EATING PRACTICES, NUTRITIONAL KNOWLEDGE AND BODY WEIGHT IN NURSING SCIENCE STUDENTS AT THE UNIVERSITY OF FORT HARE

by

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DECLARATION OF OWN WORK

I, Alice Phelgona Okeyo, student number 2004175804, hereby declare that all work included in this dissertation, "*Eating Practices, Nutritional knowledge and body weight in Nursing Science Students at the University of Fort Hare*" and submitted by me to the Department of Nutrition and Dietetics is my own work and completed by myself.

None of the work is a copy of work of any other current or former candidate or groups of candidates for the Magister in Nutrition or any other qualification. All consulted sources in all aspects used to complete the dissertation are properly and completely acknowledged and generally accepted for referencing. I further cede copyright of this research report in favour of the University of the Free State.

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DEDICATION

This work is dedicated to my beloved father, Mzee Henry Mita Awicho, my husband, Professor Daniel Okoth Okeyo and my children, Miss Allisen Anyango Nyengo Okeyo, Mr Danielsun Ochieng Okeyo, Miss Alicia Achieng Okeyo and Danielstar Omondi Okeyo.

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LIST OF ABBREVIATIONS

AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Ranges
BMI	Body Mass Index
CI	Confidence Interval
cm	Centimeter
DHHS	Department of Health and Human Services
DoH	Department of Health
DRI	Dietary Reference Intakes
EAR	Estimated Average Requirement
F	Female
FBDG	Food-Based Dietary Guidelines
FFQ	Food Frequency questionnaire
g	grams
g/day	grams per day
H	height
IASO	International Association for the Study of Obese
IOM	Institute of Medicine
L	Litre
L/day	Litres per day
Kg	Kilograms
kg/m^2	Kilograms per meter squared
kJ	kilojoules
kJ/day	kilojoules per day
M	Male
mg	milligram
mg/day	milligrams per day
n	number of subjects
µg	microgram
µg/day	microgram per day

RDA	Recommended dietary allowance
SAFBDG	South African Food-Based Dietary Guidelines
SADHS	South African Demographic and Health Survey
SASSO	SA Society for the Study of Obesity Guidelines
TEE	Total Energy Expenditure
UL	Upper Intake Levels
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
W	Weight
WC	Waist circumference
W/H^2	Weight divided by height squared
WHO	World Health Organization
WHR	Waist-hip ratio
<	less than
>	greater than
≥	greater than or equal to
β	Beta
%	%
%TE	% of total energy

LIST OF ABBREVIATIONS IN AFRIKAANS

ADT	Aanbevole Dieettoelae
LMI	Liggaamsmassa-indeks
MHV	Middel-heupverhouding
MO	Middelomtrek

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CHAPTER 1: INTRODUCTION AND MOTIVATION OF THE STUDY

1.1 Background and motivation

Overweight and obesity are serious health problems. The term overweight means excessive body weight in relation to height, whereas obesity indicates excessive fat accumulation in adipose tissue (Laquatra, 2004). However the two terms are often used synonymously. The prevalence of overweight and obesity has been escalating rapidly worldwide. Evidence suggests that the prevalence of overweight and obesity has reached "global epidemic" (World Health Organization (WHO) 1998). It is now estimated that over one billion adults worldwide are overweight, 300 million of whom are clinically obese (World Health Organization (WHO) 2004). According to WHO (1998), the number of overweight people was predicted to approach 1.5 billion, by the year 2015. Studies have shown that the health risks are associated with not only excessive body fat but also relatively small increases in body weight (Laquatra, 2004).

An obesity epidemic is not restricted to developed countries alone. Countries that are experiencing economic transition, such as China, Brazil and South Africa are also showing an increase in overweight/obese persons as their economic condition changes (Popkin, 1994). However, there is an enormous variation in the prevalence of overweight and obesity within and between the developed and developing countries. For instance, in Europe and the United States, 10 to 25 % of the population is obese (Ferro-Luzzi and Puska, 2004). According to WHO (1998), between 6 % and 8 % of the population in Nigeria are obese, while over 6 % men and 13 % women in Brazil are obese. The South African Demographic and Health Survey (SADHS) (1998) and Department of Health (DoH) (2003) found in South Africa 9.3 % and 30.1 % men and women respectively are obese. In this South African study also more women (56 %) than men (29 %) were overweight.

College students, including health professional students, are also undeservedly affected. For example in Pakistan 20.5 % and 6.2 % of medical students are, respectively,

overweight and obese (Zafar *et al.*, 2007). In Japan 5.8 % and 1.2 % of students are, respectively, overweight and obese (Sakamaki *et al*., 2005). In USA 35 % of college students are overweight or obese (Huang *et al*., 2003). A study at the university of the north, South Africa, also found 25 % of first year female students to be overweight or obese (Steyn *et al*., 2000).

These rates of overweight and obesity are of concern because of the association of obesity with numerous chronic health related conditions such as heart and respiratory diseases, Type 2 diabetes, hypertension, gallbladder diseases, certain types of cancer, osteoarthritis, breathlessness and asthma (WHO, 2004), which will eventually increase the burden on health care systems. Obese individuals are also at a social disadvantage and may be discriminated against in employment opportunities (World Health Organization (WHO) 2000). Interventions are therefore necessary to curb the epidemic. To be able to both prevent and treat the onset of overweight and obesity, it is important to understand the factors that influence the development of abnormalities in body weight; these include excess energy intake, physiologic, metabolic and genetic factors as well as inadequate physical activities (Laquatra, 2004).

The major cause of overweight and obesity is a positive energy balance in which energy intake exceeds energy expenditure (Cataldo *et al*., 2003). The positive imbalance between energy intake and energy expenditure can be attributed to a number of factors including: socio-demographic and socio-economic factors (Cavalli-Soforza *et al*., 1996; Moreno *et al*., 2004), eating practices (Steyn *et al.,* 2003; Ferro-Luzzi and Puska, 2004; Kruger *et al.,* 2002), nutritional knowledge (Grafova 2006; Burns *et al*., 1987) and decreased physical activity (Steyn *et al.,* 2003; Kruger *et al.,* 2002). Therefore establishing an association between either of these factors and body weight could assist in developing strategies to control body weight or minimize health risks associated with excess body weight.

Socio-demographic factors that may contribute to overweight and obesity include gender, ethnicity, age, education level, place of residence and socio-economic status (Cavalli-

Soforza *et al*., 1996; Kruger *et al*., 2002). Sociodemographic factors may also contribute to inadequate physical activity, including a sedentary lifestyle which often leads to overweight and obesity (Moreno *et al*., 2004; Kruger *et al*., 2002).

Eating practices fueling the global overweight and obesity epidemic include an increased consumption of energy dense foods that are high in fat and sugars but low in vitamins, minerals and other micronutrients as well as low consumption of legumes, milk, fruits and vegetables (Drewnowski and Popkin, 1997; Cavalli-Soforza *et al*., 1996). According to Triches and Giugliani (2005), food and nutrient intake is related to weight gain, not only in terms of the volume of the food ingested, but also in terms of the composition and quality of the diet. Popkin *et al.* (1993), following Chinese populations during the period of economic growth accompanied by a diet higher in fat and meat and low in carbohydrates and fiber, found the increase of fat intake to be significantly related to an increase in body mass index (BMI). In South Africa, Kruger *et al.* (2002) found that high fat and energy intakes may be among the contributing factors to a high prevalence of obesity seen in black South African women living in urban areas. Another study in South Africa showed that urban women consumed more sugar and fewer legumes than rural women and the prevalence of overweight and obesity was also higher among urban women compared to the rural women (Steyn *et al.,* 2000).

The frequency of food intake or skipping of meals is also related to weight gain and obesity. Triches and Giugliani (2005) reported that not eating breakfast in the morning as well as a low frequency of milk, fruit and vegetable consumption, were practices associated with increased body weight and obesity among primary school children. According to Dryden (2005), eating habits that contributed to weight gain in college students included eating less than five servings of fruits and vegetables per day, and in addition many did not get enough exercise.

Nutritional knowledge is believed to play an important role in promoting healthier eating practices, and consequently, maintaining appropriate body weight (Kruger *et al*., 2002). According to Grafova (2006), people who are aware of the connection between poor

nutrition and certain health conditions are more likely to follow a balanced diet and avoid excessive weight gain. This means that nutritional knowledge can be a good strategy to employ in the reduction and control of the high prevalence of obesity**.** Kolodinsky *et al*. (2007) found increased knowledge of dietary guidelines to be positively related to more healthy eating practices among college students. The author concluded that healthy eaters have a higher nutritional knowledge leading to good food choices which can promote reduction and maintenance of weight. However, studies conducted by Thakur and D'Amico (1999) found no significant differences between obese and non-obese people with respect to their knowledge concerning nutrition. This may mean that most people do not always practice what they know.

An inadequate level of physical activity or sedentary lifestyle is directly associated with weight gain in human beings. Physical activity accounts for 10 to 30 % of daily energy expenditure. For this reason, a person experiencing a reduction in physical activity due to a change in labour practices or forms of transportation may spend less energy. This decline in energy expenditure, if not accompanied by a reduction in energy intake may result in weight gain and potential obesity. Decreased physical activity due to increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization (Klumbiene *et al*., 2004; Kruger *et al*., 2002), all contribute to positive energy expenditure which contributes to overweight and obesity.

Indicators of body weight status are determinants of overweight or obesity. These indicators include body mass index (BMI) or Quetelet Index, waist circumference (WC) and waist-hip ratio (WHR) (Laquatra, 2004, p. 565). BMI is (W/H^2), in which W is weight in kilograms and H is height in centimeters. According to World Health Organization, WHO (1998) and Cataldo *et al*. (2003, p. 143), BMI is commonly used because it correlates well with body fatness and degree of disease. As a general guideline, overweight and obesity are defined, respectively, as BMI values exceeding 25 kg/m^2 and 30 kg/m^2 (Whitney *et al.,* 2006). BMI, however, does not give information about the total fat or how fat is distributed in the body. Fat distribution is measured by WC and WHR (Hammond, 2004, p. 426).

1.2 Problem statement

Available literature reveals a high prevalence of overweight and obesity, and risk factors in the development of many chronic diseases due to lifestyle, both globally and within the South African population. The high prevalence of overweight and obesity represents a serious public health concern as recognized risk factors for chronic conditions and diseases. Many health science professionals may be overweight or obese due to socio-demographic factors, eating practices and a lack of nutritional knowledge. This situation places them at significant risk for numerous lifestyle related chronic conditions and diseases such as heart and respiratory diseases, diabetes and various forms of cancer. A further problem is that nursing science students are future health professionals, who will eventually support and give recommendations on healthy eating practices. It is therefore important that they are aware of ways to ensure weight gain prevention and control in order to provide a good service to the public.

Prevention and control of overweight and obesity, particularly in university health science/nursing students is a priority since this group represents future health care providers who may not provide adequate care to the public because of their obesity. Colleges and universities can be an ideal setting for preventive intervention programs. Many college/university health students are still forming their lifestyle pattern such as eating practices. For many of them this development period may be the last opportunity for cost effective health education and preventative intervention that they will use both in their profession and in their daily lives. Prevention and management programs for overweight and obesity include the availability of information about the reality of overweight and obesity among various population groups particularly nursing students. Availability of information will assist in setting goals and targets to reduce the prevalence of overweight and obesity such as healthy eating practices and nutritional knowledge. Eating practices have been indicated as a direct determinant of this problem (Triches and Giugliani, 2005), and nutritional knowledge has been recommended as a strategy to employ so that the population can enjoy a healthy diet, and attain an appropriate weight (Kruger *et al*., 2005).

This study was undertaken in an attempt to establish the socio-demographic factors influencing body weight as well as the association between eating practices, nutritional knowledge and bodyweight among the nursing science students at the University of Fort Hare, Eastern Cape. Indicators of body weight status (BMI, WC & WHR) were used to determine and to establish causes of overweight and obesity among the students. Information obtained from this study could help design education programs for these nursing students to address identified problems and could contribute to improvement of nutrition knowledge and practices and weight management and thus improved health care of nurses and their clients.

1.3 Aim and objectives:

1.3.1 Aim

The aim of this study was to establish if eating practices and nutritional knowledge influence body weight status in nursing science students at the University of Fort Hare, Eastern Cape, Republic of South Africa. The study also evaluated socio-demographic factors and body weight status.

1.3.2 Objectives:

The objectives of the study were to determine in nursing students:

- Socio-demographic factors
- Eating practices (usual daily food, energy and macronutrient intake, meal pattern and food frequency)
- Nutritional knowledge
- Body weight status (BMI, WC, WHR)
- Association between indicators of body weight and socio-demographic factors, eating practices, and nutritional knowledge.

1.4 Organization of the dissertation

The dissertation consists of 6 Chapters. Chapter 1 is the motivation for the study**.** Chapter 2 provides the literature review/frame of reference of the study. Chapter 3 covers materials and methods used in the study. Chapter 4 describes the results. Chapter 5 contains the discussions of the results. Chapter 6 has conclusions and recommendations. The summary of the study is bound at the back of the dissertation.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Body weight is the sum of bones, muscles, organs, body fluids and adipose tissues. These body components are subject to normal change as a result of growth, reproductive status, variation in physical activity, socio-demographic factors e.g. aging, eating practices and nutritional knowledge (Laquatra, 2004). Maintaining constant bodyweight is coordinated by a complex system of neural, hormonal, and chemical mechanisms that keep the balance between energy intake and energy expenditure within precise limits. Abnormalities of these mechanisms result in exaggerated weight fluctuations such as underweight, overweight and obesity with overweight and obesity being the most common worldwide (Laquatra, 2004). Factors contributing to overweight and obesity include socio-demographic factors**;** eating practices; nutrition knowledge; physiological metabolic, emotional and genetic predisposition (Figure 1). The consequences of overweight and obesity include certain chronic diseases. For the purpose of this study the impact of socio-demographic factors, eating practices and nutrition knowledge on body weight status will be discussed. Certain indicators of body weight status, such as BMI, WC and WHR as well as dietary assessment will also be reviewed, according to Figure 1.

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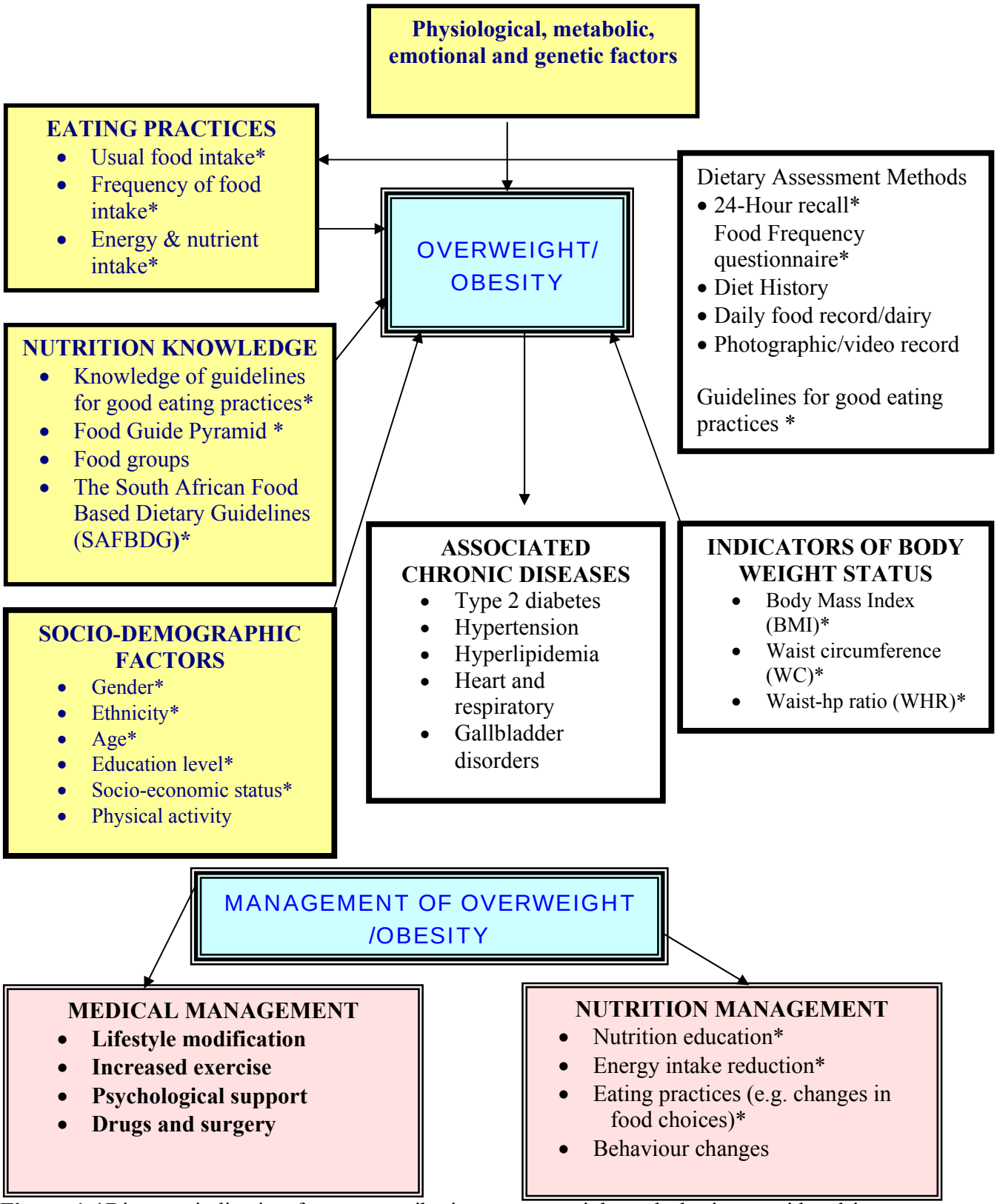

Figure 1 *Diagram indicating factors contributing to overweight and obesity considered in this study (modified from Laquatra, 2004, p. 571).

2.2 Socio-demographic factors

Socio-demographic factors that influence body weight and that will be discussed for the purpose of this study include gender, ethnicity, age, and education level, place of residence, socio-economic status and physical activity.

2.2.1 Gender

Gender plays an important role in influencing the rates of overweight and obesity between men and women in that woman are generally more overweight than men. According to the national survey of 1998 undertaken in all population groups in South Africa, one third of men and more than one half women were overweight and obese (Puoane *et al*., 2002). A similar pattern was also observed by York *et al.* (2004), who also indicated that, obesity is characterized by gender difference, with women recording 3 to 5 times the rate of obesity than men. Specific observations in Cape Town, South Africa, by Bourne *et al.* (2002) recorded a prevalence of overweight to be 22 % in men and 36.9 % in women.

2.2.2 Ethnicity

The influence of ethnicity on body weight has been observed in a number of studies. For example, in the United Stated of America, Nelson *et al.* (2007) observed a higher rate of overweight and obesity among male and female African American students. In South Africa, Cilliers (2004), found black first year university students more likely to be either overweight or obese compared to their white counterparts. The author showed black students to be 26.8 % underweight, 18.2 % overweight and 6.5 % obese, compared to their white counterparts at 7.2 % underweight, 10 % overweight and 0.8 % obese, respectively. Literature indicates that obesity affects males and females of all races, age groups and ethnicities (WHO, 2004). Differences do exist, however, and the prevalence of overweight and obesity is higher in women who are members of ethnic minorities in the USA (Laquatra, 2004, p. 566; Duncan *et al*., 2004).

2.2.3 Age

Age has a significant influence on overweight and obesity. Literature has shown that the incidences of overweight and obesity increase with age, particularly in post menopause women (Temple *et al*., 2001; Lahmann *et al*., 2000). According to Temple *et al*. (2001), the incidence of obesity increases significantly with age, with 32 % of women being obese at age 25 to 44 years, rising to 49 % at ages 45 to 64 years; while a much lower prevalence of obesity was seen in men, 14 % at 35 to 65 years. With regards to age and gender, studies by the International Association for the Study of Obesity, IASO (2004), found the prevalence of overweight including obesity among young people aged 13 to19 years to be 17 % affecting more girls than boys at a rate of 25 % and 7 %, respectively.

2.2.4 Education Level

Education attainment has been associated with body weight (Lahmann *et al*., 2000; Puoane *et al*., 2002; Kruger *et al*., 2005). The authors showed women with a low education attainment to have higher weight gains compared to those with higher education. In South Africa, Puoane *et al*. (2002) also concluded that determinants of overweight and obesity included education attainment. In another study, Sundquist and Johansson (1998) also showed a low education attainment to be associated with higher BMI in females. Education attainment can lead to the acquisition of a different lifestyle which may impact either positively or negatively on body weight.

2.2.5 Place of residence

Place of residence has been associated with weight gain (Steyn *et al.,* 2000). The author found that urban women in South Africa were more overweight and obese than rural women. Further more Brunt *et al*. (2008) showed that residing off campus may also be associated with weight gain in university students.

2.2.6 Socio-economic status

Variation in socio-economic status has been related to the variation in rates of overweight and obesity (Cavalli-Soforza *et al*., 1996; Moreno *et al*., 2004; Kruger *et al*., 2002). According to Ferro-Luzzi and Puska (2004), overweight and obesity tend to be highest among low-income populations in developed countries, and among more affluent people in developing countries. The authors concluded that as economies improve, so is the risk of becoming obese as a result of improved access to food, decreased physical activity, and consumption of a 'Western' diet.

2.2.7 Physical activity

Physical activity can increase energy expenditure and contribute to weight loss. According to Whitney *et al.* (2007), people may be obese not because they eat too much but because they expend too little energy e.g. having none or very little physical activity. Studies by Moreno *et al*. (2004) and Kruger *et al*. (2002) found decreased physical activity and consumption of 'Western' diet to be the two most important factors contributing to the high increase in overweight and obesity. Laquatra, (2004) explains that physical activity results in energy expenditure due to an increase resting metabolic rate (RMR), thus, contributing to body weight management.

2.3 Eating practices

Eating practices refer to dietary intake data which includes information about usual daily food intake, eating pattern and usual nutrient intake (Hammond, 2000, p. 353). Aspects of eating practices that will be discussed include usual food intake, frequency of food consumption, energy and nutrient intake and guidelines for good eating practices.

2.3.1 Usual food intake

Usual food intake refers to normal, customary or typical food consumption or practice. These practices can either be good or bad. Good eating practices are those that encourage the consumption of a healthy and nutritious diet that provides the right amount of energy to keep the weight in the desirable range, the proper types and balance of carbohydrates, proteins and fats, plenty of water, and sufficient but not excessive amounts of essential vitamins and minerals (Smolin and Grosvenor, 2008). According to Whitney *et al.* (2007), eating practices that supply all the nutrients required in life can be achieved through the six basic diet-planning principles which include: adequacy, balance, energy control, nutrient density, moderation and variety. On the other hand, bad eating practices are those that do not encourage consumption of a healthy and nutritious diet that provides the right amount of energy to keep the weight in the desirable range, the proper types and balance of carbohydrates, proteins; and fats, plenty of water, and sufficient but not excessive amounts of essential vitamins and minerals (Smolin and Grosvenor, 2008). Bad eating practices do not encourage the balance and moderation of food and nutrients consumed (Whitney *et al.*, 2007).

2.3.2 Frequency of food consumption

Frequency of food consumption includes a daily meal pattern such as skipping of meals and how often a given food is consumed (Piper, 1996). According to Triches and Giugliani (2005) skipping of meals and how often a food is consumed can influence body weight. A study conducted on primary school children showed that not eating breakfast in the morning as well as a low frequency of milk, fruit and vegetable consumption, were the practices associated with increased body weight and obesity among this group (Triches and Giugliani, 2005). According to Dryden (2005), eating habits that contributed to weight gain in college students included eating less than five servings of fruit and vegetables per day.

2.3.3 Energy and nutrients intake

Energy and nutrient intake come from the food consumed (Whitney *et al.,* 2007). The nutrients are divided into two groups: the energy yielding nutrients (e.g. carbohydrates, lipids, proteins) and the non-energy yielding nutrients (e.g. vitamins, minerals) (Ettinger, 2004). Energy producing foods are used in the body to fuel all its activities. If however more energy is consumed than needed, it is immediately stored as fat (Whitney *et al.,* 2007). The stored fat provides energy when dietary sources are not available. If more energy is consumed than is needed, the storage capacity of the body becomes larger, and the body weight increases. If less energy is consumed than needed, the body will burn its stored energy to meet the energy demands, and the body weight will be decreased.

2.3.4 Guidelines for good eating practices

Guidelines for good eating practices for healthy individuals include nutrient based guideline e.g. dietary reference intakes (DRI's) and food based dietary guidelines e.g. food guide pyramids (Escott-Stump and Earl, 2008, p. 338), food groups and the South African food based dietary guidelines (SAFBDG) (Gibney and Voster, 2001). These guidelines point out recommendations for good eating practices to supply energy, nutrients, and other dietary components that best support good health. Most countries have developed different tools/guidelines for good eating practices appropriate to circumstances and needs of their population. These guidelines are often based on the American DRI's. For the purpose of this study, the DRI's, food guide pyramid and the South African food-based dietary guidelines are discussed.

2.3.4.1 Dietary Reference Intakes (DRIs)

The DRI's are a set of values for the dietary nutrient intake of healthy people in the United States and Canada (Escott-Stump and Earl, 2008). These values are used for planning and assessing diets for healthy people. A DRI model has expanded out of the previous recommended dietary allowance (RDA) which focused only on levels of

nutrients for healthy populations to prevent deficiency diseases, by including four levels and nutrient recommendations for healthy individuals. Levels of DRI are discussed, as well as the recommendations.

i) Levels of the DRI's

DRI encompasses four types of nutrient levels for healthy individuals: adequate intake (AI), estimated average requirements (EAR), recommended dietary allowance (RDA), and tolerable upper intake level (UL).

(a) Adequate Intake (AI)

The AI is a recommended daily nutrient intake level based on observable or experimentally determined approximations of nutrient intakes by a group or groups of healthy people. These nutrient intakes are used when sufficient scientific evidence is not available to calculate a recommended dietary allowance (RDA) or estimated average requirement (EAR) (Whitney *et al.*, 2007, p. 9).

(b) Estimated Average requirements (EAR)

EAR is an average requirement of a nutrient for healthy individuals on which a functional or clinical assessment has been conducted and on which measures of adequacy have been made at a specified level of dietary intake (Escott-Stump and Earl, 2008, pp. 338-345). An EAR is the amount of intake of a nutrient at which one half of the experimental subjects would have their needs met and one half would not. The EAR is used for assessing and making recommendations for nutrient adequacy of a population and not individuals.

(c) Recommended Dietary Allowance (RDA)

The RDA is the amount of nutrient needed to meet the requirements of 97 to 98 % of a healthy population of individuals for whom it is developed. According to Escott-Stump and Earl (2008, p. 338), the RDA for a nutrient should serve as a goal for intake for individuals, not as a benchmark of adequacy of diets of populations.

(d) Tolerable Upper Intake Level (UL)

The UL is the highest level of daily nutrient intake that is unlikely to have any adverse health effects on almost all individuals in the general population, who consume that amount (Escott-Stump and Earl, 2008). The ULs do not reflect the desired levels of intake; rather, they represent total, daily nutrient intake from food, fortified foods, and supplements that should not be exceeded (Brown, 2005, p. 4). ULs have been established for nutrients for which adequate data are available to reduce the risk of adverse or toxic effects from increased consumption of nutrients in a concentrated form, either alone or combined with others (not in food) or from enrichment and fortification.

ii) Recommended energy and nutrient intakes according to the DRI's

Recommendations for energy and nutrient intakes according to DRI are specific for gender, various age, stage in life, and pregnant and lactating women (Escott-Stump and Earl, 2008) (Table 2.1). The recommendations are made for nutrient intakes and guide people on the amount of energy and macro and micro nutrients to consume. A DRI committee considers prevention of chronic diseases as well as nutrient adequacy when establishing recommendations.

Table 2.1 Recommended Dietary Allowance (RDA), Adequate Intake (AI) and Estimated Energy Requirement (EER) for water, energy and macronutrients for male and females (19 - 30 years) (Rofles *et al*., 2006)

Nutrients	Males (19 - 30 years)	Female (19 - 30years)
Water (L/day) (AI)	3.7	2.7
Energy(kJ/day)(EER)	12881	10093
Carbohydrates(g/day)(RDA)	130	130
Total fibre (g/day) (AI)	38	25
Protein (g/day) (RDA)	56	46
Total fat (g/day) (RDA)	102	80

a) Energy

Recommendations for energy are referred to as Estimated Energy Requirements (EER) and are set at minimum level for good health (Whitney *et al.*, 2007). The recommendations for energy are not set generously because excess energy can not be excreted and is eventually stored in the body as fat (Whitney *et al.*, 2007). For an individual to maintain a healthy body weight, energy intake should match energy expenditure (Cataldo *et al*., 2003). The amount of energy a food provides depends on how much carbohydrate, fat and protein the food contains. When broken down in the body, each type of simple and complex carbohydrate provides 17 kilojoules (kJ) of energy per gram of carbohydrate and protein and 38 kJ per one gram of fat.

b) Nutrients

Nutrients are substances obtained from food and used by the body to provide energy and structural material and to serve as regulating agents to promote growth, maintenance, and repair of body tissues (Brown, 2005, p. 2). There are two classifications of nutrients namely: macronutrients and micronutrients. All nutrients have varied intake recommendations.

i) Macronutrients

Macronutrients are nutrients needed by the body in large amounts. They include water and energy yielding nutrients, such as, carbohydrates, proteins and lipids (Smolin and Grosvenor, 2008, p. 7). Together with water, energy yielding nutrients constitute the major portion of most foods and are required in relatively large amounts by the body. Protein, carbohydrate and fat requirements are measured in grams (g). The proportion of each of the energy yielding nutrients is just as important as the total energy consumed for weight control (Cataldo *et al*., 2003). Healthy ranges of intake for energy yielding nutrients called Acceptable Macronutrient Distribution Ranges (AMDR) have been established by DRI.

1) Carbohydrates

Carbohydrates are a preferred energy source for body functions (Whitney *et al.,* 2007, p. 61). The human brain depends exclusively on carbohydrate as an energy source. In the body carbohydrates and other energy yielding nutrients are first used to build new compounds to fuel the metabolic and physical activities of the body; excess energy is rearranged into storage compounds, primarily as body fat, and kept for latter use (Whitney *et al.,* 2007, p. 61). This means that if more energy is taken into the body than expended (whether from carbohydrate, fat or protein), the result is usually a gain in body fat. Recommended intakes of carbohydrates are based on its contribution to energy intake. Acceptable Energy Distribution ranges for carbohydrate for good health is 45 to 65 % of daily energy intake (Earl, 2004, p. 369). Added sugar should contribute no more than 25 % of the total energy intake (Brown, 2005). It is recommended that adult females consume between 21 to 25 g and males between 30 to 38 g of total dietary fiber daily (Table 2.1).

2) Proteins

Protein is needed by the body for growth, repair, replacing tissues and fighting infections. As a component of a diet, protein serves to replace amino acids that are broken down to produce energy. The recommended dietary allowance (RDA) for protein, states that a generous daily protein portion for a healthy adult is 0.8 g per kilogram (kg) of a healthy body weight (Smolin and Grosvenor, 2008, p. 232). The RDA for protein is adjusted to cover additional needs for building new tissues and for this reason it is higher for infants, children and pregnant and lactating women. Dietary protein intake should contribute 10 to 30 % of the total daily energy consumed (Earl, 2004, p. 369). These recommendations can generally be met through diet alone, without the use of protein or amino-acid supplements (American Dietetic Association, ADA, 2000). Over consumption of protein offers no benefits and may pose health risks. For example, diets high in protein rich foods are often associated with obesity and accompanying health risks if total energy intake exceeds requirement (Whitney *et al.,* 2007, p.119).

3) Lipids

Lipids include fats and oils and related compounds, such as cholesterol and sterols (Brown, 2005). Fats are generally solid at room temperature whereas oils are usually liquid. Fats and oils are a concentrated source of energy; one gram of fat and oil provide 38 kilojoules (kJ) of energy (Ettinger, 2004, p. 50). According to Whitney *et al.* (2007, p. 94), defining the exact level of fat intake at which risk of inadequacy or prevention of disease occurs is not possible, hence no RDA for upper limit has been set. To promote good health, the recommendation for total fat and oil intake is set at 20 to 35 % of total daily energy intake (Earl, 2004, p. 369). Of this intake, at least 70 % should come from unsaturated fatty acids. Diets with up to 35 % of kJ from fat can be compatible with good health, if energy intake is reasonable and saturated fat intake is low. However, fats and oils below 20 % of kJ intake increase the risk of inadequate essential fatty acid intake (Whitney *et al.*, 2007, p. 91). Part of the energy allowance of total fat should provide the essential fatty acids (linoleic and linolenic acids). RDA suggests that linoleic acid should

provide 5 to10 % of daily energy intake and linolenic acids should provide 0.6 to1.2 % of daily energy intake (Whitney *et al.*, 2007, p. 91).

4) Water

Water is an essential nutrient that must be consumed in a diet for survival. Death occurs within only a few days without water (Smolin and Grosvenor, 2008, p. 404). Although it is considered a macronutrient, water does not provide energy. Water makes up to 60 % of human body weight and it is required in large amounts in daily diets. Water serves many functions in the body, including acting as a lubricant, a transport fluid, and regulator of body temperature (Smolin and Grosvenor, 2008, p. 404). Water needs depend on the food eaten, environmental temperature, humidity, as well as an individual's activity level. This makes water RDA difficult to establish. According to Whitney *et al*. (2007), for a person who expends 8400 kiloJoules per day (kJ/day), 2 to 3 litres or 8 to12 cups of water are recommended.

ii) Micronutrients

Micronutrients are needed by the body in much smaller amounts but still play a vital role in the body. If not available, the body may develop deficiencies. Micronutrients are non-energy yielding nutrients and include vitamins and minerals. Vitamins are required to regulate body processes; minerals are required for bone health and the transport of oxygen.

1) Vitamins

Vitamins are organic molecules that do not provide energy, but are needed to regulate body processes (Smolin and Grosvenor, 2008, p. 326). Vitamins are usually classified into two groups based on their solubility: (1) water-soluble vitamins (e.g. ascorbic acid, thiamine, riboflavin, niacin, pyridoxine, biotine, pantothenic acid, folate, cobalamin; Table 2.2) and (2) fat soluble vitamins (e.g. A, D, E, K; Table 2.2). Although vitamins

do not provide energy, many of them serve as coenzymes for reaction to release energy from carbohydrate, fat, protein and alcohol (Smolin and Grosvenor, 2008, p. 325). The AI and RDA for intakes of vitamins are made based on age and gender (Table 2.2).

Table 2.2 Recommended Dietary Allowance (RDA) and Adequate Intakes (AI) for Vitamins (19 – 50 year olds) (Whitney *et al*., 2007)

Vitamins	**Males (19-50 years)**	**Females (19-50 years)**
Thiamine (vitamin B_1)(mg/day)(RDA)	1.2	1.1
Riboflavin(Vitamin B_2)(mg/day)(RDA)	1.3	1.1
Niacin(mg NE/day) (RDA)	16	14
Biotin (µg/day))(AI)	30	30
Pantothenic acid (mg/day)(AI)	5	5
Vitamin B_6 (pyridoxine) (mg/day)(RDA)	1.3	1.3
Folate ((µg/day))(RDA)	400	400
Vitamin B_{12} ((µg/day))(RDA)	2.4	2.4
Vitamin C (Ascorbic acid) (mg/day) (RDA)	90	75
Vitamin A (µg/day) (RDA	900	700
Vitamin D (µg/day)(AI)	5	5
Vitamin E(mg/day) (RDA)	15	15
Vitamin K(µg/day)(AI)	120	90

2) Minerals

Minerals are inorganic molecules that do not provide energy (Anderson, 2004, p. 121). Minerals are needed for bone health, transport of oxygen, transmission of impulses and many other functions (Smolin and Grosvenor 2008, p. 432). Minerals form a large class of micronutrients, most of which are considered essential nutrients (Smolin and Grosvenor 2002, p. 432). The minerals are divided into two groups: (1) macro-minerals or bulk elements (e.g. sodium, chloride, potassium, calcium, phosphorus, magnesium; (Table 2.3) and (2) micro-minerals or trace elements (e.g. iron, zinc, iodine, selenium, copper, manganese, fluoride, chromium, molybdenum; Table 2.3) (Anderson, 2004, p.

121). AI and RDA for macro- and micro-minerals for good health are according to age and gender (Table 2.3). Macro-minerals such as calcium and phosphorous are required in amounts of 100 mg/day or more, whereas micro-minerals such as iron and selenium are required in much smaller amounts, typically less than 15 mg/day.

Table 2.3 Recommended Dietary Allowance (RDA) and Adequate Intakes (AI) for minerals (19 - 50 year olds) (Brown, 2005)

Minerals	Males (19-50 years)	Females (19-50 years)
Sodium (mg/day) (AI	1500	1500
Chloride (mg/day) (AI)	2300	2300
Potassium (mg/day) (AI)	4700	4700
Calcium (mg/day) (AI)	1000	1000
Phosphorus (mg/day) (RDA)	700	700
Magnesium (mg/day) (RDA)	400	310
Iron (mg/day) (RDA)	8	18
Zinc (mg/day) (RDA)	11	8
Iodine (mg/day) (RDA)	150	150
Selenium (μg/day) (RDA)	55	55
Copper (mg/day) (RDA)	900	900
Manganese (mg/day) (AI)	2.3	1.8
Fluoride (mg/day) (AI)	4	3
Chromium (μg/day) (AI)	35	25
Molybdenum (μg/day) (RDA)	45	45

2.3.4.2 Food Guide Pyramid

Food guide pyramid (Figure 2) translates dietary guidelines of nutrient recommendations into visual form of the kinds and amounts of food to eat each day (Earl, 2004, p. 363). The food guide pyramid was developed based on nutritional problems, food supplies, eating habits and cultural beliefs of the American population. The aim of the food guide

pyramid was (and still is) to promote good health and reduce the risk of chronic diseases, such as, heart disease, certain types of cancer, diabetes and stroke (Escott-Stump and Earl, 2008). The food guide pyramid is built around five main food groups (e.g., grains, vegetables, fruits, milks, meats and beans), with recommended daily amounts (Smolin and Grosvenor, 2008, p. 44; Figure 2). The pyramid shape, with grains at the base (Figure 1), conveys a message that grains should be abundant and form the foundation of a healthy diet. Fruit and vegetables share the next level of the pyramid, indicating that they too should have a prominent place in the diet. Meats and milks appear in a smaller section near the top meaning that a few servings of each can provide valuable nutrients. Fats, oils, and sweets occupy the part at the top of the pyramid, indicating that they should be consumed sparingly and only after basic nutrient needs have been met by foundation foods. An advantage of the food guide pyramid is that the recommended number of portions from each food group is indicated which makes this food guide pyramid a suitable tool for the evaluation of food intake of individuals and groups of individuals.

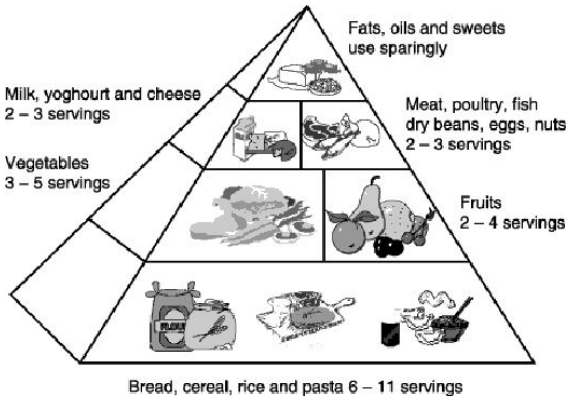

Figure 2 Food guide pyramid (Cataldo *et al.*, 2003, p. 17)

2.3.4.3 Food groups

Food groups is a diet planning tool that sorts foods of similar origin and nutrient content into groups and then specifies that people should eat a certain numbers of servings from each group (Cataldo *et al.*, 2003, p.14). Food groups assigns foods into five major groups: (1) fruit, (2) vegetables, (3) grains, (4) meat, poultry, fish, legumes, eggs and

nuts, (5) milk, yoghurt and cheese. Food groups also indicate the most noticeable nutrient of each food group and lists foods within each group sorted by nutrient density. Food groups also include a Food Guide Pyramid, which presents the daily food guide in pictorial form (Cataldo *et al*., 2003, p.15).

2.3.4.4 The South African Food Based Dietary Guidelines (SAFBDG)

SAFBDG were formulated to address the existing under- and over-nutrition (meaning, malnutrition and obesity) in different communities of South Africa (Gibney and Voster, 2001). The aim of developing the SAFBDG was to help individuals and groups choose an adequate and prudent diet, to improve dietary intake, to improve nutritional status and health, and to prevent diet related diseases (Gibney and Voster, 2001). South Africa is a society in transition with a double burden of diseases related to both under- and over-nutrition (Gibney and Voster, 2001). The SAFBDG are based on the existing consumption of locally available foods and aims to address identified nutritional related public health problems. The SAFBDG also aim to optimise nutritional status in both disadvantaged and affluent communities of South Africa. The guidelines can be used as a basis for planning, implementing and evaluation of public health nutrition strategies. The SAFBDG consist of ten, short messages to the public, explained in sections a to j:

(a) Enjoy variety of foods

Enjoy a variety of foods means including in the diet, grains, vegetables, fruit, meat and dairy products. Some of the foods listed herein are rich in protein, minerals and phytochemicals which are important for good health. A variety of foods means dietary diversity which involves choosing many different foods from within each food group. Enjoying a variety of foods will help ensure adequate nutrient intake. Not one food can provide all the nutrients the body needs for optimum health.

(b) **Be active**

Be active means physical activities. Physical activity is needed in order to maintain or improve body weight. Being overweight and gaining weight as an adult are linked to high blood pressure, heart disease, stroke, diabetes, certain cancer and other illnesses (WHO, 2004). The food eaten should balance the physical activity for good health.

(c) Make starchy foods the basis of most meals

Make starch foods the basis of most meals means, the highest portion of food consumed per day should come from starchy foods. Starchy foods are usually low in fat, high in complex carbohydrates and provide the body with an economical source of energy (i.e. 17 kJ of energy per gram of carbohydrates).

(d) Eat plenty of fruit and vegetables every day

Eat plenty of fruit and vegetables every day means consumption of a variety of fruit and vegetables daily. Fruits and vegetables contain a wealth of vitamins and minerals as well as fibre and phytochemicals that protect the body against diseases.

(e) Eat plenty of beans, peas, lentils and soy regularly

Beans, peas, lentils and soy (legumes) are rich in protein and an economical dietary source of carbohydrates, fiber, and variety of minerals and vitamins. Legumes are also low in fat and can help to protect against diseases.

(f) Meat, fish, chicken, milk and eggs can be eaten every day

Meat, fish, chicken, milk and eggs are foods of animal origin. Foods of animal origin provide nutrients to the diet; but over consumption can increase the risk of various diseases, due to the high fat content.

(g) Eat fat sparingly

Eat fat sparingly means, fat should be consumed in moderation. A high fat intake is associated with heart diseases, obesity and certain types of cancer.

(h) Eat salt sparingly

Eat salt sparingly means, salt should be taken in moderation. High intake of salt is associated with a rise in blood pressure, especially in salt sensitive individuals

(i) Drink lots of clean water

The body is largely made up of water and good hydration is crucial for optimal body functions (Smolin and Grosvenor, 2008, p. 404). Fluids could be replaced by tea, coffee, cool drinks etc. but two to three litres or 8 to12 glasses of pure water are recommended per day.

(j) If you drink alcohol, drink sensibly

Drinking alcohol sensibly means, consuming alcohol in moderation. Alcoholic beverages supply energy, but no nutrients. Alcohol alters judgment and can lead to dependency and other health problems, including liver disease and birth defects. A responsible intake of alcohol is regarded as 0 to 2 portions of alcohol per day, where one portion equals one beer or one glass of wine (Whitney *et al*., 2007, p. 510).

2.4 Nutritional Knowledge

Nutritional knowledge can be seen as a key prevention strategy for overweight and obesity (Grafova, 2006). The author speculated two distinctive patterns in the relation between nutritional knowledge and obesity: firstly, nutritional knowledge could be preventative to obesity, in which case, the greater the nutritional knowledge, the lower

the probability of being obese; secondly, nutritional knowledge could also be reactive to obesity, in which case, obesity may lead to greater nutritional knowledge. Kruger *et al*. (2002) believes that nutritional knowledge is an important factor in promoting healthier eating habits, and consequently, maintaining an appropriate body weight, thus, preventing overweight and obesity. People who are aware of the connection between poor nutrition and certain health conditions are more likely to follow a balanced diet and avoid excessive weight gain (Grafova, 2006). Thakur and D'Amico (1999) however, found no significant difference between obese and non-obese people with respect to their knowledge concerning nutrition. Other studies reported a high level of nutrition knowledge in obese students (Triches and Giugliani, 2005; Burns *et al*., 1987) and concluded that there are no differences between obese and non-obese students, with regard to their knowledge of nutrition. The studies found that the greater knowledge of nutrition had no effect on the BMI of the students.

2.4.1 Nutrition knowledge of college health students and body weight

Nutrition knowledge of college students and health care practitioners does not seem to influence food choices, which in turn can influence body weight of the groups. For example, Davy *et al*. (2006) found amongst students registered for an introductory course in nutrition a larger percentage of female than male students used too much sugar in their diets. In another study on trainee of home economics and physical education teachers, O'Dea and Abraham (2001), reported participants' use dangerous methods of losing weight, such as laxatives (19 %) and vomiting (10 %). According to O'Dea and Abraham (2001), the practices of taking laxatives and vomiting, indicates that a knowledge of nutrition has no influence on eating practices of this group. Sakamaki *et al.* (2005) found that although large numbers of university students (85.5 %) were aware of the concept of a nutritionally balanced diet, only a small number of students (7 %) applied the concept when selecting food from a menu.

2.5 Indicators of body weight status

Indicators of body weight status include anthropometric measurements such as body mass index (BMI), head circumference, waist circumference (WC) and waist and hip ratio (WHR and measure of fat distribution). These parameters are affected by ethnic, familial, and environmental factors, which should be taken into account when measurements are evaluated (Hammond, 2004, p. 421).

Anthropometric assessment has the following advantages: (1) the procedures used are safe to humans and are non-invasive; (2) it is applicable to large sample groups; (3) the equipment required for the technique is inexpensive, portable and durable; (4) the measurements can be performed by relatively unskilled personnel; (5) information on past and long-term nutritional history is obtained with equal confidence using other techniques; (6) the procedure can help identify mild to moderate malnutrition, as well as severe malnutrition (Gibson, 1998, p. 427). For purposes of this dissertation, only height, weight, BMI, WC and WHR are reviewed; measurements of the parameters are commonly used as indicators of body weight (Hammond, 2004).

2.5. 1 Body mass Index (BMI)

Body mass index (BMI) refers to the relationship between weight and height (Hammond, 2000, p. 370). Classifications of BMI accounts for differences in body composition by defining the level of adiposity according to the relationship of weight to height, thus, eliminating the dependence on frame size (Hammond, 2000, p. 370). BMI index has the least correlation with body height and the highest correlation with independent measures of the body fat for adult humans (Hammond, 2004, p. 424). BMI describes relative weight and height and is not gender specific (Zafar *et al.,* 2007). BMI categorizes individuals as underweight (<18.5 kg/m^2), normal weight (18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2) and obese (≥ 30.0 kg/m^2) (Laquatra, 2004, p. 565). BMI of 20 to 25 kg/m^2 is associated with the least risk of early deaths. The BMI values, however, are most accurate in assessing degrees of obesity and are less useful for

evaluating non obese body fatness (Smolin & Grosvenor, 2008, p. 270). WHR on the other hand, is used because it differentiates between android and gynoid obesity, and it is the most frequently used method to measure adiposity (Lee and Nieman, 1996, p. 245).

Table 2.4 Categories of body mass index (BMI) to identify, health risk in adults (WHO, 2003)

BMI (kg/m^2)	Weight categories	Health risk
< 18.5	Underweight	Increased risk
18.5 – 24.9	Normal weight	Least risk
25 – 29.9	Overweight	Increased risk
30 and over	Obese	
30 – 34.9	Obese Class I	High risk
35 – 39.9	Obese class II	Very High Risk
≥ 40	Obesity Class III	Extremely High Risk

2.5.1.1 Limitations of BMI

Limitations of BMI includes two categories: (1) BMI values are most accurate in assessing degrees of obesity and are less useful for evaluating non obese body fatness (Smolin & Grosvenor, 2008, p. 270). This is particularly true in athletes who have highly developed muscles; their BMI may be high because they have a large amount of lean body mass, but body fat may be less. (2) BMI does not give information about how much of the weight is fat, and how the fat is distributed in the body (Cataldo *et al*., 2003, p. 141), a factor which is important, as abdominal excess fat can have consequences in term of health problems. Because of these limitations BMI should not be the only tool of measurement used to determine nutritional health and fatness of an individual. Two ways of assessing fat distribution are by weight circumference WC and weight-hip-ratio WHR (Hammond, 2004, p. 426).

2.5.2 Waist circumference (WC)

WC provides a simple and practical method of identifying overweight people who are at increased risk of obesity related conditions. Ideal WC is < 94 cm and < 80 cm, respectively, for men and women. WC values of 94 to 102 cm and 80 to 88 cm, for men and women, respectively, means that these individuals have excess abdominal fat, which puts them at an increased risk of health problems, even if their BMI is normal (Hammond, 2004, p. 426). Men with WC values of ≥ 102 cm and women with WC of ≥ 88 cm are considered to be at a substantial risk for chronic diseases of lifestyle (e.g. diabetes, hypertension, cancer). Categories of WC associated with health risks for men and women are shown on (Table 2.5).

Table: 2.5: Waist circumference (WC) in men and women associated with increased risk for chronic diseases of lifestyle (SASSO, 2003)

	Ideal	increased risk	Substantial risk
Men	<94 cm	94.0-101.9 cm	≥102 cm
Women	<80 cm	80.0-87.9 cm	≥88 cm

The WC measurement divides people into two categories. The first category is of those individuals with android fat distribution (often called "apple" shape), meaning that most of their body fat is intra-abdominal and distributed around their stomach and chest, which put them at risk of developing obesity related diseases, such as diabetes, stroke, hypertension and coronary artery disease (Cataldo *et al*., 2003, p. 142). The second category is of those individuals with a gynoid fat distribution (often called "pear" shaped), meaning that most of their body fat is distributed around their hips, thighs and bottom. These individuals are at a greater risk of mechanical problems such as arthritis in the joints and thighs. Obese men are more likely to be 'apple' shaped while obese women are more likely to be 'pear' shaped.

2.5.3 Waist-hip-ratio (WHR)

WHR is a measurement tool that looks at the proportion of body fat stored in waist compared to that stored in hips and buttocks. WHR provides an index of regional body fat distribution (Lee and Nieman, 1996, p. 245); and it is a simple but valuable guide in assessing health risk (Lee and Nieman, 1996, p. 245). The method differentiates between android and gynoid obesity, and is the most frequently used method to measure adiposity (Cataldo *et al*., 2003). The WHR is calculated by dividing the waist circumference by the hip circumference (Cataldo *et al*., 2003). WHR values of ≥ 0.9 in men and ≥ 0.8 in women are indicative of central adiposity (Barasi, 2003, p. 12); and are seen as increased health risks for obesity related diseases.

Most people store their body fat in two distinct ways: around their middle (apple shape) and around their hips and thighs (pear shape) (Cataldo *et al*., 2003, p. 142). Individuals with extra weight around the stomach and chest can be at a higher risk for diseases such as heart disease and diabetes compared to those who carry extra weight around hips, thighs and buttocks) (Lee and Nieman, 1996, p. 245).

2.6 Dietary assessment

Dietary assessment estimates food consumption or nutrient intake in individuals or groups of people (Nelson, 2000, p. 315). Reasons for conducting dietary assessment may vary widely. For example, one may collect dietary intakes data, to screen, assess, evaluate, and plan interventions or monitor dietary intakes or nutritional status of individuals, groups or nations (Dwyer, 1998, p. 937). However, dietary assessment usually relates to the need to understand the effects of diet on health (Nelson, 2000, p. 311). Dietary assessment organizes and evaluates the information gathered to make a professional judgment about nutritional status of both individual and group. Once the dietary assessment is complete, the nutritional care plan can then be developed, implemented and tailored for appropriate setting.

Accurate measurement of an individual's food intake is the most difficult aspect of evaluating nutritional status. This task is compounded by weaknesses in data-gathering techniques: human behaviour, natural tendency of individual's nutrient intake (which varies considerably from day to day), and limitations of nutrient composition tables and data bases (Lee and Nieman, 2003, pp.74 to 75). Despite these weaknesses, food intake data are valuable in assessing the nutritional status of an individual when used in conjunction with anthropometric, biochemical, and clinical data (Lee and Nieman, 2003, pp. 74 to 75). Before undertaking a dietary assessment, it is important to consider the exact purpose for the assessment; what is to be measured, in whom, over what time period, and how measurements are to be collected. This will help to determine the most appropriate technique for the given purpose and avoid using a technique that does not provide an appropriate measure (Nelson, 2000, p. 315).

Two main approaches used to assess an individual's dietary intake include a prospective approach and a retrospective approach. A prospective approach requires collecting current dietary data, using food records which are kept for a number of days (Nelson, 2000, p. 316). The main advantage of the prospective approach is that it provides a direct measure of a currently consumed diet. The approach may be carried out over a length of time, depending on the level of accuracy in estimating the food consumption or nutrient intake needed at individual level.

The retrospective approach of dietary assessment requires that subjects recall their recent or past diets (Nelson, 2000, p. 316). A retrospective approach includes dietary assessment methods, such as the Food Frequency Questionnaire (FFQ) as well as 24–hour recall (Gibson, 1998, p, 427 Dwyer, 1998, p. 942). These two dietary assessment methods may involve remembering the type and amount of all food items consumed over a specified period of time, as well as recollecting the frequency of consumption of a specific food or food groups (Nelson, 2000, p. 320). Retrospective methods are quick to administer compared to prospective methods. Retrospective methods are also inexpensive in terms of equipment and the time taken to interview the subjects; there is a low respondent burden required compared to prospective methods; hence the chances of

obtaining a representative sample are increased (Nelson, 2000, p. 318 to 319). Several methods can be used to assess dietary intake. Both the 24-hour recall and the food frequency questionnaire are quick, easy to administer, and relatively inexpensive which make them suitable for dietary assessment of groups of individuals (Nelson, 2000, p. 319; Dwyer, 1998, p. 847; Lee and Nieman, 1996, p. 98).

2.6.1 24-hour recall

2.6.1.1 Characteristics

The 24-hour recall is a method of dietary assessment in which an individual is asked to remember, in detail, all the foods and drinks consumed during the period of time in the recent past (Lee and Nieman, 1996, p. 97). In most cases, the time period of recall consists of the previous 24 hours (Lee & Nieman, 1996, p. 97; Hammond, 2004, p. 419). The 24-hour recall can be obtained in a single or multiple occasions (Dwyer, 1999, p. 942). In this method the interviewer assists the respondent to recall the types of foods and drinks consumed in each meal as well as to estimate portion size. After the interview, the recall is checked for omission and/or mistakes (Lee and Nieman, 1996, p. 77). The 24-hour recall is probably the most widely used method for obtaining information on food intake from individuals. The 24-hour recall is used to determine dietary intake of large populations (> 50 people). The information gathered from a 24-hour recall is primarily used to determine the trends of eating patterns.

2.6.1.2 Advantages

The 24-hour recall method is considered quick and easy (Lee and Nieman, 1996, p.98; Nelson, 2000, p. 319; Hammond, 2000, p. 369) and a relatively inexpensive method of data collection regarding food consumption (Lee and Nieman, 1996, p. 98; Dwyer, 1998, p. 943). With a 24-hour recall a subject's motivation is less of a barrier, and compliance is good (Nelson, 2000, p. 319); no long term memory is required. It can be used to estimate nutrient intakes of food groups. It is an objective method and the respondent

does not alter the usual diet (Lee and Nieman, 1996, p. 99; Dwyer, 1998, p. 943). The data obtained by a 24-hour recall can be repeated with reasonable accuracy, and good reliability exists between interviewers (Dwyer, 1998, p. 943).

2.6.1.3 Disadvantages

The 24-hour recall method of data collection is associated with some problems, including, (1) inability to recall the kinds and amounts of food eaten; (2) difficulty in determining whether the day being recalled represents the individual's typical intake; (3) the tendency for a person to over-report low intakes and under-report high intakes of foods (Lee and Neiman, 1996, p. 99; Dwyer, 1998, p. 943; Hammond, 2004, p. 419). A cross-check of concurrent use of food frequency and 24-hour recall questionnaires is recommended to improve the accuracy of the data obtained (Hammond, 2004, p. 419). Lack of knowledge of portion size may create problems. The method does not reflect differences in intake for weekend versus weekday, season to season, or shift to shift (Dwyer, 1998, p. 943). A single 24-hour recall therefore does not represent usual intake, however according to Gibson (2005, p. 44) repeated 24 hour recalls, repeated on nonconsecutive days and/or seasons could be used to establish usual intake of groups of individuals.

2.6.2 Food Frequency questionnaires (FFQ)

2.6.2.1 Characteristics

FFQs are printed lists of foods from which individuals are asked to indicate the typical frequency of consumption, and to state in household measurements, the average amounts consumed per day (Nelson, 2000, p. 366). A FFQ is also a retrospective review of intake frequency of food that is consumed per day or per week or per month (Dwyer, 1998, p. 942; Hammond, 2004, 418). For ease of evaluation, a FFQ arranges food into groups that have common nutrients (Hammond, 2004, p. 418). A FFQ can vary in length ranging from very short (e.g. 9 food items for assessing intake of a single nutrient), to very long

and complex (e.g. 276 items for a national study of diets and heart diseases) (Nelson, 2000, p. 320). A FFQ assesses energy and/or nutrient intake, by determining the frequency of consumption of a limited number of foods known to be major sources of the dietary components in question (Lee and Nieman, 1996, p. 100). FFQs are good for use in describing food intakes of groups of people rather than for individuals (Dwyer, 1998, p. 945).

2.6.2.2 Advantages

A FFQ provides an overall picture of food intake (Dwyer, 1998. p. 943; Hammond, 2000, p. 369), which may be more representative of the usual intake of the individual than the few days of diet record given by the 24-hour record. A FFQ can be self administered (Lee and Nieman, 1996, p. 106; Dwyer, 1998, p. 943). Although it takes time to develop and validate (Nelson, 2000, p. 321), a FFQ is quick to administer (Lee and Nieman, 1996, p. 106; Dwyer 1998, p. 943). The method is also relatively inexpensive for large sample sizes. According to the literature, FFQ is the most accurate method used in evaluating the usual dietary intake (Gibson, 1998, p. 427; Dwyer, 1998, p. 847; Lee and Nieman, 1996, p. 106).

2.6.2.3 Disadvantages

FFQs do not provide meal pattern data, and require knowledge of portion sizes and literacy skills (Hammond, 2004, p. 422). If self administered, the rate of responses may be low and incomplete responses may be given (Dwyer, 1998, p. 943). According to Lee and Nieman (1996, p. 107), a FFQ may not represent the usual foods or portion sizes chosen by respondents. Because not all foods can be included in the lists, total consumption is difficult to obtain, and underestimation can occur. Over and under reporting of foods may occur; each FFQ data needs validation (Dwyer, 1998, p. 943).

2.6.3 Daily food record/Diary

Daily food record/diary is a method of data collection whereby the subject records, at the time of consumption, the identity and amounts of all foods and beverages consumed (Hammond, 2000, p. 363) for a period ranging from one to seven days (Lee and Nieman, 1996, p. 99), or three to seven days (Hammond, 2000, p. 363). Food and drinks can be quantified by estimating portion sizes, using household measures (estimated food record) or by weighing the food and beverages on scales, known as a weighed food record (Nelson, 2000, p. 318). The food record is considered most accurate if the food consumed is documented immediately after consumption or on the same day, after which the nutrient intake is calculated, averaged, and compared with recommended dietary allowances (Hammond, 2000, p. 363). The weighed food diary is considered to be more accurate than an estimated food record (Dwyer, 1998, p. 944). This can also be suitable for determining usual food intake; however it was not used because it takes more time to obtain the data (Lee and Niemman, 1996, p. 101).

2.6.3.1 Advantages

The daily food record/diary method provides a record of food consumption that does not depend on memory (Lee and Nieman, 1996, p. 99). The method can provide data about the respondent's eating habits (Lee and Nieman, 1996, p. 99), thus includes data on quantity of food, how it is prepared, and timing of meals and snacks (Hammond, 2000, p. 369). Data from a multiple daily food record would be more representative of usual food intake than single day data (as in the 24-hour recall).

2.6.3.2 Disadvantages

The daily food record/diary method requires highly motivated respondents to maintain a diary. A daily food record requires measurement of food using scales. Scales are not highly portable, and may cause technical problems (Dwyer, 1998, p. 944). The ability to measure or judge portion sizes and actual food intake may possibly be influenced by the

recording process (Hammond, 2000, p. 369), therefore, affecting reliability. It takes more time to obtain the data. Respondents not recording food intakes on assigned days may be a limitation. Checking and coding records in a standardised way may be difficult.

2.6.4 Other methods suitable to determine usual food intake

Other methods used to determine dietary intake include: (1) duplicate food collections, (2) photographic/video records (visual records), (3) weighed food intake, (4) telephonic interviews (5) observation of food intake, (6) food balance sheets, and (7) computerized techniques (Lee and Nieman, 2003, p. 84 to 91).

2.7 Summary of the chapter

Most people are overweight and obese today because as a population, we take in more energy and expend less. The positive imbalance between energy intake and energy expenditure is caused by a number of factors including socio-demographic factors (e.g. gender, ethnicity, age, and education level, place of residence and socio-economic status), physical activity and eating practices (usual food intake, food frequency and energy and macronutrient intake).

Whether it is needed to lose weight depends on body composition which gives an indication of the amount of body fat, where the fat is located, and what the health risks are. Body composition can be determined through many ways including BMI, WC and WHR. WC and WRC provide the location of fat which BMI does not provide.

Weight management involves adjusting energy intake and expenditure which can be achieved through, good eating practices, nutritional management, behavior changes as well as knowledge of food guide pyramid and SAFBDG.

Eating practices are assessed in a number of ways including 24-hour recall and FFQ. The 24-hour recall is considered a quick and easy method of dietary assessment as well as

relatively inexpensive method of collecting data regarding food consumption. The FFQ is considered quick to administer and it is relatively inexpensive for large sample sizes.

Good eating practices can be achieved by following the guidelines for good eating practices as indicated in nutrient based guidelines e.g. DRI's and food based dietary guidelines e.g. food guide pyramid (which has the advantage of including the recommended number of portions from the different groups in the pyramid), food group and SAFBDG.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The study assessed the association between eating practices and nutritional knowledge and body weight in Nursing Science Students at the University of Fort Hare, Eastern Cape, Republic of South Africa. The ethical considerations, study design, study population, variables and work definitions, techniques, pilot study procedures and statistical analyses that were used to achieve the aim of the study, are described in this chapter.

3.2 Ethical considerations

Ethical approval for the study was granted by Ethical Committee of the Faculty of Health Sciences, University of the Free State (reference number ETOVS NR 37/07). Permission to conduct study at the University of Fort Hare was obtained from the Head of Nursing Sciences, University of Fort Hare (Appendix A) prior to the study. Participants were pre-informed of the procedures to be used during the research duration and had the right to discontinue the study, should they opt to do so (Appendix B). All students provided written consent to participate in the research (Appendix C).

3.3 Study design

A cross-sectional survey was conducted with 200 Nursing Science Students at the University of Fort Hare.

3.4 Sample selection

A list of student names and contact details was obtained from the university admissions office. The list was used to avoid duplications, while effectively and efficiently organizing interviews with the students. The 200 participants comprised of first, second, third and fourth year degree students. The 200 students were then contacted in writing,

and later telephonically, to enquire of their willingness to undertake the research study. Inclusion and exclusion criteria were considered while organizing this study.

3.4.1 Inclusion and exclusion criteria

Both male and female nursing students of the University of Fort Hare, who were registered for an undergraduate degree and who were over the age of 18 years of age, were included. Those male and female students, who were part time, post diploma and post graduate nursing students of the university were excluded.

3.4.2 Sample size

The number of nursing students in various years of degree qualifications selected for this study was determined by the researcher through the use of official records available at the admission's office. The entire undergraduate nursing science student body was initially included in the research study, providing a total of 200 participants. Of 200 participants 162 met the inclusion criteria, and could be reached for data collection. All 162 participants were interviewed and provided information on eating practices, while only 161 provided information on socio-demographic factors and nutritional knowledge. The body weight status of these 161 was measured by the researcher.

3.5 Measurements

Measurements included variables and techniques used in the study.

3.5.1. Variables and operational definitions

Variables are descriptions or explanations of the terms that are measured to fulfill the objectives of the research. Variables and operational definitions included in this study were:

Socio-demographic factors, eating practices, nutritional knowledge and indicators of body weight status.

3.5.1.1 Socio-demographic factors

For the purposes of this study, socio-demographic factors include age, gender, ethnicity permanent residence, education level, and socio-economic status.

3.5.1.2 Eating practice

Eating practices refer to usual daily food, energy and macronutrient intake, meal pattern and food frequency**.**

(a) Usual daily food intake

Usual daily food intake refers to the number of portions consumed from food groups indicated in the Food Guide Pyramid, expressed as below requirement, within requirement or above requirements (Tables 3.1 and 3.2).

Table 3.1 Serving recommendations according to the Food Guide Pyramid (Earl, 2004, p. 376 and 378)

Food groups	Adults	Children 2- to 6 –year-olds
Bread, cereal, rice and pasta	6 – 11 servings /day	6 servings
Fruit	2 – 4 servings / day	2 servings
Vegetables	3 – 5 servings / day	3 servings
Meat and meat alternatives	2 – 3 servings / day	2 servings
Milk and milk products	2 – 3 servings / day	2 servings
Fats and sweets	Use sparingly	Use sparingly

Table 3.2 PORTION SIZES FOR ADULTS (Mathai, 2004, p. 304)

Grain group	**Fruit group**	**Meat group**
		30g of cooked lean meat, poultry,
1 slice of bread	1 piece of fruit or melon wedge	or fish, 1 egg
½ cup of cooked rice or pasta	½ cup of juice	½ cup of cooked dry beans
		2 tablespoons of peanut butter (add
½ cup of cooked porridge	½ cup of canned fruit	one fat exchange)
½ cup of ready-to-eat cereal	½ cup of dried fruit	
1/3 cup samp		
Vegetable group	**Milk group**	**Fats and sweets**
½ cup of chopped raw or cooked	1cup of milk or ½ yogurt	
vegetables	30g of cheese	Use sparingly
1 cup of raw leafy vegetables		2 teaspoons sugar
		2 hardboiled sweets
		10 ml of mayonnaise
		5ml oil, 10ml margarine (medium
		fat)

(b) Energy and macronutrient intake

Energy and macronutrient intake refers to usual daily energy and macronutrient consumption. Macronutrients are expressed as a percentage of total energy intakes and compared to the Recommended Dietary Allowance (RDA) and Adequate Intakes (AI) of the Dietary Reference Intakes (DRIs), and the acceptable macronutrients distribution ranges for good health (Earl, 2004, p. 369; Table 3.3). For good health one needs 45 to 65 % energy intake from carbohydrates, 10 to 30 % energy intake from protein and 20 to 25 % energy intake from fat, per day for age group older than 19 years.

Table 3.3: Acceptable Macronutrient Distribution Ranges (AMDR) (Earl, 2004, p. 369)
% of energy as kJ/day

Nutrients	**1-3 years**	**4 – 18 years**	**> 19 years**
Protein	5 – 20	10 – 30	10 – 35
Carbohydrate	45 – 65	45 – 65	45 – 65
Fat	30 – 40	25 – 35	20 – 25
Added sugar	≤ 25% of total energy		

(c) Meal pattern

Meal pattern refers to the number of meals eaten in a day expressed as once a day, twice a day, three times a day, or four times per day.

(d) Food Frequency

Food frequency refers to how often a given food and fluid is usually consumed per day, per week, per month or never.

3.5.1.3 Nutritional knowledge

For the purpose of this study, nutritional knowledge refers to an understanding of the food groups to be eaten most frequently or the recommended servings from each food group: foods with high fat, sugar and fiber content; foods with low fat, sugar and fiber content; foods high in vitamin C and beta carotene; as well as the functions of each nutrient based on the South African Food-Based Dietary Guidelines and the Food Guide Pyramid. On a scale of between 0 to 100 %, individuals total scoring of more than 50 %, are regarded as knowledgeable, while individuals scoring less than 50 % are regarded as less knowledgeable. Memorandum of nutritional knowledge questions are indicated in Table 3.4.

Table 3.4 Memorandum for nutritional knowledge questionnaires

Questions	Answers
15. According to the South African Food-Based Dietary Guidelines, from which food group should you eat the most?	**Answer No** 5. (Bread, cereal, rice and pasta)
16. From which food group should you eat the least? (Check one)	**Answer No 2**. (Fats, oils and sweets)
17. Select all the high fat foods in this list of foods	**Answers No 1** (Fried chicken) & **No 5** (Peanut butter)
18. How many servings of fruit should you have per day?	**Answer No 2** (2 – 4 Servings per day)
19. How many servings of milk/ yoghurt and cheese should you have per day?	**Answer No 2** (2 – 3 Servings per day)
20. How many servings a day should come from the bread, cereal, rice and pasta group?	**Answer No 2** (6 – 11 Servings per day)
21. Check the food you think is high in fiber.	**Answer No** 1. (Bran flakes)
22. How many servings of vegetables should you eat per day?	**Answer No 2** (3 -5 Servings per day)
23. How many servings per day should come from meat, poultry, fish, dry beans, eggs and nuts?	**Answer No 2** (2 – 3 Servings per day)
24. What advice would you give to a person trying to lose weight? (Select one**).**	**Answers: No 1**. (Increase your activity level and reduce empty calories), **No 2.** (Lookout for lots of highly processed carbohydrates), **No 3.** (Replace fat free foods with whole grains), **No 4.** (Number 1, 2 and 3 are correct)
25. Fat free foods always mean energy free?	**Answer number 2** (No)
26. Check the foods you think are high in vitamin C	**Answer No 5** (Orange)
27. Check the foods you think are best sources of Beta-carotene	**Answers N0 1** (Butternut) & **No 2** (Carrots)
28. Beta carotene is a precursor of? (Check one)	**Answer No 1**. (Vitamin A)
29. Functions of vitamin C include: (check one)	**Answers Numbers** 1 (It is involved in wound healing), **No 2** (It is important in the maintenance of membrane structure) & **No 3** (It aids in the absorption of iron)
30**.** Benefits of fiber includes: (check one)	**Answers numbers 1** (Reduces the risk of constipation), **No 2** (Maintains a healthy body weight), **No 3** (Reduces the risk of colon cancer), **No 4** (Helps alleviate hemorrhoids), & No 5 (All are correct)

3.5.1.4 Indicators of body weight status

Indicators of body weight status refer to current body mass index (BMI), waist-hip ratio (WHR) and waist circumference (WC) of the participants.

(a) Body mass index (BMI)

BMI refers to the relationship between current weight and current height (BMI = kg/m^2) (Hammond, 2000, p. 370). BMI categories are indicated in Table 3.5.

Table 3.5: Classification of BMI (Laquatra, 2004, p. 565)

Classification	BMI kg/m^2
Underweight	< 18.5
Normal weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity, class l	30.0 – 34.9
Obesity, class ΙΙ	35.0 – 39.0
Extreme obesity, class ΙΙΙ	≥ 40

(b) Waist circumference (WC)

WC refers to a measure of the narrowest area below the rib cage and above the umbilicus as viewed from the front (Lee and Nieman, 2003, p. 183). WC categories in men and women associated with increased risk for chronic diseases of lifestyle include:
Ideal (< 94cm male and < 80 cm female), Increased risk (94.0 to 101.9 cm male and 80.0 to 87.9 cm female) and substantial risk (≥ 102 cm in men and ≥ 88 cm in women (SASSO, 2003, p. 4).

(c) Waist-hip-ratio (WHR)

WHR refers to waist circumference in (cm) divided by hip circumference in (cm) (Lee and Nieman, 1996, p. 245). For the purpose of this study WHR values of ≥ 0.9 in men and ≥ 0.8 in women are indicative of tendency for central fat deposition, and possible increased health risk (Barasi, 2003, p. 12); while a WHR value of < 0.9 in men and of < 0.8 in women are considered as ideal.

3.5.2 Techniques

Techniques used in the study were chosen based on the requirements of the aims and objectives of the study. The validity of techniques and reliability of the methods are important to ensure the gathering of valid and reliable data. Validity refers to the extent to which a measure actually represents the value of the measure intended (Katzenellenbogen *et al.,* 1997, p. 90). Whereas reliability refers to the degree of similarity of the information obtained when a particular measurement is repeated on the same subject (Katzenellenbogen *et al.,* 1997, p. 90). For the purpose of this study, questionnaires and anthropometric techniques were used.

3.5.2.1 Questionnaires

Questionnaires were used to determine socio-demographic factors, eating practices and nutritional knowledge.

(i) Socio-demographic questionnaire

Socio-demographic factors included age, gender, ethnic background, place of residence, education level. This information was determined using a questionnaire (Appendix D, section a), during a structured interview with the nursing science students by one trained researcher. Completing all the socio-demographic information by one single researcher contributed to reliability of the information and validity of the results.

(ii) Eating practice questionnaires

A 24-hour recall questionnaire and a simplified food frequency questionnaire were used to determine eating practices.

(a) 24-hour recall questionnaire

A 24-hour recall questionnaire (Appendix E) was used in the study to determine usual daily food consumption, usual energy and macronutrient intake and meal patterns.

(1) Usual daily food consumption

Participants were asked to indicate all foods that they ate and drunk the previous day, as well as the type, amount and the method of preparation. In order to limit the extent of underreporting on the usual food intake, the researcher used multiple-pass 24-hour dietary recalls (Monsen, 2003, p. 228). Reliability was assured by administering 24-hour recall questionnaires on three occasions (Tuesday, Thursday and weekend) and comparing the results. Furthermore, reliability was also assured by interviewing 10 % of 162 randomly selected participants for the second time. The second interview took place one month after the first. Where answers to the questions differed by more than 20 %, the questions were considered unreliable and the results eliminated from the study. To ensure the validity of usual daily food intake, the results obtained using 24-hour recalls were compared with the recommendation from the food guide pyramid. The 24-hour recall information was used to determine the number of serving portions from food groups according to the FBDG (Table 3.1) and the macro nutrient intake (Table 3.2).

(2) Energy and macronutrient intake

Energy and macronutrient intake was also determined from the 24-hour food recall questionnaire data (Appendix E). Energy and macronutrients intake were calculated using a food exchange list. The adequacy of energy and macronutrient intake was compared to

the Dietary Reference Intake (DRI) for male and females ages 19 to 30 years (Rofles *et al*., 2006) and acceptable, recommended macronutrients intake ranges for good health, according to Earl (2004, p. 369). Reliability was assured by interviewing 10 % of the 162 randomly selected participants for the second time. The second interview took place one month after the first. Daily variation of more 100 g in carbohydrate intake, 25 g in protein intake, 20 g in fat intake and 1000 kJ in energy intake or where answers to the questions differed by more than 20 %, the questions were considered unreliable and the results eliminated from the study.

(3) Meal pattern/Number of meals per day

The number of meals consumed per day was determined by the use of eating practice questionnaire (Appendix A question number 10 and 24-hour food recall questionnaire data (Appendix E). Participants were asked to indicate how many meals they ate per day, from a list of seven options, provided in the questionnaire. Number of meals consumed was categorized as, 'once a day', 'twice a day', 'thrice a day', 'four times a day', ' five times a day', 'six times a day', and 'others'. To ensure reliability of the results meal pattern questionnaire was administered and recorded by one single researcher.

(b) Food frequency questionnaire

A simplified food frequency questionnaire (FFQ) (Appendix F) was used in the study to determine the frequency of food consumption categorized as, 'consumes it daily', 'weekly', and 'monthly' or 'does not consume it', according to Nelson (2000, p. 366). The questionnaire concentrated on 26 food items commonly consumed by most people, namely: sweets and chocolate, chips (crisps), cakes and biscuits, cool drinks, cremora, coffee, tea, sugar, full cream milk, low fat milk, eggs, peanut putter, soy beans, legumes, chicken, red meat, fish, bread, porridge, cereal, samp, margarine, fruit juice, fruit, vegetables, salt/stick and royco and alcohol.

The FFQ was based on one used by the Department of Nutrition and Dietetics, University of the Free State, but was further adapted for the purpose of the research study. By using the already validated questionnaires adopted from the Department of Nutrition and Dietetics, University of the Free State, the validity of the techniques used in the present study and reliability of the results was obtained. The FFQ was administered and recorded by one single researcher, thus ensuring the reliability of the results.

(iii) Nutritional knowledge questionnaire

Nutritional knowledge was determined by the use of nutritional knowledge questionnaires (Appendix D, section b). The nutritional knowledge questionnaire was based on a research study carried out by Thakur and D'Amico (1999) but was further modified for the purpose of this research study. Thakur and D'Amico (1999) used a similar questionnaire to determine the relationship between nutritional knowledge and obesity in adolescence. Basing the researcher's current questionnaire on these previously validated questionnaire, adds to the validity of technique used to determine nutritional knowledge of this group and also contributes to reliability of the results. A number of dietitians and experts in the field were consulted to comment on the validity of the questionnaire.

The modified nutritional knowledge questionnaire was based on the understanding of the South African Food-Based Dietary Guidelines and Food Guide Pyramid. The Food Guide Pyramid specifies the daily recommended number of portions from each food group which makes it a suitable tool for evaluation of food intake. The Food Guide Pyramid was designed to help people to put the dietary guidelines into action with the view to improve eating patterns and assist health promotion (Earl, 2004, p. 375). The nutrition knowledge questionnaire included the food groups to be eaten the most and the least; number of servings from each group; foods with high fat, sugar and fiber content; foods with low fat, sugar and fiber content. The responses of the questionnaire composed of 'correct', 'incorrect' and 'I don't know' answers. Accordingly each question answered correctly was considered equivalent to one score. Incorrect and 'I don't know' answers

were not considered to hold any score. The students' level of nutritional knowledge was categorized as, 'is more knowledgeable', when the scores were equal to or more than 50 % and 'less knowledgeable', when the scores were below 50 %. To ensure validity of the nutritional knowledge questionnaire, responses were based on the recommendations of the South African Food-Based Dietary Guidelines and Food Guide Pyramid. Reliability was assured by administering questionnaire and recording by one single researcher.

3.5.2.2 Indicators of body weight status

Indicators of body weight status data were collected by using standard anthropometric techniques as set out by Hammond (2000, pp. 369 to 372) and Lee and Nieman, 2003, p. 123) and recorded in Appendix D section c. Before the standardized techniques could be implemented in the research project, the researcher had to undergo training and practise the standardized methods used in measuring weight, height, waist circumference and hip circumference of adult individuals. The training of the researcher was essential to ensure uniformity and reliability.

(i) Weight

A calibrated platform electronic scale, with a precision to the nearest 100 g was used to determine weight. Individuals wore light clothing and no shoes and stood in the middle of the scale, without touching anything, with their body equally distributed on both feet (Lee and Nieman, 2003, p. 65). Before each participant was weighed, the electronic scale was zeroed and later was calibrated after every 20th student measured by the researcher using a known weight. These acts contributed to validity of the technique used and consequently assured reliable results. Furthermore, the method applied to the measurement of weight and consistency of the researcher when measuring weight was equivalent to a standardized technique. This therefore contributed to reliable and consistent results.

(ii) Height

A stadiometer was used and the standing height of participants, wearing light clothing and no shoes, was measured to the nearest 0.5 cm. Participants stood with their heels together, arms to the side, legs straight, and shoulders relaxed, and head in the Frankfort horizontal plane (looking straight ahead) as described by Lee and Nieman (2003, p. 65). The participants placed their heels, buttocks, scapulae and the back of the head against the vertical board of the stadiometer. Just before the measurement was taken, the participants were asked to breath in deeply, hold the breath, and maintain an erect posture, while headboard was lowered with pressure to compress the hair upon the highest point of the head. Both the researcher and the technique were standardized which contributed to the reliability of the research result.

(iii) Body Mass Index (BMI)

Since BMI refers to the relationship between weight and height, both weight and height were therefore required to calculate BMI. Standardized formula, for weight and height (weight kg/height m^2 (Hammond, 2000, p. 370) as previously discussed, were therefore utilized to determine the BMI which was then categorized as underweight, healthy weight overweight and obese. The techniques were standardized, thus contributed to consistency and reliability of the calculated BMI values.

(iv) Waist Circumference (WC)

Waist circumference (WC) was measured according to standardized procedures described by Hammond (2000, p. 372). A tape measure was used to measure WC. The measurements in centimeters (cm) were taken at the narrowest area below the rib cage and above the umbilicus as viewed from the front. The measurements were taken at the end of a normal expiration. These techniques were standardized which contributed to consistency and reliability of the calculated WC values.

(v) Hip circumference

Hip circumference was measured to the nearest 0.1 cm, according to standardized methods modified from Hammond (2000, p. 372). A tape measure was used and was placed in a horizontal plane around the hips at the point of greatest circumference. The measurement was taken in close contact with the skin, but without indenting the soft skin tissue. Standardization of the researcher and the technique used in hip measurement contributed to reliability and validity of the results.

(vi) Waist-hip ratio (WHR)

WHR is calculated by dividing waist circumference by hip circumference (Lee and Nieman 1996, p. 245). To determine WHR, waist circumference was therefore measured and subsequently divided by measurements of hip circumference according to the formula from Lee and Nieman (1996, p. 245).

3.6 Pilot study

A pilot study was performed on 10 students who met the established inclusion and exclusion criteria of the target group. These students were randomly selected and then excluded from the main study. The aim of the pilot study was to discern any errors and limitations that might have occurred on the questionnaire, anthropometrics measurements procedure, information sheet, or data analysis; any errors were adjusted before research was done. The pilot study was also used to predict the amount of time to allocate to each interview, which lasted for 30 minutes. The responses from the pilot study revealed that a few questions on the questionnaire were not clear and had to be reworded accordingly. The food frequency questionnaire (FFQ) and dietary intake questionnaires were also changed slightly and were therefore adapted from the one drawn up by the Department of Nutrition and Dietetics of University of the Free State. The pilot study revealed that the

procedure used to carry out the interview was adequate. Adaptations and corrections were then done accordingly, based on the outcomes of the pilot study.

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3.7 Data collection process

The procedure for collecting data began by obtaining a list of names of all registered nursing science students at the University of Fort Hare. Participants were then contacted through mail and telephone in order to distribute an information sheet, requesting their permission to partake in the research. Interviews were then conducted with each participant for 30 minutes. The data on socio-demographic, eating practices, nutritional knowledge and indicators of body weight status were measured by the researcher and recorded. The detailed steps of data collection process were as follows:

3.8 Steps in data collection process

Step 1

- Obtaining approval from the Ethical Committee of the Faculty of Health Science, University of the Free State (ETOVs NR 37/07)
- Obtaining permission to conduct research at the University of Fort Hare premises from the University officials (Appendix A)
- Distributing information sheets (Appendix B) and requesting research participation by individuals
- Follow up of participants by telephone and arranging interview dates
- Conducting pilot study
- Adjusting the questionnaires based on the outcomes of the pilot study

Step 2

- Participants arriving for interview at the scheduled time and venue
- Participants completing the consent form (Appendix C)
- Interviews were completed at the Department of Nursing Sciences
- Structured interview was used to determine socio-demographic factors which influence body weight (Appendix D section a) and nutritional knowledge

(Appendix D section b), eating practices using 24-hour recall (appendix E), short food frequency questionnaire (Appendix F) and anthropometric measurements (appendix D sections c)

Step 3

- Conducting reliability interviews with 16 participants, randomly selected one month after the initial interview.

3.9 Statistical analysis

Statistical analysis involved a descriptive analysis, namely, frequencies and percentages for categorical variables and means and standard deviations or medians and percentiles for continuous variables per group. The groups were compared by means of 95 % confidence intervals. Tabulated values were rounded off to one decimal point. Anthropometric status was described by means of descriptive statistics. Adequacy of dietary intake was evaluated by comparing the average from the three 24 hour-recall of each student to the intakes recommended by Food Guide Pyramid. Nutritional knowledge was evaluated by comparing students' responses with the recommendations from food guide pyramid and from the South African Food-Based Dietary guideline. To determine the effect of nutritional knowledge and body weight, percent scores were compared with different categories of BMI. Energy and macronutrient intakes were analyzed by comparing the intake for each student to the recommended ratio for total energy intake (TEE). The recommended ratio for TEE should consist of 45 to 65 % energy from carbohydrate, 10 to 35 % energy from protein and 20 to 30 % energy from fat (Earl, 2004, p. 369). The statistical analysis was conducted by the Department of Biostatistics, University of the Free State.

3.10 Problems encountered during performance of the study

The problems encountered during the performance of the study included: some of the respondents tended not to remember all the foods they had eaten the previous day; some were not familiar with portion sizes; at times some tended to underestimate food intakes

to impress the researcher; and some of the participants did not keep their scheduled interview time or date.

To ensure that the respondent recalled all the foods eaten the previous day, the researcher probed for more responses that helped the respondent to indicate all foods and amounts eaten the previous day.

To ensure that the respondents tendency to exaggerate low intakes and underreport high intakes of foods did not influence the reliability of results for usual food intake, a 24-hour recall questionnaire was administered by the researcher on three different occasions (Tuesday, Thursday and weekend). To solve the problem of the respondent not knowing the portion size, several household measuring utensils (e.g. cups spoons, plates) were shown to the respondents before the interview. To solve the problem of the participants not keeping the scheduled interview time, another date was arranged for interviews. All the socio-demographic factors, eating practices and nutritional knowledge questionnaires were administered by the researcher through face to face interview.

Anthropometric measurement (e.g. weight, height, body mass index, waist circumference, hip circumference and waist-hip ratio) were measured and recorded by a single researcher. This contributed to the reliability of the information.

CHAPTER 4: RESULTS

4.1 Introduction

The results are presented as socio-demographic factors, eating practices, nutritional knowledge and body weight status of nursing students as well as the association between the variables and body weight status in terms of body mass index (BMI).

4.2 Socio-demographic factors

The median age was 24.9 years (ranging from 18 to 42 years). Of the 161 nursing students, 68.3 % were female while 31.7 % were male (Table 4.1). The majority of nursing students were black (96.3 %) followed by colored (2.5 %) and white (1.2 %). There were 27.3 % first years students, 26.1 % second years, 19.9 % third years and 26.7 % fourth year students. Approximately 87.6 % of the students were single at the time of study. At the time of the interviews, approximately 67.7 % of students resided in the university hostels as current residences; most of the students' permanent places of residence were rural areas (42.2 %) and township (37.3 %) (Table 4.1).

Table 4.1 Socio-demographic characteristics of nursing students (n=161)

Variable	n	%	Lower Quartile (25^{th})	median	Upper Quartile (75^{th})
Age (Years)	161	100	22.3	24.9	28
Gender					
Male	51	31.7			
Female	110	68.3			
Ethnicity					
Black	155	96.3			
White	2	1.2			
Colored	4	2.5			
Academic level					
First year	44	27.3			
Second year	42	26.1			
Third year	32	19.9			
Fourth year	43	26.7			
Marital status					
Married	20	12.4			
Single	141	87.6			
Current place of Residence					
University hostels	109	67.7			
Private rental	28	17.4			
At home	23	14.3			
Other	1	0.6			
Permanent place Of residence					
Urban					
Town	33	20.5			
Township	60	37.3			
Rural areas	68	42.2			

4.3 Eating practices

Eating practices include usual daily food intake, meal pattern and food frequency.

4.3.1 Usual daily food intake

The usual daily consumption according to food groups, energy and macronutrients intake will be presented.

4.3.1.1 Usual daily consumption of food groups

The intake of milk and milk products by majority (92.6 %) of nursing students was less than the recommended two servings per day (Table 4.2). Similarly, 97.5 % of nursing students consumed less than the recommended three servings of vegetables per day, and 42.2 % consumed less than the recommended two to four servings of fruits per day. Only 48.5 % of nursing students consumed the recommended two to four servings of fruit per day.

A large percentage of students (81 %) ate more than the recommended (2 to 3) servings of meat, poultry, fish, legumes, eggs and nuts (Table 4.2). Fifty percent of nursing students ate more than the recommended (≥ 4) servings of fats and oils per day, while 77.8 % ate more than the recommended serving of sweets and sugar. The majority (82.7 %) of the nursing students consumed the recommended (6 to 11) servings of bread, cereal, rice and pasta per day; while only 3.7 % of nursing students ate less that the recommended serving and 13.6 % ate more than recommended daily serving for bread, cereal, rice and pasta. None of the data were excluded due to poor reliability. As dietary intake data can change from day to day, a change of 1 was considered non significant and according to this calculation the dietary intake data did not deviate more than 20 % , indicating that the intake of all food groups were reliable.

Table 4.2 Usual daily food intake of nursing students summarized in food groups according to the Food Guide Pyramid (Earl, 2004, p. 376 & 378)

Food groups	Number of portions/day	n	%
Milk and milk products (n=162)			
Below requirement	< 2 servings per day	150	92.6
Adequate	2-3 servings per day	12	7.4
Meat, Poultry, Fish, Legumes, Eggs and Nuts (n=161)			
Below requirement	< 2 servings per day	5	3.0
Adequate	2-3 serving per day	26	16.0
Above requirement	> 3 servings per day	131	81.0
Fruits (n=161)			
Below requirement	< 2 servings per day	68	42.2
Adequate	2-4 servings per day	78	48.5
Above requirement	> 4 servings per day	15	9.3
Vegetables (n=161)			
Below requirement	< 3 servings per day	157	97.5
Adequate	3-5 servings per day	4	2.5
Breads, Cereal, Rice and Pasta (n=162)			
Below requirement	<6 servings per day	6	3.7
Adequate	6-11 servings per day	134	82.7
Above requirement	> 11 servings per day	22	13.6
Fats and oils (n=162)			
Adequate	≤ 4 servings per day	81	50.0
Above requirement	≥ 4 servings per day	81	50.0
Sweets and sugar (n=162)			
Adequate	≤ 4 servings per day	36	22.2
Above requirement	≥ 4 servings per day	126	77.8
Alcohol (n=162)			
Recommended allowance	≤ 2 measures per day	160	98.8
Above recommendation	> 2 measures per day	2	1.2

4.3.1.2 Energy and macronutrient intakes

The median energy intake for all students was 5776.7 kJ per day, while the median energy intake for male and females were 6333.3 kJ and 5543.3 kJ per day respectively (Table 4.3). The median intake of protein was 71.3g, carbohydrates 205.8g and fat 34.7 g per day respectively (Table 4.3). Approximately all students (99.4 %) consumed protein within the recommended range of 10 to 35 % of total energy (%TE) from protein. The

intake by the majority of students of carbohydrate (77.2 %) and fat (64.8 %) was also within the recommended range of 45 to 65 % and 20 to 35 % of total energy intake respectively. Of the 162 students, 32.1 % reported fat intake below the recommended range of fat energy, while 20.4 % reported a carbohydrate intake above the recommended range of carbohydrate energy. None of the data had to be excluded due to poor reliability. As dietary intake data can change from day to day, a daily variation of 100 g in carbohydrate intake, 25 g in protein intake, 20 g in fat intake and 1000 kJ in energy intake was considered not significant and according to this calculation the dietary intake data did not deviate more than 20 %, indicating that the intake of energy and macronutrients were reliable.

Table 4.3 Energy and macronutrient intake of nursing students (n=162); % TE = percent of total energy

Variable	**n**	**%**	**Lower** Quartile	**median**	**Upper** Quartile
Protein (g)			60.7	71.3	82.3
10 -35 %TE	161	99.4			
> 35 %TE	1	0.6			
Carbohydrates (g)			174.7	205.8	235.0
< 45 % TE	4	2.5			
45 – 65 % TE	125	77.2			
> 65 % TE	33	20.4			
Fat (g)			26.7	34.7	40.0
< 20 % TE	52	32.1			
20 – 35 % TE	105	64.8			
> 35 % TE	5	3.1			
Total energy (kJ)			5113.5	5776.7	6586.0
Total energy (kJ) for male (n=51)			5611.7	6333.3	6813.3
Total energy (kJ) for female (n-110)			4978.3	5543.3	6313.3

4.3.2 Meal patterns of nursing students

Of the 162 students who participated in the study, 161 were included in the meal pattern survey. The majority of these students ate three meals (59 %) whilst 23.6 % ate two and 12.4 % ate four meals a day. The remaining 5.0 % ate five meals a day. All 160

students (100 %) indicated that the most frequently missed meal was breakfast (Table 4.4).

Table 4.4 Meal patterns of nursing students

Characteristics	n	%
Number of meals per day (n=161)		
Two	38	23.6
Three	95	59.0
Four	20	12.4
Five	8	5.0
Frequently skipped meal (n=160)		
Breakfast	160	100

4.3.3 Food frequency

The top five ranking foods consumed at high frequencies on a daily basis included salt/stock/royco (85.8 %), margarine/oil/fat (67.9 %), sugar (58.6 %), bread (55.6 %) and cereal (34.7 %) in that order (Table 4.5). The top ten ranking foods consumed at high frequencies on a monthly basis included chicken (89.5 %), red meat (88.3 %), cake/biscuits (85.8 %), vegetables (85.2 %), chips (83.2 %), eggs (82.1 %), fish (77.8 %), sweets/chocolate (77.2 %), samp/mielie rice (76.5 %) and cool drinks (72.2 %) in that order (Table 4.5) The foods that were indicated as not eaten included low fat/skim milk (76.5 %), alcohol (73.5 %), cremora (48.2 %), legumes (45.7 %), and peanut butter (42.6 %), in that order (Table 4.5).

Table 4.5 Frequency of foods consumption of nursing students (n=162)

Food	do not eat		eat monthly		eat daily	
	n	%	n	%	n	%
Sweets/chocolates	7	4.3	125	77.2	30	18.5
Chips (crisps)	7	10.5	135	83.3	10	6.2
Cake/biscuits	19	11.7	139	85.8	4	2.5
Cool drinks	13	8.0	117	72.2	32	19.8
Cremora	78	48.2	61	39.7	23	14.2
Coffee	43	26.5	85	52.5	34	21.0
Tea	63	38.9	71	43.8	28	17.3
Sugar	9	5.6	58	35.8	95	58.6
Full cream	31	19.1	111	68.5	20	12.4
Lowfat/skim milk	124	76.5	33	20.4	5	3.4
Eggs	9	5.6	133	82.1	20	12.4
Peanut butter	69	42.6	92	56.8	1	0.6
Soya mince/legumes (baked beans, dried beans/ Peas and lentils)	74	45.7	87	53.7	1	0.6
Chicken	6	3.7	145	89.5	11	6.8
Red meat	18	11.1	143	88.3	1	0.6
Fish	33	20.4	126	77.8	3	1.9
Bread			72	44.4	90	55.6
Cooked porridge	55	34.0	107	66.0	-	-
Cereal (Morevit/pronutro)	42	25.9	114	70.4	6	34.7
Samp/mielie rice	32	19.8	124	76.5	6	3.7
Margarine/oil/fat	1	0.6	51	31.5	110	67.9
Fruit juice	6	9.9	112	69.1	34	21.0
Fruit	0	0.0	124	76.5	38	23.5
Vegetable	4	2.5	138	85.2	20	12.3
Salt/stock/Royco	0	0.0	23	14.2	139	85.8
Alcohol	119	73.5	42	25.9	1	0.6

4.4 Nutritional knowledge

Nutritional knowledge includes source of information, the knowledge of the food guide pyramid and the South African food based dietary guidelines and median of correct answer in percentage.

4.4.1 Source of nutrition information

Nutrition information was mostly obtained from the media (47.8 %) and school/institution for teaching (35.4 %) (Table 4.6).

Table 4.6 Source of Nutritional information of nursing students (n=162)

Sources of nutrition Information	n	%
Friend		
Yes	37	23
No	124	77.0
School/institution of teaching		
Yes	7	35.4
No	104	64.6
Media		
Yes	77	47.0
No	84	52.2
Parents		
Yes	22	13.7
No	139	86.3
Others		
Yes	5	3.1
No	156	96.0

4.4.2 Knowledge of the food guide pyramid and the South African food based dietary guidelines

Of the 162 students, 69.3 % did not know which foods should be eaten the most according to the dietary guidelines (Table 4.7). A large percentage of students did not know the daily recommended servings for the following food groups: milk/yoghurt and cheese (60.2 %); bread, cereal, rice and pasta (85.7 %); vegetables (54.7 %); meat, poultry, fish dry beans, eggs and nuts (57.2 %); and fruits (44.7 %). Almost half of the students (49.7 %) did not know that peanut butter was high in fat. A large percentage of

students knew the correct responses for the following nutrition knowledge questions: a knowledge of the food group to be eaten the least (75.2 %); recommended servings for fruit (55.3 %); recommended serving for vegetables (45.3 %); food with a high fiber content (92.6 %); knowledge of fried chicken as a food with a high fat content (97.5 %); peanut butter as food with high fat content (50.3 %); best sources of beta carotene (96.3 %) (Table 4.7).

Table 4.7 Nutritional knowledge responses from students: no of students (n=162)

Nutritional knowledge questions	n incorrect	% incorrect	n correct	% correct
Knowledge of **food group to eaten the most**	111	69.3	51	31.7
Knowledge of **food group to be eaten the least**	41	24.9	121	75.2
Knowledge of recommended **fruit serving** a person should eat each day	73	44.7	89	55.3
Knowledge of recommended **milk/yoghurt and cheese** serving a person should have per day	98	60.2	64	39.8
Knowledge of recommended **bread, cereal, rice and pasta** serving a person should have per day	140	85.7	23	14.3
Knowledge of recommended **vegetable servings** a person should have **per day**	89	54.7	73	45.3
Knowledge of recommended **meat, poultry, fish dry beans, eggs and nuts** serving a person should have per day	93	57.2	69	42.9
Awareness of which foods have more **fiber**	13	7.5	149	92.6
Knowledge of **fried chicken** as food with **high fat** content	5	2.5	157	97.5
Knowledge of **peanut butter** as food with **high fat** content	81	49.7	81	50.3
Knowledge of foods which are **best sources of β carotene**	6	3.7	155	96.3

4.4.3 Median correct answers and percentage obtained from nutritional knowledge questionnaire

Median number of correct answers obtained by the students from nutritional knowledge questions was 9 out of 15 questions obtained by 56.3 % of the group (Table 4.8).

Table 4.8 Median marks obtained from nutritional knowledge questions (n=162)

Category	Lower quartile 25%	Median	Upper quartile 75%
Number of correct marks (n-162)	7.0	9.0	10.0
median percent of correct answers (n=162)	43.8%	56.3%	62.5%

4.5 Body weight status

Body weight status includes BMI, and fat distribution; WC and WHR.

4.5.1 Body mass index

The median BMI for the total group was 24.9 kg/m^2 ranging from 16.7 kg/m^2 to 44.5 kg/m^2 (Table 4.9). Approximately 31.7 % of students were overweight (BMI 25-29.9 kg/m^2), 18 % were obese (BMI $\geq$ 30 kg/m^2) and 46 % had healthy body weight (BMI 18.5-24.9 kg/m^2). Only 4.4 % of students were underweight (BMI < 18.5). Of the 51 male students 21.6 % were overweight and 9.8 % were obese, 9.8 % were underweight and 58.8 % were of a healthy weight. Approximately 40 % of the 110 female students were of a healthy weight, 36.4 % were overweight and 21.8 % were obese, while only 1.8 % were underweight (Table 4.9)

Table 4.9 Median body mass index according to categories for males and females

BMI (kg/m^2) Categories	**n**	**%**	**Lower** Quartile	**median**	**Upper** Quartile
			25%		**75%**
Group (n=161)			21.7	24.9	28.4
BMI < 18.5 (Underweight)	7	4.4			
BMI 18.5-24.9 (Normal weight)	74	46.0			
25-29.9 (Overweight)	51	31.7			
BMI ≥ 30 (Obese)	29	18.0			
Male (n=51)					
BMI < 18.5 (Underweight)	5	9.8			
BMI 18.5-24.9 (Normal weight)	30	58.8			
BMI 25-29.9 (Overweight)	11	21.6			
≥ 30 (Obese)	5	9.8			
Female (n=110)					
BMI < 18.5 (Underweight)	2	1.8			
BMI 18.5-24.9 (Normal weight)	44	40.0			
BMI 25-29.9 (Overweight)	40	36.4			
BMI ≥ 30 (Obese)	24	21.8			

4.5.2 Waist circumference (WC) and waist-hip-ratio (WHR)

The median WC for the total group of nursing students was 87 cm ranging from 66 cm to 126 cm. Of the 161 students, 38.5 % were in the substantial risk range, and 26.7 % were in the increased risk range, while 34 % were in the ideal waist circumference range (Table 4.10).

The median for WHR of nursing students was 0.9 (Table 4.10). Of the 161 nursing students, 62.7 % had an ideal WHR (< 0.9 cm males and 0.8 cm females) while 37.3 % had WHR of increased health risk (≥ 0.9 male and ≥ 0.8 female) (Table 4.10).

Table 4.10 Median waist circumference and waist-hip-ratio, and categories for males (n=51) and females (n=110); (N=161)

WC and WHR Categories	n	%	Lower Quartile	Median quartile	Upper quartile
Median WC			82	87	96
WC categories					
Ideal (< 94cm male & < 80 cm female)	56	34.0			
Increased risk (94.0 -101.9 cm male & 80.0-87.9cm female)	43	26.7			
Substantial risk ≥102 cm male & ≥ 88 cm female	62	38.5			
Median WHR			0.8	0.9	0.9
WHR categories					
Ideal < 0.9 males & < 0.8 female	101	62.7			
Increased risk ≥0.9 for male & ≥ 0.8 for female	60	37.3			

4.6 Association between the variables

The 95 % CI for median difference between BMI and socio-demographic factors, eating practices and nutritional knowledge was determined.

4.6.1 Association between energy intake and gender

Table 4.11 shows that median energy intake for males of (6333.3 kJ) were significantly higher than that of females (5543.3 kJ) [236.7; 970.0]*

Table 4.11 Energy intake of male and female nursing students

Students by gender	Lower quartile	Median	Upper quartile
Male (n=51)	5611.7	6333.3*	6813.3
Female (n=110)	4978.3	5543.3*	6313.3

4.6.2 Association between BMI and gender

The percentage of female nursing students who were overweight (36.6 %) and obese (21.8 %) was more than the male students at overweight (21.6 %) and obese (9.8 %) (Table 4.9).

4.6.3 Association between BMI and permanent place of residence

There was no statistical significant difference between BMI categories with regards to gender and place of residence (Table 4.12). There was however a tendency of underweight nursing students who resided in urban (town and township) rather than overweight. The 95 % CI for the median difference was [-11.4 %; 43.0 %].

Table 4.12 Association between BMI and socio-demographic factors (n=161)

	Underweight (< 18.5 kg/m^2)		Healthy weight (18.5-24.9kg/m^2)		Overweight (25-29.9kg/m^2)		Obese (≥ 30kg/m^2)		
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**Total**
Group	7	4.4	74	46	51	31.7	29	18.0	161
Gender									
Male	5	9.8	30	58.8	11	21.6	5	9.8	51
Female	2	1.8	44	40.0	40	36.4	24	21.8	110
Permanent place of residence									
Urban									
Town	3	42.9	21	28.4	9	11.3			33
Township	3	42.9	19	25.7	38	47.5			60
Rural areas	1	14.3	34	46	33	41.3			68
Current place of Residence									
hostels	1	54.1	54	73	51	63.8			109
Private rental	1	14.3	13	17.6	14	17.5			28
At home	2	28.6	7	9.5	14	17.5			23

There was no statistical significant difference between the BMI categories with regards to meal pattern, including the number of meals eaten per day and the frequently skipped meal per day (Table 4.13). The percentage of students who ate two meals, three meals, four meals and five meals a day from the different categories of BMI were relatively close to one another (Table 4.13)

Table 4.13 Association of body weight status and meal pattern

	Underweight (< 18.5 kg/m^2)		Healthy weight (18.5-24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)		
Characteristic	**n**	**%**	**n**	**%**	**n**	**%**	**Total**
No of meals/day (n=161)							
Two	1	14.3	16	21.6	21	26.3	38
Three	5	71.4	50	67.6	40	50	95
Four	1	14.3	6	8.1	13	16.3	20
Five	0	0.0	2	2.7	6	7.5	8
Frequently skipped meal (n=160)							
Breakfast	7	100	73	100	80	100	160

There was no statistical significant difference between the BMI categories with regard to median energy, and macronutrient intake (Table 4.14). There was however a tendency for students with a healthy body weight to consume more carbohydrates (median = 207.5 g) than underweight students (median = 204.3 g)

Table 4.14 Association between BMI and energy and macronutrient intake: (n=161)

Median Macronutrient Characteristic	Underweight (<18.5kg/m^2) n	Healthy weight (18.5-24.9kg/m^2) n	Overweight /obese (≥ 25kg/m^2) n
Carbohydrates (g)	204.3	207.5	205.7
Protein (g)	80.0	67.0	80.9
Fat (g)	36.7	33.3	40.0
Energy (kJ)	5663.3	5687.5	6540.8

4.6.4 Association between WC and energy and macronutrient intake

There was no statistical significant difference between the WC categories with regards to energy, and macronutrient intake (Table 4.15). There was however a tendency for students with an ideal WC to consume more protein than students with WC values of increased health risk [0; 13.0] (Table 4.15) Likewise there was also a tendency for students with WC values of substantial health risk to consume more carbohydrate than those with increased risk WC values CI 95 % [-27.0; 8.0] (Table 4.15).

Table 4.15 WC and energy and macronutrient intakes based on median intakes (n=161)
Ideal WC = <94 cm for men &< 80cm for female, Increased risk WC = 94-102 cm for male & 80-88 cm for female & substantial health risk WC = >102 for men & >88 for female

Median Macronutrients Characteristic	Ideal n	Increased Risk n	Substantial Health Risk n
Carbohydrates (g)	210.7	192.0	207.7
Protein (g)	74.0	65.7	80.0
Fat (g)	34.7	31.7	40.0
Energy (kJ)	5812.2	5446.7	6510.0

There was a statistical significant difference between underweight nursing students and overweight/obese individuals with regard to their fat intake [0.1 %; 50.1 %]* (Table 4.16) Underweight individuals consumed less fat than overweight/obese nursing students (Table 4.16). There was also a tendency for underweight nursing students to consume less fat than healthy weight nursing students; the 95 % CI for the median difference was [-3.5 %; 47.4 %] (Table 4.16).

Table 4.16 Association between BMI and fat intake: Underweight (n=7), normal weight (n=74), overweight/obese (n=80)

	Underweight (< 18.5kg/m^2)		Healthy weight (18.5-24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Characteristics	**n**	**%**	**n**	**%**	**n**	**%**
Protein (g)						
10 -35	7	100	74	100	79	98.8
> 35	0	0	0	0	1	1.3
Carbohydrates (g)						
< 45	1	14.3	6	85.7	0	0
45 – 65	0	0	56	75.7	18	24.3
> 65	3	3.8	62	77.5	15	18.8
Fat (g)						
< 20	1	14.3	29	39.2	22	27.5
20 – 35	5	71.4	42	56.7	57	71.3
> 35	1	14.3	3	4.1	1	1.3

The 95 % CI for median difference between BMI and food groups was used to determine the association between BMI and consumption from different food groups.

There was no statistical significant difference between BMI categories with regard to intake of milk and milk products and meat and meat alternatives, There was however a tendency for nursing students with a healthy body weight to consume milk and milk products below requirement compared to underweight group [-43.5; 8.3]. Likewise the tendency for overweight/obese nursing students' daily consumption of milk to be below requirement was greater than in underweight individuals [-45.2; 5.9].

A significant higher percentage (14.3 %) of underweight individuals consumed bread and cereals below the recommended daily requirements than those in overweight/obese

individuals at 1.3 % (Table 4.17) [0.1 %; 50.1 %]*. There was also a tendency for underweight students to consume bread and cereal below the recommended daily allowance compared to those with a healthy body weight [-5.1 %; 46.1].

Table 4.17 Association between BMI and daily recommended food groups

Underweight (n=7), normal weight (n=74), overweight/obese (n=80)

Food groups	Underweight (< 18.5 kg/m^2)		Healthy weight (18.5 -24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
	n	%	n	%	n	%
Breads and cereals						
< 6 servings	1	14.3	4	5.4	1	1.3
6-11 servings	2	71.4	61	82.4	68	85
> 11 servings	1	14.3	9	12.7	11	13.8
Meat and meat Alternatives						
<2 servings	0	0.0	7	9.5	3	3.8
2-3 servings	0	0.0	8	10.8	9	11.3
> 3 servings	7	100	59	79.7	68	85.0
Milk and milk Products						
<2 servings	6	85.7	68	91.9	75	93.8
2-3 servings	1	14.3	6	8.1	5	6.3
>3 servings						

There was a statistical significant difference between underweight and overweight/obese nursing students in terms of their frequency of sweet and chocolate consumption. The percentage of underweight students who ate sweets and chocolate on a daily basis was less than overweight/obese individuals at 57 % and 90.0 % respectively (Table 4.18). The 95 % CI for the median differences was [-65.3; -4.5]*. There was also a tendency for underweight individuals to consume less sweets and chocolate on a daily basis than normal weight individuals [-60.7; 0.8].

There was a statistical significant difference between all categories of BMI in terms of their daily chips (crisps) consumption. The percentage of underweight students who ate crisps/chips on a daily basis was less than healthy weight and overweight/obese

individuals (Table 4.18). The 95 % confidence intervals for percentage difference for categories of BMI and frequency of crisps/chips consumption were: underweight vs healthy body weight individuals, 95 % CI [-61.5; -1.7]*, underweight vs overweight/obese individuals, 95 % CI [-66.0; -6.8]*, and healthy body weight individuals' vs overweight/obese individuals, 95 % CI [-19.1; 9.4].

There was no statistical significant difference between BMI categories in terms of their frequency of cakes and biscuits consumption; the percentage of individuals who consumed cakes and biscuits daily from different categories of BMI was relatively close to one another (Table 4.18). There was however a tendency for underweight nursing students to consume more cake and biscuits than overweight/obese individuals [-6.5; 47.9].

There was no statistical significant difference between BMI categories in terms of their frequency of cool drink intake; the percentage of students who consumed cool drinks daily from different categories of BMI was relatively close to one another (Table 4.18).

Healthy weight and overweight/obese nursing students differ significantly [-24.7; -0.4]* in their consumption of full cream milk. Individuals with normal body weight consume less full cream milk on a daily basis than overweight individuals (Table 4.18). Tendency for underweight individuals to consume more full cream milk on a daily basis was also greater than individuals with a healthy body weight 95 % CI [-12.9; 39.6].

There was a statistical significant difference between BMI categories with regard to their daily consumption of low fat milk. A comparison of underweight and normal weight individuals in terms of their daily low fat milk consumption revealed 95 % CI [7.3; 68.8]* while the 95 % CI for healthy weight and overweight/obese was [8.7; .69.9]*. Underweight individuals eat more low fat milk on a daily basis than normal weight and overweight/obese individuals (Table 4.18)

Table 4.18 Association between BMI and frequency of food consumption: Underweight (n=7), normal weight (n=74), overweight/obese n=80

	Underweight (< 18.5kg/m^2)		Healthy weight (18.5 -24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Foods	**n**	**%**	**n**	**%**	**n**	**%**
Sweets and Chocolate						
Never eats						
Eats monthly	3	42.9	11	14.9	8	10.0
Eats daily	4	57.1	63	85.1	72	90.0
Chips (crisps)						
Never eats	0	0.0	0	0.0	1	1.3
Eats monthly	5	71.4	24	32.4	21	26.3
Eats daily	2	28.6	50	67.6	58	72.5
Cakes, biscuits						
Never eats	0	0.0	4	5.4	5	6.3
Eats monthly	1	14.3	24	32.4	32	40.0
Eats daily	6	85.7	46	62.2	43	53.8
Cool drink						
Never eats						
Eats monthly	3	42.9	30	40.5	38	47.5
Eats daily	4	57.1	44	59.5	42	52.5
Full cream milk						
Never eats	0	0.0	4	5.4	3	3.8
Eats monthly	6	85.7	61	82.4	57	71.3
Eats daily	1	14.3	9	12.2	20	25.0
Low fat milk						
Never eats	1	14.3	28	37.8	34	42.5
Eats monthly	2	28.6	34	46.0	34	42.5
Eats daily	4	57.1	12	16.2	12	15.0

4.6.5 Association between nutritional knowledge and body weight

There was no statistical significant difference between the BMI categories with regard to the students' source of information about nutrition. The tendency for overweight individuals to obtain nutritional information from media was greater than underweight students [-46.9; 13.2]. A tendency of underweight students to choose school as their source of nutritional information was greater than normal weight and overweight/obese students. The 95 % confidence intervals for the percentage difference were: underweight

and normal weight individuals [-14.8; 48.2] and underweight *vs* overweight/obese individuals [-8.0; 54.4].

Table 4.19 Association between BMI and source of nutrition information: Underweight (n=7), normal weight (n=74), overweight/obese n=80

Source of nutrition Information	Underweight (< 18.5kg/m^2) n	%	Healthy weight (18.5 -24.9kg/m^2) n	%	Overweight /obese (≥ 25kg/m^2) n	%
Friends						
Yes	1	14.3	16	21.6	20	25
No	6	85.7	58	78.4	60	75.0
Media						
Yes	2	28.6	33	44.6	42	52.5
No	5	71.4	41	55.4	38	47.5
Parents						
Yes	0	0	14	18.9	8	10.0
No	7	100	60	81.1	72	90.0
School/institution of teaching						
Yes	4	56.1	28	37.84	25	31.3
No	3	42.9	46	62.2	55	68.8

The association between BMI and knowledge of foods with a high fat content was established by comparing BMI to answers given for different foods.

There was no statistical significant difference between BMI categories with regard to knowledge of foods with a high fat content; the percentage of individuals who knew whether fried chicken had high fat content from the different categories of BMI, was relatively close to one another (Table 4.20). There was however a tendency for overweight/obese students to choose fried chicken, as a food with a high fat content compared to underweight students [-34.2; 6.7].

There was no statistical significant difference between BMI categories with regard to their knowledge of white bread as a food with a high fat content; the percentage of individuals who thought that white bread had a high fat content from the different categories of BMI was relatively close to one another (4.20). The tendency of

underweight students (BMI < 18.5 kg/m^2) to choose white bread was greater than healthy weight and overweight/obese students at [-3.5; 47.4] and [-4.4; 46.4] respectively.

Table 4.20 Association of BMI and knowledge of foods with high fat content: Underweight (n=7), normal weight (n=74), overweight/obese n=80 and group (n=161)

	Underweight (< 18.5kg/m^2)		Healthy weight (18.5 -24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Foods	**n**	**%**	**n**	**%**	**n**	**%**
Fries chicken						
Yes	7	100	71	96.0	79	98.8
No	0	0	3	4.1	1	1.3
White Bread						
Yes	1	14.3	3	4.1	4	5.0
No	6	85.7	71	96.1	76	95
Peanut butter						
Yes	3	42.8	34	46	44	55
No	4	57.1	40	54.0	36	45.0

There was a statistical significant difference between underweight and healthy body weight students with regard to their knowledge of recommended servings for milk, cheese and yoghurt [11.8; 65.9])*. There was also a statistical significant difference between underweight and overweight/obese with regard to their knowledge of recommended servings for milk, cheese and yoghurt [7.1; 61.1]* (Table 4.21). Over 85 % of underweight individuals (85.7 %) knew the recommended servings for milk, cheese and yoghurt while only 35.1 % of students with healthy body weight knew the correct answer and 40.0 % of overweight/obese individuals knew the correct answer.

There was a statistical significant difference between the healthy body weight students and overweight students with regard to their knowledge of recommended servings for bread, cereal, rice and pasta. The 95 % confidence interval for the percentage difference was [0.3 %; 22.9 %]*. The percentage of underweight individuals who knew the daily recommended serving for bread, cereal, rice and pasta was 14.3 %; 20.3 % of normal

weight individuals knew the correct response while only 8.8 % of overweight/obese individual knew the correct answer (Table 4.21).

Table 4.21 Association between BMI and knowledge of recommended servings of food groups: Underweight (n=7), healthy weight (n=74), overweight/obese (n=80) and total group (n=161)

	Underweight (< 18.5kg/m^2)		Healthy weight (18.5-24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Food groups	**n**	**%**	**n**	**%**	**n**	**%**
Bread, cereal, Rice and pasta						
<6 servings	2	28.6	41	55.4	48	60
6-11 servings	1	14.3	15	20.3	7	8.8
>11 servings	0	0.0	1	1.4	4	5.0
Don't know	4	57.1	17	23.0	21	26.3
Milk, cheese and yoghurt						
<2 servings	1	14.3	47	63.5	45	56.3
2-3 servings	6	85.7	26	35.1	32	40.0
>3 servings	0	0.0	1	1.4	3	3.8

There was a statistical significant difference between the normal weight students and overweight/obese students with regard to their knowledge of the fibre content of carrots [0.3 %; 22.9 %]*. Over 18.9 % participants with normal weight indicated carrots as food with high fiber as supposed to only 7.5 % overweight/obese individuals (Table 4.22).

There was a statistical significant difference between underweight students and overweight/obese individuals in terms of their knowledge of hamburger as a food high in fiber content [3.4; 60.4]*. Over 28.6 % of underweight individuals indicated that humbuggers were high in fiber compared to 3.8 % overweight/obese students (Table 4.22).

Table 4.22 Association between BMI and knowledge of foods high in fibre content: Underweight (n=7), normal weight (n=74), overweight/obese n=80

	Underweight (<18.5kg/m^2)		Healthy weight (18.5 -24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Responses	**n**	**%**	**n**	**%**	**n**	**%**
Hamburger						
Yes	2	28.6	6	8.1	3	3.8
No	5	71.4	68	91.9	77	96.3
Carrots						
Yes	0	0	14	18.9	6	7.5
No	7	100	60	81.1	74	92.5

There was no statistical significant difference between the BMI categories with regard to the knowledge of the statement that fat free always mean energy free**;** the percentage of students who knew that the fat free statement does not always mean energy free from different categories of BMI, was relatively close to one another (Table 4.23). A larger number of underweight students knew that fat free does not always mean energy free compared to overweight/obese individuals [-42.4; 16.7].

Table 4.23 Association between BMI and knowledge of whether the statement "fat free always mean energy free": Underweight (n=7), normal weight (n=74), overweight/obese n=80

	Underweight (<18.5kg/m^2)		Healthy weight (18.5 -24.9kg/m^2)		Overweight /obese (> 25kg/m^2)	
Response	**n**	**%**	**n**	**%**	**n**	**%**
Yes	0	0	15	20.3	7	8.8
No	5	71.4	49	66.2	62	77.5
I do not know	2	28.6	10	13.5	11	13.8

There was a statistical significant difference between the BMI categories overweight/obese and underweight with regard to their knowledge of carrot as the best source of beta carotene [-59.2 %; 2.0 %]*. A large percentage (71.4 %) of underweight students knew that carrot is a good source of beta carotene: 91.9 % of normal weight students knew that carrot was a good source of beta carotene and 95.0 % overweight individuals knew that carrot was a good source of beta carotene (Table 4.24)

There was statistical significant difference between the BMI categories, underweight and normal weight and overweight/obese with regard to their knowledge of hamburger as not being the best source of beta carotene. 95 % confidence intervals for the percentage difference were [1.6%; 51.3 %]* for underweight and healthy weight and [1.7 %; 51.3 %]* for underweight and overweight/obese. All normal weight and overweight/obese individuals knew that hamburger was not the best source of beta carotene (Table 4.24)

Table 4.24 Association between BMI and knowledge of food that are good sources of β carotene: Underweight (n=7), normal weight (n=74), overweight/obese n=80

	Underweight (<18.5kg/m^2)		Healthy weight (18.5-24.9kg/m^2)		Overweight /obese (≥ 25kg/m^2)	
Sources of β carotene	**n**	**%**	**n**	**%**	**n**	**%**
Carrots						
Yes	5	71.4	68	91.9	76	95.0
No	2	28.6	6	8.1	4	5.0
Hamburgers						
Yes	1	14.3	0	0	0	0
No	6	85.7	74	100	80	100

Association between nutritional knowledge and frequencies of food consumption was determined by comparing how frequent a given food was eaten by the group percentage marks obtained. Out of 162 participants included in the nutritional survey, 56 participants scored < 50 % on the nutritional knowledge survey and 106 scored > 50 % on the nutritional knowledge questions. Out of 56 students who scored < 50 % on the nutritional knowledge test, 85.7 % consumed sweets and chocolate on a daily basis (Table 4.25).

There was no statistical significant difference between students who scored < 50 % and > 50 % in nutritional knowledge test in terms of their daily consumption of chips (crisp); the percentage of individuals who consumed crisps/chips on a daily basis from the group that scored < 50% and > 50% in nutritional survey questions was relatively similar (Table 4.25).

There was no statistical significant difference between those that scored < 50 % and > 50 % on the nutritional knowledge test in terms of their daily consumption of cool drink; the percentage of individuals who consumed cool drink on a daily basis from the group that scored < 50% and > 50% on nutritional knowledge survey questions was similar (Table 4.25).

There was no statistical significant difference between those that scored < 50 % and > 50 % on the nutritional knowledge test in terms of their daily consumption of cremora; the percentage of individuals who consumed cremora on a daily basis from the group that scored < 50 % and > 50 % on the nutritional knowledge survey questions, was much the same (Table 4.25).

There was no statistical significant difference between those that scored < 50 % and > 50 % in the nutritional knowledge test in terms of frequency of coffee consumption; the percentage of students who consumed coffee on a daily basis from the group that scored < 50% and > 50 % on the nutritional knowledge survey questions was relatively close to one another (Table 4.25). There was no statistical significant difference between those that scored < 50 % and > 50 % in the nutritional knowledge test in terms of daily consumption of sugar; the percentage of individuals who consumed sugar on a daily basis from the group that scored < 50 % and > 50 % on the nutritional knowledge survey questions was relatively close to one another (Table 4.25). There was however a tendency for those with scores of < 50 % to consume more sugar on a daily basis compared to those who scored > 50 % [-4.6 %; 22.0 %]. There was no statistical significant difference between those that scored < 50 % and > 50 % in the nutritional knowledge test in terms of the daily consumption of full cream milk; the percentage of individuals who consumed full cream milk on a daily basis from the group that scored < 50 % and > 50 % on the nutritional knowledge survey questions was relatively similar (Table 4.25).

There was no statistical significant difference between students that scored < 50 % and > 50 % in the nutritional knowledge test in terms of the frequency of low fat/skim milk consumption. The percentage of students who scored > 50 % in the nutritional knowledge

test and consumed low fat/skim milk on a daily basis and the group that scored < 50 % and consumed low fat/skim milk on a daily basis was relatively close to one another (Table 4.25)

Table 4.25 Association between marks obtained on nutrition knowledge questions and frequency of food consumption: <50 (n=56), >50 (n=106)

Foods	Never		Monthly		Daily	
	n	%	n	%	n	%
Sweet & Chocolate						
<50 (n=56)	0	0	8	14.3	48	85.7
>50 (n=106)	0	0	15	14.2	91	85.8
Chips (crisps)						
<50 (n=56)	0	0	18	32.1	38	67.9
>50 (n=106)	1	0.9	33	31.1	72	67.9
Cool drink						
<50 (n=56)	0	0	26	46.4	30	53.6
>50 (n=106)	0	0	46	43.4	60	56.6
Cremora						
<50 (n=56)	0	0	44	78.6	12	21.4
>50 (n=106)			80	75.5	26	24.5
Sugar						
<50 (n=56)	2	3.6	40	71.4	14	25.0
>50 (n=106)	11	10.4	77	72.6	18	17.0
Full cream milk						
<50 (n=56)	3	5.4	41	72.2	12	21.4
>50 (n=106)	4	3.8	84	79.3	18	17.0
Low fat/skim milk						
<50 (n=56)	25	44.6	20	35.7	11	19.0
>50 (n=106)	38	35.9	51	48.1	17	16.0

4.7 Summary of the results

A representative sample of 161(31.7 % male and 68.3 % female) students was selected. The median was 24.9 years. Socio-demographic factors, eating practices and nutritional knowledge were evaluated using a structured questionnaire during an interview. Most students ate less than the recommended servings for food groups such as milk and milk products (92.6 %), vegetables (97.5 %) and fruits (42.2 %). A high percentage of students consumed more than the recommended servings for foods such as, meat and

meat alternatives (81 %), sweets and sugar (77.8 %) and oils (50 %). 82.7 % of the students' usual consumption of bread, cereals, pasta and rice was within recommended number of servings from the specific food groups as specified in the food guide pyramid. 99.4 % of students consumed protein within the AMDR. Usual intake in the majority of students for carbohydrate by (77.2 %) and fat (64.8 %) were also within the recommended range for %TE, respectively. Median energy intake for females (5543.3 kJ) per day was significantly lower than that of males (6333.3 kJ). All students' energy and fat intakes were relatively low, while carbohydrate and protein intakes were higher than RDA.

Meal patterns showed 59 % of students ate three meals daily, with the most frequently skipped meal being breakfast. Overweight/obese students consumed full cream milk on daily basis compared to underweight students. More overweight/obese (72.5 %) than underweight (28.6 %) students ate chips/crisps on a daily basis.

Media (47.8 %) and school/institution for teaching (35.4 %) were the sources of nutritional information for most students. Out of 162 students, 69.3 % did not know which foods should be eaten most frequently while 60.2 % did not know the daily recommended servings for milk and milk products. A large percentage of students did not know the daily recommended servings for the following food groups: bread, cereal, rice and pasta (85.7 %), vegetables (54.7 %), meat, poultry, fish dry beans, eggs and nuts (57.2 %). A large percentage of students knew the correct responses for the following nutrition knowledge questions: recommended servings for fruit (55.3 %), the food group to be eaten the least (75.2 %), food with a high fiber content (92.6 %), peanut butter as food with a high fat content (50.3%); the best sources of beta carotene (96.3%).

The median percentage for the correct answers obtained in the nutritional knowledge test was 56.3 %. Of 162 students, 34.2 % scored less than 50 % while 65.8 % scored more than 50 %. There was no statistical significant difference between BMI categories in terms of nutritional knowledge. More underweight (63.5 %) than overweight/obese (1.4 %) students knew the recommended servings for milk, cheese and yoghurt. More normal

weight students (20 %) than overweight/obese knew the daily recommended serving for bread, cereal, rice and pasta. More overweight (95.0 %) than underweight (71.1 %) students knew carrot to be good source of ß- carotene.

Over thirty percent (31.7 %) of students were overweight, 18.0 % were obese while 4.4 % were underweight. 21.6 % of male and 36.4 % of female were overweight while 9.8 % male and 21.8 % female were respectively obese. 1.8 % males and 9.8 % females were underweight. Median BMI for the group was 24.9 kg/m^2 while for WC was 87 cm. 38.5 % of students were in the substantial risk range, 26.7 % were in the increased risk range while 34 % had an ideal WC. Median WHR for the group was 0.9.

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

The study aimed at providing data on the prevalence of overweight and obesity and their association with eating practices and nutritional knowledge among Nursing Science Students at the University of Fort Hare, South Africa. The correlations with socio-demographic factors were also investigated. The results will be discussed and compared with available literature in context with the aim of the study.

5.2 Limitations of the study

Limitations experienced in this study involved mainly the study design. The study included convenience sampling, with only one health science setting, which may not have been a full representation of a wider community, and conclusions could only be made regarding the Nursing Science Students at Fort Hare.

The questionnaires did not request information about pregnancy; therefore pregnant students could have been included in the study. The possible prevalence of pregnant students in the sample population could have had an influence on the BMI and prevalence of overweight in the study. However, as both the BMI and fat distribution were established in the present study, the results can still be used despite the limitation. According to Cataldo *et al*. (2003, p.141), the distribution of fat in the body may be more critical than over fatness alone in determining obesity.

The fact that the physical activity levels of the students were not determined in this study could possibly be seen as a limitation. It is well known that the physical activity level of an individual influences body weight as well as food intake; and the association between energy intake, body weight and activity level is well established (Klumbiene *et al*., 2004; Kruger *et al*., 2002). However, physical activity was not measured because the aim of the

study was to identify whether eating practices and nutritional knowledge influenced body weight. According to Moreno *et al*. (2004) and Kruger *et al*. (2002), the two most important factors contributing to overweight and obesity are consumption of a 'western' diet and inactivity level of the students. Therefore, although the role of activity level and energy expenditure could not be used to explain weight status, the role of energy intake and dietary practices that were determined, could be used.

5.3 Eating practices

Guidelines for healthy eating practice encourage the consumption of fruit, vegetables, milk and milk products and whole grain (Wildman and Miller, 2004, p. 5). Both the United States (US) Food Guide Pyramid and the SAFBDG were used in this study to translate the eating practices of the group. The US Food Guide Pyramid was used to explain eating practices in this study because it translates dietary guidelines of nutrient recommendations into a visual form of the kinds and amounts of food to eat each day (Earl, 2004, p. 363). The SAFBDG are based on the existing consumption of locally available foods and aims to address identified nutritional related public health problems (Gibney and Voster, 2001). The SAFBDG was used in the present study to translate the dietary status of nursing students by comparing the eating practices of the students with the SAFBDG.

5.3.1 Usual daily food intake

Both the American food guide pyramid and SAFBDG recommend that breads and cereals should form the basis of the diet, followed by fruit and vegetables, meat and meat products and milk products while sweets and oils should be consumed sparingly.

More than 92 % of the students reported having a low consumption of milk and vegetables. The result from the present study also showed that over-consumption of certain food groups was a problem for these students with 50 % and more reporting an over-consumption of meat and meat alternates, sweets and sugar, as well as fats and oils.

In general, the present study shows that the majority of students eat either less than or more than the recommended daily servings for most food groups. In agreement with the present study, other studies have shown that the food choices of adolescents and young adults are not consistent with the dietary guidelines for Americans (Story *et al*., 2002). A study conducted by King *et al.* (2007) found only one in three university students eat at least three servings of vegetables a day and less than half (42.2 %) eat at least two savings of fruit a day. In another study in the USA, Huang *et al*. (2003) also found a low intake of fruit and vegetables in most college students. Also in agreement with the present study, King *et al.* (2007) reported 65.5 % of university students in the USA consume at least two servings of dairy a day, the minimum amount recommended for this age. In contrast to the present study, Sakamaki *et al*. (2005) found 80 % of university students in China eat fruit and vegetables twice daily. In our study it was found that only 23.5 % and 12.4 % consumed fruit and vegetables respectively every day, but their intakes were still below the recommended levels.

In the present study, a high proportion (82.7 %) of students reported an intake of within the recommended daily servings of bread and cereals. In contrast, Anding *et al.* (2001) reported breads and grain consumption of less than the minimum number of servings in most American students. According to Brunt *et al.* (2008), one or few grains are consumed by US college students per day indicating a lack of variety for this category. The practice of eating bread and cereals within the recommended daily intake ought to be encouraged because breads and cereals are an economical source of carbohydrates. The carbohydrates are a preferred energy source for body functions (Whitney *et al.,* 2007, p. 61), and the human brain depends exclusively on carbohydrate as an energy source.

The low intake of milk, fruit and vegetables, as well as the over-consumption of meat and meat alternates, sweets and sugar, fats and oils in the present study could be considered unhealthy according to Wildman and Miller (2004, p. 5). Low intakes of fruits and vegetables are a concern because fruits and vegetables are good sources of vitamin C and β-corotene which act as anti-oxidants protecting the body cells from damage due to

oxidation (Gallagher, 2004). In this way vitamin C and β-carotene can for example, help in prevention of diseases and infections therefore contributing to good health.

The unhealthy usual eating practices observed in the present study ought to be discouraged because the low consumption of fruit, vegetables and milk have been found to be associated with overweight and obesity (Drewnowski and Popkin, 1997; Cavalli-Soforza *et al*., 1996) which may play a major role in future risk of diseases. According to Mathai (2004, p. 305), an inadequate consumption of fruit and vegetables may result in a low intake of antioxidants and phytochemicals, which are thought to play a role in preventing cancer and heart disease.

5.3.2 Energy and macronutrient intake

The median energy intake of 6333.3 kJ/day was recorded for males and of 5543.3 kJ/day for females in the present study. These figures are lower than the recommended energy intake, which is 12881 kJ/day and 10093 kJ/day for males and for females, respectively (Rolfes *et al*., 2006). The results from the present study are in agreement with findings from Kiefer (2005) who also reported higher energy consumption in males as compared to females. The present study also shows that the median intake for protein carbohydrates and fat was 71.3 g, 205.8 g and 34.7 g per day respectively. For adequate growth and development adults should consume enough high quality protein from meat, milk and milk products as well as carbohydrates from a variety of foods sources such as cereals, maize, rice, wheat, millet sorghum and oats (Mann, 2001, P. 59). Fats and oils however should be consumed sparingly. Fat is essential for absorption and transport of fat soluble vitamins (Wildman and Miller, 2004, p. 139). When people consume too little or too much fat or a large amount of a certain type of fat, health can be affected. According to Whitney *et al.* (2007, p. 91), consumption of fats and oils below 20 % of kJ intake increases the risk of inadequate essential fatty acid intake.

Protein and carbohydrate intakes in the present study were higher than the RDA while the fat intake was lower than the RDA. This present result is in agreement with Kiefer (2005)

who found the consumption of the recommended daily allowance of protein to be high in medical university students in Austria. Although the results of the present study revealed lower energy intake than recommended, the majority of nursing students were either overweight (31.7 %) or obese (18.0 %), possibly due to underreporting of usual food intake. Under-reporting of intake is a problem inherent with the 24-hour recall method (Hammond, 2008, p. 397). However male students consumed more energy than females, an expected outcome as males usually have higher daily energy expenditure than females of the same height and age. Kiefer (2005) also reported higher energy consumption in males as compared to females.

The fact that the majority of students reported a fat intake of between 20 and 35 % of total energy, as well as a carbohydrate consumption of between 45 and 65 % of total energy could possibly indicate that these participants are moving away from the traditional low fat, high carbohydrate diet, typical of the nutrition transition as described by Bourne *et al. (*2002) and Popkin (1994).

5.3.3 Meal pattern

The meal pattern observed in the present study in the majority (59.0 %) of students was three meals per day while the most frequently skipped meal by all students (100 %) in the study was breakfast. The present study is in agreement with Sakamaki *et al*. (2005) who reported that the majority of Japanese university students (81.0 %) ate three meals but were also more likely to skip breakfast. In Korea 58.9 % of university students ate twice a day and the most frequently skipped meal was breakfast (Sakamaki *et al*., 2005) The present findings are also in agreement with Baric *et al*. (2003), who also found breakfast to be the most frequently skipped meal in Croatian university students.

5.3.4 Food frequency

The top five ranking foods consumed at high frequencies on a daily basis by more than 55 % of participants, included salt/stock/royco (85.8 %), margarine/oil/fat (67.9 %), sugar

(58.6 %) and bread (55.6 %). The top ten ranking foods consumed at high frequencies on a monthly basis by more than 72 % of participants, included chicken (89.5 %), red meat (88.3 %), cake/biscuits (85.8 %), vegetables (85.2 %), chips (83.2 %), eggs (82.1 %), fish (77.8 %), sweets/chocolate (77.2 %), samp/mielie rice (76.5 %) and cool drinks (72.2 %). The foods that were indicated as not eaten on a daily basis by 45 % or more of the students included low fat/skim milk, alcohol, cremora, peas/ lentils and peanut butter. The results for the present study coincide with that of Brunt *et al***.** (2008) who found that 95 % of all college students in US reported consuming fatty, sugary and salty snacks. According to the FBDG, foods containing fats oils and sweets should be consumed sparingly for good health (Cataldo *et al*., 2003, p. 17). The fact that the majority of students studied consumed fatty, sugary and salty foods on a daily basis probably suggests that there is room for improvement in the nursing students' dietary variety.

5.4 Nutritional knowledge

The major sources of nutritional knowledge for the studied population are media (47.8 %) and school/institution for teaching (35.4 %). In contrast, Davy *et al.* (2006) found that 46 % of college students received most of their nutritional knowledge from college. School in the present study refers to institution for teaching or giving instruction of any subject such as college. According to Rolfes, *et al*. (2006), media has been recognized as one of the forces that influence body image.

The present study shows that 69.3 % of students did not know the foods to eat the most according the United States Department of Agriculture (USDA)/United States Department of Health and Human Services (USDHHS) food guide pyramid and South African Food-Based Dietary Guidelines. Over 60 % did not know the daily recommended servings for milk/yoghurt and cheese. An equally large percentage of students did not know the daily recommended servings for the following food groups: bread, cereal, rice and pasta (85.7 %), vegetables (54.7 %), meat, poultry, fish, dry beans, eggs, nuts (57.2 %) and fruits (44.7 %) while 49.7 % of students did not know that peanut butter is high in fat. On the other hand, 31.7 % of students knew the foods to eat the most

according the dietary guide lines. In general, the students had an average knowledge of most of the nutritional knowledge questions. In contrast, Thakur and D'Amico (1999) recorded poor overall nutritional knowledge in 28 % of students studied. For knowledge on which food group they should eat the most, only 31.7 % knew the correct answer. This finding suggests a need for more nutritional education on FBDG.

The median score obtained by students on the nutritional knowledge questionnaire was 9 out of 15 which translates to 56.3 % of correct answers obtained by the students from nutritional knowledge questions. The findings suggest that the students had an average nutritional knowledge score as measured by the questionnaire. The present findings are in contrast to O'Brien and Davies (2006) who reported a high level of nutritional knowledge in United Kingdom adults.

5.5 Body weight status

Body weight status was assessed by using body mass index. Based on the BMI classification of weight status, the findings of this study indicate that less than half of the students (46.0 %) were of normal weight. Normal weight was more prevalent among males (58.8 %) as compared to females (40.0 %). In contrast, 9.8 % male students compared to 1.8 % females were underweight. In contrast with the present study, (Yahia *et al.,* 2007) found the prevalence of normal weight to be more common among females (76.8 %) compared to males (49 %) in Lebanese University students. Puoane *et al*. (2002) found that underweight rarely occurs in South African adults; however it was much higher in men (12.2 %) than women (5.6 %). This finding, although slightly higher than the present finding, the pattern is similar.

The finding from this study also indicated that the prevalence of overweight was 36.4% in females as compared to 21.6 % in males, while the prevalence of obesity was 21.8% in females as compared to 9.8 % in males. The prevalence of overweight in female students in the present study is slightly lower (36.4 %) than the finding of the South African Demographic and Health survey (SADHS) of 56 % in female ((Department of Health

(HoD), 2003). The pattern of overweight and obesity in the present study however, is consistent with the SADHS which found a prevalence of overweight and obesity to be more common among women compared to men (56 % and 29 % versus 30.1 % and 9.3 % respectively) (Department of Health (HoD), 2003).

The observed prevalence in the studied population of overweight (31.7 %) and obesity (18 %) indicated that (49.7 %) of the students were within the increased to high health risk category, according to the WHO (2003) criteria. In contrast, the percentages of overweight and obesity reported in this study were higher than those reported in a number of universities in South Africa and else where. For example, Morar *et al.* (1998) reported a lower prevalence of overweight (19.7 %) and obesity (4.6 %) for black medical students at the University of Natal, South Africa. The prevalence of overweight and obesity combined among female students in the present study is 58.2 %. In contrast Morar *et al.* (1998) reported a slightly lower prevalence (30.6 %) of overweight and obesity combined among black female medical and nursing students in South Africa. Cilliers *et al.* (2004) also reported a lower prevalence of overweight (18.2 %) and obesity (6.5 %) in black first year university students at the Stellenbosch University. While at the University of Limpopo (Turfloop Campus), the prevalence of overweight/obesity among first year female students was also slightly lower (25 %) than in the present study of 58.2 % (Steyn *et al.,* 2000).

In other countries, contrasting findings have been reported. In a mid West college in the USA, a higher prevalence of overweight (37.5 %) and obesity (7.7 %) was found in male than in female students (overweight: 12.5 %; obese: 3.4 %) (Davy *et al*., 2006). In Lebanon, the prevalence of overweight and obesity among university students was common among males compared to females (37.5 % and 13.6 % versus 12.5 % and 3.2 % respectively. In Pakistan the prevalence of overweight (20.5 %) and obesity (6.2 %) was shown in medical students (Zafar *et al.,* 2007). In Japan 5.8 % of female students were overweight while none was obese (Sakamaki *et al,* 2005).

In the present study, 38.5 % of students had a WC of substantial health risk (≥ 102 cm male and ≥ 88 cm female), while, 26.7 % had a WC of increased health risk (94.0 to 101.9 cm male and 80.0 to 87.9 cm female). The present study also shows that 37.3 % of students had WHR of increased health risk (≥ 0.9 male and ≥ 0.8 female). In contrast Puoane *et al*. (2002) also reported 42 % prevalence of increased health risk WHR in adult South Africans, particularly women (≥ 0.9 male and ≥ 0.8 female). In other studies elsewhere Zafar *et al.* (2007) reported a lower (11.5%) prevalence of abdominal adiposity (WHR ≥ 0.92) in young medical students in Pakistan (11.5 %) than the present study (37.3 %).

5.6 Association between BMI and variables

The present study also found tendency for normal body weight students to consume more energy than the underweight students. Although overweight/obese and normal weight individuals had a tendency to consume more energy, there was no statistically significant difference between overweight/obese and normal weight individual with regard to their protein and carbohydrate intakes. However Herrera *et al.* (2003) found BMI to be influenced by energy intake independent of gender in Venezuelan university students.

Based on the present study, place of residence was not associated with obesity in nursing students at the University of Fort Hare. In contrast Puoane *et al.* (2002) found the highest rate of obesity to be predominantly in urban women. There was no statistically significant difference between BMI categories with regard to place of residence. There was however, a tendency for underweight nursing students rather than overweight/obese students to reside in urban areas. The students living in urban areas could perhaps have been influenced by magazines, movies, and television which according to Rolfes *et al*. (2006, p. 261), convey the message that to be thin is beautiful. There was also no statistically significant difference found in body weight status, between nursing students that live in hostels and those that reside in a privately rented apartment. This finding is in contrast with Brunt *et al*. (2008) who found residing off campus to be associated with weight gain.

A significant positive association between underweight and overweight/obese individuals was recorded in the present study in terms of their percent fat intake. Underweight individuals consumed less fat than overweight/obese nursing students. Coinciding results have been found in a number of studies. For example, Popkin *et al. (*1993) found an increase of fat intake to be significantly related to an increase in BMI, while Kruger *et al.* (2002) reported high fat and energy intake to be among the contributing factors to a high prevalence of obesity seen in black South African women living in urban areas. Aranceta *et al.* (2001) also found high prevalence of obesity among individuals having a high fat intake or high fat sugar ratio.

The present study showed a tendency for more nursing students with normal body weight to consume less milk and milk products than their underweight counterparts. Positive association between overweight/obese individuals and the consumption of milk and milk products below the daily recommended servings was also reported in the present study. This finding is in agreement with Schulz *et al*. (2005) who also found a dietary pattern which include reduced fat dairy to be one of the eating practices associated with less weight gain in middle aged men and women in Europe. Low milk consumption may probably have contributed to the high prevalence of overweight and obesity in the present study because those who do not consume milk may probably prefer less nutritious beverages such as soft drinks which are high in energy. Triches and Giugliani (2005) found that healthy eating habits such as the consumption of breakfast, milk, fruit and vegetables were not associated with overweight and obesity among primary school pupils.

Significantly more normal weight (67.6 %) than underweight (28.6 %) students ate chips/crisps. Similarly, the present study also shows a statistically significant difference between underweight (28.6 %) and overweight/obese (72.5 %) individuals in terms of their chips/crisps consumption. This high chips/crisps intake may probably explain the high energy intake which may have influenced BMI of overweight/obese individuals. Foods, such as chips/crisps are low nutrient but high in fats which provide 38 kJ per one gram consumed.

The present study shows a positive association between underweight and low fat/skim milk consumption. This finding is in agreement with Schulz *et al*. (2005) who also found a reduced fat dairy intake to be one of the eating practices associated with less weight gain. Likewise positive association was also observed between overweight/obese students and consumption of full cream milk. More overweight/obese students (25.0 %) consumed full cream milk on a daily basis than underweight students (14.3 %) which was significantly different. Full cream milk is high in fat which contributes to high energy intake per gram of intake (Whitney *et al*., 2007, p. 96)).

A statistical significant difference was found between underweight and overweight/obese nursing students in terms of their frequency of sweet and chocolate consumption. The percentage of underweight students who ate sweets and chocolate on a daily basis was less than overweight/obese individuals at 57.1 % and 90.0 %, respectively. A positive association between BMI and sweets/chocolate exists in the present study. This finding is in agreement with Aranceta *et al.* (2001) who also reported a high prevalence of overweight and obesity among people having a high fat/ sugar ratio.

A high percentage of nursing students reported obtaining their nutrition information from media and school. Although not statistically significant, a tendency for overweight/obese nursing students to obtain nutrition information from media was greater than underweight. Likewise a tendency for underweight nursing students to choose school as their source of nutrition information was greater than normal weight and overweight/obese individuals. With respect to food intake the large number of overweight/obese individuals receiving their nutritional knowledge from media may mean that this group does not value the preferred body image as portrayed by the media (Rolfes *et al*., 2006, p. 261). It may also mean that media influence could lead to 'quick fixes' with impact on metabolism and 'yo-yo' effect on bodyweight. This group may still hold most of the African communities' beliefs where by, being hefty have long been a sign of wealth while a slim woman is often the subject of nasty gossip such as her husband is neglecting her or has contacted HIV. They therefore are happy with being overweight (Puoane *et al*., 2002).

Based on the results from the nutritional knowledge questionnaire, a lack of nutritional knowledge is not associated with obesity in nursing students at the university of Fort Hare. Obese and non obese students in this study demonstrated a similar knowledge of nutrition. In contrast to the present study, Triches and Giugliani (2005) found the average knowledge of nutrition to be greater among obese children than non obese children. Tharkur and D'amico (1999) also found significant differences between the obese and non-obese students' responses to nutritional questions, particularly the question regarding high fiber foods. The difference between students who scored > 50 % on the nutritional knowledge test from different BMI categories were relatively close together indicating that body weight status did not influence nutritional knowledge or the other way around. However, slightly more underweight (71.4 %) than overweight (65.0 %) students in the present study scored more than 50 % on the nutrition knowledge test.

A statistically significant difference was indicated between underweight and overweight/obese students with regard to their knowledge of recommended servings for milk, cheese and yoghurt. This may either mean that this group does not know the consequences associated with reduced consumption of milk or that they do not always practise what they know. Although there were no statistical significant differences between different categories of BMI in terms of their knowledge of foods to be eaten the most, there was a tendency shown in this present study of underweight individuals to know the foods that should be eaten the most which may have two possible explanations. Either the underweight individuals may not be aware of the connection between body weight and health or most people do not always practise what they know. The current study also showed a statistically significant difference between the healthy body weight students and overweight/obese with regard to their knowledge of recommended servings for bread, cereal, rice and pasta.

In conclusion there was no significant difference between nutritional knowledge and BMI in this sample. The findings suggest that the lack of nutrition knowledge model does not fully explain the individual's variation in BMI found in this sample. The results demonstrate that overweight/obese students and those of healthy weight had comparable

levels of nutrition knowledge, suggesting that there may be reasons other than poor nutrition knowledge that account for high BMIs in the overweight/obese respondents. It would be more reasonable to suppose that knowledge is important, but not a sufficient factor for dietary behavior change to influence body weight.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

The limitations of the study have been addressed and the following conclusions and recommendations can be made regarding the eating practices, nutritional knowledge and body weight status of Nursing Science Students at the University of Fort Hare and influence there on body weight status.

6.1 Conclusions

The students' eating practices included low intakes of less than the recommended servings of food groups such as milk and milk products, fruits and vegetables, and over consumption of meat and meat alternates, sweets and sugar, fats and oils. The meal pattern was that of three meals a day with the most frequently skipped meal being breakfast. The frequently consumed foods on a daily basis by the sample included salt/stock/royco, margarine/oils/fats, sugar and bread and cereal. Thus, the eating practices of nursing students at the University of Fort Hare can be seen as unhealthy. On the other hand, the majority of students reported a fat intake between 20 and 35 % of total energy, as well as a carbohydrate consumption of between 45 and 65 % of total energy.

Low intakes of milk, fruits and vegetables and over consumption of meat and meat alternates, sweets and sugar, fats and oils probably not only contributed to overweight and obesity, but also unhealthy eating practices found in this sample. Overweight and obesity together with unhealthy eating practices may play a major role in the future risk of diseases in this sample and therefore should be discouraged.

Comparison of eating practices and BMI showed a positive association between underweight and low fat/skim milk consumption, and full cream milk and overweight/obesity. Overweight/obese students consume more full cream milk on a daily basis than underweight students. Normal weight and overweight/obese nursing students consumed more chips/crisps on a daily basis than underweight nursing students which were significantly different. Likewise, overweight/obese individuals consumed

more fat than underweight which was significantly different. More overweight/obese students than underweight consumed sweets and chocolate on a daily basis which was significantly different. Students with normal body weight consumed less full cream milk on a daily basis than overweight individuals. Generally, it can be concluded that fats, sweets and chocolate, crisps, and full cream milk intake played a role in the prevalence of overweight/obesity seen in this group of students.

Nutrition knowledge showed that there was no significant correlation between the level of nutrition knowledge and BMI; although an average level of nutrition knowledge was found among the sample. The findings suggest that the lack of knowledge model does not fully explain the individual's variation in BMI found in this sample. The results demonstrated that overweight/obese students and those of healthy weight had comparable levels of nutrition knowledge, suggesting that there may be reasons other than poor nutrition knowledge that account for high BMIs in overweight/obese respondents. It would therefore be more reasonable to suppose that knowledge is important but not a sufficient factor for dietary behavior change that influence BMI. The major sources of nutritional knowledge found in this sample are the media and the school/institution for teaching. Although not statistically significant, a tendency of overweight/obese nursing students to obtain nutrition information from media was greater than underweight, which could possibly suggest that media had no influence in overweight/obesity of this sample. The tendency of underweight nursing students to choose school/institution for teaching as their source of nutrition information was greater than normal weight and overweight/obese individuals.

With respect to specific responses on nutrition knowledge, a large percentage of more than or equal to 54.7 % students did not know the correct responses for food groups to be eaten the most, daily recommended servings for milk/yoghurt and cheese, daily recommended servings for bread, cereal, rice and pasta, daily recommended servings for vegetables and daily recommended servings for meat, poultry, fish dry beans, eggs and nuts according the dietary guide lines. On the other hand a large percentage of more than or equal to 55.3 % of students knew the correct responses for recommended servings for

fruit, food groups to be eaten the least, foods with a high fiber content, knowledge of fried chicken as a food with a high fat content and knowledge of foods which are best sources of β carotene according to dietary guidelines.

Comparison of nutrition knowledge and BMI showed a statistical significant difference between underweight and normal BMI with regard to their knowledge of recommended servings for milk, cheese and yoghurt. There was also a statistical significant difference between underweight and overweight/obese with regard to their knowledge of recommended servings for milk, cheese and yoghurt. More underweight nursing students knew the recommended servings for milk, cheese and yoghurt, as compared to normal weight and overweight/obese. There was a statistical significant difference between the normal BMI and overweight with regards to their knowledge of recommended servings for bread, cereal, rice and pasta. The percentage of underweight individuals who knew the daily recommended serving for bread, cereal, rice and pasta was higher than overweight/obese nursing students. Although not significant, there was a tendency for underweight individuals to know that fat free does not always mean energy free more so than overweight/obese individuals. There was a statistical significant difference between overweight/obese and underweight nursing students with regard to their knowledge of carrot as a good source of beta carotene. More overweight/obese students knew that carrot was good source of beta carotene as compared to underweight students.

The prevalence of overweight and obesity found in the present study and other studies in South Africa among students, including black nursing students is high and also higher in females than in males. The prevalence of abdominal obesity indicating an increased health risk is also a matter of concern in these students. The prevalence of underweight is low; however more males than females were found to be underweight. Overweight, obesity and underweight are key risk factors in the development of numerous chronic health related conditions (WHO, 2004).

6.2 Recommendations

Results from eating practices showed that a high percentage of the students have unhealthy eating practices with less than or more than recommended dietary guidelines for most food groups therefore major changes in eating habits of this sample are required. The recommendation is that nutritional education should be targeted at nursing science students and should motivate more healthy food choices such as the daily consumption of fruit and vegetables, milk as well as the eating of breakfast and a variety in food choices. The students indicated in the present study are the future health care providers who will be responsible for teaching healthy living practices to the community, and should therefore be encouraged to practice what they preach.

The present study has confirmed that eating practices are associated with body weight; however nutritional knowledge does not necessarily influence body weight. Nursing students seemingly have an average nutritional knowledge; however whether they use the knowledge or not is another matter. Health professionals, including dietitians should take these differences into account when developing nutritional education and designing nutritional intervention programmes for nursing students and other young adults. The importance of creating a supporting environment cannot be over emphasized and should form part of a nutrition education intervention programme. The findings of the present study reveal that interventions for the prevention and treatment of obesity must go much further than simply prompting nutritional knowledge. Integrated actions directed towards student health involving families, universities, communities and food industries might be a solution. Efforts should also be made to understand why knowledge does not translate to practice. The findings from the body weight status suggest a need for nutritional education for female students, especially education related to body weight management. Education should include the role played by eating practices and nutritional knowledge in the development and prevention of overweight, obesity and underweight. Although mentioned, the emphasis of a nutrition education intervention programme should remain on nutrition education with the view to improve nutrition knowledge and practices.

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APPENDICES

Appendix A

Sample letter of request to the University of Fort Hare to conduct research with Nursing Science students

Alice P. Okeyo
11 Alamein Crescent
King Williams Town, 5600
June 14, 2007

Dr NPB Nzama
Head, Nursing Sciences Department
University of Fort Hare
P.O. Box 1054, East London, 5200

Permission to conduct a research study on the campus of the University of Fort Hare:

I, Alice P. Okeyo, Masters Student at the Department of Nutrition and Dietetics of the University of the Free State hereby requests for permission to undertake a study on your campus entitled *Eating Practices, Nutritional knowledge and body weight in Nursing Science Students at the University of Fort Hare*.

This study has been prompted by the problem of overweight which is prevalent in our communities. Overweight is a modifiable risk factor of cardiovascular, respiratory, metabolic (type 2 diabetes) and muscular skeletal disorders. It is for this reason that I find it necessary to create an awareness regarding the association between eating practices, nutritional knowledge and body weight in our communities.

Evaluation of eating practices and nutritional knowledge of individuals within a population group is of vital importance in public health and is a feasible indicator for determining whether one is susceptible to becoming overweight or not. This study aims to investigate the association between eating practices, nutritional knowledge and body weight among Nursing Science students at the University of Fort Hare and then use the findings to plan interventions to correct or avoid abnormal body weight.

The study will involve the following:

- Interviews with selected students, during which questionnaires regarding student's socio-demographic factors, usual eating practices and nutritional knowledge will be completed.
- Body weight and height will be measured
- Waist and hip circumference will be measured

This study has been approved by the Evaluation Committee of the School of Allied Health Professions as well as the Ethics Committee of the Faculty of Health Sciences of the University of the Free State. All information gathered in this study will be kept strictly confidential, and no information will be used for the purposes other than those intended for. A respondent's decision to participate in this research will be voluntary and withdraw from the study at any time will be allowed.

I trust my request will meet with your approval.

Thanking you in advance for your cooperation.

Sincerely

Alice Phelgona Okeyo

Student No: 2004175804

Appendix B

Information document to participants

I Alice Phelgona Okeyo, Masters Student at the Department of Nutrition and Dietetics of the University of the Free State is conducting a research entitled *Eating Practices, Nutritional knowledge and body weight in Nursing Science Students at the University of Fort Hare*.

This study has been prompted by the problem of overweight which is prevalent in our communities. Overweight is a modifiable risk factor of cardiovascular, respiratory, metabolic (type 2 diabetes) and muscular skeletal disorders. It is for this reason that I find it necessary to create an awareness regarding the association between eating practices, nutritional knowledge and body weight in our communities.

Evaluation of eating practices and nutritional knowledge of individuals within a population group is of vital importance in public health and is a feasible indicator for determining whether one is susceptible to becoming overweight or not. This study therefore will determine the association between eating practices, nutritional knowledge and body weight amongst nursing students at the university of Fort Hare, in an attempt to determine possible causes of abnormalities in body weight in students. Nutrition education programmes based on the results of this study could be used to address body weight problems in this group of students and possibly also in other subsequent groups of students.

The study will involve the following:

- Interviews with selected students, during which questionnaires regarding student's socio-demographic factors, usual eating practices and nutritional knowledge will be completed.
- Body weight and height will be measured
- Waist and hip circumference will be measured

All information provided during this study will be kept strictly confidential, and no information will be used for any other purposes other than those intended. Your decision to participate in this research will be voluntary and you will be allowed to withdraw from the study at any time.
I trust that you will find it necessary to participate in this important study.

Thanking you in advance for your cooperation.
Sincerely

Alice Phelgona Okeyo
Student No: 2004175804

Appendix C

Consent to participate in research

Research Title: *Eating Practices, Nutritional knowledge and body weight in Nursing Students at the University of Fort Hare*

I confirm that: I ----------

1. I have been asked to participate in the above mentioned research project
2. It has been explained to me that:

2.1 The purpose of this research is to evaluate the association between Eating Practices, Nutritional knowledge and body weight among University Nursing Science Students.

2.2 In order to establish the above the following tools will be used:

2.2.1 Socio-demographic questionnaires

2.2.2 Eating practices questionnaires

2.2.3 Nutritional knowledge questionnaires

2.2.4 Subject's, weight and height will be measured to determine Body mass Index

2.2.5 Subject's waist and hip circumference will be measured to determine waist-to-hip circumference ratio.

2.2.6 That before weight and height measurements are taken, the participant will be asked to empty their bladder and wear light clothes.

2.2.7 That participation in this study will take approximately 30 minutes.

3. That this research is done in this University.
4. That the information I will give shall be kept confidential, but will be used anonymously for making known the findings to other researchers.
5. That my participation in this research is voluntary and that I can refuse to participate in this research or I can stop answering questions at any time during the interview. If this was to happen, I will not in any way be disadvantaged.
6. That no pressure was applied on me to take part in this research and I have participated voluntarily without compensation for participating in this study.

I have read this consent form and voluntarily consent to participate in this study.

Subject's signature:_____ Date: _____

Appendix D

Socio-demographic, nutritional knowledge and anthropometric questionnaire

(Section a = Socio-demographic)

1. Subject Number: ----------	☐☐☐	1-3
2. Date of interview (dd/mm/yy): ----------	☐☐☐☐☐☐☐☐	4 – 11
3. Date of birth (dd/mm/yy): ----------	☐☐☐☐☐☐☐☐	12 -19

4. Gender ☐ 20

1. Male
2. Female

5. Ethnic background ☐ 21

1. Black
2. White
3. Coloured
4. Indian
5. Other: specify ----------

6. What is your academic status? ☐ 22

1. First year
2. Second year
3. Third year
4. Fourth year
5. Other: specify ----------

7. What is your marital status? ☐ 23

1. Married /traditionally
2. Single
3. Divorced
4. Widowed
5. Other: specify ----------

8. Where do you currently stay? ☐ 24

1. University hostels
2. Privately rented apartment
3. At home
4. Other: specify ----------

9. Where is your permanent residential zone? ☐ 25

1. Town
2. Township
3. Rural areas

10. How many meals do you usually eat each day? ☐ 26

1. One
2. Two
3. Three
4. Four
5. Five
6. Six
7. Other: specify ----------

11. If you skip a meal, which meal is it usually? ☐27

1. Breakfast
2. Lunch
3. Dinner

12. Who usually cooks your meals? ☐ 28

1. Self
2. Mother
3. Spouse
4. Maid
5. Other: specify ----------

13. Who usually shops for food in your house? ☐ 29

1. You
2. Brother
3. Sister
4. Parent or guardian
5. Other: specify ----------

14. Where do you <u>mostly</u> obtain nutrition information?

1.			Friends	☐ 30
2.			Media	☐ 31
3.		My	parents	☐ 32
4.			School	☐ 33
5.	Other: specify ----------			☐ 34

(Section b =nutritional knowledge)

15. According the South African Food-Based Dietary Guidelines, from which food group should you eat the most? ☐ 35

1. Meat, fish and Poultry
2. Milk, Yoghurt and Cheese
3. Fats, oils and sweets
4. Vegetables and fruits
5. Bread, cereal, Rice and pasta
6. I do not know

16. Which food group should you eat the least? (Check one) ☐ 36

1. Milk, yoghurt and cheese
2. Fats, oils and sweets
3. Vegetables and fruits
4. Meat, fish, poultry
5. Bread, cereal, rice and pasta
6. I do not know

17. Select all the high fat foods in this list of foods.

		(Y =1, N =2)	Y	N	
1.	Fried	chicken			☐ 37
2.		Bananas			☐ 38
3.	White	bread			☐ 39
4.	Broiled	fish			☐ 40
5.	Peanut	butter			☐ 41

18. How many servings of fruits should you have per day? ☐ 42

1. < 2 Servings per day
2. 2 – 4 Servings per day
3. > 4 servings per day
4. I do not know

19 How many servings of milk/ yoghurt and cheese should you have per day? ☐ 43

1. < 2 Servings per day
2. 2 – 3 Servings per day
3. > 3 Servings per day

20. How many servings a day should come from the bread, cereal, rice and Pasta group? ☐ 44

1. < 6 servings per day
2. 6 – 11 Servings per day
3. > 11 Servings per day
4. I do not know

21. Check the food you think is high in fiber.

		Y	N		**(Y=1, N=2)**
1.	Bran flakes				45
2.	Carrots				46
3.	Hamburgers				47
4.	Doughnuts				48
5.	Lettuce				49
6.	Pork				50

22. How many servings of vegetables should you eat per day? ☐ 51

1. < 3 Servings per day
2. 3 -5 Servings per day
3. > 5 Servings per day
4. I do not know

23. How many servings per day should come from meat, poultry, fish, dry beans, eggs and nuts? ☐ 52

1. < 2 Servings per day
2. 2 – 3 Servings per day
3. > 3 servings per day

24. What advice would you give to a person trying to lose weight? (Select one). ☐ 53

1. Increase your activity level and reduce empty calories
2. Lookout for lots of highly processed carbohydrates
3. Replace fat free foods with whole grains
4. Number 1, 2 and 3 are correct
5. Number 1 and 2 are correct
6. I do not know

25. Fat free foods always mean energy free? ☐ 54

1. Yes
2. No
3. Do not know

26. Check the foods you think are high in vitamin C.

		Y	N		(Y=1 N=2)
1.	Bran flakes				55
2.	Carrots				56
3.	Hamburgers				57
4.	Doughnuts				58
5.	Orange				59
6.	Pork				60

27. Check the foods you think are best sources of Beta-carotene.

		Y=1, N=2 Y	N		
1.	Butter nut				61
2.	Carrots				62
3.	Hamburgers				63
4.	Doughnuts				64
5.	1 and 2 are correct				65
6.	Pork				66

28. Beta carotene is a precursor of? (Check one) ☐ 67

1. Vitamin A
2. Vitamin K
3. Vitamin D
4. Do not know

29. Functions of vitamin C include: (check one) ☐ 68

1. It is involved in wound healing
2. It is important in the maintenance of membrane structure.
3. It aids in the absorption of iron
4. 1 and 2 are correct
5. 1, 2 and 3 are correct
6. None of these are correct

30. Benefits of fiber includes: (check one) ☐ 69

1. Reduces the risk of constipation
2. Maintain a healthy body weight
3. Reduces the risk of colon cancer
4. Helps alleviate hemorrhoids
4. All are correct
6. 2 and 4 are correct

(Section c = anthropometric data)

Anthropometrics measurements:

1. Weight (kg): ----------	☐☐☐.☐	70-74
2. Height (cm): ----------	☐☐☐.☐	75-79
3. Waist circumference (cm): ----------	☐☐☐.☐	80-84
4. Hip circumference (cm): ----------	☐☐☐.☐	85-89

Appendix E

Dietary intake/eating practices questionnaire

24 -Hour recall

Respondent No ---------- ☐☐☐ 1-3

Day of 24-hour recall **(for interviewer)** ----------

(1) Tuesday, (2) Thursday, (3) Weekend ☐ 4

Instructions

- Please tell me everything that you ate and drunk yesterday.
- Enter the type, amounts and preparation method of each food item eaten under the correct interval of the day
- **(for interviewer).**

Food and fluid intake (expressed in exchanges):

Food/Drinks and amounts	**Milk and milk products**	**Meat and meat alternatives**	**Legumes**	**Fruit ß-carotene**	**Vegetables ß-carotene**	**Fruit Vit C**	**Vegetables Vit C**	**Fruit other**	**Vegetables other**	**Bread and cereals**	**Fats and oils**	**Sweets/Sugar**	**Alcohol**
Breakfast and mid-morning													
Lunch and mid afternoon													
Supper and late night													
Total:													

Evaluation of dietary intake/ eating practices

	Quantity	Energy	Protein	CHO	Fat	Below requirement 1	Within requirement 2	Above requirement 3	
Milk and milk products		530	8	12	5				5
Meat and meat alternatives		315	7		5				6
Legumes		500	7	21	1				7
Soy beans		630	13	8	7				8
Fruit β-carotene		250		15					9
Vegetables β-carotene									10
Fruit vit C		250		15					11
Vegetables vit C									12
Fruit other		250		15					13
Vegetables B		150	2	7					14
Bread and cereal		285	3	15					15
Fats and oils		190			5				16
Sweets/Sugar		170		10					17
Alcohol									18
TOTAL									

Calculated estimated total values for:

Carbohydrate (g): ---------- 19-21

Protein (g) ---------- 22-24

Fat (g): ---------- 25-27

Energy (kJ): ---------- 28-32

Appendix F

Food frequency questionnaire

Food frequency questionnaire Number of times per day, per week or per month (**only use one option**)

Food	**/day**		**/week**		**/month**		
Sweets/ chocolates……..							33-38
Chips (crisp)……...							39-44
Cake/ biscuits……							45-50
Cool drinks……							51-56
Cremora……							57-62
Coffee……..							63-68
Tea……..							69-74
Sugar……..							75--80
Full-cream milk……..							1-6
Low fat/ skim milk……..							7-12
Eggs……							13-18
Peanut butter……							19-24
Soya mince/ legumes (baked beans, dried beans/peas, lentils)…...							25-30
Chicken……...							31-36
Red meat……							37-42
Fish……..							43-48
Bread……...							49-54
Porridge, cooked……...							55-60
Cereal (eg. Morevite/ Pronutro)……..							61-66
Samp / mielie rice……..							67-72
Margarine/ oil/ fat……..							73-78
Fruit juice……							1-6
Fruit……							7-12
Vegetables……							13-18
Salt/ stock/ Royco……							19-24
Alcohol							25-30

Remarks:_____
_____
_____
_____
_____
_____

SUMMARY

The prevalence of overweight and obesity in college and health science students is increasing. This study determined whether eating practices and nutrition knowledge are associated with body weight in nursing science students. The study also evaluated the association between socio-demographic factors and body weight status.

A cross-sectional survey of 161 full time undergraduate nursing science students (31.7 % male and 68.3 % female), aged 18 and above, were chosen randomly from the University of Fort Hare. Validated questionnaires were used to determine the socio-demographic factors, eating practices and nutrition knowledge. Eating practices were determined by means of a 24-hour recall and a short food frequency questionnaire. Standard techniques involving a calibrated platform electronic scale and stadiometer, as well as a standard tape measure were used to measure weight, height, waist and hip circumference so as to calculate body weight status (Body mass index (BMI), Waist circumference (WC), and Waist hip ratio (WHR)). Descriptive statistics were used to describe the data, including, frequencies and percentage for categorical variables and means and standard deviations or medians and percentiles for continuous data. The underweight, normal weight and overweight/obese groups were compared by means of 95 % confidence intervals for median differences.

This study showed that less than half of the students (46.0 %) were of normal weight (58.8 % male students compared to 40.0 % female students). The prevalence of overweight and obesity was more common among female students compared to males (36.4 % and 21.8 % versus 21.6 % and 9.8 %, respectively). In contrast, 9.8 % male students were underweight compared to 1.8 % females. Sixty two students had WC values above the cut off points (≥ 88 cm: F; ≥ 102 cm: M) while sixty students had WHR values above the cut off points (≥ 0.8: F; ≥ 0.9: M).

Important observations of the usual daily food intake showed that less than the daily recommended number of food portions from the food groups were consumed for milk

and milk products (92.6% of students); vegetables (97.5 %) and fruits (42.2 %). More than the recommended number of portions per day was consumed for meat and meat alternatives (81 %), sweets and sugar (77.8 %), fats and oils (50 %). The recommended number of servings per day was only met for bread and cereals (82.7 %). Median daily energy intake for female students (5543.3 kJ) was significantly lower than that of males (6333.3 kJ). For all students the median energy and fat intakes were relatively low, while carbohydrate and protein intakes were higher than the RDA.

Usual meal patterns showed that 59 % of students ate three meals daily and the most frequently skipped meal was breakfast. Foods most often consumed on a daily basis were salt/stock/royco (85.8 %), margarine/oils/fats (67.9 %), sugar (58.6 %), bread (55.6 %) and cereal (34.7%). Foods most often not consumed included low fat/skim milk (76.5 %), alcohol (73.5 %), cremora (48.2 %), soy mince/legumes, baked beans, dried beans/peas and lentils (45.7 %), and peanut butter (42.6 %).

A significant higher percentage of underweight (14.3 %) than overweight/obese (1.3 %) individuals consumed bread and cereals below the recommended daily requirements. More overweight/obese (72.5 %) than underweight (28.6 %) students ate chips/crisps on a daily basis. Fat consumption in underweight students was significantly less than that of overweight/obese students. Significantly more overweight/obese (90 %) than underweight (57.1 %) students ate sweets and chocolate on a daily basis, and significantly more underweight (57.1 %) than normal weight (16.2 %) students consumed low fat/ skim milk on a daily basis.

Of 162 students, 69.3 % were uninformed of the food groups to eat the most and 24.9 % of which food groups to eat least, according to dietary guidelines. The recommended daily portions from the food groups were not known by the students: 85.7 % of students did not know the daily recommended servings for bread, cereal and pasta, 54.7 % did not know the recommended servings for vegetables and 54.7 % did not know the recommended serving for meat, poultry, fish dry beans, eggs and nuts. Over 60.2 % did not know the daily recommended servings for milk and milk products. Over 55.3 % of

students knew the recommended servings for fruits, 92.6 % knew foods with high fiber content, 50.3 % knew that peanut butter has a high fat content, while 96.3 % knew the best sources of beta carotene.

The median percentage for correct answers obtained in the nutrition knowledge test was 56.3 %. Of 162 students, 34.2 % scored less than 50 % while 65.8 % scored more than 50 % in a nutrition knowledge questionnaire. There was no statistical significant difference between BMI categories in terms of the score in the nutrition knowledge test. However, significantly more underweight (63.5 %) than overweight/obese (1.4 %) students knew the recommended servings for milk, cheese and yoghurt. Significantly more normal weight students (20.3 %) than overweight/obese (8.8 %) students knew the daily recommended servings for bread, cereal, rice and pasta. Significantly more overweight (95.0 %) than underweight (71.1 %) students knew carrot as a good source of ß-carotene.

In conclusion, healthy eating practices need to be emphasized in this group while ensuring an adequate awareness campaign. The findings suggest the need for strategies designed to improve competence in the area of nutrition, especially with respect to information relating to guidelines for healthy eating practices and healthy weight management. Nutritional education for female students, especially related to body weight management is recommended. Interventions for the prevention and control of obesity must go much further than simply prompting nutrition knowledge.

OPSOMMING

Die voorkoms van oormassa en vetsug neem toe in kollege en gesondheidswetenskap studente. Die studie het bepaal of die eetgewoontes en voedingkennis van verpleegkunde studente met liggaamsmassa verband hou. Die studie het ook die verband tussen sosiodemografiese faktore en liggaamsmassa status bepaal..

'n Dwarssnit opname van 161 voltydse voorgraadse verpleegkunde studente (31.7% manlik en 68.3% vroulik), 18 jaar en ouer, van die Universiteit van Fort Hare wat ewekansig gekies is, is ingesluit. Geldige vraelyste is gebruik om die sosiodemografies faktore, eetgewoontes en voedingkennis te bepaal. Eetgewoontes is met behulp van 'n 24-uur herroep en 'n kort voedselfrekwensie vraelys bepaal. Standaard tegnieke wat 'n gekalibreerde elektroniese platform skaal en 'n stadiometer, asook 'n stadaard meetband ingesluit het, is gebruik om massa, lengte, middel-, en heupomtrek te meet en liggaamsmassa status (liggaamsmassa- indeks, LMI), middelomtrek (MO), en middel-heupverhouding (MHV) te bereken. Beskrywende statistiek is gebruik om die data te beskryf, insluitend, frekwensies en persentasies vir kategoriese veranderlikes en gemiddeldes en standaardafwykings of mediane en persentiele vir aaneenlopende data. Die ondermassa, normale massa en oormassa/vetsug groepe is met behulp van 95 persent vertrouensintervalle vir mediaanverskille vergelyk.

Die studie toon dat minder as helfte van die studente (46.0 %) 'n normal massa (58.8 % manlik studente vergelyk met 40.0 % vroulik studente) gehad het. Die voorkoms van oormassa en vetsug was meer algemeen onder vroulike as manlike studente (36.4 % en 21.8 % vs 21.6 % en 9.8 % respektiewelik). In teenstelling was 9.8 % manlike versus 1.8 % vroulike studente ondermassa. Twee en sestig studente het 'n MO bo die afsnypunt gehad (≥ 88 cm: V; ≥ 102 cm: M) terwyl sestig studente 'n MHV bo die afsnypunt gehad het (≥ 0.8: V; ≥ 0.9: M).

Belangrike waarnemings van die tipiese daaglikse inname was dat minder as die aanbevole daaglikse aantal porsies uit die voedselgroepe ingeneem is vir melk en

melkprodukte (92.6 %), groente (97.5%) en vrugte (42.2%). Geen van die studente het die aanbevole porsies vir β-karoteenryke vrugte en groente wat vitamien C bevat ingeneem nie. Meer as die aanbevole porsies per dag is ingeneem vir vleis en vleisalternatiewe (81 %), soetigheid en lekkergoed (77.8 %), vette en olie (50 %). Die aanbevole aantal porsies per dag is net vir brood en grane (82.7 %) bereik. Die mediaan van die daaglikse energie-inname vir vroulike studente (5543.3 kJ) was betekenisvol laer as die van die manlike studente (6333.3 kJ). Vir al die studente was die median van die energie- en vetinname relatief laag, terwyl die koolhidraat en proteïeninname hoër was as die Aanbevole Daaglikse Toelae (ADT).

Gebruiklike maaltydpatrone toon dat 59 % van die studente gewoonlik drie maaltye per dag nuttig en dat ontbyt die maaltyd is wat die meeste oorgeslaan word. Voedsel wat mees algemeen op ‘n daaglikse basis ingeneem word sluit in sout/aftreksel/royco (85.8 %), margarien/olies/vette (67.9 %), suiker (58.6 %), brood (55.6 %) en grane (34.7 %). Voedsel wat die meeste nie gebruik word nie sluit in lae vet/vetvry melk (76.5%), alkohol (73.5 %), cremora (48.2 %), soja/peule, ‘baked beans’, droëbone/-ertjies en lensies (45.7 %) en grondboonjiebotter (42.6 %).

‘n Betekenisvol hoër persentasie ondermassa (14.3 %) as oormassa/vetsug (1.3 %) studente het minder as die aanbevole daaglikse aantal porsies brood en graan ingeneem. Meer oormassa/vetsug (72.5 %) as ondermassa (28.6 %) studente het ‘chips/crisps op ‘n daaglikse basis ingeneem. Vetinname deur ondermassa studente was betekenisvol minder as die van oormassa/vetsug studente. Betekenisvol meer oormassa/vetsug (90 %) as ondermassa (57.1 %) studente het lekkergoed en sjokolade op ‘n daaglikse basies ingeneem en betekenisvol meer ondermassa (57.1) as normale massa (15 %) studente het lae vet/ vetvry melk op ‘n daaglikse basis ingeneem.

Van 162 studente, het 69.3 % nie geweet watter voedselgroep die meeste en 24.9 % watter voedselgroep die minste, volgens die dieetriglyne in die dieet ingesluit behoort te word nie. So ook was die daaglikse aanbevole porsies uit die verskillende voedslegroepe vir meeste onbekend: brood, grane en pasta (85.7 %); groente (54.7 %); vleis, pluimvee,

vis, droëbone, eiers en neute (54.7 %); melk en melkprodukte (60.2 %). Studente het wel geweet wat die aanbevole daaglikse porsies uit die vrugtegroep (55.3 %) is; watter voedsels ‘n hoë veselinhoud het (92.6 %); dat grondboontjiebotter ‘n hoë vetinhoud het (50.3 %) en watter voedsels die beste bronne van ß-karoteen is (96.3 %).

In die voedingkennistoets was die median vir korrekte antwoorde 56.3 %. Van 162 studente, het 34.2 % minder as 50 % en 65.8 % meer as 50 % behaal. Geen statisties betekenisvolle verskille is gevind tussen LMI kategorieë in terme van korrekte antwoorde in die voedingkennistoets verkry nie. Betekenisvol meer ondermassa (63.5 %) as oormassa/vetsug (1.4 %) studente het wel die aanbevole daaglikse porsies vir melk, kaas en joghurt geken. Meer normale massa (20.3 %) as oormassa/vetsug (8.8 %) studente het ook die daaglikse aanbevole porsies vir brood, grane, rys en pasta geken, en meer oormassa (95.0 %) as ondermassa (71.1 %) studente het geweet wortels is ‘n goeie bron van ß-karoteen.

Die gevolgtrekking kan gemaak word dat gesonde eetgewoontes in die groep beklemtoon moet word, gepaard met ‘n bewusmakingsveldtog. Die bevindings suggureer die behoefte dat strategieë ontwerp moet word om voedingkennis te verbeter, veral ten opsigte van ininligting oor die riglyne vir gesonde eetgewoontes en gesonde massabeheer. Voedingonderig vir vroulike studente wat veral massabeheer insluit word aanbeveel. Intervensies vir die voorkoming en kontrole van vetsug moet verder gevoer word as bloot net voedingkennis.