moderately physically active, followed by those with a low level of physical activity at 38.6%. Only 14.6% were classified as having a high level of physical activity.

A nutrition knowledge score of ≥ 50% was achieved by 63.8% of participants, followed by a third (34.3%) who had a score of less than 50%. The most noteworthy findings were that participants were not aware that starchy foods should form the basis of most meals, and that drinking boiled water does not facilitate weight loss.

An assessment of participant weight management practices, revealed that 59.1% weighed themselves, with 61.0% reporting that they do so monthly. Despite the fact that the majority of participants (70.0%) classified their current body weight as normal, 56.4% had attempted weight loss. Of those who had not attempted weight loss, the majority (37.5%) indicated that the reason for not attempting weight loss, was that they were satisfied with their body weight, followed by 35% indicating that they perceived their body weight as normal. The majority of participants who attempted weight loss, resorted to healthy weight loss practices (50.9%), followed by 42.0% who made use of a combination of healthy and unhealthy weight loss practices.

In terms of body image perceptions, the difference between perceived ("feel") and ideal body size was calculated, rendering a Feel Ideal Index (FID) score of 0.4 ± 1.33, indicating that participants desired to be thinner. The majority of participants (45.0%) had a medium dietary diversity as was indicated by the consumption of 6 to 11 food groups, followed by more than a third of participants (35.6%) having a high dietary diversity score due to the consumption of more than 11 food groups. One out of five participants (19.4%) consumed diets that lacked diversity.

Conclusion

Body image perception and level of body image satisfaction were the most important determinants of whether participants engaged in weight management practices. This was illustrated by participants who had never attempted weight loss, indicating that the reason why they have never attempted weight loss was because they "perceived their current body weight to be normal" and that they are "satisfied with current weight". An increase in BMI was positively associated with an increase in body image dissatisfaction (BID), resulting in overweight and obese participants attempting to lose weight. It was also noted that a larger proportion of participants indicated that they have attempted weight loss, and did so using healthy weight loss practices such as exercise, diet and reduced portion sizes.

Participants desired body sizes that were thinner than their perceived current body size. This was illustrated by a positive mean FID index score of 0.4 ± 1.33. Although those with a high BMI desired a large body size, it was thinner than what they perceived themselves to be. Furthermore, participants living in university residences and private accommodation, had a higher BMI than those who lived at home. Those with a higher physical activity level (PAL), weighed themselves more often when compared to those who were less active. This may suggests that participants were engaged in physical activity to improve appearance. However, it could also be an indicator that participants were physically active for the promotion of health, general wellbeing and for social reasons. Significant relationships between nutrition knowledge score and BMI, as well as dietary diversity score were not documented. However, participants with a good nutrition knowledge score perceived their current weight to be lower than those with a poor nutrition knowledge score.

ACKNOWLEDGEMENTS

I would like to acknowledge and appreciated the following people that supported and assisted through the entire process:

My supervisor Dr Susanna Kassier and co-supervisor Dr Blessing Mkhwanazi, for the continuous support, guidance and encouragements throughout the study. My friends L Zwezwe, X Gudiso, the Mzobes and Masilelas for the reassurance throughout the process. My family, particularly both my parents Nicholas and Phindile Lubisi and younger siblings for the prayers, motivation, financial, emotional support and love you have showered upon me during this time

To my Lord and Saviour Jesus Christ for the wisdom and strength you have given, I am most grateful.

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1.1 INTRODUCTION

In this chapter, an overview of the importance of the study will be given. In addition, the study aim, objectives and hypotheses will be included. In addition, the type of study, study parameters and assumptions made by the researcher will also be described. This will be followed by a definition of terms, as well as abbreviations.

1.2 IMPORTANCE OF THE STUDY

According to the South African National Health and Nutrition Examination Survey (SANHANES-1), the prevalence of overweight and obesity among females aged 15 to 24 years is 40.9% (Shisana, Labadarios, Rehle, Simbayi, Zuma, Dhansay, Reddy, Parker, Hoosain, Naidoo, Hongoro, Mchiza, Steyn, Dwane, Makoae, Maluleke, Ramlagan, Zungu, Evans, Jacobs, Faber, & SANHANES-1 Team 2013). In addition, 18.1% of females in the same age category were unhappy with their current weight (Shisana *et al* 2013).

University students are of particular interest, as they are known to experience a number of stressors during the transition from high school to tertiary education, including a change of residence, increased responsibility, peer pressure and difficult schedules (Pengpid, Peltzer, Kassean, Tsala, Sycharean, Müller-Riemenschneider 2015; Joseph, Royse, Benitez and Pekmezi 2014). University students are also at risk of being physically inactive, as well as experiencing increased emotional and psychological stress (Joseph *et al* 2014). A study conducted among female American students, found that a lack of time, stress and a change in environment were some of the factors contributing to an inactive lifestyle and the development of obesity (Duarte, Ferreira, Trindade, Pinto-Gouveia 2015).

Viljoen, Van Der Spuy and Du Rand (2018), add that at university level, students become independent, thus becoming responsible for making their own food choices (Mchiza, Parker, Makoea, Sewpaul, Kupamupindi, Labadarios 2015). Hence, this stage of the life span represents a crucial stage whereby if food choices are not made wisely, it could result in overweight and obesity, as it is accompanied by unhealthy behaviours such as sedentary activities including television watching, studying and socializing (Deforche, Van Dyck,

Deliens, De Bourdeaudhuij 2015). A study that investigated physical inactivity among university students in 23 low, middle and high-income countries, reported that among South African university students, 22% of females were inactive (Pengpid *et al* 2015).

According to the World Health Organization (WHO) (2016), factors such as overweight and obesity, unhealthy eating habits and physical inactivity have all been identified as playing a major role in the prevalence of non-communicable diseases (NCDs). Being at university is identified as the most critical stage where the majority of changes in lifestyle are made, with the potential of having a lasting impact on the development of NCDs (Pengpid *et al* 2015). Awadalla, Aboelyaze, Hassanein, Khalil, Aftab, Gaballa and Mahfouz (2014) also refer to the fact that lifestyle attributes such as physical inactivity are associated with the development of NCDs.

It is therefore not surprising that studies conducted among female South African students, have documented a positive association between increased Body Mass Index (BMI) and a lack of physical activity (Gradidge & Cohen 2018; Peltzer, Pengpid, Samuels, Ozcan, Mantilla, Rahamefy, Wong, Gasparishvili 2014; Van den Berg, Okeyo, Dannhauser, Nel 2012; Alberts, Mashego, Nel 2000).

Body dissatisfaction and incorrect body perceptions have resulted in some students resorting to extreme weight loss practices such as self-induced vomiting and using herbal mixtures, diet pills and laxatives in attempts to conform to current body ideals (Senekal, Lasker, Velden, Laubscher, Temple 2016).

Hence, the purpose of this study was to determine the relationship between BMI, body image and factors related to weight loss practices among female undergraduate students registered for study at the Pietermaritzburg campus of the University of KwaZulu-Natal (UKZN).

1.3 STATEMENT OF THE PROBLEM

To determine BMI, body image and possible factors related to weight management practices of female undergraduate students at the Pietermaritzburg campus, UKZN.

1.4 TYPE OF STUDY

The study design employed for the current study was a cross-sectional descriptive survey, as it is deemed as being suitable for determining the possible factors related to weight management practices among female undergraduate students at PMB campus, UKZN

1.5 STUDY OBJECTIVES

1.5.1 To determine the following variables among female undergraduate students on the Pietermaritzburg campus of UKZN:

- Socio-demographic characteristics
- BMI
- Level of physical activity
- Nutrition knowledge
- Body image
- Body image dissatisfaction
- Weight management practices
- Dietary diversity

1.5.2 To determine the relationship between the following categorical variables:

- Socio-demographic characteristics
- BMI
- Level of physical activity
- Nutrition knowledge
- Body image
- Body image dissatisfaction
- Weight management practices and;
- Dietary diversity

1.5.3 To determine the correlations between the following continuous variables:

- Mean BMI;
- Mean physical activity score;
- Mean nutrition knowledge score

- Feel-ideal difference index score (FID); and
- Mean dietary diversity score.

1.6 HYPOTHESES

1.6.1 There will not be a significant relationship ($p<0.05$) between participant socio-demographic characteristics, BMI category, body image category, factors related to weight management and weight management practices of female undergraduate students.

1.6.2 There will not be a significant correlation ($p<0.05$) between mean BMI, FID, mean physical activity score, mean nutrition knowledge score and mean dietary diversity score of female undergraduate students.

1.7 STUDY PARAMETERS

Table 1.1 provides an overview of the inclusion and exclusion criteria that were used for the recruitment of study participants.

Table 1.1: Study inclusion and exclusion criteria

Inclusion criteria	**Exclusion Criteria**
• Female undergraduate students registered for study on the Pietermaritzburg campus of UKZN, irrespective of race, and socio-economic status.	• Male students. • Female undergraduate students who were not able to stand unaided. • Pregnant female undergraduate students. • Female undergraduate students from other UKZN campuses. • Female post graduate students.

1.8 ASSUMPTIONS

For the purpose of this study, it was assumed that study participants were truthful in their response to the survey questionnaire and that the study participants recruited were representative of female undergraduate students registered for study on the Pietermaritzburg campus of UKZN.

1.9 DEFINITION OF TERMS

1.9.1 **Nutrition transition**

The term refers to the changes in dietary patterns of a particular population or community. This usually represents the shift in preferences to the direction of diets higher in saturated fats, animal protein and sugar and decreased intake of unprocessed food (Gradidge & Cohen 2018).

1.9.2 **Body mass index (BMI)**

A measure used for indicating nutritional status among adults defined as weight in kilograms divided by the square of a person height in meters (WHO 2016).

1.9.3 **Obesity**

A disease condition characterised by an increase build-up and storage excessive body fat (WHO 2016)

1.9.4 **Physical activity**

Any bodily activity produced by skeletal muscles that requires energy expenditure (WHO 2010).

1.9.5 **Nutrition knowledge**

The knowledge of concepts and processes related to nutrition, health and knowledge on how diets supply nutrients (Miller & Cassady 2015).

1.9.6 **Body image**

The perception one has about their physical attributes and the thoughts and feelings that result from that (McGuinness & Taylor 2016)

1.9.7 **Body dissatisfaction**

A negative view of one's body regarding body size, shape, muscularity, muscle tone, weight and fitness (McGuinness & Taylor 2016).

1.9.8 **Social media**

A platform (electronic) in which people interact and connect by sharing information and images about their day to day lives with their followers (Tiggermann & Zaccardo 2015)

1.9.9 **Feel-Ideal Difference index score**

Is a tool used to determine level of body dissatisfaction through quantifiable working out the difference in the number of the silhouette selected to best describe and current body size (Feel) and silhouette they want to look like (Ideal) (Mchiza, Goedecke, Steyn, Charlton, Puoane, Meltzer, Levitt, Lambert 2005).

1.9.10 **Weight loss practices**

In the context of health, medicine and nutrition, weight loss practises are defined as the reduction of total body mass (American College Health Association 2009).

1.9.11 **Weight management**

For the purpose of the study it refers to respondents who would like to loss or maintain body weight (ACHA 2009).

1.9.12 **Dietary diversity**

The increase in the variation of foods consumed within specific food groups (Belachew, Lindstrom, Gebremaraim, Hogan, Lachat, Huybregts, Kolsteren 2013)

1.9.13 **24-hour recall**

A dietary assessment tool that consists of an interview session in which respondent are requested to recall all foods and drinks consumed in the last 24 hours (Beaton, Wright, Devenish, Do 2018)

1.10 ABBREVIATIONS

- AIDS – Acquired Immune Deficiency Syndrome
- ACHA- American College Health Association
- BD – Body Dissatisfaction
- BI – Body Image
- BMI – Body Mass Index
- DD- Dietary Diversity
- DDS- Dietary Diversity Score
- DOH- Department of Health
- FID- Feel-Ideal Difference index
- HIV- Human immunodeficiency Virus
- IPAQ- International Physical Activity Questionnaire
- IPAQ-SF- International Physical Activity Questionnaire Short Forms
- NCDs- Non-Communicable Diseases
- NSFAS - National Student Financial Aid Scheme
- PA – Physical Activity
- PAL- Physical activity Level
- PMB- Pietermaritzburg
- SA- South Africa
- SADHS – South African Demographic Health Survey
- SANHANES-1 – South African National Health and Nutrition Survey
- UKZN – University of KwaZulu-Natal
- WHO – World Health Organisation

1.10 SUMMARY

The increased prevalence of obesity among young adult South African females, has resulted in a concomitant increase in body size/ image dissatisfaction among young women in the country. Females have been shown to be more anxious and concerned about how they look, when compared to men, as it has been shown that men often display a higher level of body size/ image acceptance than women (Duarte *et al* 2015). This has resulted in an increased involvement in various weight loss programs, requiring dietary adjustments and varying levels of physical activity, with the goal of achieving an acceptable body size. This study will investigate the various factors (BMI, BI, PAL, nutrition knowledge and dietary diversity) that are related to weight management practices in female in UKZN, PMB campus.

1.11 DISSERTATION OVERVIEW

This current dissertation will consist of six chapters which will cover the whole research process. In chapter one an overview of the importance and background was outlined as well as the study objectives, and hypotheses. In chapter two, a review of the relevant literature related to the study objectives will be provided. Chapter three describes the methods and materials used in the study. Hence, it includes the study design, research questionnaire as well as the reliability and validity of the research tools. Chapter four presents the study results obtained according to the objectives listed in chapter one, while chapter five discusses these results in relation to the relevant literature presented in chapter two. In chapter six, the study conclusions and recommendations are presented as a communication of the study findings.

CHAPTER 2: REVIEW OF THE RELATED LITERATURE

2.1 INTRODUCTION

Based on the study objectives outlined in Chapter one, the following conceptual framework was developed for the literature review:

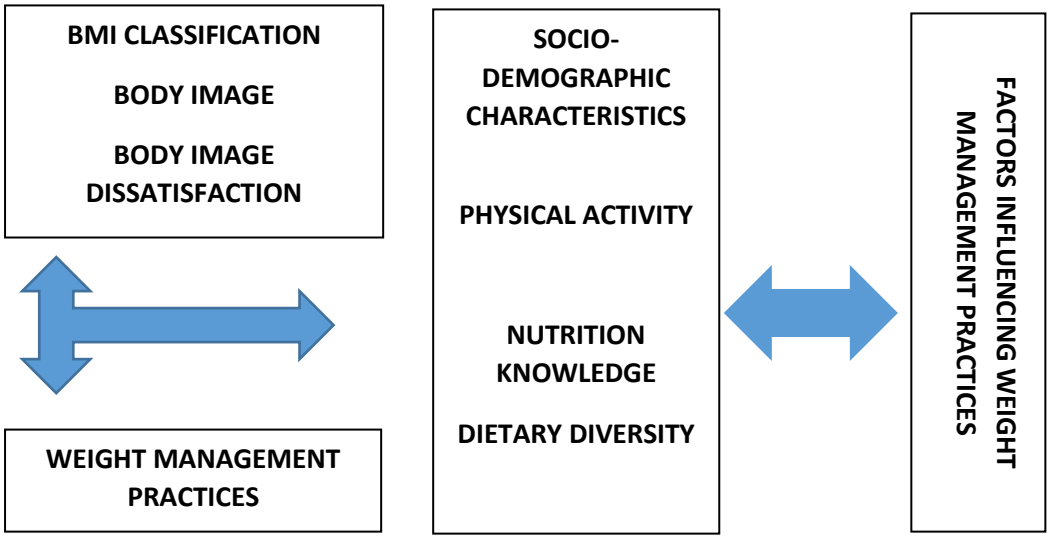

Figure 2.1: Conceptual framework for the literature review

The prevalence of overweight and obesity in South Africa is on the increase, especially among adult women (SADH 2016). South African university students are at risk for developing obesity, as some local studies have shown a positive association between an increased BMI and lack of physical activity among these young adults (Gradidge & Cohen 2018; Senekal *et al* 2016; Van den Berg *et al* 2012). A lack of time, stress and a change in environment are some of the challenges reported by female students as contributors to the development of obesity, as well as serving as barriers to successful weight management (Abraham, Noriega, Shin 2018). These factors, combined with a lack of nutrition knowledge and body dissatisfaction, can lead to unhealthy and unsafe weight loss practices (Duarte *et al* 2015).

Dissatisfaction with one's body image has been shown to be common among females, as a result of westernization and the acceptance of thinness as a desirable physical form in a country like South Africa (Bissell & Chung 2009). This phenomenon has brought about an

increase in body dissatisfaction among young women with a higher BMI, resulting in increased engagement in physical activity and diet modification in an attempt to lose weight (Isa & Kramer 2003). In a local study that assessed the level of nutrition knowledge among nursing students, it was noted that those who were underweight or had a normal BMI, had a higher level of nutrition knowledge compared to overweight participants. Thus suggesting a link between inadequate nutrition knowledge, poor dietary habits and increased BMI (Van den Berg et al 2012).

2.2 SOCIO-DEMOGRAPHIC CHARACTERISTICS, BMI AND BODY IMAGE DISSATISFACTION

Obesity continues to be a public health problem in both developed and developing countries, with different trends across population groups. An understanding of the factors that influence the prevalence of obesity among certain population groups, as well as motives for weight loss, are imperative, as these variables can assist in the development of obesity prevention programs (Lovell, Ansari, Parker 2010).

The majority of international studies have shown a relationship between BMI and various socio-cultural and socio-demographic characteristics including gender, age, ethnicity, level of education, living arrangements and socio-economic status, but were limited by the scope of socio-demographic characteristics investigated (Park 2011; Overstreet, Quinn, Agocha 2010; Holmqvist & Frisén 2010).

In the United States of America (USA), the prevalence of overweight and obesity is higher among those of a lower socio-economic status namely African Americans and Hispanics, when compared to white women of a high socio-economic status (Wang, Southerland, Wang, Bailey, Alamian, Stevens, Wang 2017). Apart from socio-demographic factors such as economic status, level of education, age, race and gender, socio-cultural factors also have an influence on desired body size within cultures (Holmqvist & Frisén 2010). Several studies conducted in the USA have shown that African American women were less concerned or dissatisfied with their body weight compared to white women, as they still considered themselves to be attractive, despite perceiving themselves to be overweight (Overstreet *et al* 2010; Roberts, Cash, Feingold, Johnson 2006). However, it was noted that socio-economic

status was a stronger determinant of body perception when compared to ethnicity, as African American women of a higher socio-economic status had similar body perceptions when compared to white women (Wang *et al* 2017).

2.3 BMI CLASSIFICATION

Determining whether an individual or groups are overweight or obese, is based on anthropometric indicators including skin-fold thickness, waist-to-hip ratio and BMI **(**WHO 2019; De Onis & Lobstein 2010). Despite the fact that there is not an ideal assessment tool to determine body fatness, BMI is the most widely accepted measure or indicator of weight status **(**WHO 2019; De Onis & Lobstein 2010) and is defined as weight in kilograms divided by the square of an individual's height in meters (WHO 2019). BMI classifications include the following: underweight (BMI = <18.4 kg/m^2), normal weight (BMI = 18.5-24.9 kg/m^2), overweight (BMI = 25.0-29.9 kg/m^2) and obese (>30.0 kg/m^2), and serve as an indicator of the degree of body fatness (Nuttal 2015).

2.3.1 BMI and body image

An individual has a self-perceived image of how large or small their body size should be, with the acceptance of body image often being influenced by cultural or societal standards of an acceptable body size (Gokee-LaRose, Gorin, Raynor, Laska, Jeffery, Levy, Wing 2009). For example, women from western countries often overestimate their BMI and consider themselves to be overweight, despite having a normal BMI (Yam, Chair, Cole, Mahalingam Ward 2013). This kind of body image distortion is often attributed to the promotion of thinness by media, commercial advertisement and the fashion industry, and is not only influenced by socio-cultural beauty norms (Yam **et al** 2013).

In addition, the cultural or societal definition of overweight often does not match the medical definition, as it is an undefined threshold or limit at which an individual is considered to be overweight or obese, which is reduced to a "I can't define it but I know it when I see it" idea (Wardle, Carnell, Haworth, Plomin 2008). Furthermore, globally there seems to be a better acceptance of obesity and being overweight among older women than younger women. There also seems to be a better acceptance of the accumulation of fat mass at certain body sites that others, in that among women, fat accumulation in the pelvic, thigh and breast

regions is more acceptable and desirable than fat accumulation in the abdominal/truncal region (Wardle **et al** 2008).

2.3.2 BMI in young adults and university students

Young adults are said to gain an average of 0.5-1 kg a year, with the largest weight gain occurring in the early to mid-twenties, largely among those who were already overweight (Truedale, Stevens, Lewis, Schreiner, Loria, Cai 2006). Therefore, young adults can be considered to be a risk group for increased BMI, highlighting the need for research targeting this age group (Ogden, Carroll, Curtin, McDowell, Tabak, Flegal 2006).

In a past study conducted to determine the prevalence of overweight and obesity, as well as diet and physical activity among American college students, it was reported that overweight and obese students had poor dietary habits, as was illustrated by not meeting the recommended daily intake of at least five fruits and vegetables and the recommended fibre intake (Huang, Harris, Rebecca, Lee, Nazir, Born, Kaur 2003). More recently, it was reported that American college students gain approximately 1.55 kg body weight during their first year at college, with a gradual increase of 1.7% fat gain over four 4 years of study (Fedewa, Das, Evans, Dishman 2014). Physical activity levels were also shown to be low, as the majority of participants did not meet the minimum goal of 30 minutes of exercise per day (Fedewa **et al** 2014). According to Abraham *et al* (2018), a lack of accessibility to healthy foods, gym equipment, limited time for physical activity, academic overload and poor time management, serve as barriers to weight management among college students.

In South Africa, the SADHS reported that overweight and obesity was documented among 27% of young females aged 15-19 years, and 52.5 % among women aged 20-24 years (SADHS 2016). According to Senekal, Lombard and Harbron (2018), weight gain among university students is noticeably greater than that of the general population. This may be attributed to the obesogenic environment the university lifestyle presents, as it is said to facilitate positive energy balance through ease of accessibility to energy dense food and the decreased need for physical activity as was reported by a study that compared the weight of university students from 22 countries (Wardle, Haase, Steptoe 2006).

A local study reported that overweight and obese female students were more likely to purchase cheap energy dense food from campus food vendors than students with normal

BMIs (Gradidge & Cohen 2018). Furthermore, individual factors such as a low level of physical activity, excessive alcohol intake, stress and irregular food intake was identified as common risk factors for the development of overweight and obesity (Chhaya & Jadav 2012). In table 2.1 below, BMI trends of South African female university students from different studies are shown.

Table 2.1: BMI trends of South African female university students

Author(s) and year	Sample size	Study design	Overweight prevalence	Obesity Prevalence
Gradidge & Cohen (2018)	110	Cross sectional	37.3 %	17.3 %
Peltzer, Pengpid, Samuels, Ozcan, Mantilla, Rahamefy Wong, Gasparishvili (2014)	62	Cross sectional	-	15.6%
Steyn, Senekal, Brits, Albert, Mashego, Nel (2000).	231	Cross sectional analytic study	18.5 %	6.5 %
Van Den Berg, Okeyo, Dannhauser, Nel (2012)	161	Cross sectional descriptive	36.4 %	21.8 %

2.4 PHYSICAL ACTIVITY

The factors that influence individual physical activity are complex and multifactorial, and include personal-, relational-, and environmental factors (Acampado & Valenzuela 2018). It is therefore important to investigate women's motives for engaging in physical activity, as well as the barriers that prevent them from exercising (Acampado & Valenzuela 2018). A study that examined the perceived benefits of exercise and barriers to exercising among female university students in the United Kingdom (UK), found that the majority of participants perceived exercise to increase levels of physical fitness, while a minority reported exercise to increase acceptance by others (Lovell et al 2010). The most widely reported barrier to exercise among non-exercising female students was the proximity of exercise facilities, while other barriers were physical exhaustion, a lack of time, lack of support and the inconvenience of gymnasium time schedules (Lovell et al 2010).

Low physical activity level (PAL) is associated with the increased risk of developing NCDs such as CVD, cancer and diabetes (Penedo & Dahn 2005). As a result, the WHO has recommended that adults between the ages of 18-64 years should be involved in at least 150 minutes of moderate to vigorous intensity of physical activity per week (WHO 2010). However, studies have shown that the majority of young women engage in PA to maintain a slim body rather than health reasons (Pengpid, Peltzer, Kassean, Tsala, Sychareun, Müller-Riemenschneider 2015). According to Schmalz, Deane, Birch, Davison (2007), university students who engage in physical activity often possess high self-esteem, a positive body image, are less anxious about their weight, receive more social acceptance and are significantly healthier both physically and emotionally than their none physically active counterparts.

An Israeli study that examined health perceptions of self and body image, physical activity and nutrition among 1574 undergraduate students, showed that male students have high health perception, perceived body size in a more positive manner and had a higher level of PAL than female students (Korn, Gonen, Shaked, Golan 2013). According to Clarke, O'Malley, Johnson, Schulenberg, Lantz (2009), females are less physically active than males, and tend to focus more on a balanced diet, are less interested in PA and pay less attention to health issues caused by a lack of PA than men. This could imply that women are more focused on nutrition than PA for the attainment of health. As a result they resort to nutrition in order to reduce caloric intake since they are less physically active and more dissatisfied with body image than males (Clarke *et al* 2009). Results from the Israeli study also showed that the contribution of physical activity towards a positive body image and health perception is greater than that of maintaining healthy nutrition. It was documented that students who engage in PA perceive their body more positive than those who practice healthy nutrition alone. Therefore, for this student population, PA played a greater role in cultivating a positive self-image than nutrition (Korn *et al* 2013).

A number of local studies have attempted to quantify the level of physical activity of South Africans (Pengpid & Peltzer 2013; Pengpid & Peltzer 2010; Bourne, Lambert, Steyn 2002). In a study conducted among students from the University of the Free State, it was found that the majority of black students were engaged in moderate physical activity (such as dancing, water aerobics and doubles tennis), while the majority of white students were engaged in more vigorous activities such as sports, squash, zomba and boot camps. It was also reported that fewer female students were physically active than their male counterparts (Pengpid &

Peltzer 2010). A study that investigated physical inactivity and associated factors among 722 university students in South Africa, reported that 33% of students had a low level of physical activity, 47.6% had a moderate level of physical activity, and 19.4% were engaged in high intensity physical activity. This study sample comprised of 57.4% male and 42.4% female participants with an average age of 21.7 years (Pengpid & Peltzer 2013).

It has also been reported that individuals living in urban and peri-urban areas, including young women aged 15 to 24 years, are the least active, in line with men and women older than 55 years (Bourne et al 2002). Although physical activity is associated with a decreased risk of mortality, cardiovascular disease, obesity and some cancers in young adults, a study conducted at the University of Limpopo found that the reason why the majority of female students engaged in physical activity was related to improving physical appearance rather than for health benefits (Peltzer & Pengpid 2010).

2.5 NUTRITION KNOWLEDGE

Nutrition knowledge is considered to be an important determinant of nutritional status and dietary selections of individuals, families and societies (Guerra, da Silveira, Salvador 2016). Developed countries such as the USA and UK include nutrition education in school programmes as way of combatting NCDs associated with poor dietary habits (Guerra et al 2016; Mayor 2013). The aim of nutrition education programs is to improve knowledge, and in turn, encourage healthier dietary choices (Heaney, O'Connor, Michael 2011; Morgan, Warren, Lubans 2010). However, factors such as taste, food cost, convenience, religion and culture can also strongly influence an individual's dietary choices (Hendrie, Coveney, Cox 2008). As a result, studies conducted in these countries failed to show significant correlations between nutrition knowledge and dietary behaviour (Spronk, Kullen, Burdon, O'Connor 2014).

A study conducted in Europe by the World Health Organisation documented that a high percentage of the general population had poor nutrition knowledge regarding foods that are high or low in starch (WHO 2015). Several studies have found that better nutrition knowledge is related to gender, high economic status and level of education (Heshmat, Salehi, Qorbani, Rostami, Shafiee, Ahadi, Khosravi, Rezvani, Ghotbabadi, Ghaderpanahi, Abdollahi 2016; Fekete Weyers, Moebus, Dragano, Jockel, Erbel, Mohlekamp, Wege Siegrist 2012), with females having a better nutrition knowledge than men, and those with a high

income and level of education generally having a better nutrition knowledge and making better dietary choices than individuals of a lower economic status (Fekete et al 2016; WHO 2015). Moreover, factors other than nutrition knowledge including food availability, cooking and food preparation skills as well as the willingness to embrace healthy eating, influence the ability to apply nutrition knowledge into day to day eating habits (Hendrie et al 2008).

The 2010 American dietary guidelines recommended that the consumption of saturated fat should be <10 % of daily calorie intake, <300mg cholesterol and <1% transfat of daily calories should be consumed to reduce the risk of cardiovascular disease (Yahia, Brown, Rapley, Chung 2016). In a study that examined the association between nutrition knowledge and fat consumption in a sample of 231 American college students, it was found that students with a poor nutrition knowledge had a higher intake of fat than those with a low fat intake ($p<0.001$) (Yahia *et al* 2016). This proved the general assumption that students with better nutrition knowledge will make better choices in relation to the types of fats they consume (Mazier & McLeod 2007).

According to Mazier & Mcleod (2007), a single nutrition course is effective in improving nutrition knowledge and dietary choices of undergraduate students. Similar findings were also made in a study conducted among 269 Canadian college students, where it was reported that students who have completed a nutrition course consumed less dietary fat than those who did not (Emrich & Mazier 2009). It has also been reported that female students had higher mean nutrition score than males, being attributed to the higher interest in diet, nutrition and body weight during college years (Yahia, El-Ghazale, Achkar, Rizk 2011). In Iran, students who perceived themselves to be of a normal weight, had a lower intake of saturated fats. However, significant correlations between nutrition knowledge, lifestyle, and BMI were not documented (Alipour, Farhangi, Dehgan, Alipour 2015).

The increased prevalence of NCDs in developing countries like South Africa has resulted in the formulation of numerous preventative strategies, with nutrition knowledge being recognised as one of the strategies that can be used to change unhealthy dietary habits (Feren, Torheim, Lillegaard 2011). Health workers are considered to be the primary source of nutrition knowledge in South African communities, but are often limited by a lack of time, educational material, necessary nutrition insight and confidence to effectively educate the public. It was also reported that health workers with a normal BMI are more at liberty to educate communities on weight management, diets and lifestyle topics than overweight and

obese health workers (van Binsbergen, Delaney, Weel 2003). This may be one of the causes of a nutritionally illiterate public (Zhu, Norman, While 2011).

In a local study that determined the nutrition knowledge of nursing students of which the majority were female, the majority of students did not know that starch should be consumed the most, but were aware that the intake of fat and sugar should be restricted. In addition, the majority did not know the daily recommendation for bread, cereals, pasta, rice, vegetables, milk, yoghurt, cheese, meat, poultry and fish intake. However, the majority were aware of food that are sources of fibre. Fewer underweight participants consumed chips on a daily basis than those of a normal weight or those that were overweight. A significantly higher number of overweight participants consumed full cream milk on daily basis when compared to normal weight participants. When the association between body weight and nutrition knowledge was determined, it was found that underweight and normal weight participants had the highest nutrition knowledge score (van den Berg et al 2012).

In a study conducted among dietetic students at UKZN, it was found that 66.7% had a normal BMI when compared to non-dietetic majors (42.1%) (Kassier & Veldman 2014). This finding suggests that nutrition knowledge may have an influence on dietary choices and weight management. Another local study conducted at the University of the Witwatersrand, found that students may not adhere to following healthy eating guidelines because they base their food choices on factors other than nutrition knowledge, as the majority of student food purchases was influenced by peers, mood and other social pressures (Gradidge & Cohen 2018).

2.6 WEIGHT MANAGEMENT PRACTICES

Weight management practices such as dieting and physical activity are commonly practiced in the USA, with an estimated 50% of obese males and 58% of obese females being actively involved in weight management practices of any sort at any given time (Kruger, Galuska, Serdula, Jones 2004). Various past studies conducted in the USA have found that obese individuals are more likely to be engaged in weight management attempts compared to those with a normal BMI (West, Prewitt, Bursac, Felix 2008; Blixen, Singh, Thacker 2006; Kruger *et al* 2004). In a more recent study investigating the weight management strategies used by African American women, it was found that both healthy and unhealthy weight management strategies are employed. Healthy weight loss practices

included reducing the intake of fried foods and sweets, and increasing the level of physical activity, while unhealthy weight loss practices included skipping meals, fasting and using diet pills (James 2013). It was also shown that obese females were more likely to use unhealthy weight loss practices than overweight women, and that it was associated with higher levels of body dissatisfaction, desperation and past weight loss failures (ADA 2009; West et al 2008).

Harring, Montgomery, Hardin (2010), documented that American college students have been recognised as a group that is at risk of making use of unhealthy weight management strategies such as diet pills, fasting and self-induced vomiting, and are behaviours that are increasingly common, even among underweight and normal weight college students. In a survey conducted by the American College Health Association (ACHA), it was reported that 62.8% of females and 45.4% of males exercise to lose weight, while 42.1% of females and 24.1% of males diet to lose weight. In addition, 3.3% of females and 0.3% of males vomit or take laxatives to manage weight and lastly 3.8% females and 1.7% males take weight loss pills. The majority of these students demonstrated an inaccurate body weight perception, more especially female participants, which suggested that BI has a major influence towards weight management (ACHA 2009).

In a study conducted to examine perceptions of body weight, weight management strategies and depressive symptoms among 97 357 USA college students, it was reported that more males than females were classified as being overweight or obese than females, yet a larger number of females indicated that they are attempting to lose weight (Harring *et al* 2010). Furthermore, more female students perceived themselves as overweight than males. The study also reported that 36.4% of female and 19% of males employed different or a combination of dieting and physical activity strategies to manage weight. However, some students felt it was difficult to implement the dietary changes a weight loss diet they were following required, while others felt PA is a real challenge to implement (Harring *et a1* 2010). In addition, females viewed healthy and acceptable weights to be lower than their current weight, suggested to be as result of thinness being presented as a norm by media. Other study findings were that normal weight females with an inaccurate body size perception were more likely to engage in unhealthy weight loss strategies such as vomiting and the use of diet pills to facilitate weight loss. Moreover, overweight females with realistic body weight perceptions, were even more likely to make use of diet pills to lose weight than those who viewed themselves to be normal, while overweight females who perceived

themselves to be of a normal weight were also likely to take diet pills to lose weight (Harring *et al* 2010)

South Africa is a multiethnic and multicultural country with different norms of cultural beauty (Puoane et al 2010). Those experiencing body dissatisfaction, are mainly as a result of urbanisation and the gradual acceptance of western culture that reaches groups which are not considered to be western (Yan & Bissel 2014). This has resulted in the adoption of western standards of beauty, as communities that were previously known to accept a large body size have since shifted to view thinness as the ideal and acceptable body image, especially among women (Chung & Bissell 2009). Women often feel they cannot attain such an image and therefore develop a negative body image (Mchiza *et al* 2015).

According to SANHANES-1, women with a negative body image are vulnerable to using extreme weight loss strategies such as food restrictions and excessive exercise (Shisana *et al* 2013). These weight loss behaviours can be observed among female South African students as they have been reported to strive for thin beauty ideals (Senekal *et al* 2016). To achieve this body ideal, they engage in unhealthy weight loss strategies such as fasting and the use of weight loss drugs, as such was noted in a USA study of college student's eating habits and knowledge regarding nutrition requirements (Abraham *et al* 2018).

In a local study conducted to determine the weight loss strategies of female students from SA universities, findings regarding weight loss practices included healthy weight loss strategies such as exercise, reduction of portion size and the consumption of sugar sweetened beverages, eating vegetables and fruit, trimming of visible fat and reducing the intake of fatty foods. It is worth noting that a comparatively lower number of female students used unhealthy weight practices, including meal skipping, fasting, smoking and diet shakes. Extreme weight loss strategies included vomiting, herbal mixtures, laxatives, diet pills and methamphetamine. Weight loss products that were commonly used included Herbex, Herbalife products, USN, GI lean products and CLA products (Senekal et al 2016)

2.7 BODY IMAGE

2.7.1 Western beauty ideals and related body image dissatisfaction

Body image is defined as the perception one has about their physical attributes and the resultant thoughts and feelings (McGuinness & Taylor 2016). According to Yan & Bissel

(2014), women are more likely to be dissatisfied with their body image than men. This can be attributed to popular culture's obsession with thinness and attaining western beauty ideals in women as they are reflected in western media (Chung & Bissell 2009). As western media reaches societies and cultures around the world, the globalisation of western beauty ideals is gaining popularity in non-westernised societies (Puoane *et al* 2010). As a result, traditional or indigenous evaluations of beauty are constantly changing around the world (Puoane *et al* 2010). There is a positive relationship between body image dissatisfaction with an increase in BMI, increasing the likelihood of behaviours such dieting and physical activity in an attempt to attain the desired and acceptable body shape and size (Kilpatrick, Hebert, Bartholomew 2005; Schuler, Broxon-Hutcherson, Philipp, Ryan, Isosarri, Robinson 2004).

2.7.2 Female body image perceptions and related factors

Women are more likely to experience body dissatisfaction than men (Chung & Bissel 2009). According to Duncan, Wolin, Scharoun-Lee, Ding, Warner and Bennett (2011), individuals who consider themselves to be overweight are more likely to engage in physical activity than those who perceive themselves as having a normal weight or being underweight. An American study that investigated the body size perception of women, found that 56% of the overweight (BMI $\geq$ 25kg/m^2) and 40% of the obese (BMI greater than 30kg/m^2) participants did not perceive themselves to be overweight or obese. These findings regarding self-perceptions were seen to be largely influenced by a participant's cultural body size norms, which defined overweight and obesity differently than the medical definition.

As a result, these norms can be considered a barrier to weight management and the prevention of obesity among African American women in particular (Lynch & Kane 2014). Furthermore, the majority of participants self-defined the threshold for being overweight as having a BMI between 30-35kg/m^2, whereas an individual with a BMI greater than 25kg/m^2 was defined as being underweight (Lynch and Kane 2014). Other studies conducted among overweight and obese women, found that African American women considered themselves to be "about the right weight" and were said to have a greater likelihood of considering themselves as having a normal BMI than white American women, pointing towards the role of culture in determining body size norms (Dorsey, Eberhardt, Ogden 2009; Bennet & Wolin 2006).

A study investigating body image or body perception among black South African women, found that although some overweight women were aware of their excess weight, they still perceived themselves as being attractive, thereby viewing the need to lose weight as being unnecessary due to their satisfaction with their current weight (Kruger, Puoane, Senekal, Van Der Merwe 2005). Another local study that examined the relationship between actual weight, self-perception and weight loss strategies, highlighted that most women's body perception is influenced by their own weight compared to the weight of their peers rather than health standards such as BMI (Puoane *et al* 2010). In the latter study, it was also noted that some obese women that were satisfied with their body size, were of the opinion that being overweight allows them to engage in activities that require strength and that being obese makes them look respectable in addition to being an indicator of good health. Although obesity was associated an increased risk for the development of NCDs, being underweight and thinness was associated with to HIV/TB (Puoane *et al* 2010).

A study investigating the body image among South African adolescent females of all ethnic groups, reported that Caucasian girls displayed the highest level of body image anxieties and body image dissatisfaction than other ethnic groups (Gitau, Micklesfield, Pettifor, Norris 2014). This may suggest that body perceptions may be closely associated with cultural norms (Gitau et al 2014). According to Puoane *et al* (2010), the majority of adolescent females adjust meal patterns, food habits and physical activity patterns as a way of adjusting their body size to meet ideal weight norms, as the majority of girls in this stage of the life span associate a thinner body size with being attractive.

2.7.3 Body image perception of female university students

The transition from high school to university is said to be a problematic stage in adulthood, as it is associated with a decrease in self-concept, depression, anxiety and psychological distress (Abraham *et al* 2018; Duarte *et al* 2015), with the majority of young women becoming highly concerned about fitting in and maintaining an attractive body shape (Abraham *et al* 2018; Duarte *et al* 2015). In a study that examined body image and weight perceptions in relation to actual measurements by means of a new index and level of physical activity among Italian university students, it was documented that female students preferred a thinner figure than men. Findings were that 13% of the female students (n=354) were satisfied with their body image, while 81% reported that they would have liked to be thinner. In addition, underweight

female participants were more satisfied with their body image than normal and overweight participants while all female participants had a tendency of overestimating their weight (Zaccagni, Masotti, Donati, Mazzoni, Gualdi-Russo 2014).

A study conducted in Kuwait that investigated the relationship between perceived body image and recorded BMI among female university students, found that a large percentage (58%) of participants with a normal BMI, perceived themselves as overweight or obese, and that 37.5% of the underweight participants viewed their weight as normal. Furthermore, overweight and obese students demonstrated a higher level of body image dissatisfaction than normal and underweight students. It was concluded that the level of body dissatisfaction and inaccurate body image/size perception, was caused by the overwhelming pressure for thinness among women that causes them to have a greater body image concern (Grilo & Masheb 2005). Results from the same study also showed that an increase in BMI resulted in body image dissatisfaction (BID). Underweight participants were also shown to be more dissatisfied with their body image than normal weight female students and desired a larger body size. It was also shown that BMI categories were not only associated with BID, but also with the perceived level of attraction and acceptability of certain body sizes. For example, heavier students tended to select heavier acceptable body sizes than their desired body sizes (Kabir, Zafar, Waslien 2013).

In a study that investigated actual body weight and body perceptions among female South African students at a the University of the Western Cape, it was found that a third of the participants overestimated their weight and viewed themselves as being overweight, while 10 % of the participants were actually classified as overweight and obese, and only 15.8% reported to be satisfied with their body weight (Cilliers, Senekal, Kunneke 2006), thus illustrating that the level of body satisfaction among female South African students is low (Puoane *et al* 2010).

2.7.4 Body image dissatisfaction and its relationship with BMI

Body image perceptions differ from one individual to another, with differences in body image perceptions illustrating the way in which individuals uniquely view their body (perceptual body image) versus how they actually feel about it (attitudinal body image) (McGuinness & Taylor 2016). Therefore, body image perception may influence an individual's attitude towards weight change and weight management (Mchiza *et al* 2005). Evidence regarding the

influence of socio-demographic and socio-cultural characteristics on body image have been shown in both international and local studies. A study conducted in the USA documented that white American women have a higher level of body size dissatisfaction when compared to their African American counterparts after controlling for age, income, education and body weight (Wang *et al* 2012). Furthermore, studies conducted among college students reported that African American college students were more accepting of large body size ideals than their white counterparts. It was therefore concluded than African American women have a higher acceptance of larger body sizes, to the extent that they have a higher likelihood of associating obesity with attractiveness than their white counterparts when level of education, age and weight was controlled for (Chithambo & Huey 2013).

A similar trend regarding body image acceptance was also found in developing countries such as Nauru, Tahiti and Saudi Arabia, where body image differences are largely influenced by socio-cultural factors, income and urbanization (Caradas, Lambert, Charlton 2001; Senekal, Steyn, Mashego, Nel 2001). Similarly, in South Africa, a large body size may be associated with wealth, good health, happiness and affluence among rural black communities and some groups of urban black women (Senekal et al 2001). In a study that was conducted among female South African university students, it was found that those from urban areas had a higher level of body size dissatisfaction and were more likely to have attempted weight loss than those from rural backgrounds (Senekal et al 2001).

2.7.5 Determining body image dissatisfaction

International as well as local studies have attempted to quantify body image dissatisfaction by developing measures or indexes to determine the degree of body image dissatisfaction of individuals or groups being assessed (Mchiza *et al* 2005). In a study investigating the relationship between body image discrepancy and BMI across ethnic groups in the USA, body image dissatisfaction was determined by making use of figure rating scales made up by schematic representations of diverse body sizes ranging from underweight to obese, with each figure or silhouette having a numeric value associated with it. Participants were required to select the figure that best represented their current weight from the range of figures or silhouettes presented to them, as well as select a silhouette that represented their desired body size. Body dissatisfaction (BD) is subsequently determined by calculating the

difference between the desired silhouette and current body weight silhouette to yield a BD rating. Hence the latter could range between -8 and 8+, implying that a BD rating greater than zero (> 0) is indicative that the respondent's current body image (BI) is larger than their ideal/desired BI. A BD rating of less than zero (< 0) indicates that the respondent's current BI is smaller than their ideal/desired BI (Fitzgibbon et al 2000).

A similar method was used in another USA study where the study objective was to establish BMI norms for standard figural stimuli using a large Caucasian population-based sample. In addition, the study sought to determine the effectiveness of the figural stimuli to identify individuals as obese or thin (Bulik, Wade, Heath, Martin, Stunkard, Eaves 2001). The findings were that BD ratings/ discrepancy showed that white females preferred a smaller body size than men, and that white women expressed a higher level of BD at a lower BMI than African American and Hispanic women who did not report BD until they were overweight at a BMI> 25kg/m^2 (Bulik et al 2001; Fitzgibbon et al 2000). A study conducted in South Africa used similar methods to measure BD, referring to it as the Feel-Ideal Difference index score (FID) where the objective was to develop and validate instruments to explore body image constructs, one for South African women and the other for their daughters. Study findings demonstrated an associating between ethnicity, culture and body image in terms of the differences in defining a fat body size. For example, black women and their daughters chose larger silhouettes to represent a normal BMI than white women, thus demonstrating a preference for a larger body among black women (Mchiza et al 2005).

2.8 DIETARY DIVERSITY

2.8.1 Dietary diversity score and BMI

Detailed information about an individual or group's dietary diversity or dietary habits can serve as an effective tool for assessing various factors of the diet that influence nutritional status or BMI of individuals (Salehi-Abargouei, Akbari, Bellissimo, Azadbakht 2016). Enjoying a variety of foods is recommended in a number of national dietary guidelines as it is positively associated with nutrient adequacy, anthropometric status and improved hemoglobin status (Salehi-Abargouei *et al* 2016). In a systematic review of observational studies on dietary diversity and obesity in European countries, it was concluded that there

was no significant correlation between dietary diversity and BMI. Similar findings were made in a Nigerian study that assessed dietary diversity in six Nigerian states (Ajani 2010). The latter study used the FAO guidelines for determining household and individual dietary diversity (Kennedy, Ballard, Dop 2011). Study findings included that the majority of study participants (83.3%), had a moderate dietary diversity score (DDS), 16.5% had a low DDS and 0.2% had a low DDS (Ajani 2010). The mean BMI of participants was 23.34 ± 4.8 kg/m^2, however the correlation between BMI and DDS was not significant (p=0.307) (Ajani 2010).

2.8.2 Dietary diversity and dietary habits of university students

According to Yahai *et al* (2016), college is a critical time in which various lifestyle habits are formed. Various American studies showed an increased intake of fast foods and high-fat foods, high alcohol intake and other related unhealthy dietary practices among college students (Yahai *et al* 2016; Chourdakis, Tzellos, Pourzitaki, Toulis, Papazisis, Kouvelas 2011). College students are prone to such dietary behaviour because of time constraints due to academic pressure and the convenience of fast foods (Chourdakis *et al* 2011). A study that investigated the effect of increased fast food intake on body weight, has shown a positive relationship between increased fast-food intake, frequency of visits to fast food outlets, increased weight gain and therefore BMI (Alfawaz 2012). Other studies conducted among young adults and university students in high- and middle-income countries including the UK, Belgium, Germany, Brazil and Saudi Arabia, reported that increased in fast-food intake is associated with low fruit and vegetable consumption (Elsoadaa, Abdelhafez, Rabeh, Zahran, Osfor 2013; Ramalho, Dalamaria, Souza 2012).

Some studies have further investigated socio-demographic, psychosocial and behavioural factors associated with low vegetable and fruit intake (Pearson, Biddle, Gorely 2009). In terms of socio-demographic factors, males were shown to have a lower intake of fruits and vegetables than females, with a low-socio economic background also being linked to a low intake of fruits and vegetables. In terms of living arrangements, a few studies have showed that university students living on or off campus by themselves, consume less fruits and vegetables than students who live at home. In terms of psychosocial factors, a lack of social support, confidence, and self-efficacy was associated with insufficient intake of fruits and vegetables. In addition, dieting, meal skipping (particularly breakfast), increased

consumption of snacks, lack of dietary fibre, excessive alcohol consumption and low PAL are behaviours directly associated with insufficient intake of fruits and vegetables (Elsoadaa *et al* 2013; Peltzer & Pengpid 2010; Pearson *et al* 2009).

A study investigating the correlation of a healthy diet containing fruit and vegetables in students from low, middle- and high-income countries, it was found that those from low to middle income countries had a significantly higher inadequate intake of vegetables and fruits than upper middle to high income countries. These results were attributed to nutrition transition occurring in these countries, which has seen them shift from a cereal-based, low-fat diet to a diet high in fat, sugar and refined foods which is low in fibre, fruits and vegetables diet resembling a western diet (Peltzer & Pengpid 2015). University students living with parents were more likely to consume fruits and vegetables than students living on their own. The possible reason being that students living with parents are more likely to consume a traditional diet, while those who live on their own may be more likely to engage in a diet which is high in fat and sugar and low in vegetable and fruit (Peltzer & Pengpid 2015).

The SADH (2016) reported that the consumption of vegetables, fruits and fruit juice was similar across all age groups. However, the highest consumption of sugar sweetened beverages was found among those aged 20 to 24 years. A lack of dietary diversity has often been shown to be the consequence of low socio-economic status and has been attributed to being one of the leading causes of poor nutrition and an increase in the prevalence of NCDs among those of a lower economic status (Faber & Wenhold 2007). The above is evident among SA university students that are recipients of the National Student Financial Aid Scheme (NSFAS), as they are often from disadvantaged backgrounds and rely on NSFAS funding to take care of food and other basic needs (Department of Higher Education and Training 2011). According to Kassier & Veldman (2013), recipients of NSFAS at UKZN are vulnerable to food insecurity and therefore a lack of dietary diversity, as the majority of students surveyed, were reported to be overweight and obese with the majority of the latter group being female and their poor nutritional status being related to food insecurity and lack of dietary diversity.

2.9 SUMMARY

The review of the related literature, provided an overview of the factors that affect BMI, body image, body image dissatisfaction and weight loss practices among young SA women with

special reference to those enrolled at institutions of higher learning. In the absence of local studies, studies conducted in other developing nations, as well as developed counties were cited. It is evident that the factors discussed are not only multifactorial, but seemingly interrelated. The paucity of local studies investigating these variables among female students, highlights the need for conducting the current study as well as the formulation of guidelines to address the variables under investigation.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter will give an overview of the methodology employed in this study, including the study design, study population and sample selection. The methods and materials employed are also reviewed, including fieldworker training and conducting a pilot study before data collection commenced. The study objectives, related variables and statistical analysis of data will also be elaborated on. Aspects of data quality control including reliability and validity is also reported. This will be followed by ethical considerations.

3.2 Study design

The study design employed in the current study was a cross sectional descriptive survey. This study design analyses data of variables that were collected at one point in time without altering any variable within the study population. However, since data regarding each participant is only recorded once, the sequential association between a risk factor and an outcome would be difficult to infer (Sedgwick 2014). As this study is conducted on a single occasion and does not require follow-up data collection, it is not costly to conduct and does not require a lot of time (Sedgewick 2014). The data collected can also be used in the creation of new theories and in-depth research of the topic (Tredoux & Durrheim 2013).

The disadvantages of this study design includes that it cannot be used to study behaviour over a prolonged period of time and has the inability to help determine any cause and effect, as data is only collected once. Furthermore, there is potential for selection bias due to a lack of randomisation (Song & Chung 2010). Therefore, the chosen sample may not be representative of the population being investigated. To ensure that the conclusions made are more reliable, a large sample size is necessary to allow appropriate inferences to be made about the population under investigation (Guo, Logan, Glueck, Muller 2013).

3.3 Study population and sample selection

3.3.1 Study population

The study population included all female undergraduate students of all races registered for study at the UKZN PMB campus in 2019.

3.3.2 Sample selection

The sampling technique used in the current study was convenience sampling, a type of non-probability sampling where the sample is taken from a group of conveniently available individuals who are willing to participate in a study (Acharya, Prakash, Saxena, & Nigam 2013). However, the disadvantage of this sampling technique is that the general population is not well presented and there is a high possibility of sampling error (Saunder, Lewis, Thornhill 2012). Therefore, the researcher must refrain from generalising the results obtained from the study sample to the population from which the sample was drawn (Etika, Musa & Alkassim 2016).

3.4 Study methods and materials

3.4.1 Fieldworker training

The fieldworkers used for data collection were three third year Dietetic students from UKZN, PMB campus. Fieldworkers were selected based on the fact that at this level of study, students are familiar with the terminology used in the research instrument and have received training on conducting anthropometric measurements. Prior to data collection, the researcher conducted a training session outlining the study's aim and objectives. This was followed by the researcher reviewing the content of the research instrument with the fieldworkers. In addition, the accuracy with which fieldworkers were able to measure height and weight was evaluated by the researcher with additional training being conducted for standardisation purposes in accordance with WHO guidelines (WHO 2019) to ensure reliability and validity of anthropometric data being collected.

3.4.2 Measuring instruments

3.4.2.1 Survey Questionnaire

The research instrument, compiled in English as English is the medium of teaching and learning at UKZN, consisted of seven sections that included the following (see Appendix A):

- Socio-demographic characteristics;
- Weight and height for the calculation of BMI;
- Physical activity;
- Nutrition knowledge;
- Source of nutrition information;
- Body perceptions; and
- 24-h recall for the assessment of dietary diversity.

Below is a detailed description of the study variables that were assessed through research instrument:

Socio-demographic characteristic

The questions used to determine the socio-demographic characteristics of the study sample were developed for the purpose of the study and also included questions regarding meal preparations and the consumption of takeaways.

Anthropometric measurements

Weight

Participant weight was measured using a portable battery-operated digital Seca 813 flat scale.

The procedure for measuring weight was as follows:

- Participants were asked to remove their shoes as well as jackets or any other heavy clothing.
- Participants were requested to stand in the centre of the scale platform with their weight evenly distributed between the two feet.
- Weight was measured to the nearest 0.5 kg, with three measurements taken and the mean between the closest two values being recorded (WHO 2019; Rinaldo & Gualdi 2015).

Height

Standing height was measured using the Seca 217 stadiometer.

The procedure for measuring height was as follows:

- Participants were requested to remove their shoes, hats and other headgear.
- Participants were requested to place their feet together in the centre on the base of the board.
- Participants were requested to stand in a completely erect and upright position, with heels, buttocks and shoulder blades touching the stadiometer, looking straight ahead while their head was placed in the Frankfort plane as shown in Figure 3.1 below.
- Participants were requested to have their arms at their side with palms outturned while remaining in the position described above.
- Height was measured to the nearest 0.5 cm, with three measurements being taken and the mean between the closest two values being recorded (WHO 2019; Rinaldo & Gualdi 2015).

Figure 3.1: Correct head positioning Frankfort oriental plane (Rinaldo & Gualdi 2015).

Body mass index (BMI)

BMI was calculated as weight divided by height squared (kg/m^2). Hence BMI shows the relationship between one's height (m^2) and weight (kg), subsequently classifying an individual as being underweight, normal weight, overweight or obese (Blundell, Dulloo, Salvador & Frübeck 2014). Classification further goes to indicate the extent to which one is

at risk of comorbidities as illustrated in Table 3.1 below (Nuttal 2015; Rothman KJ 2008). Hence, it is commonly used in population-based studies due to its widespread acceptance in defining specific categories of body mass as a health issue (Nuttal 2015).

However, BMI has been noted to have several limitations, such as its inability to distinguish between lean and fat mass as it is only a measure of excess weight rather than excess fat (Buss 2014). This means that BMI does not distinguish between extra fat, accumulated fats, muscles, bone mass neither does it provide any unique information about the distribution of fat among individuals (Nuttal 2015). Therefore, muscular individuals or athletes may be wrongly classified as obese due to increased lean muscle mass, while at the other hand individuals with high body fat and low muscle mass might be wrongly classified as normal (Buss 2014). The current made use of the BMI measure because of the following reasons, BMI is simple, cost efficient, only depends on weight and height and with the availability of equipment, individuals can have their BMI measured and calculated with sound accuracy (Center for Desease control and prevention CDC 2019). Additionally, studies have shown that BMI levels positively correlates with body fat and future health risk associated with fat accumulation. Therefore, BMI is an appropriate measure of obesity and associated health risk (CDC 2019).

Table 3.1: BMI classification for adults.

Weight/height (kg/m^2)	**Classification**	**Risk of co-morbidities**
<16	Severe malnutrition	
16 – 17	Moderate malnutrition	Low (but risk of other clinical problems increases)
17 - 18.5	Mild malnutrition	
18.5 - 24.9	Normal range	
>25	Overweight	
25 - 29.9	Pre-obese	Increased
30.0 - 34.9	Obese class I	Moderate
35.0 - 39.9	Obese Class II	Severe
>40.0	Obese Class III	Very severe

Source: WHO (2019)

Physical activity

Participant level of physical activity was determined with the International Physical Activity Questionnaire – Short Form (IPAQ-SF). This instrument was first developed in 1998, then modified in 2000 (Craig, Marshall, Sjöström, Bauman, Booth, Ainsworth, Pratt, Ekelund, Yngve, Sallis & Oja 2003). The IPAQ has a set of four questionnaires with long or short variations that allow flexibility of conducting the questionnaire via the phone (by the researcher) or allowing it to be self-administered (Craig *et al* 2003). Also, the IPAQ-SF has been shown to demonstrate a concurrent validity and test-retest reliability for vigorous physical activity, walking, sitting down total physical activity, but proved only fair validity for moderate and sitting physical activities (Oyeyemi, Oyeyemi, Adegoke, Oyetoke, Aliyu, Aliyu, Rufai 2011). However, a systematic review testing the validity of the IPAQ-SF concluded that the IPAQ-SF was likely to overestimate the level of physical activity reported than an objective device (accelerometer) and as a result, evidence that supports the use of IPAQ-SF as a relative or a precise and complete measure of physical activity level was usually considered to be weak (Lee, Macfarlane, Lam, Stewart 2011). Use of the IPAQ-SF was appropriate for this study as it is a research instrument fundamentally structured for population-based investigations of physical activity among adults between the ages of 15-69 years (Lee *et al* 2011). The tool also enabled the categorisation of participant's level of physical activity as low, moderate or high based on criteria and guidelines for activity classification using the IPAQ scoring protocol (Short forms) (see Appendix B) (IPAQ Research Committee 2005).

Nutrition knowledge

Participant nutrition knowledge was assessed by selecting multiple choice and true false questions from the instrument developed by Whati, Senekal, Steyn, Nel, Lombard & Norris (2005). The 60 questions forming part of the unabridged instrument was developed based on objectives for the South African national teaching curriculum for nutrition education, and was formulated in line with the South African Food-Based Dietary Guidelines (Vorster, Love, Browne 2001). After expert input, the researcher selected 21 multiple choice and 12 true/false questions from the 60-question version, based on the study aim and related objectives. Following completion of the nutrition knowledge questions, a nutrition knowledge score was calculated for each participant. Nutrition knowledge scores obtained were categorised as follows: poor (less than 50 %), good (50-74%) and excellent (> 75%).

Body image perception

It has been reported that in South Africa, overweight and obese individuals tend to underestimate their body size. However, despite this phenomenon, they desire to be thinner, while those of a normal weight tend to overestimate their body size (Mchiza *et al* 2015). To explore body size perception and body image dissatisfaction among the study sample, figure rating scales (silhouette) were used to allow participants to select the silhouette that best describes their current body size. In order to determine their level of body image dissatisfaction, participants were then asked to select the silhouette that best represents their ideal body size (Figure 3.2). The same concept and figure rating scales were used to determine body image in the SANHANES-1 study (Shisana *et al* 2013). To determine and quantify the level of body image dissatisfaction, the feel-ideal difference index score (FID) was calculated (Mchiza *et al* 2005), by calculating the difference between the number of the silhouette chosen that best described the participant's current weight (feel) and the one they would like to look like (ideal) (Mchiza et al 2005). Therefore, the higher the calculated FID score, the higher the level of body size dissatisfaction, with a positive value representing a desire to be thinner, while a negative value indicated a desire to be bigger. A FID index score closer to zero, represented less body size dissatisfaction, whereas a FID index score lower than -1 or higher than +1, indicated greater body size dissatisfaction (Mchiza et al 2005).

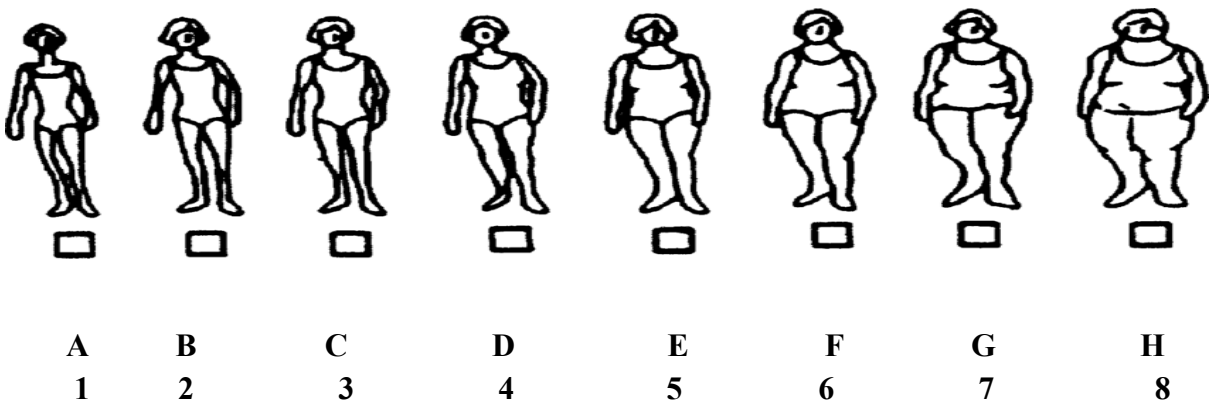

Figure 3.2: Figure rating scale or "silhouette" of different body sizes

Dietary diversity and 24-hour recall

Dietary diversity is a measure of food consumption that demonstrates household/individual access to different and varying foods (Belachew, Lindstrom, Gebremariam, Hogan, Lachat, Huybregts, Kolsteren 2013). The advantages associated with using the dietary diversity questionnaire is that it is easy to use, cost-effective and time efficient, as well as being useful

in measuring the dietary or nutritional quality of dietary habits at the household and individual level (Kennedy *et al* 2011). The questionnaire is standardised and was developed with the purpose of widespread applicability. In that capacity, it is not culture, population, or site specific, thereby making its use in the current study appropriate (Kennedy et al 2011).

Participant dietary information was obtained by means of a non-quantified 24-hour dietary recall. This method was selected because it is based on foods and amounts consumed by participants on a specific day, thereby reducing measurement error (Baranowski 2012). The dietary diversity scores of participants were calculated by summing food groups consumed over a 24-hour period (Kennedy *et al* 2011). For the purpose of this study, the dietary diversity score obtained was categorised as poor (≤ 5 food groups), medium (6-11), and good (> 11 food groups) out of a possible 16.

3.4.3 Data collection

Female undergraduate students were randomly approached by field workers on the respective campuses that make up the Pietermaritzburg campus and invited to participate if they met the study's inclusion criteria. If prospective participants were willing to participate in the study after the study aim, objectives and methods employed were explained by field workers, they were escorted to a venue in close proximity where recruitment took place where they were given an informed consent form to read and sign prior to the commencement of data collection. This was followed by the measurement of body weight and height. Participants were then requested to complete the survey questionnaire in the presence of the primary investigator for the provision of clarification and assistance if required. Upon completion of the questionnaire, field workers scrutinized the research instrument to determine if all sections were completed. However, participants were not coerced into completing sections of the research instrument if they were not able to quantify or recall the necessary detail required for the completion of e.g. the IPAQ-SF.

3.5 Pilot study

A pilot study was conducted on ten participants meeting the study's inclusion criteria prior to the commencement of data collection for the main study. However, the data collected was not included in the current study. Following the pilot study, the following adjustments were made to the research instrument:

- As the majority of participants found it difficult to estimate the number of hours engaged in physical activity when completing the IPAQ-SF activity, the question was changed to "how many minutes is spent participating in physical activity". This adjustment proved to be helpful in the actual study, as participants did not report any difficulty in understanding the question.
- Participants also reported difficulty in determining the intensity of their physical activity. To rectify the latter, numerous examples of light, moderate and vigorous physical activity were added to the IPAQ-SF to facilitate ease of completion regarding the intensity of physical activity.
- Piloting proved to be helpful in estimating the amount of time it took to complete the self-administered questionnaire, as the primary investigator could inform prospective participants that the duration of the study was 15 to 20 minutes. In Section B it was also noted that most participants struggled with estimating number of hours spent for physical activity. To rectify this, the question was changed to ''how many minutes is spent in physical activity'' this change was helpful as participants in the main study did not report any difficulty in understanding the question.
- The process of data collection was also enhanced by the pilot study as it proved to be more practical to set up the area where data collection took place as separate work stations. This included a weighing station, height measurement station, as well as an area where the completion of the research instrument took place. This allowed field workers to direct participants to subsequent stations during the period where participant turnout was high.

3.6 Variables included in the study, data capturing and statistical analysis

Table 3.2 provides an overview of the study objectives, corresponding variables and statistical analysis of data.

Table 3.2: Study objectives, corresponding variables and statistical analysis of data

Objective	Variable(s)	Statistical analysis
To determine the following variables among female undergraduate students on the Pietermaritzburg campus of UKZN: • Socio-demographic characteristics; • BMI; • Body size perception; • FID; • Level of physical activity; • Nutrition knowledge; • Dietary diversity; and • Weight management practices.	Socio-demographic variables BMI Body size perception FID Level of physical activity Nutrition knowledge Dietary diversity Weight management practices	Mean ± SD for continuous variables and frequency distributions for categorical variables.
To determine the relationship between the following categorical variables: • Socio-demographic characteristics; • BMI category; • Body size perception category; • Level of physical activity; • Nutrition knowledge; • Dietary diversity; and • Weight management practices.	Socio-demographic variables BMI Body size perception category Level of physical activity Nutrition knowledge Dietary diversity Weight management practices	Chi-square tests
To determine the correlation between the following continuous variables: • Mean BMI; • Feel-ideal difference index score	BMI FID Physical activity Nutrition knowledge	Independent samples t-tests Pearson correlation

(FID) • Mean physical activity score; • Mean nutrition knowledge score; • Mean dietary diversity score.	Dietary diversity	coefficients

3.7 Data quality control

3.7.1 Reliability

Reliability or repeatability refers to the extent to which constant results can be produced using the same methods or instruments more than once (Heale & Twycross 2015). Therefore, a reliable study is one in which other researchers can get the same results when using the same research methods under varying circumstances and at various locations (Wilson 2012). In this study, reliability was ensured by the development of a research questionnaire based on the relevant literature, using validated questionnaires and selecting questions from validated research instruments (Mchiza et al 2015; Rinaldo & Gualdi 2015; Kennedy et al 2011; Craig et al 2003; Whati et al 2005). Reliability was also ensured by using internationally recognized protocols for conducting anthropometric measurements (WHO 2019). In addition, fieldworkers were trained and a pilot study was conducted before the current study took place to ensure that the research instrument is clear, unambiguous and suitable to be self-administered by prospective study participants.

3.7.2 Validity

Validity refers to the extent to which a survey is able to measure the proposed intent of the study, with valid research being one in which the elements that were meant to be measured are actually measured (Heale & Twycross 2015). The pilot served as a means to test validity, as the findings from the pilot study enabled the identification and rectification of any potential obstacles that may hinder data collection. In addition, validity was ensured by calibrating the scale with a known weight before weight was measured. Face validity was ensured via expert input in the development of the research instrument, while content validity was ensured by using research instruments and research techniques used in previous studies that investigated similar constructs among similar study samples. The collected data was entered twice into Microsoft Excel before being entered into the Statistical Package for the

Social Science (SPSS) version 24. This eliminated errors and inconsistencies that could have occurred during data capture.

3.8 Ethical considerations

Gatekeepers permission was obtained from the registrar at UKZN (Appendix C) before submitting the proposal for ethics approval from the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal (**BE265/19**) (Appendix D). Prior to participation in the study, participants were asked to sign an informed consent form (Appendix E). Participant anonymity and confidentiality was ensured by allocating each participant with a unique code for identification purposes. Hence it was not possible to link participants to their respective data sets. Data was captured and analysed on password protected spreadsheets that could only be accessed by the primary researcher and study supervisors. Following data collection and statistical analysis, survey questionnaires were kept at Dietetics and Human Nutrition, UKZN in a room with a locked Trellidoor. Data will be stored for a period of five years, following which it will be disposed of by shredding.

3.9 SUMMARY

This chapter gave an overview of the methodology and research instruments employed to achieve the aim and related objectives of the study by providing an overview of the study design, study population, sampling technique employed, as well as the data collection methods. Prior to commencement of data collection, a pilot study was conducted to determine the time required to collect data, feasibility of the sequence in which data collection took place as well as gauge participant understanding of the research instrument and whether it was feasible to collect data as a self-administered questionnaire. The chapter also elaborated on measures that were employed to enhance the reliability of the data collection process, as well as the validity of the data collected. To ensure adherence to ethical norms and standard, gatekeeper's permission was obtained from the Registrar of UKZN, prior to submission of the research protocol being submitted for ethics approval by the Biomedical Research Ethics Committee of the university.

CHAPTER 4: RESULTS

4.1 Introduction

The results of the current study will be presented in this chapter according to the study objectives outlined in chapter 1.

4.2 Socio-demographic characteristics

Table 4.1 provides anoverview of participant's socio-demographic characteristics.

Table 4.1: Socio-demographic characteristics of study sample (N=316)

Variable		**Percentage**
Race	Black	86.7%
	Mixed ancestry	2.2%
	Indian	10.8%
	Whites	0.3%
College	Agriculture, Engineering & Science	45.6%
	Law and Management Studies	27.2%
	Humanities	27.2%
Accommodation	Residence	38.6%
	Private accommodation	44.3%
	Home	16.1%
	Other	0.9%
Source of income	Bursary	4.8%
	Allowance of parents	16.8%
	Work salary	1.3%
	NSFAS	72.7%
	Parents & NSFAS	4.4%

From the above table it is evident that the majority of study participants 86.7% were black and were registered for study within the College of Agriculture, Engineering and Science 45.6 %, followed by an equal number of participants being registered with the College of Law and Management Studies and Humanities at 27.2% respectively. The mean age of participants was 20 ± 2 years. The majority resided in private accommodation 44.3%, while nearly two fifths (38.6%) lived in university residences. Just over 72.7% received NSFAS funding, while 16.8% were funded by parents their parents 16.8%, received bursaries 4.8% or were self-funded 1.3%, with 4.4% receiving both NFAS and parental financial assistance 4.4%.

4.3 Meal preparation and consumption of take-always

Table 4.2 outlines participant's meal preparation habits, the frequency with which they consumed take-always, as well as the type of take-always they consumed.

Table 4.2: Meal preparation habits and consumption of take-always

Variable	**Minimum**	**Maximum**	**n**	**Mean ± SD**
How many times a week does participant prepare own meals	1	15	241	3.7 ± 2.3
Variable	**Response**		**n**	**Percentage**
How often does participant prepare meals	Most days of the week		257	84.3%
	Never		48	15.7%
Does participant consume take-aways	Yes		286	91.1%
	No		28	8.9%
How often does participant consume take-always?	Daily		33	13.5%
	Weekly		150	61.2%
	Monthly		62	25.3%
Type of take-always consumed	Chicken outlets¶		40	14.4%
	Burger outlets €		37	13.4%
	Sandwiches		5	1.8%
	Pizza		3	1.1%
	Vegetarian ≠		2	0.7%
	Combinations ≈		190	68.6%

¶ Chicken outlets: KFC, Nandos and Honchos
€ Burger outlets: McDonalds and Spur
≠ vegetarian options: Karanichas
≈ Combinations: above-mentioned take-always, chips and foods other than chicken and burgers

Participants that prepared their own meals did so 3.7 ± 2.3 times per week, with 84.3% reporting that they prepared their own meals on most days of the week. Just over 9/10 participants (91.1%) consumed take-always, with the majority (61.2%) doing so on a weekly basis, followed by a quarter (25.3%) consuming take-always on a monthly basis and 13.5% doing so on a daily basis. Of those that consumed take-aways, the majority (68.6%) consumed a combination of takes-always including chicken, burgers, sandwiches, pizza and vegetarian options. Take-aways from chicken outlets proved to be popular (14.4%), followed by burger outlets (13.4%).

4.4 BMI of study participants

The mean BMI of the study sample is reported in Table 4.3.

Table 4.3: Mean BMI of study sample (N=316)

Variable	Minimum	Maximum	Mean ± SD
BMI (kg/m^2)	15.9	45.3	25.2 ± 5.6

The mean BMI of participants was 25.2 ± 5.6 kg/m^2, with the lowest BMI being 15.9 kg/m^2 and the maximum 45.3 kg/m^2.

Table 4.4 reports the BMI category of study participants.

Table 4.4: BMI category of study participants (N=316)

Classification	Percentage
Underweight (≤ 18.49kg/m^2)	4.4%
Normal (18.5-24.9 kg/m^2)	48.1%
Overweight (25-29.9 kg/m^2)	19.0%
Obese class I (30.0-34.9 kg/m^2)	13.3%
Obese class II (35-39.9 kg/m^2)	12.6%
Obese class III (40> kg/m^2)	2.5%

From Table 4.4, it is evident that the majority of participants had a normal BMI 48.1%, followed by nearly two fifths (19%) being overweight. Furthermore, 13.3% were classified as obese class I, while 12.6% were classified as obese class II. Only 4.4% were underweight, while 2.5% were classified as being obese class III.

4.5 Physical activity

Table 4.5 provides an overview of the time participants were engaged in physical activity of varying intensities namely vigorous, moderate or walking for at least 10 minutes on a daily basis.

Table 4.5: Duration of engagement in various levels of physical activity

Variables	**N**	**Minimum**	**Maximum**	**Mean ± SD**
Time spent doing vigorous physical activity (minutes)	126	0	240	56 ±40
Time spent doing moderate physical activity (minutes)	95	0	1000	58 ±106
Time spent walking for at least 10 minutes	231	5	2000	231±145

As per Table 4.5, the mean time spent doing vigorous physical activity was 56 ± 40 minutes per week, while the mean time being engaged in moderate physical activity was 58 ± 106 minutes per week. The mean time spent walking for at least 10 minutes at a time was 231 ± 145 minutes per week.

Table 4.6 presents the number of days per week participants engaged in physical activity of varying intensities, namely vigorous, moderate or walking for at least 10 minutes at a time.

Table 4.6: Weekly engagement in physical activity of varying intensities

Variable	**Weekly duration**	**Percentage**
Number of days per week participants engage in vigorous physical activity.	Once	18.5%
	Twice	33.3%
	Three times	17.8%
	Four times	11.1%
	Five time	8.1%
	Six times	5.2%
	Seven times	2.2%
	Do not participate	3.7%
Number of days per week participants engage in moderate physical activity.	Once	11%
	Twice	30%
	Three times	21%
	Four times	9%
	Five times	13%
	Six times	4%
	Seven times	8%
	Do not participate	4%

Number of days per week participants walked for at least 10 minutes at a time.	Once	2.4%
	Twice	3.0%
	Three times	3.7%
	Four times	3.7%
	Five times	35.5%
	Six times	9.8%
	Seven times	41.9%

From Table 4.6 it is evident that the majority, namely a third of participants (33.3%) who were engaged in vigorous physical activity, participated three days per week. The majority of participants who were engaged in moderate physical activity (30%), participated in two days of the week. Of the participants who walked at least ten minutes at a time, the majority (41.9%) did so seven days per week

Table 4.7 presents the different categories of physical activity of those who participated in the study.

Table 4.7: Level of physical activity (n=267)

Categories	**Percentage**
Low	38.6%
Moderate	46.8%
High	14.6%

The above table shows that the majority of participants could be classified as being moderately physically active (46.8%), followed by those with a low level of physical activity (38.6%), while only 14.6% were classified as having a high level of physical activity.

4.6 NUTRITION KNOWLEDGE

Table 4.8 details participant responses to the multiple-choice section of the nutrition knowledge questionnaire.

Table 4.8: Responses to multiple choice section of the nutrition knowledge questionnaire.

Question	Percentage
The healthiest snack is? (n=313)	
A glass of milk	78.5%
A tub of unbuttered popcorn	15.3%
A slab of chocolate	3.2%
A tub of unbuttered popcorn and a slab of chocolate	3.2%
How often should fruits and vegetables be eaten (n=313)	
1 fruit and vegetable a day	52.4%
3-4 fruits and vegetables a day	35.1%
5 or more fruits and vegetables everyday	9.9%
There is no need to eat fruits and vegetables daily	2.6%
Which cooking method will use the largest amount of fat (n=315)	
Boiling	7%
Braaiing	0.6%
Frying	90.8%
Roasting	1.6%
What is a portion of cooked vegetables? (n=309)	
1 tablespoon	5.2%
Half a cup	47.6%
1 cup	40.5%
2 cups	6.8%
Which of the following foods are the lowest in fat? (n=307)	
Corn flakes and full cream milk	39.4%
Grilled lean steak and boiled carrots	55.7%
Pizza and milkshake	2.6%

Fried lamb chops and creamed spinach	2.3%
Which way of cooking eggs will result in the lowest amount fat? (n=312)	
Scrambled	2.6%
Fried	2.2%
Boiled	95.2%
None of the above	0%
Which of the following is a low-fat snack? (n=313)	
"Simba" chip	7%
Popcorn	75.4%
Fried chips	1.6%
"Niknaks"	15.8%
A well-balanced diet consists of? (n=311)	
Consists MOSTLY of meat, with smaller amounts of starch, fruits, vegetables, and dairy products	18%
Consists mostly of vegetables, and smaller amounts of meat and dairy products	47.3%
Consist mostly of starches, vegetables and fruits, with smaller amounts of meat and dairy products	30.2%
None of the above	4.5%
The key to a healthy way of eating is to? (n=313)	
Eat many different kinds of foods	21.7%
Eat some foods more than other foods	5.8%
Eat certain kinds of foods in moderate or small amounts	57.2%
All the above	15.3%
From which group of foods should you eat the most every day? (n=313)	
Bread, samp, rice, porridge	13.7%
Apples, bananas, spinach, carrots	57.5%
Milk, yoghurts, cheese	4.8%
Chicken, fish, beans, eggs	24%
A healthy diet is one that includes? (n=313)	
Mostly meat, fish, chicken	45.7%
Mostly uncooked foods	25.6%
Mostly foods in cans or tins	2.9%

Mostly bread, rice and maize meal	25.9%
Most of the foods you eat should be? (n=312)	
Starches, dairy products, meats and beans	19.2%
Vegetables, fruits and dairy products	32.4%
Starches	2.2%
Vegetables, fruits, meats, and beans	46.2%
Being physically active means? (n=314)	
Going to the gym	4.8%
Walking a lot	4.8%
Playing sports like soccer or netball	1.9%
All of the above	88.5%
Bread and rice	25.5%
Meat and fish	9.2%
Margarine	36.6%
None of the above	28.7%
The reason why beans, peas and lentils are good for you is that? (n=311)	
They contain only a small amount of fat	26.4%
They contain a lot of fibre	33.1%
They can protect you from diseases	6.1%
All of the above	34.4%
You should not have starches at most meals because? (n=312)	
They are not important for your health	11.2%
Even eating small amounts can cause weight gain	46.8%
They cause diseases	11.9%
None of the above	30.1%
Which of the following foods contains a lot of starch? (n=310)	
Bread, rice, maize meals, samp	95.2%
Maize meal only	2.6%
Fruits and vegetables	1.6%
Fresh fish and chicken	0.6%
Fibre	49.8%
Iron	38.8%

Fat	0.6%
All	10.7%
Cakes and biscuits	19.9%
Apples and carrots	65.3%
Chips and pies	1.6%
Chicken and fresh fish	13.2%

Based on the majority of responses to each question forming part of the multiple-choice section of the nutrition knowledge questionnaire, (57.9%) questions were answered correctly. Questions where the majority of responses were answered incorrectly, were related to the frequency with which fruits and vegetables should be consumed, what a well-balanced diet consists of, the key to healthy eating, the food group that the majority of foods should be consumed from, what a healthy diet consists of and what the majority of foods you eat should be. What was therefore evident, was that participants were not aware of the fact that the consumption of a variety of foods is the cornerstone of healthy eating, and that starchy foods should form the basis of every meal. In addition, participants were not aware of the foods that should be consumed when trying to lose weight.

In Table 4.9, participant responses to the true/false section of the nutrition knowledge questionnaire are presented.

Table 4.9: Results from a true or false section of the nutrition knowledge questionnaire.

Questions	True/false	Percentage
You can replace water with cold drinks like "Coca Cola" (n=314)	True	11.8%
	False	88.2%
Physical activity should be part of everyone's daily life (n=314)	True	96.8%
	False	3.2%
If you are eating a healthy diet there is no need for you to be physically active (n=313)	True	4.8%
	False	95.2%
People who are overweight should not be physically active (n=312)	True	2.9%
	False	97.1%
Eating a lot of different kinds of foods is healthier than eating only a few kinds of food (n=313)	True	68.4%
	False	31.6%
Foods such as bread, rice, maize, or samp, should be the main part of most meals (n=311)	True	47.8%
	False	51.9%
You can eat as much meat as you want every day (n=310)	True	14.5%
	False	85.5%
It is best to eat sugar-containing foods only as a snack, instead of as part of a meal (n=312)	True	66%
	False	34%
Fat or fatty foods may be eaten in small amounts (n=313)	True	90.7%
	False	9.3%
Drinking lots of water is not necessary (n=312)	True	4.8%
	False	95.2%
Drinking boiled water is a good way to lose weight (n=310)	True	68.1%
	False	31.9%
Eating bread always cause weight gain (n=311)	True	45%
	False	55%

Based on the responses to each question forming part of the true/false section of the nutrition knowledge questionnaire, 75% of the questions were answered correctly. Questions that were answered incorrectly followed a similar trend to that of responses to the multiple-choice section of the nutrition knowledge questionnaire as it alluded to the fact that participants were not aware of the fact that starchy foods should form the basis of most meals and that drinking boiled water is not a good aid to weight loss. In addition, they were not aware that it is better

to consume sugar-containing foods as part of a meal as opposed to it being consumed as a snack.

Table 4.10 presents participant knowledge scores according to the categories indicated

Table 4.10: Participant nutrition knowledge score categories (n=315)

Category	**Percentage**
Poor (score < 50%)	34.3%
Good (score ≥ 50% - 74%)	63.8%
Excellence (score ≥ 75%)	1.9%

From the above table it is evident that the majority of participants 63.8%, had a good nutrition knowledge score, followed by 34.3% who had an overall score of less than 50%.

4.7 SOURCES OF NUTRITION INFORMATION

The sources of participant's nutrition information are presented in Table 4.11.

Table 4.11: Sources of nutrition information

Source of nutrition information	**Percentage**
University	5.7%
Peer/friend/family	2.5%
Mass media* and social media	7.6%
Combination of mass media and other sources#	80.7%

* Mass media refers to sources such as television, radio and magazines.
# Other sources refer to school, health care facilities, university, peers and friends.

Just over 80.7% of participants indicated that they gained nutrition information from a variety of sources that included mass media, school, health care facilities, university, peers and friends. This was followed by 7.6% indicating that they obtained nutrition information from a combination of mass media and social media.

The perceived reliability of sources of nutrition information is presented in Table 4.12.

Table 4.12: Perceived reliability of source of nutrition information See first row.

Source	**Reliability**	**Percentage**
University (n=127)	Very unreliable	5.5%
	Unreliable	0%
	Not sure	6.3%
	Reliable	29.9%
	Very reliable	58.3%
Peer and friends (n=129)	Very unreliable	0.8%
	Unreliable	12.4%
	Not sure	39.5%
	Reliable	40.3%
	Very reliable	7.0%
Parents (n=123)	Very unreliable	0.8%
	Unreliable	3.3%
	Not sure	15.4%
	Reliable	56.9%
	Very reliable	23.6%
Radio (n=67)	Very unreliable	1.5%
	Unreliable	0%
	Not sure	17.9%
	Reliable	46.3%
	Very reliable	34.3%
Television (n=138)	Very unreliable	0.7%
	Unreliable	5.8%
	Not sure	21.0%
	Reliable	44.2%
	Very reliable	28.3%
Magazines (n=134)	Very unreliable	2.2%
	Unreliable	1.5%
	Not sure	15.7%
	Reliable	44.8%
	Very reliable	35.8%
Social media (n=206)	Very unreliable	4.9%
	Unreliable	10.2%
	Not sure	28.6%
	Reliable	33.5%
	Very reliable	22.8%
School (n=15)	Very unreliable	13.3%
	Unreliable	0%
	Not sure	13.3%
	Reliable	20.0%
	Very reliable	53.3%
Health care facility (n=3)	Very unreliable	33.3%
	Unreliable	33.3%
	Not sure	33.3%

	Reliable	0%
	Very reliable	0%

Table 4.12 illustrates that university 58.3%, followed by school 53.3%, magazines 35.8% and radio 34.3%, were considered to be the most reliable sources of nutrition information. However, school represented a very small proportion of the study sample (n=15). This was followed by parents, radio, magazines and television being considered as reliable at 56.9%, 46.3%, 44.8% and 44.2% respectively. The most unreliable source 33.3% was health care facilities. However, this only represented one participant. Hence university 5.5%, followed by social media 4.9% were considered to be the most unreliable.

4.8 WEIGHT MANAGEMENT PRACTICES

Participant weight management practices are reported in Table 4.13.

Table 4.13: Participant responses to weight management related questions

Question	**Percentage**
Do you weigh yourself? (n=308)	
Yes	59.1%
No	40.9%
How often do you weigh yourself? (n=172)	
Weekly	9.3%
Monthly	61.0%
Annually	29.7%
How would you classify your current weight? (n=307)	
Underweight	8.1%
Normal	70.0%
Overweight	19.2%
Obese	2.6%
Have you ever attempted weight loss? (n=307)	
Yes	56.4%
No	43.3%
Why have you not attempted weight loss? (n=120)	
Perceive body weight as normal	35.0%
Satisfied with body weight	37.5%
Lack of will and dedication	8.3%
Avoiding further weight loss	18.3%
Sees no need	0.8%
If you have attempted weight loss, how did you go about it? (n=169)	
Healthy weight loss options*	50.9%
Unhealthy weight loss options#	7.1%

Combination of healthy and unhealthy weight loss options	42.0%
If you attempted weight loss with a diet, what did the diet entail? (n= 133)	
Vegetables, fruits and low-fat cooking ¶	45.9%
Balanced diet	6.0%
Low carbohydrate §	20.3%
Low kilojoule µ	9%
No fast foods	9%
Low sugar and low-fat diet ø	9.8%

* Healthy options: exercise, diet, reduced meal portions
# Unhealthy options: skipping meals, fasting, induced vomiting, weight loss products, appetite suppressants, slimming tea, laxatives, and meal replacement shakes
¶ Includes: boiled and steamed food diet, high vegetable and fruit diet, and low-fat diet
§ includes: low starch diet, keto diet and high protein, low fat diet
µ includes: calorie counting diet
ø includes: low sugar, low-fat diet and calorie counting diet

In relation to participant weight management practices, the majority of the study sample 59.1% weighed themselves monthly 61.0%. Despite the fact that the majority of participants 70.0% classified their weight as normal, 56.4% had attempted weight loss. Of those who had not attempted weight loss, the majority 37.5% indicated that the reason for not attempting weight loss was that they were satisfied with their body weight, followed by 35% indicating that they perceived their body weight as normal. The majority of participants who attempted weight loss, followed healthy weight loss practices 50.9%, followed by those who made use of a combination of healthy and unhealthy weight loss practices 42.0%. Those participants that followed a diet for weight loss purposes, ate more fruit and vegetables, as well using low fat cooking methods 45.9%, followed by those who followed a low carbohydrate diet 20.3%. The latter included reducing the intake of starchy foods, following a keto diet or a diet described as high in protein and low in fat.

4.9 BODY IMAGE PERCEPTION AND BODY IMAGE DISSATISFACTION

Participant body image perceptions and body size dissatisfaction are presented in table 4.14. These concepts are related to what participants felt they looked like and what they wanted to look like referring to their ideal body size. Based on participant “feel” versus “ideal” body size, the FID score was calculated as an indicator of the level of body size dissatisfaction participants experienced.

Table 4.14: Body image perception and body size dissatisfaction

Question and related response		
Which silhouette best describes your current weight? # (n=302)		
Silhouette	n	Percentage
A/1	31	10.3%
B/2	80	26.5%
C/3	62	20.5%
D/4	70	23.2%
E/5	40	13.25
F/6	14	4.6%
G/7	3	1.0%
H/8	2	0.7%
Which silhouette would you like to have? ¥ (n=291)		
Silhouette	n	Percentage
A/1	29	10.0%
B/2	86	29.6%
C/3	99	34.0%
D/4	55	18.9%
E/5	20	6.9%
F/6	1	0.3%
G/7	1	0.3%
H/8	0	0%
Feel-ideal difference index score (FID) *		
N	**Mean ±SD**	
286	0.4 ±1.33	

[* FID = # - ¥ (difference between perceived silhouette ("feel") and ("ideal") silhouette]

As per Table 4.14, the majority of participants selected silhouette B (26.5%), followed by D (23.2%) and C (20.5%) as the silhouette they felt that best described their current body weight. When it came to the body size participants wanted to be, i.e. their ideal body size, the majority chose silhouette C (34.0%), followed by silhouette B (29.6%) and silhouette D (18.9%). When the difference between perceived ("feel") and ideal body size was calculated, it rendered a FID score of 0.4 ±1.33, indicating that participants desired to be thinner (please see graph representation of this below).

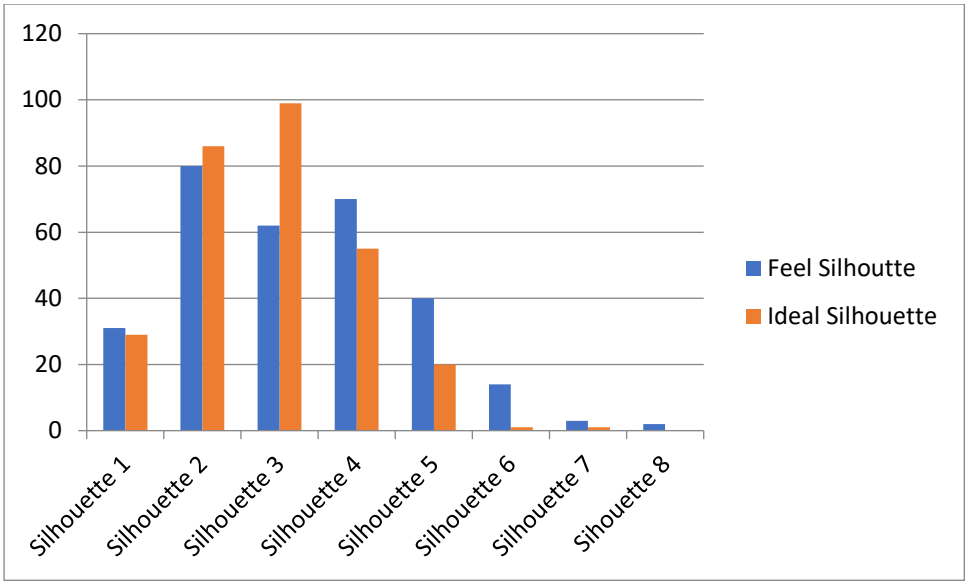

Figure 4.1: Graphical presentation of participant's body image perception and body size dissatisfaction (Feel-ideal index)

4.10 DIETARY DIVERSITY SCORE

Participant dietary diversity score is presented in Table 4.15, based on the results of a self-administered 24-h recall.

Table 4.15: Diet diversity score (n = 309)

Classification	Percentage
Low (≤ 5 food groups)	19.4%
Medium (6 – 11 food groups)	45.0%
High (> 11 food groups)	35.6%

Based on the above table, the majority of participants (45.0%) had a medium dietary diversity, followed by more than a third of participants (35.6%) having a high dietary diversity. One out of five participants (19.4%) consumed diets that lacked diversity.

4.11 RELATIONSHIP BETWEEN VARIABLES

4.11.1 Relationship between continuous variables

Significant correlations between continuous study variables are reported in Table 4.16 below.

Table 4.16: Significant correlations between continuous variables

Variables	r	P-value*
BMI vs age	0.11	0.045
Time spent doing vigorous physical activity versus the time spent doing moderate physical activity.	0.69	0.000
Time spent doing vigorous physical activity versus the time spent walking.	0.31	0.003
Time spent doing moderate physical activity versus the time spent walking.	0.93	0.000
Participant age versus the silhouette they thought best described their body size ("feel").	0.15	0.012
Participant age versus FID index score.	0.12	0.044
Time spent doing vigorous physical activity versus FID index score.	0.21	0.024
Nutrition knowledge score versus the silhouette participants thought best described their body size ("feel").	-0.231	0.023
The silhouette participants thought best described their body size versus FID index score.	0.68	0.000
The silhouette participants thought best describes their body size ("feel") versus the body size they wanted to have ("ideal").	0.51	0.000
FID index score versus the body size participants wanted to have ("ideal").	-0.269	0.000
BMI of participants versus the silhouette they thought best described their body size ("feel").	0.81	0.000
BMI of participant versus FID index score.	0.56	0.000
BMI of participants versus the body size they wanted to have ("ideal").	0.38	0.000

*Pearson correlation

A significant positive correlation (p=0.045) was documented for the relationship between participants' BMI and age, indicating that the older students were (and therefore having spent more years at university), the higher their BMI. Highly significant (p<0.000) positive correlations were documented for BMI and the following variables: silhouette participants thought best described their body size, the body size participants wanted to have, and FID

index score.

Other significant positive correlations included the relationship between participant age versus the silhouette they thought best described their body size (“feel”) ($p< 0.012$) and participant age versus FID index score ($p = 0.044$).

A significant negative correlation was documented for nutrition knowledge score versus the silhouette participants thought best described their body size (“feel”) ($p = 0.023$), while a highly significant negative correlation was documented for participant FID index score versus the body size they wanted to have (“ideal”) ($p<0.000$).

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The silhouette participants thought best described their body size versus FID index score, as well as the silhouette participants thought best describes their body size versus the body size they wanted to have (“ideal”) had highly significant positive correlations ($p<0.000$).

There was a significant positive correlation ($p=0.024$) between time spent doing vigorous physical activity and the FID index score. In addition, highly significant positive correlations ($p <0.000$ and $p<0.003$) were documented between the time spent doing vigorous physical activity and time spent doing moderate physical activity and time spent walking respectively, as well as the time spent doing moderate physical activity versus the time spent walking.

4.11.2 Relationship between categorical variables

Significant relationships between categorical variables are reported in Table 4.17.

Table 4.17: Significant relationships between categorical variables

Variables	df	P-value #
BMI and race (n=316)	12	0.017
BMI and participant living arrangements (n=316)	12	0.034
BMI and whether participant has ever attempted weight loss? (n=307)	8	0.000
BMI and body size you would like to have (n=291)	24	0.000
PAL and frequency of vigorous physical activity (n=125)	12	0.000
PAL and the number of days per week participation in moderate physical activity took place (n=94)	12	0.010
PAL and number of days per week participant walked for at least 10 minutes at a time (n=256)	12	0.000
PAL and whether participant weighed themselves (n=260)	2	0.001

Chi-square
P-value: is the probability of attaining results as extreme as the perceived results of a statistical hypothesis test, assuming that the null hypothesis is correct, a smaller p-value suggests that there is a stronger evidence in favour of the alternative hypothesis

Significant relationships between BMI (expressed as a categorical value) and the following categorical variables were found: race ($p=0.017$), living arrangements ($p=0.034$), whether weight loss was ever attempted ($p<0.000$), body size participant would like to have ("desire") ($p<0.000$).

Significant relationships between the category of PAL and the following categorical variables were documented: frequency of vigorous physical activity ($p<0.000$), the number of days per week participation in moderate physical activity took place ($p=0.010$), number of days per week participant walked for at least 10 minutes at a time ($p<0.000$) and whether participants weighed themselves ($p<0.001$).

4.11.3 Relationship between means of perceived body size ("feel") and desired body size ("ideal")

Tables 4.18, are the results of an independent samples t-test done to compare the mean score of participant perceived body size ("feel") and desired body size ("ideal").

Table 4.18: Comparison of mean scores for perceived body size versus ideal body size.

Perceived body size Mean score of silhouettes that best describes participant body size (n=302)	**Ideal body size** Mean score of silhouettes that participant desires (n=291)	**p-value***
3.24 ± 1.46	2.86 ± 1.11	0.000

*Independent samples t-test

From the above table it is evident that there was a highly significant difference between the mean score participants perceived their body size to be versus the body size they desired ($p<0.000$).

4.12 SUMMARY

The study a total response of 100% (N=316), (86.7%; 274/316) were black, followed by (10.8%;34/316) Indian, (2.2%;7/316) and (0.3%;1/316) Whites. The mean age of participants was 20 ± 2 years. The mean BMI of participants was 25.2 ± 5.6 kg/m^2, with the lowest BMI being 15.9 kg/m^2 and the maximum 45.3 kg/m^2. The majority resided in private accommodation (44.3%), while nearly two fifths (38.6%) lived in university residences. Just over 7/10 (72.7%) received NSFAS funding, while 16.8% were funded by parents their parents (16.8%), received bursaries (4.8%) or were self-funded (1.3%), with 4.4% receiving both NFAS and parental financial assistance (4.4%).

Participants that prepared their own meals did so 3.7 ± 2.3 times per week, with 84.3% reporting that they prepared their own meals on most days of the week. Just over 9/10 participants (91.1%) consumed take-always, with the majority (61.2%) doing so on a weekly basis, followed by a quarter (25.3%) consuming take-always on a monthly basis and 13.5% doing so on a daily basis. In terms of PAL a majority of participants could be classified as being moderately physically active (46.8%), followed by those with a low level of physical

activity (38.6%), while only 14.6% were classified as having a high level of physical activity. The majority of participants (63.8%), had a good nutrition knowledge score, followed by 34.3% who had an overall score of less than 50%, (80.7%) of participants indicated that they gained nutrition information from a variety of sources that included mass media, school, health care facilities, university, peers and friends.

In relation to participant weight management practices, the majority of the study sample who attempted weight loss, followed healthy weight loss practices (50.9%), followed by those who made use of a combination of healthy and unhealthy weight loss practices (42.0%). Of those who had not attempted weight loss, the majority (37.5%) indicated that the reason for not attempting weight loss was that they were satisfied with their body weight, followed by 35% indicating that they perceived their body weight as normal. In terms of body image perception, the majority of participants selected silhouette B (26.5%), followed by D (23.2%) and C (20.5%) as the silhouette they felt that best described their current body weight. When it came to the body size participants wanted to be, i.e. their ideal body size, the majority chose silhouette C (34.0%), followed by silhouette B (29.6%) and silhouette D. When the difference between perceived ("feel") and ideal body size was calculated, it rendered a FID score of 0.4 ± 1.33, indicating that participants desired to be thinner.

Results on dietary diversity also showed that the majority of participants (45.0%) had a medium dietary diversity, followed by more than a third of participants (35.6%) having a high dietary diversity. One out of five participants (19.4%) consumed diets that lacked diversity. When correlation between continuous variables were made the following findings were made; A significant positive correlation ($p=0.045$) was documented for the relationship between participants' BMI and age, indicating that the older students were (and therefore having spent more years at university), the higher their BMI. Highly significant ($p<0.000$) positive correlations were documented for BMI and the following variables: silhouette participants thought best described their body size, the body size participants wanted to have, and FID index score. Interestingly, A significant negative correlations was documented for nutrition knowledge score versus the silhouette participants thought best described their body size ("feel") ($p = 0.023$), while a highly significant negative correlation was documented for participant FID index score versus the body size they wanted to have ("ideal") ($p<0.000$). Lastly, the silhouette participants thought best described their body size versus FID index score, as well as the silhouette participants thought best describes their body size versus the

body size they wanted to have ("ideal") had highly significant positive correlations ($p<0.000$).

Correlations between categorical showed, Significant relationships between BMI (expressed as a categorical value) and the following categorical variables were found: race ($p=0.017$), living arrangements ($p=0.034$), whether weight loss was ever attempted ($p<0.000$), body size participant would like to have ("desire") ($p<0.000$). furthermore, results also showed significant relationships between the category of PAL and the following categorical variables were documented: frequency of vigorous physical activity ($p<0.000$), the number of days per week participation in moderate physical activity took place ($p=0.010$), number of days per week participant walked for at least 10 minutes at a time ($p<0.000$) and whether participants weighed themselves ($p<0.001$).

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter will discuss the results reported in chapter four in relation to the literature that was presented in chapter two. As the study objectives were to determine the socio-demographic characteristics, BMI, level of physical activity, nutrition knowledge, body image, body image dissatisfaction, weight management practices, dietary diversity and explore relationships between these variables, they will be discussed accordingly.

5.2 Sociodemographic characteristics

The study had a total of (N=316) participants. The majority of study participants 86.7%; were black and were registered for study within the College of Agriculture, Engineering and Science 45.6 %, followed by an equal number of participants being registered with the College of Law and Management Studies and Humanities at 27.2% respectively. The mean age of participants was 20 ± 2 years. The majority resided in private accommodation 44.3%, while nearly two fifths 38.6% lived in university residences. 72.7% received NSFAS funding, while 16.8% were funded by parents their parents 16.8%, received bursaries 4.8% or were self-funded 1.3%, with 4.4% receiving both NFAS and parental financial assistance 4.4%.

5.3 Meal preparation and consumption of take-aways

Participants that prepared their own meals did so 3.7 ± 2.3 times per week, with 84.3% reporting that they prepared their own meals on most days of the week. Just over 9/10 participants (91.1%) consumed take-always, with the majority (61.2%) doing so on a weekly basis, followed by a quarter (25.3%) consuming take-always on a monthly basis and 13.5% doing so on a daily basis. Of those that consumed take-aways, the majority (68.6%) consumed a combination of takes-always including chicken, burgers, sandwiches, pizza and vegetarian options. Take-aways from chicken outlets proved to be popular (14.4%), followed by burger outlets (13.4%).

The overwhelming proportion of the participants who indicated that they prepare their own meals in most days of the week was not expected as various American studies showed increase intake of fast foods and high-fat foods, high alcohol intake and other related unhealthy dietary practices among college students (Yahai *et al* 2016; Chourdakis, Tzellos, Pourzitaki, Toulis, Papazisis, Kouvelas 2011), additionally to that, college students are prone to such dietary behavior because of time constraints due to academic pressure and convenience of fast foods (Chourdakis *et al* 2011), hence the assumption was that participants of current study would not have time to prepare meals as often as indicated based on the inhibiting factors mentioned above.

5.4 Body mass index

The mean BMI of participants was 25.2 ± 5.6 kg/m^2, with the lowest BMI being 15.9 kg/m^2 and the highest 45.3 kg/m^2. It is evident that the majority of participants had a normal BMI (48.1%), followed by nearly two fifths (19%) being overweight. Furthermore, 13.3% were classified as obese class I, while 12.6% were classified as obese class II. Only 4.4% were underweight, while 2.5% were classified as being obese class III.

These results compare favourably with that of a local study by Steyn *et al* (2000), where the prevalence of overweight among female university students was 18.5%. However, Gradidge and Cohen (2018) and van den Berg *et al* (2012) recorded nearly double the prevalence of overweight among similar study samples at 37.3% and 36.4% respectively. In the current study, the total prevalence of obesity (28.4%) was higher than that recorded by Steyn *et al* (2000), Gradidge & Cohen (2018), Peltzer *et al* (2014) and van den Berg *et al* (2014), indicating that despite study participants in the current study having similar levels of overweight, their prevalence of obesity was higher than recorded among other local studies.

When the prevalence of overweight and obesity was combined in the current study (47.4%), it was lower than the 54.6% and 58.2% recorded by Gradidge & Cohen (2018) and van den Berg *et al* (2014) respectively.

The high prevalence of overweight and obesity documented among undergraduate female students in the current study as well as that recorded in similar local studies, could be indicative of the obesogenic environment a university lifestyle presents, as it is said to facilitate positive energy balance through ease of accessibility to energy dense food and the

decreased need for physical activity reported by Wardle, Haase and Steptoe (2006) in multicentre study conducted in 22 countries.

5.5 Physical activity

In the current study, the mean time spent doing vigorous physical activity was 56 ± 40 minutes per week, while the mean time being engaged in moderate physical activity was 58 ± 106 minutes per week. In addition, the mean time spent walking for at least 10 minutes at a time was 231 ± 145 minutes per week.

Based on the above figures, the majority of study participants were classified as being moderately physically active 46.8%, followed by those with a low level of physical activity 38.6%. Only 14.6% of the study sample could be classified as having a high level of physical activity. The above results are very much similar to results obtained in local a study that investigated physical inactivity and associated factors among university students in South Africa the following findings were made, 33% students had a low physical activity level, 47.6% moderate physical activity level and 19.4% were engaged in high intensity physical activity. These results were obtained in a sample of 722 South African university students (57.4% male and 42.4% female) with an average age of 21.7 years (Pengpid & Peltzer 2013).

This trend of lack of physical activity amongst women is linked to lack of sense of control and will to master physical exercise (Pengpid & Peltzer 2013). Furthemore, females are less physically active than males, and tend to focus more on a balanced diet, are less interested in PA and pay less attention to health issues caused by a lack of PA than men. This could imply that women are more focused on nutrition than PA for the attainment of health. As a result they resort to nutrition in order to reduce caloric intake since they are less physically active and more dissatisfied with body image than males (Clarke *et al* 2009).

Low physical activity level (PAL) is associated with the increased risk of developing NCDs such as CVD, cancer and diabetes (Penedo & Dahn 2005). As a result, the WHO has recommended that adults between the ages of 18-64 years should be involved in at least 150 minutes of moderate to vigorous intensity of physical activity per week (WHO 2010). However, studies have shown that the majority of young women engaging in PA in order to maintain a slim body rather than health reasons (Pengpid, Peltzer, Kassean, Tsala, Sychareun, Müller-Riemenschneider 2015; Peltzer & Pengpid 2010). Therefore, a low level of physical

activity as seen current study may be an indicator of body image satisfaction among the study's participants. Such was noted among students in the University of Limpopo where it was reported that the reason why female students were engaged in physical activity was related to improving physical appearance rather than for health benefits (Peltzer & Pengpid 2010). Other reported barrier to exercise among non-exercising female students in the UK, was the proximity of exercise facilities, physical exhaustion, as well as a lack of time, lack of support and the inconvenience of gymnasium time schedules (Lovell et al 2010). However, an assessment of the barriers to physical activity did not fall within the scope of the current study.

5.6 Nutrition knowledge

The majority of participants (63.8%) in the current study had good nutrition knowledge score (≥ 50%), followed by a third (34.3%) who had an overall score of less than 50%. The most noteworthy findings were that participants were not aware that starchy foods should form the basis of most meals and that drinking boiled water is not good aid for weight loss. Other questions that were answered incorrectly were related the frequency of fruit and vegetable consumption and what a healthy or balanced meal consists of.

Nutrition knowledge is considered to be an important determinant of nutritional status and dietary selection of individuals, families and societies, since the general assumption is that individuals with good nutrition knowledge make better dietary choices (Laban 2015). Inadequate nutrition knowledge was documented in a local study that determined the nutrition knowledge of predominantly female nursing students. Similar to the findings of the current study, the majority of students did not know that starch should be consumed the most but were aware that the intake of fat and sugar should be restricted. In addition, the majority of students did not know the daily recommendation for bread, cereals, pasta, rice, vegetables, milk, yoghurt, cheese, meat, poultry and fish intake, but were aware of which foods are considered to be sources of fibre (van den Berg et al 2012).

The lack of nutrition knowledge among study participants could be related to misinformation and confusion caused by obtaining nutrition information from a variety of sources (Grosso, Mistretta, Turconi, Cena, Roggi, Galvano 2012). This includes sources such as mass media, school, friends and family, as the majority of participants (80.7%) indicated that

they obtained nutrition knowledge from a variety of sources that included mass media, school, health care facilities, university, peers and friends.

5.7 Weight management practices

In relation to participant weight management practices, the majority of the study sample 59.1% weighed themselves. Of the participants who weighed themselves, the majority did so in a monthly basis 61.0%. Despite the fact that the majority of participants 70.0% perceived or classified their current BMI as normal, (56.4%; 174/307) participants had attempted weight loss. Of those who had not attempted weight loss (43.3%; 133/307), the majority 37.5% indicated that the reason for not attempting weight loss was that they were satisfied with their body weight, followed by 35% indicating that they perceived their body weight as normal. The majority of participants who attempted weight loss followed healthy weight loss practices 50.9%, followed by those who made use of a combination of healthy and unhealthy weight loss practices 42.0%. Those participants that followed a diet for weight loss purposes ate more fruit and vegetables, as well using low fat cooking methods 45.9%, followed by those who followed a low carbohydrate diet 20.3%. The latter included reducing the intake of starchy foods, following a keto diet or a diet described as high in protein and low in fat.

The above findings on body weight perceptions were not expected, as results showed that (70%) of the participants perceived themselves as being of a normal weight. These finding were unexpected as females tend to view a healthy and acceptable weight to be lower than their current weight, which is suggested to be as a result of thinness being normalised by media (Harring *et al* 2010). The ACHA (2009) suggested that body image has a major influence on weight management behaviour, after it was shown that females with a normal BMI inaccurately perceived themselves as being overweight or obese.

Current study's findings could be compared to an American study that investigated the body size perception of women, found that 56% of the overweight (BMI greater than 25kg/m^2) and 40% of the obese (BMI greater than 30kg/m^2) participants did not perceive themselves as being overweight or obese. These findings regarding self-perceptions were seen to be largely influenced by a participant's cultural body size norms, which defined overweight and obesity differently than the medical definition. As a result, these norms can be considered as a barrier to weight management and the prevention of obesity among African American women

in particular (Lynch & Kane 2014). Interestingly, the above was not the case in current as a large proportion (56.4%) of study's participants attempted weight loss, despite a majority (70%) reporting that they perceive current BMI as normal, meaning participant's perception of current body weight was not a barrier towards weight management. However, it should be considered that participants in current study may have a self-defined threshold for being overweight as seen in an American study where black American women defined a BMI between 30-35kg/m^2 as normal and a BMI greater than 25kg/m^2 was defined as underweight (Lynch and Kane 2014).

Additionally, a local study investigating body image or body perception among black South African women, found that although some overweight women were aware of their excess weight, they still perceived themselves as being attractive, thereby viewing the need to lose weight as being unnecessary due to their satisfaction with their current weight (Kruger, Puoane, Senekal, Van Der Merwe 2005). It is therefore possible that participants of current study perceived their current body weight as normal, based on how attractive or acceptable they felt it is.

In light of the presented literature, the current study's results in relation to weight management suggests that participants who were engaged in weight management, did so because of body image dissatisfaction, since the majority of participants who did not engage in weight management practices (37.4%), indicated that the reason for not attempting weight loss was that they were satisfied with their body weight, followed by (35%) indicating that they perceived their body weight as normal.

It was also noted that among the participants who attempted to lose weight (56.4%; 173/307), 50.9% did so by making use of healthy weight loss practices, followed by 42.0% who made use of both healthy and unhealthy weight loss practices. These findings were in line with the results obtained from a local study that investigated the weight loss strategies of female students from SA universities. The local study noted that a comparatively lower number of female students used unhealthy weight practices, including meal skipping, fasting, smoking and diet shakes, but rather opted to used healthy weight loss strategies such as exercise, reduction of portion size and reducing the consumption of sugar sweetened beverages, eating more vegetables and fruit, trimming the visible fat from meat and reducing the intake of fatty foods (Senekal 2016).

5.8 Body image and body image perception

The assessment of body image and body image perception, showed that a majority of participants selected silhouette B (26.5%), followed by D (23.2%) and C (20.5%) as the silhouette they felt best described their current body weight. When it came to the body size participants wanted to have, i.e. their ideal body size, the majority chose silhouette C (34.0%), followed by silhouette B (29.6%) and silhouette D (18.9%). When the difference between perceived ("feel") and ideal body size was calculated, it rendered an FID index score of 0.4 ±1.33, indicating that participants desired to be thinner. The FID index mean score suggests that the majority of participants desired a body size that is thinner than what they perceived their body size to be at time of assessment.

The findings of the current study is not in line with the conclusion made by a local study that used a similar method to measure BD (FID). In this local study, it was reported that black women and their daughters chose larger silhouettes to represent a normal BMI than white women, thereby demonstrating a preference for a larger body size. This demonstrated an associating between ethnicity, culture and body image in terms of the differences in defining a fat body size (Mchiza et al 2005). Here it is worth noting that the current study documented a preference or desire for a smaller body size, in accordance with the mean FID index score, which is of interest, seeing that more than half of the participants (52.5%; 166/317) had either a normal body weight (48.1%) or were underweight (4.4%) according to the BMI classification.

According to Gitau et al (2014), the preference of thinner body size among normal and underweight women is a behaviour common among urban South African Caucasians girls who have been shown to have the highest body image anxieties and body dissatisfaction compared to other ethnic groups. Therefore, findings from current study may suggest that younger women in urban settings prefer a thinner body size, regardless of ethnic background.

5.9 Dietary diversity

The majority of study participants (45.0%) had a medium dietary diversity, followed by more than a third (35.6%) having a high dietary diversity. One out of five participants (19.4%) consumed diets that lacked diversity.

Similar findings were made in a Nigerian study that assessed dietary diversity in six Nigerian states (Ajani 2010). Study findings included that the majority of study participants (83.3%) had a moderate dietary diversity score (DDS), 16.5% had a low DDS and 0.2% had a low DDS (Ajani 2010). The mean BMI of participants was 23.34 ± 4.8 kg/m^2, however the correlation between BMI and DDS was not significant (p=0.307) (Ajani 2010).

A large percentage of participants in the current study lived on their own, while only a few lived at home. Students living with parents were more likely to consume fruits and vegetables than students who lived on their own. It is possible that students living with their parents are more likely to consume a varied diet, while those who live on their own, may be more likely to consume a diet that is high in fat and sugar, low in vegetable and fruit and lacks diversity (Peltzer & Pengpid 2015).

Nearly three quarters of study participants (72.2%) were recipients of NFSAS. According to Kassier & Veldman (2013), recipients of NSFAS at UKZN are vulnerable to food insecurity and therefore a lack of dietary diversity. It is therefore possible that the low and moderate dietary score documented among these students could be related to the fact that the monthly allocations from NSFAS is used to take care of other basic needs besides food.

5.10 Relationship between continuous variables

A significant positive correlation (p=0.045) was documented for the relationship between participants' BMI and age, indicating that the older students were (and therefore having spent more years at university), the higher their BMI. Highly significant (p<0.000) positive correlations were also documented for BMI and the following variables: silhouette participants thought best described their body size, the body size participants wanted to have, and FID index score.

The positive correlation between BMI and silhouette participants thought best described their body size, suggest that participants with a higher BMI selected larger silhouettes as their

perceived current body size, while those with a lower BMI selected smaller silhouettes to represent perceived current body size. It is therefore possible that participants had a realistic perception of what their body size at the time of data collection was. The positive association between BMI and the body size the participants wanted to have, implied that participants with increased BMI wanted large body size. However, the body size participants desired, was thinner than the one that was selected as a representation of their current body image. These findings were consistent with results from as study conducted among Kuwaiti female students, where heavier students tended to select a heavier acceptable body sizes as their desired body size. This showed that BMI categories were not only associated with BID, but also with the perceived level of attraction and acceptability of certain body sizes (Kabir *et al* 2013).

Furthermore, the positive correlation between BMI and FID index scores suggest that a higher BMI resulted in greater body dissatisfaction among participants. In addition, it was also indicative that the majority of participants' current body size perception, was larger than their ideal/desired BI, thereby showing a positive relationship between body image dissatisfaction with an increase in BMI. This was also the case among female Kuwaiti students, where an increase in BMI resulted in body image dissatisfaction (BID), as was demonstrated by overweight and obese students who showed a high level of body image dissatisfaction compared to their normal and underweight peers (Grilo & Masheb 2005).

Other significant positive correlations included the relationship between participant age versus the silhouette they thought best described their body size ("feel") ($p< 0.012$) and participant age versus FID index score ($p = 0.044$).

The positive correlation between participants age and the silhouette that best described current body size, indicates that older participants selected larger silhouettes to represent their body sizes (i.e. the older they were, the bigger they "felt"). In addition, this perception could also be associated to participant BMI, as a positive correlation between BMI and age was reported in current study. Furthermore, results also showed a positive correlation between age and FID, indicating that older participants had a higher level of BD than younger participants (the older participants were more dissatisfied with BI). According to Katzmarzyk *et al* (2002), globally there seems to be a better acceptance of obesity and being overweight among older than younger women. However, this was not the case among participants in the

current study, as the mean age was 20 ± 2 years. In addition, the majority of participants were dissatisfied with their current body image.

A significant negative correlation was documented for nutrition knowledge score versus the silhouette participants thought best described their body size ("feel") ($p = 0.023$). This indicated that participants with a better nutrition knowledge score, perceived their current weight to be lower when compared to those with a lower nutrition knowledge score, i.e. the higher the nutrition knowledge score, the smaller participants perceived their body size to be and vice versa.

Results also showed a highly significant negative correlation between participant's FID index score versus the body size they wanted to have ("ideal") ($p<0.000$), as well as significantly positive correlation between the silhouette participants thought best described their body size versus FID index score ($p<0.000$). The FID index score is determined by calculating the difference between the current body weight silhouette ("feel") and desired silhouette ("ideal") to yield a BD rating. Therefore, the negative correlation between FID index score and desired silhouette ("ideal") body size is to be expected, as a more desirable silhouette is associated with a lower level of BD and hence FID index score. As the majority of participants were dissatisfied with their current silhouette ("feel"), it would have resulted in a higher FID index score, denoting a higher level of BD.

There was a highly significant positive correlation between the silhouette participants thought best describes their body size versus the body size they wanted to have ("ideal") ($p<0.000$). This correlation may suggest that participants who selected a large ("feel") body size silhouette, also selected a corresponding large ("ideal") body size silhouette, despite it being lower than the ("feel) silhouette. Similar findings were reported among female Kuwaiti students, where it was shown that students with a larger body size were more likely to select larger/heavier acceptable body sizes as their desired body sizes. The findings of the Kuwaiti study also showed that BMI categories were not only associated with BID, but also with the perceived level of attraction and acceptability of certain body sizes (Kabir *et al*), which could be the case for current study.

There was a significant positive correlation ($p=0.024$) between time spent doing vigorous physical activity and the FID index score. This correlation may suggest a positive association between body image dissatisfaction and time spent doing vigorous physical activity. According to SANHANES-1, women with a negative body image are vulnerable to using

extreme weight loss strategies such as food restrictions and excessive exercise (Labadarios *et al* 2013). Therefore, findings of current study are not in line with findings from college students from other countries (USA and Israel) in relation to PA and BI, as these studies reported that students who are engaged in PA perceive their body more positive than those who use healthy nutrition alone (Korn et al 2013).

Furthermore, results from the current study also showed a highly significant positive correlations ($p < 0.000$ and $p < 0.003$) between the time spent doing vigorous physical activity and time spent doing moderate physical activity and time spent walking respectively, as well as time spent doing moderate physical activity versus the time spent walking ($p < 0.000$). These correlations suggest that participants who spent time doing vigorously activity were also likely to spend time engaged in moderate physical activity as well as walking for at least 10 minutes.

5.11 Significant relationships between categorical variables

Significant relationships between BMI (expressed as a categorical value) and the following categorical variables were found: race ($p=0.017$), living arrangements ($p=0.034$), whether weight loss was ever attempted ($p<0.000$), body size participant would like to have ("ideal") ($p<0.000$).

The relationship between race and BMI was expected, considering that the majority of the study's participants were Black (86.7%), followed by Asians (10.7%). In terms of living arrangements, results showed that the majority of participants resided in private accommodation (44.3%), while nearly two fifths (38.6%) lived in university residences, with the remainder (16.1%) residing at home. The assumption was that participants living with parents were more likely to have a lower BMI as opposed to those living on their own. A possible reason being, that participants living with their parents are more likely to consume a balanced diet, while those who live on their own may be more likely to consume a diet high in fat and sugar and low in vegetable and fruit which is associated with an increase in BMI (Peltzer & Pengpid 2015). The above assumption could be underscored by the fact that 58.8% of the participants who lived at home 16.1%, had a normal BMI while 25% were overweight or obese. Participants living at university residences and private accommodation,

had a comparatively higher prevalence of overweight and obese students (43%), compared to those who lived at home.

The relationship between BMI and whether participants attempted to lose weight, showed that participants who were classified as underweight and of a normal weight according to BMI, were less likely to attempt weight loss compared to overweight and obese participants. Various studies conducted in the USA found that obese individuals are more likely to be engaged in weight management attempts than individuals with normal BMI (West, Prewitt, Bursac, Felix 2008; Blixen, Singh, Thacker 2006; Kruger et al 2004). This may be attributed to the BID demonstrated among participants with high BMI in the current study (Grilo & Masheb 2005).

The relationship between BMI and body size participants would like to have ("ideal") was highly significantly ($p<0.000$). If assumed that participants in the current study would prefer thin body sizes in view of the positive association between body image dissatisfaction and increased BMI as a result of adopting and accepting thinness as the standard of beauty among young women (Chung & Bissell 2009), this relationship is to be expected. However, the above relationship could also be indicative of the fact that a higher BMI results in an increased preference, desire and or acceptance of a larger body size. These findings were consistent with results from a study conducted among female Kuwaiti students where students with a larger body size tended to select heavier acceptable body sizes as their desired body sizes. This showed that BMI categories were not only associated with BID, but also with the perceived level of attraction and acceptability of certain body sizes (Kabir *et al* 2013).

Significant relationships between the category of PAL and the following categorical variables were documented: frequency of vigorous physical activity ($p<0.000$), the number of days per week participation in moderate physical activity took place ($p=0.010$), number of days per week participant walked for at least 10 minutes at a time ($p<0.000$) and whether participants weighed themselves ($p<0.001$). Participants who were classified as moderately physically active (46.8%;125/267) were shown to have been engaged in vigorous, moderate and walking for at least 10 minutes the highest number of days per week than a participant with low and high PAL. Furthermore, in terms of the relationship between PAL and whether participants weighed themselves, analysis of the results show that a majority of the participants (51.4%; 51/105) who did not weigh themselves, had a low PAL. The majority of participants (50%;

78/155) who weighed themselves, had a moderate PAL. Regular weighing by a physically active individual may be an indicator that they are trying to lose weight or monitor their weight. A local study conducted at the University of Limpopo, reported that the reason why the majority of female students engaged in physical activity, was related to improving physical appearance rather than health benefits associated with being physically active (Peltzer & Pengpid 2012). It is therefore possible that frequent weighing practiced by physically active partcipants, may be related to the fact that participants were attempting to lose weight to improve appearance.

5.12 SUMMARY

This chapter discussed the results obtained from the investigation of factors related to weight management practices of female undergraduate students at UKZN on the Pietermaritzburg campus. Results showed relationships and correlations between BMI and age, body image dissatisfaction, living arrangements, perceived body size and desired body size. Correlations between PAL and body size satisfaction and correlation between nutrition knowledge and body size perception. In chapter 6, the conclusion, study limitation and recommendations for future investigations will be presented.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Introduction

According to the World Health Organization (WHO) (2015), factors such as overweight and obesity, unhealthy eating habits and physical inactivity have all been identified as playing a major role in the prevalence of non-communicable diseases (NCDs). As the university is identified as the most critical stage where the majority of changes regarding lifestyle are made, it may have a lasting impact on the development of NCDs (Pengpid *et al* 2015). Awadalla, *et al* (2014) also refer to the fact that lifestyle attributes such as physical inactivity are associated with the development of NCDs.

It is therefore not surprising that studies conducted among female South African students, have documented a positive association between increased body mass index (BMI) and a lack of physical activity (Alberts *et al* 2000; Van den Berg *et al* 2012; Peltzer *et al* 2014; Gradidge & Cohen 2018). Body dissatisfaction as a result of weight gain and incorrect body perceptions has resulted in some students resorting to extreme weight loss practices such as self-induced vomiting and using herbal mixtures, diet pills and laxatives in attempts to conform to current body ideals (Senekal *et al* 2016). The aim of the current study was to determine BMI, body image perception and possible factors related to weight loss practices of female undergraduate students on the Pietermaritzburg campus, UKZN.

6.2 CONCLUSION OF THE STUDY

Findings from the current study showed that body image perception and degree of body satisfaction played an important role when it came to study participants engaging in weight management practices. This was illustrated by the responses from participants who have never attempted weight loss, as they indicated that the reason why they have not attempted weight loss was that they perceived their current body weight to be normal and that they are satisfied with current weight. The results of the study showed that an increase in BMI was positively associated with a subsequent increase in BID, thereby resulting in a high proportion of overweight and obese individuals attempting to lose weight. It was also noted

that a greater proportion of participants who indicated that they have attempted weight loss, did so using healthy weight loss practices such as exercise, diet and reduced portion sizes.

Study participants preferred or desired body sizes that were thinner than their perceived current body size. This was shown through the positive FID index score of 0.4 ±1.33. Increased BMI was positively associated with increased BID (i.e. increased FID index score) and the increased likelihood of selecting a larger "feel" silhouette to describe current weight. Results also showed that participants with a high BMI, desired larger body sizes that were thinner than what they perceived themselves to be. Furthermore, participants living at university residences and private residences weighed more than those who lived at home. Participants with increased PAL, weighed themselves more often than less active participants. This may suggest that they were engaged in physical activity to improve appearance or lose weight rather than for the health benefits gained from being physically active. Findings did not show a significant relationship between nutrition knowledge score and BMI as well as dietary diversity score. However, participants with a good nutrition knowledge score perceived their current weight to be thinner when compared to those with a lower nutrition knowledge score.

6.3 CRITIQUE OF THE STUDY

6.3.1 Study constraints/ limitation

The current study made use of a 24-hour recall to gather information required for determining dietary diversity. However, a 24-hour recall may not give an accurate indication of an individual's normal food consumption patterns. A record of all food consumed over a period of several days would be a more valid reflection of food group consumption and therefore a more accurate indicator of participant dietary diversity.

The pilot study revealed that completing the self-administered questionnaire would take 15-20 minutes, thereby preventing respondent fatigue. However, when the actual study commenced, it became evident that the majority of participants took much longer to complete the research instrument. It is therefore possible that respondent fatigue could have influenced participants' responses.

6.3.2. Recommendation for the improvement of study

Should a future survey of a similar nature be conducted, more detailed information regarding socio-economic background would be helpful to gauge a better understanding of whether food choices were made based on available finances or whether factors such as preference and convenience dictated food choices. Information regarding the reason for engaging in physical activity or a lack thereof, should be further explored, as it cannot be assumed that all participants who engaged in PA did so because they wanted to lose weight. In addition, information on whether attempted weight loss efforts were successful would add additional depth to the investigation. It is also recommended that a 24-hour recall should be administered by field workers to ensure consistency more accurate results.

6.4 RECOMMENDATION FOR NUTRITION PRACTICES

UKZN should implement health awareness campaigns on campus. Nutrition messages should be tailored for a student audience and offer practical ways in which they can improve or maintain a healthy nutrition status or BMI. This would include educating students on healthy weight loss practices, tips on healthy cooking, healthy eating on a limited budget and the benefits of regular physical activity. Furthermore, visual aids such as healthy eating posters can be strategically placed in student residences, their kitchens and dining halls to placed further emphasis on these dietary and lifestyle messages.

6.5 IMPLICATIONS FOR FURTHER RESEARCH

- A similar study can be conducted across all other UKZN campuses to pool data as well as enable a comparison between various campuses.
- A further exploration of socio-demographic characteristics of study participants should be conducted such as documenting whether students are from a rural, urban or peri-urban backgrounds. The level of education of parents and the socio-economic status of participants should also be conducted.
- An investigation into the impact of social media and health software applications (apps) on nutrition knowledge and weight management practices should be investigated.

- Investigating whether dietary choices are made based on available finances, convenience or body image concerns is important, as is obtaining detailed information regarding the type of meals students prepare when they do not purchase take away foods.
- The association between year of study and dietary habits, nutrition knowledge and weight management practices should be explored.

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APPENDICES

APPENDIX A: Informed consent form and study questionnaire

PARTICIPANT CONSENT FORM FOR A RESEARCH PROJECT TITLED:

Body mass index, body image and possible factors related to weight loss practices of female undergraduate students on the Pietermaritzburg campus, UKZN

PRINCIPAL INVESTIGATOR:

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You are hereby invited to be a participant in a research project that seeks to investigate the effect body composition, body image and related factor has on the weight loss practices of female undergraduate student in UKZN Pietermaritzburg campus.

Why have you been invited to participate?

This study is aimed at UKZN Pietermaritzburg undergraduate female students. The Findings of this study will be helpful towards determining how body composition, body image, nutritional knowledge and other related inform weight loss practices among female students. You participation will be highly appreciated.

What procedures will be involved in this research?

Weight and height of all participants will be taken, for determining Body-mass index. Thereafter participants will be required to fill a questionnaire, which will be used in assessing participants' physical activity, nutritional knowledge, body image and dietary diversity.

Furthermore participants will be invited for analysis of body composition through (Seca machine) at a separate location.

ETHICS:

This research project was approved by the human and social science research ethics committee (HSSREC) of UKZN to ensure that the research is acceptable. Should you wish to contact them, you can contact Mrs Mariette Snyman. Her contact details are as follows

Tel: 031 260 8350

Fax: 031 260 3093

Email: **snymanm@ukzn.ac.za**

- Your information will be confidential as we will identify your questionnaire with a number only, your personal details will not be entered
- You have the right to withdraw from the study at any stage without giving a reason
- You will not benefit directly if you take part in this study, but the information gathered from this research can give better understanding of weight management strategies used by women and why this strategies are used.

By signing below, I …….. Agree to participate in this study entitled: Body composition, body image, related factors and weight loss practices of undergraduate female students in Pietermaritzburg campus.

I declare that:

I have read or had read to me this information and consent form and it is written in a language with which I am comfortable. I have a had a chance to ask questions and all my questions have been adequately answered

I understand that taking part in this study is voluntary and I have not been pressurised to take part.

This questionnaire is to be completed for a study entitled:

"Body mass index, body image and possible factors related to weight loss practices of female undergraduate students on the Pietermaritzburg campus, UKZN

Participant code:

Dear participant

Kindly complete the following questionnaire as honestly as possible. There are no right or wrong answers. Please note that the result of this research project will not be linked or traced back to you in person

SECTION A

For use by field only:

WEIGHT	HEIGHT	CALCULATED BMI
1.	1.	
2.	2.	
3.	3.	
Mean:	Mean:	

SECTION B : SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. **Age:**

2. **Race:**

Black	Asian	White	Coloured

3. **College:**

Agriculture, Engineering & Science	Law and Management	Humanities

4. **Degree:**

5. **Accommodation:**

Residence	Private accommodation	Home	Other

6. **Source of income**:

Bursary	Allowance from parents	Work salary	NSFAS	Other

7. **How often do you prepare your own meals?**

A. Most days of the week

B. Never

C. If "A", how many times a week? (specify)

.....

.....

8. **Do you eat take-aways?**

A Yes

B No

9. **If yes, please indicate how often.**

.....

10. **If yes, what type of take-aways do you eat most often**?

A. Hot dogs

B. Burgers

C. Sandwiches

D. Fish and chips

E. Sausage and chips

F. Chips

G. McDonalds

H. KFC

I. Nandos

J. Honchos

K. Spur

L. Karanichas

M. Other (please specify) ……

SECTION C: PHYSICAL ACTIVITY

1. **During the last 7 days, on how many days did you do vigorous physical activity?**

Examples of vigorous activity include the following: jogging, aerobics, singles tennis, soccer, net ball, gym, boot camp, zomba, squash

A. _____ days per week

B. If you did not engage in vigorous physical activities, **skip to question 3.**

2. **How much time do you usually spend doing vigorous physical activity?**

A. _____ minutes per day

B. Don't know/Not sure

Think of all the moderate activities that you participated in over the past week. Moderate activity refers to activities that require moderate physical effort and makes you breathe harder than normal. Examples include water aerobics, doubles tennis, ballroom dancing, Think about those physical activities that you did for at least 10 minutes at a time.

DO NOT INCLUDE WALKING.

3. **During the past week, on how many days did you participate in moderate physical activities?**

A. _____ days of the week

B. If you did not participate in moderate physical activity, **skip to question 5.**

4. **How much time do you usually spend doing moderate physical activities?**

A. _____ minutes per day

B. Don't know/Not sure

Think of the time you spent walking in the past week. This will include on campus, at home or student residence, going shopping or any other walking you might have done.

5. **During the past week, on how many days did you walk for at least 10 minutes at a time?**

A. _____ days per week

B. If you did not walk at all, **skip to question 7.**

6. **How much time did you spend walking on one of those days?**

A. _____ minutes per day

B. Don't know/ Not sure

7. **During the past week, how much time did you spend sitting?**

A. _____ minutes per day

B. Don't know/ not sure

SECTION D: NUTRITION KNOWLEDGE

Instructions:

The following sections consist of two types of questions, namely multiple choice and true/false questions. For multiple choice questions, please indicate your answer by making a cross or tick next to the correct answer. Be assured that your response is confidential as you are only identifiable by a code allocated to you.

Cross or tick next to the correct answer

1. **The healthiest snack is?**

A glass of milk	1
A tub of unbuttered popcorn	2
A slab of chocolate	3
2 & 3	4

2. **How often should fruits and vegetables be eaten?**

1 fruit and vegetable a day	1
3-4 fruits and vegetables a day	2
5 or more fruits and vegetables everyday	3
There is no need to eat fruits and vegetables daily	4

3. **Which cooking method will use the largest amount of fat?**

Boiling	1
Braaing	2
Frying	3
Roasting	4

4. **What is a portion of cooked vegetables?**

1 tablespoon	1
Half a cup	2
1 cup	3
2 cups	4

5. **Which of the following foods are the lowest in fat?**

Corn flakes and full cream milk	1
Grilled lean steak and boiled carrots	2
Pizza and milkshake	3
Fried lamb chops and creamed spinach	4

6. **Which way of cooking eggs will result in the lowest amount fat?**

Scrambled	1
Fried	2
Boiled	3
None of the above	4

7. **Which of the following is a low-fat snack?**

"Simba" chips	1
Popcorn	2
Fried chips	3
"Niknaks"	4

8. **A well-balanced diet**

Consists mostly of meat, will smaller amounts of starch, fruits, vegetables, and dairy products	1
Consists mostly of vegetables, and smaller amounts of meat and dairy products	2
Consist mostly of starches, vegetables and fruits, with smaller amounts of meat and dairy products	3
None of the above	4

9. **The key to a healthy way of eating is to**

Eat many different kinds of foods	1
Eat some foods more than other foods	2
Eat certain kinds of foods in moderate or small amounts	3
All the above	4

10. **From which group of foods should you eat the most every day?**

Bread, samp, rice, porridge	1
Apples, bananas, spinach, carrots	2
Milk, yoghurts, cheese	3
Chicken, fish, beans, eggs	4

11. **A healthy diet is one that includes**

Mostly meat, fish, chicken	1
Mostly uncooked foods	2
Mostly foods in cans or tins	3
Mostly bread, rice, and maize meal	4

12. **Most of the foods you eat should be**

Starches, dairy products, meats and beans	1
Vegetables, fruits and dairy products	2
Starches	3
Vegetables, fruits, meats, and beans	4

13. **Being physically active means**

Going to the gym	1
Walking a lot	2
Playing sports like soccer or netball	3
All of the above	4

14. **The following foods must not be eaten at all when one is trying to lose weight**

Bread and rice	1
Meat and fish	2
Margarine	3
None of the above	4

17. **The reason why beans, peas and lentils are good for you is that**

They contain only small amounts of fat	1
They contain a lot of fibre	2
They can protect you from diseases	3
All of the above	4

18. **You should not have starches at most meals because**

They are not important for your health	1
Even eating small amounts can cause weight gain	2
They cause diseases	3
None of the above	4

19. **Which of the following foods contains a lot of starch**

Bread, rice, maize meals, samp	1
Maize meal only	2
Fruits and vegetables	3
Fresh fish and chicken	4

20. **Which one of the following nutrients are found in most fruits**

Fibre	1
Iron	2
Fat	3
All	4

21. **If you were trying to increase the amount of fibre in your diet, which of the following foods should you eat more of?**

Cakes and biscuits	1
Apples and carrots	2
Chips and pies	3
Chicken and fresh fish	4

22. **TRUE OR FALSES QUESTIONS,** please indicate your answer by putting a cross or tick

Question	**TRUE**	**FALSE**
You can replace water with cold drinks like "Coca Cola"		
Physical activity should be part of everyone's daily life		
If you are eating a healthy diet, there is no need for you to be physically active		
People who are overweight should not be physically active		
Eating a lot of different kinds of foods is healthier than eating only a few kinds of food		
Foods such as bread, rice, maize, or samp, should be the main part of most meals		
You can eat as much meat as you want everyday		
It is best to eat sugar-containing foods only as a snack, instead of as part of a meal		
Fat or fatty foods may be eaten in small amounts		
Drinking lots of water is not necessary		
Drinking boiled water is a good way to lose weight		
Eating bread always cause weight gain		

SECTION E: SOURCE OF NUTRITION INFORMATION

1. **From where do you get information about nutrition?** (You can tick more than one option)

University	
Peer**/**friends	
Parents	
Radio	
Television	
Magazine	
Social media	
Other (please specify) ……	

2. **Of the choices you have selected above, how would you rate them as sources of information;**

1 = very unreliable; 2 = unreliable; 3 = note sure; 4 = reliable; 5 = very reliable

	Very unreliable	Unreliable	Not sure	Reliable	Very reliable
University	1	2	3	4	5
Peer/friends	1	2	3	4	5
Parents	1	2	3	4	5
Radio	1	2	3	4	5
Television	1	2	3	4	5
Magazine	1	2	3	4	5
Social media	1	2	3	4	5
Other	1	2	3	4	5

SECTION F: BODY PERCEPTIONS

1. **Do you ever weigh yourself**?

Yes	No

2. **If yes, how often?** ……

3. **How would you classify your current weight?**

Underweight	Normal	Overweight	Obese

4**. Have you ever attempted to lose weight?**

Yes	No

5. **If no, why?**

……..……

……

……

6. **If yes, how did you go about losing weight?** (You can tick more than one option)

A. Exercise

B. Diet

C. Skipped meals

D. Fasting

E. Reduced portion sizes

F. Vomited

G. Weight loss products e.g. Herbex, Belly Fat Blowout, etc.

H. Appetite suppressants e.g. Herbex, G.I. Lean

I. Slimming tea e.g. Fat burn, G.I. Lean Hunger, Buster tea, Green tea

J. Laxatives e.g. Senokot, Laxador, Soflax, Brooklax, Senna tablets, Lexan, Castor Oil

K. Meal replacement shake

H. Other (please specify): _____

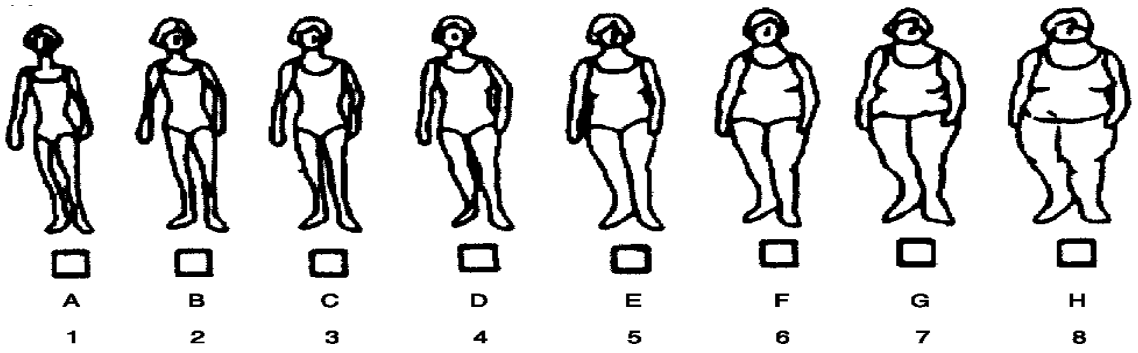
7. **If weight loss was done through a diet, explain what the diet allows and does not allow?**

……

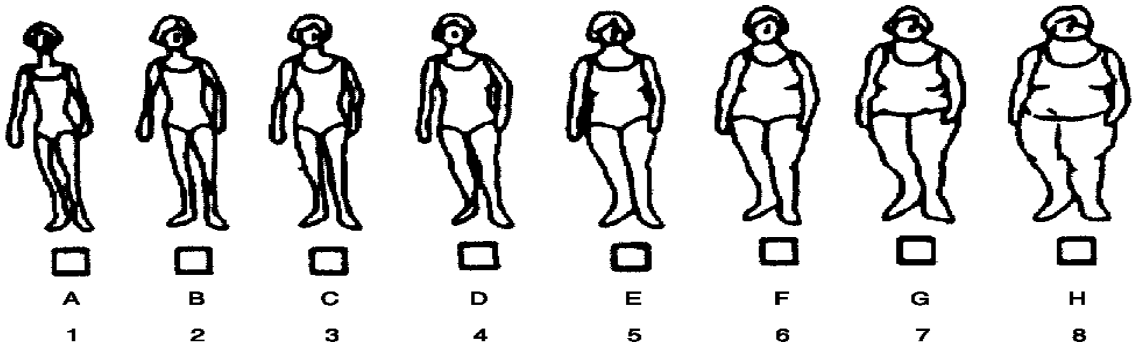
……

……

8. **Which picture do you think best describes your body size?**



9. **Which picture do you think would you like to look like?**



SECTION G: 24-h RECALL

1. Please list the food and the drinks you consumed yesterday. Kindly include meals and snacks in your list. Please be as specific as possible e.g. not only bread + jam, but also include whether bread was spread with margarine or any other spread

Breakfast	Snack	Lunch	Snack	Supper	Snack

APPENDIX B: IPAQ scoring protocol (Short forms) (IPAQ Research commitee 2005).

Physical activity categories:

Scoring a HIGH level of physical activity on the IPAQ means your physical activity levels equate to approximately one hour of activity per day or more at least a moderate intensity activity level.

Those who score HIGH on the IPAQ engage in

• Vigorous intensity activity on at least 3 days achieving a minimum total physical activity of at least 1500 MET minutes a week OR

• 7 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 3000 MET minutes a week. Scoring a MODERATE level of physical activity on the IPAQ means you are doing some activity more than likely equivalent to half an hour of at least moderate intensity physical activity on most days.

Those who score MODERATAE on the IPAQ engage in

• 3 or more days of vigorous intensity activity and/or walking of at least 30 minutes per day OR

• 5 or more days of moderate intensity activity and/or walking of at least 30 minutes per day OR

• 5 or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 600 MET minutes a week.

Scoring a LOW level of physical activity on the IPAQ means that you are not meeting any of the criteria for either MODERATE of HIGH levels of physical activity.

Calculating results TIPS:

Remember that bouts of activity lasting less than 10 minutes duration are not counted Convert all activity to minutes before calculating MET minutes. Doing the math in hours will give you incorrect results.

It is recommended that activity bouts of greater than 3 hours are truncated. That is to say that a bout cannot be longer than 3 hours (180 minutes). This means that in each category a maximum of 21 hours of activity are permitted a week (3 hours X 7 days)

To calculate MET minutes a week, multiply the MET value given (remember walking = 3.3, moderate activity = 4, vigorous activity = 8) by the minutes the activity was carried out and again by the number of days that that activity was undertaken. For example, if someone reports walking for 30 minutes 5 days a week then the total MET minutes for that activity are 3.3 X 30 X 5=495 Met minutes a week.

You can add the MET minutes achieved in each category (walking, moderate activity and vigorous activity) to get total MET minutes of physical activity a week.

APPENDIX C: Gatekeepers permission letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

26 February 2019

Mr Zethembiso Desiree Lubisi (SN 212539134)
School of Agricultural, Earth and Environmental Sciences
College of Agriculture, Engineering and Science
Pietermaritzburg Campus
UKZN
Email: lubisizd@gmail.com kassiers@ukzn.ac.za

Dear Mr Lubisi

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN) towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"Body composition, body image, related factors and weight loss practices of undergraduate female students on the Pietermaritzburg Campus."

It is noted that you will be constituting your sample by handing out questionnaires to female undergraduate students on the Pietermaritzburg campus.

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book. Identity numbers and email addresses of individuals are not a matter of public record and are protected according to Section 14 of the South African Constitution, as well as the Protection of Public Information Act. For the release of such information over to yourself for research purposes, the University of KwaZulu-Natal will need express consent from the relevant data subjects. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

MR SS MOKOENA
REGISTRAR

Office of the Registrar
Postal Address: Private Bag X54001, Durban, South Africa
Telephone: +27 (0) 31 260 8005/2206 **Facsimile:** +27 (0) 31 260 7824/2204 **Email:** registrar@ukzn.ac.za
Website: www.ukzn.ac.za

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Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

APPENDIX D: Ethics approval Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

16 July 2019

Mr ZD Lubisi
School of Agricultural, Earth and Environmental Sciences
College of Agriculture, Engineering and Science
lubisizd@gmail.com

Dear Mr Lubisi

Protocol: Body composition, body image, related factors and weight loss practices of undergraduate female students on the Pietermaritzburg campus
Degree: MSc
BREC Ref No: BE265/19

EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 04 April 2019.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 26 June 2019 to BREC letter dated **14** June 2019 has been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have been met and the study is given **full ethics approval** and may begin as from 16 July 2019. **Please ensure that site permissions are obtained and forwarded to BREC for approval before commencing research at a site.**

This approval is valid for one year from **16 July 2019.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **noted** by a full Committee at its next meeting taking place on **13 August 2019.**

Yours sincerely

Prof V Rambiritch
Chair: Biomedical Research Ethics Committee

cc: Postgrad administrator: manjoom@ukzn.ac.za Supervisor: Dr BN Mkhwanazi

Biomedical Research Ethics Committee
Professor V Rambiritch (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Telephone: +27 (0) 31 260 2486 **Facsimile:** +27 (0) 31 260 4609 **Email:** brec@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx

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