An investigation of sociodemographics, nutrition knowledge and dietary intakes of Black students attending the Steve Biko Campus of Durban Institute of Technology

By

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A dissertation presented to the Faculty of Commerce, Durban Institute of Technology in the fulfilment of the requirements for the Masters Diploma in Technology: Food and Nutrition

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I, Zama Ntuli, do hereby declare that this dissertation represents my own work, both in conception and in execution.

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Zama Ntuli Date

I express my acknowledgement and sincere gratitude to my dear friends, family and colleagues for their constant encouragement and support in pursuing this qualification. I hope it serves as encouragement and inspiration to students who aspire to further their studies to a Master's level and beyond.

The authoress acknowledges and hereby expresses her sincere gratitude to the following people for their contribution to this dissertation:

- Mrs D. Andereson of Durban Institute of Technology, my supervisor, for her tireless enthusiasm, constant encouragement and inspiration;
- Mrs S. Kassier of Durban Institute of Technology, my co-supervisor, for her expert guidance and perseverance, particularly during the initial process;
- Staff members at the Durban Institute of Technology in the Department of Food Marketing and Management for their encouragement and support;
- The M.R.C. for their guidance in data capturing;
- The fieldworkers: Zama Moya, Xolile Mkhize and Sli Mokoena for their perseverance and dedication in collecting the data;
- Students from Color Court, Myrtle Court, Breheny Court and Student Village for participating in the study;
- Linda Coertze for editing the dissertation;
- My friend and soul mate Anjellah Reddy for her invaluable pride in me and being an amazing pillar of strength and source of inspiration.

ABSTRACT

Change in the dietary pattern of South Africans has been attributed to urbanisation and acculturation. Urbanisation has resulted in a shift in the composition of dietary staples and increased consumption of fat and sugar. Within a South African context, the change in diet is from a traditional prudent African diet, low in fat and high fibre to a Western diet high in fat and refined carbohydrates. Research conducted amongst young adult populations has documented several examples of poor dietary patterns associated with urbanisation which include skipping meals, following fad diets, greater consumption of snack foods (high in saturated fat and sugar) and avoidance of certain food groups, particularly fruit and vegetable. Dietary factors related to an increase in diseases of lifestyle are a high fat, low fibre diet, as well as an insufficient intake of fruits and vegetables. This in turn has lead to higher energy intakes with insufficient and imbalanced micronutrient intake. The purpose of the study was to evaluate the nutritional adequacy of student eating habits and to determine the influence of nutrition knowledge, sociodemographic factors and weight status on students' diets.

For the purpose of this study a descriptive survey method was used. Research tools included questionnaires to determine sociodemographic characteristics, nutrition knowledge, nutrient intake and anthropometry of the respondents. The survey generated scientific evidence and foundation for the compilation of a nutrition education programme that is credible, culturally sensitive and relevant to the target group.

The results of the study indicate that nutrient intake of students at DIT: Steve Biko does not comply with dietary guidelines and nutrient standards. However, distribution of energy intake is comparable to that in the US dietary guidelines. Dietary intake from the vegetable, fruit, meat and dairy groups is low when compared to the Food Guide Pyramid. As a result, the intake of nutrients such as iodine, calcium, vitamin A, zinc, vitamin C, riboflavin, vitamin B_6, iron, magnesium is inadequate ($\leq$67% of RDA). The intake of trace elements such as copper, chromium, selenium, biotin, vitamin E and vitamin K also proved to be inadequate. However, the intake protein, fibre, thiamin, niacin, folate, vitamin B_{12}, manganese, pantothenate and vitamin D is adequate. The respondents' nutrition knowledge scores indicate shortcomings in concepts such as: "The use of food by the body" and "The relationship between nutrients and good health ".

The high prevalence of inadequate food and nutrient intake amongst students at DIT: Steve Biko Campus demonstrates the need for effective and wide-reaching strategies aimed at modification of eating habits. The need for a nutrition intervention is further underscored by findings from research studies that have suggested that eating behaviour during young adulthood may have an impact on immediate and long-term health outcomes. Recommendations for a beneficial nutrition education programme aimed at young adults as well as requirements for the implementation of such a programme are made. Areas for future research are also suggested.

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CHAPTER ONE

1.1. INTRODUCTION

South Africa is a developing country with a multicultural society (Vorster et al., 1995:119). Large segments of the population are in a process of urbanisation, which is essentially accompanied by nutritional transition (Vorster et al., 1995:119). As defined by Popkin, et al., (1993), nutritional transition describes the changes in dietary pattern and nutrient intake associated with urbanisation, acculturation or westernisation. As a result, South Africa is undergoing a rapid epidemiological transition in terms of health and disease patterns (Steyn et al., 2000). An increase in epidemiological diseases in most urban areas can be seen globally, which is due to a change in food availability and dietary habits. As communities become urbanised, they transform their social and economic structures. This has a significant influence on lifestyle, dietary and disease patterns (Garrow, James and Ralph, 2000:8).

It has been postulated that urbanisation results in a shift in the composition of dietary staples and an increase in fat and sugar consumption (Garrow, James and Ralph, 2000:8; Vorster et al., 1995:119). Within a South African scenario the change in diet is from a traditional prudent African diet that is low in fat and high in fibre, to a Westernised diet that is high in fat and refined carbohydrates. The urban population in South Africa is currently consuming this latter diet (Vorster et al., 1995:119 - 120). Learners (young adults) are a part of the population that is part of the process of urbanisation. Therefore, they are susceptible to acquiring poor eating behaviours and developing eating disorders (Koszewki and Kuo, 1996: 1286; Peters et al., 1996: 709) due to urbanisation. Research amongst student populations has documented several examples of poor dietary patterns associated with urbanisation. These include meal skipping, fad diets, greater consumption of snack foods (food high in saturated fat and sugar) and avoidance of certain food groups (Brevard and Ricketts, 1996: 35; Koszewki and Kuo, 1996: 1286; Peters et al., 1996: 709 – 710).

Eating behaviour is acquired as a result of a combination of socio-demographic factors and the level of nutrition knowledge (Nestle et al., 1998; Harnack, Block and Lane, 1997; Seymour, Hoerr and Haung, 1997). Learners are in a transition from parental control to being responsible for their own food decisions. Therefore, compliance with dietary recommendations is often poor (Slabber et al., 2000; Mhurchu, Margetts and Speller, 1997:10) due to a free-living lifestyle. This renders their dietary pattern unhealthy. Young adult life is characterised by experimenting with certain unhealthy eating behaviour such as crash dieting (Horaceck and Betts, 1998) and alcohol abuse (Seymour, Hoerr and Haung, 1997:21; Weigley, Mueller and Robinson, 1997:255). Steyn et al., (2000) indicated that at the University of the North, 22.9% of the urban student population was overweight. Black students were overweight when compared to white students at the University of Stellenbosch (Steyn et al., 2000). Similar findings are evident in the USA (Hendricks and Herbold, 1998:68; Seymour, Hoerr and Haung, 1997:24). This could suggest that poor dietary patterns of young adults result in an increase in weight status.

Nutrition knowledge and socio-demographic factors such as lifestyle, living arrangements and socioeconomic status are closely related to learner food choice (Fredenberg, Berglund and Dieken, 1996:64; Hertzler and Frary, 1996:711). Knowledgeable consumers undoubtedly make better informed food choices (Sims, 1981). According to Nestle et al., (1998:54), the level of nutrition knowledge amongst the global population is relatively high, but many people do not know how to apply it. Nutrition knowledge therefore influences dietary behaviour to a certain extent (Harnack, Block and Lane, 1997; Pelto, 1981:S4). However, other factors such as lifestyle, living arrangements and socioeconomic status may also have a great influence on eating behaviour (Harnack, Block and Lane, 1997:306). Lifestyle factors include activity patterns, body image, smoking and socialisation (Nestle, et al. 1998; Harnack, Block and Lane, 1997; Seymour, Hoerr and Haung, 1997). Pelto (1981) also argued that lifestyle factors influenced eating behaviour (Pelto, 1981).

Dietary factors related to an increase in diseases of lifestyle are a high fat, low fiber diet as well as insufficient intake of fruit and vegetables. This may lead to an insufficient or deficient intake of iron, calcium, magnesium, vitamin A and vitamin B_6, zinc and folate (Vaughan, Benyshek and Martin, 1997:1279; Oldewage-Theron et al., 2000; Brevard and Ricketts, 1996:35; Koszewki and Kuo, 1996:1286; and Peters et al., 1996:709-710). Globally, students have similar dietary habits which do not comply with recommendations such as the United States (US) Dietary Guidelines and the South African Food-Based Dietary Guidelines (SA FBDGs). As a result, these dietary habits are associated with obesity which is known to be a risk factor for coronary heart disease (CHD), cancer and type II Diabetes Mellitus. The onset of these diseases later in life reflects eating behaviours of the current life stage, namely young adulthood (Nestle et al., 1998: 133; Hendricks and Herbold, 1998: 65).

At Durban Institute of Technology (DIT): Steve Biko Campus, Student Health Services have reported cases of insufficient food intake (Smith, 1997). This anecdotal evidence points towards the possible existence of malnutrition on this campus. Insufficient food intake is speculated to be related to lack of nutrition knowledge, financial constraints and living arrangements. The availability of consumer friendly nutrition information available at DIT is limited. Available literature targets specific health problems among the student population such as anorexia nervosa and bulimia nervosa. It does not provide food based dietary advice and the benefits of healthy eating behaviour. Neither does it provide advice on economic food purchases to assist students with limited finances to utilise available resources optimally (Steve Biko Campus: Counseling Department, 2000).

Therefore, the purpose of the study was to evaluate the nutritional adequacy of students' eating habits at DIT, as well as to identify socio-demographic factors that strongly influenced student dietary patterns. The data will be used to compile a nutrition programme to serve as a student guide in making healthy, economic food choices. The availability of such information would have the potential of improving student health in the short term, thus reducing the risk for developing disease of lifestyle in the long term.

1.2 THE STATEMENT OF THE PROBLEM

The purpose of the study was to evaluate the nutritional adequacy of students' eating habits at Durban Institute of Technology: Steve Biko Campus and to determine the influence of socio-demographic factors, nutrition knowledge and weight status on existing eating habits for the compilation of nutritional recommendations for a nutrition education programme, in order to improve students' food choices.

1.2.1 SUBPROBLEMS

1.2.1.1 **The first subproblem**

The first subproblem was to determine the socio-demographic factors which strongly influenced student nutrient intake, such as age, gender, socio-economic status, living arrangements and ethnicity.

1.2.1.2 **The second subproblem**

The second subproblem was to determine the nutrition knowledge of the students in order to determine its influence on food choice and dietary intake.

1.2.1.3 **The third subproblem**

The third subproblem was to determine the students' nutritional status in terms of Body Mass Index (BMI) and waist-to-hip ratio (WHR).

1.2.1.4 **The fourth subproblem**

The fourth subproblem was to investigate the nutritional adequacy of students' eating habits and nutrient intake by means of a Food Frequency Questionnaire and a 24-hour Recall Technique and to evaluate their nutrient intake in terms of the Recommended Dietary Allowance (RDA).

1.2.2 THE HYPOTHESES

1.2.2.1 Hypothesis one

It was hypothesised that socio-demographic factors such as age, gender, socio-economic status, living arrangements and ethnicity influenced students' eating habits.

1.2.2.2 Hypothesis two

It was hypothesised that students would have poor food choices, which would be related to thier lack of nutrition knowledge.

1.2.2.3 Hypothesis three

It was hypothesised that students at DIT were overweight and would have an undesirable body fat distribution.

1.2.2.4 Hypothesis four

It was hypothesised that students at DIT had nutrient intake that is inadequate when evaluated in terms of the RDA.

1.2.3 THE DELIMITATIONS

1.2.3.1 The study was limited to Black students at Technikon Natal, Durban Campus at undergraduate level of study and who were between 17 – 30 years of age. Technikon Natal merged with ML Sultan Technikon during the process of the investigation. The merged institution is now known as Durban Institute of Technology (DIT). Steve Biko Campus is the former Technikon Natal. Geographically, the study was conducted among and limited to students at DIT: Steve Biko Campus (Annexure7.9: 274).

1.2.3.2 For the purpose of the study the sample was drawn from students that were free-living, in order to reflect independent determinants of dietary intake.

1.2.3.3 The study did not attempt to indicate the nutrient intake of all students at tertiary level of study in South Africa, but only students at DIT.

1.2.3.4 An existing Food Frequency Questionnaire (FFQ) developed and administered by MacIntyre (1998) for the study conducted in the North West Province, and a 24-hour

Food Recall were used. For the purpose of the study, both these questionnaire were piloted on a sub-sample.

1.2.3.5 The emphasis of the study was on the nutritional adequacy of the free-living students at DIT: Steve Biko Campus, and therefore no attempt was made to measure the effectiveness of the Food Frequency Questionnaire and the 24-hour Recall as tools of dietary evaluation.

1.2.4 ASSUMPTIONS

1.2.4.1 It was assumed that the response by the free-living students at DIT: Steve Biko Campus, aged between 17 – 30 years would be honest and constructive.

1.2.4.2 It was assumed that a 24-hour Food Recall and Food Frequency Questionnaire would be effective as tools of dietary evaluation in determining the students' dietary intake.

1.2.4.3 The questionnaires were available in English and Zulu, and the interviewers were fluent in English and Zulu. It was also assumed that the respondents were conversant in English and Zulu. It was therefore assumed that the possible language and cultural barriers that could influence respondents would be negated.

1.2.4.4 The interviewers were trained in the collection of dietary data required for this study. It was therefore assumed that they would be able to assist the respondents to accurately quantify their dietary intake through the use of food models and/or portion size measurements that were used during the study.

1.2.4.5 It was assumed that the data generated would be a true reflection of the students' eating habits, thus facilitating the compilation of a meaningful nutrition programme with information suitable for current and prospective students.

1.2.5 THE IMPORTANCE OF THE INVESTIGATION

Making informed choices when purchasing food is essential in ensuring optimal nutritional status. Generating nutritional information to facilitate sound eating habits and economical food purchases is a need within the DIT environment. It was argued that the investigation would give scientific evidence as to what extent student dietary intake complies with nutritional guidelines (US Dietary Guidelines and SA Food-Based Dietary Guidelines) and nutrient standards (RDA). The study aimed to identify the independent and joint influences of nutrition knowledge and socio-demographic factors on student dietary behaviour at DIT. Students have been identified as a specific risk group for nutrient deficiency. Therefore, information gathered would be used as the foundation for the compilation of recommendations for a nutrition education programme in order to improve student food choices. The study was an attempt to improve compliance with dietary guidelines such as the SA FBDGs, by generating dietary advice that is scientifically sound, practical, culturally sensitive and consistent. This has the potential to improve students' eating habits, and to reduce the risk for diseases of lifestyle in the long term.

1.2.6 CONCEPTUAL CLARIFICATION

ACCULTURATION

Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in their original cultural patterns (Voster et al., 1995:119).

DIGGS

It is a student commune. Two or more students share a house or living space and make food decisions independently.

FLAT

A set of rooms forming an individual home with a larger building

FOOD INSECURITY

An inability to acquire appropriate foods in a socially acceptable way.

FREE-LIVING

Individual/s living independently and making their own food decisions, without the influence of another within the household.

HEALTH STATUS

It's a state of mental, physical, spiritual and emotional well being, not merely an absence of disease and infection.

NUTRITION EDUCATION PROGRAMME

Educational intervention designed to address a nutrition problem among a particular segment of the population.

NUTRITIONAL KNOWLEDGE

This refers to awareness and knowledge of various nutrition concepts, and knowing how these concepts translate into particular food choices.

NUTRITIONAL STATUS

It is a condition of health as related to the use of food by the body, for example well nourished versus actively malnourished

NUTRITIONAL TRANSITION

It is a change in dietary pattern and nutrient intake associated with urbanisation, acculturation and/or westernization.

SOCIOECONOMIC STATUS (SES)

It is ranking of students based on the amount of money they spend on food monthly.

YOUNG ADULTS

Males and females between 18 and 30 years of age, (Williams, 2001).

1.2.7 ABBREVIATIONS

AI

Adequate Intake

AIDS

Acquired Immune Deficiency Syndrome

BMI

Body Mass Index

CHD

Coronary Heart Disease

CVD

Cardiovascular Disease

DRIs

Dietary Reference Intakes

HIV

Human Immunodeficiency Virus

ICNE

Interagency Concepts for Nutrition Education

NAR

Nutrient Adequacy Ratio

NHIS

National Health International Survey

NIDDM

Non-Insulin Dependent Diabetes Mellitus

NKT

Nutrition Knowledge Test

SA FBDGs

South African Food-Based Dietary Guidelines

SPSS

Statistical Package for Social Sciences

USDA FGP

United States Department of Agriculture: Food Guide Pyramid

WHR

Waist-to-Hip Ratio

1.3 SUMMARY

The study consisted of a theoretical structure and a descriptive survey. The overview of all chapters has been given in the form of an outline in section 1, page 1. The outline indicates content of each chapter, namely: Chapter one (introduction), Chapter two (related literature), Chapter three (methodology), Chapters four and five (evaluation of results and findings of the study). Chapter one has stated the problem that was researched and the background with respect to the investigation.

CHAPTER TWO

A REVIEW OF THE RELATED LITERATURE

2.1 OVERVIEW

In the previous chapter the importance of the study and the problem statement was discussed. The emphasis was on the need for a nutrition education programme amongst young adults to improve their food choices and dietary behaviour. The Lifestyle Model and Ecological Systems Perspective of the Health Belief Model have been used as conceptual tools in the literature to describe influences on dietary behaviour. The Health Belief Model has been adapted by including nutrition knowledge as one of the variables in order to apply a cognitive approach to dietary behaviour. The previous chapter stated the problem researched, as well as background with respect to the study. This chapter provides an overview of the following:

- Nutritional transition amongst young adults in South Africa;
- Factors influencing dietary behaviour: Lifestyle Model of Dietary Behaviour;
- The control of food intake;
- Assessment of nutritional status.

The developments and trends in terms of local and international findings serve as a background for the findings of the study as reported in Chapter four. The importance of the study is reflected in statements regarding the prevalence of nutritional inadequacies amongst young adults and the level of nutritional knowledge. The literature review exposes the complexities of dietary and nutrient intake amongst young adults, and substantiates the need for a nutritional education programme.

2.2 NUTRITIONAL TRANSITION AMONGST YOUNG ADULTS IN SOUTH AFRICA

Urbanisation in the Third World has an immediate impact on the nature of the household food supply because a household no longer relies on readily available home-grown produce. Urban communities are exposed to marketing strategies imposed by international and local food companies. Thus, there are external social and economic pressures on urban communities (previously rural) to change their diet towards that of affluent (Westernised) societies (Garrow, James and Ralph, 2000). Dietary patterns of urban and rural dwellers in the same country show striking differences in dietary composition. The latter (i.e. dietary composition) usually depends on their staple crops of cereals, tubers, vegetables and fruits (Garrow et al., 2000).

The principal component of a country's diet tends to relate to the nation's level of affluence. As societies become more affluent, the most prominent dietary feature is a fall in consumption of starchy foods and an increase in the consumption of animal foods, and therefore of fat. Part of the pressure to change to a Western diet comes from a widespread cultural perception that affluence is part of an American and European lifestyle (Garrow et al., 2000). These ideas are promoted by the intense marketing strategies of Western food and drink firms, such as Coca-Cola, McDonald's and Kentucky Fried Chicken in societies with very different traditional dietary patterns. The Japanese, for example, despite their complex dietary traditions, increased their fat intake from 13% in 1953 to 26% by 1988 (Food and Agriculture Organisation (FAO) 1991). Fat intake in China increased from 13 to 21% between 1990 and 1992. This indicates that marketing of American snack foods and drinks is pervasive (Garrow et al., 2000). These marketing strategies are also seen throughout the Third World, including South Africa, and are evident in the dietary composition of South Africans.

Table 2.1:18 is a summary of dietary studies conducted in South Africa amongst young adults between 1996 and 2000. South African studies in this field are limited, particularly amongst young adults. The few available studies that have been conducted have addressed regional or local variables. The South African National Nutritional Status (Labadarios, 1999) collectively analysed 55 studies in 1999. For the purpose of this analysis, studies that were included had to meet the following criteria: randomisation, ethnicity, age and the type of database used for the analysis (Labadarios, 1999). It was noted that there was a general tendency for Westernisation in the diet of most South Africans. The traditional low fat, high fibre diet of rural South Africans is being replaced by a high fat and low fibre diet (Steyn et al., 2000; Steyn et al., 1998; Senekal and Steyn, 1998; Van Eeden and Gericke, 1996). A high fat, low fibre diet is characterised by an adequate energy intake but an imbalance in micronutrient intake.

Table 2.1 South African Dietary Studies conducted in various regions between 1996 and 2000 amongst Young Adults

TITLE	Age Group	Year	Authors	Published/ Unpublished
Effect of acculturation on habitual food intake and dietary patterns of rural and urban black home economics students**, Vista and Pretoria University**	**25 – 44**	**1996**	**Van Eeden, T. S. and Gericke, G. J.**	**Published**
Current risk factors profile for coronary heart disease in South African adults**, University of Stellenbosch and University of the North**		**1998**	**Senekal, M. and Steyn, N. P.**	**Abstract**
Knowledge attitude, and nutrient intake **of elite sportsmen and women in Potchefstroom**	**19 – 25**	**1998**	**Du Plessis, A**	**Abstract**
Changing Patterns in Cardiovascular Risk Factors and Diet **in Rural Black Men, University of Orange Free State**	**25 – 64**	**1998**	**Slabber et al.**	**Abstract**
Weight Health Status of African Female Students**, Universities of the North and Stellenbosch**		**1998**	**Steyn et al.**	**Abstract**
Nutrient Intake of Undergraduate Hostel Students **at the University Orange Free State (UOFS)**		**1998**	**Badenhorst et al.**	**Abstract**
Food Preferences of Undergraduate Hostel students **at the UOFS**		**1998**	**Badenhorst et al.**	**Abstract**
Intake from the 5 Food Groups of Undergraduate **Hostel Students at the UOFS**		**1998**	**Badenhorst et al.**	**Abstract**
Nutrition Knowledge and Attitudes of Black Female Students **at the University of the North**		**1998**	**Brits, S. ; Steyn, N. and Senekal, M**	**Abstract**
Knowledge and Utilisation of Sound Weight Loss Practices in Undergraduate **Students at the UOFS**		**1998**	**Slabber et al.**	**Abstract**
Food Habits and Food Preferences of Men of the South African **Population**	**16 – 25**	**1998**	**Viljoen, A.**	**Abstract**
Urban and Rural Differences in Dietary Intake, Weight status and nutrition knowledge of Black female students**, University of the North and Stellenbosch**	**17 – 34**	**2000**	**Steyn et al.**	**Published**
Consumption of Sugar Amongst Young Females **, in the Vaal Triangle Technikon**	**13 – 25**	**2000**	**Thapeli et al.**	**Abstract**
Demographic and Health Profile of Females **in the Vaal Triangle Technikon**	**13 – 25**	**2000**	**Oldewage-Theron et al.**	**Abstract**
Food Consumption Patterns and Nutritional Intake of Females **in the Vaal Triangle**	**13 – 25**	**2000**	**Oldewage-Theron et al.**	**Abstract**
Weight Management Practices, Body Size and Body Shape Satisfaction **of Female University Students, University of Pretoria**	**19.7 average**	**2000**	**Wenhold, F. A. M**	**Abstract**
Ideals and Perception of Body Size of First Year Female students **at the UOFS**	**15 – 25**	**2000**	**Slabber et al.**	**Abstract**
Factors influencing Food Habits of Men of the South African Population**, University of Pretoria**	**16 – 25**	**2000**	**Viljoen, A. T.**	**Abstract**
Trends in Food Habits of Men of the South African Population**, University of Pretoria**	**16 – 25**	**2000**	**Viljoen, A. T. and Gericke, G. J.**	**Abstract**

Source: (The South African Journal of Clinical Nutrition, 1996 – 2000; Asia Pacific Journal of Clinical Nutrition, 2000)

2.2.1 THE LEVEL OF NUTRIENT INTAKE AMONGST YOUNG ADULTS: STUDIES CONDUCTED IN SOUTH AFRICA

The majority of the above studies was conducted using Black South African population groups. The aim of most of the studies was to measure the dietary intake of rural and urban Black females and males, relative and in comparison to the other race groups. These studies addressed the three hypotheses (section 1.2.2.1 and 1.2.2.2:7) of the proposed study individually. Therefore, the integrated influence of the three variables collectively, was tested.

The results of these studies indicate that the nutritional patterns of Black South Africans seem to be changing simultaneously with an increasing shift towards a Western lifestyle (Slabber et al.,, 1998). Dietary patterns, habitual food intake and frequency of traditional food intake are also influenced by changing socio-economic profiles (Van Eeden and Gericke, 1996). It has been shown that Whites and Coloureds have a similar food pattern. On the other hand, Black ethnic groups follow a Western type of eating pattern in combination with the traditional pattern. This indicates a changed meal pattern from the traditional diet (Viljoen, 1998). It has also been shown that urbanised Black South Africans have significantly increased risk levels of developing chronic diseases of lifestyle such as coronary heart diseases (Love et al., 2001; Senekal and Steyn, 1998) due to a high energy but low fibre intake.

2.2.1.1 Macronutrient Intake

According to Slabber et al., (1998), Black students reported the following energy intake levels: total fat (30.7%); saturated fat (10.2%); animal protein (67%); total carbohydrates (48.8%) and plant protein (33%) when compared to the recommendations of the prudent dietary guidelines. According to Senekal and Steyn (1998), 50% of the respondents in a national study consumed more than 30% of total energy from fat, and being overweight was evident in 48 – 52% of Black, White and Coloured respondents compared with 35% in Indians. High energy intake is closely associated with higher weight values. These results suggest a favourable risk profile for coronary heart disease. According to Senekal and Steyn, (1998), Black female students at the University of the North and Stellenbosch are at risk of developing coronary heart disease. The anthropometric values collected in this study indicated that a large number of students was overweight with a BMI $>$ 25, and 12.9% of the population sample exhibited an android type of obesity.

There is a changing attitude towards obesity amongst the Black population in an urban setting (Slabber et al., 1996). Results have shown that most subjects consider slimness to be attractive. Own body size was underestimated by 49% in all subjects while 14% overestimated body size. Thirty percent estimated body size correctly (Slabber et al., 2000). Most subjects had a normal BMI, but only 30.2% of Black females and 38% of White females considered that as ideal (Slabber et al., 2000). More females (19.6%) than males (8.3%), preferred a BMI $<20kg/m^2$ for themselves and considered it more attractive (21.2% vs. 13.0%) respectively. Therefore, this could indicate a desire to be slim or thin, which is a body image indicative of Western norms. Studies conducted at the University of Stellenbosch and the University of the North (Steyn et al., 1998) showed that the prevalence of overweight was higher in urban compared with rural female students. The WHR (waist-to-hip ratio) was found to be significantly greater (P = 0.0003) in rural female students compared with urban being females 0.76 vs. 0.73 (WHR), respectively (Steyn et al., 2000). As a result, there is evidence of weight loss practices amongst urban Black female students (Slabber et al., 1998) due to the desire to be thin. Hence, young Black females can be considered a risk group for the developing dietary habits that will result in malnutrition.

2.2.1.2 Micronutrient Intake

According to Badenhorst et al., (1998), more than 50% of the students assessed at the University of Orange Free State had an insufficient intake of micronutrients, especially calcium and vitamin A (Figure 2.1:22). Figure 2.1 also indicates the percentage of the student population with insufficient intake of various other micronutrients such as calcium, energy, folate, iron, magnesium, niacin, protein, riboflavin, thiamin, vitamin A, vitamin B_{12}, vitamin B_6, vitamin E and zinc. The dietary pattern of the sample resembles a typical urban diet, high in energy with a micronutrient imbalance. One of the factors that is related to insufficient micronutrient intake is the lack of nutrition knowledge.

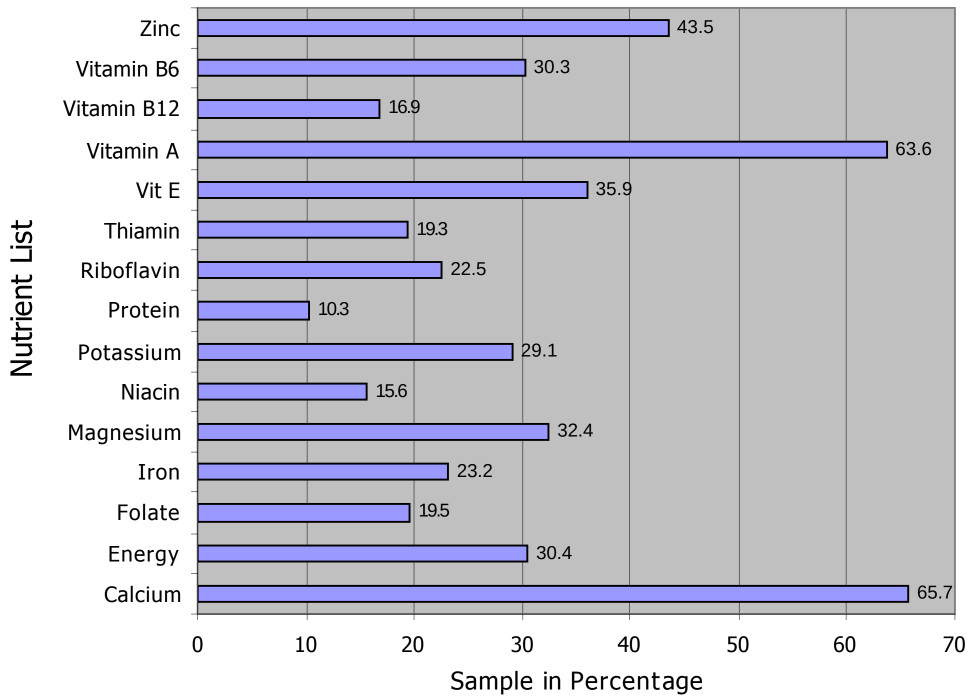

Figure 2.1 Percentages of Students with Insufficient Intake of Micronutrients

Source: Badenhorst et al., (1998)

Steyn et al., (2000) showed that there was a positive correlation between nutrition knowledge and the intake of energy, protein, carbohydrate, fibre, calcium, zinc, thiamin, niacin and folate. In a study conducted by Senekal and Steyn (1998), the majority of students (80.6%) had low nutrition knowledge scores (< 50%). This is a risk factor for diseases of lifestyle (Senekal and Steyn, 1998). Although nutrition knowledge results were poor, attitude towards healthy nutrition was positive. This study however, did not clearly indicate the integrated and systemised influence of various socio-demographic factors (variables) on existing dietary habits (behaviour). Only Steyn et al., (2000) correlated nutrition knowledge with insufficient nutrient intake. By using the Lifestyle Model of Dietary Behaviour (Pelto, 1981) as a descriptive conceptual tool, the variables that can have an influence on dietary behaviour can be clearly identified.

2.3 FACTORS INFLUENCING DIETARY BEHAVIOUR: LIFESTYLE MODEL OF DIETARY BEHAVIOUR

The Lifestyle Model of Dietary Behaviour can be used as a guide to investigate broad variables of dietary behaviour. It is useful when combined with an emphasis on intracultural diversity and a systems or holistic approach towards dietary behaviour (Pelto, 1981). Therefore, the model has been combined with an ecological systems perspective of the Health Belief Model, as a conceptual tool for compiling the literature review.

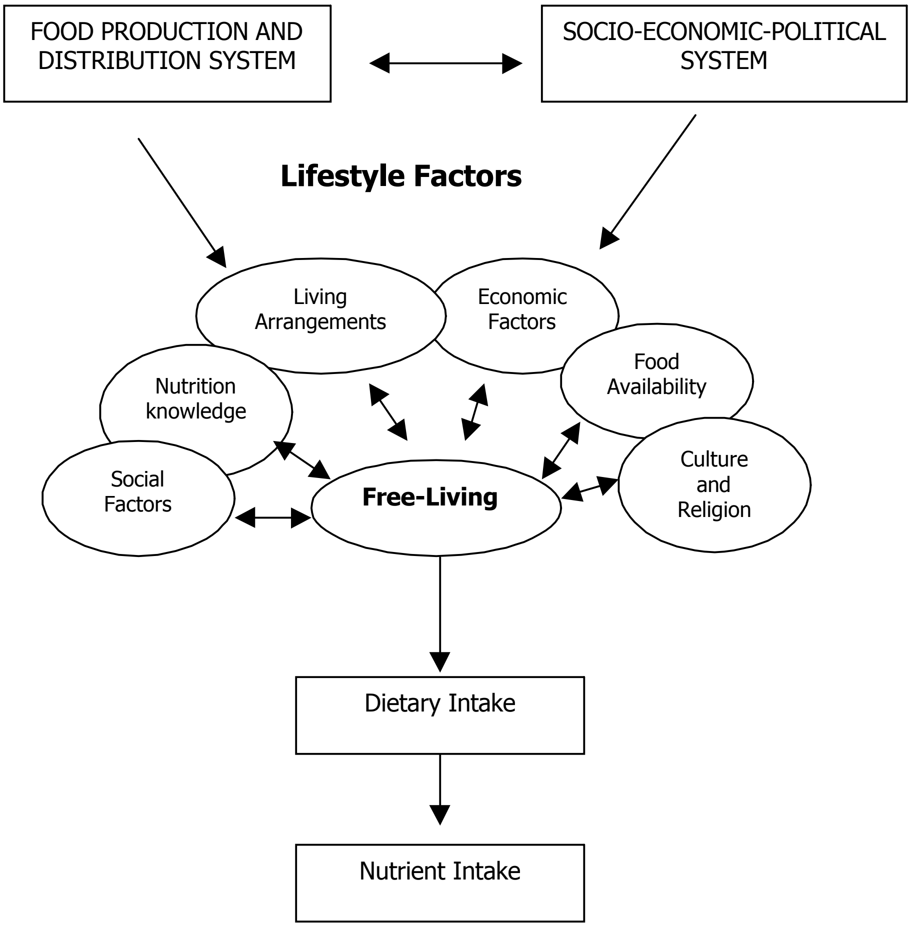

Figure 2.2 The Lifestyle Model of Dietary Behaviour

Source: Adapted from (Pelto, 1981)

Lifestyle factors are derived, in part, from social and political processes that represent the translation of these processes (or their impact) at the individual level. The variables that make up lifestyle include material features (reflecting the degree of access to resources), situational characteristics, cultural and religious features and physiological characteristics. The model postulates a process whereby these factors (variables) are integrated and systematised as individuals maintain strategies of coping and decision-making responses to their dietary needs. Household or living arrangements are a prime focus within which dietary behaviour is organised and other health processes enacted (Pelto, 1981). The Health Belief Model is among the theories of human behaviour applied in understanding obesity and other health related behaviours and interventions (Parham, 1993).

One theory cannot be expected to provide adequate explanatory power. Therefore, a combination of theories drawn from social psychology, communications, education and other disciplines is applied. The Health Belief Model has been adapted by including nutrition knowledge as one of the variables in order to apply a cognitive approach to dietary behaviour (Chapman et al., 1995). When considered alone, knowledge seldom predicts behaviour and behaviour change (Chapman et al., 1995). Therefore, the ecological perspective of the Health Belief Model with nutrition knowledge as one of the variables is used as an organizing framework for explaining dietary behaviour.

2.3.1 SOCIO-ECONOMIC-POLITICAL ENVIRONMENT

As defined by Popkin (1993) nutritional transition describes the changes in dietary pattern and nutrient intake associated with urbanisation, acculturation or Westernisation. As people in more traditional societies enter a food system in an urban area and adopt a more westernised-eating pattern, they enter a "nutritional transition". The diet becomes higher in fat and low in fibre as opposed to the more traditional prudent diet which is high in fibre and low in fat. Nutritional transition is also associated with a greater availability of processed foods such as pizza, hamburgers, cakes and pastries (Betts et al., 1997:74; Lieux and Manning, 1992:561). As milk and dairy products, fresh fruits and vegetables are incorporated into the diet, the proportion of dietary sugar and fat increases (Nestle et al., 1998:50-59). An international epidemiological study investigating dietary habits of university students in the United States showed that the total intake of fat, saturated fat and sodium intake exceeded the recommended levels (Seymour, Hoerr and Huang, 1997:24; Brevard, Crystal and Ricketts, 1996:35).

The American influence on lifestyle has affected the availability of and demand for ready-to-eat, economical food. These foods are often processed, packaged and pre-portioned and are typically high in fat and sodium (Nestle et. al., 1998:S52). These food items are also being adopted into the habitual, traditional diet of the African population (Mennen et al., 2000), especially in developing societies. Consequently, fibre and micronutrient intake is significantly reduced (Hendricks and Herbold, 1996:66). It has become evident that the influence and adoption of an urban lifestyle has a significant impact on food choice and eating patterns of individuals (MacIntyre, Venter and Voster, 1998).

The intake of fruits and vegetables is related to social and sensory appeal (Keim, Stewart and Voichick, 1997:80). On an individual level taste, smell, sight, and texture rather than nutritive value and food safety influence food consumption (Nestle et al., 1998; Marshall, 1995:36). Textural qualities that depend on fat content include hard, soft, juicy, chewy, greasy, viscous, smooth, creamy, crunchy and crisp. Generally, diets containing fat are more varied, appealing, aromatic and rich, and provide a higher energy density (Betts et al., 1997:75; Keim, Stewart and Voichick, 1997:80). Therefore, lifestyle in addition to aesthetic appeal increases the consumption of high fat foods.

2.3.1.1 Lifestyle Factors

Factors of lifestyle are derived from the macro level of social and political processes. Lifestyle represents the impact of these processes at the level of individuals. The variables that make up lifestyle include material features (reflecting the degree of access to resources), situational characteristics, cultural features, physiological and health characteristics (Pelto, 1981:S2). Lifestyle is a resultant of a broad range of independent variables. These variables are integrated and systematised as individuals maintain strategies of coping and decision making in response to their dietary needs and aspirations. This means an individual is the prime focus within which dietary behaviour is organised and other health related processes enacted. Some of the variables predicting health and diet behaviour are features of the individual's household structure. These variables include living arrangements and occupation. At the same time, food choices and available options are affected by external variables such as income and the type of community. Since individuals do not have identical values for all these variables, they each have a unique lifestyle. However, similar lifestyles can be associated with similar dietary patterns and health-related behaviours (Pelto, 1981:S4). The socio-political-economic environment has a definitive influence on eating habits. Therefore, a change in the environment or the perception of the environment will most probably lead to a change in eating habits. In the context of students' lifestyle factors such as the tertiary environment, academic pressure and living arrangements potentially determine meal patterns.

2.3.1.2 Living Arrangements

For most young adults aged 17 – 30 years, this stage of the life-cycle is the first opportunity to make their own food choices without parental influence (Weigley, Mueller and Robinson, 1997:253). Most students move out of their home into their own apartments and live either by themselves or with friends. It is suggested that food intake is higher, especially when living arrangements are composed of familiar people (group setting). This is common amongst students (Nestle et al., 1998:57; Weigley, Mueller and Robinson, 1997:21-24). Research has also shown that young adult peer groups have significant influences on eating behaviour and diet. It is suggested that the unhealthy lifestyle habits of young adults, such as the consumption of high fat foods and experimentation with new foods, influence the level of nutritional adequacy of the individual's diet (Keim, Stewart and Voichick, 1997:80).

Students' living arrangements (depending on whether it is a self-catering apartment or not), are also influenced by the availability of food systems such as restaurants, supermarkets, fast-food outlets and street vendors. The choice of a food system is however interrelated with budget constraints, food availability, adequate storage and refridgeration facilities, cooking utensils and equipment (Hendricks and Herbold, 1998:66; Koszewki and Kuo, 1996:1286; Weigley, Mueller and Robinson, 1997:21 – 24). Subsequently, these factors influence compliance with dietary guidelines and nutrient standards within the available food systems. Food insecurity has been associated with increased household size in South Africa. However, research indicating food insecurity with free-living households in urban areas is limited.

2.3.1.3 Social Factors

Food is a symbol of sociability, warmth, friendliness and social acceptance. People accept food readily from those persons viewed as friends and allies. Some foods have more prestige value than others (Weigley, Mueller and Robinson, 1997:22). These foods are used to impress friends and are often costly. Foods given a low status are minced meat, margarine, powdered milk, dry beans and canned foods (such as tuna fish). These foods are good sources of certain nutrients and are likely to be more affordable. However, since they carry such low status they may not be included in the diet (Weigley, Mueller and Robinson, 1997:22).

Food also carries gender connotations. Meat, potatoes and pies may be typical of masculine meals, whereas soufflés, salads and sorbet are classified as feminine foods (Weigley, Mueller and Robinson, 1997:22). Significant differences are found between genders in the intake of food and nutrients. In terms of requirements, males have higher nutrient needs when compared with females. Therefore, males can be expected to have higher nutrient intake when compared with females (Williams, 2001:63).

2.3.1.4 Economic Factors

Poverty is universally accepted as a fundamental cause of undernutrition, and it is a serious problem in South Africa, with the overall poverty rate at 85.9% (Love et al., 2001). Poverty can adversely affect the formation of satisfactory food habits. Inadequate income usually limits both the quantity and variety of food consumed. Limited funds to meet financial demands such student fees and food purchases lead to insufficient quantity and quality of food eaten. In addition, students lack consumer skills such as budgeting, in order to optimally utilise available resources in making food choices. For example, in the United States Department of Agriculture (USDA) Focus Group study, low-income participants expressed uncertainty about how the need to consume low fat and high fibre foods might translate into specific food choices (Nestle et al., 1998). This means consumer choices are not always based on the food's nutritional benefits.

The above could suggest that the affluent, who have more money to spend on food, could be inclined to obesity. On the other hand, poorer families would be expected to be lean because of lack of available funds to acquire the necessary food (Senekal, 1986). The poor could also be obese due to over-consumption of energy foods. However, the variation in the incidence of obesity amongst socio-economic groups can hardly be explained only by a difference in income, education and consequently the food intake (Weigley et al., 1997; Williams, 1993 and Senekal, 1986;). Food insecurity in South Africa has been associated with socio-economic status as well as an increased household size (Rensburg et al., 2000; Rose and Charlton, 2000). Even though higher socio-economic status does not translate into increased expenditure and quality of dietary intake, it does increase greater availability of food (Sheperd et al., 1996:20).

Availability of food can be described as a wide choice of food options accessible through food systems that are acceptable and affordable to consumers (Nestle et al., 1998). Food availability is influenced by technological means to process and store food. This affects the type of food chosen for consumption, and convenience of food is related to shelf life, cooking and preparation time and as well as to packaging. Foods with almost similar convenience characteristics such as chips, hamburgers and pastries are available to students from food sources such as street vendors, kiosks and cafeterias. However, despite availability, consumption is ultimately affected by the affordability of food items (Nestlé et al., 1998). Therefore, food availability in terms of food systems does not guarantee consumption.

2.3.1.5 Culture and Religion

Eating behaviours are acquired over a lifetime and culture is the pervasive foundation that underlies all food choices. These factors are also related to major life experiences from birth, religion and politics right through to general social organisation. People use categories of culture, subculture and religion as well as ethnic groups in order to frame what they consider to be acceptable and preferred foods. Perceptions and beliefs, attitudes and values towards food are constructed based on cultural and religious values together with psychosocial factors such as education and social interaction (Nestle et al., 1998:56).

Food habits are among the oldest and strongest aspects of many cultures and exert great influence on the eating behaviour of people. Cultural, subcultural, religious and ethnic backgrounds determine what shall be eaten as well as when and how it will be eaten. The amount and combination of foods chosen and considered to be ideal and proper from a cultural and religious perspective, do not always result in optimum nutrient intake (Nestle et al., 1998:57). Indigenous cultures that have remained stable for generations have encountered the world of technological change and have been rapidly and radically transformed. Their native eating patterns have therefore disintegrated and regulations of religious food practices have been liberalised (Weigley, Mueller and Robinson, 1997:23; Williams, 1993) and are marked by change in individuals' lifestyles. This phenomenon is also indicated by the general tendency of Westernisation in the dietary pattern of most South African cultural groups (Labadarios, 1999).

2.3.1.6 Nutrition Knowledge

The role of nutrition information on food choice is based on the process by which individuals acquire and understand the nutrition information, perhaps in combination with other relevant information (Anderson, Milburn and Lean, 1995:110-111). From this perspective, food choices are seen as a function of a cognitive information-handling process. This cognitive process is integration between exposure to nutrition information and dietary decision. This ultimately determines the nutritional adequacy of an individual's diet (Anderson et al., 1995).

According to Polton (1981), a correlative link between nutrition knowledge and dietary intake is still inconclusive. The latter author reported a widespread lack of correlation between nutrition knowledge and the application of that information outside the classroom. Likewise, Picardi (1981), reported that correlation of nutrition rankings with health concerns and food choices was disappointing. However, Sims and Smiciklas-Wright (1981) suggested that these studies were aimed at a cognitive level only. They ignored personal attributes that influence dietary behaviour such as attitudes, beliefs and values and thus failed to recognize the particular environment's resources that influence dietary behaviour.

Hence, later studies on dietary behaviour (indicated in Table 2.2:32) incorporated personal and environmental attributes together with nutrition knowledge in studying dietary behaviour. This provided evidence of a correlative link between nutrition knowledge and dietary behaviour. Results of studies reported in Table 2.2:32 indicate that contradiction exists between studies in terms of the influence of nutrition knowledge on nutrient intake. Authors indicating a correlative link between nutritional knowledge and nutrient intake include Neumark-Sztainer, Butler and Palti, (1996) and Levy, Fein and Stephenson (1993).

Table 2.2 Studies indicating a Correlative Link between Nutrition Knowledge and Dietary Behaviour amongst Young Adults in Developed and Developing Counties:

Author and Year	Sample	Study Design and Measure	Results
Steyn et al., 2000 Asia Pacific J Clin Nutr	Black female students, age from 17 to 34 years from the University of the North, 61% from rural and 39% urban areas	Examine dietary intake, nutrition knowledge and weight status of young Black women	Nutrition knowledge test scores were poor, no urban-rural differences were found. There was a positive correlation between NKT and energy, protein, carbohydrate, fibre, calcium, zinc, thiamin, niacin, and folate intakes
Keim, Stewart and Voichick, 1997 J Nutr Educ	Randomly selected, 18 to 24 years old, males and females.	Determine the behaviours associated with eating vegetables and fruits; and relationship between young adults' perceptions of vegetables and fruits and relative intake. Survey collected demographic information and used a repertory grid and a Food Frequency Questionnaire.	Perceptions about vegetables and fruits included both social and sensory and health aspects. Perceptions of health aspects of fruits and vegetables did not have a consistent or significant relationship with intake. Research suggests that social and sensory aspect of fruits and vegetables may be important in nutrition education.
Betts et al., 1997 J Nutr Educ	18 to 24 year old college students, and college graduates	Survey included demographics, opinion items, a repertory grid rating foods against factors thought to influence food intake and food frequency	Concurred with Keim, Stewart and Voichick (1997). In addition for students importance of nutrition disappeared as a perception while convenience emerged, while with graduates importance of nutrition appeared as a strong perception.
Harnack, Block and Lane, 1997 J Nutr Educ	A Review article	Influence of selected environmental and personal factors on dietary behaviour for chronic disease prevention	Nutrition knowledge compete with a myriad of factors in determining dietary behaviour
Neumark-Sztainer, Butler and Palti, 1996 J Nutr Educ	341 Jewish-Israeli Tenth-grade girls with mean age 15.3 years. Comparison of the sample with national norms for ethnic background and parental education and occupation indicated that the sample was fairly representative of the Jewish population as a whole	A model examining the association of potential risk factors playing a role in the development of dieting and other healthy behaviours, proposed and tested. Personal and socio-environmental variables included in the model.	Body/Self-image was a strong predictor for dieting, while nutritional knowledge and attitudes was a strong predictor of nutritional intake. The effect of socio-environmental factors was less than expected and was primarily via their effect on personal factors
Neumark-Sztainer, Butker and Palti, 1995 J Nutr Educ	341 Jewish-Israeli Tenth-grade girls with mean age 15.3 years. Comparison of the sample with national norms for ethnic background and parental education and occupation indicated that the sample was fairly representative of the Jewish population as a whole	A school-based programme aimed at the primary prevention of eating disturbances was developed and evaluated. The programme was based on social-cognitive principle for behavioural change. The goals were to change knowledge, attitudes, and behaviours related to nutrition and weight control; to improve body image, and to promote greater self-efficacy in dealing with social pressures regarding excessive eating and dieting.	The program had moderate effects on nutrition knowledge and meal patterns and preventing onset of unhealthy dieting and bingeing behaviours.
Levy, Fein and Stephenson, 1993 J Nutr Educ	Telephone interviews of randomly selected participants, 18 years or older. Data obtained from three approximately biennial Health and Diet Survey conducted by the Food and Drug Administration and the National Health, Lung and Blood Institute between 1983 and 1988.	Consumer knowledge of dietary fats and cholesterol was analysed, including food label use; awareness of diet and disease relationship; dieting behaviours with regard to calories, sodium, fats, and other demographic characteristics; sources of nutrition knowledge and health dieting behaviours.	Results indicated that consumer knowledge about dietary fats and cholesterol is poor. Nutrition knowledge was amongst those who were educated, white and those on a cholesterol-lowering diet.
Chapman and Maclean, 1993 J Nutr Educ	Women age 11-18 years, semi-structured interviews	Qualitative research examining meanings of food within adolescent female culture by looking at ways in which young people classify and use food.	The main classification of food emerged from the data analysis; "healthy foods" and "junk foods".
Trexler and Sargent, 1993 J Nutr Educ	600 randomly selected high school students in Southern Carolina.	Assessment of Nutrition Risk Knowledge to the Dietary Practices of Adolescents. Knowledge of four dietary factors associated with cardiovascular (CVD) disease (cholesterol, saturated fat, total fat and sodium) was assessed and compared with cardiovascular dietary quality.	No significant relationship was found between knowledge scores and CVD dietary quality, however physiologic knowledge of sodium was associated with sodium intake.

Research suggests that knowledge awareness related to nutrition and health captures people's attention. It increases awareness and enhances motivation. Practical knowledge (how to knowledge) is the kind that people need when they are already motivated. Behavioural capabilities (or knowledge and skills) are the kind of skills that people need in order to act on their motivations (instrumental knowledge) (Contento, 1995:287). Therefore, the degree of correlation between nutrition knowledge and dietary behaviour could point towards the types of nutrition information people or students are exposed to and respond to.

Approaches used to increase nutritional knowledge focus on familiarising people with important nutrition concepts. They emphasise reduction in the intake of certain nutrients and focus on intake of certain foods and foods that should be substituted by healthier alternatives (Anderson, Milburn and Lean, 1995:111). To put understanding of nutrition information into practice, the individual must be able to cope with issues such as quantities of food needed for maintenance of health and prevention of diseases of lifestyle. The accuracy of nutritional knowledge is influenced by the source of information used (Medeiros, Shipp and Taylor, 1993:201), for example food labels, labels on dietary supplements and the media. The source of information has an impact on the food meanings derived by the individual from the information. This interacts with lay perceptions and beliefs about nutrition and health before an individual reaches an understanding of a healthy diet (Anderson, Milburn and Lean, 1995:Ch. 5:111). Thus, it is suggested that knowledgeable consumers are inclined to make better informed food choice decisions.

(i) Nutrition Knowledge and Health Status

The contention that improved health status, resistance to disease, or reduced prevalence of diet-related disease will result from improved dietary practices can be documented for certainty. However, Hauchbaum (1981) argued convincingly that the way in which nutrition information is disseminated has been largely ineffective in terms of producing any lasting change in dietary behaviour, resulting in improved health status. This was attributed to various factors, such as:

- inability to comprehend knowledge about nutrition
- strong psychological cues for consuming certain foods
- pervasive socio-cultural norms about eating
- lack of disposable income that can be spent for food
- personal or public apathy or indifference to nutrition as an important concern when it comes to making food decisions (Sims, 1981).

A variety of models, theories and frameworks is used to guide, implement and evaluate nutrition knowledge, such as the social learning theory (SLT) (Harnack, Block and Lane, 1997:307) and the social cognitive theory (SCT) (Neumark-Sztainer and Palti, 1996:196). A combination of these models provides an understanding of various concepts and objectives of nutrition knowledge. The models take into account the challenges to effective dissemination of nutrition information. The SLT provides a framework for understanding the potential independent and joint influences of nutritional knowledge, beliefs, psychosocial and environmental factors on food selection (Harnack, Block and Lane, 1997:307). Within the context of the SLT, nutrition knowledge and beliefs are one of the factors that influence dietary behaviour, as well as health status. However, it is still not clear which factors override health concerns when it comes to making dietary changes (Harnack, Block and Lane, 1997:307).

(ii) Nutrition Knowledge and Dietary Change

Changes in dietary habits of an individual or group are often viewed as the ultimate goal of nutrition information. Dietary change is an intermediate link to improved health status or decreased morbidity and mortality from diet-related diseases (Anderson, Milburn and Lean, 1995:Ch 5:111). Anderson et al., (1995) suggest that there are three important components of nutrition knowledge that influence the approaches to dietary change, namely:

- understanding nutrition terms
- understanding the theoretical principles of good nutrition
- understanding the practical application of these theoretical nutrition principles.

People need to understand how nutrition terms translate to specific food choices. They also need to know which nutrients should be consumed in greater and lesser quantities. In practice, this means people need to know what foods to buy, where to buy and how to prepare and cook them. This can assist dietary change in the presence of an enabling and facilitating environment, for example available resources. Therefore, it is indicated that people can manifest inadequate nutritional status based on inadequate nutritional knowledge (du Plessis, 1998). Nutritional information must be able to provide a true practical understanding of appropriate food choice concerning issues that confront consumers on a daily basis (Anderson et al., 1995). Therefore, the accumulated knowledge regarding the influence of urbanisation on nutritional status needs to be assessed for relevance with respect to the needs of this segment (young adults) of the population in terms of nutrition education.

2.4 POTENTIAL NUTRIENT INADEQUACIES AND NUTRITIONAL REQUIREMENTS DURING YOUNG ADULTHOOD

Nutrients more likely to be inadequate in the diet of young adult females and males with unhealthy eating patterns are iron, calcium, magnesium, vitamin A and vitamin B6 (Vaughan, Benyshek and Martin 1997:1279). Oldewage-Theron et al., (2000), found that iron deficiency was widespread among females aged 13-25 years, and that it was induced by a plant–based South African diet containing low levels of poorly bio-available iron. Both male and female young adults have high requirements for iron (Mahan and Escott-Stump, 1996:280). Koszewski and Kuo, (1996) and Steyn et al., (2000) also indicated that the average intake by all nutrients of female and male students was above the RDA, except for energy, calcium and iron.

The nutrient requirements of females differ from those of males due to differences in genetic make-up, hormone levels and body composition, as well as growth patterns (Weigley, Mueller and Robinson 1993:31). Males have higher energy needs than females. Sufficient fat intake is necessary in females for regular hormone metabolism, for example menstruation, but excessive intake increases the risk of coronary heart disease, cancer and obesity (Hendricks and Herbold, 1997:66; Weigley, Mueller and Robinson, 1997:7). Young adults incorporate twice the amount of iron, zinc and magnesium into their bodies during years of growth than at other times. The requirement for calcium in adolescence is based on skeletal growth, 45% of which occurs during this period (Mahan and Escott-Stump, 1996:280). The RDAs for calcium and vitamin D are set at adolescent levels until young adults celebrate their 25th birthday (Weigley, Mueller and Robinson, 1997). Micronutrient intake has been found to be beneficial in reducing the risk for degenerative diseases. According to Solomons (2000), it is suggested that an incorrect juvenile diet as well as an unhealthy lifestyle may play an important role in the development of chronic diseases such as coronary heart disease and cancer.

2.5 THE CONTROL OF FOOD INTAKE

2.5.1 INITIATION AND TERMINATION OF FOOD INTAKE

Hunger initiates food-seeking behaviour. When the body needs food the characteristic sensation of hunger increases in intensity as long as the need is not satisfied. The sensation may be modified by many factors, including the cephalic phase of appetite, which is the response to the thought, sight, taste, or smell of food (Ziegler and Filer, 1996). Appetite, is a desire for food generally associated with enjoyable aspects of food choice and ingestion. The term appetite is often used to discuss signals that guide selection and consumption of specific foods and nutrients. Thus, appetite can be expressed by behaviour. Appetite also leads to specific intake of energy to satisfy body energy deficits or to the selection of foods to meet the specific nutrient requirements. It also satisfies a hedonic desire for specific taste (for example, savoury or sweet) (Ziegler and Filer, 1996). With the initiation of food ingestion a progression of psychological and physiological responses occurs, leading to satiety and termination of food intake (Ziegler and Filer, 1996; Senekal, 1986).

2.5.1.1Psychological factors

The term psychological factors refers to the intake of food influenced by the presence of others eating and feelings of happiness, love and security. This also includes consumption of food to cover up emotions of worry, grief and loneliness (Ziegler and Filer, 1996; Williams, 1993). Social factors such as occasion, culture and religion, beliefs and hedonic factors also contribute to the state of satiation and termination of hunger. However, forbiddance of certain foods due to religious beliefs can result in failure to respond to the hunger signals (Ziegler and Filer, 1996). These factors will influence and determine the habitual diet of an individual.

2.5.1.2 Physiological factors

The physiological factors include bulk of food, composition, rate of absorption and metabolic responses. These factors affect the duration in which satiety occurs. The duration of satiety and the interval to the next ingestion of food depend on a complex system of neuronal responses integrated in the central nervous system (Ziegler and Filer, 1996). The amount of food ingested depends upon sensory and cognitive responses of the individual as well as upon the energy and nutrient content of the food. In humans, cultural and social conventions are significant modifiers of the signals arising from internal metabolic and physiological conditions (Ziegler and Filer, 1996; Senekal, 1986).

Hunger is stimulated by an energy deficit which is then satisfied by ingestion of food containing macronutrients (fats, carbohydrates or proteins) which provide energy. The intake of these nutrients as well as micronutrients also satisfies specific nutrient needs. Food consumed results in energy either utilised for body metabolism or stored for metabolism (Ziegler and Filer 1996), as illustrated in Figure 2.3:40.

2.5.2 THE DEVELOPMENT OF EATING HABITS

The development of food habits is a very human process and all food habits are closely linked with lifestyle. Lifestyle includes a network of factors such as family or the individual's life-stage, culture, living arrangements and socio-economic status (Williams, 1993). Individuals' eating behaviour is a result of past life experiences, which are unique to each person. This is conditioned by each person's genetic capacities, specific past experiences and peculiar perceptions of situations (Weigley et al., 1997; Senekal, 1986). For example, children depend on others for food, and with the manner in which food is provided, the child receives information. It is from this information that the child develops attitudes, feelings and habits about food (Weigley et al., 1997).

Food habits can be identified as characteristics and repetitive acts performed under the impetus of the need to provide nourishment and meet social and emotional goals (Ziegler and Filer, 1996; Senekal, 1986). The habitual food choices that are made are towards achieving satisfaction such as security, comfort, status, pleasure and enhancement of a person's ego (Senekal, 1986). Once formed, food habits control behaviour (Willams, 1993; Senekal, 1986). The development of food habits can be divided into three phases namely: primary socialisation, secondary socialisation and re-socialisation. The first two phases are the most important in the development of food habits (Senekal, 1986).

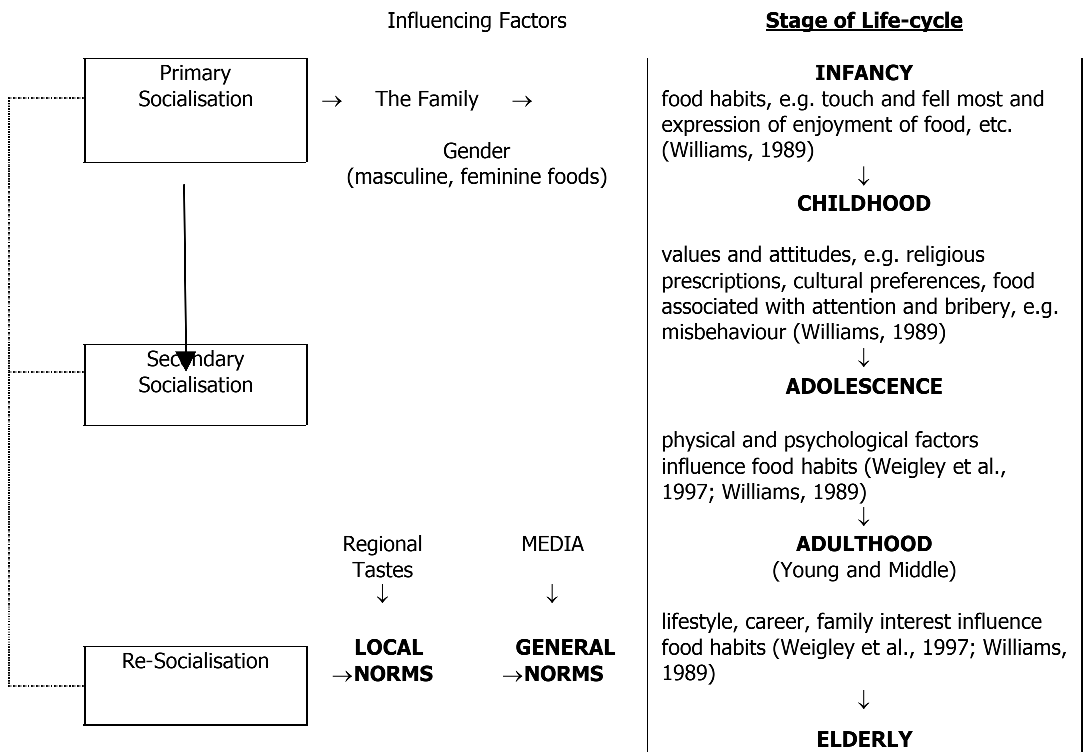

Figure 2.3 The Development of Eating Habits

Source: Adapted from Senekal (1986) p.40

2.5.2.1 Phase One: Primary Socialisation

Primary Socialisation occurs in early childhood, mainly through the influence of parents and other relations and friends (Williams, 1993). The mother has the strongest influence in most cases. Transmission of norms and internalisation of routines occur at this time, and they are culture bound. Foods begin to take on emotional significance for the child. This may override the nutritional value, for example sweetness may be associated with goodness. This association can persist through to adult life. Family food influence at this stage lies in the manner in which the food is prepared, the volume served and the rewards and punishments associated with eating (Weigley et al., 1997; Williams, 1993; Senekal, 1986).

2.5.2.2 Phase Two: Secondary Socialisation

Secondary Socialisation is a period during which the knowledge necessary for a rational explanation of which behaviour serves as reinforcement for the maintenance of behaviour is acquired. During this period the child is also exposed to a wider range of influences and to constantly differing values and opinions. At this stage the child is very likely to adopt the values, attitudes and behaviour of social groups to which he/she would like to belong (Weigley et al., 1997; Williams, 1993; Senekal, 1986).

2.5.2.3 Phase Three: Re-Socialisation

During the third phase, namely re-socialisation, the adult is usually still strongly influenced by his/her environment and the social group to which the individual belongs (Weigley et al., 1997; Senekal, 1986).

2.5.3 THE INFLUENCE OF THE DEVELOPMENT PHASE ON EATING HABITS (YOUNG ADULTHOOD)

The age span of students entering tertiary institutions ranges from 17 to 30 years of age (Thompson, 2001). According to the process of human development as described by Williams (1993) and Weigley et al., (1997), this phase is classified as late adolescence to young adulthood. Therefore, it was assumed that every participant in the study had reached this developmental phase. For this reason, the influential variables on dietary behaviour concerning early adulthood as well as late adolescence are discussed briefly.

2.5.3.1 Adolescence

Adolescence is the period that lies between childhood and adulthood (Williams, 1993). The term adolescence originated from the Latin word adolescere, which means to grow up or grow into maturity. Growth applies to physiological, psychological and social growth (Weigley et al., 1997 and Williams, 1993).

Physiological: The onset of a growth spurt as well as the process of sexual maturity, for example body size and shape, complexion and physical activity (Weigley et al., 1997).

Psychological: The problem of adolescence is that of identity vs. role diffusion. The search for self begins in early childhood and reaches a climax in the identity crisis during the teenage years (Williams, 1993).

Sociological: The experience of passing through the unstructured and ill-defined phase that lies between childhood and adulthood, as well as the crisis of discontinuity of status. The social pressures and personal tensions concerning figure control can cause individuals to follow unwise self-imposed diets for weight loss. The above is coupled with the fact that adolescents' problems involve a distorted body image (Williams, 1993).

Adolescence is therefore characterised as a period of tremendous physical and emotional change. The 18-year old is faced with responsibilities and the challenge of finding a place in the community of adults (Weigley et al., 1997). The individual has not yet entered the era of early adulthood, but exists in a transitional period or on a developmental bridge (Weigley et al., 1997). Individuals have made psychological commitments to their own sense of self, but they have not yet made the social commitments associated with adulthood, for example career, marriage and children.

Whether an individual has reached the end of adolescence (early or late) could possibly be judged by determining the level of completion of certain developmental tasks and mastery of necessary skills, knowledge and attitudes that should be attained before moving into adulthood (Senekal, 1986).

2.5.4 THE EFFECT OF THE TERTIARY ENVIRONMENT ON EATING HABITS AND THE INFLUENCE ON LATER EATING HABITS

Young adulthood is considered the time span covering people aged 17 to 30 years (Weigley, Mueller and Robinson, 1997). From a nutritional point of view, growth and development are not completed in young adults. Physical growth actually continues to about the age of 21 years, and bone growth continues to the mid-to-late twenties (Weigley, Mueller and Robinson, 1997).

A significant portion of the student population that enters the tertiary institution is still in late adolescence and early adulthood in terms of their growth stage. These age groups are considered to be nutritional risk groups (Weigley, Mueller and Robinson, 1997; Story, 1996). Therefore they require an adequate intake of micronutrients such as calcium and iron. The RDAs are based on the nutrient requirements for continual maintenance and repair of the body, rather than the further need to account for the nutrient demands of growth (Weigley, Mueller and Robinson, 1997).

Figure 2.4:44 indicates the age distribution of the population of students at DIT: Steve Biko Campus. The data indicate that more than 50% of the population of students is in their late adolescence and early adulthood. Students are in a community with more diverse opinions and backgrounds. The exposure to this new environment has an important effect on personality development. A major impact lies in the students' questioning of possible incorrect assumptions held from childhood, replacing them with more concepts that are adult (Senekal, 1986). This process advances the establishment of an adult identity. Many people and/or factors can influence this change.

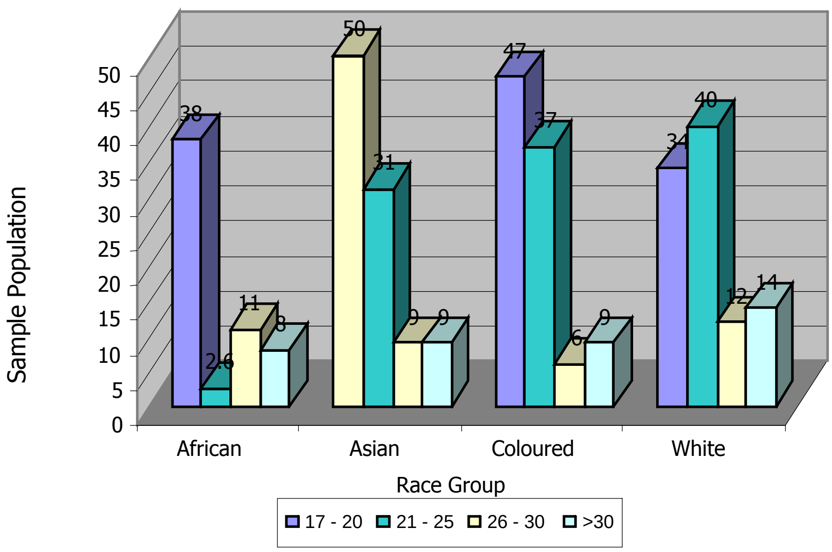

Figure 2.4 The Age Distribution of Students at DIT: Steve Biko Campus

Source: Steve Biko, **www.ntech.ac.za** (2000)

Individuals change, for example, in response to the diversity of the students' body. This poses challenges to long held views and values. The learner culture itself is structured differently from the society at large. The curriculum may offer new insights and new ways of thinking. Occasionally members of the staff take a personal interest in a student and provide a new set of role models. The choices of a field of study as well as a career could mirror these changes (Senekal, 1986). Many students arrive at a tertiary institution in participation of some unknown but great fulfilment. Many of them become disappointed academically and socially. Romantic dreams of gaiety, freedom, intellectual excitement and graceful surroundings crumble. Such dillusionment could become the source of serious anxiety for some students. These students feel isolated in a closed, unreal, artificial community, living a life removed from the main stream of their community (Senekal, 1986). Social isolation also remains a problem for many students: a lonely student stays lonely. Furthermore, students are so conditioned by the spoon-fed way they were taught at school, that they do not know how to adapt to learning on their own. By the time they do know, their final examination may be almost upon them (Senekal, 1986). The tertiary environment and the way in which students adapt to academic pressure and demand could possibly have an impact on food intake. The negative effects of the tertiary environment could lead to feelings of frustration, depression and loneliness. This could result in poor dietary behaviour. Therefore, student adaptation problems together with problems related to their growth and developmental phase can influence their behavioural patterns, including eating habits.

2.6 ASSESSMENT OF NUTRITIONAL STATUS

2.6.1 ANTHROPOMETRIC ASSESSMENT

The term nutritional anthropometry has been defined as: "measurements of the variations of the physical dimensions and the gross composition of the human body at different age levels and degrees of nutrition" (Gibson, 1990). Gibson (1990) also states that a number of publications make recommendations on specific body measurements for characterising nutritional status, standardised measurement techniques and suitable reference data.

Anthropometric measurements are used in the assessment of nutritional status, particularly when an imbalance between intakes of protein and energy occurs. Such imbalances modify the patterns of physical growth and the relative proportions of body tissue such as fat, muscle and total body water (Gibson, 1990). Various anthropometric indices are used in multiple-regression equations to predict body density and to calculate body fat and fat-free mass (Steyn et al., 2000; Slabber et al., 1998).

Anthropometric indices can be derived directly from a single raw measurement (e.g. weight for age, height for age, and head circumference for age). They can also be derived from a combination of raw measurements such as weight and height, skinfold thickness at various sites, and/or limb circumferences, as used for example in research conducted by Steyn et al., (2000) and Slabber et al., (1998). These indices give an indication of the muscle mass and total body fat content. The sensitivity and specificity of an anthropometric index vary according to the severity and prevalence of the nutritional problem. Sensitive indices exhibit large changes during nutritional deprivation and after nutritional intervention, and correctly identify those individuals who are truly malnourished. Such anthropometric indices are selected for nutritional assessment systems involving nutritional screening or surveillance. Similarly, anthropometric indices with high specificity are also desirable to identify healthy persons correctly, and thus avoid giving nutritional intervention unnecessarily. Selection of anthropometric indices for nutritional assessment systems depends on the purpose of the measurements.

2.6.1.1 Weight/Height Ratios

Weight/height ratios are frequently used for nutritional assessment in adults. They measure body weight corrected for height, with the underlying assumption that the ratios are highly correlated with obesity (Gibson, 1990). There are two types of weight/height ratios: relative weight and power-type indices. Relative weight expresses the weight of a given subject as a percentage of the average weight of persons of the same height (Weigley, Mueller and Robinson, 1997:145). The numerical values that each of these indices indicates depend on the units of measurements employed (e.g. metres and kilogram or inches or pounds). Hence, these ratios are called body mass indices (Figure 2.5:48). These ratios are employed in large-scale nutrition surveys and epidemiological studies as indirect measures of obesity (for example Steyn et al., 2000; Steyn, 1998). The measurements of weight and height are easy, quick, relatively non-invasive, and more precise than skinfold thickness measurements. Nevertheless, since obesity indices cannot be used to distinguish between excessive weight produced by adiposity, muscularity or edema, a more direct measure of obesity, such as skinfold thickness, should be employed together with weight and height measurements (Gibson, 1990).

Several studies have compared the relative merits of the above indices based on their correlation with measures of relative adiposity and the influence of height on the values of the indices (Gibson, 1990). All the indices correlate highly with relative adiposity when estimated from body density measurements. However, there are higher correlation coefficients between the Quetelet's index and skinfold thickness, compared to other weight/height indices, but a relatively low correlation with height.

Weight/height ratio	=	$\frac{wt}{ht}$
Quetelet's Index	=	$\frac{wt}{(ht)^2}$
Ponderal Index	=	$\frac{wt}{\sqrt[3]{wt}}$
Benn's Index	=	$\frac{wt}{(ht)^p}$

Figure 2.5 Indices Derived from Growth Measurements

Source: (Gibson, 1990)

According to Gibson (1990) there are marked differences in the correlation between various power-type weight/height indices and height. For example, obesity may be underestimated in short persons when assessed by the weight/height ratio, but overestimated by the Ponderal index because it has only a moderate correlation with weight. According to Gibson (1990) the Ponderal index has been successfully used for nutrition assessment in Canada. However, Gibson (1990) suggests that some confusion may arise in its interpretation because the Ponderal index is negatively correlated with weight and so decreases with increasing obesity. The power p in Benn's index is calculated to give an index that is apparently unrelated to height (Gibson, 1990). It is derived from the weight/height ratio and regression coefficients of weight on height for specific age, sex, and population. Benn's index can, however, only be used when the correct value for p for the sample population has been calculated. Benn's index is recommended to be adopted for use in routine comparisons among populations (Gibson, 1990). Many investigators consider Quetelet's index to be the best for anthropometric assessment of most adult population groups (deGonzague, Receveur, Wedll and Kuhnlein (1999); Vaughan et al., 1997).

The Quetelet's index correlates with many health-related indices such as mortality risk. Overweight (or body weight in excess of certain standards) and obesity (or excessive body fat) affects a significant portion of the South African population (Steyn et al., 2000). This has been singled out as one of South Africa's nutrition and public health problems (Steyn et al., 2000:53). Several epidemiological studies including South African studies have used BMI as an indicator of body fat, particularly in evaluating body fat content as a nutritional risk factor for unhealthy dietary behaviours as well as diseases of lifestyle. These studies include those of McMahon et al., (2000); Wenhold, (2000); Steyn et al., (1998); Bourne et al., (1996); Slabber et al., (1996). Based on this, the Quetelet's index was used in this study.

The precise relationship between Quetelet's index and percentage body fat is not clearly established, as only limited measurements of weight, height and body fat of male and female adults exist (Garrow et al., 2000). It has been recommended that, in addition to Quetelet's index, some measure of subcutaneous fat such as skinfold measurement should also be included for the assessment of leanness or obesity. Other investigators have recommended measuring the waist-to-hip ratio (waist circumference divided by hip circumference) as a measure of fat distribution, together with Quetelet's index (Steyn et al., 2000; Slabber et al., 1996 and Bourne et al., 1996).

2.6.1.2 Waist-to-hip ratio (WHR)

The waist-to-hip ratio (WHR) can be measured more precisely than skinfolds, and provides an index of both subcutaneous and intra-abdominal adipose tissue. There is evidence that not only excess adipose tissue is important for health-risks, but also its location i.e., andriod and gynoid configuration (Weigley, Mueller and Robinson, 1997:48). Android or apple configuration is an abdominal or upper body fat deposition. Gynoid or pear-shaped configuration is a deposition of fat around the thighs, hips and buttocks (Weigley, Mueller and Robinson, 1997:48). Waist-to-hip Ratio (WHR) is a simple method for determining body fat pattern or distribution. WHR is determined by taking the circumference of the waist and the hips. The waist circumference is the smallest circumference below the rib cage and above the navel. The hip circumference is the largest circumference at the posterior extension of the buttocks.

The ratio above 0.95 in males and 0.86 in females indicates a health risk. Individuals with more fat on the trunk, especially abdominal fat, are at higher risk for hypertension, Type II diabetes mellitus, hyperlidemia, coronary heart diseases, colon cancer, prostate cancer and premature death when compared to individuals who are equally fat on the gluteal and femoral area. Intra-abdominal fat is of importance in predisposing people to certain metabolic disorders (Garrow, James and Ralph, 2000). Waist circumference is a useful indicator of obesity, and in particular to central obesity (Moe et al., 2000; Rankinen et al., 1999). The measurement is taken mid-way between the lower margin of the last rib and the umbilicus. The circumference is measured to the nearest 0.1 cm at the end of normal expiration (World Health Organisation, 1995). Molarius and Seidell (1998) have critically reviewed many of the anthropometric indicators of abdominal fatness and suggest that measurements (WHR) have not yet been shown to be appropriate in non-Caucasian populations. However, the WHR measurements have been appropriately used in several South African studies related to weight and body fat composition of young adults. These studies include those of Wenhold, (2000); McMahon et al., (2000); Steyn et al., (2000); and Slabber et al., (1998).

2.6.1.3 Advantages and limitations of anthropometric assessment

Anthropometric indices are of increasing importance in nutritional assessment as the measurement procedures have several advantages. However, the application of nutritional anthropometry has several limitations. For example, it is a relatively insensitive method and it cannot detect disturbances in nutritional status over a short period of time or identify specific nutrient deficiencies. Furthermore, nutritional anthropometry is unable to distinguish disturbances in growth or body composition induced by nutrient (e.g. zinc) deficiencies from those caused by imbalances in protein and energy intake (Gibson, 1990). Nevertheless, nutritional anthropometry can be used to monitor periodic changes in growth and/or body composition in individuals (e.g. hospital patients) and in population groups, after a nutrition intervention programme. Certain non-nutritional factors (such as disease, genetics, diurnal variation and reduced energy expenditure) can reduce the specificity and sensitivity of anthropometric measurements, although such effects can generally be excluded or taken into account by appropriate sampling and experimental design (Gibson, 1990).

2.6.1.4 Sources of error in nutritional anthropometry

Errors may occur in nutritional anthropometry, all of which affect the precision, accuracy and validity of the measurements/indices. The errors can be attributed to the three major effects:

measurement errors, alterations in the composition and physical properties of certain tissues; and use of invalid assumptions in the derivation of the body composition from anthropometric indices. Measurement errors, both random and systematic, may occur in nutritional anthropometry. They arise from examiner error resulting from inadequate training, instrument error and measurement difficulties (e.g. skinfold thickness) (Gibson, 1990). For the purpose of this study the Quetelet's index, used together with WHR and dietary evaluation was used for a more conclusive nutritional assessment.

2.6.2 DIETARY EVALUATION

Nutrient standards, dietary guidelines and food guides each define aspects of a healthful diet in different ways. Nutrient standards are intended for use by the professional nutrition community as reference points, most often for planning diets and as a base for evaluating the dietary status of various population groups. Nutrient standards are similar to Recommended Dietary Allowances (RDAs) or Dietary Reference Intakes (DRIs). Dietary guidelines are different to nutrient standards in various ways. They give advice on consumption of types of food or food components for which there is a related public health concern. They are expressed in relation to the total diet and in qualitative terms, and are intended for the public directly or indirectly through educators, health professionals and policy makers. The research base for dietary guidelines relies more on clinical and epidemiological research relating to the composition of the diet, either in terms of nutrients, food components or types of foods,and to the risk of diet-related diseases of public health significance (Welsh, 1997).

Food guides are a translation of both nutrient standards and dietary guidelines into recommendations on daily food intake. A food guide is a conceptual framework for selecting the kinds and amounts of foods of various types that together provide a nutritionally satisfactory diet. Collectively, nutrient standards, dietary guidelines and food guides are referred to as nutritional guides. The connection between nutrient standards, dietary guidelines and food guides has been most visible when there has been a need to balance concerns about nutritional adequacy or excesses. Furthermore, nutrient standards, dietary guidelines and food guides are used in combination due to consumer demand for the latest research findings translated into practical advice. Nutritional guides have been introduced to various parts of the world in response to nutritional inadequacy and diet related diseases (Welsh, 1997). The focus of the nutritional guides is on controlling dietary habits in order to reduce risks and incidences of degenerative diseases (especially in affluent communities and where people have been exposed to urbanisation for a long time). The importance of nutritional guides will be discussed separately.

2.6.2.1 Nutrient Standards

Nutrient and energy standards are standards of intake of major nutrients, i.e. macronutrients (carbohydrates, proteins and fat) and micronutrients (vitamins and minerals) according to gender and age. The values of these standards are normally referred to as the Recommended Dietary Allowances (RDAs). The RDAs are defined as levels of intake of essential nutrients (with more emphasis on micronutrients) that, on the basis of scientific knowledge, are judged to be adequate to meet the known nutritional needs of most healthy persons (Lachance, 1998). The RDA is the daily intake level that is sufficient to meet nutrient requirements of nearly all (97-98%) individuals in a given life stage and gender group. These are the amounts of nutrients intended to be consumed as part of a diet. The quantitative recommendations for nutrient intake are due to the realisation of the beneficial role of micronutrients in the prevention of disease, as well as the impact of lifestyle factors such as smoking, alcohol abuse and self-imposed weight reduction. Occupation, environment, genetic variation and nutrient interactions may have an influence on RDA requirements.

Although the RDAs are not set for several important components of the diet such as carbohydrates and fat, it is recommended that diets be planned on the combined basis of the RDAs and dietary guidelines. Therefore it is not necessary for each day's diet to contain full RDAs for all nutrients, nor is it necessary for each meal to contain a fixed percentage of the RDA. Intake of most nutrients can be averaged over three days. However, the risk of nutritional deficiency increases the further the dietary intake falls below the RDAs (Welsh, 1997). RDA requirements are set above average (levels differ by nutrient), which makes quantifying the risk of developing a deficiency very complicated. Therefore, fixed cut-off points below the RDAs are not indicative of the risk of deficiency degree risk across all nutrients. For a population group, a few days of dietary intake data can provide reasonable estimates of usual intake. RDAs have been applied in a number of instances related to dietary planning and assessment (Table 2.3:55).

Table 2.3 Examples of Application of RDAs

- Users: Governmental/Industry/Academia/Health Services
- Uses:
    - Guide for procuring food supplies for group of healthy persons
    - Basis for planning meals for groups
    - Reference point for evaluating dietary intake of population subgroups
    - Components of food and nutrition education programs
    - Reference point for the nutrition labelling of food and dietary supplements

Source: (Lachance, 1998)

RDAs are currently used as a guide for procuring food supplies for groups of healthy people, such as the military, in supplemental feeding programs for risk groups and as the basis for planning meals for groups. They are used as the reference points for evaluating the dietary intake of population subgroups; as the scientific basis for food and nutrition education programs such as the US Department of Agriculture food guide pyramid; and as a reference point for nutrition labelling of food and dietary supplements (Lachance, 1998). RDAs have been updated on a number of occasions and have served as a useful guideline for individuals, institutions, populations and population subgroups. In the United States these standards have been updated and reorganised and are now called Dietary Reference Intakes (DRIs). The DRIs are a more comprehensive measure of a person's nutritional status and long-term health than those used previously (RDAs) (Williams, 2001).

2.6.2.2 Dietary Guidelines

The dietary guidelines give advice on consumption of types of food or food components for which there are related public health concerns. These are: to eat less, but of a larger variety of foods, to eat less fat especially saturated fat, and to eat more plant foods, for example bread and legumes, but more particularly vegetables and fruits, whose consumption should be double the amount generally consumed (Walker and Vorster, 1997). Recommendations apply to more developed populations. However, in developing populations, the guidelines relate principally to better-circumstanced urban dwellers. For the huge majority, who are poor, their primary problem is simply to get enough to eat. In conjunction with dietary guidelines, considerable emphasis is given to the benefits of physical activity. Weight maintenance is stressed, and more prominence is given to the guidelines on grain products, vegetables and fruits (Welsh, 1997).

The South African Food-Based Dietary Guidelines Work Group initiated by the Nutrition Society of South Africa (NSSA) in 1997, issued the preliminary Food-Based Dietary Guidelines

(FBDGs). The Work Group consisted of an intersectorial group with representation from the Department of Health, United Nation's Children's Fund (UNICEF), academia, agricultural boards and producer organisations, the food industry, professional associations (Association for Dietetics in South Africa and the Nutrition Society of South Africa), the Medical Research Council, and non-governmental organisations. The overall aim of the South African FBDGs is address the nutrition transition experienced by many South Africans (Love et al., 2001).

Table 2.4 The Comparison between the US Dietary Guidelines and SA Food-Based Dietary Guidelines

US Dietary Guidelines for Americans	**The South African Preliminary Food-Based Dietary Guidelines**
Eat a variety of foods Maintain a healthy weight Choose a diet low in fat, saturated fat, and cholesterol Choose a diet with plenty of vegetables, fruits & grain products Use sugars only in moderation Use salt and sodium only in moderation If you drink alcoholic beverages, do so in moderation	Enjoy a variety of foods Be active Make starchy foods the basis of most meals Eat plenty fruit and vegetables every day Use sugar and sugar containing food and drinks in moderation Eat legumes Foods from animals can be eaten every day Use fats sparingly Use salt sparingly Drink lots of clean, safe water If you drink alcohol, drink sensibly

Source: (Williams, 2001; Love, et al. 2001)

In comparative terms (Table 2.4:56), South Africa has adopted the same guidelines used by developed countries. The ones that are unique to the South African scenario as indicated by Love et al., 2001 are: 'eat legumes regularly; foods from animals can be eaten every day; drink lots of clean, safe water, and eat healthier snacks' (Labadarios, 2001). While certain developed countries have developed their own food-based dietary guidelines, all such countries have recommended increasing fruits, vegetables and grains/carbohydrates and decreasing fat intake. In contrast to these countries, South Africa has not advocated decreasing sugar intake. However, a moderate use of sugar and sugar containing foods and drinks is recommended. This can be seen as an enlightened decision in relation to the latest consensus on the subject as summarised by the FAO and the WHO, namely that prevention programmes to control and prevent dental carriers should focus on fluoride and adequate oral hygiene and not on sucrose intake alone, and to the documented low energy intake of young children in this country. Additionally like those of the majority of developed countries, the South African guidelines also include salt reduction, dietary variety, sensible alcohol intake and increased physical activity. The American version of the dietary guidelines is most often used as a source of reference. The new initiative world-wide is to make guidelines more positive, practical, understandable and therefore sustainable for the public. The move is towards food based dietary guidelines which should be designed for particular populations and which are based on existing eating patterns (Labadarios, 2001).

The prudent dietary guidelines are disease specific dietary guidelines designed to promote healthy dietary habits, thus reducing the risk of cancer and coronary heart disease. Cancer ranks second to heart disease as a cause of death. Up to 80% or more of the various types of cancer may have their origins in factors of the environment (Weigley, Mueller and Robinson, 1997:7). Cancer and heart disease have been closely related to dietary habits and lifestyle, and specifically to a high fat, low fibre diet and low intake of fruits and vegetables (Prewitt et al., 1997:70; Harnack, Block and Lane, 1997:307). The ultimate aim of urging dietary change and leading a prudent lifestyle is the desire of everyone to lengthen disease-free years, and their years of wellness (Walker and Vorster, 1997). The proportion of populations who observe all of the guidelines is very low, and is estimated to be 1% to 4% (Walker and Vorster, 1997).

The finalised core set of FBDGs will need to be adapted for children under 5 years, and for people with special dietary requirements such as those with HIV/AIDS, diabetes, pregnant women and the elderly. Long-term monitoring of the impact of the FBDGs on knowledge and behaviour change is also required to enable regular evaluation of the FBDGs (a 5-year period is recommend) and subsequent adjustment of the guidelines to address the changing health needs of South Africans. The quantitative guidelines (i.e. prudent dietary guidelines, Table 2.5:58) are set on fat (not more than 30% of total energy) and saturated fatty acids (less than 10% of energy). The limit set for cholesterol is 300mg/day and for sodium 2400mg/day.

Table 2.5 Disease-Specific Dietary Guidelines

PREVENTION OF CORONARY HEART DISEASE	**PREVENTION OF DIET-RELATED CANCER**
Maintain a reasonable weight Total fat intake: 30-35% of energy intake Saturated (animal fat): ≤ 10% of total energy Mono-unsaturated fat: 10-15% of total energy Polyunsaturated fat: 4-10% of total energy Carbohydrates: 50-55% of total energy intake Sugars: 10% of total energy intake Protein: 12-20% intake of total energy Cholesterol: ≤ 300mg Sodium: 2-3g Moderate alcohol consumption e.g. 1-2 drinks per day	Total fat intake: 30% of total energy intake Dietary fibre: 20-35 per day achieved by consuming sufficient amounts of whole grain cereals, fruit and vegetables with edible skin Moderate alcohol consumption Include fruits and vegetables rich in beta-carotene and vitamin C Include sufficient amounts of cruciferous vegetables e.g. broccoli, Brussels sprouts, cabbage and cauliflower Limit the intake of food preserved by means of salt curing, smoking and nitrate curing

Source: (Weigley, Mueller and Robinson, S. 1997)

The FBDGs are an attempt to provide consistent nutrition messages in a non-segregating manner. The preliminary FBDGs also describe a target diet that South Africans should be aiming towards, whether under-, over- or adequately nourished. Currently, consumers in many countries receive two distinct types of nutrition advice. One set of advice is the RDAs, with emphasis on micronutrients, reinterpreted in units such as daily values for nutritional labelling purposes. The second type of advice is the food-combination dietary guideline or pattern, emphasising macronutrients such as the three, four, or five food groups (Food Guide Pyramid).

2.6.2.3 Food Guides

The USDA Food Guide Pyramid and the Dietary Guidelines for Americans are the key components of the USDA's food and nutrition guidance system (which is widely used in South Africa). It interprets nutrient standards and dietary guidelines in simpler and practical terms for an ordinary person to understand, i.e. nutrition educators, consumers and students. The Food Guide Pyramid (Figure 2.6:61) is a visual proportional representation of foods consistent with current nutritional recommendations and can be used to plan diets consisting of a variety of food items. It helps consumers to implement the guidelines by suggesting types and amount of foods for people of different sizes and genders. The USDA Food Guide Pyramid is based on an American eating pattern. The objective of the guide is flexibility in food choices. It graphically illustrates the amount each food group should contribute to a daily diet. It represents the total diet and not just the foundation to fill a need for simple guidance (Escobar, 1997:173).

The food guide pyramid is a graphically improved Four Basic Food Group by converting the latter into six groups, namely:

1. Bread, Cereal, Rice and Pasta Group
2. Fruit Group
3. Vegetable Group
4. Meat, Poultry, Fish, Dry Beans, Eggs and Nuts Group
5. Milk, Yoghurt and Cheese Group
6. Fats, Oil and Sweets

Food groups are formed primarily based on nutrient content and the way in which foods are generally used. Within some of the major food groups, subgroups of food have been identified to give emphasis to nutrients of concern. Vegetables and fruit are separated to focus on their specific contributions of vitamins, minerals and fibre. Grain products are separated into enriched and wholegrain products to emphasise fibre. Serving sizes have been assigned by taking several factors into consideration such as: typical portion size reported in food consumption surveys, ease of use and similar nutrient content of food. Ranges in numbers of servings per food groups have been established to cover the range of RDAs appropriate for different gender and age groups. The servings for fat, oils and sweets have not been specified but recommended to be used sparingly (Williams, 2001).

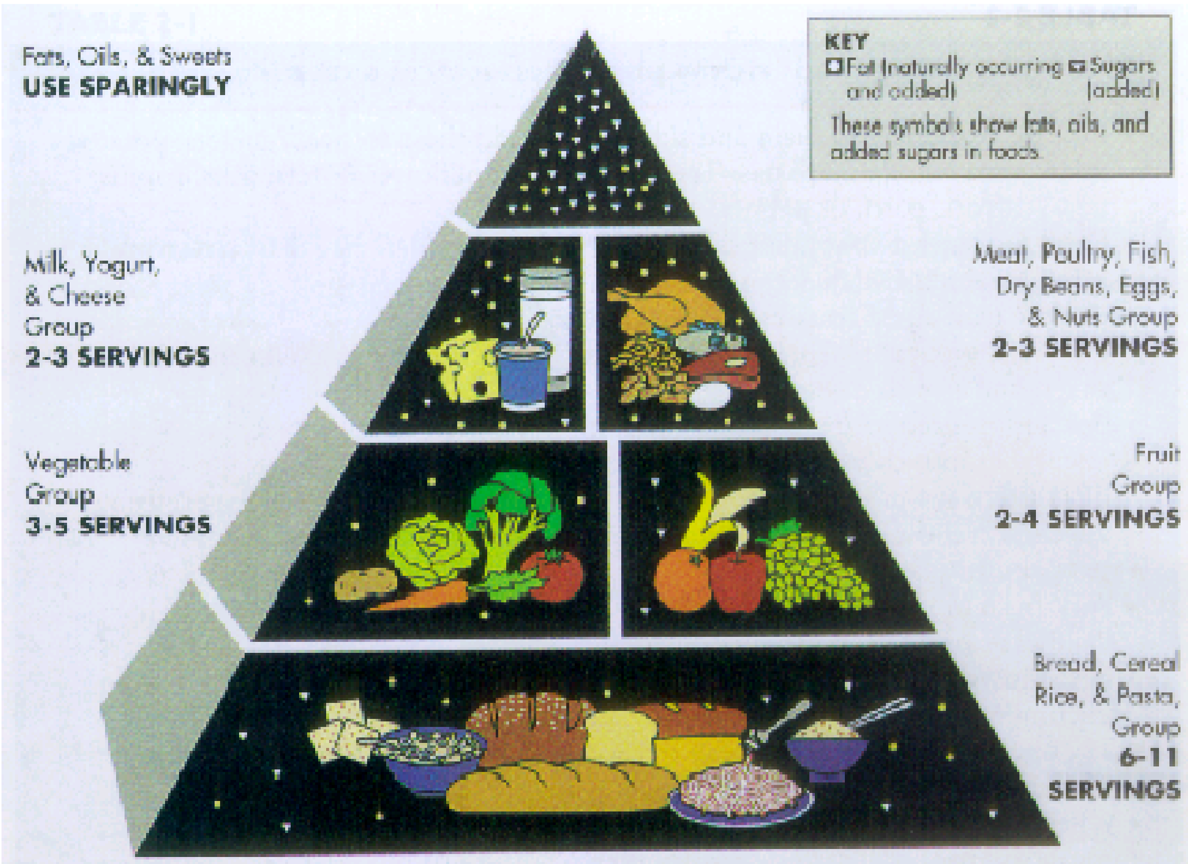

Figure 2.6 United States Department of Agriculture: Food Guide Pyramid

Source: (Williams, 2001)

The pyramid reflects recommended daily intake with the amount of space and allocation given to each food group. The pyramid emphasises variety both among and within its six groups, moderation in portions, and proportionality in eating more foods from the larger groups near its base and relatively fewer foods from other groups. It has been recognised as the best graph for helping people understand the three basic elements of a healthy diet (Escobar, 1997:172; Welsh, 1997:635). Estimates of the nutrient levels provided by the food guide pyramid indicate that the goal is 100% of the RDA for most nutrients. It is assumed that a variety of foods within a food group is consumed, and that people eat at least the number of servings that provide energy levels for their age and gender group. The pyramid also serves as a basis for general meal planning and evaluating a person's overall food intake pattern.

2.7 SUMMARY

The literature has indicated that a combination of interrelated variables such as nutritional transition, living arrangements and nutrition knowledge influences an individual's dietary behaviour. The integrated impact of these variables has been clearly indicated by using a combination of the lifestyle and health belief model of behaviour as the conceptual definition of dietary behaviour. With this basis of understanding, the literature has therefore provided the foundation and support for the objective of the study which is ultimately to improve the dietary behaviour of young adults within an urban context. A dietary disorder of public significance is a lack of dietary variety which is thought to contribute to: low micronutrient intakes; low energy intakes and chronic diseases of lifestyle. Various interventions to improve healthful eating and nutritional status of the South African population are immenent. These strategies include nutrition education and mandatory fortification of staple foods such as maize meal, breakfast cereals and margarine. These attempts are accompanied by the recently formulated South African FBDGs aimed at addressing the public health problems collectively (Maunder, Matji and Hlatshwayo-Molea, 2000). This is important to ensure that micronutrient and energy intakes increase where appropriate, and at the same time to prevent increased energy intake and obesity in those individuals who already have an adequate energy intake.

The challenge is to ensure that these goals are achieved within the context of high household food insecurity, increasing urbanisation and diversity of the South African population. Therefore, the integration of nutrient standards, FBDGs and food guides can have a significant effect on population-based recommendations for healthful eating. However, it is recognised that for the long-term resolution of nutrition-related problems in South Africa, nutrition education and the use of FBDGs, need to be part of a larger programme, which not only focuses on combating hunger and micronutrient deficiencies, but which also encourages self-sufficiency and economic sustainability.

CHAPTER THREE

METHODOLOGY

3.1 OVERVIEW

This chapter outlines the methodology used to approach the research problem. The questionnaire design, sample selection, administration of data, data collection and capturing are explained. Limitations of the survey as well as the criteria for admissibility of the data are identified.

3.2 METHODOLOGY – DESCRIPTIVE SURVEY

The purpose of the study was to evaluate the nutritional adequacy of the students' eating habits at DIT: Steve Biko Campus and to determine the influence of socio-demographic factors and nutrition knowledge on existing eating habits for the compilation of a nutrition education programme. The variables relevant to the study were identified by means of questionnaires (Annexures 7.4 to 7.7) using the descriptive survey method. Studies that had previously addressed a similar problem include Thapeli et al., (2000), Du Plessis (1998), Slabber et al., (1998), Steyn et al., (1998), Viljoen (1998); Van Eeden and Gericke (1996) and Steyn et al., (2000). The techniques and questionnaires used in the survey method of this study (i.e. to determine dietary intake, weight status and nutrition knowledge of students) were similar to the ones used in the study conducted at the University of the North and Stellenbosch (Steyn et al., 2000). Therefore, the survey under discussion generated scientific evidence and foundation for the compilation of a nutrition education programme that is credible.

3.3 THE FOUR RESEARCH HYPOTHESES

3.3.1 HYPOTHESIS ONE

It was hypothesised that socio-demographic factors such as age, gender, socio-economic status, living arrangements and ethnicity influenced students' eating habits.

3.3.2 HYPOTHESIS TWO

It was hypothesised that students would have poor food choices, which could be related to their lack of nutrition knowledge.

3.3.3 HYPOTHESIS THREE

It was hypothesised that students at DIT were overweight and would have an undesirable body fat distribution.

3.3.4 HYPOTHESIS FOUR

It was hypothesised that students at DIT had nutrient intake that is inadequate when evaluated in terms of the RDA.

3.4 DATA COLLECTION FOR SUBPROBLEM ONE

The first subproblem was to determine the socio-demographic factors that strongly influence the students' food choices, such as age, gender, socio-economic status, living arrangements and ethnicity. The data needed for testing the hypothesis of subproblem one (section

1.2.1.1:6) were obtained from the answers to the socio-demographic questionnaire (Annexure 7.4).

3.4.1 SAMPLE SELECTION

The total population of free-living students at DIT, Steve Biko Campus was determined by drawing the list of students from the Technikon Information Management Office. The Durban Institute of Technology is situated in KwaZulu Natal, with Steve Biko Campus being one of the two merged institutions (ML Sultan and Technikon Natal). Based on the year 2000 figures, the total student population was 8400 and included students who were free-living, and those living in the Technikon residences. The selected sample was made up of Black students only.

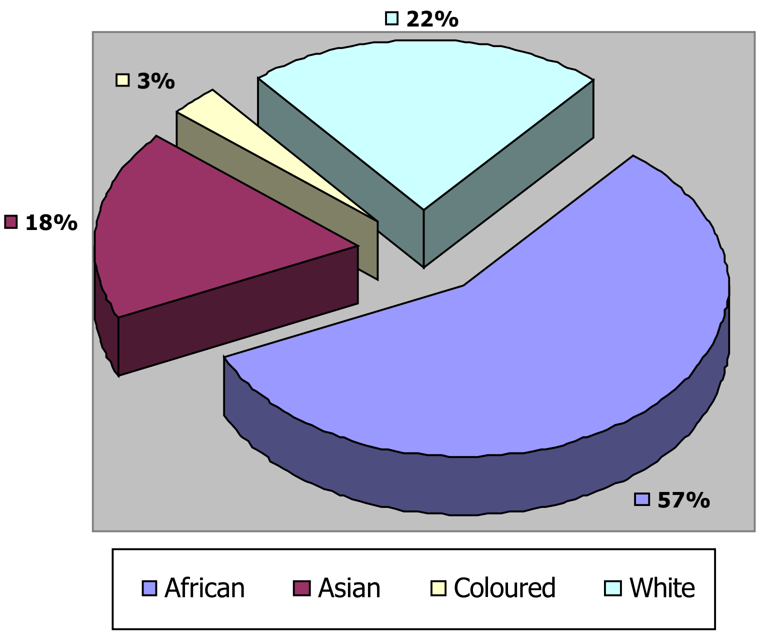

Figure 3.1 Student Population at DIT: Steve Biko Campus (formerly Technikon Natal)

Source: www.dit.ac.za (2000)

Africans are the majority of the population, followed by Whites, Asians and then Coloureds. (Figure 3.1:65). Black students aged 17 – 30 years at DIT: Steve Biko Campus, DIT were sampled. A convenience quota sampling method was used for the study. The convenience quota sampling method was selected due to the geographical location of the students. The list of the students generated did not classify students according to living arrangements, thus making it difficult for selection purposes. The list of the students also did not clearly indicate their correct residential addresses. According to addresses on the drawn list, the students were scattered around Durban and the area surrounding the Technikon.

Locating the students using their field of study proved to be difficult due to timetable complications. Some students did not attend all the lectures they were supposed to attend. Some of the students were repeating subjects and therefore did not attend lectures with the relevant group in terms of their level of study. For example, a second year student would attend lectures with first year students. Therefore, it was difficult and costly to locate sampled students. Hence, learners residing in Color Court, Student Village, Breheny, Myrtle and Shiela Court residences were sampled if they were between 17 and 30 years of age. The above residences are known to be occupied by students in a free-living arrangement and are used by Black students of DIT: Steve Biko Campus.

3.4.2 ADMINISTRATION OF DATA CAPTURING

Free-living students between aged 17 and 30 years of age residing in flats were approached to participate in the study. Students living in Steve Biko Campus residences where food was provided, as well as those living with their parents were excluded from the study, as this was not regarded as free-living. Students were sent a letter of introduction to explain the purpose of the study (Annexure 7.1:212) and confidentiality was guaranteed. Verbal consent was obtained from all the participants. The survey was conducted by means of an interview to collect the required data. The questionnaires were filled in using personal interviews that were conducted by 4 trained fieldworkers including the researcher. The objective of training sessions is outlined in Figure 3.2:67 and Annexure 7.3.

At the end of this training session the candidates must be able to:

- Understand the nature of the study and its objectives
- Understand the procedures in achieving the study objective
- Understand the importance of and theory related to nutritional assessment, including assessment tools and equipment selected for the study
- Understand the general principles related to the use of each assessment tool, namely; the demographic questionnaire, 24-hour recall and Food Frequency Questionnaire and Nutrition Knowledge Test (NKT)
- Measure and record anthropometric measurements accurately
- Record the necessary dietary data accurately and efficiently using the appropriate dietary assessment questionnaire/s.
- Understand the importance of commitment, interpersonal skills, and nutrition knowledge required for the purpose of the study
- Demonstrate good interpersonal skills while conducting interviews
- Complete an interview with each respondent accurately, consistently and successfully

Box 3.1 Objectives of the Training

The fieldworkers selected to carry out the personal interviews were learners studying towards their B Tech degree in Food and Beverage Management and Food and Consumer Sciences. This meant that fieldworkers selected for the survey had studied nutrition as a subject up to the third year level of study. The fieldworkers completed a three-day training course (Figure 3.3:68 and Annexure 7.3) and participated in pretesting of all the research tools used in the study. The training course covered all the aspects of the survey.

The interview protocol was standardised and pretested prior to the study. The objective of the training was for the fieldworkers to understand the principles related to the use of each assessment tool, namely the 24-hour Recall and Food Frequency Questionnaire. The training included the training of fieldworkers to record the dietary data accurately and efficiently using the appropriate questionnaires.

DAY 1

- The Study: The purpose of the study
  Calendar (2001) of the study
  Procedures to achieve the goals and objectives of the study
- Assessment tools and equipment:

  Height sticks, tape measures, weighing scales, questionnaires (socio-demographic questionnaire, nutrition knowledge test (NKT), 24-Hour Recall and Food Frequency List).
- Fieldwork and the role of the fieldworkers:

  Requirements of the fieldworkers: Interpersonal skills, Nutrition Knowledge of the assessment tools and Commitment

DAY 2

- Introducing assessment tools and equipment:

  Theory related to Nutritional Assessment:
  - Anthropometric Assessment (Kinanthrhopometry in exercise and health manual by J. Hans de Ridder (2000), Nutrition Congress)
  - Dietary Evaluation: 24-Hour Recall and Food Frequency List
  - Actual Dietary Processing: Treatment of the data gathered
  - Nutrition Knowledge Test
- Role of the Fieldworkers:

  Interviewing Skills
  Importance of Interpersonal Skills
  Knowledge of the nutrition assessment tools:

- Feedback

DAY 3

- Working with the assessment tools and equipment
  Role Plays
  - Taking anthropometric measurements
  - Working with questionnaires
  - Conducting interviews
  - Testing for consistency and standardisation of data gathering
- Fieldworker repeats same measurements;
- Other fieldworker to take the same measurements on the respondent
- Feedback

Box 3.2 Outline of the Three-day Training Course

It was further emphasised that fieldworkers should understand the importance of commitment, interpersonal skills and nutrition knowledge required for the purpose of the study. Roleplays were done during the training demonstrate good interpersonal skills while conducting interviews. Each fieldworker had to complete an interview with the same respondent accurately, consistently and successfully. The training was conducted using the training manual specifically developed for the study (Annexure 7.3).

One fieldworker had no prior experience in conducting surveys while the other had been involved in promotional activities and surveys for commercial purposes, but not in an activity of this nature or scale. The fieldworkers fell into the category of young adults in terms of their age. Both fieldworkers spoke English and Zulu and were therefore able to effectively communicate with the respondents. Since the target population was Black learners, it was appropriate to have fieldworkers of the same race group to facilitate a comfortable environment for the respondents. The 24-hour Recall and the Food Frequency Questionnaires were pretested for reliability and validity, and fieldworkers participated in the pretesting. The fieldworkers' interviewing skills and their ability to accurately record dietary data were tested for standardisation and consistency purposes using a paired t-test. The results showed p values of >0.005.

3.4.3 QUESTIONNAIRE FORMULATION

The information used for formulating the questionnaire in testing the hypothesis for subproblem one (section 1.2.1.1:6) was obtained from the socio-demographic variables as identified by Van Eeden and Gericke (1996) and also by including variables identified in the lifestyle model of dietary behaviour (Pelto, 1981: S71-S72). Information used to formulate the questionnaire which was used to test hypothesis one (section 3.3.1:64) was also obtained using various studies of a similar nature. These studies included those conducted by Steyn et al., (2000), Van Eeden and Gericke (1996) and other refered to in the literature review. The questionnaire (Annexure 7.4) used to collect the data was designed to attain specific objectives with regards to dependent and independent variables.

3.4.3.1 Variables

(a) Dependent Variables

The nutritional status of the students' dietary habits was determined by a 24-hour Recall and Food Frequency Questionnaire (FFQ), and by measuring the Body Mass Index (BMI) and waist-to-hip ratio (WHR) of each respondent.

(b) Independent Variables

To obtain socio-demographic information regarding the free-living learners at DIT: Steve Biko Campus, a broad range of variables was included in the questionnaire. These variables included the students' name, course enrolled, type and level of exercise, health status, marital status, living arrangements, religion/culture, ethnicity, type of high school attended, money spent on food, food storage facilities, cooking facilities and place where food is purchased. A socio-demographic questionnaire was used to determine the age, race and gender of the sample.

3.4.3.2 The Four Measurement Tools

SECTION A: Socio-demographic questionnaire (Annexure 7.9, Chapter Table 4.2:)

SECTION B: Nutrition Knowledge Test (Annexure 7.7; 7.13; 7.14, Table 4.3)

SECTION C: Anthropometric Measurements (Annexure 7.15; 7.16; 7.17 Table 4.4)

SECTION D: 24-Hour Recall and a Food Frequency Questionnaire used to collect information regarding dietary intake (Annexure 7.6; 7.6; 7.18; 7.19, Tables 4.8; 4.9; 4.10; 4.11 and 4.12)

3.4.3.3 Presentation of Data

All questions in the sociodemographic questionnaire were coded using numerical values from 1 – 20. All questions dealt with socio-demographic data except for questions 2 – 5 (Annexure 7.4) which dealt with testing the hypothesis for subproblem three. Responses to all the socio-demographic questions (except for questions 2 – 5) were recorded and are presented in Annexure 7.9, section 4.2:. These responses gave an indication of the factors that strongly influenced the students' dietary habits.

3.4.3.4 Questionnaire Formulation

The data obtained from the socio-demographic questionnaire were categorized to distinguish measurement levels of the variables. Questions 1, 6 – 17, 18 - 20 were ratio and interval variables. The rest of the questions were nominal variables. Questions 8 and 17 were the only items with categorical data.

(i) Categorical Data

Categorical type questions were used to determine the respondents' participation in physical exercise. The answers to the questions were coded and put into various categories in terms of type of activity, intensity, duration and frequency of the exercise. Question 8 was completed if the respondent answered 'yes' to question 7. The respondents ranked their activity according to intensity, duration and frequency as shown below.

Q. **8**

ACTIVITY	INTENSITY	DURATION	FREQUENCY

RANK EACH ACTIVITY ACCORDING TO INTENSITY, DURATION AND FREQUENCY

INTENSITY	DURATION	FREQUENCY
1 = NOT TIRED	**1 = 10 MIN**	**1 = ONCE A MONTH**
2= SLIGHTLY TIRED	**2 = 10 – 19 MIN**	**2 = FEW TIMES/MONTH**
3 = TIRED	**3 = 20 – 30 MIN**	**3 = 1-2 TIMES/WEEK**
4 = VERY TIRED	**4 = 30 MIN**	**4 = 3-5 TIMES/WEEK**
5 = EXHAUSTED		**5 = ALMOST DAILY**

The answers to question 17 were also put into categories, for example:

Q. 17	Money spent on food monthly	1. < R99 2. R100 – R199 3. R200 – R299 4. > R400	V 17

3.4.3.5 Pretesting the Tools for Measuring Nutrient Intake

The 24-hour Recall Technique and FFQ used in the National Food Consumption Survey (1999) were used for the study (Jonnalaganda et al., 2000). For the purpose of the study, the questionnaires were piloted on a sub-sample of the population for the purpose of testing validity and reliability. Pretesting of the existing FFQ was done to achieve the following objectives:

- to develop and refine the food list
- to check understandability and clarity of the instructions
- to see if the respondents understood the questions and answers as expected

- to determine the time needed for completion
- to test the format and layout of the FFQ, e.g. to see if there were enough spaces to fill in responses
- to test the accuracy of translations, if necessary
- to test if the fieldworkers were able to utilize the measuring tools comfortably

3.4.3.6 Precision of the 24-hour Recall Technique

The 24-hour Recall was an open-ended prompted interview conducted by a trained and standardised fieldworkers as is described in Chapter 3, section 3.4.2:69. The reference period for the 24-hour Recall was the week day before the interview. The 24-hour recall was administered on randomly selected days, avoiding weekends and days following special occasions or social events, for example birthdays. Interviews were conducted in a manner that took the respondents through a chronological order of food intake, from the first food encounter of the day to the last. All the respondents were asked the method of preparation for all the foods, particularly where fat was added, to for example cereals or vegetables; and removed from, for example meat. When a respondent was unable to identify a prepared food by name (convenience foods), only the main ingredient was identified and method of preparation reported, for example curried, stewed or dry. The Food Finder Nutrient Analysis used raw dietary data for nutrient analysis, therefore the 24-hour Recall food items were not coded. The Food Finder analysed dietary data for a standard number of nutrients, and compared nutrient scores to the RDA and prudent dietary guidelines.

Several researchers examined the precision of the 24-hour Recall to estimate the mean nutrient intake of a group. If based on a paired sample t -test and/or correlation analysis, it has been suggested that this method could provide a relatively precise estimate of the usual nutrient intake of groups. Therefore, researchers have assessed the relative validity of the 24-hour Recall, by comparing the obtained data to those of the Food Frequency Questionnaire (Subar et al., 2000; deGonzague et al., 1999 and Bardenhorst, 1998). However, very few of the reviewed studies measured the individual components of variance as a basis for their conclusion.

When a single 24-hour Recall is used, the number of subjects required for estimation of the usual average intake of a group is large. The number of subjects needed depends on the degree of precision required and the extent of inter- and intra-subject variability, which in turn depends on the nature of the sample population and the nutrients of interest. In this study, a single 24-hour Recall was used to assess individual intakes, based on the assumption that the intake over one 24 hour period together with data on food frequency would adequately represent habitual intake (Table 4.11:187). In addition, time and budgetary constraints did allow for more reliable methods of dietary assessment such 7-day food record and repeated 24-hour recalls which would have improved the validity of dietary assessment.

3.4.3.7 The Food Frequency Questionnaire

Dietary habits of the sample were determined by using a quantitative FFQ (Annexure A-2). The FFQ contained 100 food items which were categorised into eight groups, as shown in Table 3.1:74. Twelve of the food items were similar in nature but differed according to preparation method by adding one or two ingredients, or consumed in various forms, for example maize meal (stiff, soft and crumbly). Therefore, these food items were further categorized according to main preparation method and ingredients. Respondents were asked to respond to these specific food items without being prompted on the method of preparation.

Table 3.1 The Food Group Descriptions of the Food Frequency Questionnaire

Food Group	Number of Food Types	Representative Food Types
Cereals, Grains and Legumes		
Maize Meal	3	Stiff pap, soft, crumbly
Mabela	1	Soft
Breakfast Cereal	7	Cornflakes, Pronutro, Rice Crispies, Weet-bix, All bran
Samp	2	Samp, samp and beans
Rice	3	White, brown and maize rice
Pasta	2	Macaroni, spaghetti
Dried Beans/peas/lentils	2	Soup, salad
Soya Products	1	Imana
Fruits and Vegetables		
Vegetables	10	Cabbage, spinach, pumpkin, carrots, mealies/sweet corn, beetroot salad, potatoes, sweet potatoes, vegetable salad, other vegetables (mushrooms, green beans, etc.)
Fruits	10	Apples, pears, banana, orange, grape*, peach, apricots*, mangoes*,guavas*, wild fruit / berries*, other fruits
Breads and Spreads		
Bread	4	Jeqe, white, brown, whole-wheat
Spread	6	Margarine, peanut butter, jam/syrup/honey, marmite, fish paste, cheese and cheese spread, other spreads
Meats, Meat, Fish and Eggs	17	Chicken, chicken head and feet, chicken offal (livers), red meat (pork, lamb and beef), beef offal, sausages, bacon, cold meats (polony, ham, viennas), canned meat, meat pie, pilchards, fried fish, canned fish, fish cakes, eggs
Beverages	13	Tea, coffee, milk (with tea and cereal), maas, milk-drinks, squash, yoghurt, fruit juice, frizzy drinks, beer, cider, wine,
Snacks and Sweets	15	Peanuts, cheese curls, peanuts and raisins, chocolate, canfies, biscuits, cakes and tarts, scones/muffin, rusks, savouries, jelly, baked pudding, instant pudding, ice cream/sorbet, potato crisps
Sauces/Gravies/Condiments	5	Tomato sauce, Worcester sauce, chutney, packet soups
Wild birds, animals or insects	0	
Miscellaneous	0	

*seasonal fruits

The average frequency of consumption over a month and normal portion size habitually eaten by the respondent were ascertained. For food items that are eaten seasonally such as fruits and certain vegetables, the frequency was recorded for the season in which it was consumed. Portion sizes were estimated using food portion photograph book and household measurements. Direct weighing of some of the foods such as pasta, cereals, sugar and powdered milk was carried out. The FFQ obtained detailed information on both food type and portion size. Dietary data from the food frequency questionnaire were summarised up to an estimation of the average dietary intake of each participant, and this dietary intake was then analysed for its nutrient content. The purpose of the FFQ was to ascertain evidence of traditional foods being consumed and the determination of eating patterns. Foods such as maize meal, mabela, jeqe, samp and beans which resemble a traditional eating pattern were seldom consumed by the sample.

3.4.3.8 Pretest Sample

The supervisors of the study were present during the training of the fieldworkers and in the pretesting of all measures of assessment. The FFQ used for the study had been used in other studies, therefore one pretest was done. The pretesting was done on a group of twenty students with similar characteristics to the planned sample. The pretesting was done using the food portion photographs and household measurements that were to be used in the survey. Modifications of the original FFQ included the addition of vegetables and fruits, and grouping food items according to food groups. This encouraged detailed reporting. The first draft of the modified FFQ was given to the supervisors for constructive criticism. The revised draft of the FFQ was retested on two respondents during re-training of the fieldworkers prior to the survey. The retesting was done in the presence of the supervisors of the study. Each fieldworker collected dietary data using the 24-hour Recall, FFQ and sociodemographic questionnaire on the same participant for standardisation and consistency. Using a paired t-test, the results showed p values of >.005.

3.4.4 SAMPLE REALISATION

Students residing in Corlo Court, Breheny, Myrtle and Shiela residences were identified as communities of free-living learners and were used as the study population (Annexure 7.8; 7.9:217). The sample size was made large enough (N=192) to ensure precision, validity and representation of the Black learner population at DIT: Steve Biko Campus in terms of age and gender.

3.4.5 THE CRITERIA FOR ADMISSIBILITY OF THE DATA

Only the responses of the free-living students registered at DIT: Steve Biko Campus were used in testing hypothesis one. This was determined by screening the student number of each respondent, which indicated the respondent's registration status at DIT: Steve Biko Campus. Question 1 indicated the respondents' age, which indicated whether the respondent was admissible to participate in the study or not. Learners living with parents or in residences where meals were provided were excluded. The respondent had to be the one who made food purchase decisions within a free-living household.

Each questionnaire was checked for the validity of the student number and that all variables had responses. Each fieldworker filled in their name on each questionnaire, therefore all four questionnaires where administered by the same fieldworker to each participant. Therefore, each fieldworker submitted a sociodemographic questionnaire with its corresponding 24-hour recall, FFQ and Nutrition Knowledge Test. The FFQ was checked for accurate recording of dietary data, the amount, frequency and measurement of the food. The total number of 24-

hour recalls and FFQ obtained was 193 and only one FFQ was not completed and therefore could not be used.

3.4.6 THE INTERPRETATION OF THE DATA

The SPSS$^+$, Version 11.0 software package was used for the statistical analyses of the data. For the purpose of this study, the exact Probability (p) values are given. However $p = 0{,}0000$ does not mean that P is equal to zero, but that there is a statistically significant relationship between variables. The responses and tabulation of the relevant Pearson's correlation and independent t-test results for significance between the variables are reported with r^2 and/or x^2 and p values as is indicated in Table 4.2; and 4.11. Linear regression was done with the data obtained from the questionnaires to indicate the relationship between all the important variables and nutritional adequacy (independent variable). The mathematical properties; $-1 < \varnothing, r > +1$ were used in illustrating the strength of the correlation between variables.

3.5 DATA COLLECTION FOR SUBPROBLEM TWO

The second subproblem was to measure the nutritional knowledge of the students in order to determine the influence of this knowledge on food choice and dietary intake. The data needed for testing the hypothesis for subproblem two stated in section 1.2.1.2:6 were obtained from the answers to the Nutrition Knowledge Test (NKT) (Annexure 7.7; 7.13; 7.14, Table 4.3; 4.4 and 4.5).

3.5.1 SAMPLE SELECTION

All the subjects selected for the study completed a Nutrition Knowledge Test (NKT). The respondents were free-living students of DIT: Steve Biko Campus aged 17 – 30 years.

3.5.2 ADMINISTRATION OF DATA CAPTURING

The NKT was completed by the respondents after all the other measurements had been done, namely: the Socio-demographic questionnaire, 24-hour Recall and Food Frequency Questionnaire. The test was completed under the supervision of a fieldworker. A comfortable environment was provided for each subject to complete the test without any disturbance. Each subject was provided with a Nutrition Knowledge Test written in the English language. The instructions for completing the test were available in English. Clarification of the questionnaire was provided in Zulu where needed. All respondents were conversant in Zulu. No time limit was set. Each subject took approximately 30 – 45 minutes to complete the test. The reliability of the answers was closely related to the manner in which the subject interpreted the instructions of the test. Therefore, the fieldworkers were trained in adhering to the administration procedure of the NKT. The purpose for administering the test as well as the nature of the measure given was explained to the subjects. The respondents were then instructed to draw a circle around the corresponding letter of the answer which in their opinion was the most correct. It was emphasized that the subjects should answer all the questions.

3.5.3 QUESTIONNAIRE FORMULATION

The NKT was adapted from the questionnaire used by Gericke et al., (1987) and made relevant for the purpose of the study. The adapted NKT was then tested for its reliability using the SPSS correlation matrix. A combination of the empirical and analytical approach was followed in the development of the Nutrition Knowledge Test (NKT). The instrument was developed to cover the field of nutrition knowledge as broadly as possible, and has been proven to be unidimensional. The four concepts (explained in Table 3.2:81) from which the theoretical basis of the NKT can be distinguished as the dimension of the nutrition knowledge construct are:

Concept I	:	The use of food by the body
Concept II	:	The relationship between nutrients and good health.
Concept III	:	Individuals in different phases of the life cycle require the same nutrients but in varying amounts.
Concept IV	:	The way in which food is handled affects its nutritional value, appearance, taste and safety.

Obtained from the Interagency Committee on Nutrition Education (ICNE) (Préfontaine, 1975), Gericke (1987)

Each question item consisted of a question or a statement with four possible answers (marked a, b, c, d). For each item, the subject was instructed to mark the statement considered to be the most correct by drawing a circle around the corresponding letter. The questions chosen for the measurement instrument (NKT) were aimed at establishing an accurate, reliable and valid instrument for evaluating a specific dietary behavioural aspect (Steyn et al., 2000; Gericke, 1987; Smit, 1983:120). Therefore, the total score of each test was measured according to percentages of the stanine category. The description of the stanine categories is presented in Table 3.3:82. The scores of the NKT according to the four chosen concepts as its underlying dimensions are indicated in Table 3.2:81.

Table 3.2 The Nutrition Concepts, Grouping of Items and Objectives in the NKT

	ICNE Concept	Grouping of Items	Objectives	TOTAL 35
I	The use of food by the body	5, 9, 6, 11, 14, 16, 17, 22, 24, 26, 32	1. To understand the importance of food for the body 2. To understand the body's needs with regard to nutrition. 3. To understand the functions of macronutrients.	10
II	The relationship between nutrients and good health	2, 3, 7, 12, 13, 15, 18, 19, 20, 21, 23, 25, 29, 30, 33, 34, 35	1. To understand the importance of a balanced diet. 2. To know the properties of a balanced diet. 3. To have knowledge of diet-related health problems.	18
III	Individuals in different phases of the life cycle require the same nutrients but in varying amounts	8, 27	1. To understand the nutritional needs of adolescents. 2. To understand the nutritional needs of adults	2
IV	The way in which food is handled affects nutritional value, appearance, taste and safety.	1, 4, 10, 28, 31	1. To understand the effect of processing and storage on the nutritional value, appearance and taste of food. 2. To understand the effect of preparation on the nutritional value, appearance, taste and safety of food. 3. To have knowledge about the methods of storage and preparation of food to retain maximum nutritional value, appearance, taste and safety.	5

Source: (Adapted from Gericke, Boshoff and Boshoff, (1987); adapted from Préfontaine, 1975:152)

3.5.4 SAMPLE REALISATION

All the subjects selected for the study completed a Nutrition Knowledge Test (NKT). These were free-living students of DIT: Steve Biko Campus who were aged 17 – 30 years.

3.5.5 THE CRITERIA FOR ADMISSIBILITY OF THE DATA

The reliability of the scores was dependent on the accuracy with which the test was scored. Double-checking and rescoring by a second person were done. Each test was checked for completeness. In a case where two possible answers were circled, the question was regarded as unanswered. If an item was not answered it was ignored. Each item was judged according to the correctness of the answer that was circled. The correct answer to each item is given in Annexure 7.15.

3.5.6 INTERPRETATION OF THE DATA

The values for the NKT were given in the form of nine-point standard scores (stanines) and percentiles. These are stanines 1 to 9 with a mean of 5 and standard deviation of 2,0. According to the raw scores, the percentage of persons fell in a specific category and description of the categories are presented in Table 3.3.

Table 3.3 Hypothetical Percentage of Respondents in Stanine Categories

Stanine	Percentage persons in group	Description
9	4	Very High
8	7	High
7	12	
6	17	Average
5	20	
4	17	
3	12	Low
2	7	
1	4	Very Low

Source: (Gericke, Boshoff and Boshoff, 1987)

The stanine norms for the standardisation and the cross validation groups for the females and males were calculated using the $SPSS^{+}$ Statistical Software Package. A factor analysis was carried out to determine the most prominent items (variables) of the NKT. A linear regression was then done to determine the relationship between all the important variables of the NKT (independent variable) and nutritional adequacy (dependent variable).

3.6 DATA COLLECTION FOR SUBPROBLEM THREE

The third subproblem was to determine the respondents' nutritional status in terms of Body Mass Index (BMI), and waist-to-hip ratio (WHR). The data needed for testing the hypothesis for subproblem three stated in section 1.2.1.3 were obtained from the raw measurement of item 2, 3, 4 and 5 of the socio-demographic questionnaire gathered by trained fieldworkers. Various studies in South Africa had also used these specific anthropometric measurements for adult nutritional assessment, for example Steyn et al., (2000). The anthropometric assessments used were BMI and WHR, which were the ones relevant to test the hypothesis of subproblem three in sections 1.2.1.3:6

3.6.1 SAMPLE SELECTION

The anthropometric assessment was carried out on all the subjects selected to participate in the study. These were free-living learners of DIT: Steve Biko Campus who were aged between 17 – 30 years.

3.6.2 ADMINISTRATION OF DATA CAPTURING

The administration of data capturing was discussed under section 3.4.2:81. Fieldworker training was done to standardise anthropometric assessment in terms of precision and accuracy. Anthropometric measurements were derived from a combination of raw measurements, namely: weight, height, waist and hip circumference. The fieldworkers were trained to use standardised, validated techniques and instruments that were precise and correctly calibrated. The precision and accuracy of each measurement technique were firmly established prior to using each instrument. Each fieldworker took measurements from the same person twice to establish consistency and standardization. The precision was assessed by the supervisor repeating the measurements on the same subjects and the inter- and intra-examiner/fieldworker coefficient of variation was calculated as stipulated by the WHO (1983) (Gibson, 1990). The measurements were taken and recorded in triplicate and the mean reported.

3.6.2.1 Taking Body Mass and Height Measurements (Stature)

Body weight (mass) was obtained on an accurately calibrated electronic scale. The scale was first standardised using a standard weighed item: a kilogram of chickpeas. Subjects were weighed wearing light clothing so that a correction to nude weight could be made. The scale was first checked that it read zero, then the subject stood on the centre of the scale without support and with the weight distributed evenly on both feet. The head was up with the eyes looking directly ahead (De Ridder, 2000). When the scale made a blipping sound indicating that a precise measurement had been obtained, the weight of the respondent was recorded to the nearest tenth of a kilogram.

Height measurements were taken using a standard method, namely stretch stature. The measurement was made using a device known as a height stick (stadiometre). The instrument is right angled and has a footpiece, counterweighted headpiece and a tape measure readout along the vertical stick. The stretch technique requires precise positioning of the subject to obtain accurate measurements. The measurement was taken as the maximum distance from the floor to the vertex of the head. Technically, the vertex is defined as the highest point of the skull when the head is held in the Franfort plane (De Ridder, 2000). This position is obtained when the line joining the orbitale to the tragion is horizontal or at right angles to the long axis of the body. The orbitale is located on the lower or most inferior position on the margin of the eye socket. The tragion is the notch above or superior to the flap of the ear at the superior aspect of the zygomatic bone. This position corresponds almost exactly to the visual axis when the subject is looking directly ahead.

To obtain the measurement, the barefoot subject stood erect, with the heels together and the arms hanging relaxed by the sides. Heels, buttocks, upper part of the back and (usually not necessary) the back of the head were in contact with the vertical stick. While taking the measurement the fieldworker made sure that the subject's heels were not elevated. The fieldworker then brought the headpiece firmly down and into contact with vertex and made a reading. Care was taken to ensure that the subject was properly oriented. The reading was recorded with two digits after the decimal point. Cues such as "straight up, lower your shoulders, look straight ahead" were made to achieve the correct positioning of the subject.

3.6.2.2 Girths

- **Waist Circumference (mm)^{R}**

This is the girth at the level of the noticeable waist narrowing and is located approximately halfway between the costal border and the iliac crest. The fieldworker stood in front of the subject so that the narrowing of the waist could be accurately located. If the subject's waist was not apparent, an estimated waist measurement was made at this level (De Ridder, 2000). The measurement was taken at the end of a normal expiration with the arms relaxed at the sides. In taking the measurement, the fieldworker stood on the side of the respondent to make sure the tape was level. Subjects were asked to breathe normally, and to breathe out gently at the time of the measurement to prevent them from contracting their muscles or from holding their breath. Three readings were taken and recorded to the nearest millimetre for precision and accuracy (De Ridder, 2000).

- **Gluteal (hip)^{R} Circumference**

This is the girth at the level of the greatest posterior protuberance, approximately at the symphysion pubis level anteriorally. The fieldworker stood at the side of the subject to ensure the tape was held in a horizontal plane when measuring this site. During this measurement, the subject stood erect with feet together and without voluntary contracting of the gluteal muscles (De Rider, 2000). The measurement was taken at the point yielding the maximum circumference over the buttocks, with the tape held in a horizontal plane, touching the skin but not indenting the flesh (Gibson, 1990). Each fieldworker was observed by another fieldworker and the researcher to ensure accurate measurement. Three readings were taken and recorded to the nearest millimetre for precision and accuracy.

3.6.3 QUESTIONNAIRE FORMULATION

The data obtained for testing the hypothesis for subproblem three stated in section 1.2.1.3:6 was obtained according to the methodology described by De Ridder (2000). The anthropometric measurements used in this study were selective, namely: height (stature), weight (body mass) and girths (waist and hip circumferences), which were included as part of the items in the socio-demographic questionnaire. The three girth raw measurements were recorded in the columns provided and the mean was calculated.

3.6.3.1 Presentation of the Data

Questions 2 – 5 of the socio-demographic questionnaire dealt with anthropometric measurements. The raw values of the measurements indicated the height, weight, waist and hip circumference of the respondents. The anthropometric indices were calculated from a combination of the following measurements: height and weight in calculating Quetelet's BMI and waist and hip circumference for WHR which is indicative of body fat distribution. Indices were constructed from the raw measurements. Such indices included a simple numerical ratio of weight/(height)^2. This is called the body mass index (BMI). The type of weight ratio used was the relative weight which expresses the weight of a given subject as a percentage of the average weight of persons of the same height and power type indices (Gibson, 1990:183).

3.6.4 SAMPLE REALISATION

Only data obtained from the learners that were conveniently sampled to participate in the study were used. These were registered free-living learners at DIT: Steve Biko Campus who were between the ages of 17 – 30 years.

3.6.5 CRITERIA FOR ADMISSIBILITY OF THE DATA

Weight was recorded to the nearest tenth of a kilogram. The standard method used in this study to measure height was stretch stature. The measurement was made using a device known as the height stick (stadiometre). The reading was recorded with two digits after the decimal point. Three readings for both the waist and hip circumference were taken and recorded to the nearest millimetre for precision and accuracy (De Ridder, 2000).

3.6.6 INTERPRETATION OF THE DATA

Anthropometric reference data were derived from an international source recommended by the World Health Organisation (WHO), and the United States National Centre for Health Statistics (NCHS), an international standard for comparison of health and nutritional status (Gibson, 1990). The available weight and height data for adults presented for men and women with mean values (in pound and kilograms) for each inch (or centimetre) of height ranges were used. The mean, standard deviation, standard error of the mean, and selected percentiles of weight by height for each gender were determined. The international reference data for the values of anthropometric indices were used with known uncertainties in mind. There are marked differences in the amount of subcutaneous fat, and to a lesser degree muscle which occur among nations (Gibson, 1990). Populations including African-Americans and Polynesians, for example have an android pattern compared to Europeans who have a gynoid pattern. The frequency distribution of the anthropometric indices was determined and compared to the NCHS reference data as recommended by the WHO (1983) (Gibson, 1990). The proportion of individuals in the sample with indices below or above the reference limits drawn from the appropriate data was determined. The distribution of each anthropometric index was compared using percentile and standard deviation scores derived from the individual's classification. The median value of the index by age and gender was compared with the corresponding mean and median for the reference data (Gibson, 1990). A linear regression was done to indicate the relationship between the anthropometric values and socio-demographic factors, nutrition knowledge as well as nutritional adequacy.

3.7 DATA COLLECTION FOR SUBPROBLEM FOUR

The fourth subproblem was to investigate the nutritional adequacy of students' eating habits in terms of meal frequency and nutrient intake by means of a Food Frequency Questionnaire (FFQ) and 24-hour Recall and to evaluate their nutrient intake in terms of the Recommended Dietary Allowances (RDAs). The data needed for testing the hypothesis for subproblem four stated in section 1.2.1.4:6 were obtained from the dietary record in the 24-hour Recall and the Food Frequency Questionnaire (Annexure 7.5 and 7.6).

3.7.1 SAMPLE SELECTION

All the subjects selected for the study completed a 24-hour Recall and a FFQ.

3.7.2 ADMINISTRATION OF DATA CAPTURING

The data required were collected by means of an interview. The selection of the fieldworkers for conducting the personal interviews was undertaken using the objectives given in Figure 3.1: 82, under section 3.4.2:81. Fieldworker training was conducted using the training manual (Annexure 8.4) specifically developed for the study. The outline of the three-day training programme is given in Figure 3.2:68. The data collected related to the measurement of a quantitative daily consumption of food using a 24-hour Recall to determine the quantity of individual foods consumed over the previous 24 hours. A quantitative Food Frequency Questionnaire was used to obtain information regarding the variety of foods consumed periodically (i.e. daily, weekly, monthly, and seldom). By means of the quantitative FFQ more precise estimates of portion size could be obtained by referring to portion size measurement aids (PSMAs) of known weights, household measures and/or by direct weighing of some of the foods not appearing on the PSMAs. Various food models were used as memory aids and/or to assist the respondent in assessing the size of food items consumed.

3.7.3 QUESTIONNAIRE FORMULATION

During piloting of the study it was determined that the 24-hour Recall took longer to complete when dietary information was entered according to prescribed codes. A blank page was then added to the modified 24-hour recall (Annexure 7.5) in order to directly record dietary intake, and then the prescribed codes were inserted, thus maximizing precision and accuracy. The list of foods in the FFQ was organised in categories such as meats, fruits and vegetables, bread, drinks, snacks, spreads. This ensured that all possible food items were reported. The food examples used for weighed estimations included pasta, beans, cereals, sugar, milk powder, cheese, soups, carrots, jugs, spoons, food containers for brands identification as well as single portion size food photographs (MacIntyre, 2000).

3.7.4 SAMPLE REALISATION

All respondents sampled to participate in the study completed a 24-hour Recall and FFQ. These were free-living students residing in Corlo Court, Myrtle Court, Shiela Court and Breheny residence, who were between the ages of 17 – 30 years, and who were registered at DIT: Steve Biko Campus.

3.7.5 THE CRITERIA FOR ADMISSIBILITY OF THE DATA

Each questionnaire was screened for completeness, before capturing the data. A single administration of the 24-hour Recall and FFQ were the most appropriate for assessing average intakes of foods and nutrients for the sample. The Food Frequency Questionnaire used had pre-formatted lists of food categories to act as a memory prompt in an interview situation. Dietary data from the 24-hour Recall had to indicate intake of breakfasts, lunch and dinner of the previous day. Amount of foods consumed had to be indicated in grams. All FFQs were checked for the accurate recording of amount, frequency of consumption and method of preparation for each food item. Once the data was checked and cleaned the raw data was entered into the nutrient analysis database.

3.7.6 INTERPRETATION OF THE DATA

The purpose of the FFQ was to assess the frequency with which certain food items or food groups were consumed during a specified time period (for example, daily, weekly, monthly or seldom). The data from a Food Frequency Questionnaire are often used to rank subjects into broad categories of low, medium and high intakes of certain foods. In epidemiological studies, such rankings are often compared with the prevalence and/or mortality statistics for a specific disease within the population studied. The best method of assessing the food patterns for a group and/or individual, involves using a FFQ. Nutrient values in food composition tables are based on a quantitative analysis of samples of each food. Values can be expressed in terms of the nutrient content of the edible portion of the food per hundred grams and/or per common household measures. The food composition tables on which the Food Finder Package is based, are predominantly compiled from analyses of locally grown foods.

Nutrient data or a computer-stored nutrient database is food composition tables transferred to, and maintained on, a computer. Food items in the nutrient data banks are usually identified by a numerical coding system, which varies in complexity. All the data submitted were carefully screened to ensure that the food item was accurately identified and that any condition which might affect its nutritive value, such as sampling, treatment, processing, and method of preparation was known. The absence of standard conversion factors in food composition tables leads to variations in the energy content of similar foods. The energy values of foods were calculated indirectly from the amounts of protein, fat, carbohydrate and alcohol in the foods, using various energy conversion factors. Consequently, the calculated energy values represented the available or metabolised energy content of foods. The nutrient values of individuals' intake were compared to the RDA in order to determine nutritional adequacy.

3.8 LIMITATIONS

1. The list of the population of students generated did not clearly indicate the correct addresses for most students and did not classify students as to whether they were free-living or not, thus making it difficult to locate and select the students for the sample.
2. Locating the learners using their field of study proved to be difficult due to timetable complications.
3. Appointments were made with learners; however, it was difficult to obtain their commitment to the study therefore some students had to be excluded.
4. The success of the 24hour Recall depended on the subject's memory, the ability of the respondent to convey accurate estimates of the portion sizes consumed, the degree of motivation of the respondent and the persistence of the interviewer.
5. Possible errors resulted from true random variability in the nutrient content of a food, or alternatively, from systematic errors. It is possible that the extent of both random and systematic errors produced consistent overestimates of the nutrient content of individual food items, although the direction and magnitude of the error was unknown (Table 4.12, Annexure 7.19).
6. The errors associated with the estimation of portion size of foods were probably the largest source of measurement error as is the case with many dietary survey methods (Subar et al., 1998).

7. Some of the respondents were unable to accurately quantify the portion of food consumed, or the perceived average serving differed from the standard average serving used for estimating a portion.
8. The period of data collection took up to two hours per respondent, thus making the subjects irritable and tired. This factor compromised participation. A blank page was then added to the modified 24-hour Recall to directly record dietary intake, which was thus captured as raw data. Therefore, codes were unnecessary for the type of nutrient analysis software package used.
9. The list of foods in the FFQ was incomplete; a lot of food items relevant to the target group had been omitted, thus underestimating dietary intake. Therefore, it was re-organised into food categories such as meats, fruits, vegetables and bread. More food items were included to ensure that all possible foods were reported.
10. Single portion size food photographs were used for estimating portion sizes; however, it was not sufficient. As a result weighed estimations of actual food were used as models. The weighed food examples used included pasta, beans, cereals, sugar, milk powder, cheese, soups, carrots, jugs, spoons, scale and food containers for brands identification.
11. During the pilot study some of the fieldworkers did not consistently record the frequency with which some foods were consumed, the amounts consumed or the amounts related to different preparation methods of the same food. Neither did they record the quantity of food next to the appropriate code. The fieldworker had to go back to the respondents to collect the missing data. However, this was corrected during the pilot before the questionnaires were administered to the full sample.
12. Since the FFQ makes use of recalled information, it relies on the respondent's ability to retrieve the relevant information from memory, process it and provide reasonable

answers, usually within a short period of time. This could impact on the reliability of the data collected.

13. Some of the respondents were not willing to have their anthropometric measurements taken. They had to be persuaded and assured that information would be treated confidentially.
14. Availability and accessibility of expertise in terms of data capturing and data analysis using the appropriate software/s were limiting to the study. As a result data capturing techniques, the use of various sources to verify the accuracy of data capturing, as well as well as statistical analysis techniques had to be acquired.

3.9 SUMMARY

This chapter outlined the procedures followed in obtaining the data using the descriptive survey method. The methodology used to obtain the data related to each subproblem was discussed. The chapter discussed the manner in which sample selection, administration of data capturing, questionnaire formulation, determining criteria for the admissibility of the data, and the interpretation of the data for each subproblem and hypothesis was done. The limitations of the survey and its susceptibility to bias were discussed. The results of the data processing are reported in Chapter four.

CHAPTER FOUR

DATE ANALYSES, RESULTS AND FINDINGS

4.1 OVERVIEW

In the previous chapter, the methods of data collection were discussed. These included sampling methods, sample realisation, criteria for admissibility of the data and the analyses of the data. The limitations of the descriptive survey method were also discussed. This chapter reports on the results of the processed data as they were tabulated, interpreted and evaluated. Only significant results that emerged for each subproblem and its hypothesis are dealt with.

The following results are reported:

- The influence of socio-demographic factors on nutrient intake
- The level of nutrition knowledge of the student population
- The influence of nutrition knowledge on nutrient intake
- The BMI and WHR of the student population
- The nutritional adequacy of the students" dietary habits

For the purpose of this study exact probability (p) values have been given; however p = 0,0000 does not mean that p is equal to zero, but that there is a statistically significant relationship between variables. The responses and tabulation of the relevant Pearson's correlation and independent t-test results for significance between the variables are reported with r and p values as indicated in Table 4.2:130.

4.2. SAMPLE REALISATION

This sampling technique resulted in 192 (n) students being sampled, with an 80% response rate, and with both females and males participating in the study, including the pilot study. The results of the pilot study showed similar trends to the sample. On the Steve Biko Campus, (n=192) Black students, of whom 52% were females and 48% males, completed all four measurement tools (section 3.4.3.2:70). The researcher gathered data on demographic and socio-economic factors by means of a structured questionnaire during an interview session. The questionnaire included questions on age, gender, marital status, ethnicity, money spent on food, living arrangements as well as food purchasing and preparation practices. Figure 4.1:97 shows the sample distribution according to age and gender.

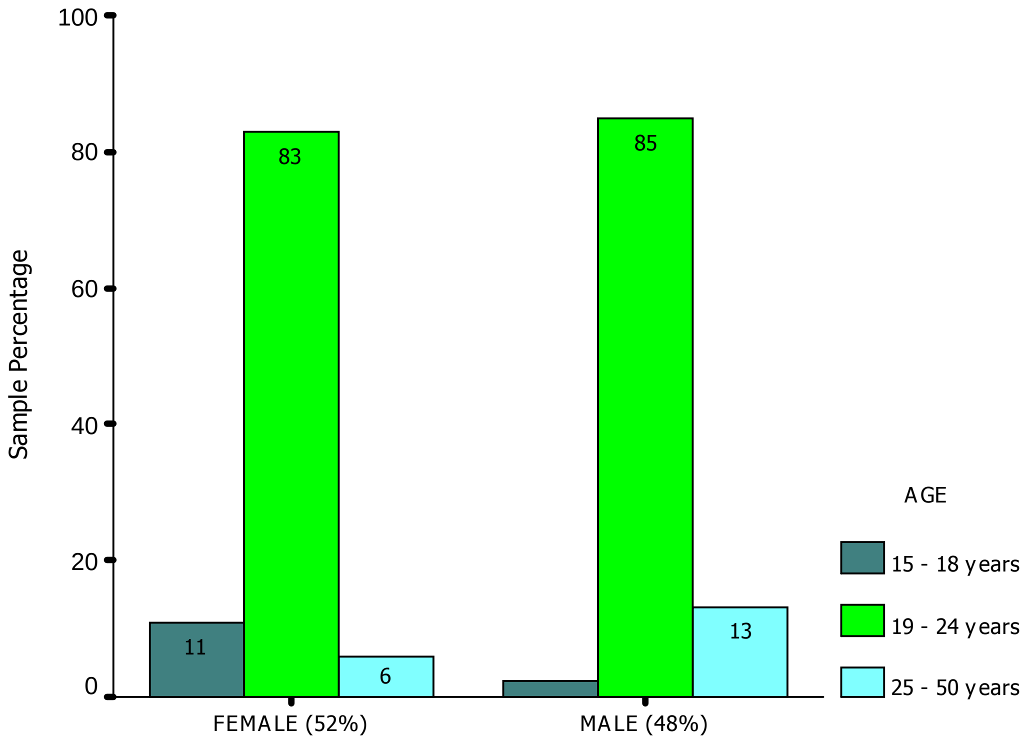

Figure 4.1 Sample Distribution According to Gender and Age

The age of the sample was divided into three categories. The most prevalent age score reported for both genders was 19 to 24 years. The following age categories were represented by the sample: 15 to 18 years (7%); 19 to 24 years (84%) and 25 to 50 years (9%). Females aged 19 to 24 years made up 83% of the sample compared with 11% in the 15 to 18 year age category, and a further 6% in the 25 to 50 years age category. For males, the age category ranges were: 19 to 24yrs (85%); 15 to 18yrs (2%) and 25 to 50yrs (13%). Therefore, males represented a higher percentage of the older age category (25 to 50yrs) in the sample compared with females. The following living arrangements were reported by the sample: Flat (89%); diggs (2%), rented room (7%), married (1%) and living with a partner (1%) as indicated in Figure 4.2:98. The students' living arrangements did not have a significant influence on their eating habits and nutrient intake (p=>0.05).

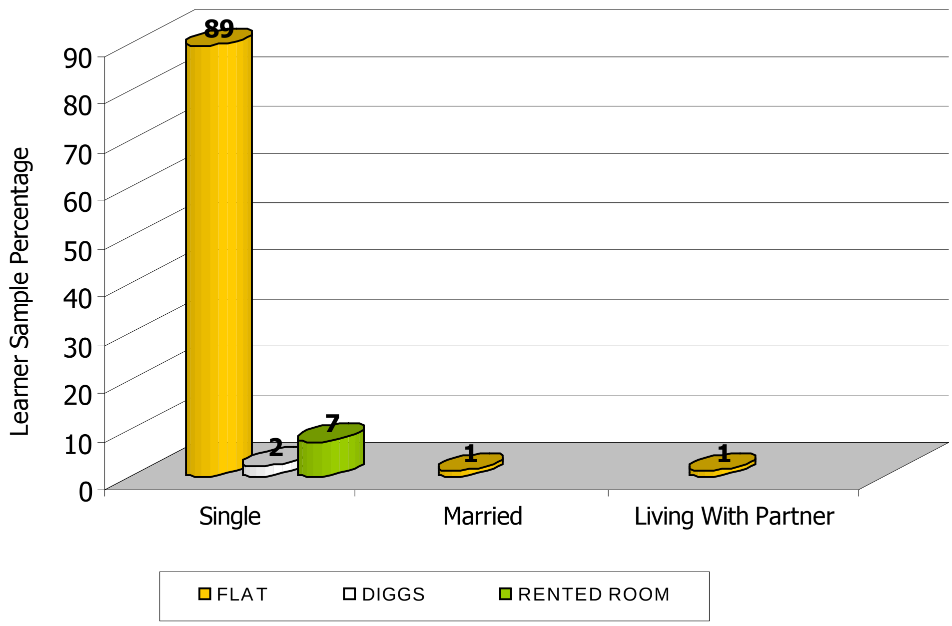

Figure 4.2 Sample Distribution According to Marital Status and Living Arrangements

The religious denominations represented in the sample were: Christianity (94%); Atheist (3%) and Islam (1%). One percent did not specify their religious denomination. The ethnic groups represented by the sample were: Zulus (67%); S-Sothos (11%); Xhosas (8%) and Swazis (7%) as shown in Figure 4.3:99. Other ethnic groups made up a small component of the sample, namely: N-Sothos (3%) and Vendas (1%).

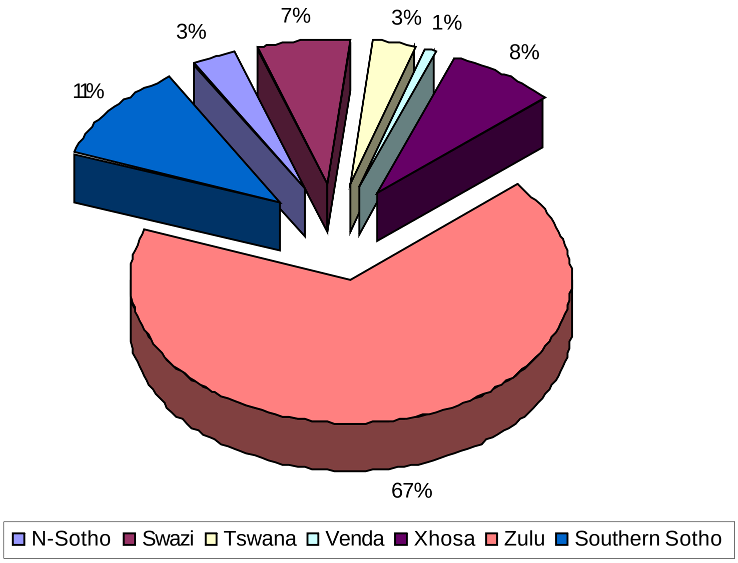

Figure 4.3 Sample Distribution According to Ethnicity

The religious and cultural practices of the students did not prove to be a significant factor as there was no statistical association found between religion (variable) and nutrient intake. The students' previous education was tested to determine its influence on eating habits. Students who had attended urban government schools prior to studying at the Technikon totaled 84% compared with 16% who had received private school education. Students' previous education had no significant influence on their eating habits and nutrient intake. However, storage facilities were statistically associated with nutrients such as total protein, animal protein and total fat, but the strength of the association was very weak (p = 0.041). Ninety-seven percent of the respondents reported having storage facilities in the form of a refridgerator with a freezer. Only 3% of the respondents reported not having storage facilities. All students had some form of cooking facility. The following cooking facilities used were reported by the sample: stove (81%); hot plate/two-plate (14%); a microwave (2%) and a frying pan (1%) as shown in Figure 4.4:100.

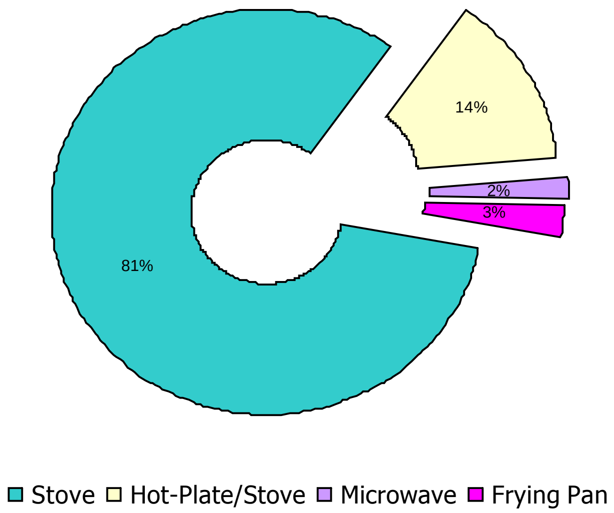

Figure 4.4 Sample Distribution According to Coooking Facilities

Students that did not have a storage facility in the form of refridgerator or freezer used either a microwave oven or frying pan for cooking. All students reported purchasing food from a supermarket or a fruit and vegetable market. The amount of money each student spent on food monthly was divided into four socio-economic categories, as indicated in Figure 4.5:101. The respondents reported spending the following amounts on food monthly: R200 – R299 (42%); >R400 (31%); R100 – R199 (23%) and <R99 (4%). The median socio-economic category was (R200 – R299) which was similar to the findings of the study conducted by Van Eeden and Gericke in 1996 at Vista University.

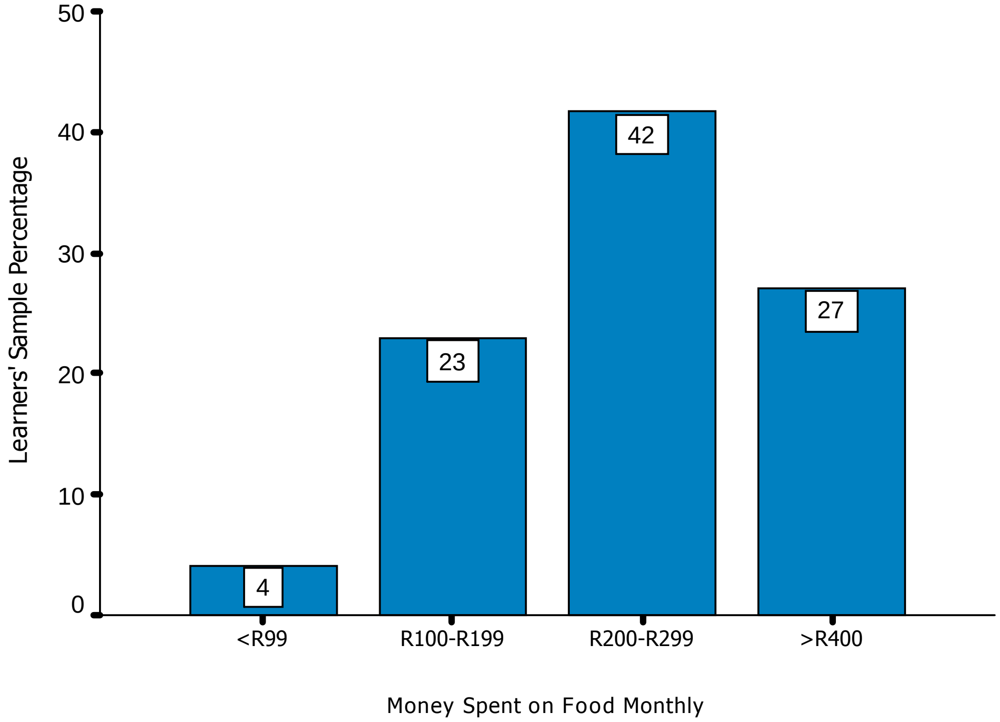

Figure 4.5 Sample Distribution According to Monthly Food Expenditure

An independent t-test and Oneway-Anova Post Hoc were conducted to test for honest significance differences between means of nutrient intake and sociodemographic variables. The chi square test was used to test the strength and significance of the association between socio-demographic variables and nutrient intake. The association between variables was found to be significant with $p = <0.05$. The correlation between variables was found to be significant with $r = 0.145$. Only sociodemographic variables and nutrients from the 24-hour Recall which showed significant associations are reported (Table 4.2:129) and indicated in Annexure 7.11, 7.12 and 7.13).

4.2.1 THE INFLUENCE OF GENDER ON NUTRIENT INTAKE

The influence of gender on nutrient intake was measured by Q9 of the socio-demographic questionnaire. An independent t-test was conducted to test for differences in nutrient intake between genders. The independent t-test identified significant differences between genders in the following areas: energy, plant protein, carbohydrate, fibre, iron, magnesium, copper, manganese and phosphorus (Table 4.2:129). However, the significance of the association between gender and fibre intake ($p = 0.027$), as well as gender and carbohydrate ($p = 0.019$) intake was very weak.

4.2.1.1 The Influence of Gender on Energy Intake

The raw scores of energy intake were compared to the RDA to determine the adequacy of energy intake for gender. Figure 4.6:103 indicates the adequacy of energy intake according to gender in this study. The mean energy intake reported for females was 6749.95 kJ. The kilojoule intake ranges reported for females were: 3000 – 5000 kJ (26%); 5001 to 10000 kJ (65%) and 10001 – 15000 kJ (8%). Fourty percent of females reported an inadequate energy intake (<67% RDA) compared with 46% (>67% RDA) that had an adequate energy intake. A further 14% of females surveyed consumed more than the recommended level (>100% RDA) of energy. The mean energy intake reported for males was 8049.7kJ. For males, the kilojoule intake ranges were: 3000 – 5000kJ (15%); 5001 – 10000kJ (55%) and 10000 – 15000 kJ (17%).

Fifty-five percent of males surveyed had an inadequate intake of energy (<67% RDA) compared with 36% that had an adequate energy intake (>67% RDA). Only 9% of males reported consumption above the recommended level (≥100%) of energy. Therefore, males had energy intakes below their requirements when compared with females.

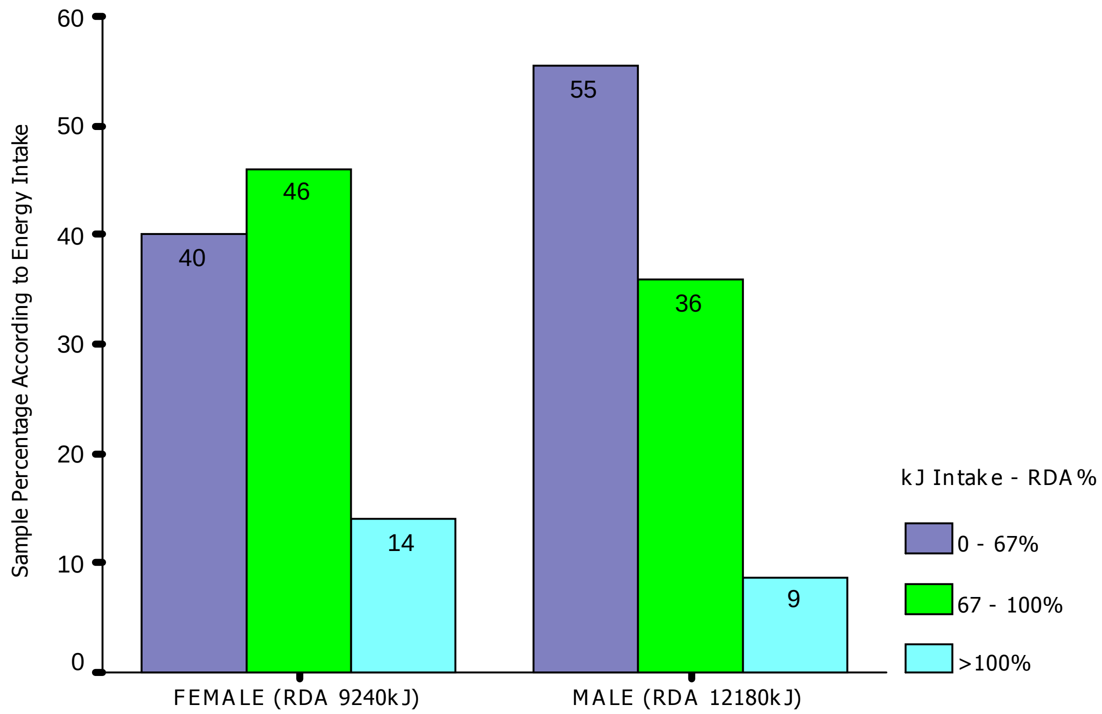

Figure 4.6 Energy Intake between Genders According to the RDA

The nutrient standards and prudent dietary guidelines stipulate energy requirements and guidelines as total kilocalorie intake or kilojoule intake from fat, protein and carbohydrates. In accordance with the prudent dietary guidelines a large portion of the sample had the recommended intake of 50 – 60% of energy from carbohydrates (Table 4.1:103).

Table 4.1 Energy Distribution Intake According to Gender

Nutrient List	**Females (n=100)**	**Males (n=92)**	**Levene's Independent t test**	**Independent t-test Sig. (2-tailed)**	***Prudent Dietary Guidelines**
	Mean % and SD		p value	p value	
Protein	13.83 (4.9)	14.27 (3.9)	0.006	NS	12 – 20% TE
Total Fat	29.97(9.2)	26.36 (8.5)	NS	0.005	<30% TE
-SAF	9.82 (3.7)	8.51 (3.6)	NS	0.013	≤10% TE
- MUFA	10.90 (6.0)	8.92 (3.9)	NS	0.007	10 – 15% TE
- PUFA	6.84 (4.0)	5.93 (3.4)	NS	NS	4 – 10% TE
Carbohydrate	54.64 (13.3)	58.91 (9.9)	NS	0.012	50 – 60% TE
Alcohol	0.16 (0.8)	0.42 (2.9)	NS	NS	-

* Prudent Dietary Guidelines, (Williams, 2001)

The mean percentage of energy from fat was lower for males (26.36%) compared with females (29.97%). However, the mean percent of energy from protein was higher for males (14.27%) compared with females (13.83%). More females had an energy intake from fat higher than the recommended level of 30%. A further 30% of females reported an energy intake from carbohydrates lower than the recommended level (≤ 50%). Therefore, according to the dietary records, energy intake of males was mainly from carbohydrates and protein compared with females whose energy intake was mainly from carbohydrates and fat. Evidently, females had a higher total energy intake due to the high kilojoule value of fat compared to that of protein and carbohydrate. An association between gender and energy intake was found where $p = 0.005$.

4.2.1.2 The Influence of Gender on Plant Protein Intake

According to the RDA, the requirements for protein are stated as total protein which includes animal and plant protein. According to the prudent dietary guidelines a recommended level of energy intake from protein is 12-20% of total energy intake. Therefore, there are no set requirements for plant protein intake. Figure 4.7:105 indicates the intake of energy derived from protein as a percentage of total energy intake according to gender. Females had a lower protein-energy intake than males. For females, energy-protein intake categories were: <12% (39%); 12-20% (57%) and >20% (4%). The energy-protein intakes reported for males were: <12% (37%); 12-20% (71%) and >20% (2%). According to the diet records, males had a higher plant protein intake compared with females, due to a higher carbohydrate intake. The mean plant-protein intake for males and females was 29g (standard deviation = 15.8) and 21g (standard deviation = 12.7), respectively. This explains the higher plant-protein intake that was reported for males when compared with females.

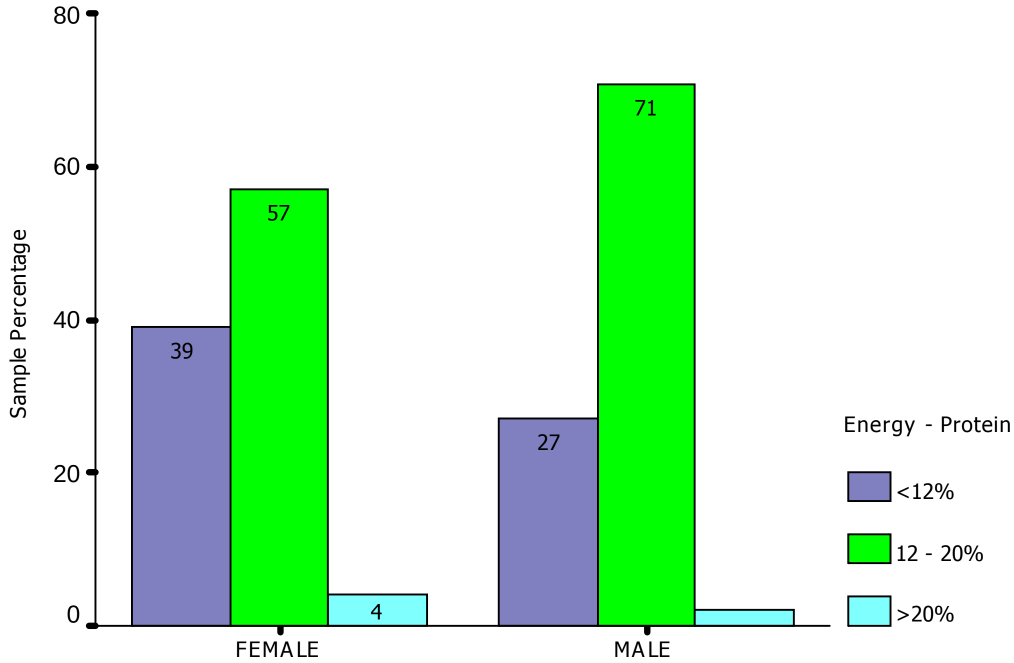

Figure 4.7 Energy-Protein Intake between Genders According to Prudent Dietary Guidelines

Mean total protein intake was above the RDA for both males and females. The mean total protein intake for females reported was 53g and for males 66g. The RDA for protein is stipulated according to gender and age is estimated at ±46g for females and ±58g for males (Williams, 2001). An association between gender and plant protein was found where $p = 0.007$.

4.2.1.3 The Influence of Gender on Carbohydrate Intake

According to the prudent dietary guidelines 50-60% is the recommended level of total energy intake that should be derived from carbohydrates. Figure 4.8:106 shows energy intake from carbohydrates between genders according to the prudent dietary guidelines. There is no single recommended dietary allowance for carbohydrates in the classic RDA or in the new DRIs. A large portion of the study sample achieved the recommended level of 50-60% of energy from carbohydrates. More females (30%) had energy intakes from carbohydrates below the recommended level when compared with males 16%.

The per capita carbohydrate intake for males and females was 256.8g (standard deviation = 109.1) and 210.6g (standard deviation = 91.5), respectively. The recommended amount of carbohydrate in the diet according to the US Dietary Guidelines is given as a percentage of total kilojoule intake. For females, the energy intake categories were: <50% (30%); 50-60% (37%) and >60% (33%) of the recommended level. A minimum of 100g of carbohydrates per day is regarded as a safe level to meet the body's requirements (Williams, 2001) and to prevent ketosis. An association between gender and carbohydrate intake was found where p = 0.019.

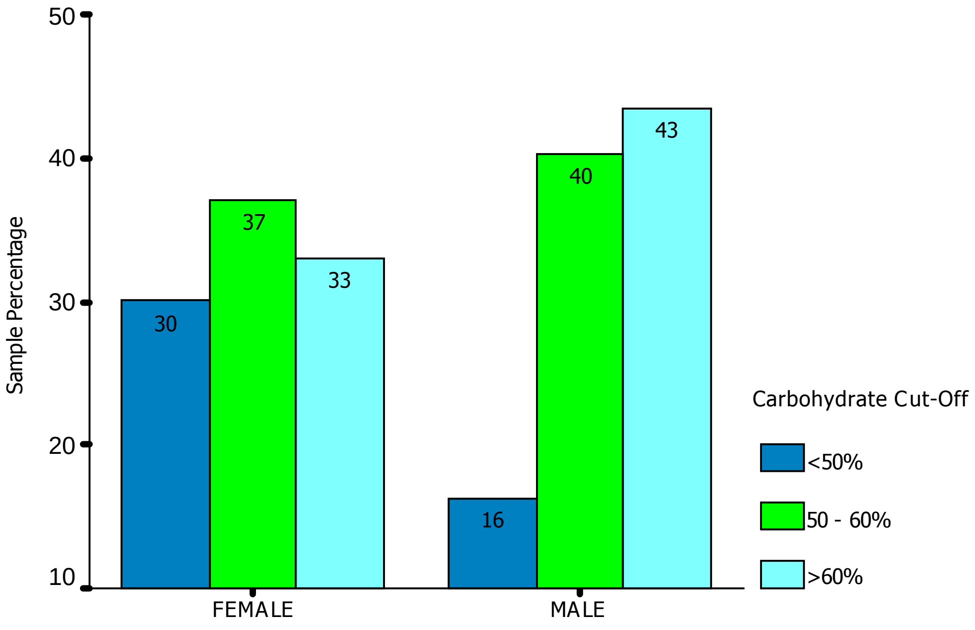

Figure 4.8 Energy-Carbohydrate Intake between Genders According to Prudent Dietary Guidelines

4.2.1.4 The Influence of Gender on Fibre Intake

The goal for fibre intake set by the American Food and Nutrition Board is 20 – 35g per day. However, a general daily intake of 25g/1000kcal to 40g/1000 kcal is regarded as a reasonable goal (Williams, 2001). This intake would require consistent use of whole grains, legumes, vegetables, fruits, seeds and nuts. The classification criteria for interpreting fibre intake in this study were: <20g; 20-35g and >35g. Figure 4.9 indicates the fibre intake between genders according to recommendations made by the US Dietary Guidelines. Fibre intake categories reported for females were: <20g (81%); 20-35g (17%) and >35g (2%). For males, fibre intake categories were: <20g (60%); 20-35g (33%) and >35g (8%) per day. The mean fibre intake for females was less than the set goal (14gwith standard deviation = 13.3) compared with fibre intake for males (20g with standard deviation = 14.0) which was within the recommendation made by the guideline.

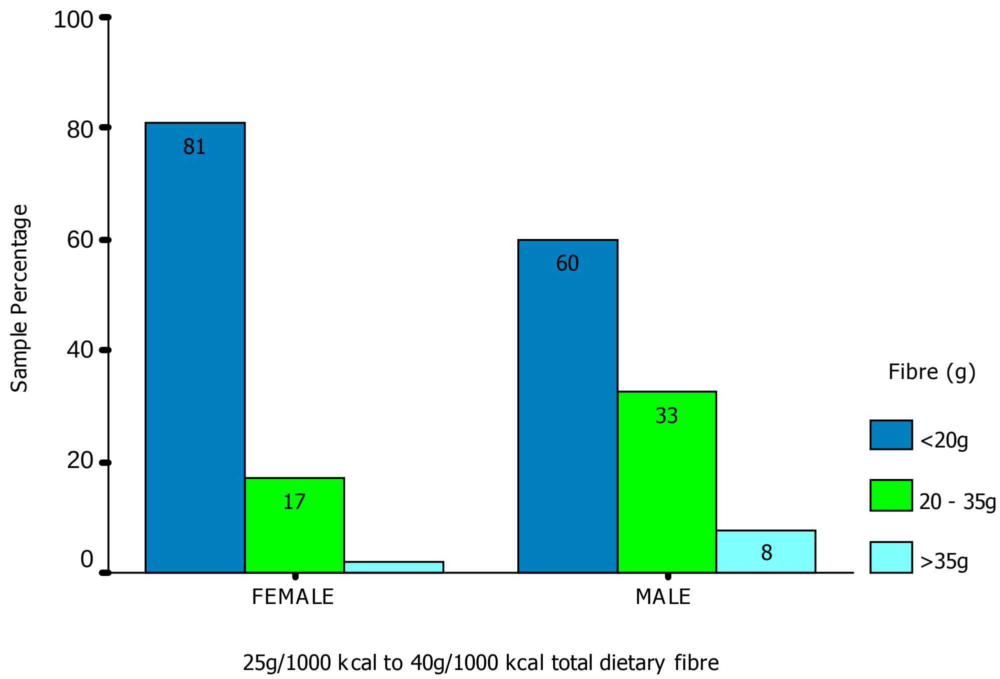

Figure 4.9 Fibre Intake between Genders Accoding to the US Dietary Guidelines

Therefore, males had a higher fibre intake than females. According to the diet records, the intake of wholegrains, legumes, fruits and vegetables, seeds and nuts was low for both genders represented by the sample. Foods reported to be consumed from the cereal group were mainly bread, rice, pasta and breakfast cereal (refined). An association between gender and fibre intake was found where p = 0.027. The significance of the association between the two variables is very weak.

4.2.1.5 The Influence of Gender on Iron Intake

Iron intake was assessed according to the following categories: 0 – 67% (inadequate), 67 – 100% (adequate) and >100% (high intakes) of the RDA. Figure 4.10 indicates the intake of iron according to gender, as a percentage of the RDA. The following iron intake categories were reported by females: <67% (69%); 67-100% (18%) and >100% (13%) of the RDA.

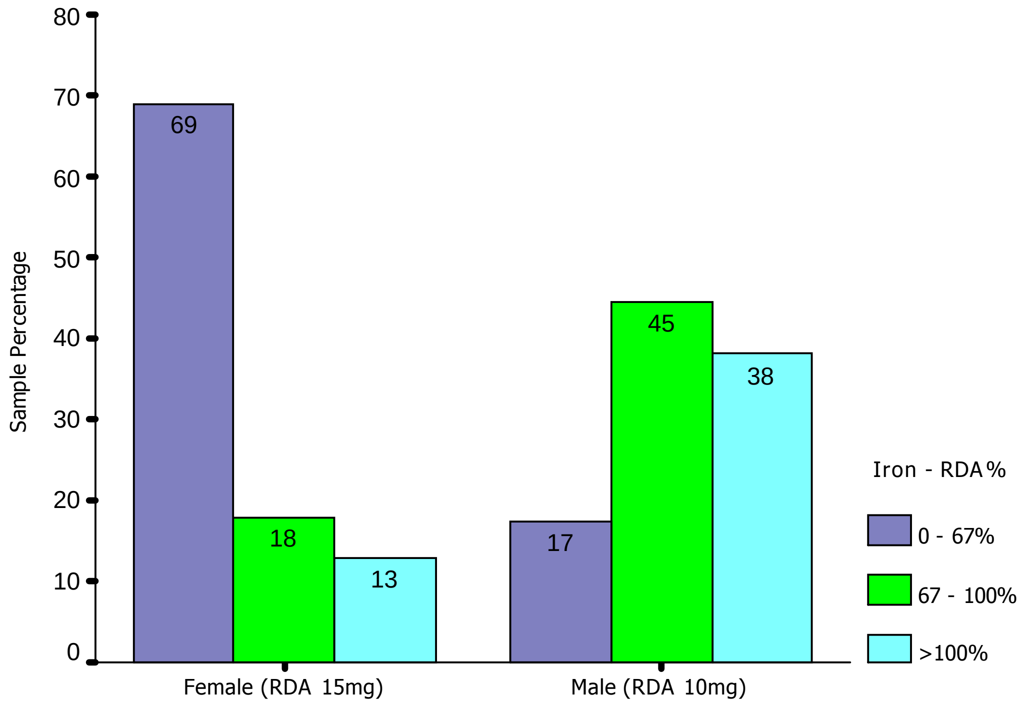

Figure 4.10 Iron Intake between Genders According to the RDA

For males, the intakes of iron ranged from: <67% (17%); 67-100% (45%) to >100% (38%) of the RDA. The level of iron intake reported for females was below the RDA for females compared with males. Therefore, males had adequate intakes of iron compared with females (Figure 4.10:108). Young women are a risk group when it comes to lacking iron in the diet as women require more iron to recover losses incurred during menstruation (Williams, 2001). An association between gender and iron intake was found where p = 0.000.

4.2.1.6 The Influence of Gender on Magnesium Intake

An adult body contains about 25g of magnesium, and about 60% of this magnesium is present in the skeleton. The new DRI guidelines establish RDA amounts by age group and gender. For the age 14 to 18 years, the RDA is 410mg/day for males and 360mg/day for females. For individuals aged 19 to 30 years, the RDA is 400mg/day for males and 310mg/day for females. According to Figure 4.11:110, over 50% of both genders had magnesium intakes above 67% and 100% of the recommended level. There were no significant differences between genders in magnesium intake at an inadequate (<67%) and adequate (67-100%) level of intake. However, there were significant differences in the high intakes (≥100%) where females scored 14% compared with 23% for males. The following nutrient adequacy ratio ranges were found in females: <67% (49%); 67-100% (37%) and >100% (14%). For males, the range of magnesium intakes was: <67% (45%); 67-100% (33%) and >100% (23%) of the recommended level.

Food sources of magnesium include whole grains, nuts, legumes and green vegetables. Over 50% of female respondents reported not including these foods in their diet, particularly dried beans, peanut and peanut butter, oats and mabela. Fourty-seven percent of males reported including food sources of magnesium regularly in their diet.

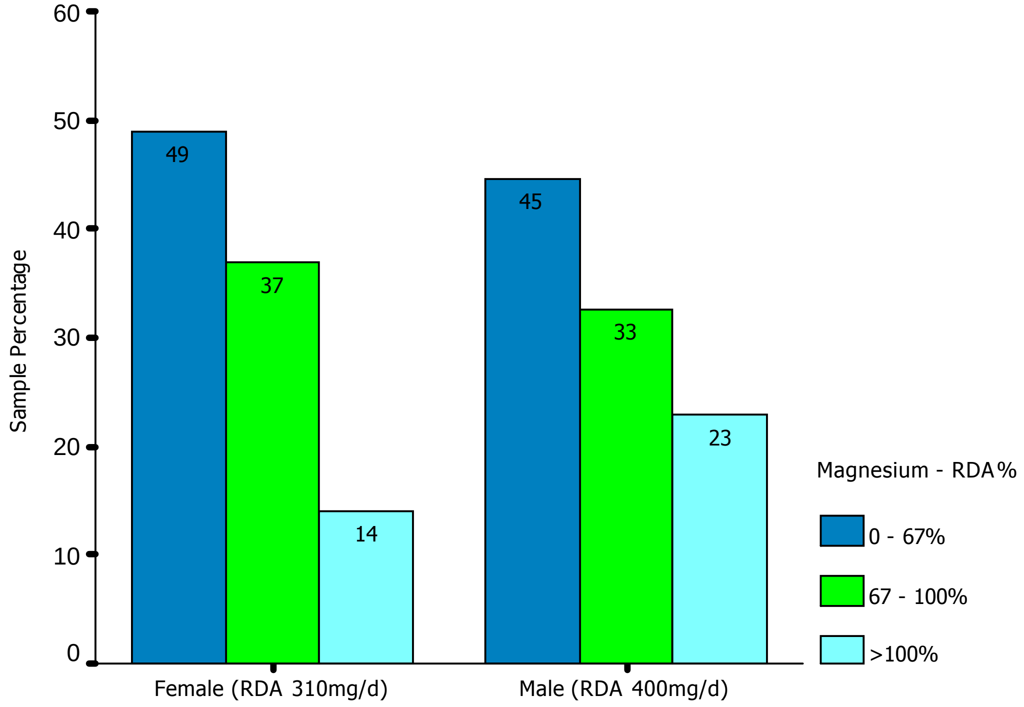

Figure 4.11 Magnesium Intake between Genders According to the RDA

Therefore, males had slightly higher intakes of magnesium compared with females in the sample. Magnesium deficiency that is purely diet-related is very rare in persons consuming natural diets. Symptoms of magnesium deficiency have been observed in clinical situations such as starvation, persistent vomiting or diarrhea with loss of magnesium-rich gastrointestinal fluids (Williams, 2001). Even though there was no indication of magnesium deficiency within the sample, there is sufficient evidence to indicate a high prevalence of inadequate magnesium intake among young adults of both genders. An association between gender and magnesium intake was found where $p = 0.000$.

4.1.2.7 The Influence of Gender on Phosphorus Intake

There were no significant differences between genders in the adequate (67 -100% RDA) intake category of phosphorus. However, significant differences between genders were found at inadequate (<67% RDA) and higher levels (>100% RDA) of phosphorus intake. For females, the intakes of phosphorus ranges were: <67% (46%); 67-100% (37%) and >100% (17%) of the recommended level of intake. The following intakes of phosphorus were reported by males: <67% (29%); 67-100% (37%) and >100% (34%) of the recommended level of intake. Therefore, males reported higher levels of phosphorus intake compared with females. Figure 4.12 indicates the intake of phosphorus between genders compared to the recommended level of intake.

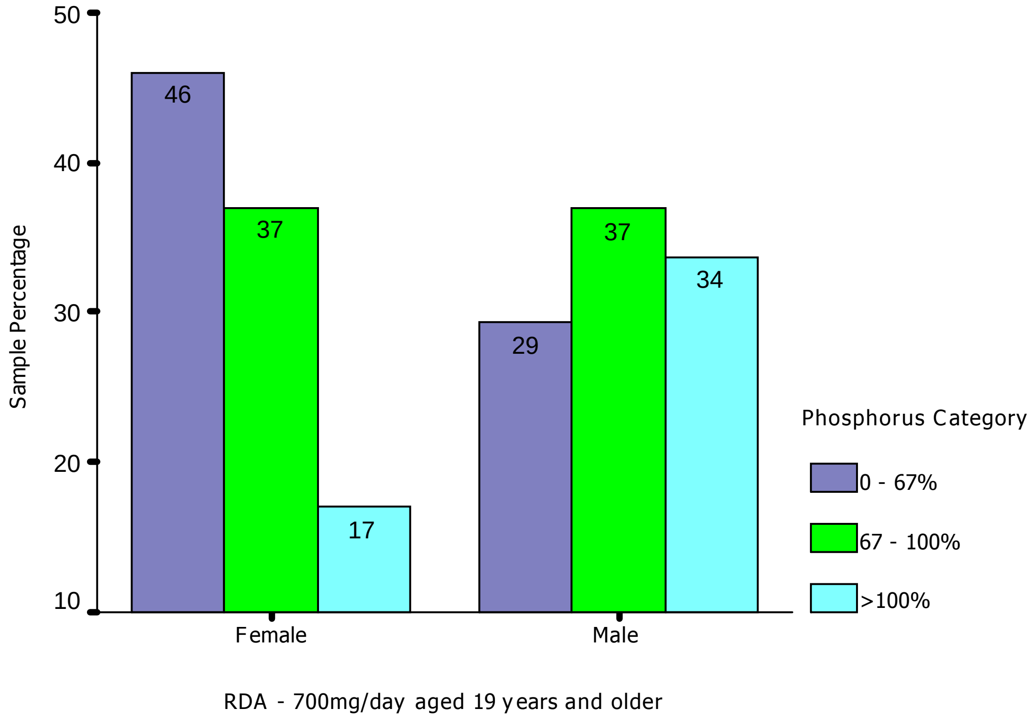

Figure 4.12 Phosphorus Intake between Genders According to the RDA

Food sources of phosphorus include milk, cheese, meat, egg yolk, as well as whole grains and legumes. More males included these food regularly in their diet compared with females in the sample. The DRI guidelines have established new RDAs for phosphorus for both males and females (aged 19 years and older) at 700mg/day. Phosphorus is widely distributed in foods and therefore a deficiency state is rare. A state of total starvation would be needed to create a dietary phosphorus deficiency (Williams, 2001). An association between gender and phosphorus intake was found where $p = 0.007$.

4.1.2.8 The Influence of Gender on Copper Intake

Copper is one of the essential trace elements and the classic RDA only recommends safe and adequate ranges of intake. For adults, the RDAs estimate a safe and adequate range of dietary copper intake at 1.5 to 3.0mg/day (Williams, 2001).

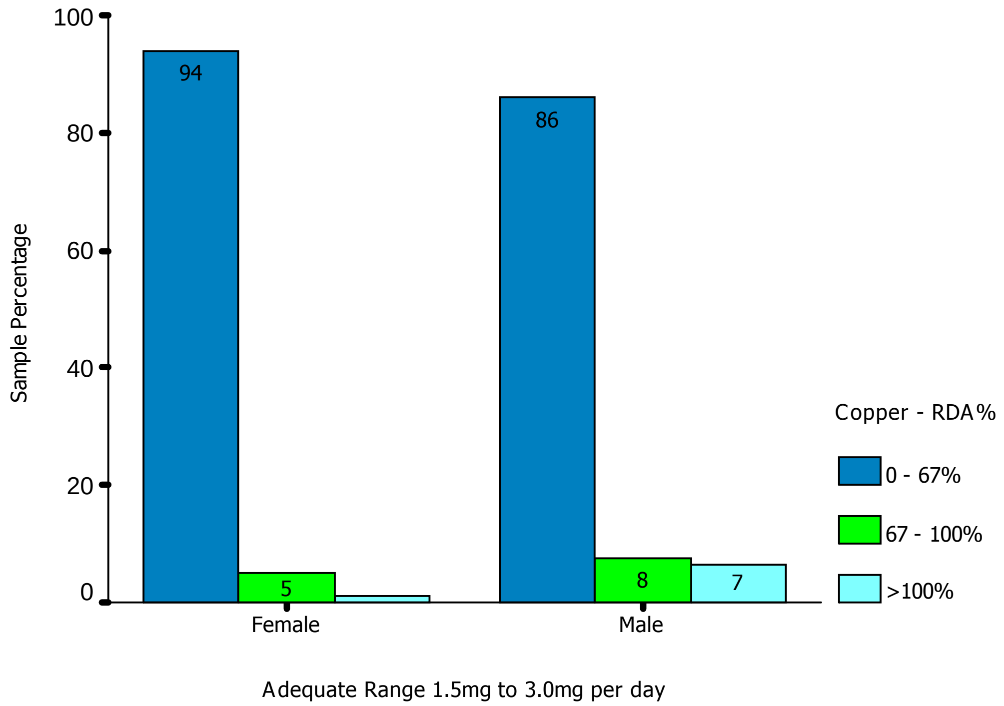

Figure 4.13 Copper Intake between Gender According to the RDA

Severe copper deficiency is rare, attributable to individual adaptation of somewhat lower intakes. Significant differences between genders in copper intake were found, as indicated in Figure 4.13:112. According to diet records the intake of copper for both genders was inadequate (≤67% RDA). For females, the ranges of copper intake were: <67% (94%); 67-100% (5%) and >100% (1%) of the safe and adequate recommended intake. The following copper intake categories were reported by males in the sample: <67% (86%); 67-100% (8%) and >100% (7%). Therefore, the intake of copper for both genders was significantly inadequate. Copper is widely distributed in natural foods. However, its richest food sources include liver, seafood, nuts and seeds, as well as legumes and grains. These foods were not consumed by almost 60% of males and females represented by the sample. An association between gender and copper intake was found where $p = 0.005$.

4.1.2.8 The Influence of Gender on Manganese Intake

The adult body contains 20mg of manganese found mainly in the liver, pancreas, pituitary gland and bone. Although it is regarded as a dietary essential, it is toxic at higher levels of intake (Williams, 2001). Figure 4.14:114 indicates the level of manganese intake between genders according to the RDA. Sixty-nine percent of female respondents reported intakes of manganese below the RDA (<67%) compared with 24% that had an adequate intake, and a further 7% with intakes of >100% RDA. For males, ranges of manganese intake were: <67% (39%); 67-100% (25%) and >100% (36%) of the recommended level of intake. Food sources of manganese include cereals, whole grains, soybeans, legumes, nuts, tea, vegetables and fruits. The consumption of these foods by the sample was significantly low. However, more males reported consumption of these foods, particularly vegetables and fruits compared with females. Manganese deficiency is very rare. The RDAs estimate a safe adequate intake range of 2.5 – 5.0mg/day for adults (Williams, 2001). Therefore, a significant portion (61% males and 31% females) of the sample had sufficient intake of dietary manganese. An association between gender and manganese intake was found where p = 0.000.

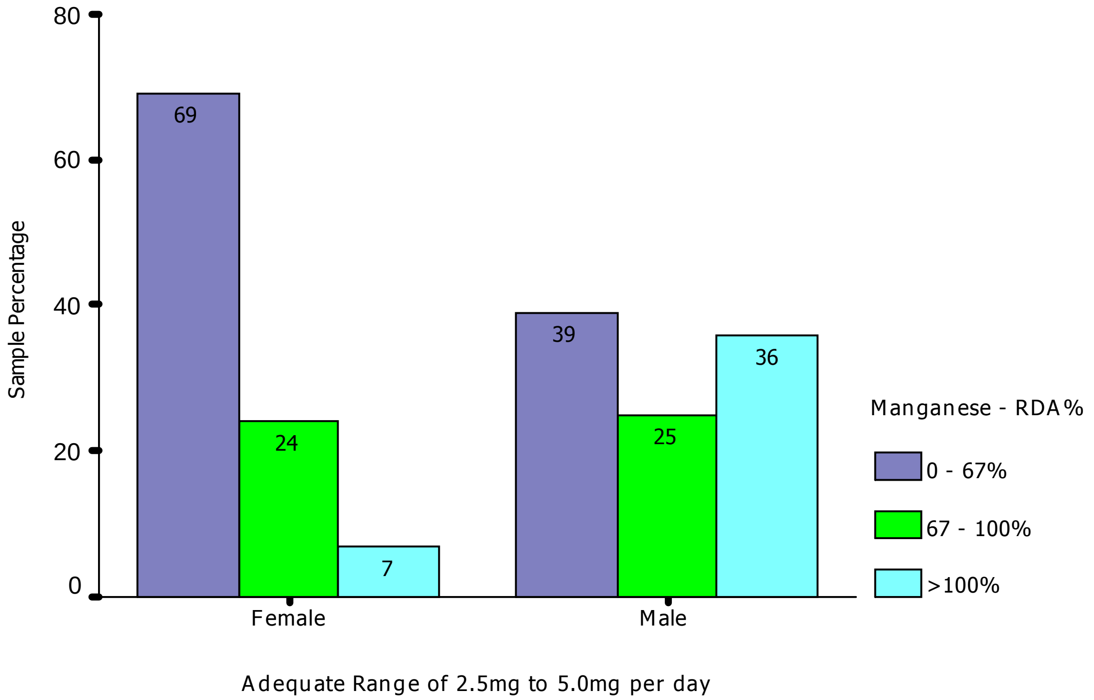

Figure 4.14 Manganese Intake between Genders According to the RDA

4.2.2 THE INFLUENCE OF ETHNICITIY ON NUTRIENT INTAKE

Ethnic groups represented by the sample were determined by Q.9 of the socio-demographic questionnaire (section 3.3.1:64, Figure 4.3:99). An independent t-test identified a significant difference in the intake of calcium, thiamin and riboflavin. The strength of the association between ethnicity and nutrient intake was weak. However, an Anova Post Hoc test indicated so significant differences between ethnic group except for calcium (p=0.031) and potassium (p=0.024). The differences in nutrient intake between the various ethnic groups could have been due to the ethnic representation by the sample, in that Zulus were the predominant ethnic group (67%) surveyed.

4.2.2.1 The Influence of Ethnicity on Calcium Intake

The following ethnic groups were represented by the sample: Swazi (7%), Xhosa (8%), Zulu (67%) and S-Sotho (11%). Other ethnic groups omitted from Figure 4.15 made up a small percentage of the study sample, and had no significant association with nutrient intake. Figure 4.15 indicates the intake of calcium according to ethnic groups represented by the sample.

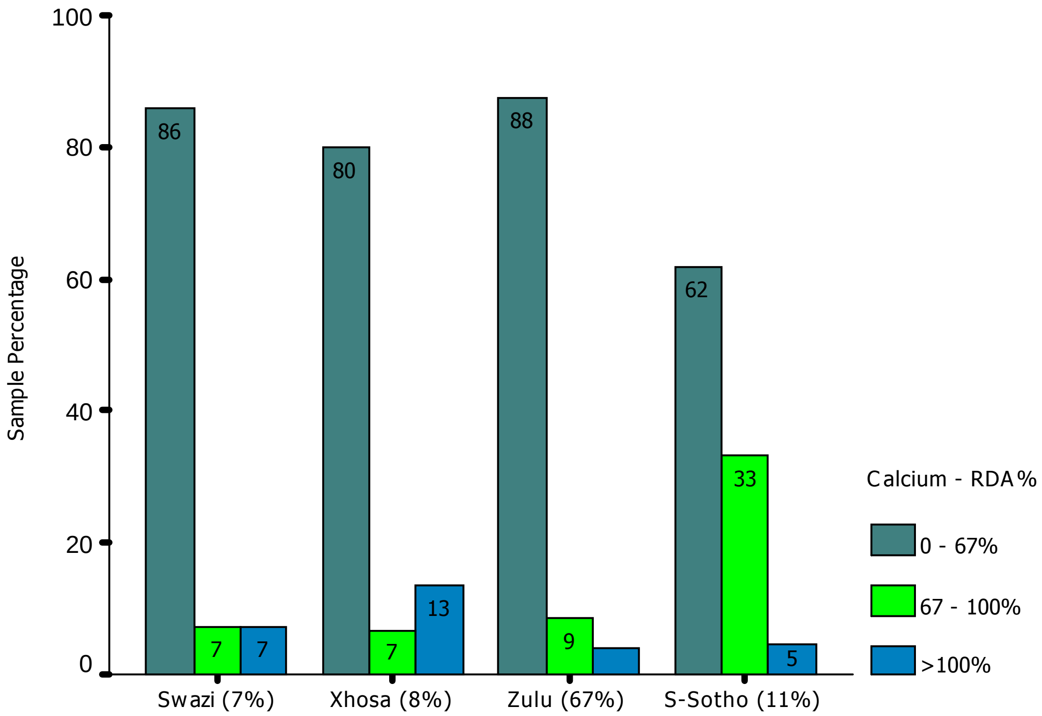

Figure 4.15 Calcium Intake in Ethnic Group According to the RDA

Thirty-three percent of the S-Sothos surveyed had the recommended level (67-100%) of calcium intake. Therefore, S-Sotho respondents had a higher intake of calcium than other ethnic groups, followed by Xhosas, Swazis and Zulus. This indicates that there could be a significant difference in dietary patterns between various ethnic groups, particularly in the consumption of the milk group. An association between ethnicity and calcium intake was found where p = 0.044.

4.2.2.2 The Influence of Ethnicity on Thiamin Intake

There were significant differences between ethnic groups in thiamin intake. The intake of thiamin was high for Xhosa respondents compared to that of other ethnic groups in the sample. Figure 4.16 compares the intake of thiamin between the various ethnic groups. The intake of thiamin was inadequate for the following ethnic groups: S-Sotho (57%); Swazi (50%); Zulu (41%) and Xhosa (33%).

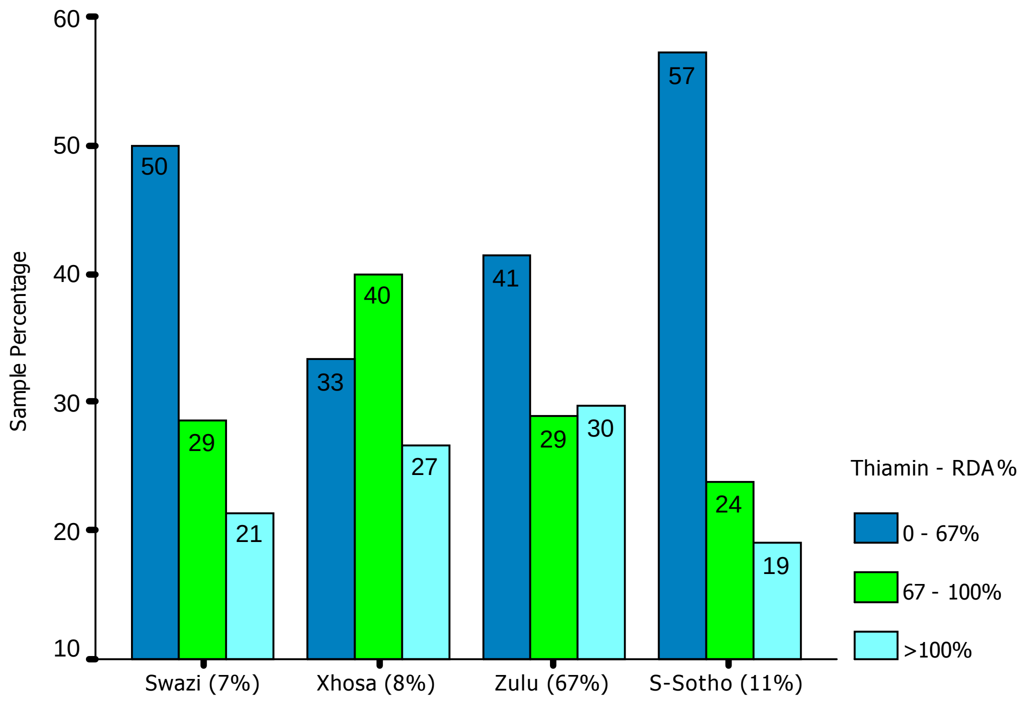

Figure 4.16 Thiamin Intake in Ethnic Groups According to the RDA

Therefore, S-Sotho respondents reported a lower intake of thiamin intake compared with other ethnic groups in the sample. This indicates a significant difference between ethnic groups in the consumption of food sources of thiamin. An association between ethnicity and thiamin intake was found where p = 0.020.

4.2.2.3 The Influence of Ethnicity on Riboflavin Intake

Significant differences found between ethnic groups in the adequacy ratio (67-100%) of riboflavin intake by the sample. S-Sotho respondents reported a lower intake of riboflavin compared with other ethnic groups, followed by Zulus, Xhosas and Swazis. Therefore, Swazi respondents reported higher intakes of riboflavin compared with other ethnic groups.

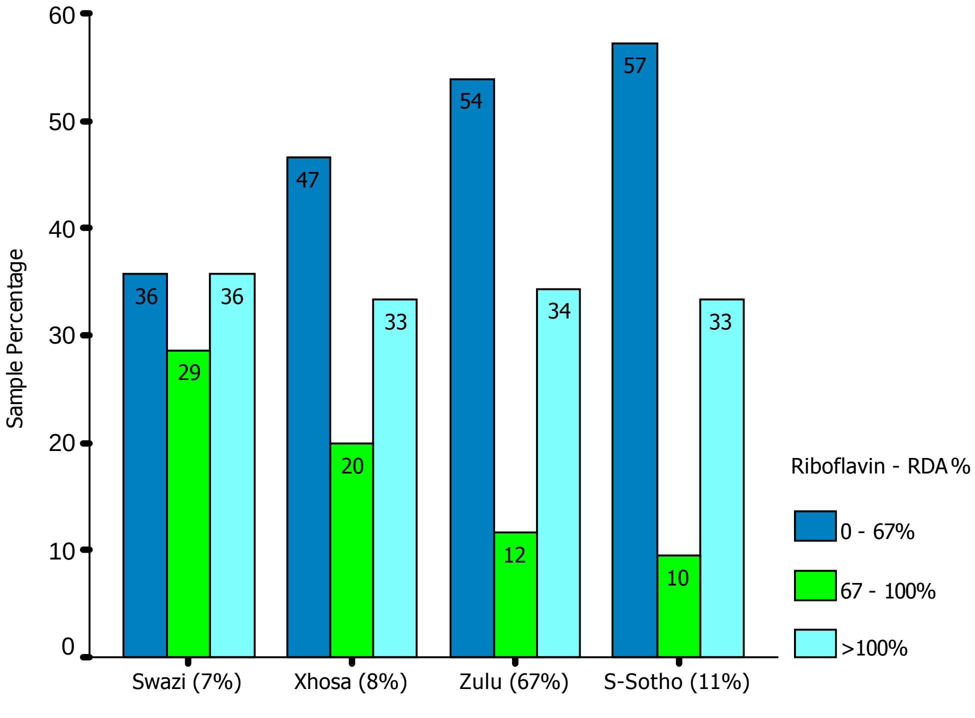

Figure 4.17 Riboflavin Intake in Ethnic Groups According to the RDA

Although the association between ethnicity and nutrient intake was statistically significant, the strength of the association was weak. The ethnic representation by the sample was not evenly distributed. Therefore, the reported nutrient intake may not be consistent with the habitual dietary intake of the various ethnic groups reported in the sample. An association between ethnicity and calcium intake was found where p = 0.044.

4.2.3 THE INFLUENCE OF SOCIO-ECONOMIC STATUS ON NUTRIENT INTAKE

It was important to determine the average amount of money spent on food per month in order to measure financial status influence on nutrient intake. Low socio-economic status has been coupled with a poor diet (Steyn et al., 2000). The amount of money spent on food per month (socio-economic status) was measured by Q17 of the sociodemographic questionnaire (Annexure 8.5; section 3.3.1:79). The socio-economic categories of the sample are reported under sample realization (section 4.2:95, Figure 4.5:101). The following socio-economic categories were represented by the sample: <R99 (4%); R100-R199 (23%); R200-R299 (42%) and >R400 (27%). Most of the respondents reported food expenditure of R200 – R299 per month. An independent t- test and Anova Post Hoc Test were conducted to determine significant differences in nutrient intake between selected socio-economic categories.

Using the independent t-test, significant mean differences were found in the intake of iron, thiamin, niacin, folate and pantothenate (pantothenic acid). However, the Anova Post hoc test only indicated honest significant differences in the intake of niacin (p=0.019) and pantothenate (p=0.030), reported in Table 4.3:130. Respondents who spent more money on food per month had a higher mean nutrient intake compared with respondents who spent less money. However, there were significant differences found in the mean for thiamin intake between lower (R99-R199) and higher (R200 - >R400) socio-economic categories. Mean intakes and standard deviation reported in Table 4.3:130

4.2.3.1 The Influence of Socio-economic Status on Iron Intake

There were significant differences in the mean for iron intake between categories of socio-economic status represented by the sample. The following mean iron intakes were reported for socio-economic categories represented by the sample: 7.5mg (3.3) (<R99); 8.2mg (5.1) (R200); 10.1mg (6.3) (R300) and 11.5mg (9.9) (>R400). The mean iron intake for all socioeconomic categories reported met the RDA, except for the low socioeconomic category (<R99), which was 65.7% of the RDA. Figure 4.18 indicates the level of iron intake according to socioeconomic status.

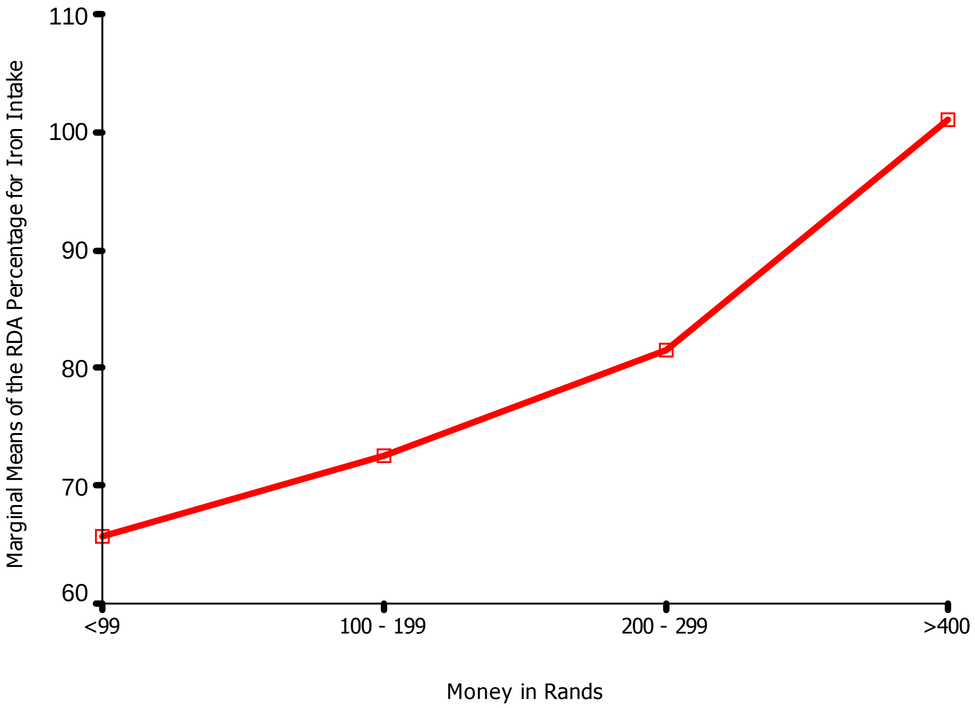

Figure 4.18 Iron Intake According to Socio-economic Status

Figure 4.18 indicates that with more money spent of food, levels of iron intake increased in terms of the nutrient adequacy ratio. Higher intakes of iron (≥100% of RDA) were reported by 44% of the students, in the highest socioeconomic category (>R400). However, there were outliers in each category of socio-economic status, that is respondents with significantly low iron intakes (≤30% RDA), as well as significantly high (≥100% RDA) iron intakes. However, a trend of low nutrient intakes and low socio-economic status, as well as high nutrient intakes and high socio-economic status remained constant for the majority of the sample. The classic RDA recommends an iron intake of 10mg/day for men 19 years of age and older, and 15mg/day for women of 11 – 50 years (Williams, 2001). Iron can be consumed from all kinds of foods with meat being a rich source of iron. Breakfast cereals, especially fortified breakfast cereals, are also good sources of iron (Williams, 2001). The following iron intakes were reported by the sample: <67% (44%); 67-100% (31%) and >100% (25%) according to RDA. Significant differences were found in iron intake where p = 0.017.

4.3.2.2 The Influence of Socio-economic Status on Thiamin Intake

In accordance with the RDA, all socio-economic categories represented by the sample had a thiamin intake at the recommended level (67-100%). There were, however, significant differences in thiamin intake between various socioeconomic categories. The means for thiamin intake reported for the various socio-economic categories represented by the sample were: 0.94mg (.48) (<R99-R200); 1.11mg (.62) (R300); and 1.28mg (.69) (>R400). Figure 4.19:121 indicates the level of thiamin intake according to socio-economic status. The mean thiamin intake of respondents of a high socioeconomic status (R200 - >R400) was 80% of the recommended level of intake. The intake of thiamin proved to be adequate for 45% of the sample. Thiamin is directly related to the metabolic need for energy and carbohydrate (Williams, 2001). For healthy persons, the new DRI guidelines establish RDAs for adults over the age of 18 years as 1.2mg/day for men and 1.1mg/day for women (Williams, 2001).

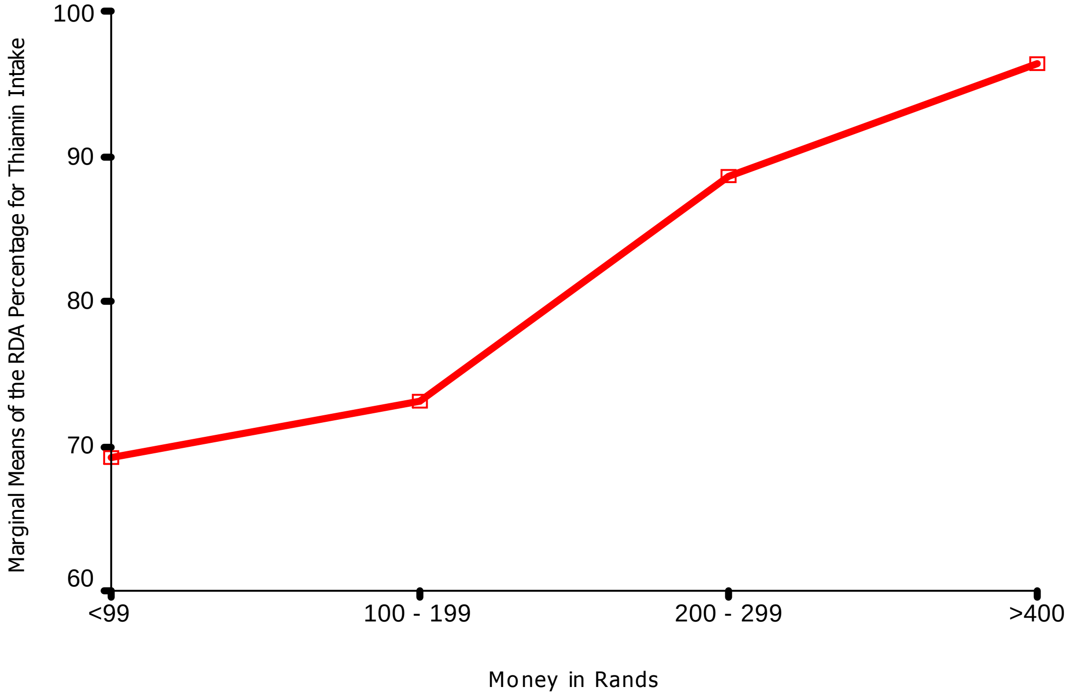

Figure 4.19 Thiamin Intake According to Socio-economic Status

Thiamin deficiency is possible when kilojoules are curtailed, for example when following an inadequate diet. Good food sources of thiamin include lean pork, beef, liver, whole and enriched grains and legumes (Williams, 2001). The following thiamin intake ranges were reported by the sample: <67% (45%; 67-100% (28%) and >100% (27%) of the recommended level. Eighty percent of the sample reported not including food sources of thiamin regularly, such as liver (including chicken liver) and pork. More than half of the sample reported a dietary intake of grains and legumes. Significant differences were found in thiamin intake where p = 0.025.

4.2.3.3 The Influence of Socio-economic Status on Niacin Intake

For the study sample, the intake of niacin was high, even for respondents of a low socio-economic status. The following mean niacin intake was reported for socio-economic categories represented by the sample: 12.2mg (10.2) (<R99); 13.4mg (7.8) (R200); 15.3mg (9.7) (R300) and 19.5mg (12.7) (>R400). Figure 4.20 shows the level of niacin intake according socio-economic status.

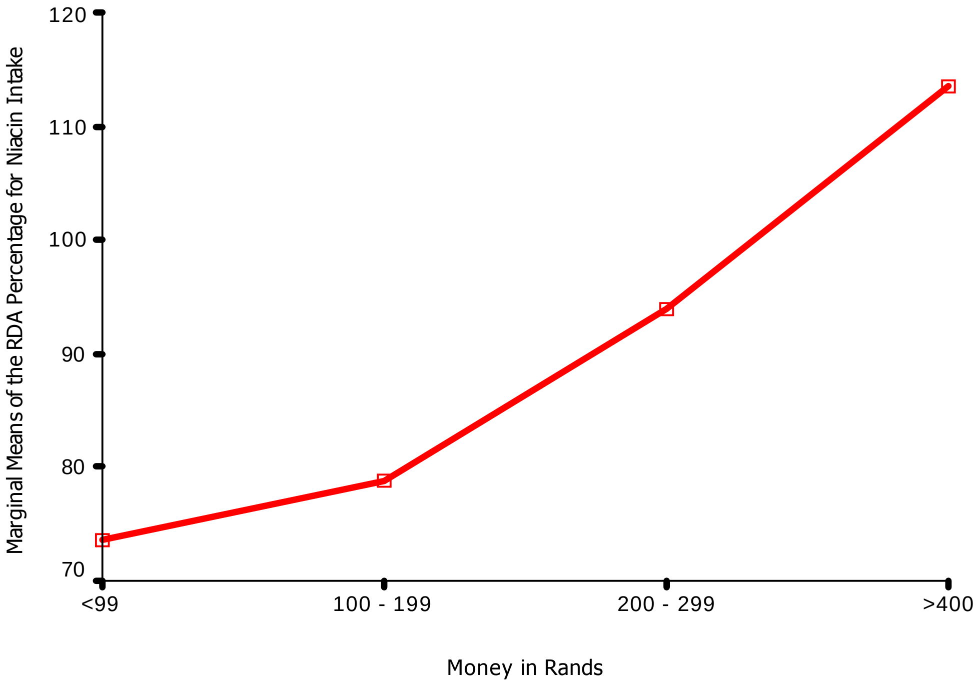

Figure 4.20 Niacin Intake According to Socio-economic Status

The trend (increased nutrient intake with higher socio-economic status) remained consistent as with thiamin and iron intake. Food sources of niacin include whole grain breads and bread products and fortified ready-to-eat cereals. Students included plenty of brown bread, as well as cereals in their diet. The DRIs establish a UL (Upper Level) for adults of 35mg NE/day. Production of energy influences the requirements of niacin. This includes age, body size and physical exercise. Fourty-seven percent of the respondents reported engaging in some form of physical exercise, which may partly explains the high niacin intake in addition to a high frequency of intake of cereal (bread) by the sample. The body can make some of its niacin from the essential amino acid tryptophan. Therefore, the total niacin requirement is stated in terms of niacin equivalents to account for both sources (Williams, 2001). The following levels of niacin intake were reported by the sample: <67% (34%); 67-100% (34%) and >100%

(32%) of the RDA. Therefore, the intake of niacin was adequate for over half of the sample. According to Labadarios (1999) niacin is not listed as one of the micronutrients with a low intake by South Africans. Significant means differences in niacin intake were found where p = 0.002.

4.2.3.4 The Influence of Socio-economic Status on Folate Intake

The mean folate intake by the sample was within the adequate parameters (67-100%) of the RDA. The mean folate intake reported for various socio-economic categories were: 142.8µg (55.9) (<R99); 183.5µg (132.8) (R200); 227.2µg (196.5) (R300) and 258.9µg (222.3) (>R400). Figure 4.21:124 indicates the level of folate intake according to socio-economic status. As with niacin, thiamin and iron, the trend in nutrient intake according to socio-economic status remained consistent, that is a higher socio-economic status correlated with higher levels of nutrient intake.

Folate is widely distributed in foods. Rich sources include green leafy vegetables, liver, yeast and legumes. Folic acid is also added to certain grain products, for example enriched white flour, white rice, noodles and fortified breakfast cereals, bread, rolls and buns. According to dietary records, the food intake of the sample lacked variety; however, adequate quantities of cereal foods, particularly breads, cereals and rice were consumed. Therefore, folate intake was high for the sample, irrespective of socio-economic status. The new DRI standards give a general RDA of 400µg of dietary folate equivalent (DFE) for both men and women age 14 and older per day. The DFE is a measure used because folate is about 50% less bioavailable to the body compared to synthetic folic acid. The DRI recommendations are aimed at providing adequate safety allowances that include specific population groups at risk such as adolescents and adults, especially with the added burden of low socio-economic status (Williams, 2001).

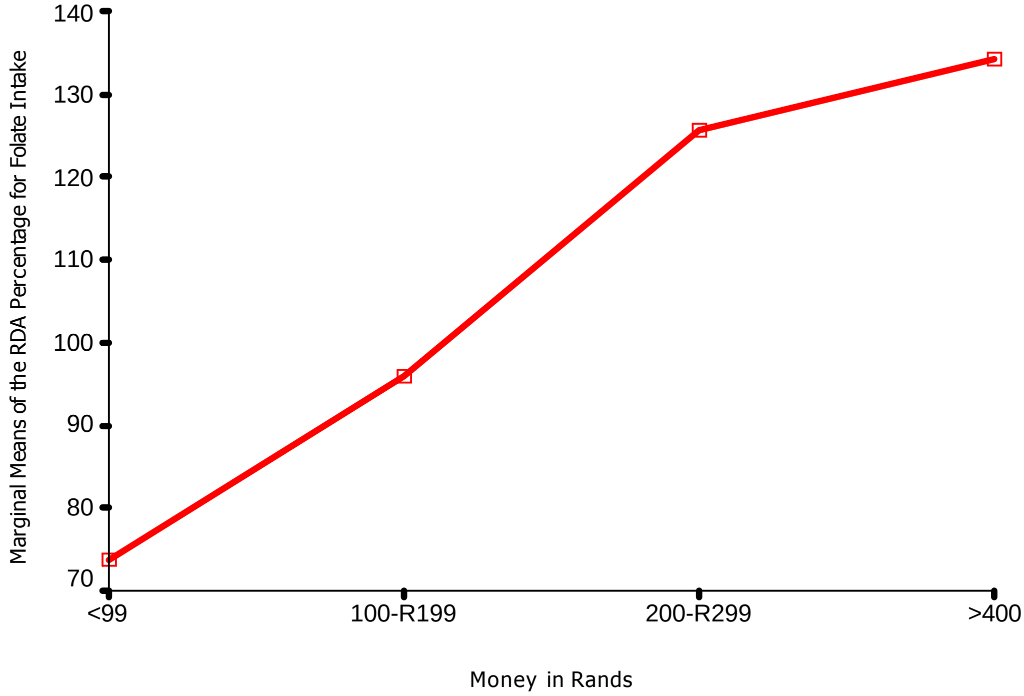

Figure 4.21 Folate Intake According to Socio-economic Status

The following folate intake ranges were reported by the sample: <67% (34%); 67-100% (22%) and >100% (44%) of the recommended level of intake. A varied diet is more likely to contain natural sources of folate. Significant differences in mean folate intake were observed where $p = 0.020$.

4.2.3.5 The Influence of Socio-economic Status on Pantothenate

A significant difference was found between various socioeconomic categories represented by the sample in the intake of pantothenate. Levels of mean pantothenate intake reported according socioeconomic status was: 2.6mg (1.6) (<R99); 3.9mg (2.4) (R200); 4.2mg (2.5) (R300) and 5.7mg (4.4) (>R400). Figure 4.22:125 indicates the level of pantothenate intake according to socio-economic status. The intake of pantothenate for the sample was low compared with thiamin, niacin and folate intakes. The following pantothenate ranges were reported by the sample: <67% (50%); 67-100% (20%) and >100% (30%) of the recommended level. There is no specific RDA for pantothenate (pantothenic acid) in the new DRI guidelines.

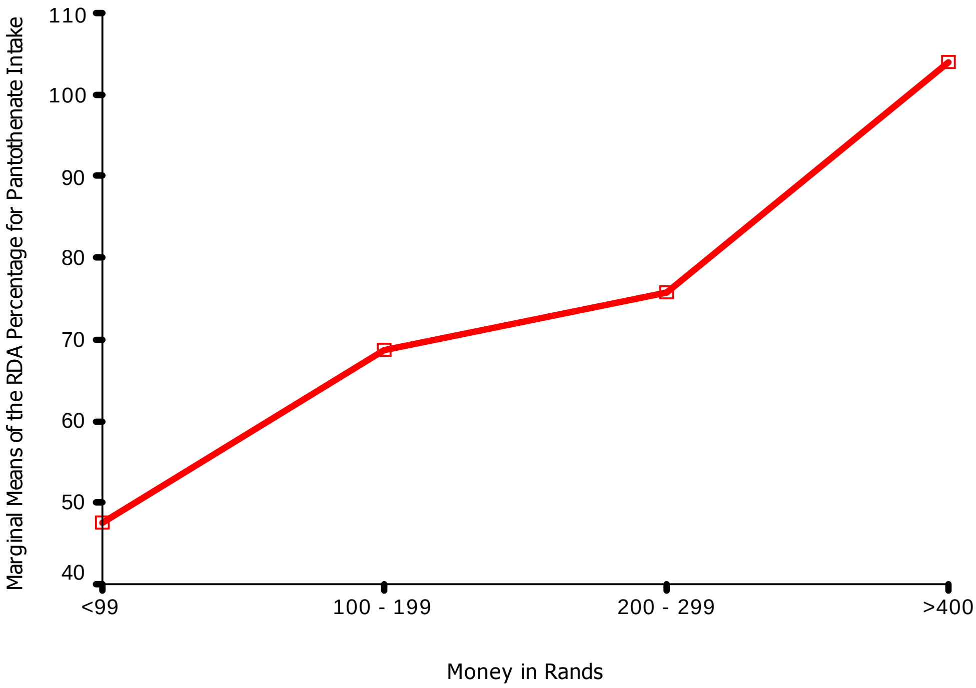

Figure 4.22 Pantothenate Intake According to Socio-economic Status

The DRIs set an AI (adequate intake) for persons' aged 14 years and older of 5mg/day. Pantothenic acid occurs as widely in foods as in body tissue (Williams, 2001). The best sources of pantothenic acid are animal foods and smaller amounts are found in milk, vegetables and fruits. Significant differences in mean pantothenate intake were found where $p = 0.001$.

4.2.3.6 Summary

The findings have shown that socio-demographic variables have an influence on nutrient intake, particularly gender, socio-economic status and ethnicity. Gender proved to be the most significant socio-demographic variable, followed by socio-economic status and ethnicity. However, the strength of the association between ethnicity and nutrient intake was very weak. There were significant differences in nutrient intake between genders represented by the sample. Males had a higher nutrient intake compared with females, particularly in the intake of the following: plant protein, carbohydrate, dietary fibre and iron intake, as well as magnesium, phosphorus and manganese. Thus, males met their nutrient requirements for reference values compared with females. According to Pelto (1981), lifestyle model variables such as household composition and income are powerful predictors of dietary behaviour. According to Van Eeden and Gericke (1996), at Vista University half of the population (urban group) spent R300 on food per month particularly in small house settings. In this study, living arrangements were not found to be associated with nutrient intake; however it was found to be significant when associated with socio-economic status, where $p = 0.000$ and $r=.479$. Therefore, there is a relationship between socio-economic status and living arrangements.

Nutrient intake was found to be higher with higher socio-economic status, particularly for iron, thiamin, niacin, folate and pantothenate. Therefore, this suggests that with more money spent on food, adequate nutrient intake (≥67% RDA) can be achieved. Low socio-economic status is coupled with a poor diet, particularly a diet low in animal protein foods and dairy products. Foods such as fish, poultry and dairy products are expensive, and might not be within the learners' food budget. Nutrient intake could adversely be affected if the food is expensive or if only a limited variety is available. In South Africa, food prices have risen sharply. This affects the food choices recommended by nutritional guides, such as the Prudent Dietary Guidelines (Van Eeden and Gericke, 1996) and Food Based Dietary Guidelines for South Africans. The prohibitive cost of some foods such as animal protein and dairy products may falsely create the impression that these foods are unknown to the consumer or not favoured. As a result, inadequate and unwise food choices detrimental to health could easily be made. This could lead to an inadequate intake of nutrients such as iron, thiamin, folate, niacin and pantothenate.

Table 4.2 The Association between Socio-demographic Variables and Nutrient Intake

[a]Variable List	Energy – KJ	Plant Protein	Carbohydrates	Fibre	Calcium	Iron	Magnesium	Phosphorus	Copper	Manganese	Thiamin	Riboflavin	Niacin	Folate	Pantothenate	Vitamin D
Age	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gender	[a] .005	.007	.019	.027		.000	.000	.007	.000	.000					.011	.002
Pregnancy Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marital Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Living Arrangement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Religion and Culture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethnicity	-	-	-	-	.044	-	-	-	-	-	.030	.028	-	-	-	-
Type of High School	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
*Money Spent	-	-	-	-	-	.017	-	-	-	-	.025	-	.002	.020	.001	-
Storage Facilities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooking Facilities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Place where food purchased	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] p value – level of significance

- no significant differences found and association found between variables

Table 4.3 Differences in Mean Nutrient Intake According SES

Nutrient List	Money Spent on Food per Month (SES) R<99 (n=8)	R100 – R199 (n=44)	R200 – R299 (n=80)	R>400 (n=60)	Anova Post Hoc Test p values
	Mean Intake and Standard Deviation				
Energy – kJ	6827.1 (2779.7)	7061.8 (3124.0)	7600.8 (3503.5)	7369.4 (2938.9)	NS
Total Protein(g)	53.1 (29.8)	55.3 (23.6)	59.1 (24.9)	63.5 (32.0)	NS
Plant Protein (g)	22.4 (10.4)	21.4 (10.8)	26.7 (17.6)	25.3 (13.2)	NS
Animal Protein (g)	28.2 (20.2)	30.8 (18.2)	32.0 (20.5)	35.6 (24.2)	NS
Total Fat	50.1 (24.9)	57.2 (30.6)	60.0 (37.7)	56.7 (32.7)	NS
Carbohydrate	221.9 (93.4)	219.2 (110.6)	245.6 (109.5)	226.9 (87.9)	NS
Fibre (g)	17.4 (10.0)	14.2 (8.12)	17.5 (15.6)	19.0 (15.1)	NS
Calcium (mg)	401.1 (240.4)	423.9 (280.9)	535.2 (332.8)	451.0 (406.1)	NS
Iron (mg)	7.5 (3.3)	8.2 (5.1)	10.1 (6.3)	11.5 (9.9)	NS
Iron-Heme	.38 (.47)	.46 (.58)	.52 (.67)	.58 (.63)	NS
Iron-Nonheme	1.7 (.91)	2.7 (1.7)	2.7 (2.1)	2.6 (1.8)	NS
Magnesium (mg)	263.9 (123.6)	200.4 (106.2)	232.1 (115.1)	244.0 (130.0)	NS
Phosphorus (mg)	867.8 (428.9)	825.7 (378.0)	976.8 (423.8)	940.7 (478.7)	NS
Potassium (mg)	1619.8 (538.6)	1678.2 (988.3)	1818.5 (947.2)	1755.9 (789.7)	NS
Sodium (mg)	104.8 (643.5)	1607.7 (957.7)	1891.2 (2217.3)	1763.6 (1102.4)	NS
Zinc (mg)	7.3 (3.9)	7.8 (4.0)	8.2 (4.2)	8.7 (5.5)	NS
Copper (mg)	.94 (.27)	.90 (.50)	.99 (.76)	.99 (.62)	NS
Chromium (mg)	29.6 (12.4)	39.5 (35.1)	38.8 (41.0)	32.5 (33.6)	NS
Selenium (mg)	20.4 (9.1)	37.2 (32.1)	33.7 (29.7)	36.0 (31.0)	NS
Manganese (mg)	2455.6 (1650.4)	2204.2 (1452.9)	2565.1 (1550.2)	2715.0 (1589.3)	NS
Iodine (µg)	18.5 (14.3)	32.2 (25.6)	34.0 (23.8)	31.2 (21.4)	NS
Vitamin A (µg RE)	221.9 (145.3)	346.8 (485.8)	599.9 (1618.5)	491.6 (915.4)	NS
Thiamin (mg)	.94 (.48)	.94 (.62)	1.1 (.69)	1.3 (.97)	NS
Riboflavin (mg)	.87 (.56)	1.1 (.78)	1.4 (1.2)	1.5 (1.6)	NS
Niacin (mg NE)	12.2 (10.2)	13.4 (7.8)	19.5 (12.7)	16.1 (10.1)	0.019
Vitamin B_6 (mg)	.93 (.63)	1.4 (1.1)	1.6 (1.2)	1.5 (1.1	NS
Folate (µg)	142.8 (55.9)	183.5 (132.8)	227.2 (196.5)	258.9 (222.3)	NS
Vitamin B_{12}	3.0 (3.1)	2.9 (2.7)	5.0 (15.7)	3.4 (3.6)	NS
Pantothenate	2.6 (1.6)	3.9 (2.4)	4.2 (2.5)	5.7 (4.4)	0.031
Biotin	17.0 (12.1)	23.2 (22.1)	26.6 (26.2)	29.8 (26.6)	NS
Vitamin C (mg)	27.0 (36.1)	95.4 (299.8)	73.9 (129.3)	48.7 (61.1)	NS
Vitamin D (µg)	3.0 (2.7)	3.5 (3.7)	4.6 (4.1)	3.4 (3.3)	NS
Vitamin E (mg α-TE)	5.2 (3.6)	5.9 (4.1)	6.5 (4.7)	6.4 (6.9)	NS
Vitamin K	23.3 (34.0)	23.9 (30.1)	29.7 (53.5)	18.6 (20.2)	NS
Saturated FA (g)	16.7 (9.7)	16.7 (11.6)	19.1 (10.5)	17.8 (11.5)	NS
Monounsaturated FA (g)	17.7 (10.8)	20.2 (11.9)	46.6 (243.1)	19.7 (12.7)	NS
Polyunsaturated FA (g)	10.8 (5.5)	12.7 (7.8)	15.9 (19.5)	229.3 (1677.4)	NS
Total Trans FA (g)	.95 (.84)	.75 (1.0)	1.3 (2.5)	.66 (1.2)	NS
Cholesterol (mg)	108.3 (109.9)	211.5 (184.2)	231.8 (178.6)	214.6 (156.5)	NS

4.3 THE LEVEL OF NUTRITION KNOWLEDGE OF THE STUDENTS

Nutrition knowledge was measured using the nutrition knowledge test (NKT) (Annexure 7.8; section 3.3.2:64; Table 4.4:131) developed by Gericke (1987) but adapted for the sample. The reliability test proved that the test questions of the NKT were interrelated to the same construct (nutrition knowledge). Therefore the NKT could be considered a reliable tool. The NKT scores (Table 4.6:133) were categorised into four ICNE (Interagency Committee on Nutrition Education) concepts as discussed in Chapter 3 under questionnaire formulation section 3.5.3:79, Table 3.2:81. All the items of the NKT were tested for reliability using the correlation matrix on the SPSS^{+}, version 11.0; 2000. The reliability test proved that the test items of the NKT were interrelated to the same construct (nutrition knowledge). Therefore the NKT as applied in this study, was a reliable tool.

4.3.1 THE SCORES OF THE NUTRITION KNOWLEDGE TEST

The multiple-choice questions or statements of the NKT had four possible answers, of which only one was correct. Each test was scored for correctness, which means that the respondent had to choose the correct answer to the question or statement. Only the correct scores, as well as the mean, mode and standard deviation of the NKT are reported in Table 4.3.1. Poor scores were noted for questions: 5; 7; 10; 12; 14; 16; 19; 24; 25; 26; 30; 33 and 34 (Table 4.3:129) by the sample. These questions and statements are related to: "The use of food by the body" and "The relationship between nutrients and good health" (Table 4.3.3). Therefore, nutritional knowledge of the sample with regards to these specific concepts of nutrition was found to be poor.

Table 4.4.The Frequency and Descriptive Scores of the NKT

Q.	NUTRITION KNOWLEDGE QUESTIONS AND QUESTION WITH FOUR POSSIBLE ANSWERS	Frequency Score[a]	Mode
1.	When vegetables and fruit are cooked, nutrients are retained best by:	51	3
2.	A well composed diet is a diet that:	55	3
3.	To improve one's diet, one should:	56	2
4.	To limit the amount of vitamins and minerals lost during the cooking process, one must:	67	3
5.	When compared to potato chips (1 portion or 10 chips), a medium-sized apple contains	18	1
6.	What is a kilojoule?	66	1
7.	Examples of foods which contain a large amount of energy and few nutrients are	39	3
8.	Adults gain mass (weight) because:	46	3
9.	The best fruit and vegetable sources of vitamin A are:	69	1
10.	Which of the following nutrients will probably be partially lost during the cooking of vegetables and fruit?	24	1
11.	A good way to lose weight without harming one's health, is to:	55	3
12.	If a person regularly eats three meals a day, it can be assumed that:	21	1
13.	What is the best way of obtaining all the nutrients needed every day for good health?	46	2[b]
14.	A potato (1 portion or 1 medium sized potato) cooked in its skin, compared to potato chips (1 portion or 10 chips) contains:	21	2
15.	A high intake of table salt (NaCl) is not healthy because too much salt:	82	3
16.	Water is an essential part of the diet because it:	19	1
17.	If a person wants to gain mass (weight) he/she must:	45	2
18.	One of the nutrients that contributes to good strong bones and teeth is:	92	3
19.	Why is white meat (for example chicken) considered to be healthier than red meat (for example fillet or topside)?	44	1
20.	The best way to ensure that one is well nourished is to:	71	4
21.	The eating of a well composed breakfast:	74	4
22.	Eggs and cheese can replace meat in the diet because they:	71	2
23.	Iron (nutrient) has a crucial function of carrying oxygen to all cells. To increase intake of iron, one has to eat the following best sources of iron:	56	1
24.	What nutritional advantage does an expensive cut of meat (for example fillet) have over a cheaper cut (for example topside) (from the same carcass)?	20	1
25.	Which one of the following conditions will always be prevented by a well composed diet?	8	3
26.	The best sources of dietary fibre in the diet are:	25	3
27.	Severe overmass (overweight) is a risk factor for the development of:	58	4
28.	Which of the following substances will probably be partially lost when vegetables and fruit are peeled inexpertly thickly:	35	2
29.	Adding fibre your daily diet reduces the risk of the following diseases:	50	4
30.	A well composed breakfast could consist of fruit juice, tea or coffee and:	25	1
31.	Which of the following foods will spoil (go off) fastest if not kept in a refrigerator:	72	2
32.	Which group of foods is an especially good source of vitamin C?	69	3
33.	The development of tooth caries (cavities in the teeth) is associated with:	27	1
34.	Is it necessary for a South African to use a vitamin and mineral supplement?	45	3
35.	The following foods are the body building foods from animal products:	94	1
	[a] Percentage of sample with correct scores, NKT has four possible responses with one correct response [b] Multiple modes exist, the smallest value is shown [*] Raw scores of the NKT, Annexure 7.14		

All the raw scores of the NKT were calculated out of a percentage for the stanine scale and ranked from a very low to very high score as indicated in Table 4.5. According to the description of the stanine categories, the following scores were reported by the sample: low (26%); average (69%) and high (5%). There were no reports of respondents who scored very low and very high in the test. Therefore, the overall NKT score by the sample ranked 50%, which is average.

Table 4.5 NKT Score of the Sample According to Percentage of the Stanine Categories

Stanine	Percentage of Person in Group	Description
9	-	Very High
8	-	High
7	5	
6	14	Average*
5	21	
4	34	
3	20	Low
2	6	
1	-	Very Low

*NKT score for the sample was average

The results of the NKT by the sample were also scored according to the four ICNE concepts of the test, and are reported in Table 4.5. According to ICNE concepts, the scores were fairly consistent in all four categories of the test. The scores for the ICNE concepts by the sample were 45%, 53%, 50% and 60%, for Concept I, II, III and IV respectively. The ICNE concepts' scores serve as a diagnosis for shortcomings in the areas of nutritional knowledge. Therefore, the sample proved to have shortcomings in the areas of nutrition related to Concept I, II and III as indicated under section 4.6:133.

Table 4.6 The Scores of the NKT according to ICNE Concepts in Percentage

ICNE Concept		Grouping of Items	†TOTAL 35	% SCORE
I	The use of food by the body	5, 9, 6, 11, 14, 16, 17, 22, 24, 26, 32	11	45
II	The relationship between nutrients and good health	2, 3, 7, 12, 13, 15, 18, 19, 20, 21, 23, 25, 29, 30, 33, 34, 35	18	53
III	Individuals in different phases of the life cycle require the same nutrients but in varying amounts	8, 27	2	50
IV	The way in which food is handled affects nutritional value, appearance, taste and safety.	1, 4, 10, 28, 31	5	60

†scores used for education diagnosis for shortcomings in the different areas of nutrition knowledge.

An independent t-test identified significant ($p = 0.000$) differences between genders in the scores of the NKT. Figure 4.23 indicates the NKT scores between genders according to stanine descriptions. The mean NKT raw score for females was 51% compared with 44% for males. The following NKT scores in stanine categories were reported for females represented by the sample: Low (19%); Average (74%) and High (7%). For males, the stanine category scores reported were: Low (34%); Average (62%) and High (3%). Therefore, females had a higher nutritional knowledge compared with males. There were no significant differences found between genders in the scores of the ICNE concepts.

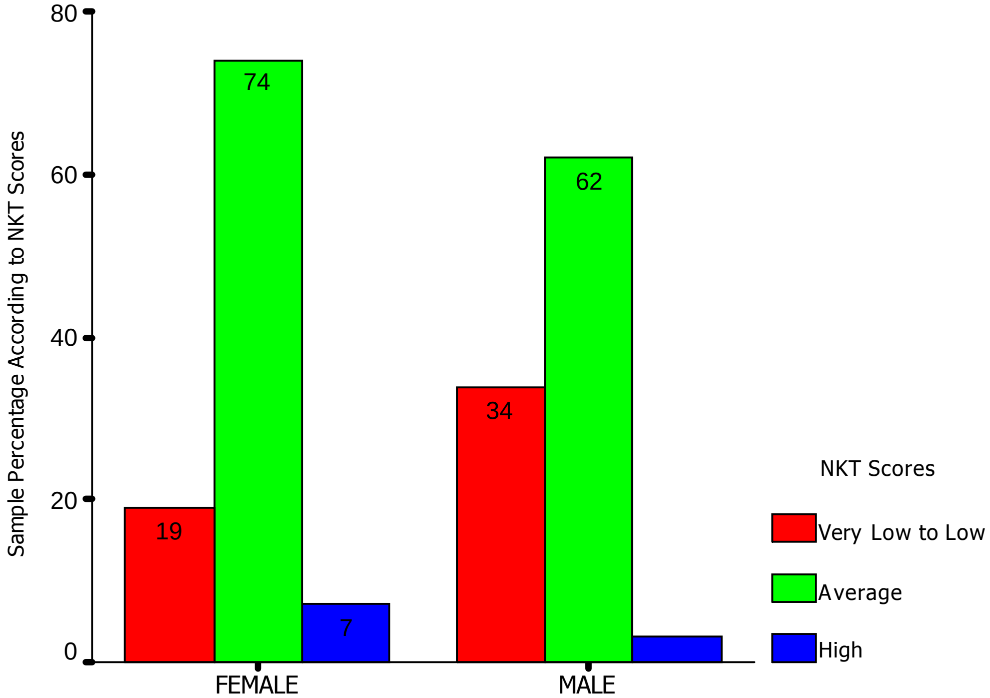

Figure 4.23 Nutrition Knowlegde According to Gender

4.3.2 THE INFLUENCE OF NUTRITION KNOWLEDGE ON NUTRIENT INTAKE

A Pearson's correlation and an independent t-test were conducted to test for significant differences in mean nutrient intake at different levels of nutrition knowledge, as well as to detect a correlation between nutrition knowledge and nutrient intake. Raw scores of the NKT and nutrient intake were used for the statistical analysis. The strength of the positive correlation between NKT scores and nutrient intake was very weak. Nutrients that proved to have a significant correlation with NKT were: energy, total protein, animal protein, plant protein, total fat, carbohydrate, potassium, manganese, iodine, magnesium, vitamin D, vitamin E, pantothenate, chromium, selenium and zinc. However, using the ANOVA post hoc test the mean difference of nutrient intake at different level of NKT score was not found to be significant. According to Steyn et al., (2000), there was a weak correlation between NKT with nutrient variables such as energy, carbohydrates, protein, fibre, calcium, zinc, thiamin, niacin and folate. Table 4.6 indicates mean nutrient scores according to levels of nutritional knowledge.

Table 4.7 Mean Nutrient Intake According to NKT Scores (independent t-test p = <0.05)

	Score Description		
*Nutrients	**Very Low to Low** (n=50)	**Average** (n=131)	**High** (n=10)
Energy (kJ)	6646.7 (2557.0)	7710.9 (3463.1)	6410.0 (1689.6)
Total Protein (g)	56.5 (23.7)	60.8 (29.0)	53.3 (18.0)
Animal Protein (g)	31.8)19.3)	33.2 (22.3)	31.2 (15.7)
Plant Protein (g)	23.2(13.0)	25.6 (15.6)	22.1 (8.7)
†Total Fat (g)	49.1(27.5)	62.4 (36.2)	43.6 (18.4)
†Carbohydrate (g)	209.7(81.7)	242.6 (110.8)	209.9 (60.7)
**Potassium (mg)	1581.5(781.1)	1808.3 (945.5)	2010.2 (569.8)
Manganese (mg)	2612.5(1588.1)	2487.5 (1532.6)	2491.5 (1626.1)
Iodine (mg)	33.2 (24.8)	31.7 (23.3)	31.5 (13.8)
**Magnesium (mg)	210.5 (101.1)	235.9 (126.7)	246.8 (86.5)
Vitamin D (µg)	4.2 (3.7)	3.9 (3.8)	2.8 (3.1)
Vitamin E (mg)	6.0 (4.3)	6.4 (5.7)	4.2 (3.2)
Pantothenate (mg)	4.7 (2.7)	4.5 (3.6)	4.1 (2.5)
**Chromium (mg)	36.7 (37.3)	36.3 (36.0)	39.8 (43.6)
**Selenium (mg)	32.2 (32.8)	35.2 (29.4)	39.5 (26.8)
Zinc (mg)	7.9 (4.6)	8.4 (4.7)	7.9 (2.3)

*only nutrients with p=<0.05 level of significance
†intake lower for learners with a high NKT score
**intake higher for learners with a high NKT score

Students that scored high in the NKT had a lower intake of energy-total protein (animal and plant) and total fat compared to students that had a low to average score. The intake of potassium, magnesium, chromium and selenium was higher with a high NKT score compared with a lower NKT scores by the sample. The correlation between nutrition knowledge and nutrient intake did not clearly indicate the level of influence on nutrient intake due to a very weak correlation. Hence, there was no correlation found between NKT scores and nutrient adequacy ratio (RDA percentage). A positive weak correlation was also found between the NKT and food frequency intake, particularly foods from the cereal and meat group. Foods that proved to have a significant correlation with NKT were: maize meal, pasta, samp, rice, eggs, pilchards, dried beans and peanut butter, as well as fruit and fruit juice. The correlation between NKT scores and dietary variables is relevant, as it has been speculated that an increased nutrition knowledge results in the consumption of a diet with improved quality. There was no correlation found between NKT scores and socio-economic status which could suggest that nutrient intake was influenced by financial means.

A parallel association can however be drawn between dietary pattern and poor nutritional knowledge. Even though the correlation was statistically weak, poor NKT scores can be associated with poor dietary intake from certain food groups, such as fruit and vegetables, in view of the ICNE concepts. For example, the results could suggest that students had a poor intake of fruits and vegetables because they lack nutrition knowledge with regards to: "The use of food by the body". In addition, students may lack an understanding of the relationship between nutrients and good health.

4.4 WEIGHT STATUS AND BODY FAT DISTRIBUTION OF THE STUDENT SAMPLE

Anthropometric measurements were determined by Q2 and Q3 of the socio-demographic questionnaire (Annexure 8.5, section 3.3.3:79), taken by trained fieldworkers using standard techniques. The anthropometric parameters, Body Mass Index (BMI) and waist-to-hip ratio (WHR) were used to evaluate the obesity status of the sample as a risk factor for the development of diseases associated with weight status and body fat distribution. The BMI was calculated using the Quetelet's index (weight (kg) divided by height (m^2)). The BMI classification criterion for overweight used in this study was a BMI of $\geq$25 for both males and females as described by Steyn et al., (2000) and Gibson (1990). The WHR was calculated for each respondent by dividing the waist measurement by the hip measurement. A WHR greater than 0.8 and >1.0 is associated android obesity for females and males respectively. The descriptive anthropometric profile of the sample for all measurements is reported in Table 4.8.

Table 4.8 The Anthropometric Profile of the Sample

Anthropometric Measurements in Categories		Percent
Age		
	15 – 18yrs	6.8 **(n = 13)**
	19 – 24yrs	83.9 **(n = 161)**
	25 – 50yrs	9.4 **(n=18)**
Height (cm)		
	149 – 158	20.3 **(n = 39)**
	159 – 168	38.5 **(n = 74)**
	169 – 178	33.3 **(n = 64)**
	179 – 188	6.3 **(n = 12)**
	189 – 198	1.6 **(n = 3)**
Weight (kg)		
	48.70 – 57.70	32.8 **(n = 63)**
	58.70 – 67.70	37.5 **(n = 72)**
	68.70 – 77.70	18.2 **(n = 35)**
	78.70 – 87.70	3.6 **(n = 7)**
	88.70 – 97.70	3.1 **(n = 6)**
	>98.70	4.7 **(n = 9)**
BMI		
	<18.5 = Underweight	8.9 **(n = 17)**
	18.5 – 24.9 = Healthy Weight	67.7 **(n = 130)**
	25 – 29.9 = Overweight	13.5 **(n = 26)**
	>30 = Obese	9.9 **(n = 19)**
WHR		
(waist-hip ratio):	<0.8	76.6 **(n = 147)**
waist circumference	0.8 – 1.00	21.8 **(n = 42)**
gluteal circumference	>1.00	1.5 **(n = 3)**

The majority of the sample (83%) was aged 19 to 24 years. The weight and height raw scores were compared to NCHS/NHANES height and weight reference data for age and gender (Gibson, 1990), presented in Table 4.8:137. Both females and males (70.3%) had the correct weight for age and were within the recommended median values. The anthropometric measurements of the sample according to age and gender are reported in Table 4.8. An independent sample t-test and chi-square test were used to test the significance of the difference between anthropometric values and socio-demographic variables, as well as anthropometric values and nutrient intake. Anthropometric values were found to be associated with gender and ethnicity as well as with energy intake.

4.4.1 THE INFLUENCE OF GENDER ON WAIST-TO-HIP RATIO

The readings of the waist and hip circumference of the sample were used to calculate WHR in order to indicate body fat distribution. The mean gluteal circumference reported for females was 97.54cm compared with 94.80cm for males. The mean waist circumference reported for females was 71.98cm compared with 74.37cm for males. WHR classification criteria for fat distribution used in the study were 0.8 or greater for females and 1.0 or greater for males, which were indicative of central obesity with an increased risk for cardiovascular complications and diabetes mellitus (Steyn et al., 2000; Gibson, 1990). Figure 4.24:140 indicates WHR according to gender. The following WHR values were reported for females represented by the sample: <0.8 (85%); 0.8-1.0 (13%) and >1.0 (2%). Male respondents reported WHR values of: <0.8 (67%); 0.8-1.0 (30%) and >1.0 (13%). The majority of the sample was not at risk for diseases of lifestyle, except for 23% of the sample found to be at risk in terms of body fat distribution, particularly females.

Androïd fat distribution is noted on the upper half of the body and is referred to as the "apple shape" body (Weigley, Mueller and Robinson, 1997). The fatty tissue is characterized by smaller, more active cells, higher levels of free fatty acids, LDL cholesterol and lower glucose tolerance. The individuals with this type of fat distribution are more prone to coronary heart disease and diabetes mellitus than individuals with a healthy fat distribution. The genoïd fat distribution is concentrated in the lower part of the body and is referred to as a "pear shape" body (Weigley, Mueller and Robinson, 1997). An independent t-test and Pearson's correlation were used to measure the influence of energy on WHR. A positive correlation was not found between WHR and energy intake, nor between BMI and energy intake. There were also no significant differences in energy intakes according to anthropometric values.

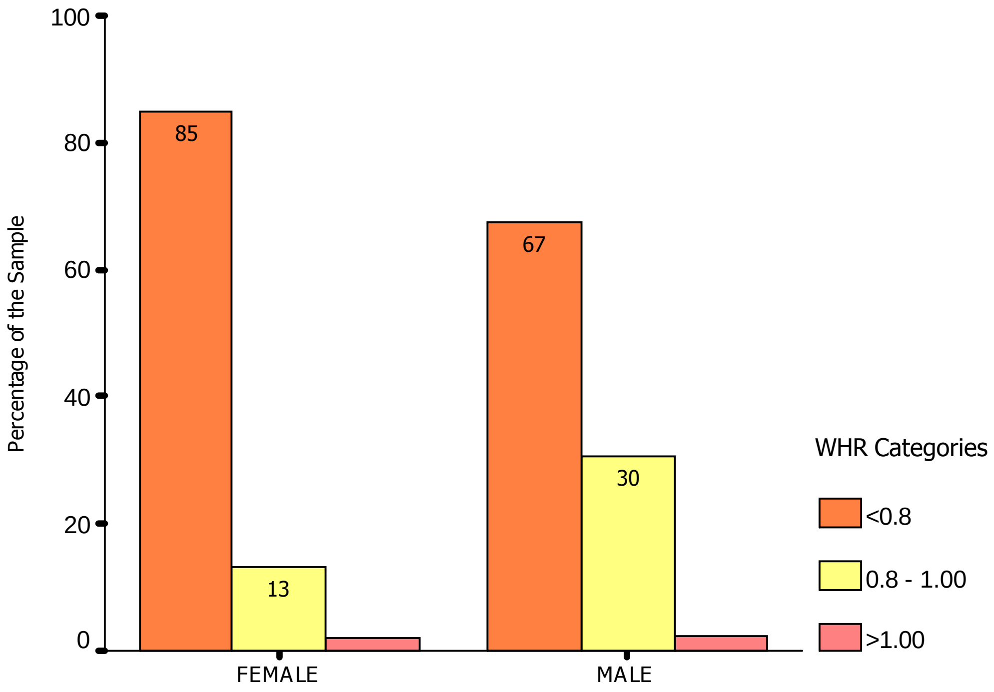

Figure 4.24 Waist-to-hip Ratio According to Gender

WHR and BMI remained constant after controlling for age, exercise and total energy intake. Therefore, there were no significant trends observed in the anthropometric parameters as a result of energy intake or exercise by the sample. However, 23% of the sample who fell within a WHR of .8 to 1.0 and greater tended to have an energy intake above the recommended level. Respondents with a WHR of 0.8 and 1.0 had higher energy intake levels from total fat and carbohydrates.

The majority of the respondents with a BMI of >25 (13.5%) had an energy intake at recommended levels, while some had an intake of 15 000kJ per day, which is above the recommended level. This could possibly suggest that students with a BMI of >25 restricted their energy intake or were inactive because of being overweight or underreported. BMI classifications reported for female respondents were: <18.5 (9%); 18.5 – 24.9 (61%); 25 – 29.9 (17%) and >30 (13%). For males, the following BMI categories were reported: <18.5 (9%); 18.5 – 24.9 (75%); 25 – 29.9 (10%) and >30 (7%), as is indicated in Figure 4.25:140. Some of the respondents classified to be of a healthy weight and underweight reported an energy intake within the recommended level of intake. This indicates that there were outliers in energy intake within each classification criteria for BMI and WHR. BMI values remained constant at different levels of energy intake. Therefore, no unique trends were found when BMI and energy intake were compared. Significant differences between genders for BMI classifications were found, in that more females were found to be overweight when compared with males.

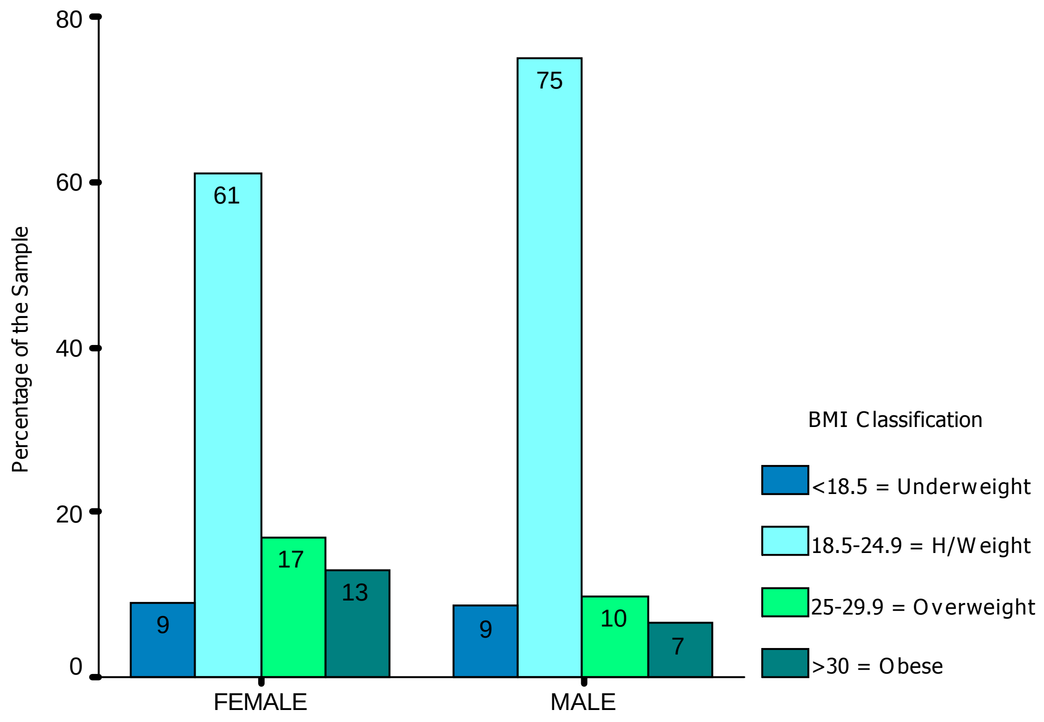

Figure 4.25 Body Mass Index According to Gender

More females (13%) were also found to be obese compared with males (7%). However, the majority of the sample proved to be of a healthy weight for height. According to a study conducted by Steyn, et al. (2000) 25% of the females between 12 – 17 years were overweight, whereas Oldewage-Theron et al. (2000) reports that 67.70% of the females (19 – 25 years) surveyed were of a healthy weight. Slabber et al., (2000), at the University of the Free State reported that 62.3% of females were of a healthy weight and 11% underweight. This could prove that "big is beautiful" in an African context is phasing out amongst Black South African females which might suggest that Black females have become more slim figure conscious. An association was found between WHR and gender where $p = 0.012$ and $r = .209$. There was no statistical association found between BMI and gender.

4.4.2 THE INFLUENCE OF ETHNICITY ON WAIST-TO-HIP RATIO

WHR classification criteria for body fat distribution have been used in several South African studies conducted among young adults. These studies include Wenhold, (2000); McMahon et al., (2000); Steyn et al., (2000); and Slabber et al., (1998). Therefore, WHR is an appropriate parameter for evaluating body fat distribution in terms of ethnicity. Figure 4.26:142 indicates WHR values according to the different ethnic groups. More Zulu respondents reported WHR of 0.8-1.0 and greater compared with other ethnic groups. However, they were the largest percentage of the sample. The prevalence of NIDDM in South Africa amongst urban Blacks varies between 4.8% and 8.0% (Steyn et al., 2000). It is speculated that the rise in obesity in urban Black women (Zulus) constitutes an important risk factor in the emergence of NIDDM within the population.

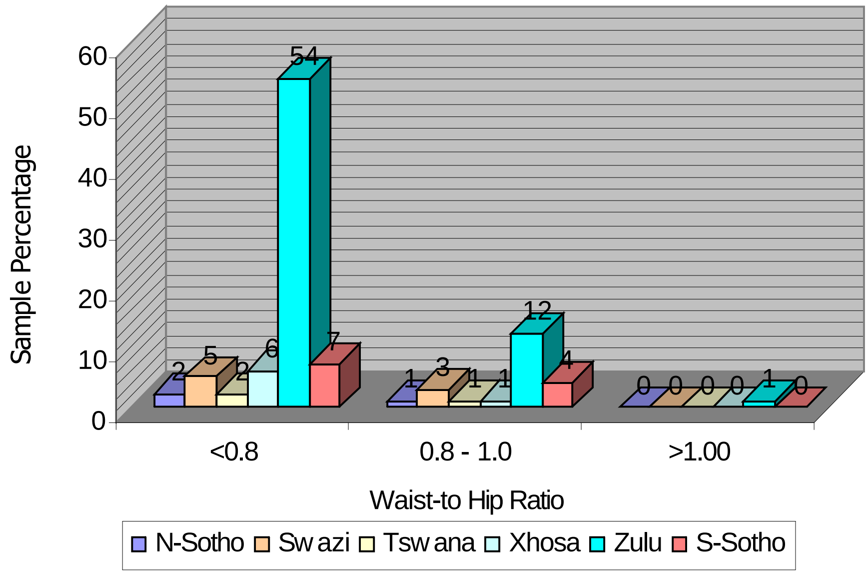

Figure 4.26 Waist-to-hip Ratio According to Ethnic Groups

In this study, the majority of the study sample was Zulu, and 52% were female, therefore, comparable to their Black counterparts at the University of OFS in terms of gender and WHR values. The findings therefore indicate that a small segment of the sample is at risk for developing NIDDM and CHD. There were no significant correlations found between BMI, WHR and physical activity. However, the students that engaged in any formal physical activity (46%) tended to have healthy BMI values. An association was found between WHR and ethnicity where $p = 0.004$ and $r = .377$.

4.5 THE NUTRITIONAL ADEQUACY OF STUDENTS' FOOD INTAKE

The nutritional adequacy of the respondents' eating habits was determined by using the 24-hour Recall and Food Frequency Questionnaire (FFQ), (Annexure 7.6 and 7.7). Diet records were analysed using the Food Finder Nutrient Analysis Package for absolute energy and nutrient intake, as well as nutrient density. Nutrient analysis was done from raw dietary data, therefore coding of the 24-hour Recall and FFQ was unnecessary. The Statistical Package for Social Sciences (SPSS, version 11.0) was used for analysis of the data, applying analysis of variance and a Pearson's correlation, as appropriate.

4.5.1 DIETARY HABITS OF THE SAMPLE

Dietary habits of the sample were determined by using a quantitative FFQ (Annexure A-2), and the 24-hour Recall used to determine nutrient intake. The purpose of the FFQ was to ascertain evidence of traditional foods being consumed and the determination of eating patterns. Foods such as maize meal, mabela, jeqe, samp and beans which resemble a traditional eating pattern were seldom consumed by the sample. According to the FFQ, the respondents' dietary habits are westernized. The majority of the respondents reported consuming foods from the cereal, meat and sweets and oil group, with a significantly low consumption from the fruit and vegetable group.

4.5.1.1 The Intake from the Bread, Cereal, Rice and Pasta Group

Foods reported from the cereal group were bread (98%), rice (95%), pasta (63%) and breakfast cereal (79%). Very few respondents reported consumption of oats (21%) and mabela (8%). Figure 4.27:144 indicates the frequency of intake from the cereal group. Rice was found to be the more popular starch compared with mealie-meal. The consumption of rice reported by the sample was: none (5%); few times/month (9%); 1-2/week (22%); 3-5/week (52%) and almost daily (12%). Mealie-meal porridge was consumed either soft/crumbly or stiff as an alternative to breakfast cereal, and provided 300g of the per capita serving size compared with ±100g of rice. Consumption of bread reported by the sample (72%) provided 90g to 360g of the per capita serving size.

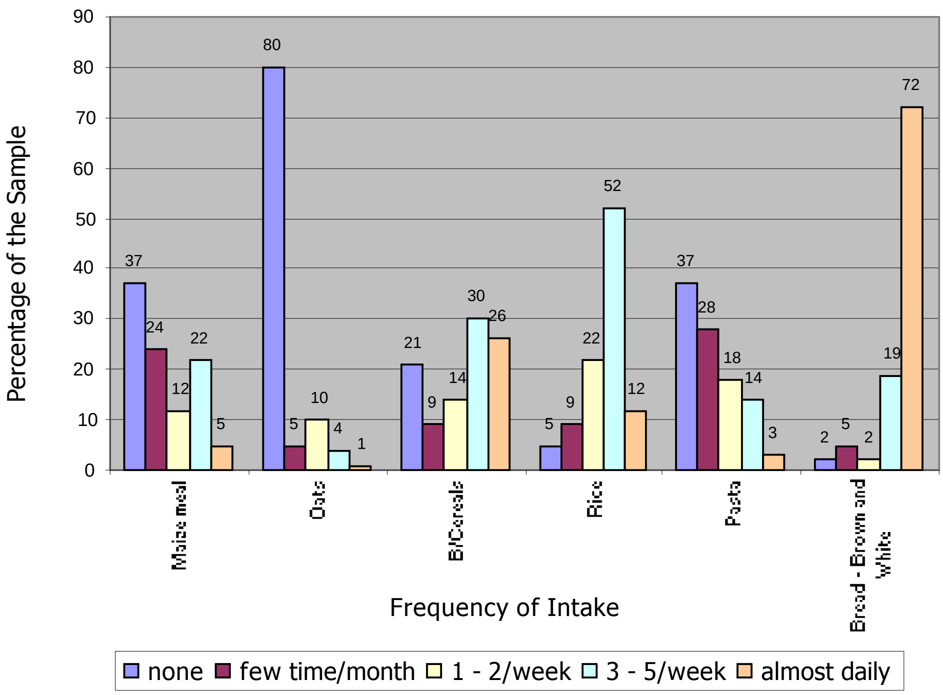

Figure 4.27 The Frequency Intake from the Cereal Group

A significant portion of the sample reported consumption of bread for all three meals of the day (breakfast, lunch and supper), thereby increasing the per capita serving size of bread per day. The consumption of pasta by the respondents was low. Data from the FFQ showed that consumption of pasta occurred a few times/month (28%), 1-2/week (18%) and 3-5/week (14%). Consumption of foods from the cereal group indicated a lack of variety and very little evidence of traditional food patterns, such as the consumption of samp, steamed bread and mabela porridge. Limited variety in dietary intake of foods from the cereal group influenced the level of intake for nutrients such as thiamin, riboflavin, iron, niacin, folate, magnesium and fibre (William, 2001), which were found to be inadequate for a significant portion of the sample (Table 4.10:155).

4.5.1.2 The Intake from the Fruit Group

Respondents reported a very low consumption of fruits. Fruits that were consumed almost daily were: apples and bananas (27%); oranges (4%) and fruit juice (23%). The intake of seasonal fruits used to determine variety in the diet was seldom consumed by the sample, even if in season. These included berries, kiwi, pineapples, grapes, peaches, mangos, grapefruits and plums (93%) and apricots and guavas (97%). Figure 4.28:146 indicates the frequency of intake from the fruit group by the sample. The consumption of fruit juice occurred few times/month (9%); 1-2/week (10%); 3-5/week (14%) and almost daily (23%) and none (44%). Sixty-six of the respondents reported drinking fruit juice. The following fruit beverages were consumed by the sample: liquifruit/fresh/ceres (38%); tropica (7%) and cooldrink (11%). Diluted cooldrink was consumed by the sample instead of fresh fruit juice because it was cheaper.

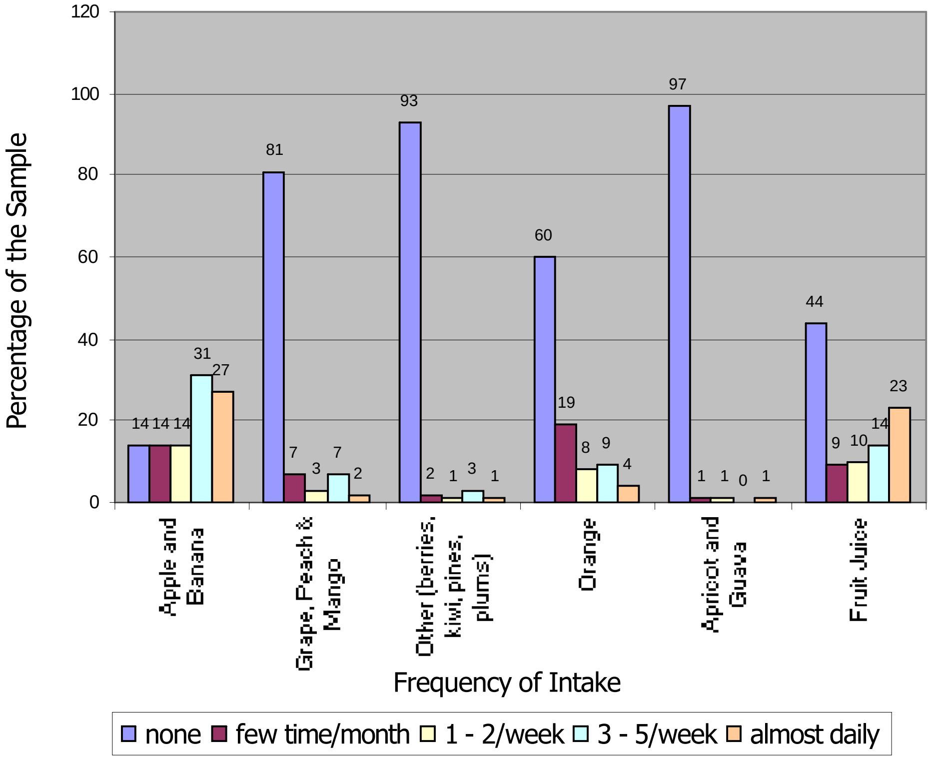

Figure 4.28 The Frequency Intake from the Fruit Group

Other forms of fruit such as dried fruit and fresh fruit salad were not consumed by the sample. The per capita median serving size for fruits was 1-2 daily servings for the sample. The fruit group is the best source of vitamin C and fibre (Williams, 2001). The intake of vitamin C by 77% of the respondents was significantly low due low consumption of fruits.

4.5.1.3 The Intake from the Vegetables Group

Sixty-five percent of the respondents reported consuming less than a serving of vegetables per day. Vegetables were added to cooked stew or curry or consumed as a frozen vegetable mix. The per capita serving size for frozen vegetable reported by the sample was 40g, less than the suggested serving of 90g (Williams, 2001) of vegetables per day. The percentage of the sample omitting specific foodstuffs out from their diet was as follows: cabbage and spinach (72%); pumpkin and carrot (58%); sweetcorn and beetroot (85%); potato (19%); vegetable salad (68%) and frozen vegetables (38%). Therefore, the intake of vegetables was very poor. Figure 4.29:147 indicates the frequency of vegetable intake by the sample. Potato proved to be the most popular vegetable consumed by the sample and was either boiled/baked with skin (30%); mashed (16%); roasted (4%) or French fries (34%). The frequency of potato intake by the sample was: few times/month (25%); 1-2/week (15%); 3-5/week (30%) and almost daily (11%). The average serving sizes for vegetables reported by the sample were: ±70g (cabbage and spinach); ±60g (pumpkin and carrot); ±40g (sweetcorn and beetroot); ±120g (potato) and ±30g (vegetable salad).

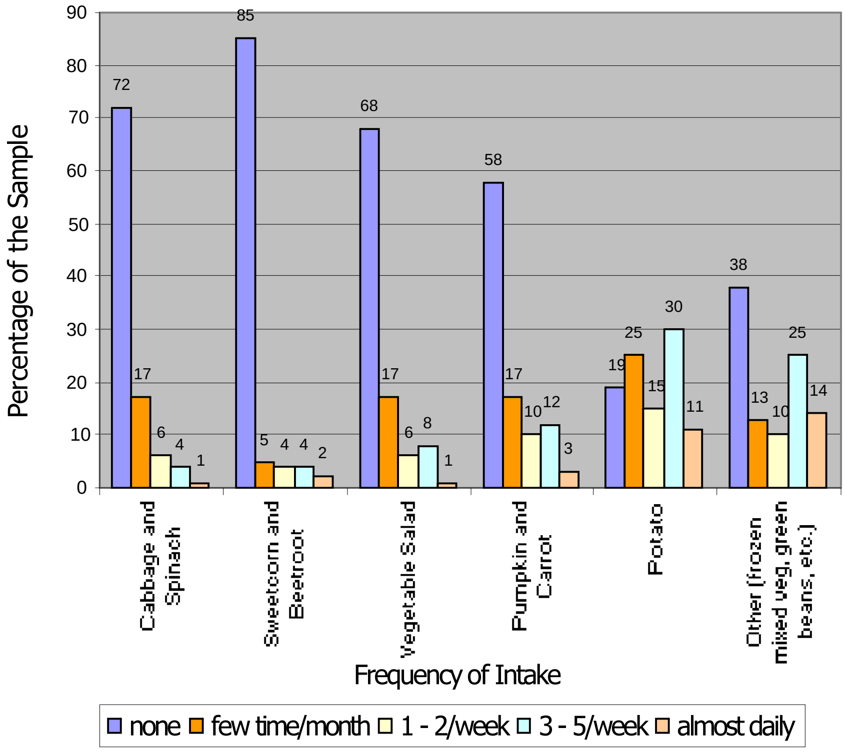

Figure 4.29 The Frequency Intake from the Vegetable Group

Vegetables were seldom included in the diet in other forms, such as salads and soups. More than half of the sample had an insufficient intake of fruits and vegetables which indicates an inadequate intakes of vitamin A, vitamin C, folate, magnesium and fibre.

4.5.1.4 The Intake from the Milk, Yoghurt and Cheese Group

A poor consumption of dairy products was reported by the sample. Respondents reported consuming milk only with coffee or tea and breakfast cereal, which included full cream milk (81%), 2% low fat milk (2%) and milk powder (1%). The percentage of the sample omitting specific dairy foods from their diet was as follows: milk with cereal (21%), milk with coffee (57%), maas (73%), cheese (51%), milk drinks (79%) and yoghurt (50%).

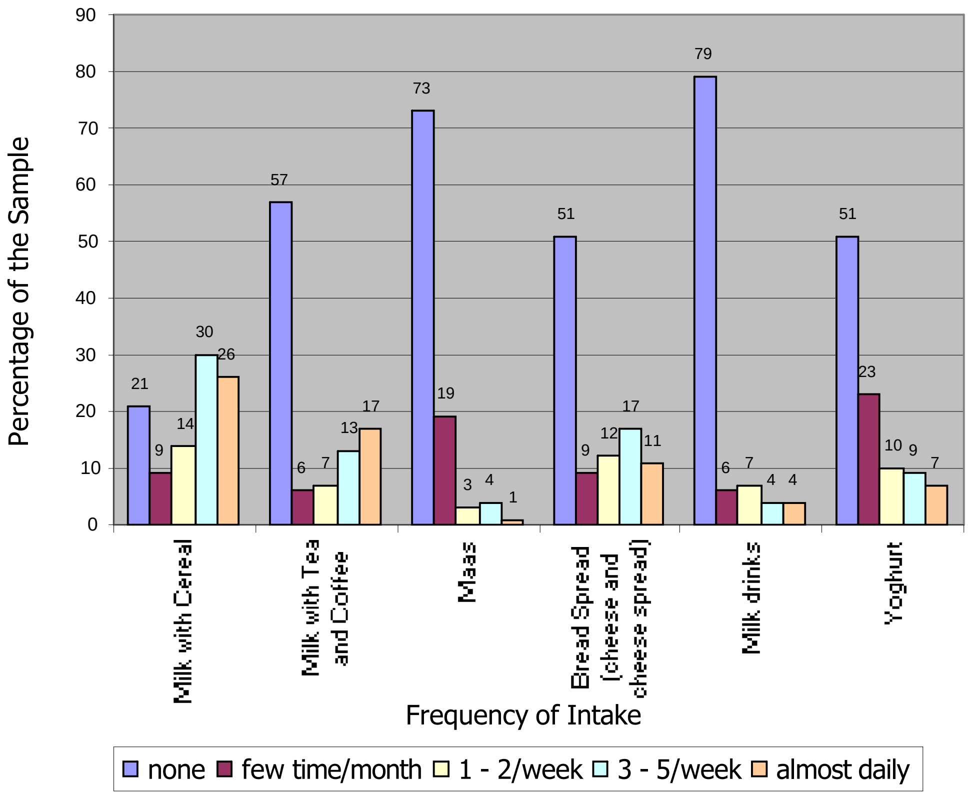

Figure 4.30 The Frequency Intake from the Milk, Yoghurt & Cheese Group

Over 70% of the sample did not have a daily serving from the milk group such as maas, cheese, milk drinks, dairy spreads and yoghurt. Therefore, only milk was regularly consumed compared with other dairy foods. Figure 4.30:148 indicates the frequency of consumption of milk and milk products by the sample. The average frequency of intake from the milk group reported by the sample was few times/month. The median daily serving sizes for milk products reported by the sample were: 200g (milk with cereal); <50g (milk with tea or coffee); <300g (maas); 15g (cheese); 300g (milk drinks) and 175g (yoghurt). Insufficient intake of dairy foods contributed to the inadequate intake of calcium, riboflavin, protein, potassium and zinc by the sample.

4.5.1.5 The Intake from the Meat, Poultry, Fish, Dry Beans, Eggs and Nut Group

Foods regularly consumed from the meat group were: poultry (90%); polony (71%); meat (33%); and eggs (80%). Respondents reported consuming meat a few times/month (31%); 1-2/week (26%); 3-5/week (43%) and almost daily (2%) compared with 19%, 20%, 44% and 7% of the sample who consumed poultry a few times/month, 1-2/week; 3-5/week and almost daily, respectively. Figure 4.31:150 indicates the frequency of intake from the meat group by the sample. Fish, offal, bacon and other processed meats except polony were not consumed by more than 80% of the sample. The frequency of intake of polony was almost similar to eggs. Eggs were consumed a few times/month (16%); 1-2/week (15%); 3-5/week (32%) and almost daily (17%) by the respondents. Twenty-eight percent of the respondents reported consumption of meat pies and hamburgers a few times/month.

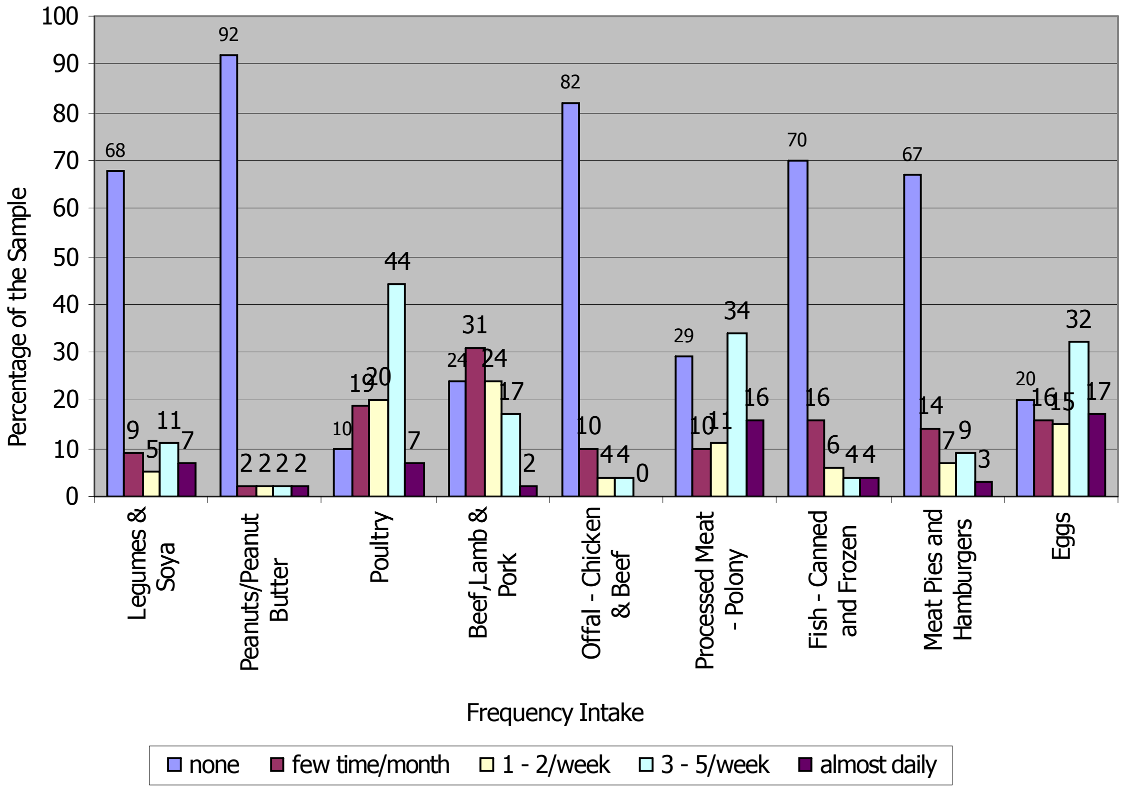

Figure 4.31 The Frequency Intake from The Meat, Poultry, Fish, Dry Beans, Eggs & Nut Group

The average serving size for poultry, meat (with bone), polony and eggs was <60g (50%), <240g (29%), <30g (40%) and 90g (38%) respectively. Sixty-six percent of the respondents reported not consuming legumes, soya products and nuts compared with 30% that included baked beans (canned) and/or soup powders. The frequency of intake of legumes reported by the sample was: few times/month (9%); 1-2/week (5%); 3-5/week (11%) and almost daily (7%). Insufficient intake of animal protein leads to inadequate intake of protein, niacin, iron, vitamin B_6, zinc, thiamin and vitamin B_{12}. The prevalence of an inadequate nutrient intake by the sample is reported in Table 4.10:155.

4.5.1.6 Fats, Oils and Sweets

Less than 50% of the sample reported the consumption of sweets as part of their diet. The consumption of sweet food such as chocolates, cookies, ice-creams and crisps was reported by less than half of the respondents. Figure 4.32:151 indicates the frequency of intake of sweets, fats and oils by the sample. The following sweet/savoury/fat foods were not reported by the sample: ice cream (61%), crisps (56%), squash (44%), tomato sauce (66%), fat spread (margarine) (2%) and sugar (45%). Hard margarine was used regularly as a spread or added to maize meal during cooking.

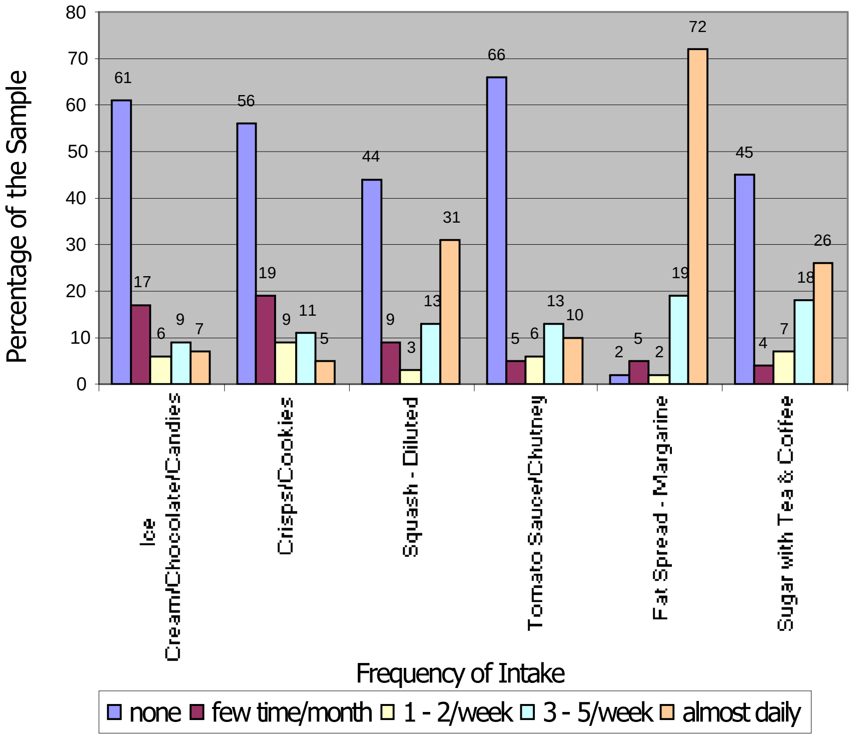

Figure 4.32 The Frequency Intake from the Fats, Oils and Sweets Group

Sugar was added to breakfast cereals and hot beverages. Respondents reported a limited consumption of sugary and fatty foods such as pastries. However, diluted cooldrink was consumed as a daily beverage by 31% of the sample. The FFQs of the sample were compared to nutritional guides such as: The Prudent Dietary Guidelines and the South African Food-Based Dietary Guidelines (SA FBDGs) to determine nutrient energy distribution and a healthy eating pattern (Table 4.9:152). According to the FFQs, the respondents' dietary habits were in accordance with the Prudent Dietary Guidelines and the US Dietary Guidelines.

Table 4.9 The Dietary Intake of the Sample According to Nutritional Guides

Prudent Dietary Guidelines[a]		**US Dietary Guidelines**[c]		**SA FBDGs**[b]		**Comments**
Maintain a reasonable weight	√	Maintain healthy weight	√	Be active	×	67.7% were of healthy weight; only 45.8% of sample embarked in some form of physical exercise
-		Eat a variety of Foods	×	Enjoy a variety of foods	×	minimum two kinds of food were consumed from each food group
Total fat intake: 30 – 35% of energy intake	×	-		-		33% of sample had up to 40% energy-total fat
Monounsaturated fat: 10 – 15% of total energy; Polyunsaturated fat: 4 – 10% of total energy intake	√	Choose a diet low in fat, saturated fat and cholesterol	√	Eat fats sparingly	√	57.3% of sample had <10% energy MUF; 43.8% had energy from PUF less than 5%
Carbohydrates: 50 – 55% of total energy intake	√	-		Make starchy food the basis of most meals	×	41% of population had <50% energy CHO intake; bread formed the basis of all meals; rice, pasta included a few times a week
-		Choose a diet with plenty of vegetables, fruits and grain products	×	Eat plenty of fruit and vegetables every day	×	65% of the sample did not consume fruits and vegetables, whole grain foods not eaten regularly
Sugars: 10% of total energy intake	√	Use sugar only in moderation	√	Use sugar and sugar-containing foods and drinks in moderation	√	sugar only added to tea/coffee or cereal
-		-		Eat legumes	×	68% of sample did not include legumes in the diet, Soya products not included by 72.4%
Protein: 12 – 20% intake of total energy	×	-		Foods from animals can be eaten every day	×	33% consumed <12% energy from protein; 63% had up to 15% and 3% had >20%; protein – energy intake; animal foods consumed a few times a week, serving size less than the suggested serving
Cholesterol: ≤ 300mg	√	-		-	√	no evidence of high dietary cholesterol intake; hard margarine; less than 50% indicated intake of sweets and fatty foods
Sodium: 2 – 3g	√	Use salt and sodium only in moderation	√	Use salt sparingly	√	salt added during cooking; no evidence of intake of salty foods
Moderate alcohol consumption, 1 – 2 drinks per day	√	If you drink alcoholic beverages, do so in moderation	√	If you drink alcohol, drink sensibly	√	alcohol drunk occasionally, large volumes drunk at once which is not sensible
-		-		Drink lots of clean, safe water	√	Respondents reported at least two glasses of water a day; 66% consumed diluted cooldrink

× sample's dietary habits do not adhere to nutritional guide
√ sample's dietary habits adhere to nutritional guide
[a] Prudent Dietary Guidelines, Williams, (2001)
[b] United States Dietary Guidelines for Americans (USDGs), Williams (2001: 13)
[c] South African Food Based Dietary Guidelines (FBDGs), Love (2000: 11)

Energy intake from fat reported by the sample was <30% and 63% had energy-protein up to 15%. This was within the recommended level of the prudent dietary guidelines. The majority (68%) of the sample was of a healthy weight, some of them (49%) embarked on some form of physical exercise. It was also noted that respondents' dietary habits lacked variety, and the intake of fruits and vegetables was low. Students did not regularly include legumes in their diet and animal foods were only consumed a few times a week, hence energy derived from protein was less than 10% of the total energy intake. Legumes are the basis of an indigenous South African meal and an economical source of protein. There was no evidence of traditional food patterns by the sample. Traditional starches and vegetables such as spinach and pumpkin were not consumed regularly. Therefore, the respondents' dietary habits and intake can be regarded as inadequate and considered unhealthy when compared to the SA FBDGs.

4.5.2 NUTRIENT INTAKE OF THE SAMPLE

Nutrient intake was determined by using the 24-hour Recall. Raw dietary data from the 24-hour Recall were analysed using the MRC Food Finder Nutrient Analysis Package, which reported respondent's raw nutrient scores, nutrient adequacy ratio (NAR) and comparison of dietary data to the prudent dietary guidelines. The SPSS^{+} Statistical Analysis Software Package was used in conducting descriptive and inferential statistics. The food composition tables on which the Food Finder Package is based, are predominantly compiled from analyses of locally grown foods. The nutrient adequacy ratio represents an index of adequacy for a nutrient based on the corresponding US RDA for that nutrient. The NAR in this study is expressed as a percentage. The mean, standard deviation and percentile nutrient intake by the sample are reported in Table 4.10:153

Table 4.10 The 24-hour Recall Nutrient Intake According to RDA Percentiles

	*Descriptive Statistics			Percentage of Sample According to RDA percentiles for nutritional adequacy (n=192)					
Nutrient List	**Mean**	**Median**	**Std Dev.**	**<10%**	**10 – 20%**	**30 -40%**	**50 – 67**	**67 – 90%**	**>100%**
Energy – kJ	7372.7	7040.0	3206.5	-	4	19	28	37	12
Total Protein(g)	59.3	54.6	27.3	1	-	3	16	27	53
[b] Plant Protein (g)	24.9	22.6	14.7						
[a] Animal Protein (g)	32.7	28.3	21.2	9	44	29	11	5	2
#Total Fat	57.9	51.3	34						
#Carbohydrate	232.7	222.6	102.7						
[c] Fibre (g)	17.2	14.8	13.9						
Calcium (mg)	477.8	413.5	345.2	6	31	35	13	10	5
Iron (mg)	9.9	8.4	7.4	-	11	20	17	27	25
Iron-Heme (mg)	.51	.30	.63						
Iron-Nonheme (mg)	2.6	2.2	1.8						
Magnesium (mg)	229.9	211.0	118.9	-	8	21	19	34	18
Phosphorus (mg)	926.3	844.5	433.1	-	5	13	22	35	25
Potassium (mg)	1758.5	1583.5	893.3						
*Sodium (mg)	1765.9	1574.0	1627.4						
Zinc (mg)	8.2	7.2	4.6	1	9	33	28	19	10
Copper (mg)	.97	.84	.65	2	26	44	19	5	4
Chromium (mg)	36.6	26.3	36.6	24	38	22	7	5	4
Selenium (mg)	34.7	26.4	30.1	5	26	27	15	13	14
Manganese (mg)	2524.7	2216.5	1544.4	3	12	19	22	23	21
Iodine (µg)	32.1	25.0	23.2	26	48	18	6	1	-
Vitamin A (µg RE)	492.3	258.5	1187.0	16	35	23	13	6	7
Thiamin (mg)	1.1	.95	.77	1	6	18	20	28	27
Riboflavin (mg)	1.3	.9	1.2	1	12	25	17	13	32
Niacin (mg NE)	16.1	13.6	61.7	1	4	15	15	34	31
Vitamin B_6 (mg)	1.5	1.4	1.1	1	15	22	17	19	26
Folate (µg)	223.6	172.5	190.7	-	6	12	16	22	43
Vitamin B_{12}	3.9	2.4	10.5	3	9	7	12	13	56
Pantothenate (mg)	4.5	3.7	3.3	2	12	16	22	17	31
Biotin (mg)	26.4	21.7	25.0	8	32	40	10	6	3
Vitamin C (mg)	69.0	26.5	169.5	19	21	12	13	8	26
Vitamin D (µg)	3.9	2.9	3.8	22	27	20	8	13	10
Vitamin E (mg α-TE)	6.3	5.1	5.3	3	18	21	18	20	20
Vitamin K (mg)	24.6	15.5	39.7	25	39	15	6	9	6

* descriptive statistics derived from nutrient raw scores
#no set RDA for the nutrients, except the Prudent Dietary Guidelines
*no nutrient reference value based on Food Finder Nutrient Analysis
[a] amount in grams for dietary animal protein
[b] amount in grams for dietary plant protein
[c] amount in grams of dietary fibre, recommended intake 30g per day

Respondents reported loweran nutrient scores compared to mean nutrient scores. The mean values reported overestimated the level of nutrient intake by the sample. The mean was particularly higher for nutrients such as vitamin A, riboflavin, niacin and folate due to a greater variation in their intake. Respondents reported extremely low (<10% RDA) as well as higher (≥100%) intakes of nutrients. Raw nutrient scores by the sample were not adjusted. However, a significant portion of the sample had a nutrient intake below the recommended level (RDA). The respondents' nutrient scores were evaluated by direct comparison with the corresponding RDA of each nutrient for reference age and gender.

The "cut-off" point for adequate nutrient intake is two-thirds (67%) of the RDA (Gibson, 1990). However, nutrient intakes below the recommended level do not necessarily mean that the intake is inadequate. The RDA exceeds actual requirements of most individuals. The RDAs are set at the mean requirements plus two standard deviations as a margin of safety (Gibson, 1990). A probability approach was used to reliably assess the prevalence of nutritional inadequacy in this study. This approach has been applied for nutrients such as protein, vitamin A, vitamin C, thiamin, riboflavin and calcium (Gibson, 1990). Arbitrary percentiles were used to indicate the prevalence of an insufficient nutrient intake by the sample, as is shown in Table 4.10:154. Descriptive statistics with a histogram and normal distribution curve were computed for each nutrient intake by the sample as is reported in Annexure 7.20, Figure 4.33:156 indicates the percentage of the sample with an intake of less than 67% RDA for nutrients known to be at risk amongst young adults (Labadarios, 1999).

The intake of iodine (98%), calcium (85%), vitamin A (87%), zinc (71%), vitamin C (65%), riboflavin (55%), vitamin B_6 (55%), iron (48%), magnesium (48%) and folate (34%) was low in the sample. Current research has not identified iodine as one of the nutrients at risk for low intake by South Africans (Labadarios, 1999). Twenty-six percent of the respondents reported an intake of less than 10% RDA and 66% had an iodine intake of up to 40% of the RDA. The classic RDA recommends an intake of 150µg/day for all persons above 11 years of age (Williams, 2001). The per capita mean iodine intake was 32µg for the sample, with a standard deviation of 23µg. The mean iodine intake for females was 28µg compared with males which was 36.5µg. Both mean values reported by males and females were below 67% of the RDA.

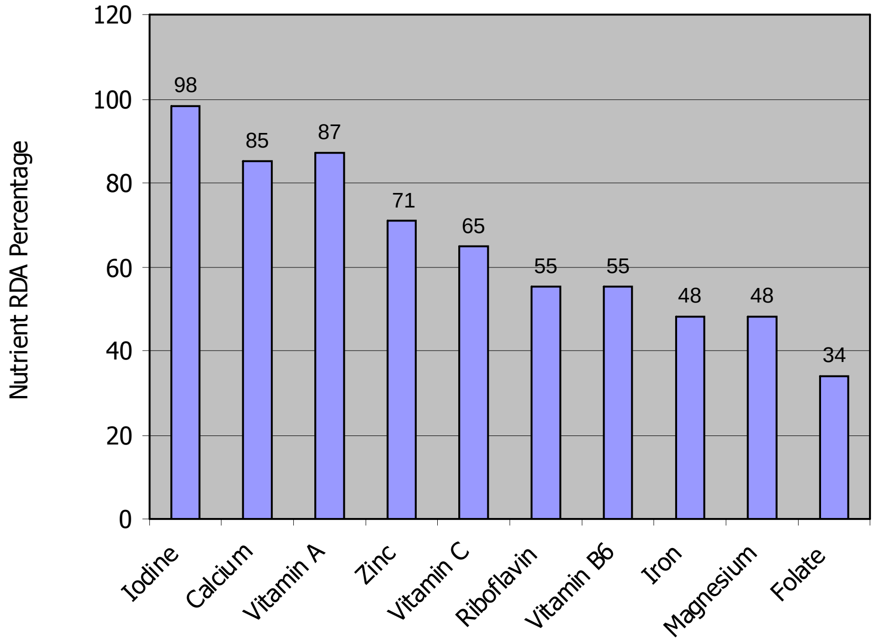

Figure 4.33 Percentages of the Sample with Inadequate Nutrient Intake (less than 67% of the RDA)

Eighty-five percent of the sample had a low calcium intake. Over 70% of the respondents reported no daily consumption from the milk group, and only 15% of the sample achieved a calcium intake of ≥67% of the RDA. The intake of dairy products for the sample was significantly low (Figure 4.30:148). The mean calcium intake reported by the sample was 477.8mg with a standard deviation of 345.2mg. The DRI guidelines give AI levels of 1300mg/day for people aged 18 years and 1000mg/day for those aged 19 and older (Williams, 2001). For males, the mean calcium intake was 439mg (43.9% RDA) compared with females: 519.9mg (52% RDA).

Greater variations were found in vitamin A (retinol) intakes in that they were either very low or very high. Mean vitamin A scores reported by the sample was 492.3µg RE with a standard deviation of 1187.0µg RE. Students with a higher (>100% RDA) vitamin A intake represented 7% compared with 74% with significantly low intakes (up to 40% RDA). Seventy-four percent of the sample had a significantly low intake of vitamin A which was 40% of the RDA. Vitamin A intake has been found to be low in the diet of South African adults (Labadarios, 1999) due to an insufficient consumption of fruits, vegetables and animal foods. Dietary intake of fruits and vegetables was very low for over 55% of the sample. The per capita serving size for meat was less than the suggested serving. The DRI standards for vitamin A are currently under study; however, the classic RDA standards for adults are 800µg for women and 100µg for men (Williams, 2001). Significant differences between genders were found in the intake of vitamin A. Vitamin A intake reported by male respondents was 567.98µg RE compared with 422.7µg RE for females. A similar distribution pattern to that of vitamin A intake was observed for riboflavin.

Riboflavin intake ranged from 20% to 67% RDA. Fifty-four percent of the respondents reported a riboflavin intake of <67% compared with 14% with an intake of >67% and 32%

with >100% RDA riboflavin intake. Significantly low intakes of riboflavin (<10% RDA) were noted as with vitamin A. Mean riboflavin reported by the sample was 1.3mg with a standard deviation of 1.2mg. The DRI guidelines establish an RDA of 1.3mg for men aged 18 and older and 1.1mg for women. The mean riboflavin intake was 1.2mg and 1.4mg for females and males respectively, and fell within the parameters of the RDA. However, the intake of zinc was very low.

Seventy-one percent of the respondents reported significantly low levels of zinc intake. Zinc has been found to be one of the nutrients of low intake by South Africans (Steyn et al., 2000; Labadarios, 1999). The greatest source of dietary zinc in the United States is meat, which supplies about 70% of zinc consumed. Eggs are also a good source. Legumes and whole grains are additional sources. A balanced diet usually meets adult zinc requirements; however, evidence has shown that a diet high in processed foods is low in zinc. Animal food sources supply a major portion of zinc (Williams, 2001). Mean zinc intake reported by the sample was 8.2mg with a standard deviation of 4.6mg. The mean intake of zinc for females was 7.1mg/day, and for males 9.4mg/day. Both means were less than the recommended level (<67% RDA). The classic RDA standard for zinc is 15mg/day for males aged 11 and older, and 12mg/day for females aged 11 and older.

Sixty-six percent of the respondents reported an inadequate intake (<67% RDA) of vitamin C, compared with 35% with an intake of ≥67% RDA. Greater variation in vitamin C intake was found as was the case with vitamin A and riboflavin. The mean vitamin C intake reported by the sample was 69mg with a standard deviation of 169.5mg. The new DRI guideline for adults over 18 years of age is 75mg/day for females and 90mg/day for males.

The mean intake of vitamin C for females and males was 52.3mg/day and 87.1mg respectively. However, both mean values of vitamin C were within the set standard of the RDA (>67% and >100%). The consumption of fruits and vegetables contributed most of the vitamin C intake, which was found to be low in the sample.

Dietary intake of vitamin B_6 was inadequate (<67% RDA) for 55% of the sample. Fourty-five percent of the respondents reported an adequate intake of vitamin B_6, which was >67% and >100% of the RDA. The mean vitamin B_6 intake reported by the sample was 1.5mg with 1.2mg as a standard deviation. The requirements for vitamin B_6 vary with protein intake. Mean vitamin B_6 intake is expressed as milligrams per gram of total protein intake. The new DRI guidelines set the RDA for vitamin B_6 at 1.7mg and 1.5mg for males and females respectively. The mean vitamin B_6 for males was 1.6mg compared with 1.3mg for females.

The level of iron intake ranged between low and high levels of intake by the sample. Twenty-five percent of the respondents reported an intake of over 100% of the RDA for iron compared to 10% that had an intake of up to 20% RDA intake for iron. A further 38% of the respondents reported a 40% to 67% of the RDA for iron. Iron intake was inadequate for 52% of the sample. The mean iron intake reported by the sample was 9.9mg with a standard deviation of 7.4mg. Non-haeme iron provided 26% of the per capita iron (9.9mg) available compared with haeme iron which provided 5%. The mean non-haeme and haeme iron reported was 2.6mg and 0.51mg respectively. Female respondents reported lower mean iron intake (8.8mg/day) compared with males (11.2mg/day). The mean haeme iron intake was 0.47mg/day for females and 0.57 mg/day for males. The mean non-haeme iron intake was 2.3mg and 2.9mg for females and males respectively. Therefore, the intake of non-haeme iron was higher than that of haeme iron and males had a higher iron intake compared with females.

Fourty-seven percent of the respondents reported an inadequate intake of magnesium compared with 53% that reported magnesium intakes within RDA recommendations. Fifty-three percent of the respondents met the recommendations of the RDA for magnesium. The mean magnesium intake reported by the sample was 229.9mg with a standard deviation of 118.9mg. Mean magnesium intake for females and males was 194.6mg/day and 268.3mg/day respectively. The mean magnesium intake for males was within adequate levels of the RDA compared with inadequate intakes to females (<67%). The DRIs set an RDA for magnesium at 400mg/day for males and 310mg/day for females.

Sixty-five percent of the respondents reported an adequate intake of folate. An intake of folate for 6% and 29% of the sample was 20% and 40 to 67% of the RDA respectively. The mean folate intake reported by the sample was 223.6µg with a standard deviation of 190.7µg. Male respondents reported a higher mean folate intake (252.3µg) compared with females (197.0µg). In accordance with the RDA, males and females had folate intakes below the recommended level. The new DRI standards give a general RDA of 400µg dietary folate equivalent (DFE) per day for both men and women aged 14 and older (Williams, 2001).

A significant portion of the sample reported an intake of less than 50% of the RDA for energy, calcium, iron, zinc, vitamin A, vitamin B_6, vitamin C and vitamin E (Table 4.12:164). The per capita intake of protein was 59.3g; fat 57.9g and carbohydrates 232.7g for the sample. According to Vaughan, Benyshek and Martin (1997:1279), nutrients likely to be inadequate in the diet of young adults with unhealthy eating patterns are iron, calcium, magnesium, vitamin A and vitamin B_6. Koszewski and Kuo (1996) also indicated that the average intake of all nutrients for young adults was above the RDA, except for energy, calcium and iron. According to Labadarios (1999) and Steyn et al., (2000), the dietary intake of South Africans is low in calcium, folate, iron, magnesium, riboflavin, vitamin A, vitamin B_6, vitamin C and zinc. Findings in this study are consistent with those of Labadarios, (1999) and Steyn et al. (2000). Other nutrients that were found to be of a low intake by the sample were copper, chromium, selenium, manganese, biotin, vitamin E and vitamin K. However, current research conducted in South African has not provided evidence or data indicating the prevalence of inadequate intake of these nutrients and trace elements.

4.5.3 THE RELIABILITY OF THE 24-HOUR RECALL

A Pearson's correlation was used to test agreement between the two instruments (24-hour Recall and FFQ). A positive correlation was found where r = >.145 (Table 4.11:163). A correlation may not be adequate for representing agreement across methods or for showing the difference in nutrient values, therefore a paired and independent t-test was done to compare the means for nutrient intake between the 24-hour recall and FFQ (Table 4.12:164). A parametric Pearson's (reported) and a Spearman's (rank order) correlation coefficients were computed, as is the standard practice in studies of dietary assessment (Subar et al., 2000). Dietary reports were not repeated as respondents were not freely available or cooperative, and the interviewer administered dietary assessment instrument was time-consuming and costly. This limited the validity and reproducibility of the data. For repeated dietary evaluation the strength of the correlation between the 24-hour Recall and

FFQ is known to be higher (Subar et al., 2000). Even though the difference in means between the 24-hour Recall and FFQ were found to be significant (Table 4.12:164), the correlation coefficient values (r = >.145) from Pearson's correlation indicated an agreement between the two instruments.

Table 4.11 Pearson's correlation between 24-hourr Recall and Food Frequency Questionnaire (p = 0.000)

FFQ	Energy (kJ)	Total Protein	Plant Protein	Animal Protein	Total Fat	Carbohydrate	Fibre	Calcium	Iron	Non-heme	Magnesium	Phosphorus	Potassium	Zinc	Copper	Selenium	Manganese	Iodine	Vitamin A	Thiamin	Riboflavin	Niacin	Folate	Vitamin B^{12}	Pantothenate	Biotin	Vitamin C	Vitamin D	Vitamin E	Vitamin K
Energy (kJ)	.310	.248	.264	-	.235	.311	.158	-	.206	.181	.264	.245	.253	.256	.236	.148	.203	.178	-	.252	.149	.221	.213	-	-	-	-	-	-	-
Total Protein	.285	.290	.258	.235	.199	.271	-	.151	.176	.285	.252	.268	.264	.326	.233	.233	.186	.280	-	.227	.154	.213	.209	-	-	-	-	.174	-	-
Plant Protein	.347	.268	.391	-	.204	.399	.253	-	.185	.170	.393	.308	.261	.313	.292	-	.390	.157	-	.233	-	.202	.213	-	-	-	-	-	-	-
Animal Protein	-	.175	-	208	-	-	-	-	-	.286	-	.149	.194	.213	.152	.268	-	.277	-	-	-	-	.188	-	-	-	-	-	-	-
Total Fat	.249	.189	.186	.145	.243	.222	-	-	-	.176	.186	.165	.254	.200	.168	-	.147	.169	-	.177	-	.164	-	-	-	-	-	-	-	-
Carbohydrate	.345	.258	.305	-	.225	.379	.251	-	.264	.157	.318	.294	.247	.266	.287	.145	.224	.150	-	.295	.199	.249	.277	-	-	-	-	-	.164	-
Fibre	.245	.177	.279	-	-	.282	.188	-	.160	-	.290	.200	.216	.207	.215	-	.281	-	-	.197	-	.182	.173	-	-	-	-	-	-	-
Calcium	-	-	.152	-	-	-	-	.169	-	-	-	-	-	-	-	-	-	-	-	.147	.160	.158	.147	-	-	-	-	-	-	-
Iron	.304	.269	.195	-	.226	.282	.257	.208	.391	-	.164	.287	.144	.212	.195	-	-	-	-	.346	.345	.380	.293	-	.237	-	-	-	.151	-
Non-heme	.177	-	-	-	-	.214	-	-	-	.265	-	-	.237	.153	.153	.272	-	.224	-	.216	.144	-	.208	-	-	-	-	-	-	-
Magnesium	.240	.187	.308	-	.145	.282	-	-	-	.145	.277	.210	.233	.218	.212	-	.271	.172	-	.162	-	.160	.142	-	-	-	-	-	-	-
Phosphorus	.256	.219	.311	.153	.151	.274	-	-	.165	.181	.277	.249	.261	.252	.214	-	.229	.210	-	.215	-	.201	.193	-	-	-	-	.145	-	-
Potassium	.163	-	-	-	-	.195	-	.177	-	-	.150	.151	.257	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	.275	.316	.224	.244	.178	.263	-	.175	.228	.255	.304	.293	.256	.376	.252	.171	.224	.259	-	.270	.199	.262	.211	-	.148	-	-	.174	-	-
Copper	.198	.175	.191	-	-	.232	-	-	.159	.179	.193	.171	.221	.192	.250	.147	-	-	-	.200	.154	.196	.193	.156	-	-	-	-	-	-
Selenium	.156	.179	-	.190	-	-	-	-	-	.276	-	.145	.148	-	-	.359	-	.260	-	.223	.179	-	-	-	-	-	-	-	-	-
Manganese	.250	.206	.319	-	-	.294	.163	-	-	.151	.317	.196	.196	.297	-	-	.414	.171	-	-	-	-	.212	-	-	-	-	.144	-	-
Iodine	.150	.153	.155	.219	-	-	-	-	-	.166	-	.150	-	.184	.233	.152	-	.232	-	.178	-	-	-	-	-	-	-	-	-	-
Vitamin A	-	-	-	.201	-	-	-	-	-	.151	-	-	-	-	.155	-	-	.155	.204	-	.193	-	-	.251	-	-	-	-	-	-
Thiamin	.422	.380	.242	.167	.328	.382	.351	.325	.463	-	.314	.429	.237	.329	.281	-	.144	-	-	.437	.411	.423	-	-	.272	-	-	-	.267	-
Riboflavin	.266	.248	-	.185	.206	.227	.202	.297	.407	-	-	.299	-	.175	.183	-	-	-	.176	.347	.431	.396	.350	.143	.246	-	-	.156	-	-
Niacin	.395	.356	.261	-	.302	.354	.315	.282	.455	.169	.252	.387	.196	.298	.302	.144	-	-	.180	.390	.401	.440	.306	.145	.294	-	-	.159	.212	-
Folate	.312	.287	.220	.171	.202	.305	.278	.252	.408	-	.224	.325	-	.253	.228	-	-	-	.151	.374	.381	.351	.362	.486	.223	-	-	.148	-	-
Vitamin B_{12}	-	.160	-	.157	-	-	-	-	.183	.277	-	.144	-	.188	.328	.232	-	.230	.372	.159	.286	.169	.184	.486	-	-	.186	.172	-	-
Pantothenate	.197	.187	.210	-	-	.200	-	-	.176	.212	.143	.168	.178	.158	-	.206	-	.215	-	.202	.157	.209	.212	-	.149	-	-	.184	-	-
Biotin	-	-	-	-	-	-	-	-	.159	.172	-	-	-	-	-	-	-	.193	-	.202	.170	.148	-	-	-	-	-	.191	-	-
Vitamin C	-	-	-	.176	-	-	-	-	-	-	-	-	.155	-	-	-	-	-	-	-	-	-	-	-	-	-	.191	-	-	-
Vitamin D	.187	.228	-	-	-	.163	-	.152	.202	.165	-	.206	-	.242	-	-	.144	.220	-	.215	.212	.197	-	-	-	-	-	.274	.179	-
Vitamin E	.249	-	.301	-	-	.300	-	.446	.551	.293	.606	.591	.386	.154	.223	-	-	.244	-	.240	-	.178	.397	-	.637	.162	.241	.431	.153	-
Vitamin K	-	-	-	-	-	-	-	-	-	.213	-	-	-	-	.167	-	-	-	.178	-	-	-	-	-	-	-	-	-	-	.198

P value = <0.001 level of significance

Only the Pearson's correlation coefficient reported

The mean nutrient scores reported for the 24-hour Recall were lower compared with those of the FFQ,. Mean nutrient scores reported for the FFQ were overestimated, particularly for micronutrients such as protein, calcium, fibre, iron, vitamin A and vitamin E, sodium, vitamin B_6, vitamin C and vitamin K.

Table 4.12 Comparison of the Mean between the 24-hour Recall and FFQ

	24hr Recall		†FFQ		
Nutrient List	**Mean**	***SD**	**Mean**	**SD**	**p value**
Energy – kJ	7372.7	(3206.5)	11521.7	(4928.4)	0.000
Total Protein(g)	59.4	(27.3)	80.6	(34.6)	0.000
[a] Plant Protein	24.9	(14.7)	36.3	(18.4)	0.000
[b] Animal Protein	32.7	(21.2)	40.4	(22)	0.004
Total Fat (g)	57.9	(34)	95.6	(52.5)	0.000
Carbohydrate (g)	232.7	(102.7)	349.2	(146.8)	0.000
[c] Fibre (g)	17.2	(13.9)	28.8	(16.0)	0.009
Calcium (mg)	477.8	(345.2)	744.7	(412.5)	0.019
Iron (mg)	9.9	(7.4)	15.8	(8.3)	0.000
Iron - Heme	.51	(.63)	.47	(.52)	NS
Iron – Non-Heme	2.6	(1.9)	3.9	(2.1)	0.000
Magnesium (mg)	229.9	(118.8)	376.5	(182.4)	0.000
Phosphorus (mg)	926.3	(433.1)	1367.5	(627.5)	0.000
Potassium (mg)	1758.5	(893.3)	3119.2	(1925.3)	0.000
Zinc (mg)	8.2	(4.6))	11.4	(5.2)	0.000
Copper (mg)	.97	(.65)	1.5	(.81)	0.000
Chromium (mg)	36.6	(36.6)	60.0	(120.5)	0.000
Selenium (µg)	34.7	(30.1)	44.1	(33.7)	NS
Manganese (mg)	2524.7	(1544.4)	3941.8	(2349.4)	0.000
Iodine (µg)	32.1	(23.2)	50.6	(33.2)	0.001
Vitamin A (µg RE)	492.3	(1187.0)	967.1	(977.4)	0.004
Thiamin (mg)	1.1	(.78)	1.9	(.94)	0.000
Niacin (mg NE)	16.1	(10.6)	23.8	(11.7)	0.000
Vitamin B_6 (MG)	1.5	(1.1)	21.6	(265.3)	NS
Folate (µg)	223.6	(190.7)	347.1	(207.2)	0.000
Vitamin B_{12} (µg)	3.9	(10.5)	5.8	(5.8)	0.000
Pantothenate (mg)	4.5	(3.3)	6.4	(3.5)	0.039
Biotin (µg)	26.4	(25.0)	42.1	(28.4)	NS
Vitamin C (mg)	69.0	(169.5)	140.4	(177.2)	0.008
Vitamin D (µg)	3.9	(3.8)	6.5	(4.5)	0.000
Vitamin E (mg α-TE)	6.3	(5.3)	11.3	(11.9)	0.034
Vitamin K (mg)	24.6	(39.7)	55.9	(48.8)	0.006

n = 192
†FFQ – food frequency questionnaire
* Standard Deviation

This could be due to under-reporting in the 24-hour Recall by the sample compared with the FFQ, particularly for fruits and vegetable intake.

4.6 SUMMARY

- Selected socio-demographic factors had an influence on nutrient intake, namely: gender, ethnicity and monthly food expenditure (SES). However, gender and socio-economic status proved to be the most significant variables. Gender was significantly associated with the intake of energy, plant protein, carbohydrate, fibre, iron, magnesium, phosphorus, copper, manganese and pantothenate. Male respondents reported higher nutrient scores compared with females.
- Ethnicity had an influence in the intake of calcium, thiamin and riboflavin in the sample. Zulu students had a higher intake of these nutrients. However, it should be borne in mind that the Zulu students made up a significantly larger portion of the sample compared with other ethnic groups. Nutrient intake by Zulus, Xhosas and Swazis was higher for calcium, thiamin and riboflavin.
- Socio-economic status (monthly food budget) had a significant influence ($p = <0.005$) on iron, thiamin, niacin, folate and pantothenate intake in the sample. Respondents that spent more money on food had a higher nutrient intake compared with respondents who spent less. The significance between low socio-economic status and lower nutrient intake was noted.
- The influence of nutritional knowledge on nutrient intake proved to be very weak. According to the NKT scores, the nutritional knowledge of the sample was found to be average. Respondents' scores indicated shortcomings in the areas of: "The use of food

by the body" and "The relationship between nutrients and good health". The NKT proved to be a reliable tool for testing nutritional knowledge of the sample (Annexure C- 2).

- Thirteen percent of the sample was found to be at risk for degenerative diseases related to central obesity, particularly females. An association was found between WHR and energy intake, as well as WHR and ethnicity. Respondents with a WHR of 0.8-1.0 or greater had a higher energy intake, particularly from saturated fat and carbohydrates. However, 68% of the sample proved to be of a healthy weight in terms of BMI, and had a healthy body fat distribution. There were no significant trends in BMI values when compared to different levels of energy intake.
- The FFQ proved to be an appropriate tool for validating the 24-hour Recall findings. The strength of the correlation between the 24-hour recall and FFQ was low to moderate, due to the use of a single dietary report. There were marked differences between mean values of the 24-hour Recall and FFQ reported by the sample. The food frequency questionnaire had higher mean nutrient scores compared with those of the 24-hour Recall.
- Respondents reported an inadequate dietary intake when diet records were compared to the South African FBDGs. However, they were comparable to the US Dietary and Prudent Dietary Guidelines in terms of the distribution of energy intake. Dietary intake from the vegetable, fruit, meat and dairy groups was significantly low. As a result, the intake of nutrients such as iodine, calcium, vitamin A, zinc, vitamin C, vitamin B_6, iron, magnesium and folate was inadequate ($\leq$67%). The intake of trace elements such as copper, chromium, selenium, manganese, biotin, vitamin E and vitamin K also proved to be inadequate for the sample. However, the intake of protein (plant), fibre, magnesium, thiamin, niacin, folate, vitamin B_{12}, manganese, pantothenate and vitamin D was adequate for a significant portion of the sample.

CHAPTER 5

GENERAL DISCUSSION AND RECOMMENDATIONS

5.1 OVERVIEW

In the previous chapter the results of the processed data were presented, interpreted and evaluated. In Chapter Five, the results and findings are integrated and evaluated with reference to the literature. A discussion of the findings follow in order to identify the objectives needed for the formation of an educational programme promoting adequate nutrient intake and healthy eating habits. The research process is reviewed and recommendations for further research are made.

5.2 INTEGRATION OF THE RESULTS

The information required to identify the objectives needed for the formulation of a nutrition education programme to improve studets' eating habits was collected from the responses to the questionnaires as described in Chapter Three (section 3.4.3.2:70). The results are presented in Chapter Four, section 4.2, 4.3, 4.4 and 4.5. The results, in terms of the sociodemographic profile, nutrition knowledge, eating habits and nutrient intake, presents a challenge in designing a nutrition education programme that is practical in promoting healthy eating habits and economic food choices. The results of the study pointed towards the following elements that need to be addressed through a nutrition education intervention:

- Socioeconomic status, gender, ethnicity and nutrition knowledge of the sample that impacts on food choice and nutritional adequacy of their dietary pattern.
- The level of nutrition knowledge of the students which provides a cognitive insight into the influence of dietary behaviour/habits.
- The anthropometric status of the respondents in terms of WHR and weight status as risk factors for the development of obesity, DM, CVD and other diet-related diseases.
- The use of reference standards (values) to determine the prevalence of nutrient inadequacy amongst young-adults and existing strategies used to address nutrient/dietary inadequacy and promote healthy eating habits of the population.
- The existing models and theories that have been proposed as the basis for formulating a nutrition education programme related to nutritional problems amongst young-adults.

The impact of these elements on nutritional status needs to be assessed in order to fulfill the aim of the study, namely: to evaluate the nutritional adequacy of Black students' eating habits at DIT (Steve Biko Campus) and to determine the influence of nutrition knowledge and sociodemographic variables on existing eating habits for the compilation of a nutrition education programme.

5.2.1 THE IMPACT OF SOCIO-DEMOGRAPHIC VARIABLES ON NUTRITIONAL ADEQUACY

Sociodemographic factors had a more significant influence on nutrient intake compared with other variables. Studies that have shown the influence of gender and socioeconomic status on nutrient intake amongst young-adults include Horacek and Betts, (1998); Milligan, Burke, Beilin, Spencer, Balde and Gracey, (1998); Wirfalt and Jeffrey, (1997); Vaughan, Benyshek and Martin, (1997) and Betts, Amos, Keim, Peters and Stewart (1997).

Significant sociodemographic variables that were identified in the present study were gender, ethnicity and socioeconomic status. The results of this study showed that females had an inadequate nutrient intake (in terms of their reference values) compared with males, whose intake was adequate (Annexure 7.19). This was evident in the intake of energy from protein and carbohydrate, fibre, iron, magnesium, phosphorus and manganese. When optimal adult growth is achieved, energy needs of young adults level off. Differences between genders are expected when comparing energy intakes due to different energy requirements for both males and females. Males are expected to have a higher intake of energy than females because of differences in physiological make-up. However, more females than males had energy intake >67% of the RDA. This was not due to the gender representation of the sample. Females also had higher BMI values particularly in the overweight and obese category when compared with males.

Ethnicity proved to be significant in the intake of calcium, thiamin and riboflavin. However, this finding may not be consistent for dietary intake of the population of the ethnic groups represented in the sample, due to uneven ethnic distribution. Culture and religion also had no significant influence on nutrient intake. This could indicate that the cultural/religious eating pattern has disintegrated and regulations governing food practices have been liberalised (Nestle et al., 1998; Oldewage-Theron et al., 1998; Viljoen, 1998; Weigley et al., 1997 and Van Eeden and Gericke, 1996).

Findings also showed that nutrient intake is higher when more money is spent on food. Socioeconomic status was a significant predictor of intake of nutrients such as iron, thiamin, niacin, folate, and pantothenic acid. Limited dietary variety indicated the impact of socioeconomic status on the dietary pattern of the sample.

According to a Nigerian study conducted by Oguntona, et al., (1998), there were no significant differences in nutrient intake between males and females. Population ethnicity did not have a significant influence on nutrient intake. However, socioeconomic status affected sources of dietary calcium, iron and protein. Calcium and riboflavin intake is found to be low for Blacks in rural and urban settings in South Africa (Labadarios, 1999). These low intakes are due to the infrequent consumption of milk and milk products, which are the best sources of these nutrients, as well as fruit and vegetables (Labadarios, 1999). According to a study conducted in the United States by Neumark-Sztainer, et al. (1995) young-adults from low socioeconomic backgrounds are at greater risk for inadequate food intake. Other nutrients found to be of low intake for the Black population group in South Africa includes iron, zinc, vitamin B_6 and vitamin A (Labadarios, 1999). These nutrients were found to be of low intake for a significant portion of the sample due to socioeconomic status. Adequate micronutrient intake from a balanced diet is realistic if one has the financial means, time and effort to invest in eating healthy. Neumark-Sztainer, et al. (1995) suggests that young-adults of a higher socioeconomic status have greater access to health information and greater variety of food which in turn influences their behaviour.

It has been speculated that complying with dietary recommendations is costly. If this is the case, it is likely that individuals from a lower socioeconomic status will be unable and unwilling to comply with dietary guidelines due to the added cost. For young-adults, convenience is more important than nutrition when making food decisions (Betts, et al. 1997). According to NHIS Cancer Epidemiology Supplement Surveys by the National Cancer

Institute in the United States (Harnack, Block and Lane, 1997:07), the perceived cost is one of the barriers reported in adherence to dietary guidelines, particularly consumption of fresh fruits and vegetables which impacts on adequate micronutrient intake. In addition, the extra time needed for shopping for food, planning and preparing meals, as well as maintenance of a healthy eating pattern is a challenge.

In SA undernutrition in terms of inadequate dietary/nutrient intake has been explained in terms of food insecurity, where low socioeconomic status is the cause. Food insecurity has been advocated particularly in increased household size (Van Rensburg, et al. 2000; Rose and Charlton, 2000). However, there is very little empirical data that indicates food insecurity for smaller households (free-living individuals) in South Africa. A decrease in income leads to a change in dietary variety, quantity and quality of food eaten. In this study 42% of the respondents spent R200 – R299 on food per month. Male respondents spent more money of food compared with females.

The average food expenditure of the urban respondents in the Van Eeden and Gericke (1996) study at Vista and Pretoria University was R300 per month compared with R200 by the respondents in this study. This indicates that respondents in this study are spending even less money on food if the time lapse, inflation rate and increase in food prices are taken into account since the study reported by Van Eeden and Gericke (1996). According to Shepherd, et al. (1996:20) increase in socioeconomic status does not necessarily increase food expenditure nor does it improve the quality of dietary intake. However, in this study the trend of increased nutrient intake with higher socioeconomic status remained consistent. Even though there were cases of inadequate nutrient intake for the higher socioeconomic category of the sample, they were insignificant. These results were consistent with findings of the study by Neumark-Sztainer, (1995).

Exposure to an urban lifestyle illustrates the shifts in food choice behind macronutrients (Solomons, 2000) as a result of socioeconomic pressure. Consequently, this means elimination of certain high fibre foods, such as grains, legumes and cereals and the inclusion of a high intake of fat, making the diet more westernized. In this study, young-adults' living arrangements did not have an effect on nutrient intake. An evaluation of students' dietary patterns revealed that the respondents' diet was confined to a relatively narrow range of foods. Insufficient intake of dairy products, vegetables, fruits and meat was striking, although recommendations for cereal and fat were met by the sample. The prevalence rates for inadequate intakes of certain food groups are reported in a study conducted by Neumark-Sztainer, et al. (1995).

According to Solomons, (2000), energy adequacy for most urban dwellers is met by a combination of lower needs (due to lower levels of activity) and more accessible food. Food is often loaded with fat and consists of empty calories with a variety of packaged snacks and fast food eaten from street vendors. This dietary pattern leads to a diet which is adequate in energy and macronutrient density, but imbalanced in terms of micronutrient intake. Energy intake by the respondents was adequate and complied with prudent dietary guidelines (section 4.5:143, Table 4.9:152). However, energy intake was obtained through consumption of a narrow range of foods and characterised by an imbalance in micronutrient intake. Therefore, the dietary pattern of the respondents is consistent with that of most urban dwellers, as suggested by Solomons (2000). Table 5.1:173 indicates a comparison between energy contribution from the food group from the BRISK study (Bourne and Steyn, 2000) and the respondents' dietary intake from the various food groups.

The BRISK study shows that with increased exposure to urbanisation, energy intake from the meat, fruit and vegetables, and fats increases compared with energy intake from dairy and cereal foods, which show a decrease in consumption. Dietary intake by the sample was consistent with the BRISK study with regards to the level of intake from the dairy, meat and fat, except for fruits, vegetables, and cereals. The consumption of fruit and vegetables was significantly low for the sample, with an adequate intake (although limited in variety) of cereal foods.

Table 5.1 The Influence of Increasing Urban Exposure on Energy Contribution of Food Groups (19 – 44yrs old, N = 649, men and women combined – the BRISK study)

Food groups	% Life spent in a city			% Change between extremes of urbanisation	Level of Dietary Intake from Food Groups by the Sample
	0 – 20%	21 - <80%	80 – 100%		
Dairy	12.4	10.2	8.3	↓ 33	↓
Meat	24.4	24.8	27.7	↑ 14	↑
Fruit and Vegetables	14.3	17.4	17.0	↑ 19	↓
Cereal	43.7	37.2	32.5	↓ 26	↑
Fats	10.4	10.2	11.2	↑ 8	↑
Non-basic	13.2	20.2	15.4	↑ 17	

Source: Bourne and Steyn, (2000:S25)

Even though the prehistoric diet and the length of exposure to urban life of the respondents were not determined, the dietary pattern of the sample was westernized. This indicates that exposure of young-adults to an urban lifestyle has an influence on their dietary intake. However, it should be noted that over time there is little variation in the level of protein intake between rural and urban areas (Bourne and Steyn, 2000), but fat has an overall upward trend. Conversely, the proportion of energy derived from carbohydrate decreases in both urban and rural areas (Bourne and Steyn, 2000). The household setting of the sample suggests that food insecurity could possibly be a nutritional problem, not only with a family setting, but also with smaller household settings, particularly with free-living young-adults in urban areas. Young-adults need the necessary skills to make economic food decisions within their budgetary constraints (R200 – R299) without compromising the nutritive value of the diet. The influence of gender on nutrient intake by the sample, suggested that females could be more influenced by their environment compared with males. The sociodemographic variables (gender, socioeconomic status and ethnicity) provided an ecological perspective of the respondents' dietary pattern and nutrient intake. Therefore, the factors expanded the understanding by giving insight with regards to the dietary decisions made by sample.

5.2.2 THE NEED FOR NUTRITION KNOWLEDGE AMONGST YOUNG ADULTS

The results for subproblem two (sections 4.3:130) indicated that the respondents' nutritional knowledge is average. The respondents had a very vague understanding and awareness with regards to selected areas of nutrition. This emphasized the need for increased nutritional knowledge with specific reference to aspects of nutrition such as the use of food by the food and relationship between nutrients and good health.

5.2.3 THE IMPACT OF NUTRITION KNOWLEDGE ON NUTRIENT INTAKE IN YOUNG ADULTS

According to stanine categories the average nutrition knowledge score of the sample was 52% (Table 4.5:132). According to results obtained by Steyn, et al. (2000), the nutritional knowledge of students was poor. The nutrition knowledge test used in this study used the ICNE concepts based on specific areas of knowledge. The results revealed the following about the sample's nutrition knowledge:

The respondents were aware of nutrition concepts with regards to dietary habits. However, there was no correlative link between dietary and nutrient intake and nutrition knowledge scores, which is consistent with the literature (section 2.3.1.6:31, Table 2.2.2:32) for South Africa and the rest of the world (Steyn, et al. 2000; Harnack, Block and Lane, 1997; Trexler and Sargent, 1993. Levy, Fein and Stepheson, 1993). The value of the NKT was to measure nutritional knowledge and to identify shortcomings in different areas of this knowledge. The nutrition knowledge test did not measure attitude and motivation behind each respondent's choice of food. Therefore, it proved to be limited in terms of comprehension of nutritional knowledge by the respondents. However, a parallel association can be drawn between poor nutrition knowledge and poor nutrient intake. The scores for questions 5, 10, 12, 14, 16, 24, 26, 28, 30 and 33 were particularly low (section 4.3.2: 149). These questions were related to "The use of food by the body", "The relationship between nutrients and health", and "The way in which food is handled". Therefore, the impact of poor nutrition knowledge scores on nutrient intake emphasizes the need for knowledge on specific nutrition aspects by the sample.

The literature on dietary behavior and its relation to nutrition knowledge is contradictory, as shown in the literature review. Some researchers have found that nutrition knowledge is highly and positively related to dietary behaviour (Betts, et al. 1997; Neumark-Sztainer, Butler and Palti, 1995). However, others have found little correlation between nutrition knowledge and actual food and nutrient intake (Steyn, et al. 2000; Harnack, Block and Lane, 1997; Levy, Fein and Stepheson, 1993; Trexler and Sargent, 1993). A moderate positive correlation was found between a few questions of the test and nutrient intake. However, the correlation did not have an impact on the nutritional adequacy by the respondents' dietary intake. Nutrition knowledge has been found to be generally poor amongst young-adults. According to Lilley and Johnson, (1996:23) nutrition knowledge tends to be more important to older adults than to young adults. Thus, young adults are resistant to change (Mederios, Shipp and Taylor, 1993:204) in terms of dietary behaviour.

The existing nutrition knowledge of the respondents can be attributed to various factors such as pervasive socio-cultural norms about eating, personal or public apathy or indifference to nutrition as an important concern when it comes to making food decisions. The other aspect of nutrient intake based on nutritional knowledge is related to accessibility of nutrition knowledge, poor coverage of and insufficient educational material (Love, 2000). For the purpose of this study the respondents' source of nutrition information was not determined. It has been acknowledged that there is a likelihood that dietary/health messages currently used for educational purposes in South Africa are inappropriate because they do not reflect relevant health issues, accessibility of and price of food as well as lifestyle, culture and socioeconomic circumstances of the population (Love, 2000). Nutritional knowledge has to be understood within the context of low socioeconomic status and food insecurity as a predictor for dietary behaviour.

Based on the household-setting of the respondents, a food budget of R200 per month, even though minimal, can provide respondents with a nutritionally adequate diet. However, the respondents must have the nutritional knowledge and the skill to purchase food economically without compromising the nutritive value of their diet. The development of the

FBDGs for South Africans was based on this understanding. They present an opportunity to be used as a foundation for the development of an authentic nutrition education programme aiming at improving the nutritional knowledge of South Africans, including young-adults, thereby improving their health status.

Within the context of the social learning theory (SLT), nutritional knowledge and other environmental factors influence dietary behaviour (Harnack, Block and Lane, 1997:307). This presents a challenge in terms of the approach needed to address barriers and factors that influence the dissemination of nutrition information for that could result in improved dietary behaviour and thereby improved health status. Therefore, the respondents' environment, including lifestyle, living arrangements and age, are vital for this purpose, even though it was found to be statistically insignificant. In this study, based on the NKT scores of the respondents, a nutrition educational programme can be formulated, built around the aspects found to be lacking in the respondents within a broader framework of their environment. However, it is still not clear which factors override health and nutritional concerns other than socioeconomic factors when it comes to dietary choice, which is an intermediate link to improved health status.

5.2.4 THE ANTHROPOMETRIC STATUS OF YOUNG ADULTS AGED 17 – 30 YEARS

The results obtained for subproblem three (section 4.4: 136) indicated that the majority of the respondents were of a healthy weight and body fat distribution in terms of BMI and WHR classification criteria. Similar findings are reported in Slabber, et al. (2000) and Steyn, et al. (2000). The value of anthropometry in adults is related to quantifying risk for susceptibility to chronic diseases. In South Africa, various researchers have found that the risk for developing chronic diseases of lifestyle have significantly increased (Love, et al. 2000; Senekal and Steyn, 1998) amongst the black population in both rural and urban areas (Peltzer, 2002). According to Kalk, (2001) the level of overweight in men 15 – 24 years of age in the country as a whole have increased from 11% to 44% and obesity from 2.7% to 15%. For women, (15 – 24yrs) overweight have increased from 29% to 55% and obesity levels from 9.4% to >44%. Black females in particular, have been found to be overweight and at risk for the development of obesity and diabetes mellitus in terms of an increased WHR. According to James, (2001), 80% to 90% of type II DM is associated with weight gain.

According to Kalk (2001), black female undergraduate students have relatively higher rates of overweight (18.2%) and obesity (6.5%) and nearly 12% aged ≥24 were obese (Kalk, 2001). The important and valid generalization as a result of these findings is that mortality from chronic disease is seen primarily in later life. It is assumed that the middle years are the breeding ground for two principal chronic diseases namely cardiovascular disease and cancer. However, it is suggested that juvenile diet and lifestyle may play a more important role than previously contemplated (Solomons, 2000). The comparison of the anthropometric values from research conducted amongst young-adults in South Africa (Pouane, et al. 2002; Steyn, et al. 2000; Wenhold, 2000 and Slabber, et al. 1998) and in the United States (Seymour, et al. 1997) presents a wave of consistent change, in terms of susceptibility to diseases due to lifestyle.

Studies indicating the anthropometric status of young black adult males in South Africa are limited. However, the current available data indicates that overweight and obesity is prevalent particularly among young black females. According to Pouane, et al. (2002), the

BMI values reported for males were: <18.5kg/m^2 (12.2%); >25kg/m^2 (29.2%) whereas 9.2% had abdominal obesity (WHR >1.0). For Females, the BMI values reported were: <18.5kg/m^2 (5.6%); >25kg/m^2 (56.6%) and 42% had abdominal obesity.

Table 5.2 Summary of Dietary Studies conducted amongst Young Adults: Anthropometric Assessment

Anthropometric Assessment					
	*Body Mass Index		#Waist-to-Hip Ratio		Comments
References	Females	Males	Females	Males	
[a]Pouane et al., (2002)	27.1	22.9	>.85	>1.0	Overnutrition prevalent among adult South Africans, particularly women due to age, level of education, ethnicity and residence
[b]Steyn et al., (2000)	22.3	-	0.73	-	22.9% of respondents had BMI ≥ 25; mean WHR of white students compared well with black urban students
[c] Wenhold, (2000)	22.4		0.8		Weight management practised by many subjects and body shape dissatisfaction were common
[c] Slabber et al., (2000)	19 – 24	-	-	-	76.9% Black and 77.2% white female students considered underweight attractive; "big is beautiful" being phased out amongst African blacks
[d]Seymour et al., (1997)	24.4	24.6	-	-	Females with higher BMI reported participating in physical activities; high BMI in males associated with physical activity, weight fluctuation and frequent eating

[a] Pouane, et al..Obesity Research (2002); [b]Steyn, Senekal, Brits and Nel; Asia Pacific J Clin Nutr (2000); [c] Wenhold; Slabber, Laubscher, van de Heever and Joubert; SA J Clin Nutr (2000); [d] Seymour, Hoerr and Haung; J of Nutr Educ (1997); * Mean BMI values reported; # Mean WHR values reported

The mean BMI of the studies used for comparison (Table 5.2:179) indicate that young-adults are of a healthy weight, but there is a prevalence of overweight. Findings in this study were consistent with results of the above studies. The BMI categories reported by female respondents in the study were <18.5kg/m^2 (9%); 18.5 – 24.9kg/m^2 (61%); 25 – 29.9kg/m^2 (17%) and >30kg/m^2 (13%). For males, the BMI categories reported were <18.5 kg/m^2 (8.7%); 18.5 – 24.9 kg/m^2 (75%); 25 – 29.9 kg/m^2 (9.8%) and >30 (6.5%). In terms of body fat distribution, females had a WHR of <0.8 (85%); 0.8 - 1.0 (13%) and >1.0 (2%), respectively. For males, the WHR categories reported were <0.8 (67.4%); 0.8 – 1.0 (30.4%) and >1.0 (2.2%). However, a higher percentage of females (30%) were overweight and obese when compared with males (16.3%). The majority of the respondents had a desirable body fat distribution. Fifteen percent of female respondents were at risk for chronic diseases related to greater WHR values when compared with males (2%). These results confirm the increasing rate of obesity amongst young-adults, particularly in black females, as found by Pouane, et al. (2002); Steyn, et al. (2000), and Bourne and Steyn (2000). The prevalence of NIDDM in urban Black South Africans varies between 4.8% and 8.0% (Steyn, et al. 2000). The increased risk of obesity-related problems varies according to population. Table 5.3:180 indicates the new classification for assessing risk based on the BMI and WHR of Blacks, Whites and Asians.

Table 5.3 The New Classification Criteria for BMI and WHR of Blacks, Whites and Asians

Obesity Class			**Chronic disease risk relative to normal weight and waist circumference**			
			Waist circumference			
			Black/White		**Asian**	
			Men ≤ 102	**>102**	**<90**	**>90**
BMI(kg/m²)	**Black/White**	**Asian**	**Women ≥ 88**	**>88**	**<80**	**>80**
<18.5	Underweight	Underweight	Low (but incr. risk of other clinical problems)	Low (but incr. risk of other clinical problems)	Low (but incr. risk of other clinical problems)	Average
18.5 – 22.9	Normal	Normal	-	-	Average	Increased
23.0 – 24.9	Normal	Overweight	-	Increased	Increased	High
25.0 – 29.9	Overweight	Obese	Increased	High	High	Very High
20.0 – 34.9	Obese	Severe	High	Very High	Very High	Extremely High
35.0 – 39.9	Severe	Extreme	Very High	Very High	Extremely High	Extremely High
>40	Extreme	Extreme	Extremely High	Extremely High	Extremely High	Extremely High

Source: James, (2001:559), Continuing Medical Education

According to the above classification criteria, Black females are now comparable to white counterparts. In addition, they are not considered be at risk for chronic diseases relative to weight status and WHR. The new classification criteria challenge the interpretation of anthropometric values of the black population based on the previous criterion. Therefore, the interpretations of the respondents' anthropometric values need to be understood within this context. Increased BMI and WHR have been associated with a higher energy intake (Steyn, et al. 2000) and physical inactivity (Seymour, et al. 1997). In this study BMI and WHR values of the respondents remained constant at various levels of energy intake and no unique trends were observed. However, respondents that had WHR of >0.8 and a BMI of >25kg/m^2 had a higher energy intake from saturated fat >40%. This also illustrates the shifts in food choices influencing the macronutrient trends observed due to urban exposure (Solomons, 2000). According to Steyn, Kazellenbogen, Lombard and Bourne, (1997) obesity is associated with a degree of urbanisation and unhealthy lifestyle in the Black population of the Cape Peninsula. Respondents found to be underweight (8.9%) had an adequate mean energy intake (7916.2 kJ), that is, 74% of the RDA. The percentage of respondents that were underweight (8.9%) was comparable to the findings of Pouane, et al. (2002). A correlative link was not found between anthropometric values and physical activity. However, respondents (47%) who participated in some form of physical exercise had healthy BMIs.

The anthropometric profile of the respondents also proved that there is a change in body shape amongst black females from that of a "big figure". This could suggest that black females have become more figure conscious and the desire for a lower body weight which is a Western norm of beauty, make them comparable to their white counterparts in South Africa in terms of anthropometric profile (Table 5.3:180). However, a lower body weight does not override the risk to degenerative diseases later in life since their weight status is not consistent with their dietary pattern and nutrient intake. In addition, it is important to acknowledge the prevalence of the HIV/AIDS epidemic in SA, which is rapidly gaining momentum, and could become the most common cause of morbidity and mortality compared with chronic diseases of lifestyle in SA. According to Bourne and Steyn, (2000) HIV/AIDS has the potential of shifting incidences and distribution of diseases in South Africa with its transmission escaping preventative control.

5.2.5 NUTRITIONAL ADEQUACY AMONGST YOUNG ADULTS

The results for subproblem four indicated that nutrient intake by the respondents was inadequate for a significant number of nutrients (section 4.5:143). The nutrient standard (RDA) was used to measure the level of nutrient intake against the requirements for age and gender. Various researchers have indicated that young-adults have an inadequate nutrient intake (Oldewage-Theron, et al. 2000; Vaughan, Benyshek and Martin, 1997; Koszewski and Kuo, 1996). Dietary intake by the respondents was insufficient and lacked variety. Subsequently, intake of nutrients such as calcium, iron, zinc, vitamin A, riboflavin, niacin, vitamin B_6, folate, vitamin C, vitamin E, biotin, iodine and selenium were inadequate. The percentage of young-adults with an inadequate micronutrient intake (Figure 4.33:156) was significantly higher in this sample when compare with findings of the study conducted at the UOFS (Figure 2.2:21) by Badenhorst, et al., (1998). Inadequate nutrient intake amongst young-adults has been associated with various factors such as, gender, socioeconomic status (Milligan, et al. 1998), nutritional knowledge (Steyn, et al. 2000) and low consumption from fruit, vegetable and dairy food groups (Labadarios, 1999).

According to Oldewage-Theron et al., (2000), iron deficiency is widespread among South African females between 13 to 25 years of age as a result of eating a plant-based diet containing low levels of poorly bio-available iron. A significant difference was also found between genders in the intake of non-haeme and haeme-iron in this study. Iron intake was higher for males irrespective of the form of iron compared with females. Food sources of iron are found in both animal and plant foods. Plant foods contain up to 60% of non-haeme iron and 40% of animal foods contain haeme-iron. A higher intake of iron from plant sources could be due to plant foods being more readily available and affordable than animal foods, which are known to be expensive (Williams, 2001).Table 5.4:184, is a summary of dietary studies conducted amongst young-adults indicating nutrients at risk for inadequate consumption.

Researchers have found similar nutrients to be of low intake by young-adults, in South Africa and the rest of the world. According to Steyn, et al. (2000) micronutrients that appear to be most deficient in the diet of young-adults are calcium, iron and zinc, as well as vitamin B_{12}, folic acid and iodine (Solomons, 2000). Similar nutrients are found to be of low a intake by South Africans including magnesium, riboflavin, vitamin A, vitamin B_6 and vitamin C. According to Solomons, (2000) the common denominator of food insecurity and inadequate energy intake is the risk of inadequate micronutrient intake. In accordance with the prudent dietary guidelines the respondents' dietary pattern did not resemble a typical high fat, low fibre diet. Respondents included sufficient fibre in their diet and total fat intake was within recommended levels when compared to the prudent dietary guidelines. According to Milligan,et al. (1998) in a study conducted in Australia, fibre intake was less than 30g/day for 93% and 77% of females and males, respectively.

Table 5.4 Summary of Dietary Studies among Young Adults: Dietary Evaluation

Reference	Population	Dietary Intake method	Sampling	Nutrients of concern for low intake	Comments
[a] Steyn et al., (2000)	South Africa – University of the North (n=115)	Quantified food frequency questionnaire, anthropometry	Convenience	Calcium, zinc and iron	Prevalence of Black females with a BMI of ≥ 25, poor nutrition knowledge
[b] deGonzague et al., (1999)	North America – Ojibwe - (n=104)	24Hour Recall, Food Frequency Questionnaire	Randomly Selected	Vitamin A, folate, calcium, iron and zinc	Fat contributed 37% (for men) and 40% (for females) of energy intake
[c] Bardenhorst et al., (1998)	University of Orange Free State	24Hour Recall, Food Frequency Questionnaire		Calcium, vitamin A and Zinc	Insufficient intake of micronutrients
[d] Horacek and Betts, (1998)	Lincolin – University of Nebraska – (n=325)	Food Frequency questionnaire	Clustering	Vitamin A, vitamin C, fibre, iron, calcium and folate	Moderate to high energy intake, higher energy intake from fat
[d] Horacek and Betts, (1998)	New York – Syracuse University – (n=302)	Food frequency Questionnaire	Convenience	Not indicated	Low consumption of dairy products, mean fat intake higher than the recommended level of 30%, dietary quality mediocre
[b] Georgiou et al., (1997)	Arizona, Idaho, Iowa, Kansas, Michigan, Nebraska, New York, Oregon and Winscosin – (n=1338)	Food Frequency Questionnaire	Randomly Selected	Not indicated	Low consumption of vegetables, dairy products
[b] Koszewski and Kuo, (1996)	New York and Central California – (n=246)	Food Frequency Questionnaire	Randomly Selected	Energy, calcium and iron	Ability to obtain food at a good value affected the adequacy of the diet
[c] Van Eeden and Gericke, (1996)	Vista University, SA – (n=434)	24Hour Recall	Convenience	Not indicated	Total dietary intake was found to be sub-optimal

Source: [a] Asia Pacific Journal of Clinical Nutrition (2000); [b] Journal of the American Dietetic Association , (1999), (1997) and (1996); [c] South African Journal of Clinical Nutrition, (1998); [d] Journal of Nutrition Education, (1998) and (1997)

Seventy-eight percent of the respondents reported less than 35% of energy from total fat compared with 22% who consumed >35%. Sixty-nine percent of the respondents had less than a 10% energy intake from saturated fat compared with 31% who consumed more than 10%. More than 50% of the respondents consumed less than the recommended intake of MUFAs and PUFAs. The intake of monounsaturated fats reported by the sample was <15% (78%) and >15% (22%). For polyunsaturated fat, the intake categories reported by the sample were <10% (82.3% and >10% (17.7%). In the similar study (Milligan, et al. 1998), fat intake exceeded 30% of energy for 80% of respondents, and was greater than 40% for 20% of the respondents. Saturated fats contributed to more than 10% of dietary energy intake for more than 90% of respondents. Less than 1% of the sample achieved a PUFA to SFA ratio of at least one. Primary sources of MUFA and PUFA such as olive oil, avocado, nuts, seeds, fish and fish oil were seldom consumed by the sample. Respondents reported a consumption of sunflower oil and hard margarine. Energy-dense foods such as pastries, cookies and pies were marginally consumed by the sample, thus 68% proved to be of healthy weight. Therefore, energy intake by the sample was provided by carbohydrates, rather than energy-dense foods. Foods contributing to fat intake in the study of Milligan, at al. (1998) included convenience foods and meats. Although, results in this study illustrates that respondents' diets met the prudent dietary guidelines, their diets indicated a shift in the direction of a Western diet, an adequate energy intake and an imbalance in micronutrient intake.

The respondents' dietary intake proved to be inadequate in terms of quality when compared to the SA Food Based Dietary Guidelines. Respondents did not include sufficient amounts of fruits and vegetables, legumes and animal foods, particularly dairy products (Table 4.9:152) Over 50% of the sample did not consume fruits and vegetables and 68% did not include legumes in their daily diet. Foods from animals were consumed only a few times a week and the portion size was less than the suggested serving. With the lack of variety, nutrients such as iodine, calcium, vitamin A, zinc, vitamin C, riboflavin, vitamin B_6, iron, magnesium and folate were of a significantly low intake (Figure 4.33:156).

Significant differences between genders were found for nutrients such as energy, plant protein, carbohydrate, fibre, iron, magnesium, copper, manganese and phosphorus (section

4.2.1:101). Males reported higher nutrient intakes for their reference compared with females. According to Milligan, et al. (1998), differences found between genders were in the intakes of calcium; magnesium potassium, vitamin C and vitamin A, and females had higher intakes compared with males. However, findings in this study are consistent with the current research criteria. Other nutrients found to be of a low intake by the sample were copper, chromium, selenium, manganese, biotin, vitamin E and vitamin K. However, current research has not indicated the prevalence of inadequate intake of these nutrients and trace elements.

To estimate the prevalence of inadequate usual intakes of nutrients can be challenge. Mean intake values do not indicate the percentage of respondents who are at risk of having an inadequate intake. The distribution of intake during a single day does not accurately capture the distribution of people's usual intakes because of substantial day-to-day variation in intakes (Suitor and Gleason, 2002). Arbitrary percentages were used to indicate the prevalence and distribution of inadequate nutrient intakes by the sample (Table 4.10:154). Assessment of nutritional status was done using the relevant research criteria in terms of estimating the prevalence of inadequate nutrient intakes by comparing it to an arbitrary percentage of the RDA (67%). The RDAs are set at the mean requirements plus two standard deviations as a margin of safety.

The standard deviation for nutrients indicated wide variation in levels of adequacy on males and females to age and socioeconomic status. The intake of iodine, calcium, vitamin A, zinc, vitamin C, riboflavin, vitamin B_6, iron, magnesium and folate was significantly low ($\leq$67%) for the sample. Standard deviation of vitamin A (1187.0µg) and vitamin C (169.5mg) indicated wide variations in levels of adequacy for both males and females. Therefore, the results of this study provides an opportunity for a more precise and customized approach to defining and designing quantitative recommendations for dietary intake, with the realization of the beneficial role of micronutrients and the impact of lifestyle, environment, socioeconomic status and nutritional knowledge for the food choices of respondents.

5.3 THE RESEARCH PROCESS

5.3.1 METHODOLOGY

The following descriptive survey methods were used for obtaining the data:

- the interview conducted with respondents consisted of questionnaires (Sociodemographic, NKT, Anthropometry, 24hour recall and FFQ), which was completed by the sample of free-living young-adults, aged 17 to 30 years enrolled at the Durban Institute of Technology, Steve Biko Campus.
- the formally structured interviews were conducted by trained and standardised interviewers, and completed by the sample.
- the NKT was completed by the sample

For sampling purposes, the total population of free-living young-adults at Steve Biko Campus was included in the survey. However, despite efforts of encouraging and locating the respondents to participate in the study proved these efforts proved to be futile. Therefore, a quota sampling method was used to fulfill the criteria set out in the delimitations for this study (section 1.2.3.1:7). This method of sampling resulted in 192 respondents being sampled 80% response rate, both females and males participating in the study. Even though the sampling method may indicate bias in the study, the procedures followed excluded sampling bias (section 3.4.2:66, 3.4.3:69). The large number of respondents made the sample representative of the free-living young-adults at Steve Biko Campus, in terms of gender and age. Therefore, it is possible to extrapolate the results of this study to a similar population in South Africa.

5.3.2 THE DESCRIPTIVE SURVEY QUESTIONNAIRES

In the design of the questionnaires, it was assumed that the respondents were fluent in English and the interviewers were fluent in both English and Zulu. The possible language and cultural barriers were therefore overcome. The interviewers had studied nutrition as a subject up to the third year level of study and completed a three-day training course. The interviewers understood the relevant nutrition concepts and procedures to be followed in administering the questionnaires. This enabled to the respondents' responses to be honest, accurate and constructive. Lack of contradiction and apparent lack of confusion in the interpretation of the responses given, indicated that these assumptions were valid (section 4.2:97). The low level of non-response rate limited the influence of age and ethnicity on nutrient intake, due to representation of the sample.

The use of trained and standardised interviewers to administer the questionnaires was beneficial, as not only did using trained interviewers eliminated bias, but also the duration in which the interview was conducted was reasonably shorter. This increased the validity of the results and ensured that the results based on respondents' responses were comparable to the current research criteria. Interviews were conducted in their mother tongue of the respondents, which eliminated problems related to language barriers.

The study was limited to free-living undergraduate learners, registered with the Durban Institute of Technology, Steve Biko Campus, ages of 17 to 30 years, as it was assumed that it would be their role to make food purchase decisions within their household-setting. Of the respondents surveyed, 100% of the respondents were responsible for their food purchase decisions. These findings validate this delimitation (section 1.2.3.1:7).

The questionnaire was broad in its scope due to its general nature, but limited in its depth due to time constraints. The purpose of the questionnaire was carried out as it indicated that the nutrient intake of the respondents is inadequate due to their gender differences, ethnicity, socioeconomic status and nutritional knowledge. The fact that the nutrition knowledge questions did not measure beliefs and motivation of the respondent's food choice in its context, proved to be limiting in the comprehension of the effect of nutrition knowledge by the respondents on food choice. However, nutrition knowledge related to various concepts of nutrition (ICNE) was measured. Therefore, its purpose was carried out in terms of identifying shortcomings in nutrition knowledge related to specific concepts of nutrition, providing a cognitive approach to interpreting the dietary intake of the respondents.

The anthropometric status of the sample was determined using the Quetelet's index (weight (kg)) divided by height (m^2) for weight status, and waist-to-hip ratio using waist and hip circumference to determine body fat distribution. Different BMI and WHR classification criteria were used for females and males. Despite the latter, it was found that more females are at risk for chronic diseases related to greater anthropometric values compared with males. A combination of anthropometric assessment methods was beneficial to the study as it overcame the fundamental limitations of the BMI in reflecting excess weight, and ethnicity-to-ethnicity inconsistency of overweight associated with a given BMI classification. The combination of anthropometry and dietary evaluation improved the credibility and reliability of the findings in terms of nutritional status of the sample. Comparability of the results among surveys of the relevant criteria in a South African context as well as globally, also eliminated this uncertainty.

Nutritional adequacy of the dietary intake of the sample was determined using the 24hour recall and the quantitative food frequency questionnaire. The 24hour recall and FFQ was conducted to obtain more precise estimates of portion sizes given by reference to single portion size food photographs of known weights, household measurements and direct weighing of some of the foods, thus reducing the level of measurement errors associated with estimation of portion size. Therefore, the magnitude and direction of random and systematic errors resulting from variability in the nutrient content of individual food items is unknown. The use of probing questions by interviewers in gathering dietary data related to serving and portion size was beneficial as it decreased non-response and increased accuracy among respondents that found it difficult to estimate usual portions and serving sizes. The nutrient data was derived from the gram weight equivalent estimated portion size of dietary intake reported in the 24-hour recall and FFQ. The dietary information was captured and analysed using the Food Finder Nutrient Analysis Package.

A similar procedure was followed with the FFQ. However, the FFQ was more complex since several recipes could be available for a single food item or some respondents' recipes were significantly different from that of database. Therefore, recipes formed the main database for linking the foods listed on the FFQ to the nutrients listed in the Food Finder Nutrient

Analysis. Seasonal availability of food items was considered in the evaluation of dietary intake and proved to be significant for fruit and vegetable intake by the respondents. The average serving size for each food group was calculated from the respondents' usual serving size of the food item from each food group. Some of the food items reported by the sample were mixtures requiring separation before their ingredients could be categorized into a food group, for example: hamburgers, sandwiches, stew with vegetables, breakfast cereal with milk and pasta dishes. Therefore, the dietary pattern of the respondents in terms of adherence to the food group was carried out, as it indicated that the respondents had a low intake from the fruit, vegetable and milk group, and a sufficient intake from the meat and cereal group (with limited variety).

Single dietary records (24-hour and FFQ) were obtained from the respondents, which could introduce bias to the validity of the data. A Pearson's correlation coefficient and paired t test suggested that this method was not relatively precise, which serves as a limitation of the study (Table 4.12:164). Therefore, the purpose of using the 24hour and FFQ was not completely carried out, even though statistical analysis proved that there is positive correlation (r=>.145 and p=0.000) between these measurements of dietary evaluation for certain nutrients.

A probability approach was used to reliably assess the prevalence of nutritional inadequacy (Gibson, 1990). The NAR represents an index of adequacy (>67%) for a nutrient based on the corresponding U.S. RDA for that nutrient. Therefore, this procedure validated the delimitation (section 1.2.3.5:8). Nutrient scores of the sample were not adjusted for extreme low and high intake. Therefore, the NAR reported in the study is based on reported dietary data and validated the assumption.

5.3.3 THE HYPOTHESES

During the time lapse since the survey was conducted and the study written up, the dietary habits and nutrient intake of the respondents have probably not changed.

In section 3.3.1:64, it was hypothesised that sociodemographic factors such as age, gender, socioeconomic status, gender, living arrangements, and ethnicity influence respondents' dietary habits this hypothesis was accepted. Gender, socioeconomic status and ethnicity were the strongest sociodemographic variables that influenced nutrient intake. The influence of these variables was noted. The literature and the current research criteria support this hypothesis.

The hypothesis for subproblem two (sections 3.3.2:64), was that the respondents' food choice is related to a lack of nutritional knowledge. This hypothesis was rejected as the nutritional knowledge of the respondents proved to be average, and above average on some of the nutritional concepts. However, the influence of nutritional knowledge on dietary intake was statistically weak and moderately positive in some instances, and thus fragmented. In terms of the literature, the influence of nutritional knowledge on dietary intake is contradictory. However, the moderate positive correlative link between nutrition knowledge and certain foods was noted (sections 4.3.2:134, Table 4.6:133) and indicated a certain level of influence.

In section 3.3.3:64 it was hypothesized that the respondents are malnourished in terms of weight status and body fat distribution. This hypothesis was rejected as it was proven that the majority of the respondents are of healthy weight and body fat distribution. Although there were cases of overweight and undesirable body fat distribution, these involved more females than males. However, in terms of the new classification criteria black females previously classified as overweight (25kg/m^2) are now considered to be of normal weight and may not be at risk for chronic diseases relative to weight status. This is supported by James, (2001).

The hypothesis for subproblem four (sections 3.3.4:64) was that the respondents consume irregular meals and have a nutrient intake that is inadequate when evaluated in terms of the Recommended Dietary Allowances, which was accepted. Nutrient analysis of dietary data proved that the respondents have a significantly low and limited consumption of foods from the food guide pyramid and have an inadequate intake of micronutrients. The literature and current research criteria (chapter two, sections 2.4:36) supported this hypothesis. The adequate intake of other micronutrients was noted (chapter four, sections 4.5.2:153, Table 4.10:154).

5.3.4 CONSTRAINTS ON THE RESEARCH PROCESS

5.3.4.1 The Survey Questionnaires

The descriptive survey included four questionnaires to determine sociodemographics, weight status, nutritional knowledge and dietary intake. The process relied on the compliance and participation of the respondents in terms of time and memory. This was time consuming for the respondents, thus increasing non-response and influencing the reliability of the responses. More food items could have been added on the FFQ to determine variety in the dietary intake of the respondents. This would have added more pressure in terms of the respondents' willingness to spend more time being interviewed. Some of the questionnaires were done in segments to encourage the respondents to participate and this could have influenced the respondents' responses.

Even though the purpose of the nutrition knowledge test was explained to the respondents, a substantial number of respondents were more concerned about the merit score of the test than the intent of the knowledge questions. However, the interviewers were trained in ensuring that the respondents were relaxed and fully understood the questions, as well as the purpose of the test. The average nutritional knowledge score of the respondents could have been due to their general awareness. The source for nutrition knowledge of the respondents could have been determined in order to determine accessibility of nutrition information. However, the NKT score give an indication of the content a nutrition education programme should encompass.

5.3.4.2 Selection Criteria

Problems were experienced in the selection criteria for the free-living respondents who studied at the DIT, Steve Biko Campus. Attempts were made in trying to encourage participation by the free-living population of the DIT, Steve Biko. The data generated by the Technikon Information Management Office for the population did not consistently give the correct addresses for the respondents, or misclassifying them according to their various living arrangements, thus making it difficult for them to be located. Problems were also encountered in locating participants using their field of study due to timetable complications. Potential respondents did not honour appointments made due to lack of commitment.

Therefore, participants were selected using a quota sampling method from residences known to be of a free-living setting such as Color Court, Student Village, Breheny, Myrtle and Shiela Court,. However, the procedure followed in conducting the survey when this was encountered increased the validity of the study. The results of this study showed that the monthly food expenditure by the respondents is R200-R299. This should be taken into account when designing a nutrition education programme since cost of food is one of the barriers to dietary change and compliance with nutritional guidelines. The results indicated that there is an association between nutrient intake and ethnicity, particularly for the intake of riboflavin, calcium and niacin. However, these results need to be carefully interpreted due to the ethnic representation by the sample. Zulu respondents represented the majority of the sample when compared with other ethnic groups.

The age category reported by the majority of the respondents was 19 to 24 years (84%). Respondents over the age of age 30 were eliminated from the study, as most of them were employed and likely to be married and did not reside in a free-living setting. This need to be considered in terms of nutrient needs of the target population and the target population the nutrition education programme is intended for. It is likely that nutritional benefits in terms of food consumption are not a priority with this particular age group. Studies have shown that nutritional information seemed to be more important to older adults when compared with young-adults. However, nutrition education could be of great benefit to this segment of the population since their age has been known to be linked to chronic diseases of lifestyle.

5.4 RECOMMENDATIONS

The high prevalence of inadequate food patterns among respondents demonstrates the need for effective and wide-reaching strategies aimed at modification of eating behaviour. The need for a nutrition intervention is further exemplified by findings from research studies that have suggested that eating behaviour during young-adulthood may have an impact on immediate and long-term health outcomes. The challenge lies in the development of interventions that are effective in increasing motivation among the youth and in decreasing barriers to eating a healthful diet and being physically active. The inverse associations between socioeconomic status and food intake patterns and overweight status point to the need for targeting young adults young-adults from low socioeconomic backgrounds with suitable interventions.

The SA FBDGs are an attempt to provide consistent nutrition messages in a non-segregating manner, for individuals that are over- and undernourished. According to Love and Bourne, (2001), the SA FBDGs have been developed in view of specific health issues, availability, accessibility and price of food within the country; and acceptability in terms of the population's lifestyle, cultural diversity and socioeconomic status. Therefore, they can be used as one of the tools in formulating a nutrition education programme to improve dietary patterns of young-adults.

In order for the nutrition education programme to be of real benefit to young-adults, it is recommended that:

- The relevant strategies that have been established by the nutrition fraternity in South Africa in order to facilitate nutrition interventions be identified and incorporated into the design of a nutrition education programme. This will ensure that the nutrition education programme designed is credible and within the structural approach and goals for South Africans.
- Information channels that the target group is exposed to, for example magazines, television, and health services within an institution should be identified in order to be used as part of the strategy for accessibility of nutrition information. Nutrition education needs to be part of the broader framework of educational information accessible to the youth, for example the "Love Life" campaign. All effective models of reaching young-adults need to be utilized.
- Positive dietary practices of young-adults need to be identified and used as a basis for nutrition education, thus making the formulated nutrition education programme authentic and relevant to the group.
- The influence of identified shortcomings of nutritional knowledge on dietary intake need to be made apparent in order to incorporate nutrition knowledge relevant to the target group as part of the nutritional education programme.
- The presence of food insecurity in free-living households needs to be acknowledged for this age group in order to formulate a nutrition education programme (using SA FBDGs). The programme should not focus only on limited food and micronutrient intake but should also encourage economic food choice. Nutrition information promotes a positive change in food choice. Through effective education, young-adults would be empowered to make informed food purchase decisions with confidence.

Nutritional guidance is an inexact science. It compromises of two seemingly competing goals: nutrient adequacy and moderation, and what can be achieved with the kinds and quantities of foods available to the target population.

In order to implement the nutrition programme the following are recommended:

- Nutrition messages need to focus on encouraging dietary variety that leads to increased intakes from food groups which are currently infrequent in the young-adult's diet. This is important to ensure that micronutrient intake and energy intake increase where appropriate, and prevent increased intake for individuals who already have an adequate energy intake.
- Concern for health risks among young-adults needs to be assessed, as it is speculated that promoting benefits of dietary practices may not be sufficient to encourage dietary change. Including a high motivational value to facilitate change in eating habits, suggests that nutrition information could be potentially useful in encouraging young-adults to improve their dietary pattern. Individuals need to have skills; an abstract thinking ability (i.e. understanding that a healthy diet influences health); consumer skills related to basic knowledge of nutrition; and mathematical skills (an ability to spend the food budget wisely in terms of nutrients) (Van Eeden and Gericke, 1996).
- Using the food group composite in the formulation of a nutrition education programme, the number of food groups and subgroups patterns needs to be assessed in terms of adjustments that may be required to meet the new DRIs for calcium, magnesium and folic acid.

- Determining the impact of food fortification on the expected nutrient profile for a particular food group within the requirements for age and gender, thus testing the changes that may occur to total energy and nutrients other than the ones targeted.

Evaluation of the nutrition educational programme should be made to measure its success and to identify areas that can be improved on. Key points in the evaluation process would include:

- An assessment on how the programme is running operationally;
- An assessment of the programme's content and context for relevance;
- Administering the same questionnaire to test the prevalence of nutritional inadequacy and nutritional knowledge before and after the initiation of the programme;
- An analysis of the respondents dietary pattern and susceptibility to chronic diseases
- Assessing the level of awareness and concern of health risks and benefits of health dietary practices by the target group;
- Assessing the budgetary skills related to food purchase decisions by the target group;
- Assessing the level of exposure to relevant nutrition information by the target group.

Because of the time constraints not all the factors, which impact on the formulation of a nutrition education programme for young-adults, were researched. The trends observed in this study suggest the following areas for future research:

- Exploring various ways to increase the response rate within this age group to participate in dietary studies in order to determine the extent of bias introduced by age and ethnicity represented by the sample;

- An in-depth evaluation of nutritional knowledge, including motivational factors and beliefs that influence young-adult's food choices and therefore nutrient intake;
- A further investigation of the impact of factors such as ethnicity, living arrangements and level of education which may influence the dietary pattern of young-adults;
- Identification of information channels suitable for encouraging young-adults to use nutrition information in making healthy food decisions;
- Availability and accessibility of relevant nutrition information to the targeted group;
- The effectiveness of the nutrition knowledge test based ICNE concepts in assessing the nutritional knowledge of the South African population in terms of comprehension;
- The prevalence of overweight and obesity states among young-adult males and females;
- The recommended level of intake from food groups in order to comply with the SA Food Based Dietary Guidelines;
- The short-term outcome of nutritional inadequacy within this phase of life-cycle (young-adulthood);
- The prevalence of inadequate iodine intake and the impact of inadequate dietary trace elements;
- Effectiveness of SA FBDGs as a tool to formulate and design nutrition education programmes focusing on promoting healthy eating within low socioeconomic groups.

In conclusion, the results of this study suggest that young-adults have an inadequate nutrient intake, and there are incidences of overnutrition for a portion of the sample. Even though there was statistically no significant correlation between nutritional knowledge and nutrient intake by the sample, the existing level of nutrition knowledge and inadequate intake from food groups emphasizes the need for a practical, relevant and tailored nutrition education programme. The findings of this study emphasize that this segment of the population is at greater risk for nutritional inadequacy due food insecurity and thus predisposed to chronic diseases of lifestyle in a South African context.

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7. ANNEXURES

Annexure 7.1

M E M O R A N D U M

TO: BREHENY RESIDENCE/ COLOR COURT/SHEILA COURT/MYRTLE COURT AND STUDENT VILLAGE

CC: SUPERVISORS: D. Anderson
Lecturer Dept of Food and Nutrition
S. Kassier
Sen. Lecturer Dept of Food and Nutrition
HOD : S. Vermeer
Dept Food and Nutrition

DATE: 2001-10-02

FROM: ZAMA NTULI
FOOD AND NUTRITION

SUBJECT: TECHNIKON NATAL STUDENTS SELECTED FOR A RESEARCH STUDY

I am a staff member in Department of Food and Nutrition and currently a registered student for Mtech: Food and Nutrition, student number 9118349. I hereby request your assistance in participating in the research study, in the form of an interview. The students requested to participate are registered full time students living in the Block. The interview takes 30 minutes with the assistance of a fieldworker. The survey will commence on Monday 5 November 2001.

Thanking you for your assistance in this matter

Zama Ntuli
Lecturer/Student: Department of Food and Nutrition

Annexure 7.2

NOTICE

DEPARTMENT OF CONS MAN & QTY SURV

The following students have been randomly selected to participate in a research study, and are therefore are requested to come to the Department of Food and Nutrition

9902040	KEMP, S	(BUILDING)
0104319	LUTHULI, NN	(BUILDING)
0104618	MATIMA, MG	(QTY SURV)
0102797	MBIZA, NN	(QTY SURV)

DATE:	Tuesday, 2001-08-21	11:00 – 16:00
	Wednesday, 2001-08-22	09:00 – 16:00
	Thursday, 2001-08-23	09:00 –16:00
VENUE:	S9 LEVEL 2 RM 211	

The students will receive a token of appreciation. But, I have been advised not to make this publicly known as it might make the study biased.

Thanking you for your assistance in this matter.

ZAMA NTULI
LECTURE: DEPT OF FOOD AND NUTRITION

Annexure 7.3

The Student Study Sample

STUDENT NUMBER	GENDER	DATE OF BIRTH
0000308	Female	16/06/83
0000309	Female	04/01/81
0000809	Male	14/03/82
0000986	Male	23/12/70
0001005	Female	02/02/79
0001007	Male	22
0001122	Male	01/10/78
0001130	Male	20/02/69
0001911	Male	19/11/77
0002576	Female	02/02/81
0002722	Female	10/05/80
0002753	Male	26/10/81
0002852	Female	16/01/82
0002901	Female	29/05/81
0002903	Female	15/06/83
0002937	Male	12/09/74
0003041	Male	21
0003044	Female	18/09/80
0003304	Female	06/06/80
0003374	Female	04/04/83
0003411	Male	20
0003411	Male	02/02/81
0003451	Male	23/03/80
0003541	Female	02/02/82
0003566	Female	06/03/82
0003635	Male	24/08/79
0004039	Female	24/05/82
0004121	Female	24
0004129	Female	28/04/77
0004135	Female	07/06/78
0004295	Male	02/04/80
0004433	Female	16/04/80
0004728	Female	02/05/78
0005131	Male	02/02/78
0101095	Female	13/09/83
0101167	Female	05/05/82
0101344	Female	02/02/74
0101443	Female	06/07/83
0101448	Female	20/02/81
0101466	Male	19/12/81
0101478	Male	20
0101565	Female	11/01/84

0101745	Male	02/02/80
0101751	Female	12/12/72
0101827	Male	06/04/79
0102166	Male	21
0102190	Male	01/12/77
0102199	Female	02/02/83
0102205	Female	15/02/83
0102421	Female	26/09/81
0102508	Male	28/06/82
0102735	Male	26/09/71
0102776	Male	02/02/83
0102857	Female	30/04/82
0102889	Female	19/04/83
0102909	Female	18/11/82
0103080	Female	31/05/83
0103350	Male	23/03/82
0103373	Male	26/09/81
0103407	Male	13/01/82
0103416	Male	03/09/82
0103472	Female	27/03/83
0103681	Female	27/06/80
0103897	Male	21/04/77
0103958	Male	16/06/77
0105455	Male	21
0200135	Male	22/02/83
0200943	Female	18
0202458	Female	12/11/82
0202460	Male	15/09/82
0202502	Female	19
0202519	Male	08/11/83
0202589	Female	29/05/81
0202608	Male	22/02/81
0202613	Female	20
0202617	Female	18/09/82
0202641	Female	19
0203121	Female	20
0252330	Female	04/07/84
0252346	Female	09/04/83
0252415	Female	17
0252603	Female	20
0270118	Male	19
9454721	Female	26/06/75
9609600	Female	06/04/76
9610609	Female	12/09/78
9610767	Female	28/04/76
9701791	Male	05/05/77
9702502	Male	24/08/77

9702660	Female	10/03/78
9703043	Male	13/04/78
9703297	Male	18/02/79
9703550	Male	14/02/79
9703902	Male	28/01/77
9704224	Male	15/08/79
9704305	Male	11/07/81
9705089	Male	23/01/74
9705868	Female	25/06/79
9705943	Female	07/10/78
9706963	Female	07/02/79
9707113	Female	14/04/79
9800372	Male	16/12/77
9800415	Male	04/04/78
9800496	Male	08/05/79
9800979	Female	17/06/78
9800991	Female	29/11/79
9801005	Female	08/07/76
9801011	Male	27/12/76
9801013	Female	17/04/79
9801030	Female	12/05/79
9801042	Male	02/02/80
9801493	Male	25/05/78
9801509	Male	22
9801707	Female	19/05/80
9803256	Male	28/02/79
9803683	Female	02/02/80
9803894	Male	06/10/77
9804028	Female	27/11/77
9804067	Female	29/12/80
9804111	Female	01/02/79
9804169	Female	08/12/80
9804182	Male	13/07/78
9804190	Male	25/12/78
9804268	Female	02/02/80
9804272	Male	09/06/79
9804433	Female	22
9804441	Female	18/06/80
9804448	Female	14/06/80
9804594	Male	31/05/80
9804642	Male	04/07/78
9804643	Male	21
9804678	Male	28/12/78
9804814	Male	26/09/80
9804890	Male	06/08/80
9804892	Female	12/08/79
9804995	Male	20/08/78

9805042	Male	05/01/78
9805249	Male	27/03/76
9805313	Male	17/07/77
9805317	Male	10/06/78
9805668	Male	13/03/77
9806082	Male	19/09/80
9806091	Male	05/10/80
9900300	Female	02/02/81
9900300	Female	20
9900390	Male	21/04/80
9900425	Male	21
9900598	Female	20/10/78
9900810	Female	01/12/80
9900889	Female	08/10/78
9901035	Female	21/03/76
9901047	Female	19/03/80
9901150	Male	02/02/81
9901160	Male	13/12/78
9901303	Male	22/05/75
9901480	Female	08/05/81
9901710	Female	18/11/80
9901979	Male	17/04/81
9902025	Male	06/01/80
9902057	Male	02/02/80
9902061	Male	12/10/80
9902111	Female	29/09/79
9902190	Male	01/01/80
9902276	Male	03/04/67
9902518	Female	13/06/78
9902768	Female	17/08/81
9902826	Male	21
9902901	Male	10/08/81
9902924	Female	28/10/79
9902985	Female	22/11/80
9903026	Female	03/10/80
9903145	Female	08/09/79
9903182	Female	21/01/77
9903281	Male	21/03/80
9903384	Male	02/02/78
9903498	Female	04/02/82
9903537	Female	20
9903538	Female	25/10/80
9903784	Female	19/12/76
9903792	Male	02/02/74
9903800	Female	21
9903963	Female	20/11/78
9903964	Female	02/02/81

9904035	Male	15/10/76
9904043	Male	22
9904106	Female	02/02/81
9904119	Male	16/11/81
9904123	Male	17/04/81
9904196	Male	15/02/77
9904230	Female	09/09/81
9904306	Male	02/02/80
9904418	Female	03/04/82
9904423	Female	03/12/81
9904480	Female	02/12/79
9904643	Male	22/05/81
9905108	Male	25/04/810
9934969	Female	23
9970061	Male	04/06/80
9970142	Male	28/04/78
9980151	Female	07/01/82
9981152	Female	25/05/78
9904106	Female	20

Annexure 7.4

FIELDWORKERS TRAINING MANUAL

(DIETARY DATA COLLECTION METHODS)

COMPILED FOR:	**RESEARCH STUDY CONDUCTED AT DIT: STEVE BIKO CAMPUS:**
	The purpose of the study is to evaluate the nutritional adequacy of student-eating habits at DIT: Steve Biko Campus and to measure the influence of nutrition knowledge and socio-demographic factors on existing eating habits for the compilation of a nutrition education program.

COMPILED BY: ZAMA NTULI
STUDENT NUMBER: 9118349
DEPARTMENT OF FOOD MARKETING AND MANAGEMENT

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1. OBJECTIVES

At the end of this training session the candidates must be able to:

- Understand the nature of the study and its objectives
- Understand the procedures in achieving the study objective
- Understand the importance of and theory related to nutritional assessment, including assessment tools and equipment selected for the study
- Understand the general principles related to the use of each assessment tool, namely; the demographic questionnaire, 24-hour recall and Food Frequency Questionnaire and Nutrition Knowledge Test (NKT)
- Measure and record anthropometric measurements accurately
- Record the necessary dietary data accurately and efficiently using the appropriate dietary assessment questionnaire/s.
- Understand the importance of commitment, interpersonal skills, and nutrition knowledge required for the purpose of the study
- Demonstrate good interpersonal skills while conducting interviews
- Complete an interview with each respondent accurately, consistently and successfully

2. OUTLINE OF THE THREE TRAINING

2.1 DAY 1

- The Study: The purpose of the study
  Calendar (2001) of the study
  Procedures to achieve the goals and objectives of the study
- Assessment tools and equipment:

  Height sticks, tape measures, weighing scales, Questionnaires (socio-demographic questionnaire, nutrition knowledge test (NKT), 24-Hour Recall and Food Frequency List).
- Fieldwork and the role of the fieldworkers:

  Requirements of the fieldworkers: Interpersonal skills, Nutrition Knowledge of the assessment tools and Commitment

2.1 DAY 2

- Introducing assessment tools and equipment:

  Theory related to Nutritional Assessment:
  - Anthropometric Assessment (Kinanthrhopometry in exercise and health manual by J. Hans de Ridder (2000), Nutrition Congress
  - Dietary Evaluation: 24-Hour Recall and Food Frequency List
  - Actual Dietary Processing: Treatment of the data gathered
  - Nutrition Knowledge Test
- Role of the Fieldworkers:

  Interviewing Skills
  Importance of Interpersonal Skills
  Knowledge of the nutrition assessment tools:

- Feedback

2.2 DAY 3

- Working with the assessment tools and equipment
  Role Plays
  - Taking anthropometric measurements
  - Working with questionnaires
  - Conducting interviews
  - Testing for consistency and standardisation of data gathering
  - Fieldworker repeats same measurements;
  - Other fieldworker to take the same measurements on the respondent
- Feedback

3. INTRODUCTION

The purpose of dietary assessment is to determine food consumption or nutrient intake in individuals or groups of people. Assessments vary from very precise estimates of nutrient intake in metabolic studies to broad estimates of the amounts of food available to the entire population. The reasons for carrying out dietary assessment vary widely. They usually relate to the need to understand the effects of diet on health.

Before undertaking dietary assessment, it is necessary to consider the exact purpose of the assessment. This includes, what is to be measured, in whom, over what time period, and how the measurements are to be collected. This determines which technique is most appropriate for a given purpose, and avoids wasting resources using a technique that does not generate appropriate data. All dietary assessments aim to measure food consumption or to estimate the intake of nutrients or non-nutrients. However, there is an underlying purpose, which dictates the level and nature of measurements to be made (Garrow, James and Ralph, 2000).

The purpose of the manual is to:

- explore the reasons for undertaking dietary assessment.
- outline the different techniques that are available
- clarify which techniques are appropriate for specific purposes
- consider errors that arise when assessing nutrient status and how to overcome them

4. THE STUDY

The research project was approved in 2000, and is to be completed by December 2001. The research project's calendar is attached (see Annexure 1). The success of the research project is dependent on understanding the procedural principles under which the research is being conducted. This means, understanding the purpose of the study, thus understanding the objective of all aspects of the study. This includes the subjects, and assessment tools and equipment.

4.1 What is the underlying purpose?

The purpose of the study is to evaluate the nutritional adequacy of student-eating habits at Technikon Natal and to measure the influence of nutrition knowledge and socio-emographic factors on existing eating habits for the compilation of a nutrition program.

4.2 What is to be measured?

In a given culture it is essential to know which substances constitute food or drink and which are taboo or unacceptable. The type of food consumed contributes significant amounts of nutrients. Therefore, it is vital to identify the important food sources n order to determine food consumption and measure nutrient intake. For the purpose of this study, determining patterns of food consumption is significant. Therefore, food and drink items have to be recorded in detail.

4.3 Whose diet is to be measured?

The study will be conducted amongst students at Technikon Natal, Durban Campus. For the purpose of the study, only free-living students will participate in the study. Data will be collected on an individual level. The choice of assessment method has considered literacy and the level of education of the subjects.

4.4 When is diet to be assessed?

In individuals, diet on weekdays and weekends may differ. The timing of administration of a dietary questionnaire (before or after a meal, for example) may influence the reported levels of consumption. For the purpose of the study, dietary data will be collected only on weekdays. Dietary patterns on weekdays tend to represent regular eating habits (Garrow, James and Ralph, 2000).

4.5 How is diet to be assessed?

The method of dietary assessment to be used includes the:

- 24-Hour Recall
- Food Frequency Questionnaire,
- Other methods include, Socio-demographic questionnaire and Nutrition Knowledge Test

5. <u>NUTRITIONAL ASSESSMENT</u>

- encompasses **anthropometric**, clinical, laboratory and **dietary evaluation**
- scope of assessment depends on the purpose and goals of the study
- may be brief and selective, e.g. height-weight measurements
- each has its advantages and limitations
- one is made more valuable by supporting information from one or more of the other facets of assessments

5.1 METHODS OF DIETARY ASSESSMENT:

5.1.1 ANTHROPOMETRIC ASSESSMENT (Appendix A)

- science of measuring the human body, commonly height and weight
- triceps, skinfold, subscapular skinfold, sometimes skinfolds from other parts of the body, and midarm and wrist circumferences values are frequently obtained

• **Height**

- genetically determined
- maximum height – assume optimal nutritional and environmental conditions
- malnutrition – may prevent an individual from reaching optimum height

• **Weight**

- body weight in excess of some set standards, i.e. overweight and obesity (excessive body fat)
- singled out as a major nutrition and public health problem
- measured using a beam-balance scale with non-detachable weights or a digital scale

• **Height-Weight Standards**

- Metropolitan Life Insurance Company height-weight tables commonly used for adults
- range of weights and heights is consistent with good health and well being
- "healthy" or "reasonable" weight has replaced "ideal" or "desirable" as the standards

- **Body Mass Index (BMI)**

- an indicator of body fat or mass content
- calculated from height and weight data

- **BMI =** $\dfrac{\text{Weight, kg}}{\text{Height m}^2}$

Example: Individual's Height: 167cm or 1.68m, Weight: 54kg

$$\text{BMI} = \frac{\text{Weight, 54kg}}{\text{Height, 2.79 m}^2} = 19.4$$

- **Waist-to-hip ratio:**

- Determining weight and levels of overweight and obesity is complex, since both body weight and fatness are involved

- obese individuals by weight standards, also have excess amounts of fat, with the exception of well muscled athletes

- there is evidence that not only excess adipose tissue is important for health, but its location namely:

1. **Andriod** or apple configuration – abdominal or upper body fat
2. **Gynoid** or pear-shaped deposits – thighs, hips, and buttocks

- waist-to-hip (abdominal to gluteal) ratio calculated

- for example, male waist 137.5 cm, hips 112.5 cm

$$\frac{\text{waist} \div \text{hips}}{\text{Waist, 137.5} \div \text{Hip, 112.5}} = 1.22$$

- ratio = 1.22 (person would be at risk)

5.1.2 ANTHROPOMETRIC EQUIPMENT

- Tapes
- Calipers
- Weighing scales
- Height stick

5.1.3 TECHNIQUES IN TAKING AND RECORDING ANTHROPOMETRIC MEASUREMENTS

- Refer to Kinanthropometry in exercise and health Manual, by J. Hans de Ridder from Nutrition Congress 2000.

- **WEIGHT**

Electronic scales will be used to measure weight.

- **How to measure weight:**

1. Place the scale on a firm, flat surface
2. The person that has to be measured must be barefoot and wear light clothing
3. Let the person stand on the scale and take the reading to the nearest 0.5kg

- **HEIGHT**

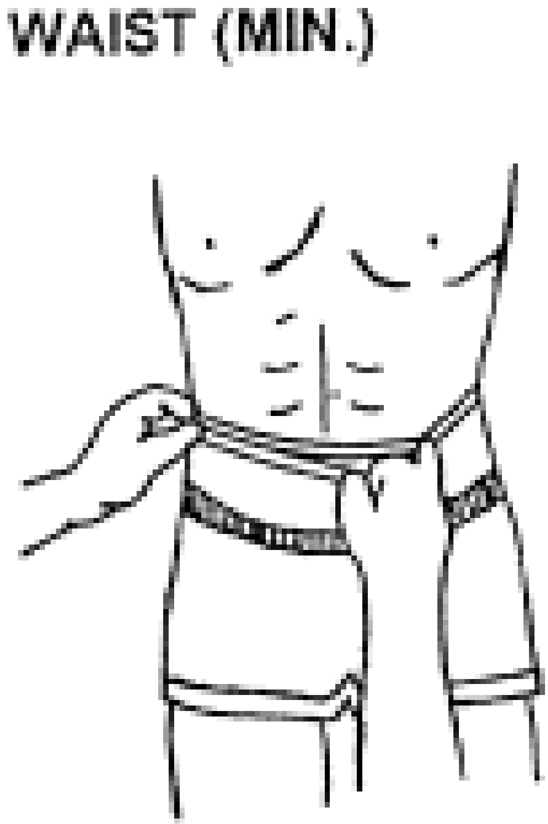
1. The person must stand barefoot, with his/her back against the stick. The feet must be together and the heels must be firmly on the ground touching the stick. The legs and back must be straight.

2. Now straighten the head with your hands so that a line drawn between the corner of the eye and the point where the top of the ear joins the head, would be at right angles to the height stick. A sliding headpiece is lowered to the vertex of the head. See illustration below:

- **WAIST CIRCUMFERENCE**

1. Participants stands straight up
2. The measuring tape is placed around the waist two fingers above the belly button. In difficult cases, for instance obese persons, stand behind the participants to find the narrowest part of the waist.
3. The measuring tape must be parallel to the ground. On side must not be higher than the other.
4. Do not let the tape cut into the participants.
5. The measurement is taken to the nearest 0.1cm after expiration. See illustration below:

FIGURE 5.1.3.2 **TAKING WAIST CIRCUMFERENCE**

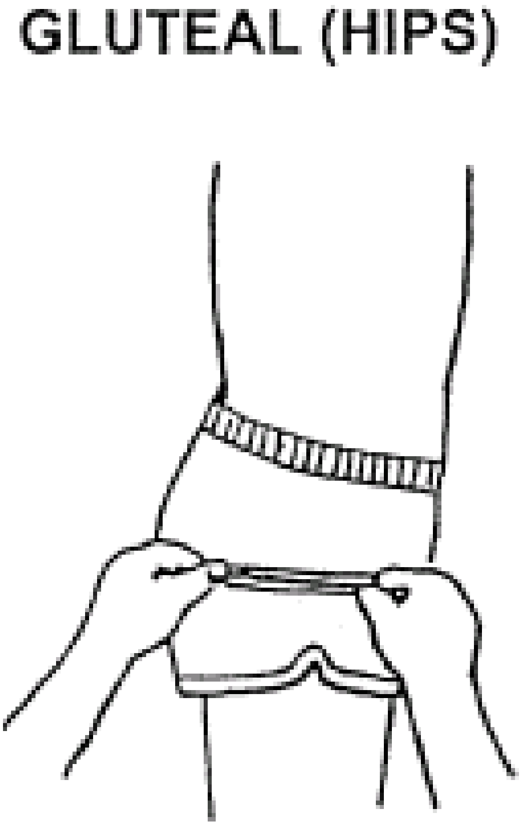


Source: Ridder, 2000: (Kinanthropometrty in exercise and health)

- **HIP CIRCUMFERENCE**

1. Participant stands up straight with feet together.
2. Let the measuring tape slide from the waist to the broadest part of the hips over light clothing.
3. The measuring tape must be parallel to the ground
4. Do not let the tape cut into the participant.
5. The measurement is taken to the nearest 1,0cm. See illustration below:

FIGURE 5.1.3.3 TAKING HIP CIRCUMFERENCE



Source: Ridder, 2000: (Kinanthropometrty in exercise and health)

5.2 DIETARY EVALUATION

- **evaluation of the diet provides a foundation for dietary counseling/education**

- together with anthropometric, clinical and laboratory information can provide nutritional profile

- for the purpose of the study dietary evaluation is used together with anthropometry

5.2.1 24-Hour Recall (Appendix B)

- done through interview or questionnaire
- client reports food and beverages consumed in the past 24 hours
- (length of time recalled ranges from a few days to 7 days), with 24 hours being the most common
- information obtained by the interviewer during a **personal interview** or by telephone
- an open ended questionnaire, a **precoded questionnaire**, a tape recorder, or a computer programme is used

- different ways of collecting information may influence the study results, for example may overestimate or underestimate intake

- details on how the recall data were obtained should be explained clearly when the results are reported

- **Practical Aspects**

Demands on the interviewer:

- interviewer should be trained in the art of questioning and have a thorough knowledge of general food habits and commonly eaten foods of the study population

- interviewer should have a thorough knowledge of the purpose of the study and food composition tables or data bank to be use during the subsequent data processing stage

- the above is important if enough dietary detail is to be recalled in a form that is appropriate and can be coded

- interviewer should keep an open mind and avoid showing signs of surprise,, approval, or disapproval of the subject's diet

- if more than one interviewer is involved, a standardised protocol must be followed and the data obtained should be checked frequently to detect any systematic differences

- for repeated recalls it may be advantageous for the subject to have the same interviewer each time through the study

- **Demand on the subjects:**

- the recall method is dependent on the subject's ability to remember and adequately describe his/her diet

- the method takes a minimum of time, approximately 15 – 20 minutes for a single 24-hour recall

- no special skills, including writing, are needed by the subjects

(MacIntyre, 2000)

- **Recommended Procedure**

- give no prior warning: the subjects should not know beforehand if or when they will be questioned about their food intake

- always conduct the recall as an interview: a 24-hour recall may be **persona**l or conducted by telephone

- personal interviews are common and probably provide the best interview situation

- the interview should take place in a relaxed atmosphere in a quiet place

- since location is influenced by the ability and willingness of the subjects to participate, all subjects within a study should be interviewed in the same place

- even representation of days: ideally the interviews should include recalls for all days of the week, however this is not always possible. For this reason, it is used together with FFQ for more conclusive dietary data

- order of food recall: it is preferable to start with the first food/drink taken in the morning and proceed throughout the day

- use open ended questions: the interviewer should use neutral questions like 'when?' and 'what did you drink or eat.....after you woke up in the morning, before you left home?'

- no questions should be suggestive or lead the subjects to an answer

- the ability to ask good questions requires a detailed knowledge of local foods, general activities, and ways of eating among the particular group being studied

- usual food combinations may not be explained during the interview unless the interviewer knows about them and specifically asks 'Did you have anything on, in or with it?'

- for example, butter or margarine on bread, sugar or milk in tea or on cereal, tomato sauce with the hot dog?

- details like brand names, the physical nature of the food item and, if homemade the method of preparation may be asked for, according to the purpose of the study

- standard list, picture, or photograph of foods commonly used by the target group may be presented at the end of the interview, as an aid to memory

- estimation of amounts: graduated food models of some sort are highly recommended, as well as selection of familiar household cups, glasses, bowls, and spoons for estimating food quantity

- a ruler may also be of help to determine the size of the other types of foods

- food models should not be shown until needed for quantifying specific foods

- a picture book, a selection of natural foods, or realistic food models may be presented at the close of the interview as an additional memory aid

- open-ended form: names of meals or foods or codes for foods or food amounts may be provided on the form to aid writing during the interview

(MacIntyre, 2000)

- **Uses, examples and limitations**

• **<u>Main Advantages</u>**	• **<u>Main Disadvantages</u>**
Low burden on respondents Low refusal rate Takes little time Suitable for large numbers	Relies on memory One recall not representative of individual's intake – only for groups > 50 Does not represent <u>usual</u> intake Underestimation of intake

- Other challenges are that people may not remember fully or accurately what they ate

  description of portion sizes

  previous day's food intake may not be

  representative of their customary diet

  subject to memory lapses and untruthfulness, and is inappropriate for those with irregular eating habits

- recall methods have been used in a number of large field studies where a representative sample is important, for example in the South African National Food Consumption Survey 1999.

- a more serious problem is the intra-individual or day-to-day variation found in many groups, especially in industrialised countries

- therefore, a single 24-hour recall should only be used in studies examining the mean level of food and nutrient intake

- **Comparison with other methods**

- a number of studies have measured the relative validity of the 24-hour recall by comparing it with another method

- for group means, the method shows good agreement with estimated and weighed food records, even though a few other studies have come to other conclusions

- the ability of the methods to produce comparable estimates varies greatly with the food or nutrient under consideration

- **Precision**

- precision or reproducibility of group means may be improved by repeating the recalls and increased sample size will do the same

- it would be preferable in most cases to use a single interview with an increased sample size rather repeating the recalls

- when the analysis and interpretation of the data is to go further than group means, repeated interviews are strongly recommended, at least on sub-sample
- number of recalls necessary to obtain a reasonable precision in classifying individual's intake for food groups and nutrients depends upon the nutrient in question and the food pattern of the specific population group

(MacIntyre, 2000)

5.2.2 Food Frequency List

- **Definitions**

- Food Frequency questionnaire (FFQ): respondents report usual consumption of foods and beverages from a set list of items for a specific period

- Quantitative food frequency questionnaire: more precise estimates of portion sizes are given by reference to PSMAs of known weight, household measures or by direct weighing

- Culture sensitive food frequency questionnaire: A FFQ that takes account of the values, beliefs and behaviours of a specific cultural group (Cassidy, 1994)

- **General principles of questionnaire design**

- have a clear objectives for the study:

  Objective will determine the format, questions and food items to be included

- Content:
  Each question should be related to the study objectives. The questionnaire should be as brief as possible but provide sufficient information to answer the research question

- Types of questions:

  a. Demographic or background data – date of birth, area of residence, marital status
  b. Behavioural: what does the respondent do?

c. Knowledge: what does the respondent know?
d. Attitude: what does the respondent believe or feel?

- Question format:

  a. Open: respondents answer in their own words. Used for non-categorical data
  b. Closed: possible answers

- Question wording:

  Use clear, simple non-technical wording. For example use the common or local names of foods.

  Each question should deal with one idea.

  Do not ask about two foods in one question.

  Avoid ambiguous and double barelled questions.

  Avoid "leading" questions which could be sensitive

- Question sequence:

  Questions should follow a logical sequence. For example, foods listed together according to food habits of the target population. (See later: food lists).

  Use branch questions to avoid asking questions that are not applicable to a respondent.

  Keep branching simple and follow the branching instructions

  Start with easiest and most important questions. For example, ask about the staple foods first to give the respondent confidence and to get this information while the respondent is still fresh.

  Vary questions format and provide short breaks to avoid respondents fatigue and response set

  Ask knowledge of the questionnaire.

  Try to avoid asking questions that might influence the answers to later questions

- Recording of responses and coding:

  Responses must be clear and unambiguous.

  Responses should be easy to code

Coding scheme should suit the data analysis programme to be used and must be decided on at the planning stage.

As far as possible precoded the questionnaire to reduce errors

(MacIntyre, 2000)

Very important for FFQ: know the nutrient analysis programme to be used: Does it accept food items as text or as codes? Can it convert household measures to weight (g) or must this be done manually? Will it automatically calculate total intakes from the given frequencies? Will it convert intakes of a week to an average daily intake?

- Method of administration

  a. Interview administered questions are asked on one-to-one, interviewer records responses: can be used for target populations with low literacy, ensures that all questions are answered and allows for clarification

- **Food Lists**

- **Foods to be included**

Foods to include depend on the objective of the study. For example, whether the objective is to measure intakes of specific nutrients or foods or whether a comprehensive assessment of the diet is needed

Lists that are too short may omit important foods resulting in the underestimation of intakes.

Long food lists may lead to boredom, fatigue and loss of concentration and over and under estimation of intakes. Thus, foods must be selected carefully.

For a food to be included it must: be used reasonably often by an appreciable number of individuals in the target population; have a sustainable content of the nutrient(s) of interest; portion size and frequently of use should vary from person to person within target population.

Not only are individual food items important, but so are combined dishes and recipes. Information on local food preparation methods is essential

Decisions about foods to include may be made based on:

a. Existing knowledge food habits of the target population

b. Preliminary or exploratory collection of quantitative data prior to the development of FFQ.

- **Order and grouping of foods on the food list**

- Related items should be clustered together, such as by the "traditional" food groups. However, the perception of foods that "belong" together will depend on the target population. Food groupings may be identified from the preliminary studies, by separate studies in which participants are asked to group similar foods together using picture cards or from focus group discussions.

- Order of the list is recommended as foods making the most substantial contribution to food intake listed first, followed by less frequently consumed foods. Within each cluster of foods, ask about the most common foods first. Allow for an "other" option at the end of each section to cover any foods eaten but not included on the list

- A combination of food clusters and of foods usually eaten together may be helpful. This may mean, however, that a food may be listed several times. For example, ask about milk used on cereal and porridge after asking about these foods, milk used in tea and coffee when these are listed, and milk drinks and milk as a drink on its own when asking about beverages. An alternative would be ask about milk once, but broken down to milk used on porridge, milk added to tea; milk added to coffee; milk drinks; milk on its own

- Ask about each food item separately. Do not combine several foods into a single question.
- Asking about each food item has drawbacks:

  i. It increases the time needed to complete the FFQ
  ii. Respondents may answer "yes" to all foods as you list them, even though they may not eat these foods.

An alternative is to ask, for example: "What fruit do you eat"?, then mark off the items on the list as the respondent mentions them. Once the respondent has finished go back and asks about the amount and frequency of each marked fruit separately.

- **Cross-checking questions**

Questions included for quality control

a. The same food item is asked twice in different ways or in different sections to try to improve accuracy. However, they increase the length of the FFQ, may be coded and entered each time and may irritate the respondent.

b. A control or summary question asking how many times a week in total a category of food is eaten may be given at the beginning of the category. The individual items within the list are then asked. The sum of the frequencies of the individual items should equal the answer to the control question.

Example: At the beginning of the fruit category ask, "How many times a week do you eat fruit? Should the response is "four times". The interviewer asks about individual fruits. The respondent replies that he eats an apple once a week, two bananas in a week and one orange a week. The interviewers cross checks with the control question.

Disadvantages

Adding control questions increases the length of the FFQ.

The respondent is made to do a mental calculation on how often he eats all items in the category in total and then has to break it down to individual items.

What is done if the answer to the control question and the sum of the frequencies do not match? Does one assume that the control answer is correct and adjusts the item frequencies accordingly or vice versa? Does one go through the section again with the respondent until you get a match?

Interviewers may not ask the control question, ask about the individual item frequencies, then add them together and write in the total as the answer to the control question.

Control questions, if properly planned and used may add to the quality of the data. However, if not correctly used, they may do more harm than good.

- **Food descriptions**

Food descriptions specify the preparation methods and specific types of food.

Amount of detail needed in the descriptions will depend on the objective of the survey and the food preparation practices of the target population.

- **Asking about frequency**

- Period of recall

Period covered will depend on study objective. In general, most FFQs use the preceding year or six months as the reference period. Theoretically this should eliminate the effects of season. In practice, respondents tend to answer according to what is in season at the time of the study. For example, intake of oranges was higher when interviews were done during the citrus season than at other times of the year.

Using shorter reference period of one to three months may improve the accuracy of the recall (Heath et al, 2000.

- Frequency response format

Closed format with multiple choice options (Appendix C)

Example: column headings of never, less than once a month, 2 – 3 times a month; once a week; 2 – 4 times a week; daily; once more than once a day

Advantages:

Only the appropriate column needs to be marked.

The respondent has a guide as to what to answer.

Most suitable for self-administered FFQ

Disadvantages:

Frequency is expressed as a categorical variable

The choice may bias the results. If there are too few options information may be lost

For analysis: what value do you use for calculation of intake in each category?

- Open response categories. (Appendix D and E)

  Columns are headed as times per day; per week, per month, seldom; never.

  Response is filled as the number of times within each category

Advantages:

Treats the frequency as a continuous rather than a categorical variable.

Respondent can describe frequency in detail. Responses such as consumption of a food twice a day for six days of the week can be recorded.

Disadvantages:

May be confusing if instructions are not clearly given.

Needs explanation by the interviewer. Therefore, more suitable for an interviewer administered FFQs.

Different FFQ may have different ways of giving frequencies:
One may assume that a frequency filled in under "per day" implies that food is eaten every day

Another may ask for a frequency per day and the, under "per week" the number of days per week, on which that food is eaten.

Involves more writing than for closed categories and thus more room for error

NOTE: Irrespective of the method used, instructions must be clear and consistently followed

- **Pretesting the FFQ**

Pretesting is an essential part of both the development of a new FFQ and the modification of an existing FFQ. Pretesting must not be confused with pilot or reproducibility studies. Several pretests may be needed before FFQ is finalised.

- Reasons for pretesting

  - To develop and refine the food list
  - To check understandability and clarity of the instructions
  - To see if the respondents understands the questions and answers as expected
  - To determine the time needed for completion
  - To identify respondent reactions such as boredom, fatigue, irritation, confusion
  - To test the format and layout of the FFQ. Is there enough space to fill in responses
  - To test accuracy of translations, if necessary
  - To test completeness

- Pretest sample

Two groups of people should be involved in pretesting:

- Experts such as other dietitians and nutritionists. This group will be able to comment on the "academic" level such as the completeness of the FFQ, does the FFQ address the study objectives, will it be possible to analyse the information obtained?

Select experts with experience of food intake studies. Their experience will enable them to spot problems with FFQ early on. Their input is most useful in the early stages of drafting the FFQ.

Three to five experts should be sufficient

- Members of the target population with similar characteristics to the planned sample. Normally ten respondents will be sufficient.

- **Pilot Study**

While the pretest is only concerned with the development of the FFQ, the pilot study can be seen as a "practice run" of the entire research procedure on a small scale, including sample selection, data collection and data analysis.

The aim is to ensure that all procedures are feasible, all the necessary equipment is available and to identify and solve problems before the start of the actual survey.

It provides the opportunity to use the FFQ in the field research circumstances and to solve any problems that may not have been evident before.

- **Sources of error**

- Natural variation of diets

  - The dietary intakes of free-living are characterised by day-to-day variation superimposed on an underlying consistent patter.

  - Factors contributing to this intra individual variation include day-of-week or month, season, work and recreational patterns and state of health.

  - Differences between individuals such as gender, age, activity level and weight status contribute to inter individual variation

  - The degree of variation differs according to nutrients. Variation is less for macronutrients than for micronutrients, which tend to be concentrated in certain foods, so that daily intakes may be high or low, depending on the foods consumed on a given day.

  - **Measurement error**

- Respondent bias

  Since FFQ make use of recalled information, they rely on the respondent's ability to retrieve the relevant information from memory, process it and provide reasonable answers, usually within a short period of time.

Asking respondent to recall frequencies, implies some form of calculation from a simple number to a rate (number of times per week or per month)

Missing or inaccurate responses may occur because:

- Respondents may truly not remember their food consumption accurately, and thus omit foods consumed.

- They may make inferences using partial information from memory to provide answers or they may simply give an answer they think is appropriate, whether that food was consumed or not

- Respondent have to remember all dishes which contain a given item, separate mixed dishes into their component foods, estimate the amount they usually consume, add it together with other sources of the food and then estimate the frequency of consumption. This may result in respondent making inferences from the foods most easily estimated or simply guessing amounts and frequencies.

- They may be unable to conceptualise or describe portion size or they may not be able to remember portion sizes of foods, which are not eaten often.

- They may not have the information necessary to answer a question.

- They may not, for whatever reason, be willing to answer a question.

- They may try to give what they think are acceptable responses

- They may not understand the question or what is expected of them.

- Interviewer bias

  - Interviewer biases include errors caused by incorrect questions, incorrect recording of responses, intentional or unintentional omissions.

  - Personal characteristics of the interviewer such as age, gender, social background, ethnic group or manner of speech may all affect the way the respondent answers questions

  - Respondents may pick up intentional or unintentional cues in the interviewer's tone of voice, an expectant pause, or the interviewer agreeing in an effort to maintain rapport.

Use of quality control methods such as careful planning, training interviewers and regular checks of interviewers during data collection can reduce interview bias.

(MacIntyre, 2000)

6. Nutrition Knowledge Test (NKT)

The main objective of the NKT is to measure the level of nutrition knowledge of young adults in South Africa. The NKT was developed as an objective test consisting in its final form of closed format items. Objective items are compiled so that only one answer can be correct.

Test Material

Each testee should be provided with a test in the language of his/her choice. If necessary the person administering the test may read the instructions to the testees in the relevant language(s). No time limit is set. Each participant can take approximately 30mins to complete the test. The test is self-administered.

7. Exercise for the Fieldworkers

- **Role Plays:**
  Using all the assessment tools and equipment
- **Test for consistency and standardisation**

  Three volunteers: each interviewer is to take dietary data from the same participant so that recorded data can be compared.

Annexure 7.5

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

Title: Evaluate the nutritional adequacy of the student-eating habits at Technikon Natal and measuring the influence of nutrition knowledge and socio-demographic factors by means of Nutrition Knowledge Test, 24hr Recall and Food Frequency Questionnaire.

Name & Surname: ______ Student No. ______

Course: ______

1. Age: **17 - 30** ______ **(cont.)**

2. Height ___ ▪ ___

3. Weight ______ BMI ______

Girths		Trial 1				Trial 2				Trial 3			
	4. Waist (min)[R]				▪				▪				▪
	5. Gluteal (hips)[R]				▪				▪				▪

6. Physical Exercise

1. YES ☐

2. NO ☐

7. Do you participate in any physical activity, (recreation or sport)

YES ☐ **If yes complete 4**

NO ☐

8.

ACTIVITY	INTENSITY	DURATION	FREQUENCY

RANK EACH ACTIVITY ACCORDING TO INTENSITY, DURATION AND FREQUENCY

INTENSITY	**DURATION**	**FREQUENCY**
1 = NOT TIRED	**1 = 10 MIN**	**1 = ONCE A MONTH**
2= SLIGHTLY TIRED	**2 = 10 – 19 MIN**	**2 = FEW TIMES/MONTH**
3 = TIRED	**3 = 20 – 30 MIN**	**3 = 1-2 TIMES/WEEK**
4 = VERY TIRED	**4 = 30 MIN**	**4 = 3-5 TIMES/WEEK**
5 = EXHAUSTED		**5 = ALMOST DAILY**

9. Gender:

Female	**Male**

10. Are you pregnant?

1. YES

2. NO

11. Marital status:

1. Single

2. Divorced

3. Married

4. Living with partner

12. Living Arrangements:

1. Flat

2. Diggs

3. Rented Room

13. Race:

1. Black

2. White

3. Asian

4. Coloured

5. Other: Specify

14. Religion/Culture:

1. Christian

2. Hindu

3. Islam

4. Buddhist

5. Atheist

15. Ethnicity:

1. Ndebele

2. N-Sotho

3. Swazi

4. Tswana

5. Venda

7. Xhosa

8. Zulu

9. Other: Specify

16. Type of High School:

1. Urban

2. Rural

3. Government

4. Private

17. Money spent on food monthly:

1. R≤ 99

2. R100-R199

3. R200-R299

4. R≥ R400

18. Food Storage Facilities:

1. Refrigerator

2. Freezer

3. Other: Specify

19. Cooking Facilities:

1. Stove

2. Hot/Plate stove

3. Microwave

4. Gas burner

5. Other: Specify

20. Place where food is purchased:

1. Fast Food outlet ☐

2. Street Vendors ☐

3. Supermarket ☐

4. Other: Specify ☐

Annexure 7.6

24-hour Recall **FIELDWORKER.................................**

1. Day of the week interviewed:

1		MON
2		TUES
3		WED
4		THUR
5		FRI
6		SAT
7		SUN

2. Was yesterday typical/ routine for the child
(i.e. not sick, no birthday/party/funeral)

YES ☐ **NO** ☐

Now I want you to tell me everything you ate and drank yesterday. Lets start with when you woke up. Then proceed through the day following the your activities. Any forgotten items can be added last.

<u>Instruction to the field worker</u>
Enter each item eaten in grams under the correct interval of the day eaten.
Specify when new items are entered.

Abbreviations:

Measures:
1t= 1teaspoon
1T=1tablespoon
1Ls=1serving spoon
C= measuring cup(250ml)
s/s =small size
m/s=medium size
l/s=large size

Meat
F=with fat
Ft=fat trimmed

Bread
Wh=white
Br=brown
Ww=wholewheat

Milk
Sm=skim milk
Wm=whole milk
LL= long life
Bl=blend

Oil/fat
B=butter
HM=hard marg
Pm=polyunsaturated
Med=Medium margarine
Vo= vegetable oil
Wf=white fat

Meals
BR=breakfast
IS=inbetween snack, L= Lunch, D= Dinner, AD= after dinner

MENU (24HR-RECALL)

FOOD ITEM	CODE	QUANTITY(G/ML)	BR	IS	L	IS	D	AD
Cheddar-0010; Sweetmilk/0011		grated:med=10g Thick=15g 1 melrose =30g						
Cheese spread	0018	med=12g ; thick=25g						
Macaronui cheese: SM-4176; Wh-4120		1T=45g; 1LS=90g; 1/2 cup=115g						
Bacon: Fried; Lean=1510 F =1501		1 rasher=10g						
Beef: Corned/Cold cuts:F-1519		138x85x3=20g						
Fillet: F-1528		100x70x10=90g						
Mince:Pan fried F-1505		T=40g;LS=85g; 1/2c=100g						
Mince Savoury (tomato & onion)	1586							
Cottage pie: WM + HM	1628							
Beef roast		120x60x5 =35 120x60x10=70						
Beef stew: cabbage,onion,potatoes	1619	1LS=105g;1/2c =125g						
Beef stew: pot, carrots, peas, onions	1504							
Chicken boiled+ skin-1621		breast+ skin=125g thigh=80g drumstick=42g						
Chicken: Giblets-1610								
Chicken pie	1549	pie=150g						
Chicken roast								
Chicken stew: Carrts, pot, peas=1618 Cabbage, potato=1619 Tomato + onion=1583		1LS= 90g; 1/2c=125g						
Chicken,battered+fried	1634	!LS=105g;1/2c=125g						
Cornish pie	1548	med=150g						
Liver: Beef fried1515 , Chicken 1567, Sheep 1550		Sheep=55g Beef= 80g Chicken= 30g						
Meat patty Hamburger	1561	s/s=50g; m/s=100g						
Polony	1514	Slice 5mm thick=8g Comm slice=16g						
Salami & Russians	1543	Slice 5mm thick=12g 1 russian=50g						
Sausage: Beef		Thinx200mm =45g thick;165mm=90g						
Sausage: pork	1527	Med=55g						
Toppers: Cooked	3527	LS=85g; 1/2c =120g						

FOOD ITEMS	CODE	QUANTITY	B R	I S	L	I S	D	A D
BREAKFAST CEREALS								
Mabella: soft or stiff	4034	1/2c=125ml						
M/Meal: soft	4254	1c=250g						
Crumbly	4256	1c=crumbly						
Stiff	4255	1c stiff=250g						
Oats	4032	1/2 c = 125ml						
Corn flakes	4036	1c=40g						
Pronutro	4316	1/2c=50g						
Rice crispies	4046	1/2c=20g						
Coco pops	4216	1/2c=20g						
Weetbix	4037	1=25g						
+milk: Wh-0006: 2%-0069: BL-0068								
+Sugar	9027	1t=6g						
FISH								
Fish cakes	2531	65 x 15mm=50g						
Fish fingers	2532	85mm=35g						
Pilchards: Tomato sauce	2503	1=75g						
Sardines + oil	2560	S/s=7g;L/s=25g						
White fish: hake -batter	2523	S/s piece 50x55x30=60g						
White fish: hake- fried	2509	Med:100x55x30=120g						
STARCH								
Maize pap: Stiff Crumbly	4255 4256	T LS 1/2cup 75 120 125 30 75 70						
Mabella	4315							
Maize rice	4043	25 45 65						
Samp Cooked	4043	55 125 125						
Rice: White	4040	25 60 65						
Spagetthi/ macaroni	4062	35 70 90						
LEGUMES & SOUP								
Baked beans	3504	50 105 135						
Soup: commercial	3504	125						
Sugar Beans	3542	50 85 135						

FOOD ITEMS	CODE	QUANTITY	BR	IS	L	IS	D	AD
TEA & COFFEE								
Tea	9514	Teacup=180ml Mug=250ml						
Rooibos	9560							
Coffee	9513							
+Sugar	9012	1t=6g						
+ Non dairy milk	0039	1 t = 10 g						
+ Milk blend	0068	20ml tea in cup 35ml tea in mug 40ml coffee in cup 75ml coffee in mug						
+Whole milk	0006							
MILK DRINKS								
Maas	0085	S/s+ 175ml L/s=500ml 1/2 c = 125g						
custard-WH	0004							
Ice cream	6548	1 scoop =40g						
Sorbet	6516							
Milo, cocoa	0024	1t=5g						
Yoghurt: Flavoured (yogisip)	0044	S/s=175ml yogisip=350ml 1/2c =125g						
:Fruit	0020							
COOL DRINKS/ JUICE								
Apple juice- no sugar	7080	Liquifruits=250ml Ceres=200ml Cartons/bottles s/s=350ml L/s=500ml						
Orange juice with sugar	7033							
Orange juice with no sugar	7133							
Carbonated cooldrinks	9001	S/s bottle=300ml S/s can =340ml						
BREAD & ROLLS								
Bread: Wh-4001; Br-4002: Ww-4003	4001	Wh+br10mm=30g Ww10mm=35g Wh20mm=70g Ww20mm=70g						
Rolls-white	4206	Wh 10cm long=30g						
Scones	4029	6cm=35g 8cm diam=60g						
Vetkoek	4057	8cm diam=60g						
SPREADS & BUTTER		Thin Med Thick						
Butter	6502	5 10 15						
Fishpaste	3567	5 7 10						

FOOD ITEMS	CODE	QUANTITY	B R	I S	L	I S	D	A D
Jam		10 20 35						
Marg: H-6508: Med6560: PM-6521		5 7 10						
Marmite	9502	2 4 7						
Peanut Butter	6509	5 10 20						
EGGS								
Boiled	1001	1 egg=50g						
Fried	1037	1egg=52g						
Scrambled/Omelette	1008	1T=35g; 1Ls=80g						
SALADS								
Beetroot grated & sugar	8005	1T=25g: Ls=65g						
Carrot raw	8015	1T=25g						
Coleslaw & mayonnaise	8011	1T=20g; Ls=40g						
Cucumber raw	8025	Med slice=10g; thick=15g						
Lettuce	8031	1 med leaf=30g						
Mixed tomato, cucumber, lettuce- no dressing	8240	1T=40g: 1Ls=85g						
Tomato raw	8059	Med=120g; slice=15g						
Potato & mayonnaise	8247	T=45g; 1 Ls=105g						
Other								
DRESSING								
French dressing	6512	1t=5g; 1t=15G						
Mayonnaise		1T=10G; 1t=40G						
COOKIES								
Comm+fill, plain-4007								
Doughnuts: Jam-4031; Plain-4024								
SWEETS								
Chocolates:assorted	9017							
Coated bars:tex, lunch,chomp	9024							
Milk:smarties,flake,aero	9010							
Marshmallows	9028							
Jelly sweets:sugus, Jelly tots	9009							
PUDDINGS & CAKES								
Ice cream	6507							
Instant pudding	4135							

FOOD ITEMS	CODE	QUANTITY	BR	IS	L	IS	D	AD
Jelly	9004							
Sorbet	6516							
Trifle	4310							
Custard	0004							
Banana loaf								
Sponge plain	4011							
MISCELLANOUS								
Popcorn	4163							
Potato crisps; Simba	4275							
Fritos, Niknaks	4067							

VEGETABLES	Boil	Fat added or fried								BR	IS	L	IS	D	AD
	NF	B	HM	PM	Vo		T	Ls	1/2						
Green Beans	8002	8080	8098	8099	8100		25	60	80						
Green bean, potato, onion		8003	8102	8103	8104		40	75	120						
Brocolli	8007	8114	8115	8116			25	60	75						
Cabbage	8066	8012	8120	8121	8122		30	55	80						
cabbage, potato, onion		8014	8123	8124	8125		35	75	80						
Carrots	8067	8074	8126	8127	8082		20	50	80						
Carrots, potato, onion		8073	8132	8133	8134		35	70	105						
Marog	8302						40	105	90						
Mealies	8033						30	60	95						
Mix veg: tin/froz	8035	8144	8145	8146	8147		35	75	75						
Peas	8026	8075	8166	8167	8168		30	105	90						
Potato+ skin	8046						S/s=60; m/s=90g								
Potato chips	8044						1/2c=50g;med=80g								
Potato peeled	8045	8076	8177	8178	8179		S/s=60g;m/s=90g								
Potato mash WM		8047	8817	8188			50	115	125						
Pumpkin & butternut	8069	8050	8202	8203	8081		45	85	105						
Spinach	8071	8055	8209	8210	8121		40	105	90						

FOOD ITEMS	CODE						QUANTITY		BR	IS	L	IS	D	AD
Spinach, potato, onion		8056	8212	8213	8096		50	105	110					
Gem Squash	8070	8052	8193	8194	8195		1/2 gem=45g 1Ls=marrow=85g							
Sweet potato	8214			8214			50	110	145					
Other														
FRUITS	Canned +sugar	Raw	Dry	Stewed	Code		Quantity							
Apple	7001	7001	7074	7077			1T=60g: 1/2c=120g 1 med =150g							
Banana		7009			7009		1 med=75g							
Fruit Salad	7051	7079	7066	7062			1/2c=110g							
Grapes		7020			7020		1/2c=90g							
Guava	7023	7021					Med(6cm)=95g							
Mango		7026			7026		135mm=350g							
Nartjie	7110	7028					5cm=75g							
Orange		7031					7cm=180g							
Paw-paw	7114	7034					wedge: 165x26x27=90g							
Pineapple	7123	7052					1 slice=40g							
Pear		7053	7056	7057			1 med=165g							
Raisins	7054	7022					handful=27g							
Other														

Annexure 7.7

QUANTITATIVE FOOD FREQUENCY QUESTIONNAIRE

Student number:…………………………Interview Date:……………………………..Fieldworker: …………………………

Birth Date:………………………………..

Thank you for giving up your time to participate in this survey. I would like to find out what you usually eat and drink. This information is important to know, as it will tell us if you are eating enough of the right foods and if you are healthy.
Please think carefully about the food and drink you have consumed in the past month as a person identified to participate in this study survey. I will now go through a list of foods and drinks with you and I would like you to tell me:

- **if you eat the food**
- **how the food is prepared**
- **how much of the food do you consume at a time**
- **how many times a day do you eat it and, if you do not eat it everyday, how many times a week or month do you eat it.**

To help you describe the amount of food, we will use cups (250ml), tablespoons (15ml) and teaspoons (5ml)

THERE ARE NO RIGHT OR WRONG ANSWERS

EVERYTHING YOU TELL ME IS CONFIDENTIAL

IS THERE ANYTHING YOU WANT TO ASK NOW?
ARE YOU WILLING TO GO ON WITH THE QUESTIONS?

DO YOU FOLLOW A SPECIAL DIET? YES:……… NO……..:

please specify
Diabetic diet
Slimming diet
Allergies
Other:…………………………

INSTRUCTIONS TO THE FIELDWORKERS:

Circle the chosen answer and/ or fill in the amount of food and times eaten in the appropriate columns

STARCHES (BREAKFAST CEREALS, GRAINS AND LEGUMES)

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Maize meal porridge	Stiff pap						4225	
Maize meal porridge	Soft						4254	
Maize meal porridge	Crumbly						4256	
Mabella	Soft						4315	
Oats							4032	
Breakfast cereal	Cornflakes Pronutro Rice Crispies Coco Pops Weetbix Muesli						4036 4316 4046 4216 4037	

Do you pour milk on your porridge or cereal? Yes: 1 No: 2

If YES, what type of milk (whole, sour, 2%fat free, milk blend)

____

INSTRUCTION: Show subjects examples

If YES, how much milk?						0006	

Do you pour sugar on your cereal /porridge/mabella

If YES how much sugar?							

Samp	Bought Self ground						4077 4073	
Samp and beans							A013	
Rice	White Brown Maize rice						4040 4134 4043	
Pastas	Macaroni Spaghetti Other						4062	
Dried beans/peas/ lentils	Soup Salad						3504	
Soya products e.g Imana	Brands at home now Don't know						3527	

FRUITS AND VEGETABLES

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Cabbage	How do you cook cabbage? Boiled nothing added Boiled with potato and onion and fat Fried nothing added Other Don't know						8066 A006 A007	
Spinach	How do you cook spinach? Boiled, nothing added Boiled with onion tomato and fat -onion ,tomato & potato -with peanuts Other Don't know						8071 A011	
Pumpkin	How do you cook pumpkin? Cooked in fat and sugar Boiled Other Don't know						A010 A009	
Carrots	How do you cook carrots? Boiled, sugar & fat With potato and onion Raw, salad Other Don't know						8129 A008 8015	
Mealies/ sweet corn	On cobb Off cobb						8033 8034	
Beetroot salad	Home made Bought						8005	
Potatoes	How do you cook it? Boil/baked with skin Mashed Roasted French fries Other						8046 8187 8048 8179	
Sweet potatoes	How do you cook sweet potatoes? Boil/baked with skin Mashed Other						8057	
Salad vegetables	Raw tomato Lettuce Cucumber						8059 8061 8025	

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Apples/Pears	Fresh Canned						7001 7054	
Bananas							7009	
Oranges/naartjie							7031	
Grapes							7020	
Peaches	Fresh Canned						7036 7038	
Apricots								
Mangoes							7026	
Guavas	Fresh Canned						7021 7023	
Wild fruit/berries	Specify type							
Other fruit								

If subject eats canned fruit: Do you have custard with can fruit: Yes:……….. No:

BREADS AND SPREADS

Jeqe								
Bread/Bread rolls	White Brown whole wheat						4001 4002 4003	

Do you spread anything on the bread? Yes:……… No:……..

Margarine	brand name Don't know Show examples							
Peanut butter							6509	
Jam/syrup/honey							9008	
Marmite								
Fish paste Cheese Other spreads							3567	

CHICKEN, MEAT, FISH

Do you eat chicken skin ? **Yes:………….. No:…………**

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Chicken	Boiled fried in batter/ crumbs fried- not coated Roasted/ grilled						1521 1634 1520 1520	
Chicken head & feet							A003	
Chicken offal							1610	
Red meat	How do you like meat? -With fat -Fat trimmed							
Red meat	Fried Stewed minced with tomato & onion						AA001 1585	
Beef offal	intestines: boiled, nothing added Stewed with vegetables Liver Kidney Other, specify						1616 1515 1518	
Wors/Sausage	Fried						1526	
Bacon							1501	
Cold meats	Polony Ham Viennas Other-specify:						1514 1564 1531	
Canned meat	Bully beef Other: specify							
Meat pie	Bought						1548	
Hamburger	Bought						1561	
Pilchards in tomato/chili / brine	Whole Mashed with onion						2509	
Fried fish	With coating Without coating						2509	
Other canned fish	Tuna Sardines Other						2547 2562	
Fish cakes	Fried						2531	
Eggs	Boiled/ Poached Scrambled Fried						1001 1025 1003	

DRINKS

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Tea							9514	
Coffee							9513	
Sugar with tea or coffee								
Milk cup of tea or coffee	what type of milk do you use in tea or coffee? Fresh/long life whole Fresh/ long life 2% fresh/long life fat free whole milk powder-Brand Skimmed milk powder Brand Milk blend Brand Whitener Brand Condensed milk Evaporated milk None						0006 0069 0072 0009 0008 0068 0039 0002 0003	
Mass								
Milk drinks-brand	Hot chocolate Milo Flavoured milk Other						0023	
Squash	Sweet O Oros/ Lecol with sugar artificial Kool aid Other: specify						9013 9002	
Yoghurt	Drinking yoghurt Thick yoghurt						0044 0020	
Fruit juice	Fresh/liquifruit/ceres Tropica						0535 0089	
Frizzy drinks-Coke, fanta	Sweetened Diet						9001 9013	
Beer/Cider								
Spirits	Brandy or Whisky							
Wine	Red or White							

SNACKS & SWEETS

Food	Description	Amount	Per day	Per week	Per month	Seldom / never	Code	Amount
Peanuts	Raw Roasted						6001 6007	
Cheese curls, Nik Naks							4076	
Peanuts 7 raisins							6007 7022	
Chocolates	Name						9024	
Candies							9009	
Biscuits	Types							
Cakes and tarts	Types							
Scones							4029	
Rusks							4160	
Savouries	Sausage rolls Samoosas Biscuits-bacon chips						1534 4196 4162	
Jelly							9004	
Baked pudding							4181	
Instant pudding							4066	
Ice cream Sorbet							6507	
Other; specify							6516	
Potato crisps							8049	

SAUCES/ GRAVIES/ CONDIMENTS

Tomato sauce worcester sauce							9505	
Chutney							9524	
Pickles							8176	
Packet soups							4069	

WILD BIRDS, ANIMALS OR INSECTS(hunted in rural areas or on farms)

Wild Fruit								

MISCELLANEOUS: Please mention any other foods used more than once in two weeks which we have not talked about:

Salt use:

Annexure 7.8

NUTRITION KNOWLEDGE TEST

RESPONDENT STUDENT NUMBER:							

- Each item consists of a question or statement with four possible answers (marked a, b, c, d)
- Read each item carefully. For each item, mark the answer which you consider to be the most correct by drawing a circle around the corresponding letter
- Please answer each item

Example

Vegetables and fruits are

a) good sources of protein

b) good sources of fat

c) unnecessary in the daily diet

d) good sources of vitamins and minerals

Please turn over

1. When vegetables and fruit are cooked, nutrients are retained best by

a)	Placing in cold water, bringing to the boil and boiling for 30 minutes		**1**
b)	By cooking for a long time at a low temperature		**2**
c)	Cutting in large pieces and cooking for a short period only		**3**
d)	Peeling 45 minutes before cooking and leaving in water	$\mathbf{V_1}$	**4**

2. A well composed diet is a diet that

a)	Enables a person to maintain his/her ideal mass (weight)		**1**
b)	Contain adequate amounts of proteins, carbohydrates (sugars and starch) and fats		**2**
c)	Contains all nutrients that are needed by the body		**3**
d)	Consists of three meals that are eaten at regular intervals per day	$\mathbf{V_2}$	**4**

3. To improve one's diet, one should

a)	Eat brown eggs instead of white eggs		**1**
b)	Eat unsifted maize meal instead of sifted maize meal		**2**
c)	Eat white bread instead of brown bread		**3**
d)	Use coffee creamer instead of milk in one's coffee	$\mathbf{V_3}$	**4**

4. To limit the amount of vitamins and minerals lost during cooking process, one must

a)	Add bicarbonate of soda to the water		**1**
b)	Add salt to the water		**2**
c)	Use as little water as possible		**3**
d)	Soak vegetables in water before cooking	$\mathbf{V_4}$	**4**

5. When compared to potato chips (1 portion or 10 chips), a medium-sized apple contains
`

a)	More energy		**1**
b)	More fat		**2**
c)	The same amount of protein		**3**
d)	Less energy	**V_5**	**4**

6. What is a kilojoule?

a)	The unit of measurement which express the energy value of food and the energy used by the body		**1**
b)	The substance in food that causes mass (weight) gain		**2**
c)	The unit of measurement in which body fat is expressed		**3**
d)	The metric form of Calorie	**V_6**	**4**

7. Examples of foods which contain a large amount of energy and few nutrients are

a)	Hamburgers and hotdogs		**1**
b)	Pies and pasts (e.g. macaroni and spaghetti)		**2**
c)	Sweets and tarts		**3**
d)	Potatoes and pumpkin	**V_7**	**4**

8. Adult gain mass (weight) because

a)	A tendency to overmass (overweight) is inherited		**1**
b)	Overmass (overweight) is unavoidable with increasing age		**2**
c)	They take in more energy than is burnt by the body		**3**
d)	They do not participate in organized sport	**V_8**	**4**

9. The best fruit and vegetable sources of vitamin A are:

a)	Carrot, pumpkin, peaches		**1**
b)	Cauliflower, garlic, ginger		**2**
c)	Banana, apple, garlic		**3**
d)	Lemon, mushrooms, eggs	$\mathbf{V_9}$	**4**

10. Which of the following nutrients will probably be partially lost during the cooking of vegetables and fruit?

a)	Calcium and proteins		**1**
b)	Iron		**2**
c)	Vitamin A		**3**
d)	Vitamin C	$\mathbf{V_{10}}$	**4**

11. A good way to lose weight without harming one's health, is to

a)	Eliminate carbohydrates from the diet		**1**
b)	Eliminate carbohydrates and starches from the diet		**2**
c)	Increase physical activity		**3**
d)	Apply all the above	$\mathbf{V_{11}}$	**4**

12. If a person regularly eats three meals a day, it can be assumed that

a)	He/she has good eating habits		**1**
b)	He/she eats adequate meals		**2**
c)	His/her nutrient needs are met		**3**
d)	None of the above	$\mathbf{V_{12}}$	**4**

13. What is the best way of obtaining all the nutrients needed every day for good health?

a)	Drink large amounts of milk		**1**
b)	Eat a variety of fruit and vegetables		**2**
c)	Take vitamin pills		**3**
d)	Eat a variety of different types of food	**V_{13}**	**4**

14. A potato (1 portion or 1 medium sized potato) cooked in its skin, compared to potato chips (1 portion or 10 chips) contains

a)	Less energy		**1**
b)	Less starch		**2**
c)	Less dietary fibre		**3**
d)	Less protein	**V_{14}**	**4**

15. A high intake of table salt (NaCl) is not healthy because too much salt

a)	Spoils the taste and acceptability of food		**1**
b)	Can make a person fat		**2**
c)	Can lead to high blood pressure		**3**
d)	Makes one drink a lot of water	**V_{15}**	**4**

16. Water is an essential part of the diet because it

a)	Replaces the water excreted from the body		**1**
b)	Makes up one-third of the body mass (weight)		**2**
c)	Is a very good source of minerals		**3**
d)	After oxygen, meets the most important need of the body	**V_{16}**	**4**

17. If a person wants to gain mass (weight) he/she must

a) Eat lots of food **1**

b) Take in more energy than what his/her needs are **2**

c) Not eat much food high in fibre **3**

d) Not participate in sport **V_{17}** **4**

18. One of the nutrients that contributes to good strong bones and teeth is:

a) Vitamin C **1**

b) Vitamin A **2**

c) Calcium **3**

d) Phosphorus **V_{18}** **4**

19. Why is white meat (for example chicken) considered to be healthier than red meat (for example fillet or topside)?

a) White meat contains less fat than red meat **1**

b) White meat contains more protein than red meat **2**

c) White meat contains more vitamins and minerals than red meat **3**

d) White meat is digested better than red meat **V_{19}** **4**

20. The best way to ensure that one is well nourished is to

a) Read articles on nutrition in popular magazines **1**

b) Eat what on feels like at a specific time **2**

c) Eat at regular times **3**

d) Use the Basic Food Groups as a guide **V_{20}** **4**

21. The eating of a well composed breakfast

a) Is recommended especially in winter to prevent colds **1**

b) Contributes to better concentration and work performance **2**

c) Helps to meet the body's nutritional needs more readily **3**

d) Both answers (b) and (c) are correct **V_{21}** **4**

22. Eggs and cheese can replace meat in the diet because they

a) Are easier to digest **1**

b) Provide approximately the same amount of protein **2**

c) Are also of animal origin **3**

d) Serve as very good source of unsaturated fat **V_{22}** **4**

23. Iron (nutrient) has a crucial function of carrying oxygen to all cells. To increase intake of iron, one has to eat the following best sources of iron:

a) Liver, Nuts, Lentils **1**

b) Spinach, carrots, apples **2**

c) Milk, Cheese, Yoghurt **3**

d) Cauliflower, banana, sugar **V_{23}** **4**

24. What nutritional advantage does an expensive cut of meat (for example fillet) have over a cheaper cut (for example topside) (from the same carcass)?

a) The more expensive cut probably contains less fat **1**

b) The more expensive cut probably contains more protein **2**

c) The more expensive cut probably contains more vitamins and minerals **3**

d) The more expensive cut probably has no nutritional advantage over the cheaper cut **V_{24}** **4**

25. Which one of the following conditions will always be prevented by a well composed diet?

a)	Cancer		**1**
b)	Colds		**2**
c)	Heart attack		**3**
d)	Bleeding gums	$\mathbf{V_{25}}$	**4**

26. The best sources of dietary fibre in the diet are

a)	Vegetables, fruit and starch products		**1**
b)	Vegetables, fruit and refined grain products		**2**
c)	Fruit, grain products and brown bread		**3**
d)	Vegetables, fruit and unrefined grain products	$\mathbf{V_{26}}$	**4**

27. Severe overmass (overweight) is a risk factor for the development of

a)	Sugar disease (diabetes mellitus)		**1**
b)	Ischaemic heart disease and heart attack		**2**
c)	Varicose veins and back problems		**3**
d)	All the above disease conditions	$\mathbf{V_{27}}$	**4**

28. Which of the following substances will probably be partially lost when vegetables and fruit are peeled inexpertly thickly

a)	B vitamins		**1**
b)	B vitamins and vitamin C		**2**
c)	B vitamins and dietary fibre		**3**
d)	Vitamin C	$\mathbf{V_{28}}$	**4**

29. Adding fibre your daily diet reduces the risk of the following diseases:

a)	Constipation, Obesity		**1**
b)	Pimples and Gum disease		**2**
c)	Diabetes Mellitus and Colon Cancer		**3**
d)	A and C	V_{29}	**4**

30. A well composed breakfast could consist of fruit juice, tea or coffee and

a)	Brown toast (with soft yellow margarine) and a fruit, such as banana		**1**
b)	Brown toast (with soft yellow margarine) and jam, for example apricot jam		**2**
c)	Brown toast (with soft yellow margarine) and a protein rich filling such as peanut butter		**3**
d)	Brown toast (with soft yellow margarine) and marmite/bovril	V_{30}	**4**

31. Which of the following foods will spoil (go off) fastest if not kept in a refrigerator

a)	Bread		**1**
b)	Tuna fish salad		**2**
c)	Tomatoes		**3**
d)	Spanspek (melon)	V_{31}	**4**

32. Which group of foods is an especially good source of vitamin C

a)	Yellow vegetables and soft fruit		**1**
b)	Milk and milk products		**2**
c)	Citrus fruit and green vegetables		**3**
d)	Bread and grain products	V_{32}	**4**

33. The development of tooth caries (cavities in the teeth) is associated with

a)	Eating sweet things		**1**
b)	The amount of sugar in the diet		**2**
c)	The type of sugar and frequency of intake thereof		**3**
d)	A diet with high fluoride content	**V_{33}**	**4**

34. Is it necessary for a South African to use a vitamin and mineral supplement

a)	It is necessary for everybody because processed food is poor in nutrients		**1**
b)	It is necessary to ensure that enough B vitamins are consumed		**3**
c)	It is unnecessary if the diet is well planned and food is chosen wisely		**3**
d)	It is worthless because synthetic vitamins are ineffective	**V_{34}**	**4**

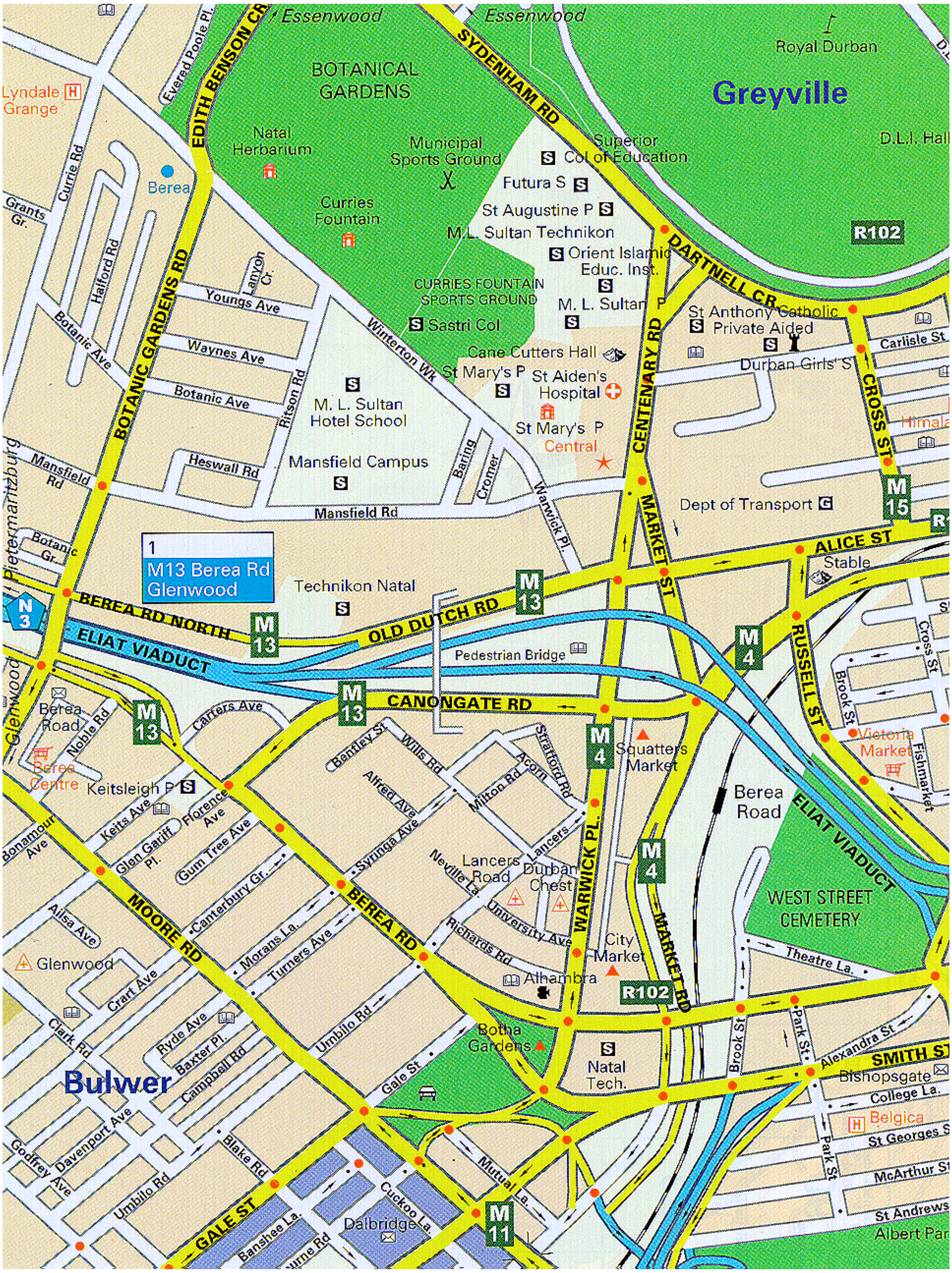
35. The following foods are the body building foods from animal products:

a)	Eggs, Liver, Steak		**1**
b)	Spinach, Samp		**2**
c)	Oil, Potatoes,		**3**
d)	Rice, Beans	**V_{35}**	**4**

THANK YOU ONCE AGAIN FOR YOUR CO-OPERATION

Annexure 7.9

Location of DIT: Steve Biko Campus and students' residences



Annexure 7.10

THE STUDENT SAMPLE REALISATION:

Sociodemographic Data	Response Rate %
Age	
15 – 18yrs	6.8
19 – 24yrs	83.9
25 – 50yrs	9.4
Gender	
Female	52.1
Male	47.9
Pregnancy Status	
YES	.5
NO	99.5
Marital Status	
Single	97.9
Married	1.0
Living with Partner	1.0
Living Arrangements	
Flat	89.6
Diggs	1.6
Rented Room	2.1
Other: Specify	6.8
Religion and Culture	
Christian	93.8
Hindu	.5
Islam	1.0
Atheist	3.1
Other: Specify:	1.6
Ethnicity	
Ndebele	.5
N-Sotho	3.1
Swazi	7.3
Tswana	2.6
Venda	1.0
Xhosa	7.8
Zulu	66.7
Other: Specify	10.9
Type of High School	
Urban	3.6
Rural	2.1
Government	78.1
Private	16.1
Money Spent on Food Monthly	
R<99	4.2
R100 - R199	22.9
R200 – R299	41.7
R>400	27.1
Other: Specify	4.2
Storage Facilities	
Refridgerator	96.4
Freezer	.5
None	3.1
Cooking Facilities	
Stove	83.3
Hot plate	14.1
Microwave	1.6
Other: Specify	1.0
Place where food is purchased	
Supermarket	99.5
Other: Specify	.5

Annexure 7.11

CROSSTABULATION OF GENDER AND LEVEL OF NUTRIENT INTAKE

				Energy Intake (kJ) – p=0.005		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	20.8	24	7.3	52.1
	Male	92	26.6	17.2	4.2	47.9
	Column Total %		47.4	41.1	11.5	100
				Protein Intake – p=0.007		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	8.3	13	30.7	52.1
	Male	92	8.9	15.6	23.4	47.9
	Column Total %		17.2	28.6	54.2	100
				Fibre Intake – p=0.027		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	42.2	8.9	1.0	52.1
	Male	92	28.6	15.6	3.6	47.9
	Column Total %		70.8	24.5	4.7	100
				Calcium Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	45.3	4.2	2.6	52.1
	Male	92	39.1	6.8	2.1	47.9
	Column Total %		84.4	10.9	4.7	100
				Iron Intake– p=0.000		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	35.9	9.4	6.8	52.1
	Male	92	8.3	21.4	18.2	47.9
	Column Total %		44.3	30.7	25.0	100
				Magnesium Intake – p=0.000		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	25.5	19.3	7.3	52.1
	Male	92	21.4	15.6	10.9	47.9
	Column Total %		34.9	18.2	54.2	100
				Phosphorus Intake – p=0.007		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	24	19.3	8.9	52.1
	Male	92	14.1	17.7	16.1	47.9
	Column Total %		38.0	37.0	25.0	100
				Zinc Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	36.5	10.9	4.7	52.1
	Male	92	31.8	21.4	10.4	47.9
	Column Total %		68.2	21.4	10.4	100

			Copper Intake – p=0.000			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	49.0	2.6	.5	52.1
	Male	92	41.1	3.6	3.1	47.9
	Column Total %		90.1	6.3	3.6	100
			Chromium Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	49.5	2.6	-	52.1
	Male	92	42.2	2.6	2.6	47.9
	Column Total %		91.7	5.2	2.6	100
			Selenium Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	35.4	8.3	8.3	52.1
	Male	92	37.0	5.7	5.2	47.9
	Column Total %		72.4	14.1	13.5	100
			Manganese Intake – p=0.000			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	35.9	12.5	3.6	52.1
	Male	92	18.8	12.0	17.2	47.9
	Column Total %		54.7	24.5	20.8	100
			Iodine Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	51.6	.5	-	52.1
	Male	92	47.4	.5	-	47.9
	Column Total %		99.0	1.0	-	100
			Vitamin A Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	44.8	3.6	3.6	52.1
	Male	92	41.1	3.1	3.6	47.9
	Column Total %		85.9	68	7.3	100
			Thiamin Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	22.9	12.5	16.7	52.1
	Male	92	22.4	15.6	9.9	47.9
	Column Total %		45.3	28.1	26.6	100
			Riboflavin Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	26.0	8.6	17.7	52.1
	Male	92	27.6	5.7	14.6	47.9
	Column Total %		53.6	14.1	32.3	100

				Niacin Intake – p=0.007		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	17.2	18.8	16.1	52.1
	Male	92	16.7	15.6	15.6	47.9
	Column Total %		33.9	34.4	31.8	100
				Vitamin B_6 Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	26.0	12.5	13.5	52.1
	Male	92	28.1	6.8	13.0	47.9
	Column Total %		54.2	19.3	26.6	100
				Folate Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	20.3	13.5	18.2	52.1
	Male	92	14.1	8.3	25.5	47.9
	Column Total %		34.4	21.9	43.8	100
				Vitamin B_{12} Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	15.1	9.9	27.1	52.1
	Male	92	13.5	5.7	28.6	47.9
	Column Total %		28.6	15.6	55.7	100
				Pantothenic Acid Intake – p=0.011		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	29.2	9.4	13.5	52.1
	Male	92	20.3	10.9	16.7	47.9
	Column Total %		49.5	20.3	30.2	100
				Biotin Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	49.0	1.0	2.1	52.1
	Male	92	41.1	5.7	1.0	47.9
	Column Total %		90.1	6.8	3.1	100
				Vitamin C Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	36.5	4.2	11.5	52.1
	Male	92	28.1	4.7	15.1	47.9
	Column Total %		64.6	8.9	26.6	100
				Vitamin D Intake – NS		
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	42.7	6.3	3.1	52.1
	Male	92	32.3	7.3	8.3	47.9
	Column Total %		75.0	13.5	11.5	100

		Vitamin E Intake – NS				
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	32.8	12.0	7.3	52.1
	Male	92	26.0	9.4	12.5	47.9
	Column Total %		58.9	21.4	19.8	100

		Vitamin K Intake – NS				
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
GENDER	Female	100	43.8	5.2	3.1	52.1
	Male	92	40.1	4.7	3.1	47.9
	Column Total %		83.9	9.9	6.3	100

Annexure 7.12

CROSSTABULATION OF SOCIO-ECONOMIC STATUS AND LEVEL OF NUTRIENT INTAKE

			Energy Intake (kJ) – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	2.1	-	4.2
	R99 – R199	44	12.5	7.8	2.6	22.9
	R200 – 299	80	16.7	18.8	6.3	41.7
	R300 – R400	60	16.1	12.5	2.6	31.3
	Column Total %		47.4	41.1	11.5	100

			Protein Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	1.6	1.0	1.6	4.2
	R99 – R199	44	4.2	6.8	12.0	22.9
	R200 – 299	80	6.3	11.5	24.0	41.7
	R300 – R400	60	5.2	9.4	16.7	31.3
	Column Total %		17.2	28.6	54.2	100

			Fibre Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	2.1	-	4.2
	R99 – R199	44	16.7	6.3	-	22.9
	R200 – 299	80	30.7	8.9	2.1	-
	R300 – R400	60	21.4	7.3	2.6	-
	Column Total %		70.8	24.5	4.7	100

			Calcium Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.6	.5	-	4.2
	R99 – R199	44	20.8	1.6	.5	22.9
	R200 – 299	80	32.8	5.2	3.6	41.7
	R300 – R400	60	27.1	3.6	.5	31.3
	Column Total %		84.4	10.9	4.7	100

			Iron Intake– p=0.017 and r=0.172			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.1	-	1.0	4.2
	R99 – R199	44	14.1	4.7	4.2	22.9
	R200 – 299	80	19.3	13.5	8.9	41.7
	R300 – R400	60	7.8	12.5	10.9	31.3
	Column Total %		44.3	30.7	25.0	100

			Magnesium Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	1.6	1.0	1.6	4.2
	R99 – R199	44	14.6	5.7	2.6	22.9
	R200 – 299	80	17.7	15.6	8.3	41.7
	R300 – R400	60	13.0	12.5	5.7	31.3
	Column Total %		46.9	34.9	18.2	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Phosphorus Intake – NS			
SES	R<99	8	2.1	.5	1.6	4.2
	R99 – R199	44	12.0	7.8	3.1	22.9
	R200 – 299	80	14.1	15.6	12.0	41.7
	R300 – R400	60	9.9	13.0	8.3	31.3
	Column Total %		38.0	37.0	25.0	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Zinc Intake – NS			
SES	R<99	8	3.1	1.0	-	4.2
	R99 – R199	44	16.1	4.7	2.1	22.9
	R200 – 299	80	29.7	6.8	5.2	41.7
	R300 – R400	60	19.3	8.9	3.1	31.3
	Column Total %		68.2	21.4	10.4	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Copper Intake – NS			
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	21.4	1.0	.5	22.9
	R200 – 299	80	37.0	2.6	2.1	41.7
	R300 – R400	60	27.6	2.6	1.0	31.3
	Column Total %		90.1	6.3	3.6	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Chromium Intake – NS			
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	19.8	2.6	.5	22.9
	R200 – 299	80	38.0	2.1	1.6	41.7
	R300 – R400	60	29.7	.5	.5	31.3
	Column Total %		91.7	5.2	2.6	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Selenium Intake – NS			
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	15.1	3.1	4.7	22.9
	R200 – 299	80	30.7	6.8	4.2	41.7
	R300 – R400	60	22.4	4.2	4.7	31.3
	Column Total %		72.4	14.1	13.5	100

		(n)	0 – 67%	67% - 100%	>100%	Row Total %
			Manganese Intake – NS			
SES	R<99	8	2.1	1.0	1.0	4.2
	R99 – R199	44	14.6	3.1	5.2	22.9
	R200 – 299	80	22.9	10.9	7.8	41.7
	R300 – R400	60	15.1	9.4	6.8	31.3
	Column Total %		54.7	24.5	20.8	100

			Iodine Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	22.9	-	-	22.9
	R200 – 299	80	41.1	.5	-	41.7
	R300 – R400	60	30.7	.5	-	31.3
	Column Total %		99.0	1.0	-	100

			Vitamin A Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	20.8	1.0	1.0	22.9
	R200 – 299	80	33.9	4.2	3.6	41.7
	R300 – R400	60	27.1	1.6	2.6	31.3
	Column Total %		85.9	6.8	7.3	100

			Thiamin Intake – p = 0.025 and r = .162			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	1.6	.5	4.2
	R99 – R199	44	13.5	4.2	5.2	22.9
	R200 – 299	80	16.1	14.1	11.5	41.7
	R300 – R400	60	13.5	8.3	9.4	31.3
	Column Total %		45.3	28.1	26.6	100

			Riboflavin Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.1	-	1.0	4.2
	R99 – R199	44	14.6	2.1	6.3	22.9
	R200 – 299	80	20.8	6.8	14.1	41.7
	R300 – R400	60	15.1	5.2	10.9	31.3
	Column Total %		53.6	14.1	32.3	100

			Niacin Intake – p=0.002 and r = .227			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	1.0	1.0	4.2
	R99 – R199	44	9.9	7.3	5.7	22.9
	R200 – 299	80	15.1	14.1	12.5	41.7
	R300 – R400	60	6.8	12.0	12.5	31.3
	Column Total %		33.9	34.4	31.8	100

			Vitamin B_6 Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.1	-	1.0	4.2
	R99 – R199	44	12.0	4.7	6.3	22.9
	R200 – 299	80	24.0	7.8	9.9	41.7
	R300 – R400	60	15.1	6.8	9.4	31.3
	Column Total %		54.2	19.3	26.6	100

			Folate Intake – p = 0.020 and r = .168			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	1.6	.5	4.2
	R99 – R199	44	9.9	3.6	9.4	22.9
	R200 – 299	80	14.6	9.4	17.7	41.7
	R300 – R400	60	7.8	7.3	16.1	31.3
	Column Total %		34.4	21.9	43.8	100

			Vitamin B_{12} Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	-	2.1	4.2
	R99 – R199	44	7.8	3.6	11.5	22.9
	R200 – 299	80	8.9	8.3	24.5	41.7
	R300 – R400	60	9.9	3.6	17.7	31.3
	Column Total %		28.6	15.6	55.7	100

			Pantothenic Acid Intake – p=0.001 and r = .242			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.1	1.0	-	4.2
	R99 – R199	44	13.5	4.7	4.7	22.9
	R200 – 299	80	21.4	10.9	9.4	41.7
	R300 – R400	60	11.5	3.6	16.1	31.3
	Column Total %		49.5	20.3	30.2	100

			Biotin Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	4.2	-	-	4.2
	R99 – R199	44	20.8	1.6	.5	22.9
	R200 – 299	80	37.0	3.6	1.0	41.7
	R300 – R400	60	28.1	1.6	1.6	31.3
	Column Total %		90.1	6.8	3.1	100

			Vitamin C Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.6	-	.5	4.2
	R99 – R199	44	14.6	2.6	5.7	22.9
	R200 – 299	80	25.0	4.7	12.0	41.7
	R300 – R400	60	21.4	1.6	8.3	31.3
	Column Total %		64.6	8.9	26.6	100

			Vitamin D Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	2.1	2.1	-	4.2
	R99 – R199	44	12.5	7.8	2.6	22.9
	R200 – 299	80	16.7	18.8	6.3	41.7
	R300 – R400	60	16.1	12.5	2.6	31.3
	Column Total %		47.4	41.1	11.5	100

			Vitamin E Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.1	.5	.5	4.2
	R99 – R199	44	14.1	4.2	4.7	22.9
	R200 – 299	80	22.9	8.9	9.9	41.7
	R300 – R400	60	18.8	7.8	4.7	31.3
	Column Total %		58.9	21.4	19.8	100

			Vitamin K Intake – NS			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
SES	R<99	8	3.6	-	.5	4.2
	R99 – R199	44	19.3	2.1	1.6	22.9
	R200 – 299	80	33.9	4.7	3.1	41.7
	R300 – R400	60	27.1	3.1	1.0	31.3
	Column Total %		83.9	9.9	6.3	100

Annexure 7.13

CROSSTABULATION OF ETHNICITY AND LEVEL OF NUTRIENT INTAKE

			Calcium Intake – p = 0.044			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
ETHNICITY	Ndebele	1	.5	-	-	.5
	N-Sotho	6	3.1	-	-	3.1
	Swazi	14	6.3	.5	.5	7.3
	Tswana	5	2.1	.5	-	2.6
	Venda	2	1.0	-	-	1.0
	Xhosa	15	6.3	.5	1.0	7.8
	Zulu	128	58.3	5.7	2.6	66.7
	S-Sotho	21	6.8	3.6	.5	10.9
	Column Total %		84.4	10.9	4.7	100

			Thiamin Intake – p = 0.020			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
ETHNICITY	Ndebele	1	.5	-	-	.5
	N-Sotho	6	3.1	-	-	3.1
	Swazi	14	3.6	2.1	1.6	7.3
	Tswana	5	1.6	.5	.5	2.6
	Venda	2	-	.5	.5	1.0
	Xhosa	15	2.6	3.1	2.1	7.8
	Zulu	128	27.6	19.3	19.8	66.7
	S-Sotho	21	6.3	2.6	2.1	10.9
	Column Total %		45.3	28.1	26.6	100

			Riboflavin Intake – p = 0.028			
		(n)	0 – 67%	67% - 100%	>100%	Row Total %
ETHNICITY	Ndebele	1	.5	-	-	.5
	N-Sotho	6	3.1	-	-	3.1
	Swazi	14	2.6	2.1	2.6	7.3
	Tswana	5	1.6	1.0	-	2.6
	Venda	2	-	.5	.5	1.0
	Xhosa	15	3.6	1.6	2.6	7.8
	Zulu	128	35.9	7.8	22.9	66.7
	S-Sotho	21	6.3	1.0	3.6	10.9
	Column Total %		53.6	14.1	32.3	100

THE SCORES OF THE NUTRITION KNOWLEDGE TEST (NKT) **Annexure 7.14**

Q.	NUTRITION KNOWLEDGE QUESTIONS AND QUESTION WITH FOUR POSSIBLE ANSWERS	MALES RESPONSES (%)				FEMALE RESPONSES (%)			
		(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
1.	When vegetables and fruit are cooked, nutrients are retained best by:	40.2	15.2	41.3	3.3	24.0	11.0	60.0	5.0
2.	A well composed diet is a diet that:	9.8	34.8	46.7	8.7	6.0	15.0	63.0	16.0
3.	To improve one's diet, one should:	22.8	57.6	13.0	6.5	24.0	54.0	12.0	10.0
4.	To limit the amount of vitamins and minerals lost during cooking process, one must:	9.8	14.1	60.9	15.2	6.0	7.0	72.0	15.0
5.	When compared to potato chips (1 portion or 10 chips), a medium-sized apple contains	59.8	10.9	16.3	13.0	45.0	10.0	22.0	23.0
6.	What is a kilojoule?	65.2	200.7	7.6	6.5	66.0	7.0	18.0	9.0
7.	Examples of foods which contain a large amount of energy and few nutrients are	12.0	15.2	35.9	37.0	16.0	12.0	42.0	30.0
8.	Adult gain mass (weight) because:	2.2	7.6	47.8	42.4	4.0	11.0	45.0	40.0
9.	The best fruit and vegetable sources of vitamin A are:	65.2	4.3	26.1	4.3	72.0	11.0	13.0	4.0
10.	Which of the following nutrients will probably be partially lost during the cooking of vegetables and fruit?	41.3	22.8	14.1	21.7	33.0	16.0	25.0	26.0
11.	A good way to lose weight without harming one's health, is to:	3.3	7.6	53.3	35.9	1.0	8.0	57.0	34.0
12.	If a person regularly eats three meals a day, it can be assumed that:	46.7	27.2	5.4	20.7	38.0	25.0	16.0	21.0
13.	What is the best way of obtaining all the nutrients needed every day for good health?	5.4	50.0	5.4	39.1	2.0	43.0	2.0	53.0
14.	A potato (1 portion or 1 medium sized potato) cooked in its skin, compared to potato chips (1 portion or 10 chips) contains:	17.4	43.5	21.7	17.4	31.0	40.0	20.0	9.0
15.	A high intake of table salt (NaCl) is not healthy because too much salt:	8.7	6.5	76.1	8.7	5.0	1.0	87.0	7.0
16.	Water is an essential part of the diet because it:	35.9	21.7	25.0	17.4	47.0	14.0	19.0	20.0
17.	If a person wants to gain mass (weight) he/she must:	25.0	46.7	19.6	8.7	23.0	44.0	28.0	5.0
18.	One of the nutrients that contributes to good strong bones and teeth is:	6.5	1.1	89.1	3.3	6.0	-	94.0	-

19.	Why is white meat (for example chicken) considered to be healthier than red meat (for example fillet or topside)?	40.2	30.4	14.1	15.2	48.0	26.0	8.0	18.0
20.	The best way to ensure that one is well nourished is to:	9.8	7.6	17.4	65.2	7.0	1.0	16.0	76.0
21.	The eating of a well composed breakfast:	4.3	13.0	10.9	71.7	1.0	17.0	5.0	77.0
22.	Eggs and cheese can replace meat in the diet because they:	6.5	71.7	4.3	17.4	3.0	70.0	10.0	17.0
23.	Iron (nutrient) has a crucial function of carrying oxygen to all cells. To increase intake of iron, one has to eat the following best sources of iron:	48.9	30.4	18.5	2.2	62.0	17.0	17.0	4.0
24.	What nutritional advantage does an expensive cut of meat (for example fillet) have over a cheaper cut (for example topside) (from the same carcass)?	41.3	15.2	18.5	25.0	46.0	17.0	21.0	16.0
25.	Which one of the following conditions will always be prevented by a well composed diet?	6.5	15.2	70.7	7.6	4.0	8.0	80.0	8.0
26.	The best sources of dietary fibre in the diet are:	18.5	28.3	33.7	19.6	17.0	14.0	39.0	30.0
27.	Severe overmass (overweight) is a risk factor for the development of:	14.1	26.1	3.3	56.5	13.0	27.0	1.0	59.0
28.	Which of the following substances will probably be partially lost when vegetables and fruit are peeled inexpertly thickly:	8.7	45.7	30.4	15.2	4.0	39.0	40.0	17.0
29.	Adding fibre your daily diet reduces the risk of the following diseases:	39.1	3.3	12.0	45.7	33.0	4.0	9.0	54.0
30.	A well composed breakfast could consist of fruit juice, tea or coffee and:	62.0	10.9	20.7	6.5	49.0	10.0	29.0	12.0
31.	Which of the following foods will spoil (go off) fastest if not kept in a refrigerator:	9.8	72.8	10.9	6.5	5.0	72.0	16.0	7.0
32.	Which group of foods is an especially good source of vitamin C?	21.7	14.1	62.0	2.2	18.0	6.0	76.0	-
33.	The development of tooth caries (cavities in the teeth) is associated with:	57.6	6.5	19.6	16.3	49.0	6.0	34.0	11.0
34.	Is it necessary for a South African to use a vitamin and mineral supplement?	23.9	31.5	41.3	3.3	31.0	18.0	49.0	2.0
35.	The following foods are the body building foods from animal products:	92.4	3.3	2.2	2.2	95.0	2.0	1.0	2.0

Annexure 7.15

TOTAL NUTRITION KNOWLEDGE SCORES BETWEEN GENDERS

FEMALE		MALE	
Raw Score	Percent (%)	Raw Score	Percent
10	2.0	7	1.1
11	6.0	8	3.3
12	7.0	9	2.2
13	4.0	10	4.3
14	5.0	11	4.3
15	10.0	12	7.6
16	7.0	13	10.9
17	10.0	14	9.8
18	8.0	15	7.6
19	5.0	16	6.5
20	8.0	17	12.0
21	5.0	18	12.0
22	6.0	19	4.3
23	8.0	20	4.3
24	2.0	21	1.1
25	3.0	22	2.2
26	4.0.	23	3.3
		26	3.3
Total	100	Total	100

Annexure 7.16

ANTHROPOMETRY SCORES OF THE SAMPLE ACCOPRDING TO AGE AND GENDER

HEIGHT				
	Gender	Measurement	Frequency (n)	Percent (%)
	Female	149 – 158	39	39
		159 – 168	46	46
		169 – 178	12	12
		179 – 188	1	1
		189 – 198	2	2
			100	100
	Male	149 – 158	28	30.4
		169 – 178	52	56.5
		179 – 188	11	12.0
		189 – 198	1	1.1
			92	100
WEIGHT				
	Female	48.70 – 57.70	44	44.0
		58.70 – 67.70	28	28.0
		68.70 – 77.70	15	15.0
		78.70 – 87.70	4	4.0
		88.70 – 97.70	4	4.0
		>97.70	1	1.0
		Other: <48.70	4	4.0
			100	100
	Male	48.70 – 57.70	19	20.7
		58.70 – 67.70	44	47.8
		68.70 – 77.70	20	21.7
		78.70 – 87.70	3	3.3
		88.70 – 97.70	2	2.2
		>98.70	4	4.3
			92	100

Annexure 7.17

FREQUENCY OF BMI AND WHR OF THE SAMPLE ACCORDING TO AGE AND GENDER

	Gender	Age	Classification	Frequency (n)	Percent (%)
WHR					
	Female	15 – 18yrs	<0.8	11	
		19 – 24yrs	<0.8	70	
			0.8 – 1.0	11	
			>1.0	2	
		25 – 50yrs	<0.8	4	
			0.8 – 1.0	2	
				100	
	Male	15 – 18yrs	<0.8	2	
		19 – 24yrs	<0.8	53	
			0.8 – 1.0	23	
			>1.0	2	
		25 50yrs	<0.8	7	
			0.8 – 1.0	5	
				92	
BMI					
	Female	15 – 18yrs	<18.5 = Underweight	3	
			18.5 – 24.9 = Healthy Weight	6	
			25 – 29.9 = Overweight	2	
			>30 = Obese	-	
		19 – 24yrs	<18.5 = Underweight	4	
			18.5 – 24.9 = Healthy Weight	53	
			25 – 29.9 = Overweight	15	
			>30 = Obese	11	
		25 – 50yrs	<18.5 = Underweight	2	
			18.5 – 24.9 = Healthy Weight	2	
			25 – 29.9 = Overweight	-	
			>30 = Obese	2	
	Male	15 – 18yrs	<18.5 = Underweight	-	
			18.5 – 24.9 = Healthy Weight	2	
			25 – 29.9 = Overweight	-	
			>30 = Obese	-	
		19 – 24yrs	<18.5 = Underweight	7	
			18.5 – 24.9 = Healthy Weight	58	
			25 – 29.9 = Overweight	7	
			>30 = Obese	6	
		25 – 50yrs	<18.5 = Underweight	1	
			18.5 – 24.9 = Healthy Weight	9	
			25 – 29.9 = Overweight	2	
			>30 = Obese	-	

Annexure 7.18

CROSSTABULATION OF ANTHROPOMERTY CLASSIFICATIONS AND NUTRIENT INTAKE

		Energy – Total Fat Intake <35%	>35%	Row Total (%)
BMI	<18.5 = Underweight	6.8	2.1	8.9
	18.5 – 24.9 = Healthy Weight	54.2	13.5	67.7
	25 – 29.9 = Overweight	11.5	2.1	13.5
	>30 = Obese	5.7	4.2	9.9
	Column Total	78.1	21.9	100
WHR	<0.8	62	14.6	76.6
	0.8 – 1.0	15.1	6.3	21.4
	>1.0	1.0	1.0	2.1
	Column Total	78.1	21.9	100

		Energy-Carbohydrate Intake			
		<50%	50 – 60%	>60%	Row Total (%)
BMI	<18.5 = Underweight	1.6	5.7	1.6	8.9
	18.5 – 24.9 = Healthy Weight	14.1	27.6	26.0	67.7
	25 – 29.9 = Overweight	3.1	4.7	5.7	13.5
	>30 = Obese	4.7	.5	4.7	9.9
	Column Total	23.4	38.5	38	100
WHR	<0.8	16.1	30.7	29.7	76.6
	0.8 – 1.0	6.3	7.8	7.3	21.4
	>1.0	1.0	-	1.0	2.0
	Column Total	23.4	38.5	38	100

NUTRIENT INTAKE ACCORDING TO AGE AND GENDER – MEAN AND STANDARD DEVIATION REPORTED **ANNEXURE 7.19**

	MALES			FEMALES		
	15 – 18yrs (n=2)	**19 – 24yrs (n=78)**	**25 – 50yrs (n=12)**	**15 – 18yrs (n=11)**	**19 – 24yrs (n=83)**	**25 – 50yrs (n=6)**
Nutrient List						
Energy – Kj	11157.0 (7484.0)	8088.5 (3226.8)	7279.3 (3033.2)	7137.2 (2593.9)	6715.8 (3089.3)	6511 (3012.2)
Total Protein(g)	83.4 (51.3)	65.4 (30.5)	67.7 (29.7)	52.3 (15.6)	53.4 (23.5)	51.4 (16.6)
[a] Plant Protein	31.5 (24.8)	29.7 (16.5)	22.2 (7.3)	21.7 (9.0)	21.8 (13.5)	16.1 (5.1)
[b] Animal Protein	44.6 (16.1)	33.7 (22.8)	45.6 (28.5)	29.4 (12.6)	27.8 (19.3)	35.3 (16.0)
Total Fat	94.6 (59.0)	58.4 (33.6)	57.6 (36.5)	58.4 (29.7)	57.1 (34.4)	51.8 (36.3)
Available Carbohydrates	346.5 (249.5)	261.6 (106.2)	210.8 (99.6)	222.9 (74.1)	209.1 (93.6)	208.6 (103.3)
[c] Fibre (g)	20.3 (10.7)	20.7 (14.8)	17.5 (8.5)	15.8 (9.4)	14.5 (14.1)	10.4 (3.7)
Calcium (mg)	1059.5 (765.8)	535.7 (397.9)	327.7 (226.8)	399.9 (273.9)	434.6 (293.9)	571.8 (140.6)
Iron (mg)	15.1 (12.6)	11.3 (9.1)	10.1 (5.8)	6.9 (3.0)	8.8 (5.4)	12.6 (11.6)
Heme Iron (mg)	.3 (.4)	.5 (.6)	.83 (.70)	.4 (.5)	.5 (.7)	.7 (.8)
Non-heme Iron	3.3 (.78)	2.8 (2.0)	3.5 (2.3)	2.6 (1.6)	2.3 (1.6)	2.6 (1.9)
Magnesium (mg)	371.5 (269.4)	267.3 (139.5)	257.2 (82.3)	201.4 (105.7)	195.7 (88.5)	167.2 (45.2)
Phosphorus (mg)	1525.0 (1079.0)	1036.9 (493.9)	939.1 (277.3)	812.2 (386.0)	830.3 (361.8)	801.3 (161.6)
Potassium (mg)\	3045.5 (1809.5)	1913.3 (915.4)	1821.0 (898.9)	1992.3 (1301.8)	1563.1 (767.4)	1466.7 (444.3)
Sodium (mg)	2630.0 (2612.0)	1779.8 (958.9)	1247.7 (650.8)	1910.1 (1135.9)	1832.8 (2207.4)	1145.7 (830.2)
Zinc (mg)	10.9 (5.0)	9.2 (5.1)	10.5 (6.3)	6.7 (1.6)	7.2 (3.9)	6.8 (3.0)
Copper (mg)	1.3 (.5)	1.2 (.9)	.98 (.45)	.9 (.4)	.8 (.4)	.6 (.3)
Chromium (mg)	44.5 (9.7)	41.1 (43.3)	47.4 (41.5)	31.8 (20.5)	31.8 (30.9)	30.1 (25.4)
Selenium (mg)	33.5 (37.1)	34.6 (34.2)	47.3 (36.7)	35.9 (27.0)	33.0 (25.9)	31.3 (21.9)
Manganese (mg)	3330.5 (2735.8)	3186.4 (1741.5)	3332.2 (1501.4)	1957.1 (833.5)	1918.9 (1068.0)	1458.7 (1021.2)
Iodine (mg)	54.0 (57.9)	34.7 (24.9)	42.3 (29.7)	25.7 (17.2)	28.1 (19.7)	30.8 (20.2)
Vitamin A (µg RE)	560.0 (258.8)	625.6 (1615.3)	194.8 (159.3)	245.1 (150.6)	437.8 (874.2)	540.0 (563.0)
Thiamin (mg)	1.9 (1.8)	1.2 (.8)	1.2 (.92)	.97 (.5)	.99 (.66)	1.4 (1.2)
Riboflavin (mg)	2.6 (2.2)	1.4 (1.6)	1.1 (1.0)	.9 (.6)	1.1 (.83)	1.9 (1.7)
Niacin (mg NE)	24.6 (21.0)	17.4 (11.9)	18.1 (10.2)	13.3 (7.3)	14.6 (8.9)	17.5 (15.3)
Vitamin B_6 (mg)	2.4 (2.2)	1.6 (1.3)	1.4 (1.1)	1.3 (.80)	1.3 (.9)	1.5 (1.7)
Folate (µg)	331.0 (328.1)	260.0 (213.4)	189.8 (126.2)	152.9 (105.3)	197.2 (166.0)	275.3 (321.4)
Vitamin B_{12} (µg)	5.3 (3.3)	5.0 (15.9)	3.2 (3.1)	2.2 (1.0)	3.1 (3.5)	4.3 (3.9)

		MALES			FEMALES	
	15 – 18yrs (n=2)	19 – 24yrs (n=78)	25 – 50yrs (n=12)	15 – 18yrs (n=11)	19 – 24yrs (n=83)	25 – 50yrs (n=6)
Nutrient List						
Pantothenic acid (mg)	5.5 (4.1)	5.1 (4.1)	5.1 (2.2)	4.5 (3.2)	3.9 (2.6)	3.2 (1.1)
Biotin (µg)	38.8 (31.8)	28.1 (17.5)	29.2 (11.9)	18.5 (7.3)	25.5 (33.3)	21.7 (7.6)
Vitamin C (mg)	63.0 (43.8)	82.9 (230.8)	118.8 (222.2)	58.9 (70.0)	51.2 (92.0)	54.7 (68.6)
Vitamin D (µg)	7.6 (7.9)	4.6 (4.4)	4.9 (4.9)	2.6 (1.8)	3.2 (2.8)	3.0 (2.5)
Vitamin E (mg α-TE)	9.2 (5.0)	7.6 (6.9)	7.2 (5.4)	5.0 (4.2)	5.2 (3.2)	2.9 (1.3)
Vitamin K (µg)	9.2 (8.9)	30.0 (54.8)	15.8 (21.7)	18.5 (18.7)	22.7 (26.0)	16.3 (14.0)
Saturated FA (g)	34.4 (20.1)	18.6 (11.6)	18.1 (13.6)	17.1 (6.7)	17.9 (9.7)	22.3 (16.3)
Monounsaturated FA (g)	36.5 (25.6)		20.7 (14.6)	20.5 (8.7)	19.1 (11.2)	19.0 (15.0)
Polyunsaturated FA (g)	14.3 (11.9)	13.5 (9.9)	12.5 (9.4)		14.8 (17.9)	5.6 (3.2)
Total Trans FA (g)	2.0 (.5)	.75 (1.0)	.80 (1.3)	1.5 (2.3)	1.1 (2.4)	.75 (.86)
Cholesterol (mg)	367.0 (340.8)	234.3 (183.5)	326.2 (250.6)	130.6 (63.5)	194.2 (147.1)	185.5 (114.6)

Annexure 7.20

NORMAL DISTRIBUTION OF NUTRIENT INTAKE BY THE SAMPLE

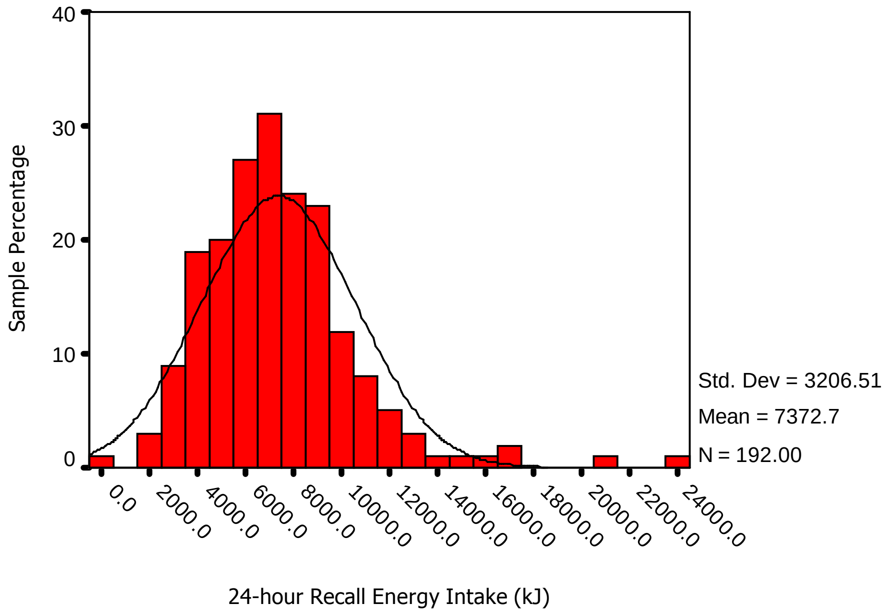


Figure 1 The mean energy intake of students aged 15 - 30 years at DIT: Steve Biko Campus

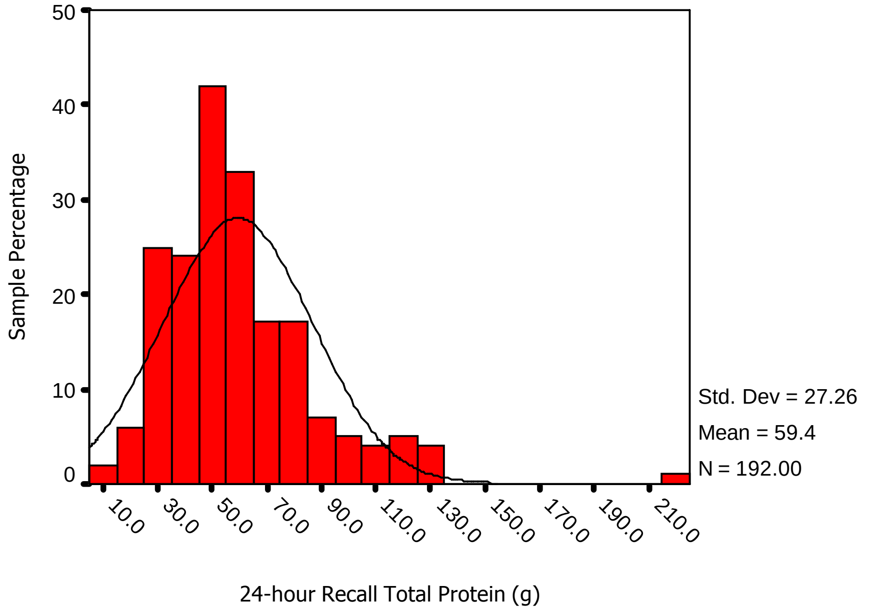


Figure 2 The mean total protein intake of students aged 15 - 30 years at DIT: Steve Biko Campus

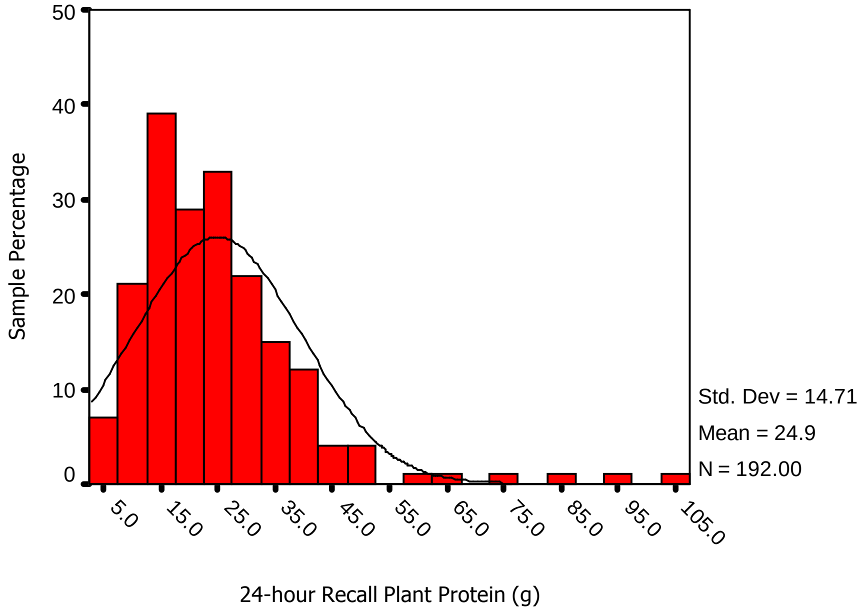


Figure 3 The mean plant protein intake of students aged 15 - 30 years at DIT: Steve Biko Campus

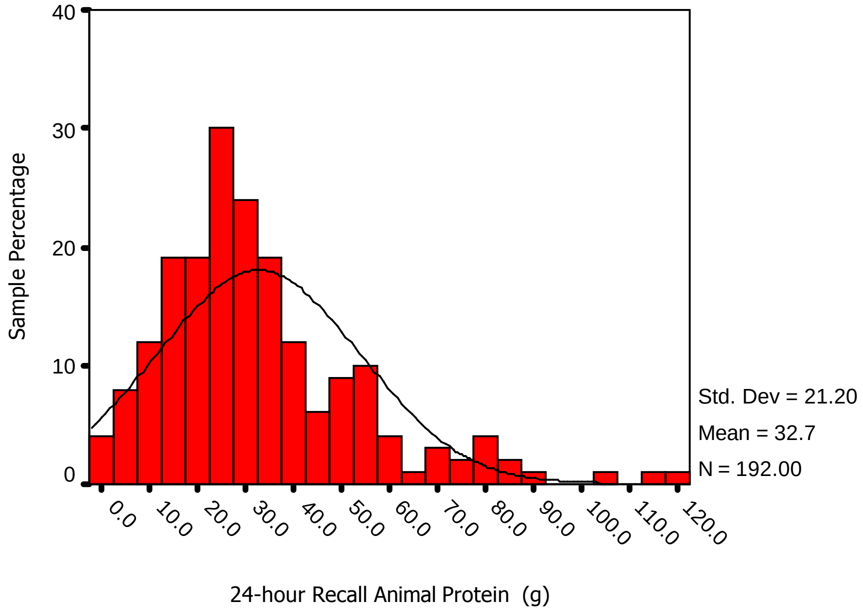


Figure 4 The mean animal protein intake of students aged 15 - 30 years at DIT: Steve Biko Campus

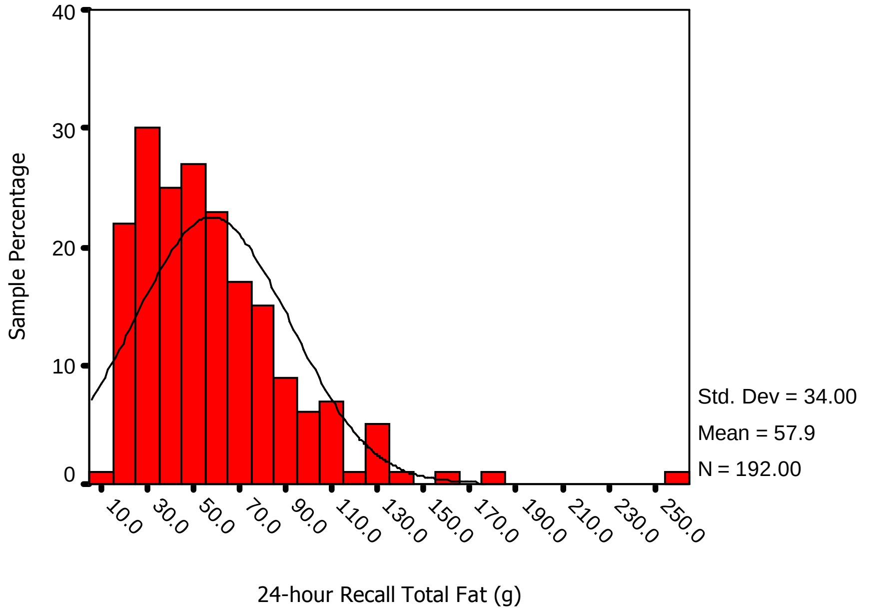


Figure 5 The mean total fat intake of students aged 15 - 30 years at DIT: Steve Biko Campus

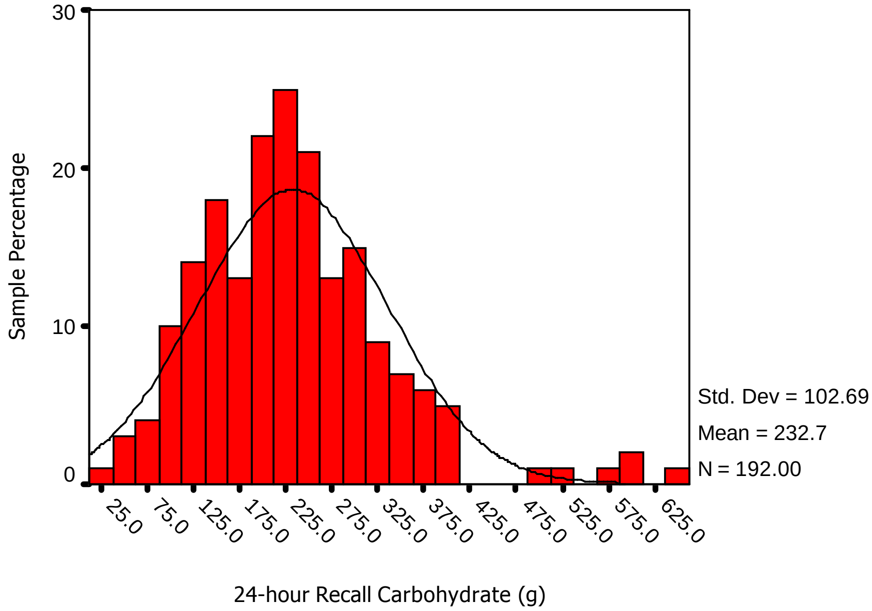


Figure 6 The mean carbohydrate intake of students aged 15 - 30 years at DIT: Steve Biko Campus

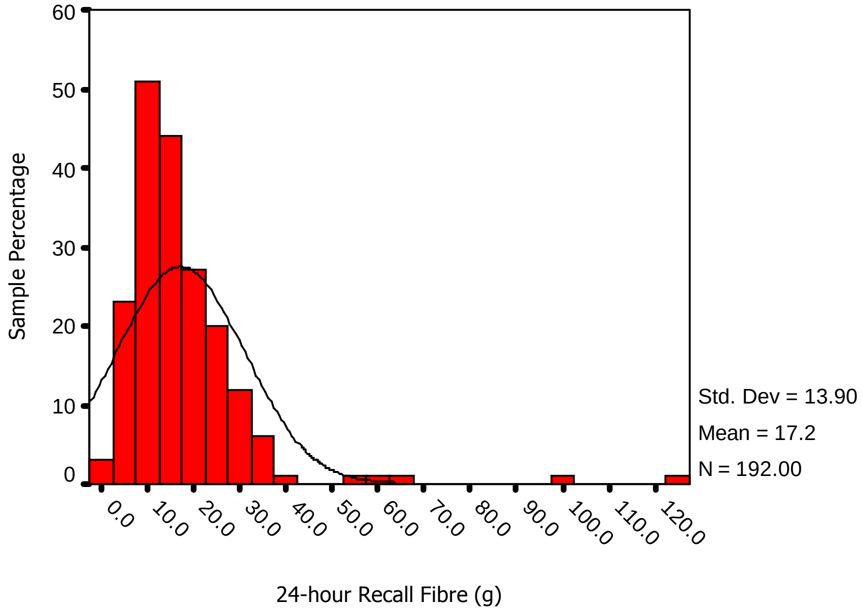


Figure 7 The mean fibre intake of students aged 15 - 30 years at DIT: Steve Biko Campus

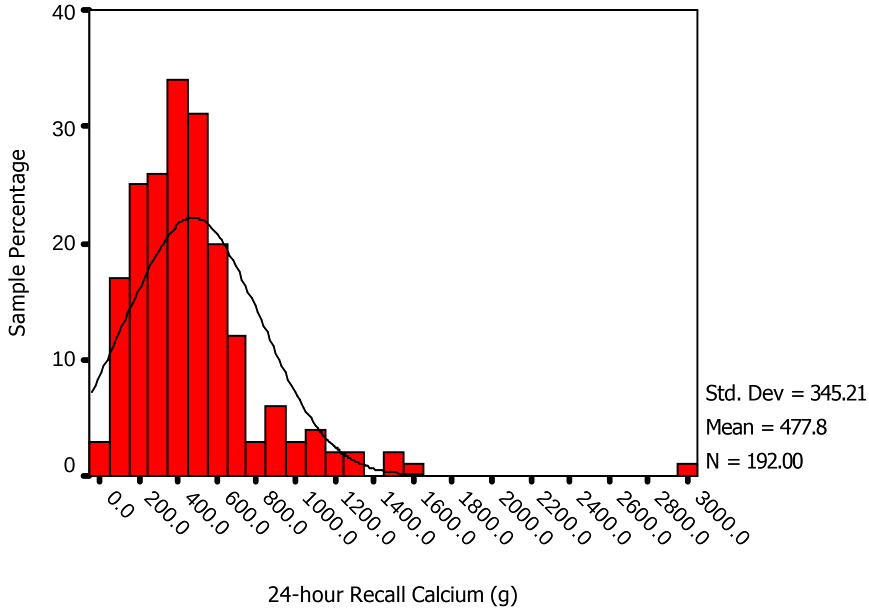


Figure 8 The mean calcium intake of students aged 15 - 30 years at DIT: Steve Biko Campus

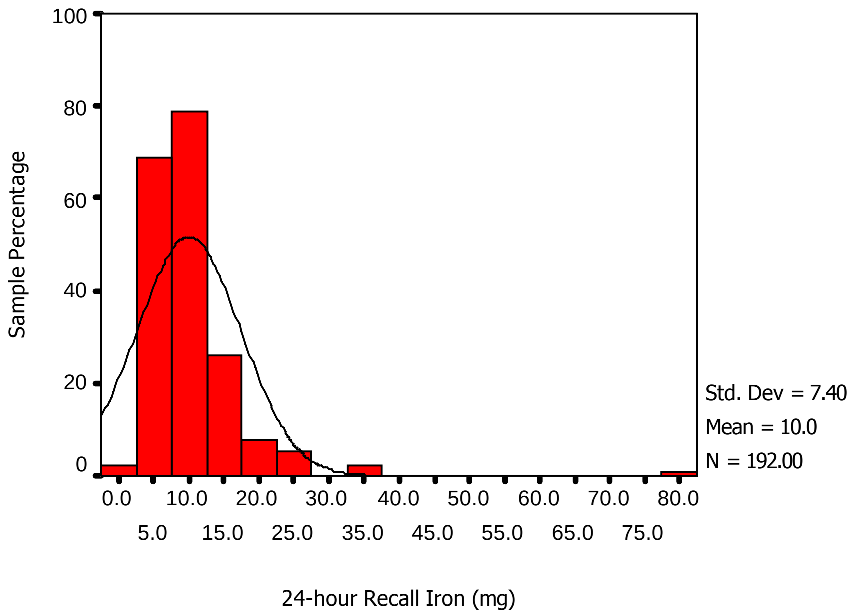


Figure 9 The mean iron intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

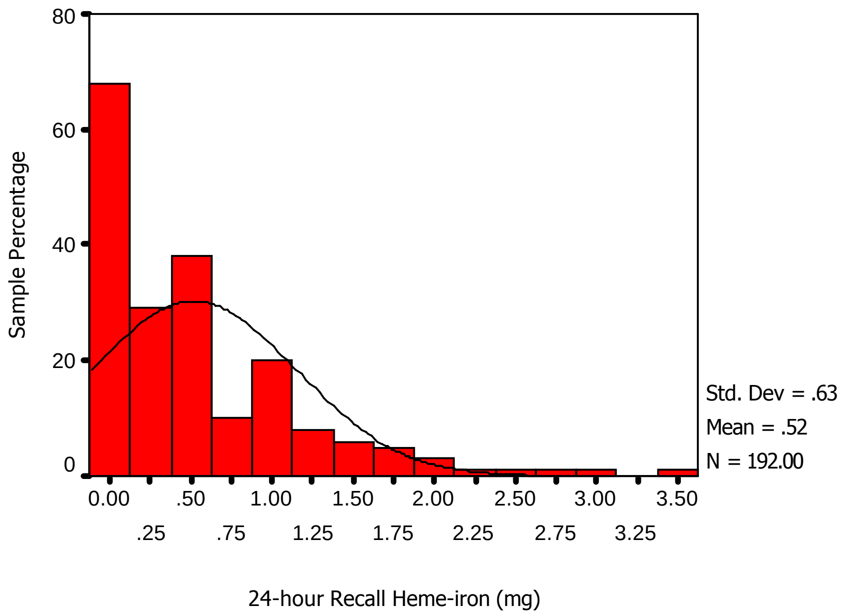


Figure 10 The mean heme-iron of students aged 15 30 years at

DIT: Steve Biko Campus

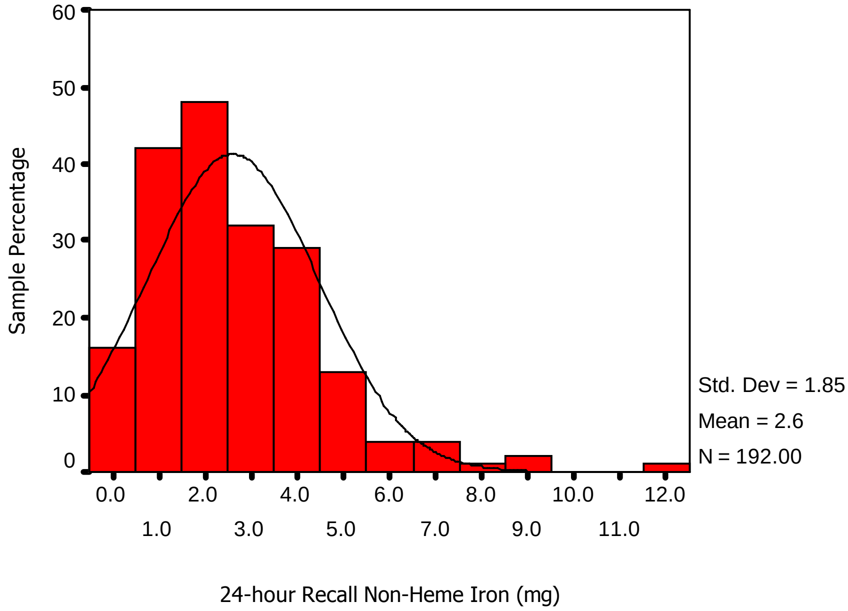


Figure 11 The mean non-heme iron intake of students aged 15 - 30 years at DIT: Steve Biko Campus

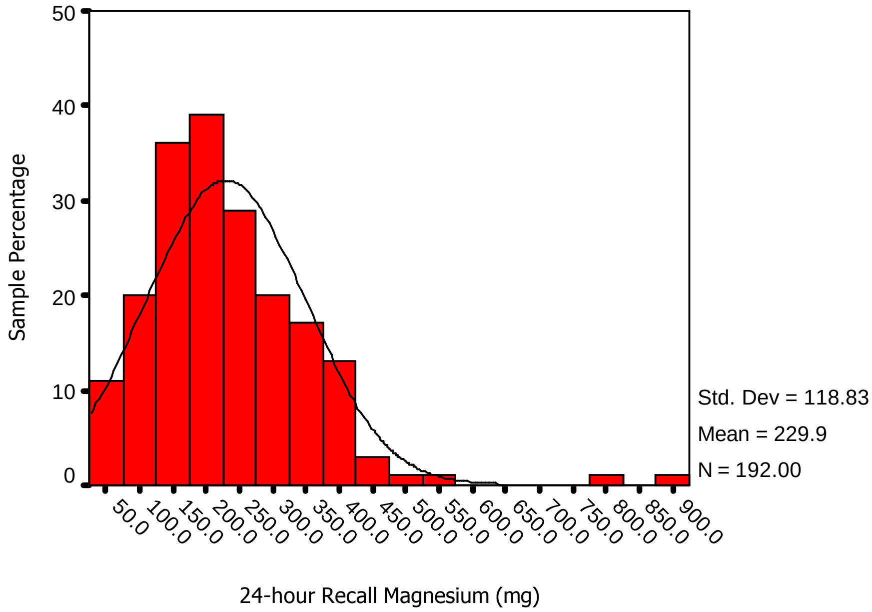


Figure 12 The mean magnesium intake of students aged 15 - 30 years at DIT: Steve Biko Campus

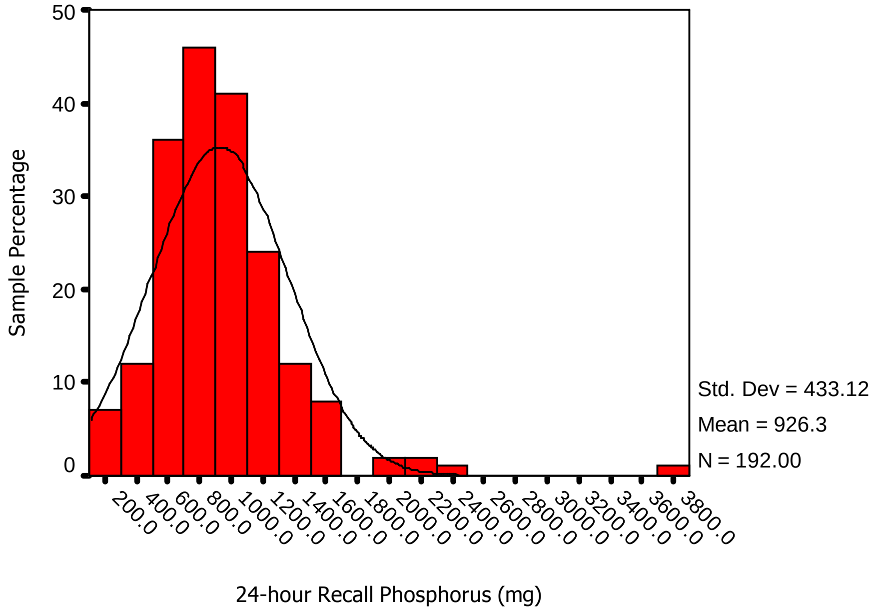


Figure 13 The mean phosphorus intake of students aged 15 - 30 years at DIT: Steve Biko Campus

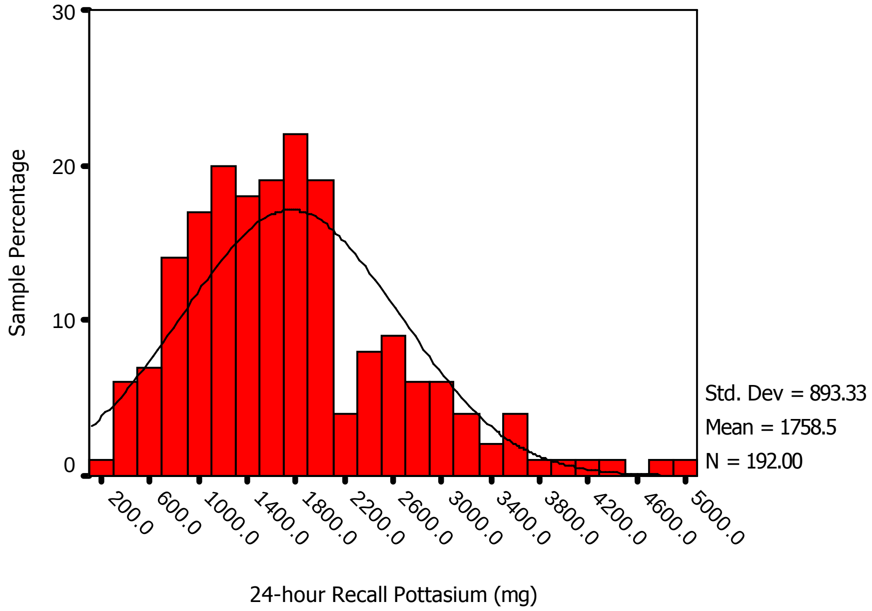


Figure 14 The mean pottasium intake of students aged 15 - 30 years at DIT: Steve Biko Campus

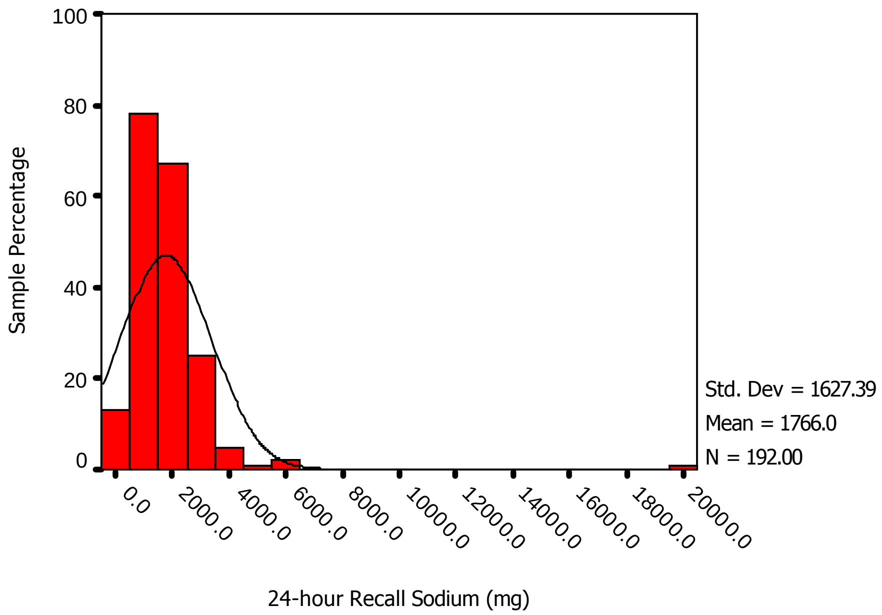


Figure 15 The mean sodium intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

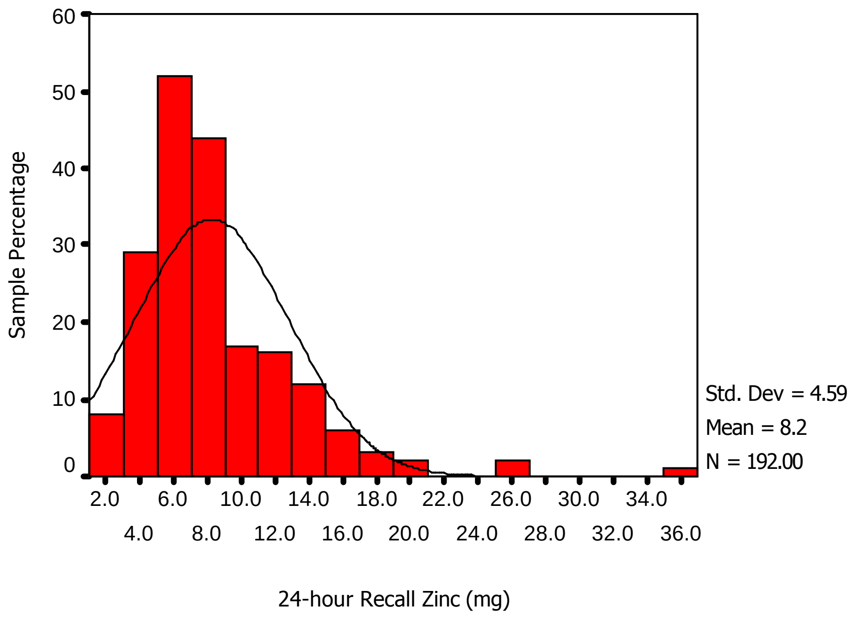


Figure 16 The mean zinc intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

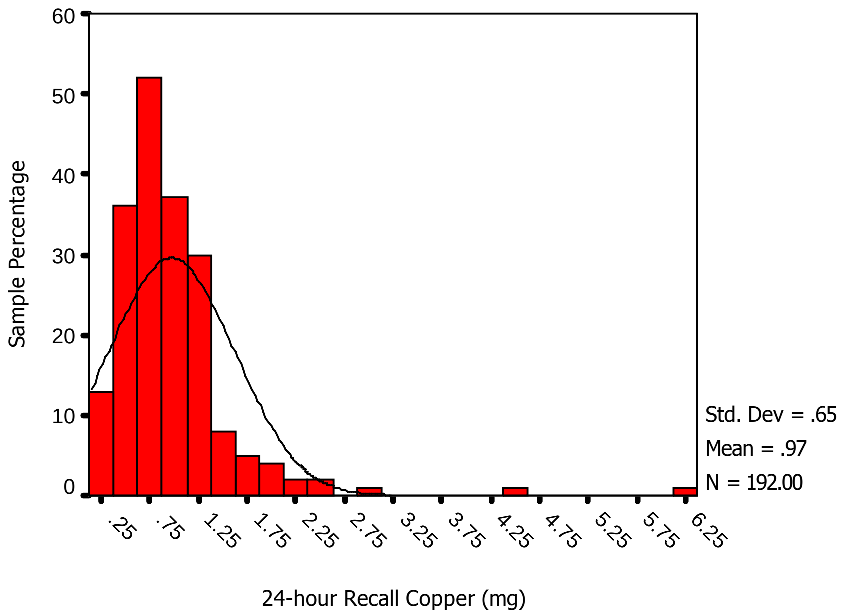


Figure 17 The mean copper intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

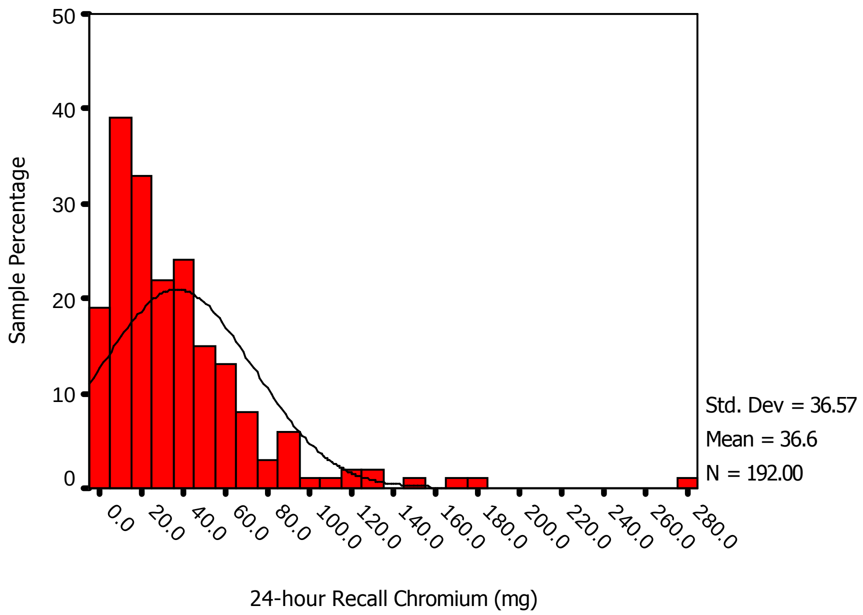


Figure 18 The mean chromium intake of students aged 15 - 30 years at

DIT - Steve Biko Campus

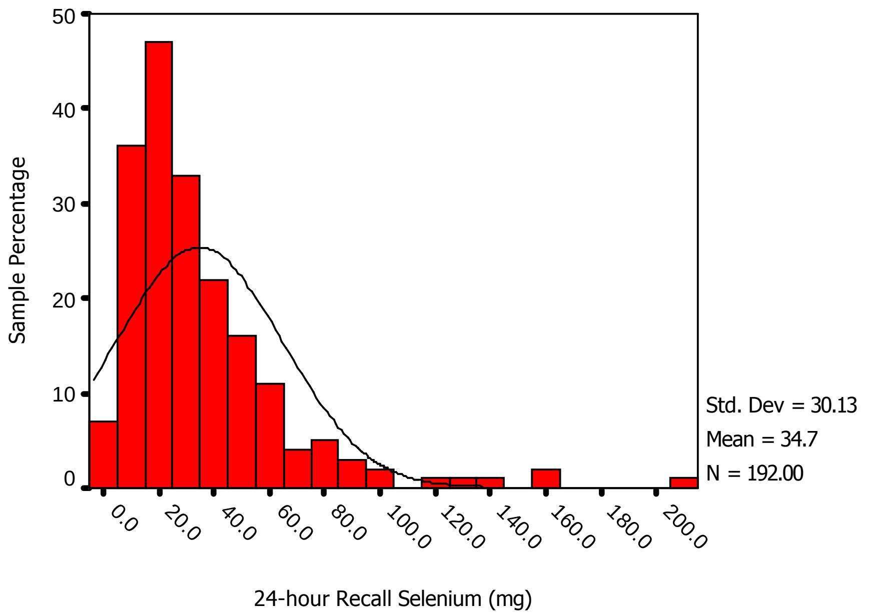


Figure 19 The mean selenium intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

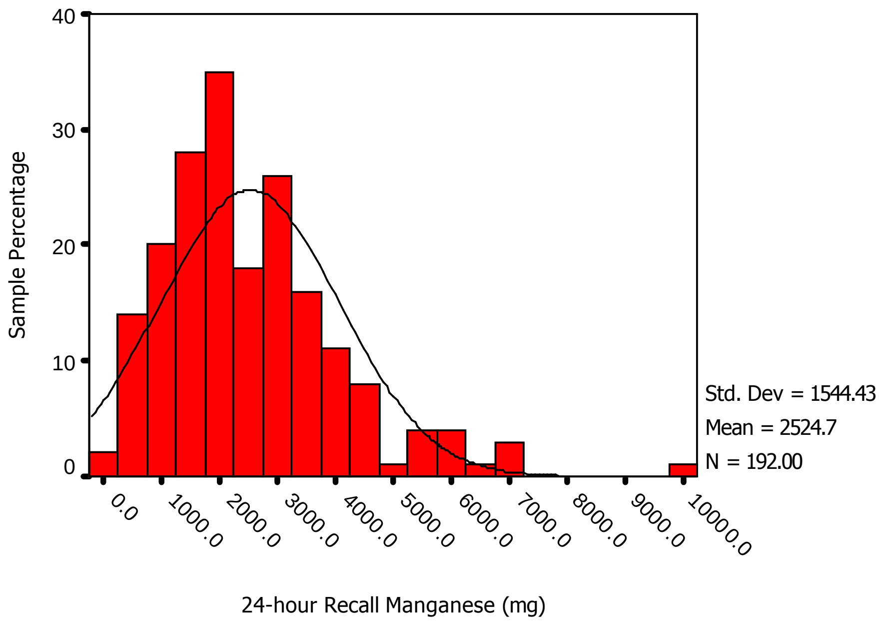


Figure 20 The mean manganese intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

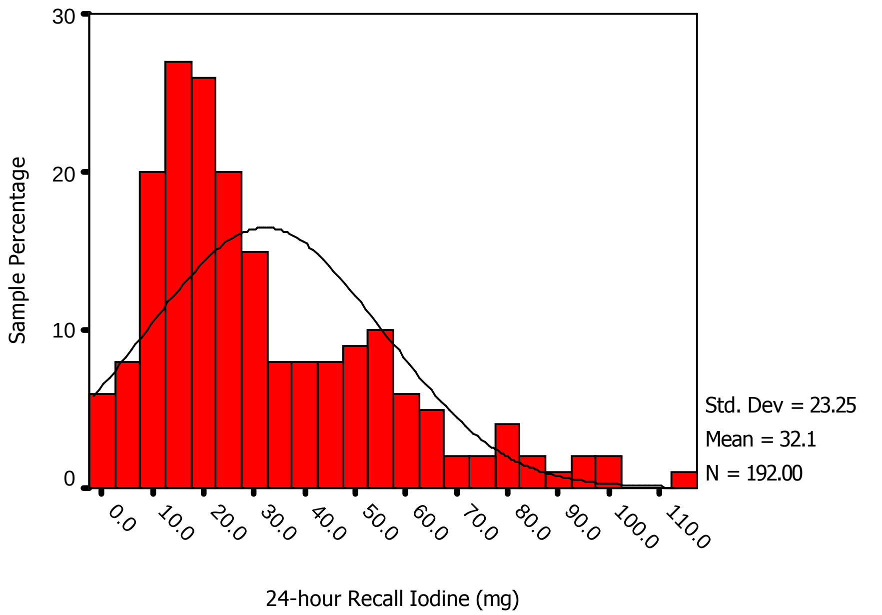


Figure 21 The mean iodine intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

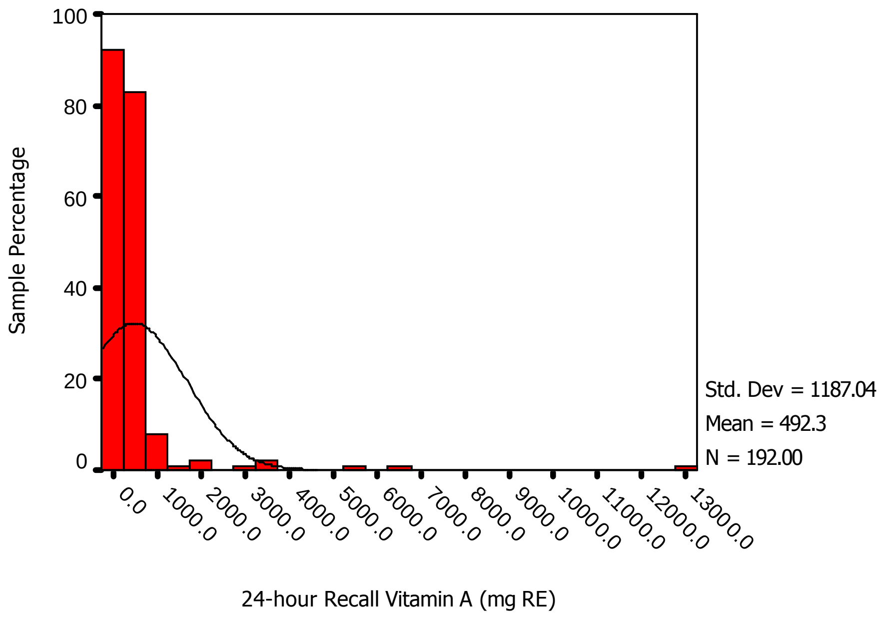


Figure 22 The mean vitamin A intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

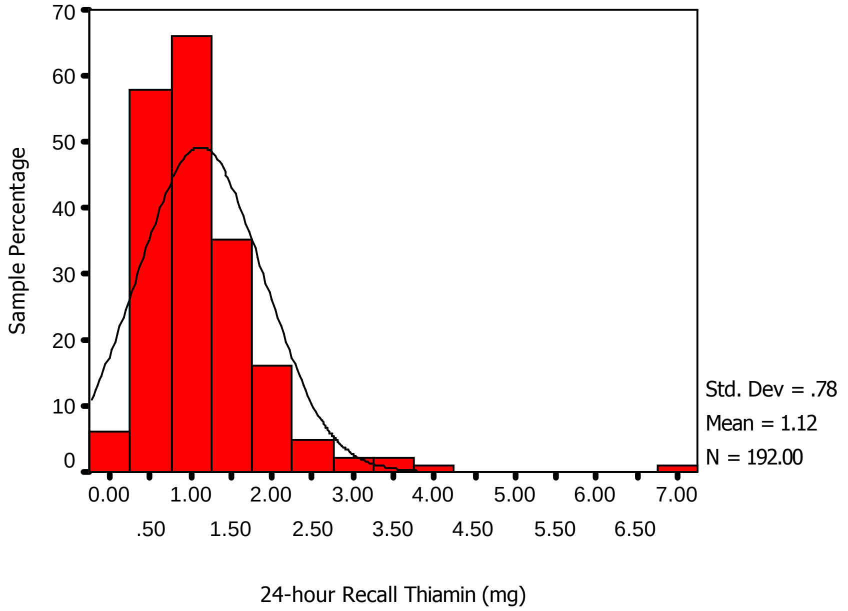


Figure 23 The mean intake of thiamin of students aged 15 - 30 years at

DIT: Steve Biko Campus

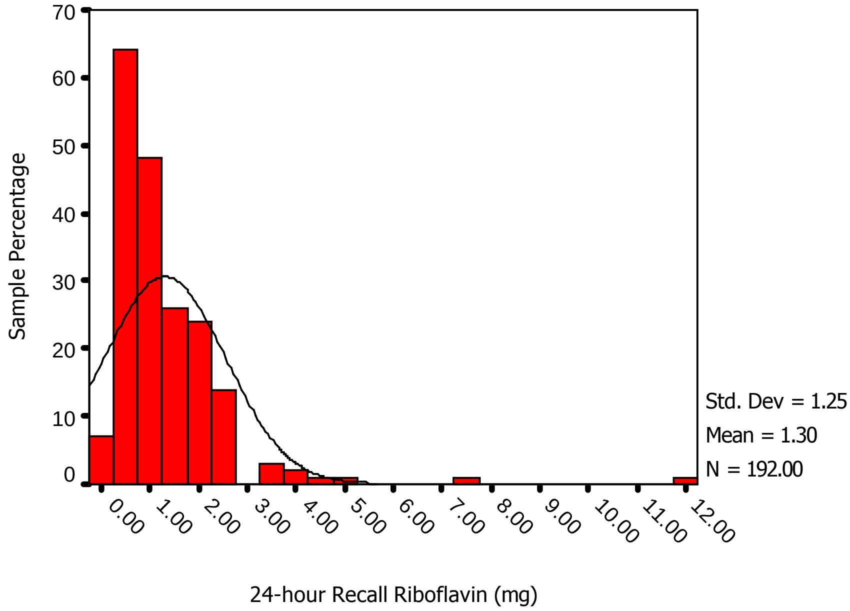


Figure 24 The mean riboflavin intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

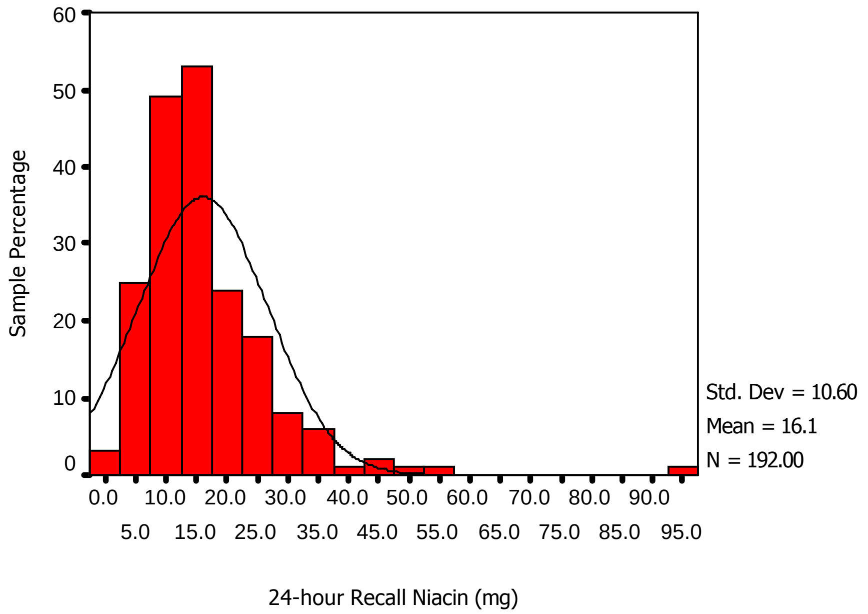


Figure 25 The mean niacin intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

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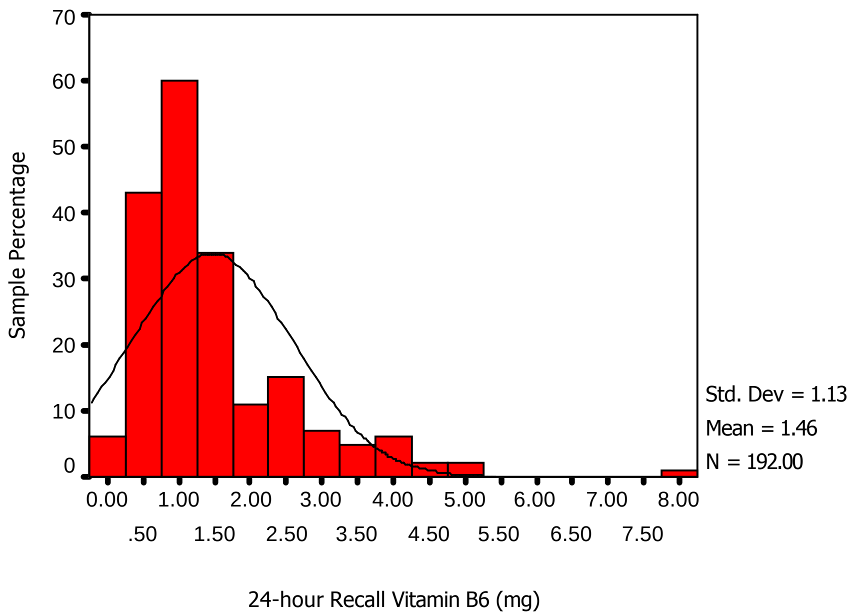

Figure 26 The mean vitamin B6 intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

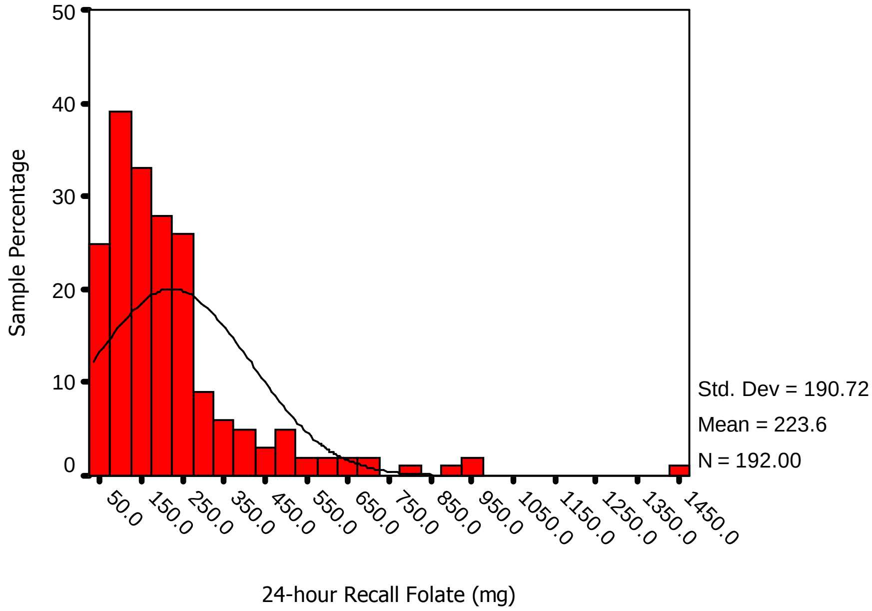

Figure 27 The mean folate intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

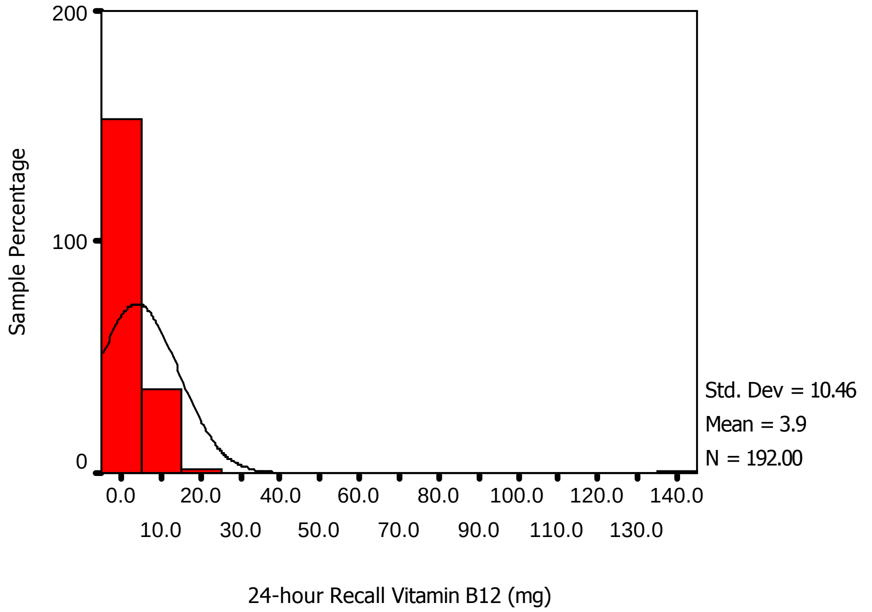

Figure 28 The mean vitamin B12 intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

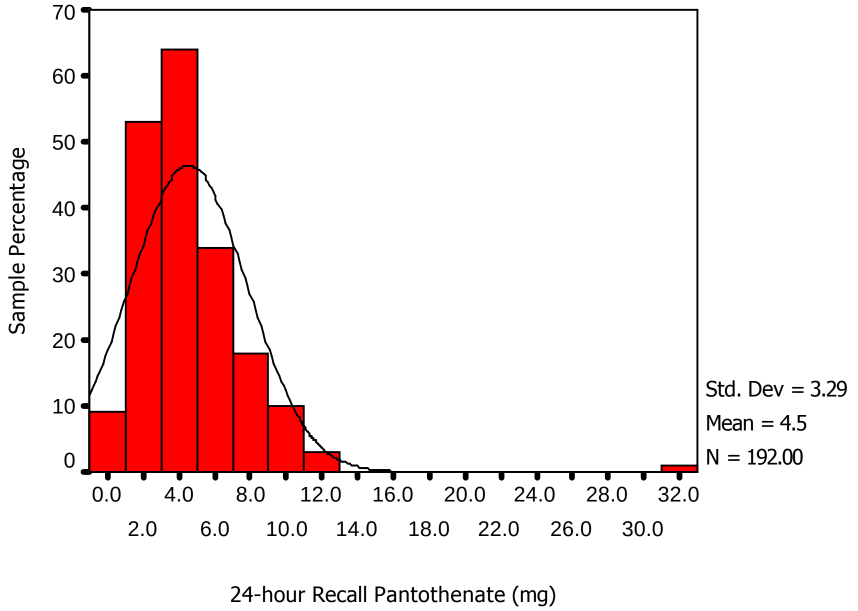

Figure 29 The mean pantothenate intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

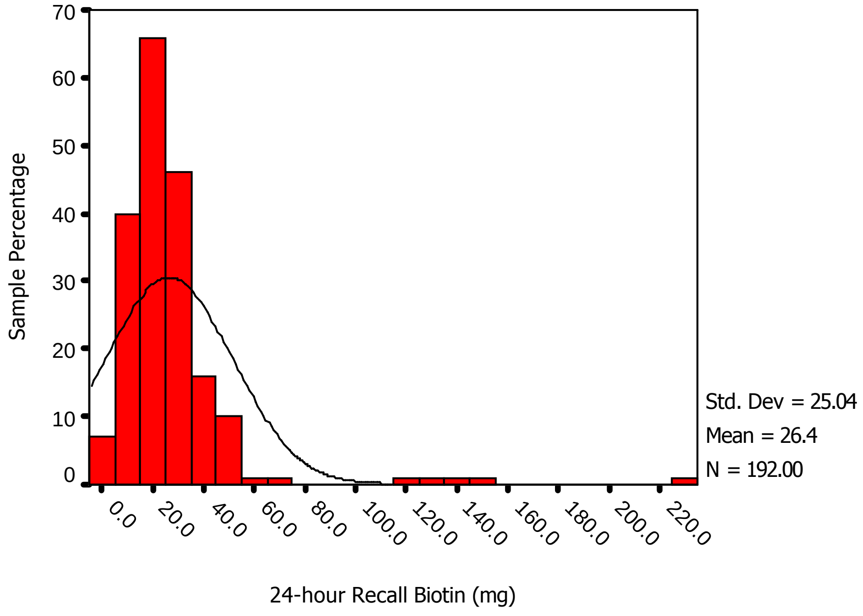

Figure 30 The mean biotin intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

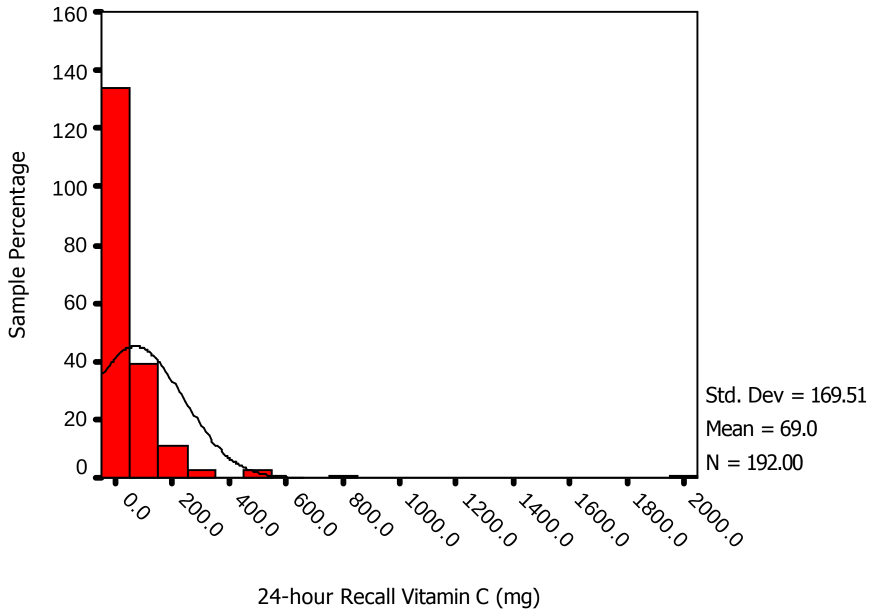

Figure 31 The mean vitamin C intake of students aged 15 - 30 years at DIT: Steve Biko Campus

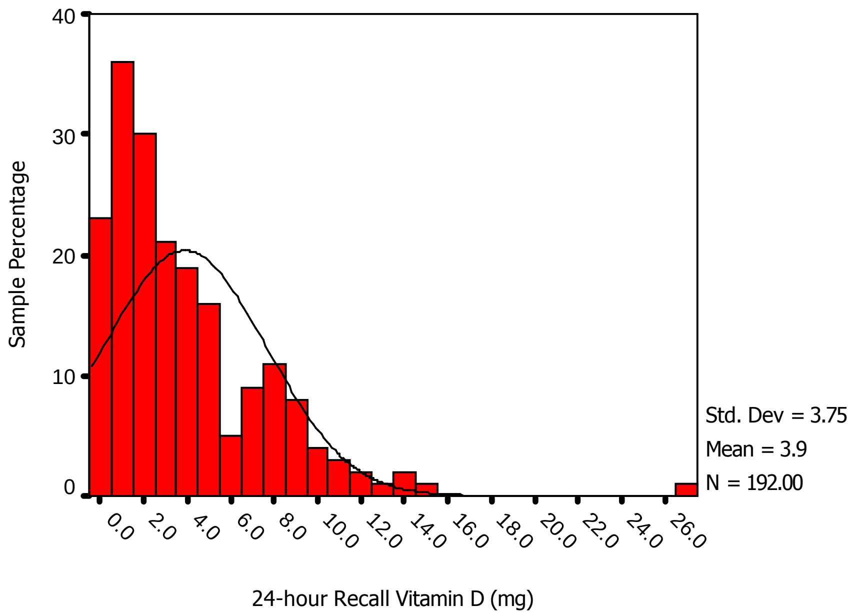

Figure 32 The mean vitamin D intake of students aged 15 - 30 years at DIT: Steve Biko Campus

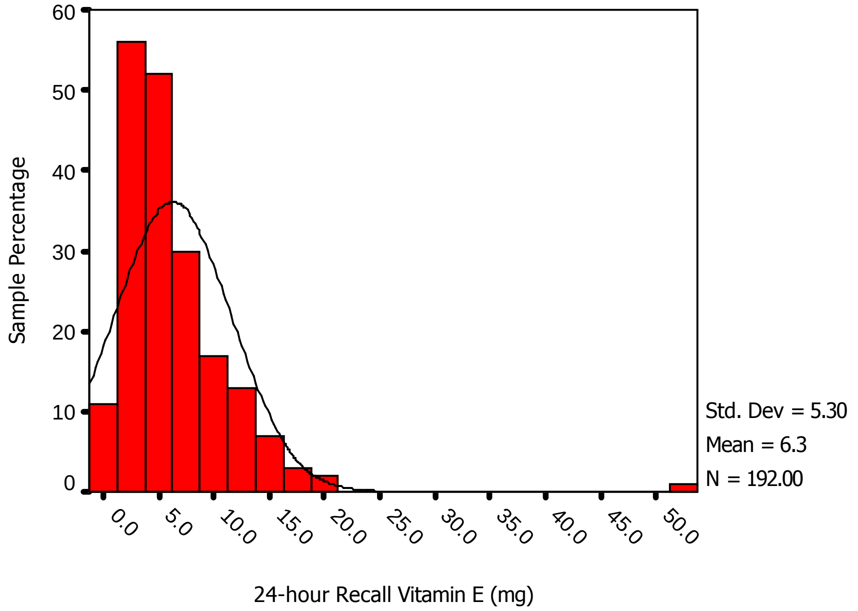

Figure 33 The mean vitamin E intake of students aged 15 - 30 years at

DIT: Steve Biko Campus

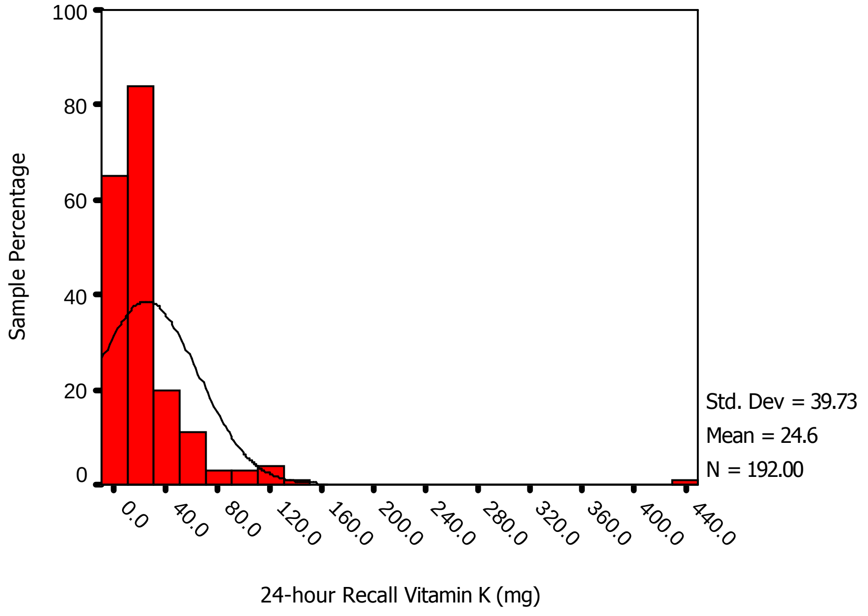

Figure 34 The mean vitamin K intake of students aged 15 - 30 years at

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