DETERMINING THE CONTRIBUTION OF LUNCHBOX CONTENT TO THE DIETARY INTAKE OF GIRLS (13-18 YEARS OLD) IN A HIGH SCHOOL IN LINDELANI

By

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DECLARATION

This work has not previously been accepted in substance for any degree and it is not being concurrently submitted in candidature of any degree.

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ABSTRACT

There is lack of data on the dietary intake and patterns of Lindelani adolescents, which necessitates comprehensive nutritional assessment.

Objectives: The objectives were to investigate the dietary intake and nutritional analysis of lunchbox contents of high school girls (13 -18 years of age) in Lindelani and evaluate its contribution to their dietary intake.

Methodology: The study was of a descriptive nature with an analytical component, a convenience sample of 61 learners who brought lunchboxes from home and completed a socio- demographic questionnaire, QFFQ and two 24- hour recall questionnaire used for evaluation of their dietary intake. Anthropometric measurements, including body composition, were performed. Anthropometric data were captured on a Microsoft Excel spreadsheet and displayed on WHO growth charts to determine stunting, wasting, underweight and over-weight. . Lunchboxes were required and collected without informing participants to avoid bias, each lunch box was weighed and the content recorded and analysed using Food Finder 3 computer software program. It was analysed by selecting the mean intake of the group and comparing it to the Daily Recommended Intake (DRIs) for this group of individuals.

Results: The results indicated that the food group most commonly consumed was carbohydrates. The lunchbox mean energy content was 90.14 kJ (>100% of DRIs) which is a big portion for a lunchbox since there are other meals of the day to be eaten too. The mean intake of fruit portion consumed was 135g which was only consumed by 1% in the top 20 food items compared to 141.82g consumed by 18% in 24- hour recall. Bread, margarine and polony were commonly consumed in QFFQ, Lunchboxes and 24- hour recall. Fat consumption for lunchboxes was 34.04% higher than the WHO nutrient intake goal which put these teenagers at risk of overweight. Fruit and vegetable intake was 106.95g (QFFQ), 107.27g (24-hour recall) and 109.49g (mean lunchbox content). This indicates poor intake of fruit and vegetables, being far lower than WHO recommendation of 400g per day. Dietary fibre was also found below 25g.

Conclusion: Although the group seemed to consume all the nutrients but it is a small sample of the population. The study indicated that the majority of the respondents consume mostly

carbohydrate diets and the lunchboxes did not meet the basic requirements of a balanced diet. The lunchboxes contributed on average one third of the girl's daily food intake.

DEFINITION OF TERMS

Body Mass Index: A simple index of weight for height that is used to classify underweight, overweight and obesity in both children and adults.

Correlation: A measure of relationship that uses a correlation coefficient

Descriptive: Research that describes an existing or past phenomenon quantitatively.

Low birthweight: Birthweight less than 2,500 grams at birth.

Malnutrition: Various forms of poor nutrition caused by a complex collection of factors including dietary inadequacy, infections and socio-cultural factors. Both underweight or stunting and overweight are forms of malnutrition.

Obesity: Excessive body fat content; commonly measured by BMI. The international reference for classifying an individual as obese is a BMI greater than 30.

Overweight: Defined as weight for height above two standard deviations from the median weight for height of the reference population.

Reliability: The extent to which measures from a test are consistent.

Standard deviation: A measure of variability; a numerical index that indicates average dispersion of scores around the mean.

Stunting: Defined as height for age below minus two standard deviations from the median height for age of the reference population.

Underweight: Low weight-for-age is two standard deviations below the international reference for weight-for-age.

Wasting:	Weight divided by height that is two standard deviations below the international reference. It describes a recent or current severe process leading to significant in emergency situations such as famine.
Quintile:	A system of ranking and funding schools taking into account the socio-economic circumstances of learners (inequality and poverty). For example, the poorest quintiles (1 and 2) receive more funding in terms of the Norms and Standards for Funding Schools.
Z-score:	The number of standard deviations (SD) below or above the reference median value.

ACRONYMS

ADA	American Dietetic Association
AI	Adequate Intake
AIDS	Acquired Immunodeficiency Syndrome
BINP	Bangladesh Integrated Nutrition Programme
BMI	Body Mass Index
BP	Blood Pressure
CACFP	Child and Adult Care Food Programme
CBNP	Community Based Nutrition Programme
CDC	Centres for Disease Control
CED	Chronic Energy Deficiency
CHD	Coronary Heart Disease
CHO	Carbohydrates
CSFP	Commodity Supplemental Food Programmes
CVD	Cardiovascular Disease
DALYs	Disability Adjusted Life Years
DBSA	Development Bank of Southern Africa
DGA	Dietary Guidelines for America
DoH	Department of Health
DOSD	Department of Social Development
DRI	Dietary Reference Intake
DUT	Durban University of Technology
EAR	Estimated Average Requirement
ECD	Early Child Development
EDI	Eating Disorder Inventory
EFAP	Emergency Food Assistance Programme
FAO	Food and Agriculture Organisation
FDPIR	Food Distribution Programme on India Reservation
FGT	Foster- Greer- Thorbecke
FSP	Food Stamp Programme
GDP	Gross Domestic Product
GI	Glycaemic Index

GNP	Gross National Product
HFBCP	Health Facility Based Community Programme
HIV	Human Immunodeficiency Virus
ICMR	Indian Council of Medical Research
IOM	Institute of Medicine
INP	Integrated Nutrition Programme
IOTF	International Obesity Task Force
KWANALOGA	KwaZulu Natal Local Government Association
MAC	Mid arm Circumference
MDG	Millennium Development Goals
MPI	Multi dimensional Poverty Index
MSF	Mèdicins Sans Frontières
NDFSM	National Diploma in Food Service Management
NEF	New Economic Foundation
NHANES	National Health and Nutrition Examination Survey
OPHI	Oxford Poverty and Human Development Initiation
OVC	Orphaned and Vulnerable Children
PEM	Protein Energy Malnutrition
PPS	Proportion to Size
QFFQ	Quantitative Food Frequency Questionnaire
RDAs	Recommended Dietary Allowances
SAFBDG	South African Food Based Dietary Guidelines
SAVACG	South African Vitamin A Consultative Group
SD	Standard Deviation
SES	Socio- Economic Status
SFT	School Food Trust
SGB	School Governing Body
SSF	Sub scapular Skin fold
TEFAP	The Emergency Food Assistance Programme
TSF	Triceps Skin folds
UL	Upper intake Level
UNICEF	United Nation’s Children Fund
UNSCN	United Nation Standing Committee on Nutrition

USDA	United States of Department of Agriculture
WC	Waist Circumference
WHO	World Health Organisation
WHtR	Waist- Height Ratio
WRI	World Resource Institute
YRBS	Youth Risk Behaviour Survey

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CHAPTER 1

PROBLEM SETTING AND OVERVIEW OF THE STUDY

1.1 BACKGROUND TO THE STUDY

In South Africa malnutrition is a continuous problem existing in both forms of under and overnutrition. Nationwide more than 50 percent of women are either overweight or obese; while undernutrition affects many children. Childhood malnutrition is more common in children in their first two years as this is a risk period. Chronic malnutrition is indicated by stunting while acute malnutrition is indicated by wasting. Twenty one percent of stunted children in South Africa are iron deficient and 5 percent suffer from iron shortage anaemia. Regular figures for childhood malnutrition vary between and within provinces. South African children eat mainly a maize based diet (Faber and Wenhold, 2007).

Teenagers around the world have poor eating habits and as time goes on these habits are not improving. It is quite common for teenagers to turn to high fat and high sugar fast food instead of healthier alternatives. Teenage girls are most at risk of diets which consist of a low food variety. Teenagers are prone to eating disorders like compulsive overeating, anorexia and bulimia (Van Zyl, Ontong, Van Wyk, Van der Linde and Nkhabutlane, 2006).

Malnutrition is referred to as the imbalance of protein, energy, vitamins and other nutrients vital for the repairs of healthy body tissue and function (Malnutrition Forum, 2008). It has also been found that 95 percent of children with type-2 diabetes in the United Kingdom were either overweight or obese, and that obesity is one of the causes of diabetes in children (Norton, 2005). Temple, Steyn, Myburgh and Nel (2006) concur that dietary patterns predispose to obesity, type-2 diabetes, hypertension, coronary heart disease and other chronic diseases of the lifestyle and these can start in childhood.

Rideout, Levy-Milne, Martin and Ostry (2007) found that children spend much of the day in school and several studies showed that children consume one third of daily food intake at school. Temple et al. (2006) discovered that different countries with low and high income have shown that the majority of children regularly consume a nutritionally poor diet obtained from various sources like shops at school. According to Temple et al. (2006) one American study reported that almost 90 percent of food sold in school shops is high in fat and sugar. In

a study conducted in South Africa by Temple et al. (2006) it was indicated that 10 percent of students in the Limpopo Province took lunch to school, while 22 percent regularly bought snacks at the school tuck shop. Temple et al. (2006) further state that in a study done in Cape Town 10 percent of children were obese and the study showed that a large number of students buy food items at school which are high in energy, fat and sugars. Wiecha, Finkelstein, Troped, Fragala and Peterson (2006) found that consumption of added sugars peaks in American adolescents at about 20 percent of daily calories, the mean daily intake of soft drinks increases from 5 to 11 oz (142.22ml – 312.84ml) among girls.

The increase of vending machines and fast food restaurants in schools contribute to high sugar sweetened beverage consumption among teenagers (Rideout et al. 2006). The prevalent accessibility of less or no nutritional food such as candy, potato chips and soft drinks may have a harmful outcome on the nutritional value of the diet (Temple et al. 2006); (Rideout et al. 2006) and 25 percent of calories from food low in nutritional value are sold in schools and consumed by Canadian children.

1.2 THE GLOBAL NUTRITION PROBLEM

Nutritional deficiencies (e.g. iron, zinc, vitamin A) account for almost two-thirds of childhood deaths worldwide (Welch and Graham, 2004). Hossain, Bisher, Kawar, and Naha (2007) concur with the above statement stating that globally, malnutrition and infectious diseases are a major health problem threatening the developing world; 155 million children worldwide were overweight or obese according to the International Obesity Task Force and more than 1.1 billion adults worldwide were overweight with 312 million being obese.

Hossain et al. (2007) further say that the adoption of a Western standard of living relating to less physical activities and overconsumption of low-cost energy dense foods affect children in developing countries. However, some developing countries face the inconsistencies of families in which children are wasted compared to adults who are overweight. This is due to intestine growth retardation and results in low birth weights which are a predisposition to obesity later in life when accompanied by rapid childhood weight gain which leads to development of insulin resistance and metabolic syndrome (Hossain et al. 2007).

The 2002 World Health Organisation's (WHO) level of estimated disability-adjusted life years, indicated that insufficient iron was the ninth risk factor accounting for 2.4 percent of

universal disability-adjusted life years (DALYS) or the loss of 35 million healthy life years. Forty three percent of all South Africans, 18 years and older, reported that they "went without" food at least once in the past year; 40 percent experienced at least periodic shortages of fuel for cooking or home heating; 45 percent experienced at least periodic shortages of electricity; and 60 percent experienced at least periodic shortages of income (Day and Gray, 2006). The high percentage of teenage pregnancies in India has been indicated as another reason for malnourishment and anaemia. Underweight infants were born and that influenced the whole life of a child and teen mother. It is also argued that food shortage and undernourishment are main causes of the deprivation and suffering targeted by all of the other Millennium Development Goals (MDGs), for example, "as the underlying cause of more than half of all child deaths, hunger and malnutrition" (Day and Gray, 2006).

Undernutrition results in the death of more than one-third of children under the age of five years, the fundamental cause of 3.5 million of deaths yearly. About 20 percent of expecting mothers die at delivery due to maternal undernutrition (United Nation's Children Fund (UNICEF), 2008). In 68 main concern countries, 33 had at least 20 percent mild or severely underweight children and stunting exceeded 20 percent in 62 countries (UNICEF, 2008). The World Resource Institute (WRI) (1999) found that globally, the shortage of vitamin A in children under the age of 6 years is a major problem whereby 42 million children have mild to moderate insufficiency of vitamin A; while about 254 million preschool aged children are at risk of a vitamin A deficiency and 250,000 to 300,000 children go blind annually. An estimated 3 million lose night vision although suffering less fifty to eighty percent of these children die within one year (WRI, 1999).

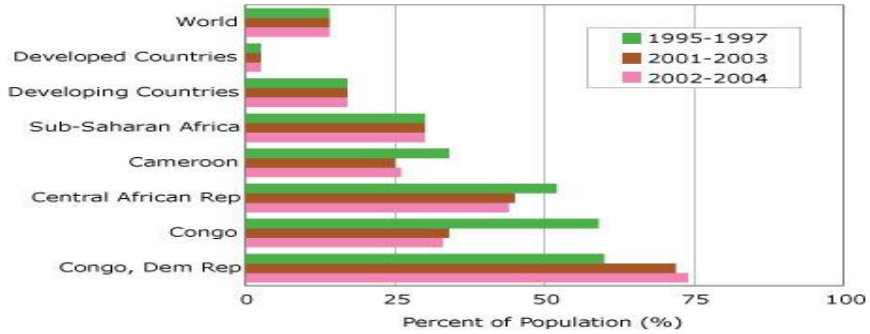

Figure 1.1: Countries with whole population undernourished (WRI, 2010).

Figure 1.1 indicates that African countries display a high percentage of undernourished populations. In Sub-Saharan Africa and Cameroon more than 25 percent of populations were found undernourished. Malnutrition is a major problem mostly in developing countries although the Congo and Central African Republic showed improvement between the years 2001 and 2004. The percentage of undernourished people was still high at 30-45 percent while in, Democratic Republic of Congo the problem of undernourished was approaching 75 percent of the population in 2002-2004 (WRI, 2010).

According to Higgins, McArdle, McEvoy and Tully (2005), eating patterns among children and adolescents continue changing with an increase in frequent snacking and consumption of junk foods. Higgins et al. (2005) found in a study of Irish children that more than 50 percent consumed sweets, 37 percent drank fizzy drinks, and 27 percent consumed crisps, 12 percent chips and 7 percent hamburgers at least once daily. Higgins et al. (2005) reported a decline in fruit consumption among school going children and a low intake of fruit and vegetables.

There is a need to educate teenagers about healthy eating and physical education. It has been emphasized that teenagers are physically inactive. Rasekholo (2008) suggested that lunch prepared at home is the best for children rather than giving money for food. Breakfast is very important especially for children who do not eat at school. Hamilton-Ekeke and Thomas (2007) found that meals eaten at school by children are high in fat and these choices can result in a poor balanced diet. The lack of nutritional knowledge can also lead to unbalanced dietary patterns with excess fat and sugar (Hamilton-Ekeke and Thomas, 2007).

The World Bank (2006) stated that the MDGs will not be reached without major improvement in eliminating malnutrition. The World Bank (2006) also stated that there are significant relations between nutrition and most of the MDGs, but mostly in malnutrition and starvation (MDG 1), child death (MDG 4), maternal health (MDG 5) and diseases such as HIV and Aids, Human Immune Virus (HIV) and acquired immune deficiency diseases (AIDS) (MDG 6). According to Casazza and Ciccazzo (2007), a major cause of morbidity and mortality in the United States of America is due to problematic behaviour patterns established during adolescence that tend to influence long term health behaviour and have an impact on long life health. According to UNICEF (2012) in poorest countries and poorest groups within the country life saving treatments remain inaccessible for majority of children

and diseases such as pneumonia, diarrhoea, malaria neonatal deaths undernutrition and HIV and Aids are still the major cause of death.

1.3 THE AFRICAN NUTRITION PROBLEM

According to Fanzo, 2012 prevalence of stunted overall African children increased from estimated 43 million in 1990 to 52 million in 2008 with 10 percent of obese children in 8 of 45 Sub-Sahara African countries. The food security system indicated by Food and Agriculture Organisation (FAO, 2010) in Figure 1.2: shows that the African continent is mostly affected by nutrition problems.

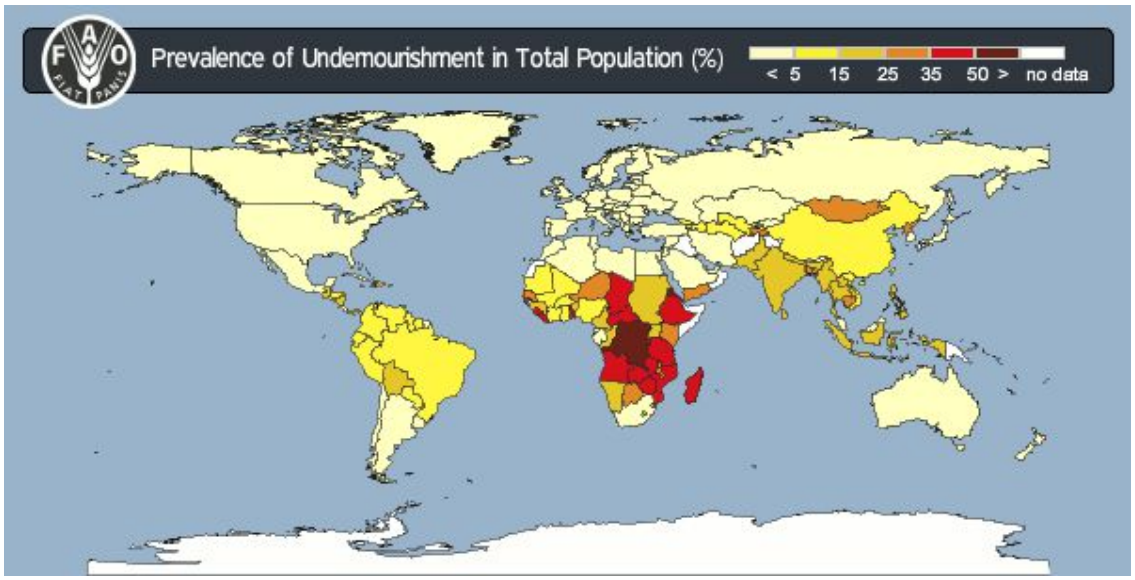

Figure1. 2: Prevalence of Undernourishment in Total Population (%) (FAO, 2010).

In the Democratic Republic of Congo the prevalence of undernourishment in the total population was 69 percent, the number of undernourished people 41.9 million from a total population of 60.8 million with the dietary energy supply of 6678kJ per person per day. The Central African Republic prevalence of undernourishment was 40 percent with 1.7 million people undernourished from a population of 4.2 million. The South African prevalence of undernourishment in the total population was less than 5 percent. In Angola the prevalence of undernourishment in the total population was 41 percent which was 7.1 million of people from a population of 17.1 millions. Kenya also presents a high percentage of undernourished population (31%) (FAO, 2010).

According to the FAO (2005a), Uganda indicated an increase of undernourished from 4.2 million to 4.6 million between 1990 and 2003. In Zambia the increment of undernourished individuals was from 4.0 million to 5.1 million, however, food shortage in Sub-Saharan Africa is as constant as it is very common. Between 1990 and 2003, the huge numbers of undernourished people increased from 169 million to 206 million, and out of 39 countries only 15 countries reported the elimination of undernutrition in their data (FAO, 2005a).

1.4 THE SOUTH AFRICAN NUTRITION PROBLEM

According to a report by the Development Bank of Southern Africa (DBSA) (2008), South Africa is in a nutritional change which includes the presence of both overnutrition and undernutrition and has a malnutrition problem of public health significance. Labadarios, Steyn, Maunder, Maclntryre, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesmvuni and Nel (2005) also indicated that 10 percent of children were overweight and 4 percent obese, while one out of four women had a poor vitamin A and 45.3 percent of children had an inadequate zinc status.

Stunting and underweight were found most among children in the Northern Cape (27.7 percent stunted, 38.3 percent underweight) and Free State (28.2 percent stunted, 14.1 percent underweight). The prevalence of women of 16-35 years with chronic energy deficiency (CED) as defined by BMI<18.5 was 4.6 percent Northern Cape leading with 16.7 percent followed by Limpopo Province at 7.9 percent. Nationally overweight and obesity were found in 51.5 percent women with the highest prevalence in the Western Cape (58.7 percent with one in two women overweight or obese in the Free State, Gauteng, the Eastern Cape and KwaZulu–Natal (Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste, Dannhauser, Nel, Molefe and Kotze 2008; DBSA, 2008).

Steyn, Nel and Casey (2003) indicated that the avarage consumption of 10-15 year adolescents did not differ from that of adults, however, the population in the Northern Province, Free State and North West in both urban and rural areas indicated high consumption of maize, while adolescents in Mpumalanga, Easten Cape, Gauteng and KZN high consumption of maize was only found in rural areas. Kruger, Kruger and Macintyre, (2005) state that the eating patterrns of all the children indicated a high consumption of cereal or starch based staple food and cold drinks and low consumption of nutrient dense foods

(milk, meat, fruit and vegetables). The National Food Consumption Survey (NFCS)) of 1999 further presented micronutrient deficiencies of less than 67 percent of the Recommended Dietary Allowances (RDAs) for energy, calcium, iron, zinc,vitamin A.

Table 1.1: Studies published in South Africa over the last 10 years on adolescents' food intake and nutritional status.

No	Author & Reference	Study Population	Measuring Instrument	Results
1	Mould, Grobler, Odendaal & De Jager (2011). Ethnic differences in age of onset and prevalence of disordered eating attitudes and behaviours: a school based South African study.	418 Black and White school girls between 13.7 and 16.7 years.	Eating Attitudes Test (EAT - 26) and Eating Disorder Inventory (EDI).	The South African students showed a greater drive for thinness and poorer eating attitudes compared to Canadian teenage girls between 12 & 18 years.
2	Venter & Winterbach, (2010) Dietary fat knowledge and intake of mild adolescents attending public schools in Bellville area of the city of Cape Town.	168 learners of 17 years old girls.	Knowledge/ screening questionnaire, 24-hour recall & QFFQ.	58% Knowledge score. 75% interested in nutrition.
3	Reddy, Resnicow, James, Kambaran, Omardien, and Mbewu, (2008) underweight, overweight & obesity among South African adolescents: Results of the 2002 National youth risk survey.	9224 students between 13 - 19 years of age.	Socio-demographic Anthropometric.	9.0% underweight, 16.9% overweight, 4.0% obese.
4	Jinabhai, Taylor, Reddy, Monyeki, Kamabaran, Omardien and Sullivan (2007). Sex differences in under and over- nutrition among school- going Black teenagers in South AFRICA: an uneven nutrition trajectory.	5322 Black African school going teenagers between 13.0 & 17.9 years, 2924 were girls.	Anthropometric, Youth Risk Behaviour Survey (YRBS).	20.9% girls were overweight, shorter but stunted & had higher BMI than boys.
5	Temple, et al. (2006) food items consumed by attending schools in Cape Town.	476 students between 12- 16 years of age.	24- hour recall, socio, breakfast & knowledge questionnaires.	77.8% had breakfast before school, 79.7% ate at school, 41% brought food to school, 69.3% purchased no health items, and 73.2% purchased 2 or more of unhealthy food, 64% of high socio economic brought lunch from home.

6	Kruger, Kruger & Macintyre (2005). The determinance of over- weight & obesity among 10-15 years old school children in North West Province S.A. Transition & health during urbanisation of South Africa Bana Children (THUSA BANA Children) Study.	1257 of 10- 15 years old school going children in North West Province, Black, White, Coloured & Indian group primary & secondary schools.	Socio-demographic economic, anthropometric measures.	78% obese, 14.2% obese among White children. 7.1% obese Blacks, 6.4% among Indians, 2.9% among coloured.
7	Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste, Dnnhauser, Nel, Molefe, Kotze (2005). National Food Consumption Survey- Fortification Baseline (NFCS-FB-I)	All children aged 1-9 years and all women of reproductive age 16 - 35 years in South Africa.	Socio-demographic, Knowledge, Attitude & Behaviour questionnaire (KAB).	One third of women & children were anaemic. Two thirds of children & one out of four women nationally had a poor vitamin A status, in KZN six out of ten women had poor vitamin A; Ten percent nationally were overweight & 4% were obese.
8	Steyn, Nel & Casey (2003). Secondary data analysed of dietary survey under- taken in S.A. To determine used food consumption of the population.	75 children between 14 - 18 years and 30between 19 - 25 years of age.	24- Hour recall and QFFQ.	99% consumed cereal. >80% consumed sugar cereal 690 - 879g in 10 + years old. 57 - 67% consumed meat and offal group. 11-15% consumed pulse.
9	Montanari & Zierkiewicz (2000). Adolescent S.A.Ballet Dancers.	37 adolescents between the ages 14-17 years in Gauteng high school.	Eating disorder inventory (EDI), Biographical questionnaire.	Indicate adolescent dancers have strong eating disorder of both Anorexic & Bulimic.

Table 1.1 indicates South African nutritional status and food intake of adolescents studies conducted in the last ten years. Malnutrition is still a problem amongst teenage girls as various surveys show results of obesity, underweight and overweight. It has also been found that above 40 percent of teenage girls have no knowledge of nutrition and 75 percent are interested in nutrition while these teenagers indicate eating disorders like Anorexia and Bulimia which indicate that much needs to be done in South Africa to eradicate malnutrition(Venter & Winterbach, 2010). In Cape Town it was found that only 41 percent of teenagers brought lunch from home and 64 percent are from high socio-economic families, 69.3 percent purchased food at a school tuckshop, however, 70 percent purchased unhealthy items (Venter & Winterbach, 2010; Temple, et al. 2006).

1.5 STUDY AIM

The aim of this study is to analyze the lunchbox content of high school girls between 13-18 years old in Lindelani and evaluate its contribution to their dietary intake.

1.5.1 Specific objectives

The specific objectives for this research are formulated as follows:

- To determine the socio-demographic characteristics of the children.
- To determine the nutrient content and top 20 foods consumed by the children on a daily basis and of the lunchboxes of the children.
- To assess the contribution of the lunchbox content to the daily intake of the adolescents.
- To determine the nutritional status of the children (13-18 years old) through anthropometry.

1.6 CONCEPTUAL FRAMEWORK OF THE STUDY

This framework was developed by the researcher to guide the researcher through various stages of the survey to the end of the dissertation.

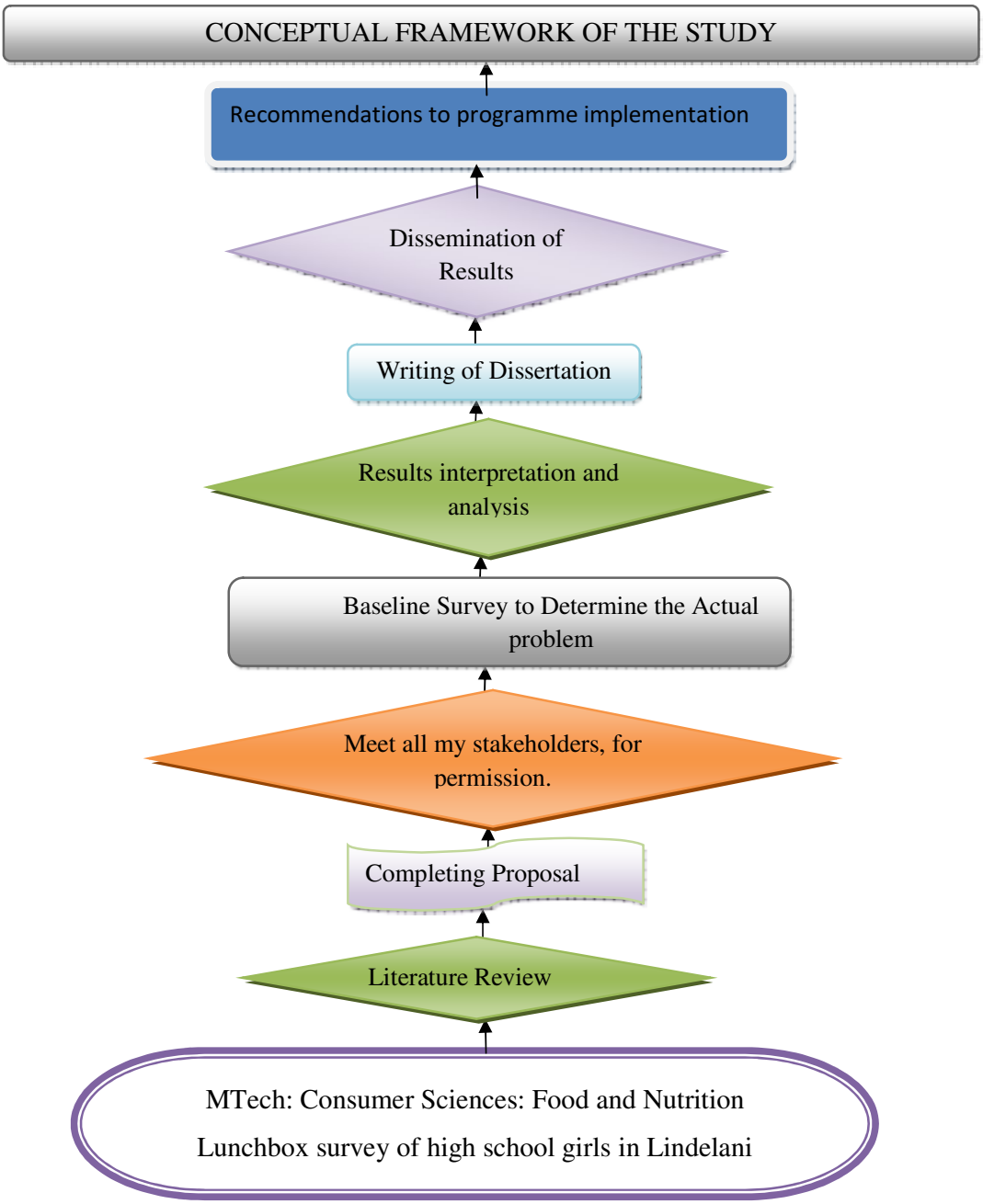

Figure1.3: Conceptual framework of the study

1.7 STRUCTURE OF THE DISSERTATION

Chapter 1 Introduction and motivation for the study.

Chapter 2 Literature review: Causes of malnutrition.

Chapter 3 Methodology.

Chapter 4 Results.

1.8 CONCLUSION

Overnutrition and undernutrition are global challenges. It has been observed that infants, young children and adolescents are the main victims of these social issues. Ignorance has been seen as the result of under and overnutrition.

CHAPTER TWO
LITERATURE SYNTHESIS

2 INTRODUCTION TO MALNUTRITION

Poverty and low food production are two of the causes of malnutrition (Lawal and Jibowo, 2006). Lack of material resources like food preparation equipment, money, the shortage of space and skills, disabled and sick caregivers, and lack of interest, knowledge, creativity and time has an influence on eating habits and food choices which may result in malnutrition (Baker, Cornelissen, De Villiers and Turley, 2005). Oogarah-Pratap (2007) also indicates that food skills like shopping, planning and preparation of meals have been found to be important determinants of eating behaviour of teenagers in making appropriate food decisions later in life. It has been found that poor eating habits or food insecurity may lead to malnutrition. Research has shown that adolescents' choice regarding healthy food choices are influenced by peer relationships, school involvement and family support (Mackey, 2007).

The Malnutrition Forum (2008) stated that undernutrition is a consequence of consuming insufficient energy and other essential nutrients or using energy faster than it is being replaced. However, overnutrition results from eating too much, eating too many of the wrong foods and lack of physical activities. Malnutrition Forum (2008) found that children in many parts of the world are becoming increasingly overweight and malnutrition is a major cause of death and illness throughout the world. Adequate nutrition during adolescence is very important for growth, cognitive development, health, attendance and performance in school. Undernutrition and overnutrition in adolescence can be linked to immediate health risks as well as long term risk in the form of metabolic syndrome related diseases (Dapi, Omoloko, Janlert, Dahlgren and Haglin, 2007).

2.1 WHAT IS MALNUTRITION?

Malnutrition is a state when the human body has improper amounts of protein, energy, vitamins and other nutrients required to sustain healthy tissue and body function (Malnutrition Forum, 2008). Medical Research Council (MRC) (2007) indicated that South Africa is a country of inconsistency, where obesity in the children co-exists with stunting and

early nutritional deficiency. The Report showed that more than 30 percent of adolescent girls were either overweight or obese. In primary school 22 percent of girls are overweight or obese and 17 percent of children under the age of 9 years were overweight or obese and 19 percent were stunted. Children in rural areas are at risk of stunting, while those children from urban settings may be at a higher risk of obesity (MRC, 2007).

Malnutrition has been found as a continuous problem amongst primary school children globally (Napier, Oldewage-Theron and Kearney, 2009). The FAO has estimated that 80 percent of malnourished children living in the developing world are from the countries that produce food surpluses although it is claimed that lack of technology leads to malnutrition contributed by the shortage of food.

Mannar (2006) further stated that even though privileged earnings and good food security improve nutrition over the longer term, malnutrition is not just the result of poor food security; many children in food-secure upbringing are stunted due to unsuitable care and feeding practices of infants, poor access to health services together with poor hygiene as indicated by UNICEF in Figure 2.1. A report by UNICEF (2009b) indicated that underweight reflecting both chronic and acute malnutrition, decreased from 10.3 percent in 1999 to 9.3 percent in 2005 in the United Kingdom, although in urban areas it appeared to have increased (from 7.7 percent to 9.5 percent). Malnutrition occurs in different forms namely overnutrition, undernutrition and obesity.

2.2 OVERNUTRITION

Geyer, Mogotlane and Young (2009) found that the most common forms of overnutrition are overweight and obesity and these conditions are associated with high health risks including hypertension, heart disease, type-2 diabetes, stroke, gallbladder disease, sleep apnoea, respiratory disorders and certain cancers. According to Chopra, Galbraith and Darnton-Hill, (2002), problems of overnutrition are increasing even in countries where hunger is endemic and the increase in overweight increase non communicable diseases especially diabetes which are now global problems.

Overnutrition can result from binge eating and consuming too much junk food with high fat and sugar content and without doing adequate physical exercise (Steyn and Temple,

2008:167). According to Taveras, Sandora, Shih, Ross-Degnan, Goldmann, and Gillman (2006), television viewing is linked with poor eating behaviour of high consumption of fast foods, sugar sweetened beverages, high-fat foods and less intake of fruit and vegetables among older children and adolescents. Kruger et al. (2005) agrees that the high consumption of sugar sweetened soft drinks may increase energy and replace nutrient dense foods in the diet, and the high glycaemic index (GI) foods may stimulate overeating, contributing to weight gain.

2.2.1 Obesity

The WHO (1998) defines obesity as the accumulation of excessive body fat in adipose tissue, to the level that health may be impaired. Alton (2005) concurs with the above definition when defining obesity as a disorder of energy metabolism involving extreme adipose tissue stores, which may be related to health or psychosocial morbidity. The prevalence of obesity in adolescents is increasing at a very high rate, making it one of the most serious health problems affecting adolescents. According to the WHO (1998), statistics obese people are increasing worldwide.

Alton (2005) states that according to what was discovered from the American National Health and Nutrition Examination Survey (NHANES 1999-2000), around 30 percent of adolescents were at risk of being overweight ($\geq$ 85th percentile and < 95th percentile), and 14 percent of these teenagers were severely obese ($\geq$ 95th percentile). Not only cultural and socioeconomic groups are affected, as higher rates in African American females and American Indian and Hispanic youth of both girls and boys were also distinguished. Overweight and obesity are becoming a global problem in countries undergoing epidemiological transition for example in South Africa there is a high percentage of obese woman covering more than 56 percent of the entire obese women population with 62 percent of black group urban woman compared to white group urban women (53 percent) (Mciza, Goedecke, Steyn, Charlton, Puoane, Meltzer, Levitt and Lambert, 2005).

The American Dietetic Association (ADA, 2003) reported that obesity results as a lack of physical activity and childhood obesity in the USA and has increased to 4, 7 million of obese children between the age of 6 and 17 years. Monteiro, Conde and Popkin (2002) found that in Brazilian regions there was an increase of obese women and underweight declined from

13.4 percent to 7.5 percent while obesity increased from 6 percent to 10.9 percent. An increase in obese women was found more in less developed regions among lower income women.

Drewnowski and Specter (2004) stated that problems of high obesity are usually associated with poor income and poor education levels amongst women. Batch and Baur (2005) identify that obesity in children and adolescents has become very high as 20-25 percent of children and adolescents were obese, less desirable meal patterns such as frequent snacking, also appear to be related to established obesity.

2.2.2 Diseases of lifestyle as an effect of obesity

It has been found that food insecurity can lead to both undernutrition and overnutrition which in turn can lead to overweight and obesity (Tanumhardjo, Anderson, Horwitz, Bode, Emenaker, Haqq, Jessie, Satia, Silver and Stadler, 2007). It was further found that type-2 diabetes is a health problem that develops more in obese children. Batch and Baur (2005) agree that obesity in childhood and adolescence may be associated with insulin resistance, which can lead to severe obesity and insulin resistance and may progress to type-2 diabetes if no appropriate medical interventions are taken.

According to Lichtenstein, Appel, Brands, Carnethon, Daniels, Franch, Franklin, Kris-Etherton, Harris, Howard, Njeri Karanja, Lefevre, Lawrence Rudel, Frank Sacks, Van Horn, Winston, Wylie-Rosett (2006), obesity is a risk factor for cardiovascular disease (CVD) as a result of excessive body weight, increasing low density lipoprotein cholesterol levels, triglyceride levels, hypertension and blood sugar levels while reducing excessive density lipoprotein cholesterol and raise the possibility of developing coronary heart disease (CHD), heart failure, stroke and cardiac arrhythmias. Factors leading to overweight and obesity include increased portion sizes of calorie-dense food.

It has been found that obesity impacts on the development of CVD, heart attack and stroke as a result of imbalanced food consumption, physical inactivity and tobacco use (Labarthe, Dai and Harrist, 2009). Access to low-cost food, inactive lifestyle, commercial and cultural influences promotes high eating of calorie dense food. Lichtenstein et al. (2006) found that a diet high in vegetables and fruit meet micronutrients, macronutrients and fibre requirements

without adding to overall energy consumption. Hence it is necessary to include fruit and vegetables and exclude foods associated with CVD risk reduction in the diet.

A diet rich in vegetables and fruits has been shown to lower blood pressure (BP) and improve CVD. Soluble fibre reduces LDL cholesterol levels. Nayak, Varghese, Ganghi, Wood, Balman and Mann (2007) also discovered that 9.4 percent of overweight children had hypertension and pre-hypertension compared with 4.8 percent of children with a normal BMI. It has been found that different lifestyle factors have an influence on type-2 diabetes. Obesity and physical inactivity increases the risk of diabetes; cigarette smoking also increases diabetes risk whereas moderate consumption of alcohol reduces the risk of diabetes. A diet with a high glycemic index (GI) and low in fibre also increases the risk of diabetes (Hu, Manson, Stampfer, Colditz, Liu, Solomon and Willett, 2001:345).

2.3 UNDERNUTRITION

Undernutrition is defined as the result of inadequate dietary intake and recurring communicable diseases which includes being underweight, stunted, wasted (becoming very thin), and lack in vitamins and minerals (UNICEF, 2006; Oldewage-Theron, Dicks and Napier, 2006). Tanumhardjo et al. (2007) also defines undernutrition as improper nutrition due to food shortage or inability of the body in utilizing or absorbing food. Undernutrition is the result of insufficient dietary intake and it can cause communicable diseases and being underweight and deficient in vitamins and minerals (Steyn and Temple, 2008). Underweight status represents depleted body fat and/or lean tissue stores (Luder and Alton, 2005). Gopalan (2000) also sees undernutrition as part of poverty syndrome from low family income, large family size, poor education, poor environment and housing, poor access to health care and inadequate access to food. Persistent diseases frequently become more severe during adolescence, further increasing nutrient and energy demands. It has been found that in 2004, 10, 5 million children died worldwide due to illnesses caused by undernutrition. Undernutrition, growth failure and pubertal delay is common, which may have a negative impact on the adolescent's body image and self esteem (Luder and Alton, 2005).

2.4 PROTEIN ENERGY MALNUTRITION (PEM)

Whitney and Rolfes (2011) state that PEM result from both protein and energy deprivation and mostly affects children. Research shows that in every four children worldwide one is affected by PEM and 33,000 children in the world die each day due to malnutrition. Whitney and Rolfes (2011) found that children who are underweight for their heights suffer from acute PEM and Chronic PEM occur in children who are short for their age (stunted). PEM is a global problem especially in developing countries (Odabas, Caksen, Sar, Tombul, Kisli, Tuncer, Yuca and Yilmaz, 2005) resulting in children being underweight or stunted (Mannar, 2006).

PEM is one of the leading nutrition problems of public health concern in Malawi, and it continues to exert a negative impact on the health and survival of Malawian children. Recent estimates have shown that nationally, 47.8 percent of preschool children are stunted (22.2 percent severely), 22 percent are underweight, and 5.2 percent are wasted (Kalimbira, Dorothy Chilima and Mtimuni, 2006). According to Padula, Salceda and Seoane (2009), PEM is a result of food insufficiency and poor social and economic conditions.

It has been found that children between 1 to 60 months with severe PEM showed an increased frequency of chromosomal disorder in peripheral lymphocytes and bone marrow cell cultures, and abnormalities continue even after the children have attained normal weight and height. Total chromosomal disorder rate was found to be almost seven times higher among infants with PEM compared with controls (14.61 percent vs. 2.2 percent). PEM can disable the immune system, leaving malnourished children less able to fight common diseases such as measles, diarrhea, respiratory infections, tuberculosis, pertussis, and malaria (WRI, 1999). According to Whitney and Rolfes (2011) and Shashidhar and Grigsby (2009), PEM is classified into two forms, namely marasmus and kwashiorkor.

2.4.1 Marasmus

Geyer et al. (2009) define marasmus as a result of an insufficient intake of carbohydrate, fat and protein over a period of months and is characterised by severe wasting of subcutaneous fat and muscle. According to Whitney and Rolfes (2011), marasmus is derived from the Greek meaning dying away if a person is deprived of food for a long period of time.

Marasmus is very common in children aged between 6 to 18 months and it is most prevalent in the poor regions of the world. In such regions people eat food with low protein and other nutrients like vitamins, minerals and fats. Children in these areas have diluted cereals that supply limited amounts of energy, less than required; as a result of such undernutrition the life expectancy of these children is very short (Whitney and Rolfes, 2011).

2.4.1.1 Symptoms and signs of Marasmus

Due to undernutrition, children can appear as old people since they are very skinny and have skin folds on the buttocks (WHO, 2008a). Body muscles become weak if there is no adequate nutrition. Marasmus disturbs the brain development and learning ability of children (Whitney and Rolfes, 2011). According to Geyer et al. (2009) and WHO (2008a), marasmus is characterised by severe wasting of subcutaneous fat and muscle. Beers and Berkow (1999) and the WHO (2008a) report that marasmus is characterised by weight loss, weight-for-age and weight-for-length/height that are likely to be very low and growth retardation is evident.

2.4.2 Kwashiorkor

Whitney and Rolfes (2011) explain that kwashiorkor is when a child is deprived of food. Unlike marasmus, in kwashiorkor there is a sudden change in the manner in which the child was fed. Kwashiorkor is believed to start when the child is suddenly deprived of food when the mother gives birth to the next child and interrupts breast feeding too early. In this case the child is changed from protein rich breast feeding into protein poor cereals. Kwashiorkor is more common between the ages of 18 and 24 months old. Once a child has kwashiorkor he or she is more vulnerable to measles or other infections. There is a loss of weight but it is not as severe as in marasmus (Whitney and Rolfes, 2011).

2.4.2.1 Symptoms and signs of Kwashiorkor

Children with kwashiorkor tend to have swollen limbs. The lack of protein results in fatty liver and this fatty liver lacks enzymes that deal with the toxins in the body (Whitney and Rolfes, 2011). Kwashiorkor is characterised by oedema and poor wound healing (Geyer et al. 2009). According to Beers and Berkow (1999) and WHO (2008a), kwashiorkor is also characterised by flaky dermatosis; thinning, decolouration and reddening of the hair, and retarded growth. Beers and Berkow (1999) and the WHO (2008a) state that kwashiorkor may

cause hair to have a dramatic “striped flag” appearance. Kwashiorkor may lead to pneumonia, diarrhoea and the child will usually be underweight, but oedema may mask the true weight (WHO 2008a).

2.5 CAUSES OF MALNUTRITION

Conceptual Framework of Malnutrition

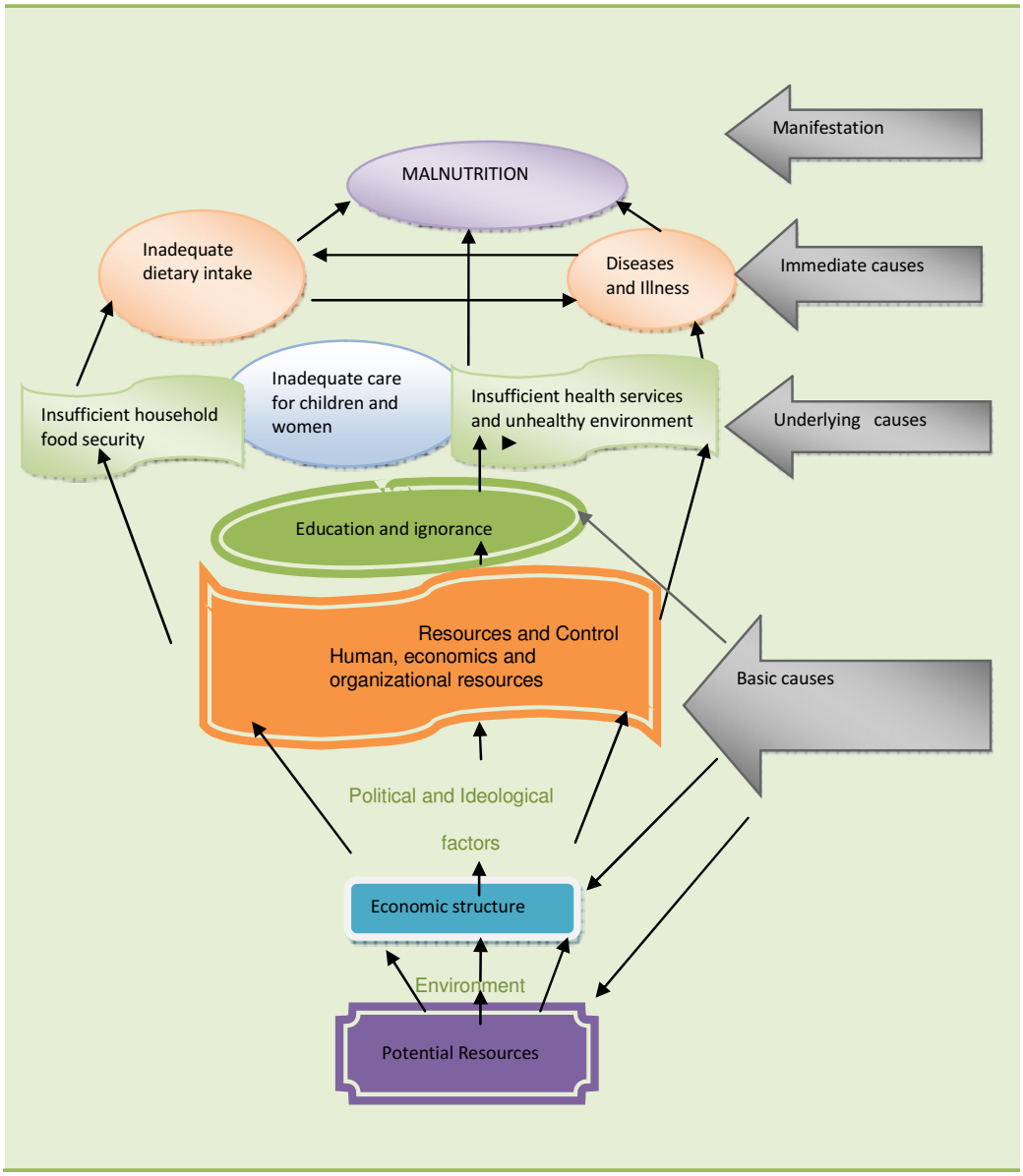

Figure 2.1: Adapted from United Nations Children's Fund (UNICEF) framework of malnutrition (UNICEF, 2009b)

The global conceptual framework developed by UNICEF indicated in Figure 2.1 identifies malnutrition and death in children and women as the result of inadequate dietary intake and illness as immediate cause (Bellette, 2005; Benson, 2005 and Chanyalew, 2005). The various causes will be discussed in detail in this chapter.

2.5.1 IMMEDIATE CAUSES

2.5.1.1 Inadequate dietary intake

Klimis-Zacas, Kalea, Yannakoulia, Matalas, Vassilakou, Papoutsakis-Tsarouhas, Yiannakouris, Polychronopoulo and Passos (2007) agreed that inadequate dietary intake and poor food choices of teenagers lead to malnutrition. The researchers found that deficiency in vitamin D during adolescence can harmfully impact calcium balance and availability for bone mineralisation at a stage where 50 percent of adult bone mass was being required.

Feldman, Eisenberg, Neumark-Sztainer and Story (2007) indicated that the dietary intake of children who have two or more meals with the television on were less nutrient rich and more processed food and soft drinks were consumed as compared to children who have meals with the television off. Both internal and external factors like food preferences and availability, body weight perception, parental and peer influence contribute to adolescent eating patterns (Videon and Manning, 2003).

UNICEF (1992) states that dietary inadequacies might be caused by an insufficient food supply or by mothers having too little time to prepare food or to feed children. Inadequate dietary intake is also caused by food unavailability and limited access to food. Therefore, the individual's desire to obtain food and one's knowledge of appropriate food, composition and meal servings amongst family members can improve the situation (Reinhard and Wijayaratne, 2002).

2.5.1.2 Diseases and illnesses

Micronutrient deficiencies and infectious diseases often lead to malnutrition and infection in underprivileged populations; this has been indicated in patients with active TB who commonly had anaemia and lower plasma concentration of retinol and zinc than healthy subjects (Romieu, 2005). According to De Waal and Whiteside (2003),

results of the Southern African development community study indicated that skipping of meals was not only characteristic in all rural areas but was also more common in households with a chronically ill adult. Fifty seven percent of such households had gone entire days without eating in the preceding 2 months. Researchers further states that "Adults living with HIV endanger their health by going hungry hence many types of nutritional deficiencies suppress the immune system, and make infections more virulent" (De Waal and Whiteside, 2003).

Food shortage and malnutrition also increase the risk of infection and death from malaria and tuberculosis as it has been found that children and pregnant women with micro nutrient deficiency and already suffering from anaemia were commonly attacked by very severe malaria (FAO, 2005b). Malaria infection rates can be significantly reduced, by an improved diet with high supplementation of vitamin A and zinc. Diseases like AIDS, has been found to put the Ethiopian population in danger as it directly affect the agricultural production in the community (International food policy research institute (IFPRI), 2005:75). According to UNICEF (2012) diarrhoea is associated with inadequate nutrition, poor or unhygienic food handling. Due to diarrhoea or vomiting the body become unable to retain nutrients from food that are required by the body also lead to malnourish.

2.5.2 UNDERLYING CAUSES

2.5.2.1 Insufficient household food security

Chanyalew, (2005) defines food security as the availability, access and utilization of sufficient food by all people at all times for an active and healthy life. According to Bhutta, Bawany, Feroze and Rizvi (2008), food security is the sufficiency of safe, and nutritious food and sufficient physical, social and economic access to meet peoples' dietary needs and food preferences for an active healthy life for all people, every time, for an active and healthy life to sustain human development. Oldwage-Theron et al. (2006) stated that nutritional status is usually associated with food intake which, in turn, is taken to be dependent on household income. Oldwage-Theron et al. (2006) further stated that the primary causes are household food insecurity, insufficient care for the exposed groups such as mothers and childcare, shortage of necessary human services such as health, education, water and environmental hygiene or cleanliness and shelter.

Armed conflict contributes to malnutrition as it results in inadequate household food security due to violence against farming manufacturers which lead to physical inactivity of food producers, shortage of agricultural inputs and additional services, corrupting infrastructure and markets, and loss of agricultural incomes. Dislocation or death of working family members results in food shortage which makes it difficult to provide adequate energy for planting a sufficient area of land to grow food (FAO, 1996).

In rural populations, wars and conflicts leading to the loss of livestock and nutritional consequences are also contributing factors to malnutrition (FAO, 2004). Lack of food storage, consumption of wild food, reduced number of meals per day and high rate of unemployment indicate low food accessibility and all these lead to food insecurity (Reinhard and Wijayaratne, 2002). According to Ravindranath, Venkaia, Vishnuvardhana Rao, Arlappa, Reddy, Mallikharjuna Rao, Kumar, Brahmam and Vijayaraghavan 2005 drought affect the economy of the country. Drought drops the agricultural production and industrial output, increase the level of unemployment, decrease the purchasing power and reduce household food and nutrition security, migration of rural poor to urban areas and more of displacement or death of cattle. However all these lead to increase communicable diseases and poor nutritional status due to lack of safe clean water food and shelter.

2.5.2.2 Urbanisation

Urbanisation is the movement of the people from rural areas to cities; population movement is due to the availability of industries in the cities as people are moving to the cities in search of employment. Unemployment and lack of resources can lead to malnutrition, because children are left alone at home of which the eldest child will look after the siblings and decide what to eat. According to Shashidhar and Grigsby (2009), overpopulation, more commonly seen in developing countries, can reduce food production, leading to inadequate food intake or intake of foods of poor nutritional quality. Overpopulation reduces land space to grow crops for household security.

It has been noticed that refugees in the Southeast Asia might be at nutritional risk because of low access to food supplies and parasitic anaemia (Escott-Stump and Earl, 2008). According to Stamoulis, Pingali and Shetty (2004), urbanisation is accompanied by changes in habitual dietary practices and food consumption patterns. Stamoulis et al. (2004) found that the

differences between rural and urban diets are the higher average wages and opportunity cost of time in urban and higher participation of women in the labour force.

According to WHO (2004) and Stamoulis et al. (2004), urbanisation has improved open movement of processed foods and other products including cooking oil, soft drinks, biscuits, cakes, sweets and chocolates and ready to eat foods which contribute to problems of malnutrition. These have become readily available and consumption has increased significantly in urban areas of Africa. WHO (2004) and Popkin (2002) stated that the dietary intake pattern is rapidly changing from a habitual diet of high carbohydrate, high fibre to one containing many artificial, processed and non-traditional foods. The WHO (2004) concluded by saying that this trend was accelerated by the increased rate of urbanisation. Increased urbanisation and changing food habits and lifestyles have created an additional burden of nutrition problems in Africa. Internal migration put more pressure on housing and food as well as important public services like safe water, sanitation, transportation and medical care, among others (Stamoulis, et al. 2004).

2.5.2.3 Poverty

The World Bank (2007) defines poverty as the inability to achieve a minimum standard of living. The poverty level is seen as people living below the poverty line of $1.25 or $2 per person per day (Alkire and Santos 2010). Worldwide 1700 million people live in poverty (<$2/day). According to Alkire and Santos (2010), in Sub-Sahara Africa 64.5 percent of people are poor living <$2/day. Insufficient access to essential services, such as health, education, water and sanitation, is also linked to poverty, as the housing quality and living environments, even with an income above the poverty line, someone living in an area with no access to these services might well be considered as poor (New Economic Foundation (NEF) 2008).

According to Kumar (2008), research done in three cities, Bombay, Calcutta and Madras showed that a high proportion of girls fall in category II (high risk of malnutrition) and III (moderate risk of malnutrition) malnutrition. According to the United Nations Standing Committee on Nutrition (UNSCN) (2009), populations in category II are at high risk of becoming malnourished and populations in category III are at moderate risk of malnutrition.

The cumulative effect of poverty, under nourishment and neglect was reflected by the poor body size and narrow pelvis as pre-teenage girls grew into adolescence stage. Patel (2003) identifies a close relationship between poverty and malnutrition and concluded his research by saying the poor are the group affected most by malnutrition. KwaZulu-Natal Local Government Association (KWANALOGA) (2010:18) sees extreme poverty and lack of education as factors that impact on employment which make it impossible to find acceptable housing, electricity, water and food. Poverty disadvantages children as it becomes difficult to complete school education as these children have to go and look for jobs in order to sustain the family. Low paying jobs that they qualify for and unemployment are directly related to malnutrition.

The new estimates of poverty show that the proportion of people living in poverty in South Africa has not changed between 1996 and 2001, however, those households living in poverty have sunk deeper into poverty and the gap between richer and poor has widened. KWANALOGA (2010) also explains that about 57 percent of individuals in South Africa were living below the poverty income line in 2001, unchanged from 1996. The Limpopo and Eastern Cape Provinces were found to have the highest percentage of poor with 77 percent and 72 percent of the population living below the poverty income line. The Western Cape (32 percent) had the lowest percentage in poverty followed by Gauteng (42 percent).

According to UNICEF (2010), KwaZulu-Natal has the highest rate of poverty, and the second and the third maximum poverty headcount. Limpopo is ranked third in terms of the severity, but comes first on the poverty headcount measure. Western Cape ranked the highest for all three of the Foster-Greer-Thorbecke (FGT) poverty measures – it has the lowest child poverty headcount rate, in both depth and severity of the child poverty. Children in rural areas have been seen as the children most facing severe poverty compared to children in urban areas.

The percentage presented in 2007 by UNICEF proves the above statement as 44.9 percent of people live in poverty in urban areas compared to 58.7 percent in rural areas. Given differential price effects, indicating people in urban areas usually face higher price levels which increases poverty than those in rural areas (UNICEF, 2010).

Alkire and Santos (2010) used a socio-demographic questionnaire to measure poverty. According to Alkire and Santos (2010), Multi Dimensional Poverty Index (MPI) is an index of acute multidimensional poverty which indicates deprivation in basic services and human functioning for people across 104 countries. MPI referred to "poor" as indicated by living with someone in a household who is undernourished with poor education of less than five years in school.

Someone might be in a household which has previously faced a child's death and is deprived in at least three living criterion indicators (sanitation, water, cooking fuel, electricity, floor, and assets). At the same time the person could live in a household that is underprivileged in three living criterion indicators and in which there are school-aged children not attending school (Alkire and Santos, 2010). According to Alkire and Santos (2010), 32 percent of the total residents in 104 countries are deprived. One thousand three hundred and thirty four million people (25 percent) are living on less than $1.25/day, and 2,509 million people (48 percent) are living on less than $2/day.

2.5.2.4 Insufficient health services and unhealthy environment

Díaz-Bonilla, Babinard, Pinstrup-Andersen and Thomas (2002:423) stated that Global environmental concerns, from climate change (global warming) to stressed ecosystems, are major problems which require huge amounts of money to address but this contributes to food security and the health and nutrition of the world's poor. Díaz-Bonilla et al. (2002) further stated that fading environmental conditions may emphasize violent cycles of conflict over resources and humanitarian crises, and the poor will pay the higher price for delays.

Muoki, Tumuti and Rombo (2008) in their research found that the physical environment in Kenya in the city of Nairobi's Mukuru slums was characterised by inappropriate rubbish and human waste dumping causing stinking smells and dirt. The uncollected loads of refuse were breeding grounds for rodents, mosquitoes, flies and other pests. People hunt for food while children play with the rubbish putting themselves in more health risks and disease problems. It was further discovered that people were not well educated about personal and food hygiene as 47.5 percent did not practice good personal and food hygiene as were failing to wash hands when handling food. Dirty hands and open sores add to food contamination. Studies in

Sub-Saharan Africa found that unhygienic domestic environments, lack of toilets and lack of piped water were associated with the risk of diarrhoea leading to chronic malnutrition (Muoki et al. 2008).

Thom (2008) reported that poor health care in Eastern Cape hospitals left more than 140 needy children dead in one of South Africa's poorest districts in early 2008. The report indicated that Empilisweni Hospital children ward had a high rate of death due to insufficient health services and unhealthy environment. The report further shows that clean and dirty areas are not separated.

The toilets were located near the food preparation area, linen storage and dressing rooms next to the sluice room and filthy areas opposite patients' cubicles. Gopalan (2000) found that environmental sanitation, underprivileged housing conditions and poor personal hygiene due to shortage of water lead to acute gastrointestinal infection which mostly affects children. Tuberculosis spreads quickly among poor people living in packed surroundings, with very weak immune system due to malnutrition (FAO, 2005a). Unhealthy environment can cause diseases and with poor access to health services lead to malnutrition.

2.5.2.5 Inadequate care for children and women

Women's workload, insufficient time and access to information about breastfeeding and infant feeding practices are the factors that may have a negative impact on the care of women and children; and the women's position in households, families, relationships and communities, in particular women's position in making independent decisions about their children. As a result of various household tasks, women find it difficult to spend enough time on food preparation, child feeding and other caring activities that have valuable nutritional outcomes (DOH, 2008). UNICEF (1992) explains that nutrition may be sustained and improved through analysing the women's role in society and through addressing basic causes of the problem.

Child care is directly associated with the condition of the household and the circumstances of women, knowledge of a mother about child care and access to and control of resources determine the care she can give for her child (UNICEF, 1992). Children need to be cared for by adults to ensure survival and development (UNICEF, 2009a). Insufficient access to water

increases the work-load of women as it reduces the time available for child care which indirectly affects child nutrition (UNICEF, 2002a; UNICEF, 1992).

According to UNICEF (2002a), insufficient or poor education, mostly of women, is often a core cause of malnutrition. It promotes the incapacity to make resources for better nutrition for families. Women were given skills and knowledge necessary for creating better opportunities for better care for themselves and their children (UNICEF, 1992). International Food Policy Research Institute (IFPRI), (2010) shows that the persistent hunger is a major contributor to high prevalence of child undernutrition. Persistent hunger can cause significant health problems as hungry people are likely to be underweight and stunted. IFPRI, (2010) indicated that globally child underweight is the most contributor to the world Global Hunger Index (GHI) score.

It is stated that GHI accounts for almost half of the world GHI score although the percentage of underweight in children under the age of five years is only one of three elements in the GHI. Child undernutrition is determined in a few countries and regions and is not extended uniformly across the globe (IFPRI, 2010).

2.5.3 BASIC CAUSES

2.5.3.1 Education and ignorance

The Millennium Development Goals (MDG) set the target of ensuring that every child in the world receives a primary school education by the year 2015. According to UNICEF (2009a) strong laws, policies and programmes lay the basis for all school aged children to be at schools and ensuring learner–friendly school environments whereby No–Fee School policy is applied by 58 percent of public ordinary schools.

The National School Nutrition Programme (NSNP) aims to provide all children in targeted schools with at least one meal per day to relieve hunger and serves as incentive for school attendance (UNICEF, 2009a). The distance that children travel to school also makes it difficult for them to meaningful cooperation in school work as they become tired (UNICEF, 2009a). The Food and Agricultural Organisation (FAO 2005a) states that better education for women gives better nutrition for their children and family health.

Research indicates that an educated farmer is an average of 9 percent more productive than a farmer with no education. Those with education apply fertilizers with a clear understanding, new seeds and understand the use of farm machinery which can lead to a productivity increase of 13 percent. Lack of food and malnutrition is often the result of poor education amongst people living in poverty. Poverty deprives the majority of children of the opportunity to obtain an education (FAO, 2005a).

Underprivileged families often cannot afford school fees and depend on children mostly girls, for household activities such as fetching water and wood. Malnutrition leads to poor health and stunting which often delays enrolment of children in schools; hunger and malnutrition weaken children's performance when attending school (FAO, 2005a).

Low birth weight, PEM, anaemia and iodine deficiency all reduce cognitive abilities and lessen children's ability to learn. It has been found in a study by The Global Campaign for Education that providing universal primary education could save 7 million young people from contracting HIV (FAO, 2005b). Jenkins, Scanlan and Peterson (2007) stated that improving the access of women and girls to education provides greater economic and social opportunities that benefit both household and society as a whole.

According to Walsh, Dannhauser and Joubert (2003) insufficient food intake and improper hygiene and nutritional practices are often associated with low understanding of good nutrition practices. Inadequate resources, lack of understanding of sound budgeting, food purchasing and food preparation methods can compromise household food security. Gopalan (2000) stated that poor education and ignorance reflect inadequate supply of food in young children and women, and the education of women has an impact on the health and nutritional status of the whole family.

2.5.3.2 Political and Ideological Factors

According to FAO (2005b), poor nutrition for women is seen as the most harmful result of gender inequality as it limits women's prospect for education and employment while it undermines women's health hindering development towards gender equality and empowerment of women. According to Koekemoer (2006), apartheid policies in South Africa

from 1948 till 1994 created unequal access to employment as well as education and health services.

UNICEF (2010) indicated that in South Africa education is offered to everyone free up to secondary school level and this is now close to universal. The poor has the opportunity to be at school although the quality of education offered is often poor.

UNICEF (2009a) found that high enrolment rates do not balance in terms of quality education and there is an oversupply of educators in some learning areas and undersupply in critical areas such as mathematics, mathematical literacy, physical science and language, und uneven distribution of qualified educators especially in rural areas. UNICEF (2008) found that the nutritional status of children under five years got worse in Zimbabwe due to drought, HIV and AIDS and political insecurity between May and August 2002. According to Vinton, Perry, Reinhard, Santoro and Teixeira-Santos (2009), infectious disease and malnutrition are influenced by state–level civilization on indigenous societies. According to Koekemoer (2006), apartheid also removed assets such as land and livestock from the African majority and any opportunities to develop these assets were denied. Women's political participation is essential to certify the security of children and other vulnerable populations, helping change the political environment, as this will promote the gender equality and empower women and fulfil children's rights (UNICEF, 2006).

According to WHO (2007a), political commitment at both national and local level is required to stress the importance of interventions to create an environment that supports physical activity. Public health issues linked to legislative and planning procedures such as health impact assessments made politicians aware of public health aspects of obesity and physical inactivity (WHO, 2007a). According to UNICEF (2002a), ideological factors cover broader aspects of society such as religion, culture tradition and beliefs with regards to the rights of women.

According to Jinabhai et al. (2007), the political changes in South Africa have influenced the socio-economic status of many South Africans and such improvements have had the greatest impact on the black African community with important implications for diet, exercise and nutritional status among teenagers.

2.5.3.3 Economic structure

According to WHO (2007) an economic argument may be one that stresses that health promotion is cost-effective and healthy, or that environments that promote physical activity are relevant both to people's health and the public health budget. Another economic argument might be that aesthetically pleasing, healthy residential environments could attract more taxpayers to an area and thereby contribute to an increase in the regional tax income (WHO, 2007). WHO (2007) stated that there is also a significant positive association of level of education with prevalence of overweight and obesity in adults. Overweight and obesity are particularly prevalent among those with a low level of education. According to World Fact (2008) South Africa is well developed in financial, legal, communications, energy, and transport sectors; the country fall under middle income and also emerging with multiple supply of natural resources, a stock exchange that is 17th largest in the world, and modern infrastructure supporting a well-organized delivery of goods to major urban centres throughout the region.

World Fact (2008) further stated that a lack of jobs remains high and old and poor infrastructure has delayed growth towards the end of 2007, South Africa faced a challenge of failing power supply by Eskom due to old plants, residents and businesses were experiencing load-shedding in the major cities.

2.5.3.4 Environment

UNICEF (2002a) stated that the insufficiency of ready access to water and poor environmental sanitation are main core causes of malnutrition. Alkire and Santos (2010) concurred the above statement saying that safe drinking water satisfies the need of hydration and hygiene and clean cooking fuel preventing respiratory diseases, which are a leading cause of preventable death, and contribute to a healthy home environment.

According to UNICEF (2009a), South Africa has made progress in the provision of basic water and sanitation since 1994, however, in 2006, 59 percent of South Africa's children had access to piped water to homes while others were dependent on water tanks, boreholes or natural resources and 12 percent of children lived in households that reported using hazardous water from streams and rivers.

South Africa's poor households benefit from free basic water which guarantees six kilolitres of drinkable water per month to all households (UNICEF, 2009a). Adequate sanitation is linked to child health and survival, however, South Africa in 2006 had 59 percent of households with sufficient sanitation in the form of flush toilets or pit latrines with improved ventilation compared to 47 percent in 2002, although in 2007 some provinces had still a higher percentage of improper sanitation as can be seen in the Eastern Cape (24 percent), Free State (14 percent) and Limpopo (11 percent) (UNICEF, 2009a). The availability of a park or green spaces close to the home is associated with a lower prevalence of overweight and obesity in the whole population (WHO, 2007a). Well maintained and an interesting environments that meet the needs of different population groups within a residential area increase people's readiness to walk and cycle in the neighbourhood and use recreational facilities (WHO, 2007a).

2.6 FACTORS CONTRIBUTING TO MALNUTRITION IN ADOLESCENTS.

2.6.1 Canteens and tuck-shops

According to a study by Sanigorski, Bell, Kremer and Swinburn (2005), in Australia 9.8 percent of children indicated a snack intake by school canteen users. That resulted in a higher energy provision from cakes, fast food, milk and soft drinks, with low energy provided by bread, biscuits, fruit, muesli/fruit snack bars, sweet spreads, fat spread and other dairy products compared to non canteen users determined by the age, gender, and socio-economic status (SES).

A South African study by Wiles, Green and Veldman (2011) discovered that food consumed by adolescents contain an elevated fat, sugar and sodium content, poor nutrient density and low amounts of dietary fibre, even those foods regarded as "healthier" food like salad rolls and salads were high in both total fat and saturated fat. According to Wiles et al. (2011), ten percent of South African children aged one to nine years were overweight while four percent were obese which increases the risk of developing lifestyle diseases at a young age and the contribution of tuckshops in Pietermaritzburg which sells products that encourage unhealthy lifestyles could have contributed to this.

School tuckshops in South Africa showed high sales of corn crisps, frozen popsicles, savoury pies and fizzy drinks (Wiles et al. 2011). It has been found that teenagers visit convenient stores and supermarket more often than any other group. Fast food restaurants employ more teenagers, and teenagers now become more exposed to fast food which is low in vitamins, minerals and fibre but high in added fats, sugars and sodium (Stang, 2008).

According to Kruger et al. (2005) urban children consumed slightly more energy and fat and had the highest BMI, Triceps Skinfold (TSF) and Subscapular Skinfold (SSF) values due to more fast food outlets selling more refined carbohydrates and fatty food. In the same study a survey was done on those children intending to purchase from the canteen during break times. According to Sanigorski et al. (2005), children from low socio-economic status (SES) using school canteens and food services showed consumption of foods and beverages that were low in nutritional value and high in sugar, fat and salt.
According to Sanigorski et al. (2005) the canteen is an important icon in Australian schools and the food offered for sale should indicate an underlying priority for healthy eating and nutrition at the school. Sanigorski et al. (2005) suggested that major improvements of canteens menus required reducing the amount of energy-dense, micronutrient-poor dietary consumption by students and increasing the food quality of those who use the food service meals.

It was further stated that mostly consumed food is brought from home in most of the Australian schools, and therefore, parents need to be encouraged to pack fruit and other nutritious alternatives instead of energy dense snacks for their children. To improve health sweetened beverages should be replaced by water (Sanigorski et al. 2005).

2.6.2 School lunchboxes or packed lunch

Parental involvement in children's lunchboxes can play an important role in adolescent girl's nutrient intake. Videon and Manning (2003) discovered that parental rules regarding breakfast were effective as it guides adolescents instead of letting them decide for themselves.

According to Francis (2007), a healthy lunchbox should contain four basic elements:

- A portion of protein like meat, fish, egg, cheese, beans, lentils, soya products, nuts, seeds.
- Some complex low GI carbohydrates for slower release of energy e.g. wholegrain bread for sandwiches and whole meal pasta and brown rice for salad
- A calcium rich food such as cheese, yogurt, and milk, the mineral essential for healthy bones and teeth, alternative sources of calcium should be considered if a child is lactose intolerant such as calcium enriched orange juice and soya milk.
- One portion of fruit and vegetables, fibre, vitamins and minerals (School Food Trust (SFT), 2009).

The SFT in the United Kingdom used steps to develop a healthy packed lunch and to encourage schools to use a consistent approach to healthy school lunches. The steps include:

- Ensuring that parents and pupils have access to knowledge and skills to select a healthy packed lunch.
- To assist families to make affordable choices for school packed lunches.
- To address the issue of food poverty.
- To convey consistent messages about school packed lunches to support the Change 4life campaign that educates pupils about healthy eating and promotes school meals.
- The SFT also ensures that the packed lunch policy embraces equality, diversity and community cohesion.

The School Food Trust emphasized that schools need to develop a packed lunch policy to improve the nutritional content of packed lunches and bring it closely in line with the meals provided by schools (SFT, 2009).

According to Bell and Swinburn (2004), school sources of energy made a greater contribution to the energy intake of girls compared to boys. Girls obtained 39.5 percent of energy in the diet at school, while boys obtained 35.7 percent. Canteen users consumed 200 kJ more energy at school than those who obtained energy only from lunchboxes (Bell and Swinburn, 2004).

Red Branch School Health (2006) in Ireland combined practical education for healthy food and physical activity in children using the following lunchbox guidelines:

- Take fresh fruit in every lunch if you can - as an alternative, a portion of dried fruit may be included.
- One vegetable may be included every day.
- Choose whole-grain bread for sandwiches or choose a white bread that has some seeds in it.
- Include some salad or fruit in the sandwich - for example peanut butter and banana, ham and tomato, or chicken and lettuce.
- Avoid fizzy drinks, fruit drinks or sports drinks with lunches - choose water, milk or 100 percent fruit juice as healthier alternatives.
- Reduce the intake of salted and oily foods like crisps.
- Avoid cakes, chocolate and sweets.

2.6.3 School lunch programmes

According to Gunderson (2009), interventions in the form of lunch programmes in the United States of America were reduced due to a lack of Federal support by means of donated food which makes schools hesitate to undertake the programme. The school lunch implementation programme was regarded as a high risk investment and that prevented programme growth due to high costs of kitchen equipment installation and addition or remodelling of existing buildings, especially in rural areas where there was no suitable dining space and rooms for kitchen installation (Gunderson, 2009).

The FAO promotes activities like student fundraising through cooking and selling food within schools and communities that enable school children to get safe and nutritious food within the school surroundings, whereby both family and community provides the information, education and skills required to empower children, teachers, and families to prefer healthy diets and exercise all-time healthy eating lifestyle. Cross-sectional partnership among education, agriculture, health and community services is encouraged and the importance of addressing problems of malnutrition through locally appropriate solutions was emphasized (FAO 2007).

Wentzel-Viljoen (2003) has stated that the Primary School Nutrition Programme (PSNP) was introduced as one of the 100 day Presidential lead projects of the Reconstruction and Development Programme (RDP) on the 24 May 1994 when the then President, Mr Mandela said a nutritional feeding scheme will be implemented in every school. According to Wentzel-Viljoen (2003) the PSNP caused learners to stop bringing lunchboxes to school, however, it improved school attendance, punctuality, concentration and school performance.

Hindle (2008), the Director General in the Department of Education in South Africa indicated that the implementation of the programme in the primary schools was successful though high food prices had an impact. It was further indicated that the department was hoping to expand the programme to secondary schools which have been categorised as quintile one and two schools by the year 2010; R1.3 million has been allocated to the programme for secondary schools in the quintile one category (Hindle, 2009). The Department of Education in South Africa expanded its school nutrition programme to 1500 secondary schools which fall in the category of the poorest of the poor. This commenced in 2011 (Khumalo, 2008).

2.6.4 Food eaten away from home

Paeratakul, Ferdinand, Champagne, Ryan and Bray (2003) found that the frequency of fast food use had increased and the number of fast food outlets has also increased, in a survey of 11 – 18 years old children it was reported that 75 percent of these adolescents ate at fast food outlets twice a week before the survey and the survey showed high intake of unhealthy food which is high in calories, fat, salt, sugar and low in calcium, fruit and vegetables. However previous studies have shown that despite its high fat content, fast food provides an adequate intake of protein and carbohydrate (Paeratakul, et al. 2003).

Taveras, Sandora, Shih, Ross-Degnan, Goldmann and Gillman (2006) have found that two to five years old and teenage girls were more influenced by advertisements on television and ended up eating away from home. It was found that more time spent watching television increases the eating of unhealthy food in children. According to Davis and Carpenter (2009), fast food consumption by 2 to 18 year-olds increased 5-fold from 1977 to 1995; by the latter year, fast food was consumed at 9 percent of eating occasions and comprised 12 percent of daily caloric intake, almost one third of all youths now eat at fast-food restaurants on any given day. It has also been found that weekly consumption of fast food by young

adults is directly associated with a 0.2-unit increase in body mass index (BMI). Davis and Carpenter (2009) discovered that youth living near fast food restaurants tend to eat most meals from these fast food outlets and were overweight compared to those eating meals at home.

According to Paeratakul et al. (2003) people with higher income were regarded as the most fast-food users together with children, adolescents and young adults. Individuals who reported eating fast food on a given day may have a less favourable dietary and nutrient intake profile compared with those who did not report eating fast food. Mahan and Escott – Stump (2008) explains that the use of fast food or snacks is popular with adolescents and fast food tend to be low in iron, calcium, riboflavin and vitamin A, folic acid and vitamin C content of fast food is also low unless fruit or fruit juice are consumed.

2.6.5 Pregnancy

In India the majority of girls from poor households are pushed into early marriages, and girls between the age group of 14-18 bearing first babies are at obstetric risk and that may result in low birth weight babies and prenatal problems. These possible mothers and future homemakers continue to face the constraints of nutritional inadequacy related to high maternal mortality and morbidity (Kumar, 2008). The Indian Council of Medical Research (ICMR) (2009) surveys indicated that above 70 percent of pregnant women and adolescent girls in India were anaemic. Kalaivani (2009) found that anaemia begins in childhood and becomes worse during adolescence in girls and is aggravated during pregnancy. According to the ICMR (2009) iron deficiency in India is the major cause of anaemia followed by a folate deficiency. Derbbyshire (2009), found that in the UK pregnant adolescent's folate and iron intakes fell below UK requirements.

Bezerra and Donangelo (2007) explained that during pregnancy and lactation calcium requirements are increased, calcium requirements in adolescent mothers is doubled to ensure sufficient fetal skeletal formation and milk production. Researchers also discovered that in adolescent mothers consuming calcium of 1200mg/d, urinary calcium excretion was high during pregnancy and decreased by about 75 percent in the postpartum period. According to Bezerra and Donangelo (2007), micronutrient intake during pregnancy may influence bone metabolism, therefore, zinc, copper magnesium and the vitamin C, A, D and K are also

required for adequate synthesis of bone matrix constituents, bone cell differentiation and bone responses to growth factors.

Maia, Figueiredo, Anastacio, Porto da Silveira and Donangelo (2007) suggested that adequate zinc and copper are required during the life cycle, with increased needs during the infantile and adolescent growth spurts and during pregnancy and lactation. Maia et al. (2007) also found that poor quality diets of adolescents during pregnancy may lead to zinc and copper deficiency. Prenatal malnutrition can hinder foetal brain development, learning and lead to lower IQ while it can also lead to low birth weight which will relate to adult intelligence weight less than 2.49kg and this impact a child's life long after the mother gives birth (Medina, 2011).

According to Panday, Makiwane, Ranchod and Letsoalo (2009), teenage pregnancy is associated with poor access to health services, poverty, unemployment and poor educational achievement and it can result in STIS and HIV. Panday et al. (2009) found that teenage learner pregnancy rate in South Africa between 2004 and 2008 was 58.22 percent for the country; KZN had a teenage pregnancy prevalence of 62.2 percent while the Eastern Cape is leading with 68.81 percent. A regular pattern of high pregnancy rates is reported for provinces that are poor and mostly rural (Eastern Cape, KwaZulu-Natal and Limpopo) (Panday et al. 2009).

2.6.5.1 Peer pressure

According to Trahms and McKean (2008), as children grow food attitudes and choices are more influenced by peer pressure, children either refuse food or request a currently popular food. According to Walet (2009), peer pressure is a well studied topic, especially concerning risk taking behaviour of adolescents. It is argued that peer groups can have various effects on individuals, including influencing what to wear, eat, buy, use or do.

2.6.5.2 Lack of exercise

Exercise is essential to keep the body fit, it also assist improving in overall vitality and makes one feel energetic and vibrant. According to Thom, (2008) exercise can contribute to the following:

- The transfer of oxygen through the blood to the cells is affected.
- The risk of cancer increases.
- Insulin sensitivity is increased.
- Lack of exercise can lead to obesity, which leads to several health problems like heart diseases, stroke, and hypertension.
- Exercise reduces the chances of suffering from cognitive problems or dementia.
- It has also been found that regular exercise prevents osteoporosis. It lessens the chance of a bone breaking.
- It has been found that people who do not exercise regularly are prone to depression while active people are less likely to suffer from depression and their self esteem remains high.
- Regular exercise helps in boosting the immune system.
- It can lead to hepatic steatosis which is a liver disease.
- Increased risk of injuries.
- Elderly face loss of balance.

MRC (2007) reported that South African girls between 16 and 19 years, youth and women of about 40 percent are not involved in vigorous physical activities due to a lack of appropriate facilities and improvement of existing facilities. There is also a decline in the number of physical education (PE) teachers trained by tertiary institutions. PE classes are within the life orientation (LO) classes in school curriculum but more than 30 percent of children do not do any physical activities during these classes although grade 10 -12 learners are encouraged to engage themselves in LO fitness programmes (MRC, 2007).

2.6.5.3 Eating behaviour

At an early age a child's attitude and belief about food is greatly influenced by home and environment. Parents are the most influential although media, peers and quality nutrition education replace those attitudes and beliefs as children grow (Wiles et al. 2011). Here it is important to explain why people act differently in the presence of others. De Castro in Walet (2009) presents several explanations on how the presence of others can influence eating behaviour. It is claimed that imitation plays a role.

According to Moller (2003) and Bandura (2004), people learn through modelling and imitation. It is argued that people tend to imitate others. According to De Castro in Walet (2009), the amount of food one eats is usually determined by the person next to him or her. It is stated that if people present eat more food, the other person would try to increase the amount eaten. If a person is living with people who take fat rich food one will automatically change to such food due to imitation. According to Littleton and Ollendick (2003) and Tremblay and Lariviere (2009), parental pressure on the child to maintain a low weight can lead to a number of eating disorders.

2.7 EATING DISODERS

Eating disorders are disorders related to eating habits. According to Alton (2005), eating disorders have become more and more common in adolescents of all cultural, ethnic and socio-economic groups. Above 75 percent of eating disorder problems occur during adolescence. Anorexia Nervosa is generally expected to occur in early to mid adolescence and Bulimia Nervosa during or after late adolescence. Montanari and Zietkiewicks (2000) state that Peterson found that 50 percent of ballet dancers in a study conducted in America were malnourished. However, a study conducted in South Africa found that ballet dancers showed eating disorders of both Bulimia and Anorexia.

2.7.1 Bulimia Nervosa

According to Kaplan and Sadock (2003), Bulimia Nervosa is an eating disorder characterised by frequent overindulge eating, followed by inappropriate methods of weight control commonly known as defensive vomiting sometimes called purging; fasting, the use of laxatives, enemas, diuretics and over exercising. It is argued that the person may over eat food at once and then try to get rid of the food by vomiting or using laxatives. Because many individuals with Bulimia can maintain a normal weight, the condition can be kept a secret for years. If Bulimia is not treated it can be the main cause of nutritional deficiencies and even mortal difficulties (Kaplan and Sadock, 2003).

In South Africa Black students were found to experience a significant increase in reported bulimia-associated behaviours in grades seven to nine teenagers but did not report any significant increases in drive for thinness, body dissatisfaction or poor eating attitudes' while

White students reported significant increases in all measured disordered eating attitudes and behaviours in grades 10-12 teenage girls (Mould et al. 2011).

2.7.1.1 Causes of Bulimia Nervosa

Kaplan and Saddocks (2003) stated that Bulimia may be a genetic component and there is some evidence that women who have a mother or sister with bulimia are at high risk of developing the condition. Cultural pressures to appear thin contribute to the disorder, particularly among teenagers. According to the first nationally representative study of eating disorders in the United States, which appeared in the February 2007 edition of Psychiatry, 1.5 percent of women and 0.5 percent of men reported suffering from Bulimia in their life time.

2.7.2 Anorexia Nervosa

According to Kaplan and Saddocks (2003), Anorexia is a serious psychological illness. Anorexia is a condition that goes beyond out of control dieting. A person with Anorexia often at first begins dieting to lose weight. Over time weight loss become a sign of mastery and control. The drive to become thinner is due to a low self esteem, unhappiness and fears relating to one's body (Kaplan and Saddocks, 2003).

2.7.2.1 Causes of Anorexia Nervosa

Kaplan and Saddocks (2003) argue that there is no definite cause for Anorexia that has been determined. However, research suggests that a genetic (inherited) component may play a more significant role in determining a person's susceptibility to Anorexia than was previously thought. It is also argued that peer pressure may lead to this condition especially in teenagers.

2.7.2.2 Signs and symptoms of Anorexia Nervosa

According to Kaplan and Saddocks (2003), the following signs can be noticed when an individual is Anorexic. The person can turn into skin-and-bone, which can lead to misery and social withdrawal. The individual can become short-tempered and easily offended and have difficulty in mixing and interacting with others. Most individuals with Anorexia become obsessed with food and thoughts of food. Physically, an individual may have gastrointestinal complications. Starvation and over use of laxatives can disrupt the body‘s normal functions involving the elimination process. There is a high bone density loss since women acquire 40-

60 percent of their bone mass during adolescence. It is argued that 0.5 percent - 3.7 percent of females suffer from Anorexia Nervosa in their lifetime. Ten percent report onset at 10 years or younger. Thirty three percent report onset ages 11-15 years. Forty percent report onset at 16 – 20 years (Kaplan and Saddocks, 2003).

2.8 FOOD CHOICE

Neumark-Sztainer, Story, Perry, and Casey (1999) stated that adolescents have different food choices. It is argued that there are various factors that influence those food choices. These factors includes hunger and food cravings, appeal of food, time considerations of adolescents and parents, convenience of food, food availability, parental influence on eating behaviours, benefit of food, mood, body image, habit, cost, media and vegetarian beliefs.

In support of the above, Coli Bari, Kajfe and Cvijeti (2000) conducted a study on food choices of adolescents and findings revealed that there is a vast difference in girl's grain intake which is less when compared to boys. Girls consume more snacks during the day and such snacks are high in energy. The study also showed that adolescent girls do not consume more alcohol but tend to have more smoking habits than boys. Girls tend to be characterized with higher body fat (Coli Bari et al. 2000). Venter and Winterbach (2010) found that the food intake of many adolescents consists of high fat products.

2.9 CULTURAL BELIEFS AND TRADITIONS

According to Escott-Stump and Earl (2008), cultural, ethnic or religion policy can contribute to access of food, food choices and preparation and storage methods Lamla (2005) states that culture plays a role in determining what one can or cannot eat. The researcher argues that culture can even develop some gender differences in terms of what to eat and what not to eat. According to Lamla (2005), culture may dictate which food is good and which food is not good. In the Chinese culture food plays an important role in preventing and treating diseases and addressing other health conditions.

The Chinese traditional diet is richer in carbohydrates with more than 80 percent from grains, legumes and vegetables, 20 percent from animal protein, fruits and fats (Escott-Stump and

Earl, 2008), however, it was identified that Hispanics rich source of vitamin C is chilli pepper and for cultural reasons is not eaten by a pregnant person. Lamla (2005) states that in South Africa the Pondo culture claims that girls must not be allowed to eat eggs because it is believed that eggs cause a higher fertility level causing the girl to become pregnant.

2.10 RELIGION

According to Earl (2008) in the Jewish religion no food is allowed to be cooked or heated on Saturday, all food eaten on Sabbath is cooked on Friday and eaten cold. The Shembe religion also believe in having a rest on the Sabbath and do not attend any ceremonies such as weddings and funerals, food is not cooked on Saturdays and is eaten cold on that day and previously prepared on Friday, hot food is allowed after 6:00 pm on Saturday and during the month of fasting all leavened food prepared with flour is prohibited. The vegetarian diet may contain insufficient nutrients; the diet tends to be lower in iron.

Long term vegans may develop megaloblastic anaemia due to vitamin B_{12} deficiency if not well planned. A well planned vegetarian diet is safe for infants, children and adolescents and can meet all the nutritional requirements for growth, with more attention on sufficient calcium, iron, zinc, vitamin B_{12} and vitamin D (Earl, 2008). Earl (2008) also found that Muslims are advised to eat for living not just because of hunger and must always share, Muslims only eat halal food; meat, milk, and dates, seafood, sweets, honey and olive oil are highly recommended but pork is prohibited.

Stefanek, McDonald and Hess (2005) found that the Hindu religion has a negative effect on the health of the Indian community; it has led to an increase in iron deficiency among Indian women and increase in deaths because they don't eat most of food which are high in iron such as red coloured vegetables and meat which is the major cause of anaemia. Stefanek et al. (2005) also found that Hinduism encourages the society to avoid unhealthy behaviour like smoking and unhealthy eating habits which help prevent diseases like cancer, heart diseases and lung disease.

2.11 NUTRITIONAL NEEDS OF ADOLESCENTS (13-18 YEARS)

2.11.1.1 DRIs

Dietary reference intake (DRI) is an overall term designed to encompass the four specific types of nutrient recommendations for healthy individuals, adequate intake (AI), estimated average requirement (EAR), recommended dietary allowance (RDA), and tolerable upper intake level (UL); used for nutrient recommendations for the United States and Canada (Escott-Stump and Earl, 2008; Institute of Medicine (IOM, 2005).

2.11.1.2 EARs

Estimated average requirement (EAR) is the average requirement of nutrients for healthy individuals; the EAR is the amount of a nutrient with which approximately one half of individuals would have their needs met and one half would not (Escott-Stump and Earl, 2008; IOM, 2005). The EAR should be used for assessing the nutrient adequacy of population intakes, and as the basis for calculating RDAs for individuals (IOM, 2005).

2.11.1.3 RDAs

Recommended dietary allowance (RDA) is the amount of nutrients needed to meet the requirements of almost all (97 to 98 percent) of the healthy population of individuals in a group (IOM, 2004). The RDA for a nutrient should serve as a goal for intake for individuals, not as a benchmark of adequacy of diets of populations (Escott-Stump and Earl, 2008; IOM, 2005).

2.11.1.4 AI

Adequate intake (AI) is a nutrient recommendation of daily intake level based on observed or experimentally determined approximations of nutrient intake by a group (or groups) of healthy people; used when a recommended dietary allowance cannot be determined (Escott-Stump and Earl, 2008; IOM, 2005). According to IOM (2004), AI is believed to cover needs of all individuals in the group.

2.11.1.5 UL

Tolerable upper intake level (UL) is the highest daily intake amount of a nutrient that is likely to cause no risk of poor health effects for almost all individuals in the general

population (IOM, 2004). UL has been established for many nutrients to reduce the risk of toxic effects from increased consumption of nutrients in concentrated amounts combined with others or from enrichment and fortification (Escott-Stump and Earl, 2008).

2.12 MACRONUTRIENTS DEFICIENCIES

According to Berdanier, Gorny and Yousef (2000), adequate intake of macronutrient (protein, fat and carbohydrate) is vital to normal growth improvement and body protection, but unlike micronutrients (vitamins and minerals) where a specific shortage or surplus can be linked to a specific disease, the interaction between macronutrients and nutritional disease is not clear and more complicated to recognize. Berdanier et al. (2000) discovered that the main potential adverse effect associated with macronutrients is that if they are not consumed in the required amounts, a nutritional deficiency disorder may result, affecting body function more severely.

According to Stang (2008), the low intake of protein rich food may impair growth and increase the risk of iron-deficiency anaemia and delayed growth and sexual maturation, while the low intake of dairy products which are good sources of calcium reduces peak bone mass and contributes to later risk of osteoporosis. Low intake of dietary fibre is associated with constipation and an increased risk of colon cancer (Stang, 2008). A common problem associated with the uneven intake of macronutrients is diabetes, a metabolic disorder whereby the body cannot regulate blood glucose levels properly due to the shortage of the hormone insulin in the body (Berdanier et al. 2000).

2.13 MACRONUTRIENT REQUIREMENTS OF ADOLESCENT GIRLS

According to Berdanier et al. (2000), adolescents require both macronutrients and micronutrients to sustain health. The main function of macronutrients is to provide energy, counted as kilojoules (kJ). Berdanier et al. (2000) indicated that each of the macronutrients provides kJ; the amount provided by each varies as carbohydrates provides 17 kJ /g per gram, protein also 17kJ/g while fat provides 38kJ/ g and it can also inter-convert, while all contribute to energy intake.

2.13.1 Carbohydrates

According to the IOM (2005), the carbohydrates EARs of adolescents are estimated to be 100g/day. Stang (2008) further said that adolescent's carbohydrates intake will also be determined by the individual's activity and growth as teenagers who are inactive or have chronic conditions that limit mobility may require fewer carbohydrates whereas active teenagers may need additional carbohydrates to maintain sufficient energy intake. Carbohydrates should contribute 55-75 percent of daily energy in the diet (WHO, 2003).

2.13.1.1 Sources of Carbohydrates

Geyer et al. (2009), IOM (2005) and Harvard School of Public Health (2011) outline the following sources of carbohydrates:

- Grains: bread, cereal, rice and pasta.
- Vegetable group: starchy vegetables, e.g. peas, corn, potatoes and legumes.
- Fruit group: dried fruits have higher sugar content than fresh fruits as the removal of water increases the sugar concentration.
- Dairy group: milk, yoghurt and cheese contain the sugar lactose.
- Other: the food in the meat, poultry, fish, dry beans, eggs and nuts group are mostly protein. Dried.
- Beans are also high in carbohydrates such as starch. Legumes (beans) also high in protein.

2.13.1.2 Functions of carbohydrates

Geyer et al. (2009) outline the following functions of carbohydrates.

- Carbohydrates provide a quick source of energy for the body.
- Carbohydrates have a protein sparing effect.
- Carbohydrates prevent ketosis during energy production.
- Carbohydrates provide basic molecules required for the synthesis of non essential amino acids by the liver.
- Carbohydrates provide the chemical precursors for the synthesis of essential substances and tissues in the body, such as bone connective tissue, cartilage, nervous tissue and compounds involved with deactivation of the toxins in the liver.

- Lactose, a disaccharide, aids in the absorption of calcium and phosphorus as well as in the growth of intestinal bacteria that manufactures certain B-complex vitamins.
- Lactose provides a laxative action.

2.13.2 Fibre

Anderson, Baird, Ferreri, Knudtson, Koraym, Waters, and Williams (2009) and IOM (2005) found that a high intake of fibre lowers the risk for coronary heart disease, stroke, and peripheral vascular disease, major risk factors like hypertension, diabetes, obesity and dyslipidemia which are less common in people with high consumption of fibre. Researchers also indicated a recommended adequate intake (AI) of 26 kJ/ g/day and this AI includes non-starch polysaccharides, analogous carbohydrates (e.g. resistant starches), lignin, and associated substances (WHO, 2003).

2.13.2.1 Sources of fibre

Geyer et al. (2009) outlined two forms of fibre.

- Soluble fibre: found in fruits, vegetables, oats, brown rice, legumes and grain.
- Insoluble fibre: found in the bran layers of cereal grains and whole grain bread.

2.13.2.2 Functions of fibre

Geyer et al. (2009) discussed functions of fibre as follows:

- Soluble fibre binds bile acid so it cannot be reabsorbed in the colon.
- Soluble fibre prevents building up of cholesterol in human arteries.
- Soluble fibre helps delay blood glucose concentration in diabetic patients by slowing glucose absorption in the small intestines.
- Insoluble fibre increases faecal bulk and decreases free radicals in gastro-intestinal tract and promotes digestion.

2.13.3 Proteins

According to Stang (2008), the protein requirement is determined by the physical maturation in the adolescent stage; however, an inadequate protein intake in still growing adolescent will result in stunted increases in height and weight while in physically mature teenagers it will result in weight loss, loss of lean body mass and alterations in body composition. According

to IOM (2005), the EARs for protein intake is estimated to allow for adequate pubertal growth and positive nitrogen balance is 0.71g/kg/day or 46g/day (RDA). The WHO (2003) recommends protein to supply 10-15 percent of energy per day for girls in this age group.

2.13.3.1 Sources of protein

According to Geyer et al. (2009) proteins can be found in plant and animal sources. Based on the Food Guide Pyramid, plant and animal sources of proteins can be found in:

- Milk, yoghurt and cheese group (cottage cheese, yoghurt and hard cheese).
- Milk, poultry, fish, dry beans, eggs and nut group (chicken, red meat, dry beans and peanut-butter).

2.13.3.2 Functions of protein

The following functions of proteins have been discussed by Geyer et al. (2009):

- Provides energy.
- Can be converted to glucose to provide energy if carbohydrates are insufficient.
- Proteins are required for anabolic processes in the body like the regeneration and growth of new tissue and the maintenance and repair of old tissue.
- Protein forms the basis of the structure of all the cell and tissues of the body including bone, muscle and cartilage.
- Blood protein has got specific functions like haemoglobin for oxygen transport, fibrinogen for clotting of blood, albumin for regulation of fluid balance in the intravascular fluid compartment, transferring for the transport of iron.
- Proteins are frequently used to transport substances in the body.
- Proteins are essential for the normal functioning of the immune system as it assists in creating lymphocytes and antibodies.
- The retina of the eye contains a light sensitive protein bound to vitamin A, called Rhodopsin, which is essential for normal vision.

2.13.4 Fat

Tapsell and Batterham (2002) stated that during adolescence and the young adult stage dietary fat continues to play an important role as an energy source, a significant cell structural component, a precursor to agents of metabolic function and as a potent gene regulator. Tapsell and Batterham (2002) also stated that energy requirements for the final stage of

growth can be highly variable, but the increasing prevalence of obesity suggests a problem with energy imbalance.

Petrie, Stover and Horswill (2004) stated that for young girls (9-13 years), AI levels are 10 grams per day (g/day) and 1.0 g/day for linoleic acid and linolenic acid, respectively. Adolescent girls (14-18 years) require AI levels of 11g/day and 1.1g/day, respectively, for these two essential fatty acids, although there is no adequate intake (AI) or recommended daily allowance set for total fat, there are AI levels set for the essential fatty acids, linoleic acid, and linolenic acid.

The SA National Health and Medical Research Council's Dietary Guidelines for children and adolescents suggest that the fat intake for children between the ages 5–15 years should supply 35 percent of energy, with not more than 10 percent of total fat as saturated fat. This recommendation reduces the total energy of 30 percent from fat for children at the age of 15 years and over. The review of the summary guidelines suggest the inclusion of about 30 percent of total energy as fat, with no more than 10 percent as saturated fat to children aged 5–14 years (Gibbson, 2002). According to the WHO (2003), the total daily energy intake supplied by fat should not exceed 15-30 percent of which <10 percent is provided by saturated fat.

2.13.4.1 Sources of fats

According to Geyer et al. (2009), there are various sources of fats. Animal sources account for approximately 57 percent of total fat intake and plant sources account for the rest and some fat is visible while others are invisible. The following sources have been identified:

- Vegetable and fruit groups. With the exception of avocado, coconut and olives, vegetables that are fried, creamed, served with cheese or mixed with mayonnaise contain more fat.
- Milk, yoghurt and cheese group items come in fat free, reduced fat and whole fat varieties.
- Meat, poultry, fish, dry beans, eggs and nuts group. Plant items are cholesterol free and have little or no saturated fat. Shellfish is high in cholesterol but low in saturated fat.

2.13.4.2 Functions of fats

Geyer et al. (2009) discussed the following functions of fats.

- Fats contribute to a feeling of fullness.
- Fats transport fat–soluble substances in and out of cells.
- Extra energy not needed by the body is stored in the fat cells for future use.
- Essential fatty acids are needed for healthy skin and normal growth in children.
- The fat layer under the skin serves as insulation and it helps to maintain a constant body temperature.
- Fats act as natural lubricant in the skin, protecting and maintaining the condition of the skin and hair.
- Lipids are the sources of fat soluble vitamins A, D, E and K.

2.13.5 Water

Wenhold and Faber (2009) stated that water contains various inorganic nutrients like fluoride, the most important nutrient in nutrition perspective. According to Charney (2008), the water requirement is determined by the age, gender and body size that results in 50-60ml/kg in children and 150ml/kg in infants while a suitable daily allowance for water from all sources including food is 2.7L for females and 3.7L for males. Dorfman (2008) stated that temperature and physical activities determine the water need, however, water needs increase to more than 10L/day in exercising individuals and in a warm environment. Dorfman (2008) found that the body balances its fluid by regulating mechanisms that reduce urinary water and sodium excretion, stimulate thirst and control the intake and output of both water and electrolytes. Dorfman (2008) further stated that more water is required to excrete the urea from protein metabolism and more electrolytes intake.

2.14 MICRONUTRIENT DEFICIENCIES

2.14.1.1 Iron

Girls of 13-18 years show a lower percentage of iron deficient anaemia (Kumar, 2008). Hoppe, Sjöberg, Hallberg and Hulthen (2008) concur that iron deficiency is a major health problem. During adolescence there is a high requirement for iron due to red blood cell volume increase. This helps to support iron lost during menstruation and active growth as

well as due to the deposition of lean body mass. Iron deficiency may impair the immune response and decrease resistance to infection, and can also affect learning (Stang, 2008). Meishra, Ahluwalia, Garg, Kar and Panda (2012) state that iron deficiency anaemia occurs in women of reproductive age as they are under childbearing stage, and this is also due to the usual loss of blood through menstruation.

According to Barba and Feliciano (2002), iron deficiency anaemia remains the most serious micronutrient problem among the country's vulnerable groups and it was also stated that the past five National Nutritional Surveys indicated that micronutrient malnutrition is still a problem to most poor residents especially infants, preschool children and pregnant and lactating women. Vitamin A deficiency, Iron Deficiency Anaemia and Iron Deficiency Disorder remain serious public health concerns.

According to Berry and Hendricks (2009) at the Children's Institute, the iron status of children in South Africa appears to have deteriorated since 1994. In 2005, 6 percent of children aged 1–9 years were iron deficient and children most affected by iron deficiency were those aged 1–3 years. The higher percentage of iron deficiency (13 percent) in children aged 1–9 years was in children who lived in formal rural areas followed by children in informal urban areas (6 percent). Three of the nine provinces in SA had a higher iron-deficiency incidence rates compared to the national rate (Berry and Hendricks, 2009). The Free State presented almost 20 percent iron deficiency in children between the age of 1 – 9 years which is the highest percentage in the country while five of the nine provinces had rates of 5 percent or less.

Eight percent of anaemic children nationally were considered low compared to the higher percentage of anaemic children in three South African provinces Limpopo, Free State and Western Cape. However, 17 percent of children between 1-3 years were found with iron deficiency which was higher than the rate of children between 4-9 years old. The two provinces Limpopo and Free State both had the highest rate of 12 percent for anaemic children between the ages of 1–9 years, followed by 9 percent of the Western Cape. Mostly affected children by anaemia were found from formal (9 percent) and informal (8 percent) urban areas (Berry and Hendricks, 2009).

2.14.1.2 Calcium

According to Stang (2008) the adolescent stage is characterized by a growth spurt which is the rapid growth of skeletal, muscular and endocrine development in the body. Therefore, calcium needs are greater in childhood than in adulthood. According to Gallagher (2008) insufficient intake of calcium and vitamin D contribute to osteomalacia. A low calcium intake may have an impact on colon cancer and hypertension and may cause osteoporosis later in life (Gallagher, 2008).

2.14.1.3 Iodine

Gallagher (2008) states that iodine deficiency result in goitre. Goitrogens have been found as the cause of goitre by blocking the uptake of iodine from the blood by the thyroid cells. The South African UNICEF (2002b) stated that iodine deficiency is the most common preventable cause of mental retardation and brain damage in the world and further stated that a high shortage of iodine may result in disorders such as impulsive abortions, prenatal death, cretinism, hypothyroidism and mental retardation. Even if iodine deficiency is moderate it causes common goitre, hypothyroidism and abnormalities in the psycho-neuro-motor and intellectual development of children and adults.

2.14.1.4 Zinc

Adolescents with low serum zinc levels may have acne problems (Stang, 2008). Gallagher (2008) found that zinc deficiency results in various immunologic defects whilst severe deficiency leads to thymic atrophy, lymphopenia, low lymphocyte proliferative response to mitogens a selective decrease in T_4–helper cells decreased NK cell activity, energy and deficient thymic hormone activity while mild zinc deficiency can reduce immune function and moderate zinc deficiency is associated with energy and diminished NK cell activity but not with thymic atrophy or lymphopenia.

The FAO (2005b) states that children whose diets lack sufficient zinc have increased risk of dying from diarrhoea, pneumonia and malaria, more than one third of all children suffer from these deficiencies in many regions of the developing world and other micronutrients. It has been found that shortages of vitamin A and zinc alone cause the deaths of more than 1.5 million children each year.

2.14.1.5 Vitamin A

According to Stang (2008), it has been found that in the United States 62 percent of teenage girls consume less than the DRI for vitamin A. Intake below the EAR were detected in 34 percent of young teenage females and 54 percent of older teenage females (Stang, 2008). Vitamin A deficiency lead to an increased susceptible to infection, growth retardation in children, night blindness and mortality can be 50 percent or more (Brown, 2008; Beers and Berkow 1999). According to Labadarios et al. (2008) children in eight provinces in South Africa had a vitamin A consumption of less than two thirds of the required RDA amount.

Labadarios, Cilliers, Visser, Van Stuijvenberg, Shephard, Wium and Walker (2006) stated that the NFCS in 2005 found that nearly two-thirds (64 percent) of children aged 1–9 years had insufficient vitamin A status, and about one in seven children (14 percent) had a major shortage of vitamin A. Mostly affected children (17 percent) were children living in "ethnic" areas.

The highest percentage (89 percent) of children with an insufficient vitamin A status was found in KwaZulu-Natal, with almost half of the 1–9-year populations severely lacking. Similarly, large proportions of children in Limpopo (76 percent), Gauteng (65 percent) and Eastern Cape (64 percent) provinces had inadequate vitamin A status. Vitamin A deficiency in children aged 1–5 years increased abundantly between 1994 (33 percent) and 2005 (65 percent) (Berry et al. 2010).

2.14.1.6 Vitamin C

Stang (2008) indicated that the poor intake of vitamin C occurs more in adolescents who use tobacco, about 9 percent of young adolescents and 42 percent of older adolescents females experienced vitamin C levels below the EAR. Brown, (2008); Geyer et al. (2009); and Beers and Berkow (1999) explain that vitamin C deficiency results in scurvey, gums become swollen and bleed and slow recovery from infections and poor wound healing.

2.14.1.7 Vitamin B_1 (Thiamine)

Vitamin B_1 deficiency results in beriberi, affecting the neuromuscular and circulatory system, impaired growth, heart irregularity, failure and swelling (Brown, 2008; Geyer et al. 2009).

2.14.1.8 Vitamin B_3 (Niacin)

Geyer et al. (2009) and Brown (2008) state that vitamin B_3 deficiency result in pellagra, a disease which makes a human feel tired and causes skin and central nervous system problems.

2.14.1.9 Vitamin B_6 (Pyridoxine)

According to Geyer et al. (2009) vitamin B_6 deficiency results in anaemia, dermatitis near the eyes, irritability depression, muscular weakness, convulsions twitching, kidney stones and seizures.

2.14.1.10 Vitamin B_{12} (Cabalamin)

Vitamin B_{12} deficiency results in pernicious anaemia, increased blood homocysteine level fatigue and neurological disorders (Brown, 2008; Geyer et al.2009).

2.15 MICRONUTRIENT REQUIREMENTS IN ADOLESCENT GIRLS.

According to Geyer et al. (2009) micronutrients are essential vitamins and minerals required by the body for tissue growth and maintenance. There are a number of vitamins that every human being needs. Geyer et al. (2009) made mention of the following vitamins as essential, vitamins A, B, C and D. All such vitamins have different sources and functions (refer Table 2.1).

Table: 2.1 Micronutrients requirement for adolescent girls (IOM, 2005).

Micronutrients Requirement for adolescents Girls 14-18 years			
Micronutrients	DRIs	Sources	Function
Vitamin A	485mcg/day (EAR)	Liver, kidney, yellow & dark-green leafy vegetables, fortified margarine, egg yolk, sweet potatoes, cantaloupe	-essential for integrity of night vision -growth &development -immune function -reproduction -functions as antioxidant.
Vitamin B6	1.0 mg/day (EAR)	Pork, glandular meat, cereal bran & germ, milk , egg yolk, oatmeal,	-essential for normal growth. -antibody formation -fat and protein utilisation -haemoglobin production

		legumes	
Vitamin B_{12}	2.0 mcg/day (EAR)	Liver, kidney, milk & dairy foods,eggs, fish, muscle meat, oysters	-play role in metabolism of nervous tissue. -blood cell formation -cellular and nutrient metabolism
Vitamin C	56mg/day (EAR)	Citrus fruit, tomato, melon, peppers, greens, raw cabbage, guava, potato, kiwi , pineapple, strawberries	-important in immune responses, wound healing and allergic reactions. -increases absorption of nonheme iron. -digestion , fine bone and tooth formation -iodine conservation -infection resistance
Vitamin D	5mcg/day (AI)	Irradiated food, milk fat, liver, egg yolk, salmon, tuna fish	-essential for normal growth and development -importance for the formation and maintenance of normal bones and teeth -influence absorption and metabolism of phosphorus and calcium.
Iron	7.9mg/day (EAR)	Liver, meat, egg yolk, legumes, whole grains, dark green vegetables, dark molasses, shrimp, oysters	-is important in oxygen transfer -is a component of hemoglobin and myoglobin
Calcium	1300mg/day (AI)	Milk and milk products, sardines, clams, oysters, kale, turnip greens, mustard greens, tofu	-for strong bones and teeth -essential for iron transport across cell membranes
Phosphorus	1055mg/day (EAR)	Cheese, egg yolk, milk, fish, meat and almost all other foods	-plays a role in bones and teeth -important for pH regulation -is a component of every cell and metabolites
Iodine	95mcg/day (EAR)	Iodized table salt, sea food, water and vegetables in region without goiter	-synthesize triiodothyronine (T_3) and thyroxine (T_4). -T_4 functions in the control of reactions involving cellular energy.
Zinc	7.5mg/day (EAR)	Oysters, shellfish, herring, liver, legumes, milk, wheat- bran	-is a constituent of many enzymes -is important for nucleic acid metabolism. -also helps in the stabilization of protein and in transport processes, immune function and expression of genetic information.

2.16 METHODS TO DETERMINE DIETARY INTAKE

2.16.1.1 Quantitative Food Frequency Questionnaires (QFFQs)

According to Joubert, Ehrlich, Katzenellenbogen and Karim (2007), Food Frequency Questionnaires (FFQs) are pre-printed lists of food that contribute to the population's intake of energy and nutrients. This can be compiled by a researcher or researchers can use an existing one depending on the objectives of the assessment and the circumstances of the target population, hence the tool used to assess the trends in eating patterns and usual food intake of the population. Researchers emphasize that FFQs are good for describing intake of a group rather than individuals and are mostly used in epidemiological research investigating the relationships between diet and disease.

Ramkin, Hanekom, Wright and Macintyre (2010) define FFQ as a list of foods to which the participant responds by reporting the frequencies and amounts of the food consumed per day, per week or per month while QFFQs are known as a long list in which food and beverage portion sizes are quantified in terms of grams or millilitres.

Hammond (2008) explains a QFFQ as a method of dietary assessment whereby data collected relate to the intake frequency and what amount of food consumed focusing (Joubert et al. 2007; Wolmarans, Kunneke and Laubscher, 2009) on the servings per week, month or year. Researchers further say that this focus on food groups is not on specific nutrients but for easy evaluation of food charts that are organised into groups that have common nutrients. Wolmarans et al. (2009) explains that a QFFQ places a heavy burden on the respondent and interviewer. The QFFQ is much more time consuming as it is a long questionnaire; however, an advantage is that it provides an indication of habitual dietary intake and information is collected on the frequency of food consumption of food items.

2.16.1.2 24-hour recall

Ramkin et al. (2010); Hammond (2008) and Joubert et al. (2007) explain the 24-hour recall method as a method whereby participants report all food and beverages consumed during the previous 24-hours. However, (Hammond 2008) found that sometimes it becomes a problem to recall the amounts and type of food eaten.

Ramkin et al. (2010) concur with the above statement by saying that 24-hour recall relies on the participant's memory and ability to recall portion sizes which could lead to recall bias subjective to socially desirable responding, and it might not be representative of the participant's usual dietary intake. However, the advantage of the 24-hour recall is its simplicity, it is thought to be the most useful method when gathering dietary data from adolescents (Ramkin et al. 2010). The best results can be obtained when completing three recalls, one weekend day and two weekdays.

2.16.1.3 Food record

Ramkin et al. (2010) refer to a food record as a golden standard assessment method in adolescents since the researcher is not dependant on the memory of the participant to recall portion sizes accurately. The food record is a daily food record and has been found accurate if dietary intake of food and amounts is recorded at the time of consumption (Hammond 2008 Joubert et al. 2007).

The food record gives the time of consumption, the types and amounts of all food and beverages consumed for a period ranging from one to seven days; however, respondents must be trained to weigh and measure food correctly and to report accurately the intake of dishes that contain a variety of ingredients like pizza or stews (Joubert et al. 2007). A food record is an alternative to a 24-hour recall while correlated errors are more likely to happen with those of a FFQ and 24-hour recall (Ramkin et al. 2010).

2.16.1.4 Diet history

Hammond (2008) defines dietary history as a review of an individual's usual patterns of food intake and the food selection variables that show food intake (Joubert et al. 2007) over an extended period of time such as the past month or year. Joubert et al. (2007) further said that the diet history is a comprehensive method of obtaining dietary information together with other relevant information and this is suitable for a small group or individuals who can be followed by a 24-hour recall or a 3–day food record to double check the data.

2.16.1.5 Nutrient content analysis

The nutrient content analysis is an instrument used to identify nutritional imbalance by monitoring intake before deficiencies develop. This is done through direct observation on how much an individual consumed and how much is left on the plate and recorded over a 72 hour period, therefore, the records of the total intake are analyzed for nutrient content using computerized methods available (Hammond, 2008). In South Africa the nutrient content analysis is done by using the Food Finder 3 computer software programme. A disadvantage is the lack of food items in the food composition database used in the software program (Wolmarans et al. 2009).

2.17 METHODS TO DETERMINE NUTRITIONAL STATUS

2.17.1.1 Anthropometric indicators

Anthropometric indicators are the physical measurements obtained from an individual related to a standard that indicates the growth and development of the individual. Anthropometric data is very important if it is accurate and recorded over a period of time (Hammond, 2008:399). The WHO (1995) relates indices to the proportion of children below a certain level of weight-for-age to indicate community status.

2.17.1.2 Anthropometric indices

According to WHO (1995) anthropometric indices are a combination of weight and height to produce the BMI (weight/height^2) or weight may be related to height through the use of reference data. In children most commonly used anthropometric indices are weight-for-height, height-for-age, weight-for-age and BMI-for-age. Indices can be expressed in terms of Z-scores, percentiles percent of median which can then be used to compare a child with a reference population (WHO, 1995). Z-score or standard deviation score (SD) is defined as the deviation of the value for an individual from the median value of the reference population, divided by the standard deviation for the reference population.

$$\text{Z-score or SD score} = \frac{\text{(observed value) – (median reference value)}}{\text{Standard deviation of reference population}}$$

Fixed Z-score intervals show a fixed height or weight difference for children of a given age and allow the mean and standard deviation to be calculated for a group of Z-scores. Percentiles are defined as the rank position of an individual on a given reference distribution stating what percentage of the group the individual equals or exceed. Percentiles are easily interpreted and, therefore, used for clinical settings (WHO, 1995).

2.17.1.3 Height

Height can be measured using direct or indirect methods. The direct method uses a measuring rod or stadiometer and the person must be able to stand straight, while the indirect method includes arm span, and recumbent length and knee height measurement which may be an alternative for those who cannot stand straight (Hammond, 2008).

2.17.1.4 How to measure height

According to WHO (2008a), when measuring the height ensure that the height board is on level ground, shoes, socks and hair accessories must be removed. WHO (2008a) listed the following procedures on how to measure height:

- The child must stand on the base board with feet slightly apart. The back of the head, shoulder blades, buttocks, calves and heels should all touch the vertical board, if a child is obese help the child to stand on the board with one or more contact points touching the board.
- Hold the child's knees and ankles to keep the legs straight with heels and calves touching the perpendicular board without the child moving.
- Position the child's head so that a horizontal line from the ear canal to the lower border of the eye socket runs parallel to the baseboard. Hold the bridge between your thumb and forefinger over the child's chin to keep the head on the required position.
- Pull down the head board or rod to rest firmly on top of the head and compress the hair.
- Read the measurement and record the child's height.
- Height should be recorded twice and the average of the two is the one used to record the height of the child, but the measurement should not differ by more than 0.5cm.

2.17.2 Weight

Weight is a more sensitive measure of nutritional adequacy than height in children and it indicates recent nutritional intake (Hammond, 2008). A person's weight is measured through the use of a scale and is measured in kilograms. One stands on the scale with shoes off and then a weight is recorded. Weight should be recorded twice and the variation should not be more than 0.5kg.

2.17.2.1 How to weigh the child

According to WHO (2008a), when weighing a child, a child must stand still with shoes and outer clothing removed.

- The scale should be on a level, non carpeted surface.
- Turn on the scale, when the number 0.0 appears the scale is ready.
- Ask the child to stand in the middle of the scale, feet slightly apart, and to remain still until the weight appears on the display.
- Record the child's weight on the nearest 0.1 kg.
- A child is measured twice and the average recorded.

2.17.3 BMI

Body mass index defines the level of adiposity according to the relationship of weight to height, (WHO 2008a); while BMI calculation requires height and weight measurement and is based on the outcomes it indicates overnutrition or undernutrition (Hammond, 2008). BMI–for–age is an indicator used in determining the nutritional status of children indicating underweight (WHO, 2008a).

2.17.3.1. How to calculate BMI

WHO (2008a) indicated how to calculate BMI as follows: BMI= weight (kg) /height^2 (m).

2.17.3.2 Stunting/short for age (height-for-age)

Stunting is a major health problem among young children, accounting for more than 49 percent of all child deaths worldwide. Stunting in children younger than 3 years reflects an ongoing process of failure to grow, caused by frequent bouts of infection and/or dietary deprivation over an extended period of time. Globally, 33 percent of children under the age of

5 are stunted, 27 percent are underweight, and in developing countries 9 percent are wasted (Labadarios, Steyn, Maunder, Macintrye, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesmvuni and Nel. 2005). In South Africa (Labadarios et al. 2005) 22 percent of children between the ages of 1 and 9 years were stunted.

According to Kleynhans, MacIntyre and Albertse (2006), The South African Vitamin A Consultative Group (SAVACG) survey documented the highest stunting rates in Northern Province/Limpopo (34 percent), with the lowest stunting rates in Gauteng (12 percent). According to Labadarios et al. (2005), there were more than 21 percent stunted South African children aged 1-9 years in 1999, indicating that these children suffered from chronic malnutrition and in 2005 there was little improvement as stunting affected 18 percent of children, with the best improvement in the rural areas (from 26.5 percent down to 20.3 percent), but no significant change in children living in urban areas (16.2 percent) (UNICEF, 2009b).

2.17.3.3 Wasting/thinness (weight-for-age)

Wasting is an indicator of acute malnutrition and is often associated with morbidity (mainly diarrhoea). Wasting increased from 3.7 percent in 1999 to 4.5 percent in 2005 among children aged 1-9 years in South Africa (Hammond 2008). The WHO (2012) estimates that there are 20 million young children globally with severe acute malnutrition at any given point in time. According to Mèdecins Sans Frontières (MSF) (2008a), malnutrition in children is the result of little or no nutrients, lowering the body's immune system as bodies become unable to fight diseases and cause retarded growth.

Too many nutritional deficiencies can lead to muscle waste and wasting is a sign of severe malnutrition (MSF, 2008a). It has been found that in some regions of the world, such as in Africa's Sahel (A semi-arid region of North-Central Africa south of the Sahara Desert), wasting is particularly frequent among children during the 'hunger gap' period, between harvests (MSF, 2008a).

2.17.3.4 Underweight (BMI-for-age)

Hopkins Technology (2010) reported that BMI is a number calculated from a child's weight and height however BMI-for-age in teenagers refers to age and is gender specific. According

to Hopkins Technology (2010) after BMI is calculated for both children and teenagers, the BMI can be plotted on the Centres for Disease Control and Prevention (CDC) or WHO, BMI-for-age growth charts (for either girls or boys) to obtain a percentile ranking. The Anthroplus software of WHO can be used to calculate BMI-for-age. Percentiles are described as an instrument used to assess the size and growth pattern of individual children in United States which shows the relative position of the child's BMI number among children of the same sex and age. High BMI-for-age will mean that the child is obese or overweight (Hopkins Technology, 2010).

2.17.3.5 Waist circumference-for-height

According to Hammond (2008), waist circumferences are obtained by measuring the distance around the smallest area below the rib cage and above the umbilicus using a non stretchable tape measure to assess abdominal fat content. Low energy and nutrient intake is often linked with food insecurity, emotional stress, incomplete diets, (multiple food allergy) or lifestyle habits, and this is the most common cause of a low waist-to-height ratio in adolescents (Luder and Alton, 2005).

According to Li, Ford, Mokdad and Cook (2006), researchers proposed that Waist to Height Ratio (WHtR) might be a better predictor of risk for cardiovascular risk diseases than BMI or Waist Circumference (WC) because firstly, WHtR is more highly correlated with visceral fat mass and clustering of cardiovascular risk in children. Secondly it may be a precise tracking sign of fat supply and build up by age in most children and adolescents as it accounts for the growth in both WC and height over age. Lastly the rate of WHtR is free of measurement units and is in a close concurrence between males and females at each age group.

Nambiar, Truby, Abbott and Davies (2008) concur with the above statement by stating that WHtR has been associated with cardiovascular risk factors because of abdominal obesity in both children and adults. However, $\geq$0.5 cut-off as an indicator for risk is used for both adult males and females and was found normal while this $\geq$0.5 cut-off has been suggested as a suitable cut-off to be applied in children and adolescents. Li et al. (2006) found that using the WHtR cut-off value of 0.5 in children and adolescent may generate a higher prevalence of abdominal obesity than using >90th percentile for WC by gender and age.

According to Nambiar et al (2008) and McCarthy and Ashwell (2006) WHtR is calculated by dividing the WC (cm) by height (cm), both measured in centimetres. Li et al. (2006) conclude by saying WHtR is a simple, easy, inexpensive and accurate index for identifying overweight and obesity in children and adolescents.

2.17.3.6 Mid upper arm circumference (MUAC)

MUAC is measured in centimetres halfway between the acromion process of the scapula and the olecrano process at the tip of the elbow, however, arm muscle area was found best in growing children and is important in evaluating possible protein–energy malnutrition (PEM) as a result of chronic illnesses, stress and eating disorders, infants, toddlers and adults may use MUAC lying down (Hammond 2008).

2.17.3.7 Head circumference

Hammond (2008) referred to head circumference as a measurement useful in children less than 3 years of age to show non nutritional abnormalities. Undernutrition does not easily affect head circumference unless it is severe.

2.17.3.8 Calf circumference

According to Lohman (cited by Hammond 2008), calf circumference can be used combined with other anthropometric measures to estimate body weight in older adults.

2.17.3.9 Skin- fold- thickness

Hammond (2008) explains skin-fold thickness as a means of assessing the amount of body fat in an individual. It was found that skin-fold thickness validity depends on accuracy of the measurement technique which is based on the total body fat estimates and can become bias with increasing obesity (Hammond, 2008).

2.18. SOCIO-DEMOGRAPHIC DATA

According to Joubert et al. (2008), socio-demographic questionnaires are used to measure poverty, social and economic conditions that are important determinants of health. To concur with the above statement Joubert et al. (2008) state that individuals of low socio-economic

status have fewer social and economic resources that low socio-economic status people can use to maximise individual's health compared to those of higher socio-economic status. Macintyre and Anderson in Margetts and Nelson (2000) also agree with Joubert's statement but state that individual and area of level depreciation do not always go together.

Age, gender ethnicity, social class and marital status provide differences in nutritional exposure that link socio-demographic characteristics with nutritional exposure and health outcomes (Macintyre and Anderson in Margetts and Nelson, 2000). According to Joubert et al. (2008), in the case of tuberculosis, poverty increases the risk of this disease through overcrowded housing, poor nutrition and less access to health services.

Joubert et al. (2008) explain that socio-demographic questionnaires may be difficult to administer in South Africa and other developing countries especially in informal settlements and rural areas. Income and expenditure may be inadequate as measures of access to resources where there is trade of resources such as sharing food and income between families and neighbours, while education may be a vague measure of socio-economic status in South Africa where few older adults received post primary schooling due to historical underdevelopment of schools (Joubert et al. 2008).

2.19 LUNCHBOX SURVEY

A survey done in Australian schools on lunchbox content aimed to identify the nutrient content of food and beverages consumed while determining the difference of costs and consumption pattern between children using school canteens and those who brought lunchboxes from homes (Sanigorski et al. 2005). The children in this study were weighed and measured; lunchbox content was recorded as soon as the children arrived at school and sometimes before any break times. Children unpacked the food and the food content was recorded by trained fieldworkers. Where there were doubts about the foods, participants were asked for more information.

According to Griffin and Barker (2008), primary school packed lunches were found below recommended nutritional and food standards. Children's taste preferences play an important role in determining what parents prepare for children's lunch and sandwiches were a popular

choice, given by 94 percent of parents, of which 81 percent used brown or '50/50' (50 percent white flour, 50 percent brown flour) bread (Griffin and Barker, 2008).

2.20. STRATEGIES TO ADDRESS MALNUTRITION

2.20.1.1 Food fortification

Steyn, Nel and Labadarios (2008) discovered that in the South African population inadequate amounts of micro nutrients like iron, vitamin A, calcium, zinc, vitamin C, niacin, folic acid and vitamin B_6 are due to a monotonous diet. It was decided to add micronutrients into maize meal and wheat flour to improve inadequate nutrients without changing traditional food eating patterns. Mannar (2006) stated that cereals are important food vehicles for fortification. The Food Consumption Survey identified that maize, bread, sugar and tea, (Mannar, 2006) dairy products and a range of processed foods with other minerals and vitamins were most commonly consumed by the South Africa population, making these ideal foods for fortification.

In South Africa vitamin A, 5400–6400 IU; iron 37mg–43mg; zinc 18.5mg–20mg; folic acid,1.5mcg–1.5mg; thiamine, 3.6 mg–3.6 mg; niacin, 28.5mg–31 mg; vitamin B_6 3.2 mg have been added to maize meal and wheat flour since 2004 to maintain traditional consumption patterns with enriched vitamins (UNICEF, 2008; Africa Food Fortification Regulation, 2002). Hurrell (2002), however, found that staple foods fortified with iron were not successful as iron gets lost and the colour changes after addition of iron.

Olayiwola, Soyibo and Atinmo (nd) stated that the Nigerian government has published standards for flour (wheat/maize), sugar and vegetable oil fortification including levels of fortification with vitamin A. The above mentioned products were selected based on eating habits of the population and the value in the national food market.

The projected standards were signed into law, making it obligatory for manufacturers to fortify these products in Nigeria. Fortification of salt with iodine has been seen as the most successful fortification globally and has been used successfully to reduce goitre and cretinism, preventing mental retardation and Subclinical iodine deficiency disorders and contributes to improve national productivity. It has been reported that most countries which

were formally severely affected were now free of iodine deficiency (WHO 2006). Folic acid fortification of cereal flour is having an impact on reducing women's risk of having a baby born with Spina bifida. According to Sayed, Bourne, Pattinson, Nixon and Henderson (2008), a 33 percent reduction in neural tube defects in children is due to folic acid fortification in South Africa.

2.20.1.2 Food supplementation

Barba and Feliciano, (2002) states that in the Philippines micronutrient supplementation programmes cover the provision of vitamin A, iron and iodine to most affected groups, particularly infants, pre-scholars and adolescents through targeted regular supplementation. Supplementation is done on National Micronutrient day with the World Food Day celebration through the distribution of vegetable seeds, conducting nutrition counselling, iodized salt testing and distribution of iodized salt and promotion of fortified foods.

In South Africa, the PEM Scheme is currently providing food supplements on monthly clinic visits of children of 6 months to 6 years, pregnant and lactating women and those with persistent illness. Food supplied includes 2 kg of full-cream milk powder to infants 0–71 months of age and 4 kg of a protein, vitamin and mineral (PVM) mixture (Hendricks, Le Roux, Fernandes, and Irlam, 2003).

2.20.1.3 Supplements through drops

The WHO (2006) recommended administering vitamin A supplements with routine and other immunization contacts as a way of integrating provision with other health services. Many countries integrated vitamin A supplementation and oral polio vaccine distribution, enabling large number of children to receive one vitamin A supplement dose annually. About 90 developing countries provide vitamin A supplements to young children. Mannar (2006) reports that vitamin A supplementation is responsible for a reduction in mortality of up to 35 percent among preschool children in the South African population in which vitamin A deficiency was endemic.

According to Mannar (2006), Iron deficiency became a problem which is not easy to overcome because iron supplementation has to be taken daily and sometimes has unpleasant side effects. However, guidelines have been developed to guide effective iron

supplementation programmes. The researcher further said that zinc deficiency strategies are not implemented easily. In reaction to the low micro-nutrients, in September 2008 in Pretoria, a Vitamin A supplementation for children below five years, campaign was launched targeting 4 million children and is still in progress in reaction to the low micro-nutrients. It has been suggested that maximum implementation of vitamin A on child mortality is required and 80 percent of South African children need the provision of vitamin A supplements every six months (UNICEF, 2009a).

2.20.1.4 Food diversification

Wahlqvist (2003) discusses food diversity as a variety of food which represents various food cultures the opportunity for food exchange based on proximity and historical linkages. According to Wahlqvist (2003), diversity in food intake is encouraged by the exchange of products, ideas, observations, beliefs and technologies through human eating experiences out of the country of their origin and the enrichment of these by traders. The researcher further emphasizes the role of food diversity in food security as it brings sustainable, affordable and diverse food supply.

Dietary diversification strategies to reduce micronutrient deficiencies was implemented successfully in 2004 in Cambodia which was achieved by making a sufficient, affordable and diverse supply of food available throughout the year and by improving consumption for rural households (Cambodia Nutrition Investment Plan (CNIP) Report 2004).

2.20.1.5 Nutrition education

Initially it has been explained that South Africa and the rest of the world is challenged with malnutrition and obesity. Many strategies have been tried to minimize the risk of teenagers being the victims of malnutrition and it has been found that nutrition education can play a vital role in fighting malnutrition. Nutrition education can take different forms, namely general nutrition education, individual education, peer education and group education (Stang and Story, 2005). Stang and Story (2005) state that nutrition education is about educating people about nutrition and the human body by providing educational resources that promote healthy eating patterns and teaching adolescents the skills necessary for making and sustaining change in the diet.

Steyn and Temple (2008) support the statement above by stating that the main objective of nutrition education is to reinforce nutrition behaviour to change habits that contribute to poor health. According to Patel (2003), nutrition education for women is very important as women are mostly responsible for feeding the children and shows that the lack of nutrition knowledge can lead to childhood malnutrition. Poor health status into adulthood and the childhood illnesses are the results of malnutrition with micronutrients deficiencies (Patel, 2003).

Stang and Story (2005) argue that adolescents are often not aware of potential health risks associated with poor eating habits. It is then stated that in general nutrition education topics such as making healthy food choices should be taught. General nutrition and health education must be taught in schools in order for teenagers to be aware of healthy eating. According to the FAO (2005a) nutrition must be included and be compulsory in primary schools. The curriculum must cover topics such as what food is. The learners must be made aware of what constitutes a balanced diet. The relationship between food and nutrition needs to be addressed.

2.20.1.6 Individual nutrition education

Stang and Story (2005) found that individual nutrition education is a good approach especially for adolescents who have special needs. Therefore, education related to diabetes, pregnancy and hypertension nutrition needs should make use of an individual approach that can improve nutrition knowledge.

2.20.1.7 Peer nutrition education

According to Stang and Story (2005), nutrition education can be more effective when peers are used. Van Dyk (2008) argues that peer education can be more successful where other forms of education have failed. It is argued that teenagers may be more willing to adapt to suggestions provided by peer educators than health professionals as they perceive such suggestions as more relevant to their life style and needs (Stang and Story, 2005). It is also argued that during peer education teenagers may be willing to ask where teenagers do not understand since teenagers are not intimidated. Peer education make things easier since peer

educators are using language and terminology that is understandable for other adolescents (Stang and Story, 2005).

2.20.1.8 Group nutrition education

According to Stang and Story (2005), group education can provide an effective means of reaching many adolescents with common nutrition messages. In group education the facilitator should allow teenagers to participate actively in discussions and topics such as weight management, vegetable eating and sport nutrition (Stang and Story, 2005).

2.21 FOOD BASED DIETARY GUIDELINES

According to Gibney and Vorster (2001), South African Food Based Dietary Guidelines (SAFBDG) were developed and recommended by FAO/WHO to fight the global burden of diet related diseases. The SA guidelines were based on the eating patterns of various South African dietary cultures. According to Vorster, Love and Browne (2001) and DoH (2004), the SAFBDGs include:

FOOD BASED DIETARY GUIDELINES

- Enjoy a variety of foods.
- Be active.
- Make starchy food the basis of most meals.
- Eat dry beans, split peas, lentils and soya regularly.
- Chicken fish, milk, meat or eggs can be eaten daily.
- Drink lots of clean, safe water.
- Eat plenty of vegetables and fruits every daily.
- Eat fat sparingly.
- Use salt sparingly.
- Use food and drinks containing sugar sparingly and not between meals.
- If you drink alcohol, drink sensibly.

These guidelines were recommended to be integrated with nutrition programmes and to form the basis of nutrition education in South Africa (Gibney and Vorster, 2001). Maunder, Matji and Hlatshwayo (2001) state that a variety encourages people to change their diets and to increase the variety of foods eaten and enjoy their food. Fish and dairy products are excellent sources of calcium that improves endothelial function and better arterial compliance and prevention of thrombosis. However, beans lower cholesterol and blood glucose concentration, and dietary fibre has a major protective effect against CVD. Fatty acids displace fat from the diet (Maunder et al. 2001). The SAFBDGs have been revised and new streamlined guidelines will be launched during 2012.

2.22 FOOD ASSISTANCE PROGRAMMES

According to Wellman and Kamp (2008), the United States of Department of Agriculture (USDA) introduced The Food Stamp Programme (FSP) to eradicate hunger and improve nutrition and health of low income Americans. There were FSPs operating in United States

through local welfare offices under USDA guidance and authorization. In these programmes food stores were involved as these foods were bought from the stores through the use of debit cards.

Wellman and Kamp (2008) discovered that the FSP introduced food stamp nutrition education to improve the knowledge of participants on making healthy choices within a limited budget, and to choose an active lifestyle consistent with the current Dietary Guidelines for Americans (DGA). My Pyramid and this education were provided by nutrition education networks, public health departments, welfare agencies and university centres. The USA has recently switched from a food pyramid to a plate model.

Commodity Supplemental Food Programmes (CSFP) supplement low income American diets with nutritious USDA commodity foods and The Child and Adult Care Food Programme (CACFP) serves nutritious meals and snacks to eligible children and older adults in participating child care centres, day care homes. Centres serve breakfast, lunch, supper and snack and meals and must meet minimum nutritional requirements (Wellman and Kamp, 2008).

The Emergency Food Assistance Programme (TEFAP) was developed to minimize federal food inventories and storage cost while assisting the needy, hence USDA buys food including

processing and packaging and ships it to the States distributing agencies and each State allotment depends on the number of its low-income and unemployed population (Wellman and Kamp, 2008). Wellman and Kemp (2008) also found that India has a programme called Food Distribution Programme on Indian Reservations (FDPIR) which was used instead of food stamps, especially in winter when travel was impossible, to ship commodity foods to Indian tribal organizations and state agencies.

The Bangladesh Integrated Nutrition Program (BINP) was developed by the government of Bangladesh between 1996 and 2002. The aim of the programme was to minimize the number of children who seemed to be very underweight. The focus was to improve the capacity of individuals, households, communities and government institutions so as to prevent and reduce malnutrition. In this programme supplementary food was given to children who are affected by malnutrition and who show signs of severe growth failure (Hossan, Duffield and Taylor, 2005). It simply means that government involved all stakeholders in an attempt to fight malnutrition and retarded growth among children.

2.23 SOUTH AFRICAN GOVERNMENT'S INITIATIVE INTERGRATED NUTRITION PROGRAMME

According to the National Department of Health, Western Cape, the Nutrition Committee of 1994 was developed. The Integrated Nutrition Programme (INP) is a nutrition strategy for South Africa to replace the previously fragmented food based approach.

The INP was developed to solve nutrition problems in South Africa by using a Conceptual Framework (Department of Health (DoH), 2004). The main aim of INP firstly is to educate all women to breastfeed their children until six months of age and continue breastfeed them until twenty four months and more with other complementary foods. Secondly, the INP aimed to ensure optimal growth of infants and young children. Thirdly, to promote the health of women, in particular those who are pregnant and breastfeeding. Fourthly, is to improve the capacity of communities by solving malnutrition and hunger problems. Lastly to improve inter-sectoral collaboration and community ownership of the nutrition programme.

The National INP is a comprehensive nutrition strategy targeted at children under 6 year old, at-risk elderly people, pregnant and lactating women, nutritionally vulnerable communities

and groups, primary school children from poor households, and those affected by communicable and non-communicable diseases (DoH, 2008).

The INP areas of focus includes the community based nutrition programme (CBNP) with the aim of strengthening household food security, improving knowledge about nutrition supporting care of women and children and promoting a healthy environment. It is a health facility based nutrition programme (HFBNP) focusing on problems of undernutrition, micronutrient deficiencies and chronic diseases of lifestyle, which will provide nutrition education, growth monitoring and micronutrient and food supplementation and the integration of PEM. A nutrition programme which will focus on nutrition promotion through policy development, improved communication, promotion and protection of breastfeeding, marketing of infant foods and food fortification (INP 2003). There is a focus area on food management whereby good food service management should present meals that are good enough and ample in quality and quantity and harmless to consumers of public institutions by also providing a normal diet that furnishes the nutritional, psychological and aesthetic needs of the customer (INP 2003).

In 1994 South Africa held its first democratic elections and the country had its first government of the people by the people. The newly established government introduced many departments which were not present in the past. The Department of Social Development (DOSD) is such a department with its main objective as poverty alleviation. In order for this department to achieve this objective, it developed a food assistance programme which is commonly known as 'food parcels'. This programme focuses more on impoverished regions which are mostly rural areas. Here families are directly given food parcels by the department (Kendall, 2007).

Steyn and Temple (2008) concur with the above view when they state that the DOSD in 2002 introduced the programme of food parcels which aimed at assisting poor families with food. Families that spend less than R300.00 per month on food qualified for the food parcels. It therefore, means that countries with people living in poverty need to develop programmes like the above, namely Emergency Food Assistance Programmes, FDPIR, INP, Food Parcels and BINP so as to assist poor people especially school going children.

2.24 MILLENNIUM DEVELOPMENT GOALS

The United Nations Millennium Development Goals are eight goals that all 191 UN member States have agreed to try to achieve by the year 2015. South Africa was one of these UN members of which the goals were developed to improve various indicators in countries. Millennium Development Goals were developed for combating poverty in its many dimensions-including reducing income poverty, hunger, disease, environmental degradation and gender discrimination (UNICEF, 2000).

2.24.1.1 Aims of Millennium Development Goals

According to the MDG report (2010), the United Nations Millennium Declaration was signed in September 2000 to commit the States to:

- Eliminate severe poverty and hunger.
- Get general primary education.
- Promote gender equality and women empowerment.
- Eliminate child mortality.
- Make the maternal health better.
- Fight HIV/AIDS, malaria and other diseases.
- Sustain environmental resources.
- Develop a global joint venture for progress.

The following are some measures of the progress that has been made so far: (MDG Report 2010).

- The ratio of people worldwide living in severe poverty fell from nearly a third to less than one fifth between 1990 and 2004.
- The number of extremely poor people in Sub-Sahara Africa has levelled off, and the poverty rate has declined by almost six percent points since 2000.
- Progress has been made in getting more children into school in the developing world, a progress of eight percent of enrolment since 1999 to 2005.
- Gender equality has been improved by political contribution in countries where only men were allowed to stand for political elections; women now have a say and seat in the parliament.

- ❖ Child death has declined globally, and the number of deaths caused by measles decreased indicating successful improvements achieved by life saving interventions.
- ❖ More interventions done to control malaria.
- ❖ The tuberculosis outbreak seems to be managed, even though improvement is not fast enough to halve prevalence and death rates by 2015.

What has been achieved indicates how much is left to be done and how much more progress is required until all concerned is done fully then only will the goals be met (MDG report, 2010).

- ❖ The death of pregnant and childbearing women is above half a million, dying from treatable and unnecessary problems of pregnancy and childbirth and there are more dying in Sub-Saharan Africa than in the deve1oped world (1 in 16 compared to 1 in 3.800 in the urbanized world).
- ❖ People dying from AIDS globally increased to 2.9 million in 2006, and prevention measures do not meet the growth of the epidemic. More than 15 million children became orphans due to parents dying of AIDS in 2005.
- ❖ Poor basic sanitation in developing countries is still an unsolved problem; during the period of 2005-2015 about 1.6 billion people will need access to improved sanitation.
- ❖ Eastern Asia is more concerned about the inequality of income, where the share of consumption of the poorest people went down severely between 1990 and 2004.
- ❖ Lack of employment opportunities for the youth, resulted in more unemployed youth than adults.
- ❖ Climate change is the largest contributor to the severe economic and social impact due to the emissions of carbon dioxide, which rose from 23 billion metric tons in 1990 to 29 billion metric tons in 2004.

South African Deputy President Motlanthe, (2010) said the MDGs will not be accomplished "if producers have no information and are not active participants in developing essential awareness and morals required for sustainable development; if they are not producing new generations of scholars and researchers; and if the significant thinkers that are required to refresh democracy are also not produced".

2.25 THE ECONOMIC IMPACT OF MALNUTRITION

2.25.1.1 Economic impact of malnutrition on a country's health system

Malnutrition contributes to poor economic growth and influences poverty through direct losses in production from poor physical status of employees and indirect losses through high health costs incurred by government (World Bank, 2006). According to the DoH and UNICEF, (2008) the World Bank estimated a 6 percent to 12 percent economic loss of the Gross National Product (GNP) of developing countries due to malnutrition. The World Bank, (2006) explains that malnutrition costs are very high, productivity losses more than 10 percent of individual's lifetime earnings, and gross domestic product (GDP) lost due to malnutrition.

A large number of people are presently lacking micronutrients contributing to poor national economic development and deteriorating human potential and fertility as learning disabilities among children, increased morbidity and death rates, reduce worker productivity, and increase healthcare costs. Insufficient good nutrition leads to the death of about two-thirds of the childhood globally (Welch and Graham, 2004).

Jenkins et al. (2007) agrees on the empowerment of the disadvantaged to increase economic and social development by giving access to secure resources, political freedom and gender equity. This may have better success at alleviating hunger than international food aid and conventional development assistance. Bhutta et al. (2008) explain that the financial crisis in Indonesia between 1997-98 lead to more wasting and nutritional anaemia in women, whilst child undernutrition was not affected.

Bhutta et al. (2008) further mentions that nutritional problems severely affected children born and breastfed during the micronutrient deficiency crisis. However, the inflation in the Republic of Congo in 1994 increased the price of imported staple foods resulting in high wasting among mothers, more low birth weight babies and more stunting and wasting levels amongst children. While stunting also occurred in infants in Zambia during the drought of 2001-2002, it also lead to households experiencing high prices of staple food and micronutrients deficiencies in pregnant women (Bhutta et al. 2008). Research showed that the global economic crisis has a negative impact on human lives resulting in the high mortality rate.

Hossain et al. (2007) found that in 2004 in the Pacific Islands, the economic consequences of non communicable diseases, mainly obesity and diabetes, amounted to $1.95 million-almost 60 percent of the health care budget of Tonga. According to UNICEF (2010), world inflation lead to low production increasing unemployment rates as production sectors cut down employment opportunities. However, household's income drop due to job losses, and the circumstances for casual workers that do not have the protection of an effective wage floor that unions provide. Employees face an enormous fall in earnings. Firms also suffered from the crisis as income and savings decreased strongly (UNICEF, 2010).

2.25.1.2 Nutrition investment

Investing in nutrition has been effective in eliminating the challenge of diseases whereby much has been invested in controlling HIV and AIDS and scaling up basic health services and the challenge of malnutrition and hunger (World Bank, 2006). Most countries invested in malnutrition by providing micro-nutrients and fortification of food, and developing new agricultural technologies to reduce malnutrition which impact on the economy (World Bank, 2006). According to the World Bank (2006), provision of improved good nutrition contributes to economic development and poverty reduction. This means that healthy people are more productive due to improved physical capacity, less diseases and death and increased cognitive development and school performance.

According to the Cambodia Nutrition Investment Programme (CNIP) (2004), investing in nutrition is important for three reasons, improved nutrition for early child survival and growth because under nutrition mostly affects children and women as malnourished mothers produce malnourished children which will be a continuous problem of malnutrition from generation to generation. Secondly, the Royal Kingdom of Cambodia states that investing in nutrition in Cambodia is reflected as a human right. Thirdly, in terms of productivity, efficiency and equity it argues that improving nutrition is an economic investment with high returns.

CNIP (2004) states that this argument is supported by the conclusion from current studies and reviews that have shown large economic benefits from modest investment in nutrition, in terms of improved worker productivity measured by quantity and quality of work output and wages earned. An increased income generating capacity, reduced morbidity and nutrition related disabilities prevent losses in earning and reduction of health cost due to fewer

illnesses and complications. CNIP (2004) also states that improved learning capacity, school performance and attendance are other important benefits.

2.26 Conclusion

Malnutrition has been described in it various forms, namely undernutrition and overnutrition. Different studies have shown that parents play a key role in their modelling of healthful eating behaviours at home and in their selection of foods at away locations, however, parents can let adolescents know that eating healthful breakfasts and lunches is important and that skipping meals can be detrimental to maintaining a healthful weight (Briefel, Wilson and Gleason, 2009). Literature review reflects challenges, causes and interventions for malnutrition. The objective of the study is to determine the nutritional status food intake of the school girls in relation to the literature reported.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to explain how data were collected. This chapter will discuss the study population and participants. Apart from the above the procedures followed to collect the data will be explained. Reliability and the validity of instruments will be discussed as well as methods used to analyse the data. The purpose of this study was to analyze the lunchbox content of high school girls in Lindelani and relate it to their nutritional status; therefore, the measurements chosen for this study included a socio-demographic questionnaire, Quantitative Food Frequency Questionnaire (QFFQ), 24-hour recall questionnaires anthropometric measurements and lunchbox data sheet.

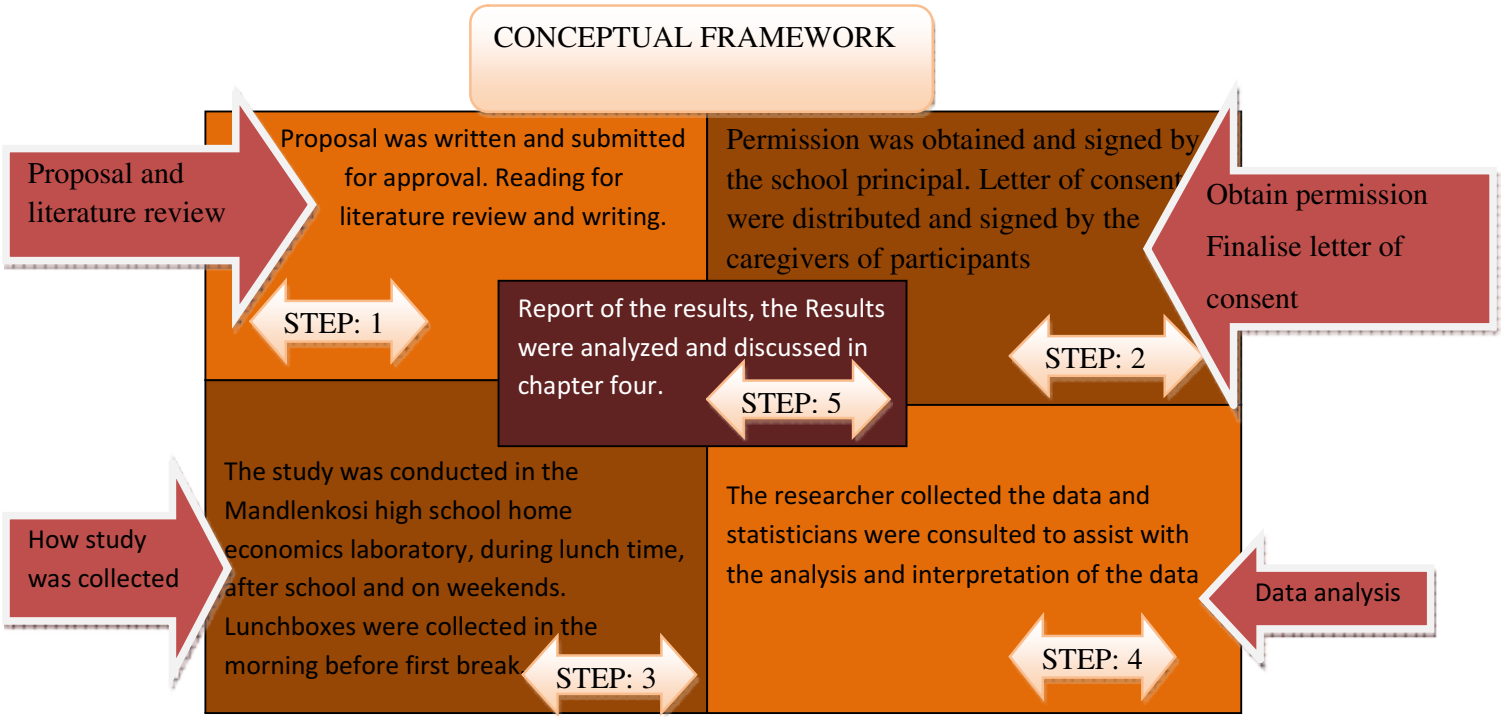

Figure 3.1: phases discussed in Chapter 3

3.2 ETHICAL CONSIDERATION

It is important that when the researcher is conducting research he or she should take ethical considerations seriously. In this study the researcher considered the research ethics as recommended by Human Sciences Research Council (HSRC). Ethical approval was obtained from the Faculty Research Committee at the Durban University of Technology (DUT).

3.2.1 Permission and informed consent

The study was approved by the DUT Faculty Research Committee. The stakeholders (Principal, learners, parents and colleagues) participating in the study were approached before the study started. Permission was granted by the principal of Mandlenkosi High School to conduct interviews on school premises using a home economics classroom (Annexure A).

Learners who qualified to participate in the study were informed about the study and the researcher explained the study to this target group at school. Learners who agreed to participate were given consent forms to take home for completion by parents (Annexure B).

The principal informed the staff members about the research. Parents who returned the signed consent forms were invited to a parent's meeting which was conducted prior to the study to explain the purpose of the study and to inform parents that the children may be delayed after school and will be required on weekends. Parents were given time to ask questions.

3.2.2 Voluntary participation

The researcher explained to the learners and parents/caregivers that participation was voluntary. All research participants were given an equal chance to participate voluntarily. It was explained that participants had the right to withdraw anytime during the study.

3.2.3 Confidentiality and anonymity

The participants were informed that the information would be kept confidential and different subject numbers were allocated to all participants to ensure confidentiality and anonymity. The information will be stored at the University for a period of 5 years after which it will be shredded and disposed of. No one will have access to the data except the Supervisor and the researcher.

3.2.4 Deception of participants

Participants were not deceived in any form and were not promised any incentives in order to participate in the study.

3.3 RESEARCH DESIGN

The study was conducted in kwaZulu Natal in Mandlenkosi high school 20km away from Durban on the way to Ntuzuma (refer Figure: 3.2).

Figure 3.2: Area map Lindelani in relation to kwa-Mashu

3.4 STUDY TYPE

The study was of a descriptive nature with an analytical component. Quantitative data were collected using questionnaires during personal interviews. Anthropometric measurements were collected at the same time. A stratified sampling method was used to select the school in the area of Lindelani and the children who brought lunchboxes was purposeful sampling. The researcher used random sampling of 161 as all learners had the opportunity to be in the study but only 61 who brought lunchbox from home could participate in study. Food in lunchboxes was measured, weighed and analysed. Anthropometric measurements were collected on the same day as the QFFQ and 24-hour recall interviews were conducted. This research design is very effective when one has a short space of time to conduct the study.

3.4.1 Data collection

Socio-demographic data, QFFQ and one of the two 24-hour recall questionnaires was collected on weekends during personal interviews with learners and parents that took between 45–90 minutes in the school home economics kitchen. The other 24-hour recall was conducted during the lunch time for 15-20 minutes together with anthropometric measures. Each participant had a copy of the English food intake questionnaires and the fieldworkers asked the questions as it appears on the questionnaires and explained it in the participant's home language, with the aid of food samples to assist in estimating portion sizes. To ensure quality control and standardisation of interviews the main researcher was present during the data collection periods and data collected for each day were checked by the researcher at the end of each day. Data were collected over a period of six months.

3.5 STUDY VARIABLES

The variables for the study were illustrated as follows:

- **Study area:** Mandlenkosi high school in Lindelani local area
- **Sampling strategy:** Stratified sampling (girls, the school); 61 teenage girls with lunchboxes
- **Study setting:** Lindelani-KwaZulu-Natal, South Africa, in home economics class on school days and weekends.
- **Human resources:** Fieldworkers, caregivers, participants, researcher.
- **Assessment instruments:** Socio-demographic questionnaires, Anthropometric measurement, QFFQ and 24-hour recall Dietary intake questionnaires, Lunchbox content.

The variables measured in this study included: age, gender, family composition, accommodation, employment, income, anthropometric measurements, dietary intake and lunchbox content.

3.6 SAMPLING STRATEGY

Stratified sampling was used although purposive sampling was also utilised. Purposive sampling is very effective when the research targets a particular group of people (McMillan

and Schumacher, 2001). When the desired population of a study is rare or very difficult to locate then recruiting this sample is the only option. Although the power calculation indicated a sample of 161 the researcher had only 61 respondents who brought lunchboxes.

The sample was calculated using a power calculation (Cole, 1997) and 161 out of a population of 406 girls in the school was indicated. The samples size was 61, after only 61 brought lunchboxes to school out of a possible 161

3.6.1 Sample Size

$$ss = \frac{Z^{2*} (p)^{*} (1-p)}{C^2}$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal

(.5 used for sample size needed)

c = confidence interval, expressed as decimal = .06 (Cole, 1997).

3.6.2 Inclusion criteria

The study focused on Mandlenkosi High School adolescents' girls from grade eight to twelve. Four hundred and eight learners were all given consent letters and 161 parents gave consent. Only 61 teenage girls of Mandlenkosi High School brought lunchboxes to school and were part total of the 161. The research was designed for Mandlenkosi learners, teenage girls of 13-18 years only. Participation was allowed after completing a consent form and participants who brought lunchboxes from home. Age was determined from the school register. Teenagers were targeted in this study because of poor eating habits and diet related problems occurring at a later stage as a result of poor eating happening at this stage (Van Zyl, et al. 2006). N = 61 implies the study was underpowered in relation to the sample size determined.

3.6.3 Exclusion criteria

Girls below 13 years and above 18 years, and boys were excluded in the study. Learners who did not bring back the consent forms were excluded from the study. Learners who did not bring lunchboxes were also excluded.

3.7 RESPONSIBILITY OF FIELD WORKERS

Four trained fieldworkers were recruited from among the 3rd year Food and Nutrition and B-Tech students in the Department of Food and Nutrition Consumer Science at DUT. The fieldworkers were called together on two occasions where a dietician explained the purpose of the study and the completion of the QFFQ with correct use of the food models that were to be used in the study. Fieldworker's guidelines (Annexure D) were prepared and printed in English; the purpose of the manual was to ensure standardisation and uniform procedure. The importance of reliability and punctuality was highlighted during the training. English was the medium of instruction for the training session. The fieldworkers were trained in role play situations on how to take anthropometric measurements. Fieldworkers were trained on how to complete 24-hour recall and QFFQ questionnaires using food samples to assist in estimating portion sizes and memory in the adolescents and administering socio-demographic questionnaires.

The fieldworkers spoke English; however, they were able to speak the local language (isiZulu) in order to avoid any language barriers between them and the respondent. All the fieldworkers were women. The researcher was responsible to arrange both the fieldworkers and participants for participant's interviews. The fieldworker's responsibility was to interview the participants and assisting participants in completing the questionnaires, weighing and measuring participants.

3.8 ADMINISTRATION OF MEASURING INSTRUMENTS

The researcher and the fieldworkers were responsible for administration of measuring instruments. Fieldworkers had sessions with participants during lunchtime, after school and on weekends.

3.8.1 Socio demographic data

A socio demographic questionnaire (Annexure E) which was already developed (Napier, 2006) was adapted to suit the study and completed in an interview situation with the parents. The demographic questionnaire consisted of questions on household family member role, age, gender, residence setting, assets, income level of the family, employed number of people per household, frequency, amount spent on food and place where each household bought food, number and ages of children per household, number of meals eaten per day, means of transport, level of education of family household members, lunchbox content and frequency of carrying it and food procurement pattern and responsibilities (Napier, 2006).

Figure 3.3: Photograph showing interview process

3.8.2 Anthropometric measurements

The learners were weighed on a digital physician scale (scale 2000, model: portable physician scale-pps) twice and the average was recorded on an anthropometric sheet (Annexure F). Participants' height was measured using a stadiometer. Subjects took off shoes and jerseys before height and weight were measured and were always reminded to stand still with the head up and eyes level. All participants were weighed and measured twice and average recorded to ensure accuracy.

Figure 3.4: Learner being measured

3.8.3 DIETARY INTAKE

3.8.3.1 The 24-hour recall

A structured existing 24-hour recall (Annexure G) was used. The 24-hour recall was used to determine food eaten in 24 hours. Two 24-hour recall were conducted one weekend day and one weekday were completed in an interviews situation and food samples were used to assist the respondents in estimating portion sizes consumed. These food models were used to show respondent various portion sizes that were then rounded off. The 24-hour recall relies on memory (Ramkin et al. 2010) that is why two 24-hour recalls were conducted, a QFFQ was used as a reference measurement (annexure H), (Oldewage-Theron, & Kruger, 2008). A lunchbox analysis (Annexure I) was also conducted to determine the food brought to school by the respondents. The 24-hour recall, QFFQ and lunchbox analysis were used to determine the top twenty food items consumed.

3.8.3.2 QFFQ

The QFFQ dietary intake questionnaire consisting of 17 pages with 197 questions was used to interview the participants on their habitual food intake and fieldworker interviewed one subject at a time. Subjects were asked if the food was consumed, how the food was prepared, how much of the food they ate at a time, how many times a day they ate it and if not consumed everyday, how many times a week or a month they ate it. Participants were also asked purchasing habits. Food samples were used to assist pupils with memory and to quantify portion sizes.

Figure 3.5: Completion of QFFQ interviews

3.8.3.3 LUNCHBOX ANALYSIS

3.8.3.3.1 Weighed food record

A calibrated kitchen scale (MICRO- CW, Scales 2000) measuring from 20g-30kg in 1g increments from Scales 2000 was used to measure the lunchboxes content. The lunchbox analysis was done randomly when subjects were not expecting it to be done to make the study reliable.

Lunchboxes were collected by the researcher before the first period started and students came to collect their lunchboxes at first break. Food was removed from the lunchbox and weighed in front of the participants, which made it easy for the researcher to ask questions about cooking methods used and hygienic handling. Then all the accompaniments were weighed separately with the scale set on 00, using greaseproof paper on the scale before any food item was placed on it, in cases whereby containers were used and required the weight of the container the scale was returned to 00 before food was added and recorded on a spreadsheet (Annexure H). Combined meals were separated into the various food groups if possible, starch, protein and fruit and vegetables. Lunchbox content was measured once for each and every learner.

Figure 3.6: Lunchbox analysis

3.9 PROCEDURES FOR CONDUCTING ANTHROPOMETRIC MEASUREMENTS

Anthropometric measurements included weight and height.

3.9.1 Weight

Weight was determined to the nearest kg on a good quality electronic standardised medical scale (scale 2000, model: portable physician scale-pps). Two field workers were responsible for taking all anthropometric measurement. Each participant was dressed in light clothing and removed shoes, jerseys and emptied pockets prior to being weighed. The scale was placed on an uncarpeted level area.

The scale was switched on and waited until the zero indication (0.0), if zero error appeared it was removed until it appeared as the stable indicator. The subjects had to stand in the middle of the scale upright and looked straight ahead. The feet had to be flat and slightly apart and they had to keep standing until measurements were recorded on the data form. The subject then stepped down from the scale and the fieldworker would wait for zero recording to appear on the digital display before weighing the subject for the second time and before the next respondent (WHO, 2008a).

3.9.2 Height

The following procedures were followed when measuring height:

- The respondent removed shoes, socks and hair accessories
- The respondent was helped to stand on the baseboard with feet slightly apart with the back of the head, buttocks and heels touching the vertical board.
- Participant's knees and ankles kept together and legs straight, heels touching the vertical board.
- The fieldworker pulled down the head rod to rest firmly on top of the head and compresses the hair.
- The measurement of the participants height was recorded
- The fieldworker had to record the respondent's height in cm in the anthropometric data sheet.
- The average of the two readings was the one used to record the height but the measurement should not vary by more than 0.5cm (WHO, 2008a). The procedure was repeated twice as well as with the next respondent (refer Figure: 3.4).

3.10 STATISTICAL ANALYSIS OF DATA

3.10.1 Socio-demographic

Completed questionnaires were checked by the researcher for completeness and accuracy on the same day after the interviews. Data from the completed questionnaires was captured by the researcher on to an excel spread sheet. Questionnaires were analysed using the statistical software package for social sciences (SPSS) for windows version 17.0. Descriptive statistics (frequencies, means standard deviations and intervals) were determined with the assistance of a statistician. Data were presented in tables, frequencies and percentages and standard methods were used.

3.10.2 Anthropometric

The average of the taken weight and height measurements was captured on an excel spread sheet and analysed using the Anthroplus computer software from the WHO indicating, Height-for-age (stunting) and BMI-for-age indicating underweight, overweight and obesity (WHO, 2008a). Weight-for-age was not used because it is used for children under nine years and the participants of the study were older than nine years of age.

3.10.3 Dietary assessment

The dietary intake from the 24-hour recall, QFFQ and lunchboxes were analysed by a trained food and nutrition specialist using the Food Finder version 3 computer software program that is based on medical research composition tables (MRC) (Langenhoven, Kruger, Gouws and Faber 1991). The nutritional intake data were captured and related on tables and graphs for interpretation. The minimum, maximum and mean intake of the participants were analysed and compared to 100% of the EAR, means and standard deviations (SD) of the lunchbox, 24-hour recall and QFFQ was calculated for the total group. Means standard deviation and nutrient intake were calculated and compared to the DRIs, (IOM, 2005). The top twenty most consumed foods were also identified.

3.10.4 Relationships

Anova (test of homogenity of variance) was conducted to determine significant differences. A P-value less than 0.05 was considered to indicate statistical significance and a value of less than 0.01 as strongly significant. A *p*-values of <0.05 indicated that there was significant

association between two variables. A *p*-value of >0.05 indicated that there was no significant association between two variables

3.11 Conclusion

In this chapter all the instruments to determine the socio-demographic status, anthropometric data, dietary intake and lunchbox content have been discussed. The instruments used in this chapter were appropriate in gathering the data to achieve the purpose of the study. The purpose of the study was essentially to conduct a lunchbox analysis and the contribution of lunchboxes to adolescent girls in Lindelani. Results will be reported in detail in Chapter four.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

In this chapter the researcher will focus on the analysis and interpretations of the data obtained in this study. The sample included 61 adolescent girls of 13-18 years old who brought lunchboxes from home.

4.2 SOCIO-DEMOGRAPHIC DATA

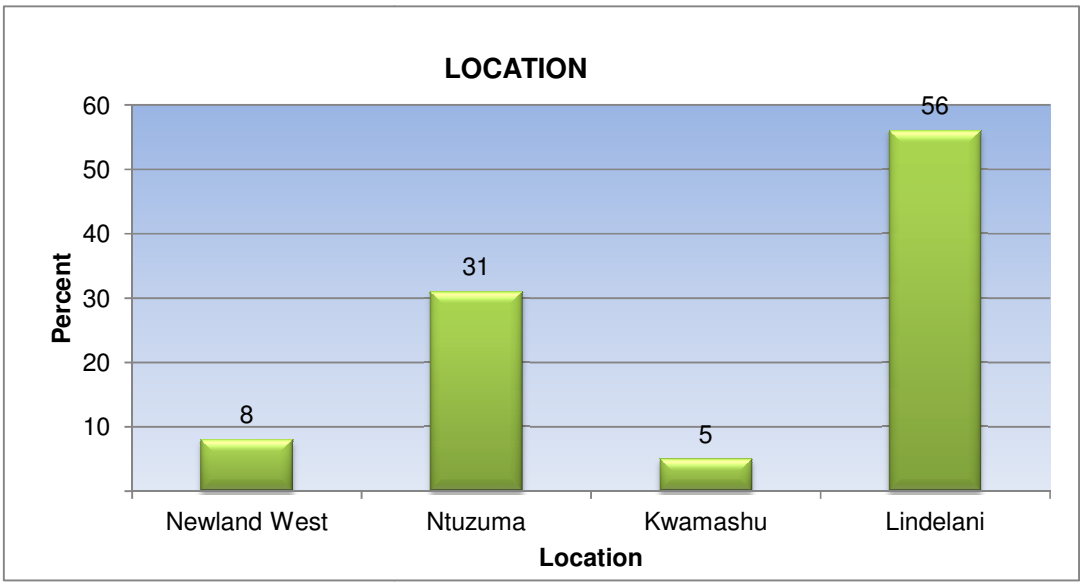

Figure 4.1: Distribution of respondents/participants by residential location of the students (n=61)

The majority of the participants (56 percent resided) in Lindelani with access to tuckshops and no supermarket while the rest resided in neighbouring townships with 31 percent of the population in Ntuzuma which comprises of low cost housing. eight percent lived in Newland West, a developed area with shopping malls and 5 percent in Kwa-Mashu also with low cost housing but a developed area with shopping malls.

4.2.1 Personal information

Table 4.1: Age and gender of the caregivers (n= 61)

Variable	Number (n=61)	Percentage %
Age		
< 21 years	22	36.3
21- 30 years	1	1.6
31- 40 years	12	19.4
41- 50 years	9	15.0
51- 60 years	10	16.3
61- 70 years	4	6.4
>70	3	5.0
Total	**61**	**100**
Gender		
Male	4	6.6
Female	57	93.4
Total	**61**	**100**

The results in Table 4.1 indicates that a high number of households 36.3 percent comprise of caregivers below the age of 21 years, 6.4 percent were 61-70 years and 5.0 percent above 70 years old living on old-age pension. The caregivers in most of the households were women (93.4 percent).

4.2.2 Distribution of caregiver's status

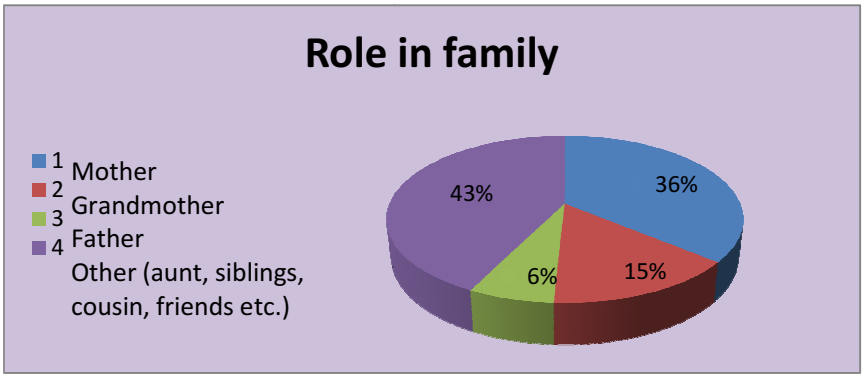

Figure 4.2: Role of caregivers in the family (n=61)

Figure 4.2 indicates that 36 percent of the caregivers were the mothers in the household and very few were fathers (6 percent). Forty three percent of the caregivers sorted under other

(aunt, siblings, cousin, friends etc.) A high number of the children are cared for by other people with 15 percent cared for by grandmothers.

Table 4.2: Accommodation and family composition

Variable	Number (n=61)	Percentage %
Place of residence		
Squatter camp	10	16.4
Rural village	1	1.6
Township	50	82
Total	**61**	**100**
Living with other people in your house		
Yes	**61**	**100**
Number of people in household		
2–5	23	37.7
6–10	35	57.3
10+	3	5
Total	**61**	**100**
Permanent residence		
No	3	4.9
Yes	58	95.1
Total	**61**	**100**
Duration of residence		
<1 year	5	8.2
1–5	7	11.5
> 5 years	49	80.3
Total	**61**	**100**
House material		
Brick	59	96.7
Shack/Zinc	2	3.3
Total	**61**	**100**
Other house in same yard		
No	26	42.6
Yes	35	57.4
Total	**61**	**100**
No of rooms in the house		
<2 rooms	10	16.4
3–4	21	34.4
>4 rooms	30	49.2
Total	**61**	**100**

Variables	Number (n=61)	Percentage %
Living conditions of the household of the child		
Living with relatives	4	6.6
Squatter camp	1	1.6
Rented house	2	3.3
Own house	53	86.9
Living with boyfriend	1	1.6
Total	**61**	**100**
Problems with state of house		
Leaking	13	21.3
Small & have cracks	13	21.3
No problem	35	57.4
Total	**61**	**100**
Eat &sleep more than 4 days a week in household		
No	1	0.3
Yes	396	99.7
Total	**397**	**100**

The results in Table 4.2 indicated that 95.1 percent of respondents are permanent residents and 80.3 percent had been living in this community for more than 5 years with 99.0 percent of the family members eating and sleeping in these households more than four days a week. Table 4.2 also indicates that 82.0 percent of respondents reside in the township with 86.9 percent owning the houses, however 21.3 percent of these houses experience problems of leaking, 21.3 percent are small and cracked while 57.4 percent reported no problems with the houses. The majority of respondents (57.3 percent) lived with between six and ten family members while only 37.7 percent consisted of less than six members however 5.0 percent had more than ten members. Results showed that the living space in 49.2 percent of the houses comprised of more than four rooms.

Table 4.3: Infrastructure in the community

Variables	Number (n= 61)	Percentage %
Access to water		
Tap in the house	30	49.0
Tap outside the house	20	33.0
Borehole	2	3.0
Spring / river /dam water	9	15.0
Total	**61**	**100**
Toilet facilities		
Pit latrine	22	36.1
Flush / sewage	39	63.9
Total	**61**	**100**
Waste removal facility		
No	3	4.9
Yes	58	95.1
Total	**61**	**100**
Tarred road		
No	22	36.1
Yes	39	63.9
Total	**61**	**100**

Although Table 4.2 indicated that 82.0 percent lived in a township, only 49.0 percent had taps inside the house, 33.0 percent had taps outside the house and 15.0 percent had no taps at all and get water elsewhere. Results also showed that 36.1 percent use pit latrines toilet facilities with 4.9 percent having no waste removal facility and 36.1 percent with no tarred road.

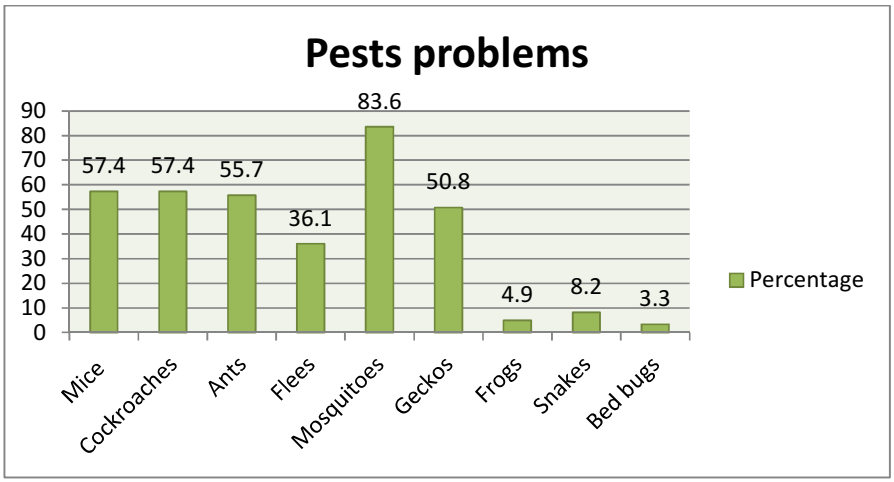

Figure 4.3: Pests problems in the house

Pest problems were reported as a major problem in almost all the households affecting safety and hygiene conditions. Mosquitoes were the most commonly reported pest 83.6 percent followed by cockroaches and mice 57.4 percent, ants 55.7 percent and 36.1 percent flees.

Table 4.4: Work statuses of caregivers

Work status of family members	Number (n=61)	Percent %
Unemployed	6	9.0
Retired	2	3.2
Housewife	3	5.0
Permanently employed	40	66
Temporally employed	6	9.8
Employed on contract	4	7.0
Total	**61**	**100**
Unemployed /retired/housewife for		
<6 months	1	1.6
6–12 months	1	1.6
1–3 years	1	1.6
>3years	8	13.2
Title of your current job		
Professional	4	7.0
Labour	36	59.0
Domestic worker	7	11.0
Self employed	3	5.0
Total	**61**	**100**
Looking for a job		
No	52	85.2
Yes	9	14.8
Total	**61**	**100**

The majority of the respondents in Table 4.4 (66.0 percent) were permanently employed however, 59.0 percent are working as labourers, 11.0 percent are domestic workers and only 7.0 percent are professional employees. Although 66.0 percent are employed, 9.0 percent are unemployed and 14.8 percent had been looking for a job for more than three years.

4.2.3 Household income

Household income is the combined income of all residents in the house.

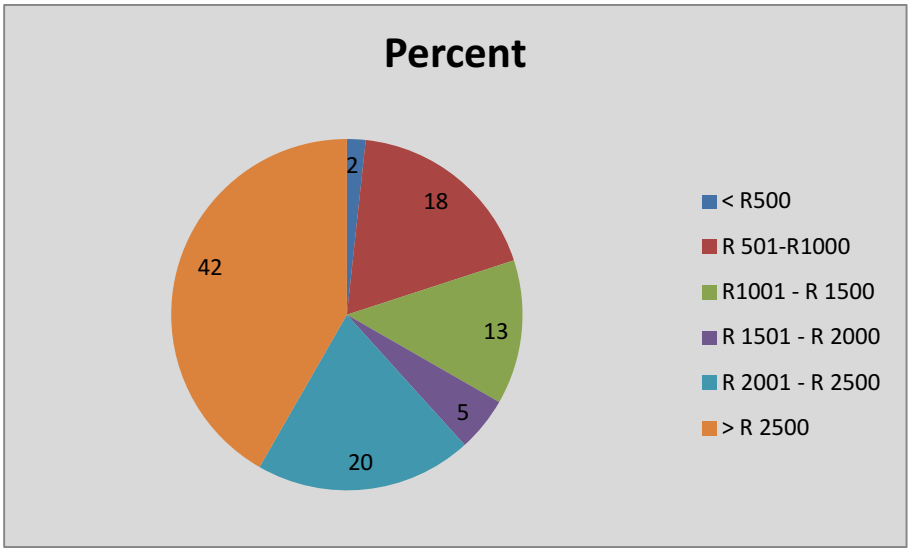

Figure 4.4: Household income

Although 42 percent of the respondents earns more than R2 500 per month there is 20 percent earning between R2001-R2 500 followed by R501- R1000 (18 percent) and R1001- R1 500 (13 percent). The level of income in Figure 4.4 reflects the job titles in Table 4.4 since there are only 6.5 percent professional employees.

4.2.4 Education and language

Table 4.5: Family composition and education

Variables	Number (n=61)	Percentage %
Education level of caregivers		
None	1	1.6
Primary school	13	21.3
Secondary school	43	70.5
Tertiary	4	6.6
Total	**61**	**100**
Home language		
IsiZulu	58	95.1
IsiXhosa	2	3.3
Swazi	1	1.6
Total	**61**	**100**
Children with birth certificate in household		
Some	18	29.5
All	43	70.5
Total	**61**	**100**
Children completed immunisation		
Some	24	39.3
All	37	60.7
Total	**61**	**100**
Number of children attending school		
1–3	42	69
4–6	18	30
> 6	1	2
Total	**61**	**100**
Transport used to school		
Walk	41	67.21
Bus	5	8.19
Taxi	7	11.4
Lift	8	13.1
Total	**61**	**100**

The education level indicated that although 70.5 percent of the caregivers have secondary education, only 6.6 percent have college education, 21.3 percent had primary education and 1.6 percent was not educated. The lack of a birth certificate for some children is one of the

main obstacles to receiving a Child Support Grant and consequently to benefiting from the automatic links to other poverty eradication programmes (UNICEF, 2009a). However in the present study some of children (29.5 percent) had no birth certificates and 39.3 percent had not completed their immunisation schedules which prevent children's identification before the law and an essential situation for the protection of rights and enabling admittance to very important services for children and families within the context of poverty (UNICEF 2009a). Means of transport within the area to school indicate that 67.21 percent walk while 13.1 percent use lifts offered by other people (refer Table 4.5).

4.2.5 Food preparation

Appliances available in the household will determine what food can be prepared.

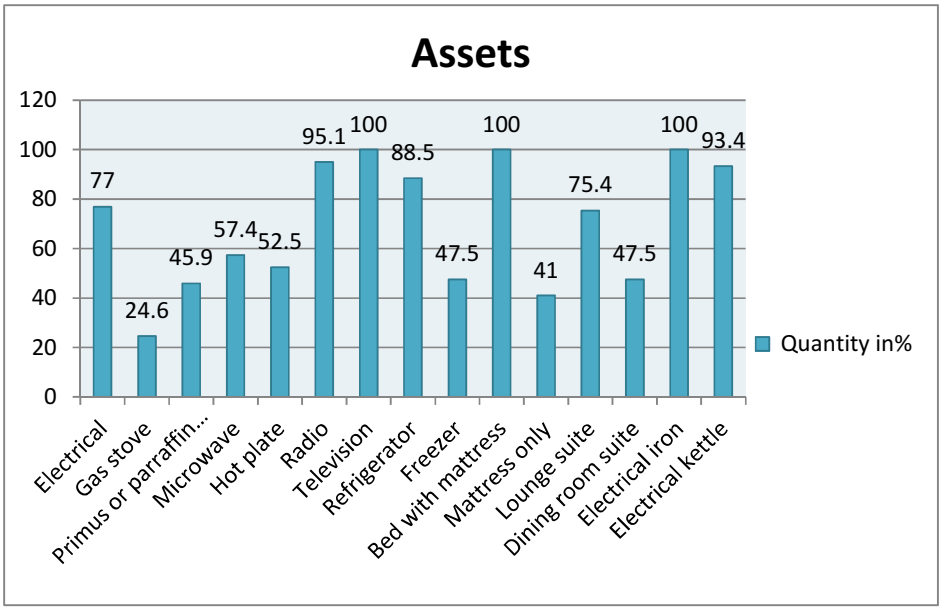

Figure 4.5: Household assets and appliances

Figure 4.5 indicated positive access to household assets as the majority of household owned electrical appliances. The most commonly owned appliances included televisions (100 percent) and irons (100 percent) followed by radios (95.1 percent), electrical kettles (93.4 percent) and refrigerators (88.5 percent). The majority of households owned electrical stoves (77 percent). Other forms of cooking appliances included were microwaves (57.4 percent) followed by hot plates (52.5 percent), primus stoves (45.9 percent) and gas stoves (24.6 percent). The availability of non electrical assets was also indicated and included a bed with a

mattress (100 percent), followed by a lounge suite (75.4 percent) and dining room suite (47.5 percent).

Table 4.6: Food procurement and preparation patterns in the household

Variable	Number (n=61)	Percentage %
Food preparation responsibility		
Father	1	1.6
Mother	25	41
Siblings	30	49.2
Other (Grandpa, aunt , uncle , cousin , friend)	5	8.2
Total	**61**	**100**
Decision making on buying food		
Father	2	3.3
Mother	39	65
Siblings	2	3.3
Other (Grandpa, aunt , uncle , cousin , friend)	18	28.4
Total	**61**	**100**
Children feeding responsibility		
Mother	23	37
Siblings	11	18
Grandma	18	30
Other (Grandpa, aunt , uncle , cousin , friend)	9	15
Total	**61**	**100**
Reported household head		
Father	26	42.6
Mother	16	26.2
Siblings	1	1.6
Other (Grandpa, aunt , uncle , cousin , friend)	18	29.6
Total	**61**	**100**
Food spending responsibility		
Father	16	26.2
Mother	27	44.3
Siblings	2	3.3
Other (Grandpa, aunt , uncle , cousin , friend)	16	26.2
Total	**61**	**100**
Number of daily meals		
< 3	0	0
=3	9	15
>3	52	85
Total	**61**	**100**

Table 4.6: Food procurement and preparation patterns in the household - continued

Children eating place		
Home	61	100
Food preparation fuel type		
Paraffin	7	11.5
Electricity	54	88.5
Total	**61**	**100**
Frequency of money shortage for food		
Always	1	1.6
Sometimes	25	41
Seldom	6	9.8
Never	29	47.6
Total	**61**	**100**
Place where food is bought most of time		
Wholesale	1	1.6
Supermarket	60	98.4
Total	**61**	**100**

Table 4.6 indicates that 49.2 percent of siblings prepared food although the mother decides what food to purchase (65 percent) and also carry the money spending responsibility (44.3 percent), however, 41.0 percent of the households sometimes have a shortage of money for food while 47.0 percent never have a problem with food shortage. Eleven point five percent is still relying on primus stoves for food preparation. It has been reported that 42.6 percent of these household are headed by fathers, 29.6 percent by other people (Grandpa, aunt, uncle, cousin or friend) and 26.2 percent by mothers.

Table 4.7: Snacks purchased at school in a week (5 days)

Variables (per week)	Number (n=61)	Percentage %
Sodas canned (sweetened)		
0	22	36.0
1–3	30	49.0
4–7	9	15.0
Total	**61**	**100**
Apple munch (frozen ice block, sweetened)		
0	20	33.0
1–3	25	41.0
4–7	16	26.0
Total	**61**	**100**
All sweets		
0	15	25.0
1–3	16	26.0
4–7	19	31.0
>7	11	18.0
Total	**61**	**100**
Ice cream (milk based)		
0	21	34.0
1–3	32	53.0
4–7	8	13.0
Total	**61**	**100**
Frozen sweet aid (Homemade)		
0	16	26.2
1–3	13	21.0
4–7	26	43.0
>7	6	9.8
Total	**61**	**100**
Ice lollies (retail)		
0	44	72.0
1–3	12	20.0
4–7	5	8.0
Total	**61**	**100**

The socio-demographic questionnaire also requested the learners to report on the snacks purchased over the last five days and is indicated in Table 4.7. A high consumption of frozen

sweet aid bought at school by 73.8 percent of the respondents was evident, 9.8 percent bought it more than five times a week. Apple munch consumption was four to five times a week or 26.0 percent, sweets were consumed by 18.0 percent of the children more than five times a week, however 66.0 percent of respondents indicate ice cream consumption one to three times a week which was bought after school hours from local street vendors.

4.3 Anthropometric data

Anthropometric data is about measuring the height and the weight of an individual and is used to indicate malnutrition.

Table 4.8: Anthropometric data of the girls

Z-score	Classification	Girls (n=61) % (n)
	Stunting (Height-for-age)	
< -3 SD	Severely stunted	0
< - 2 SD to >-3SD	Stunted	4.9 (3)
>-1SD to +3SD	Normal height-for-age	95.1 (58)
	Wasting/Thinness (BMI-for-age)	
< -3SD	Severely wasted	0
< -2SD to >-3SD	Wasted	0
>-1SD to <+1SD	Normal BMI-for-age	49.2 (30)
>+1SD to <+2SD	Possible risk of overweight	36 (22)
>+2SD to <+3SD	Overweight	11.5 (7)
>+3SD	Obese	3.3 (2)

The anthropometric results in Table 4.8 indicate that 4.9 percent of the respondents were stunted (<-2SD to >-3SD), although the majority of respondents displayed normal height-for-age (95.1 percent) and normal BMI-for-age (49.2 percent) there is still a high percentage of respondents who were at risk of overweight (36 percent) (>+1SD to <+2SD) followed by 11.5 percent overweight (>+2SD to <+3SD) and 3.3 percent of respondents were obese (>+3SD) according to the WHO Anthropometric classification data for children (WHO 2008a).

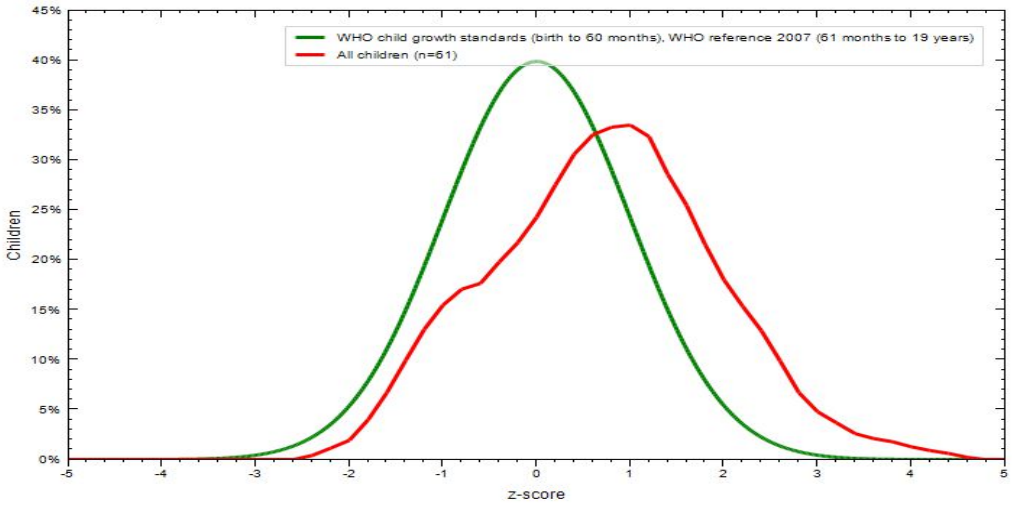

Figure 4.6: BMI-for-age WHO child growth standards (n=61)

The BMI-for-age indicated by the red line in Figure 4.6 indicates that 11.5 percent of the girls were overweight (>+2SD to <+3SD) and 3.3 percent obese (>+3SD) compared to the WHO growth standard curve in green (mean: 0.71 ±1.13).

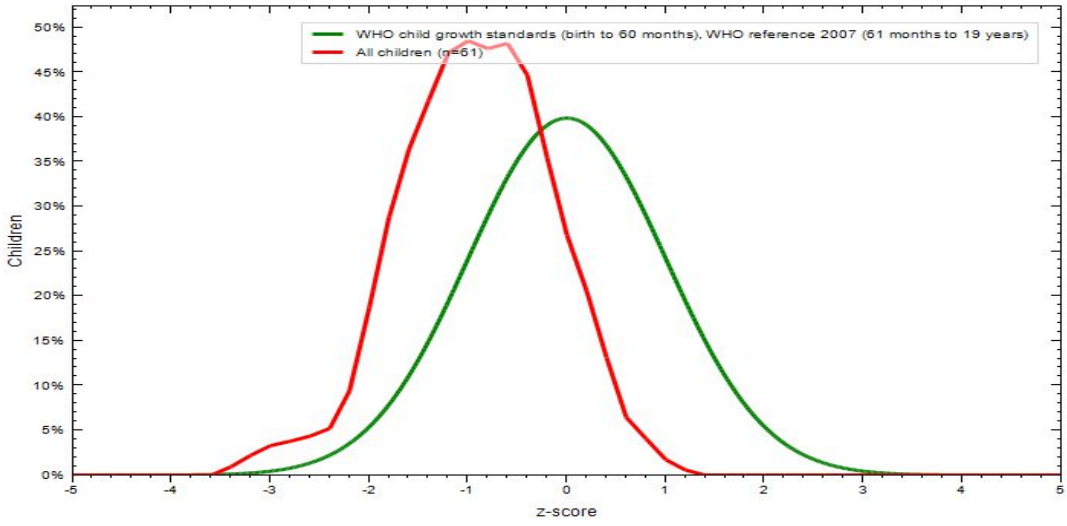

Figure 4.7: Height-for-age WHO child growth standards (n=61)

The height-for-age indicated by the red line in figure 4.7 indicates that 4.9 percent of the girls were stunted (mean -0.92 ±0.73).

4.4.DIETARY INTAKE

The food consumption patterns were determined with two 24-hour recall questionnaires, one QFFQ and a lunchbox survey. The 24-hour recall data will be discussed first then the QFFQ after which the lunchbox data will follow.

4.4.1 24-hour recall

Table 4.9: The mean intake of the adolescent girls (n=61) as measured by 2 x 24-Hour Recall questionnaires

Nutrient /day (unit of measurement)	DRIs	24-Hour recall mean intake ± SD	% Nutrient adequacy compared to DRIs	Respondents not meeting DRIs n=%
Energy (kJ) (EER)	9946	7503.00 ± 1985.69	75.44	54=88.5
Total protein (g) (RDA)	46	61.86 ± 22.30	134.48	13=21.3
Carbohydrates available (g) (EAR)	100	234.60 ± 59.93	234.60	0
Total dietary fibre (g) (AI)	26	16.60 ± 6.18	63.85	57=93.4
Calcium (mg) (AI)	1300	383.70 ± 231.36	29.52	61=100
Iron (mg) (EAR)	7.9	8.85 ± 3.49	112.05	30=49.1
Phosphorus (mg) (EAR)	1055	854.89 ± 271.38	81.03	48=78.6
Zinc (mg) (EAR)	7.5	8.59 ± 2.93	114.53	23=37.7
Chromium (mcg) (AI)	24	47.66 ± 32.27	108.58	17=27.8
Selenium (mcg) (EAR)	45	41.51 ± 26.48	92.24	39=69.9
Iodine (mcg) (EAR)	95	29.97 ± 21.67	31.54	60=98.3
Vitamin A (RE) (mcg) (EAR)	485	374.20 ± 391.33	77.15	48=78.6
Thiamine (mg) (EAR)	0.9	0.86 ± 0.37	95.56	41=67.2
Riboflavin (mg) (EAR)	0.9	1.36 ± 0.82	151.11	22=36
Niacin (mg) (EAR)	11	15.24 ± 7.59	138.55	100
Vitamin B_6 (mg) (EAR)	1.0	1.25 ± 0.63	125.00	30=39.1
Folate (mcg) (EAR)	330	234.60 ± 111.38	71.09	47=77
Vitamin B12 (mg) (EAR)	2.0	2.96 ± 2.68	148.00	26=42.6
Pantonthenate (mg) (AI)	5.0	5.35 ± 2.62	107.00	26=42.6
Biotin (mg) (AI)	25	20.47 ± 13.43	81.88	45=73.7
Vitamin C (mg) (EAR)	56	24.52 ± 19.24	43.79	57=93.4
Vitamin D (mcg) (AI)	5	3.24 ± 2.70	64.80	44=72.1
Vitamin E (mg) (EAR)	12	7.35 ± 4.62	61.25	52=85.2
Vitamin K (mcg) (AI)	75	84.12 ±206.68	112.16	47=77

EAR:	Estimated Average Requirement	EER:	Estimated Energy Requirement
SD:	Standard Deviation	AI:	Adequate Intake
RE:	Retinol equivalent	RDA:	Recommended Daily Allowance
kJ:	Kilojoules	mg:	milligrams
mcg:	micrograms	g:	grams

The mean of the two 24-hour recalls presented in Table 4.9 indicate the deficiencies of both macro and micronutrients including total energy as well as calcium, fibre, zinc, vitamin A, vitamin C, vitamin D, vitamin E, biotin, folate, thiamine selenium and phosphorus. The nutrient adequacy percentage for energy is 75.44 percent at a mean of 7503kJ compared to the DRI of 9 946kJ. The data also indicates that 88.5 percent of respondents did not meet the EER. The majority of respondents (93.4 percent) did not meet the AI for fibre (26g) with a mean intake of 16.6g. The results also indicated that 100 percent of the respondent did not meet calcium requirements (1300mg) with a mean intake of 383.7mg. Iron intake seems to be adequate 112.5 percent of the EAR (8.85mg) but 49.1 percent of participants did not meet the EAR (7.9mg), 37.7 percent of respondents did not meet zinc requirements (7.5mg). It also show that 78.6 percent did not meet the EAR for vitamin A (485mcg) with a mean intake of (374.20mcg) and vitamin C is also inadequate (24.52mg) in 93.4 percent of participants compared to the 56mg DRIs requirement.

Table 4.10: Top 20 food intake (2x24-hour recalls) of the adolescent girls (n = 61)

No	Food item	Frequency consumed	Mean intake (g) ± SD	Total intake (g)
1	Rice	93	306.02 ± 89.98	28460.00
2	Cold drink squash	72	276.18 ± 67.99	19885.00
3	Maize meal phutu	63	284.29 ± 76.36	17910.00
4	Bread white / brown	150	115.77 ± 39.88	17365.00
5	Tea	40	251.00 ± 36.13	10040.00
6	Polony	65	49.54 ± 18.49	3220.00
7	Curry chicken	23	139.13 ± 37.04	3200.00
8	Stew, chicken with skin	17	177.06 ± 50.93	3010.00
9	Samp and beans	12	241.67 ± 136.64	2900.00
10	Milk full cream	39	73.59 ± 51.04	2870.00
11	Maas/sour milk	7	354.29 ±129.06	2480.00
12	Beans, sugar (cooked)	20	120.00 ± 33.87	2400.00
13	Chicken fried	18	121.11 ± 35.79	2180.00
14	Mixed vegetables	22	86.59 ± 29.86	1905.00
15	Mabella	10	182.00 ± 69.09	1820.00
16	Egg, fried	19	93.00 ± 28.33	1767.00
17	Ice block	16	107.88 ± 47.03	1726.00
18	Coffee	6	266.67 ± 40.82	1600.00
19	Cold drink carbonated	5	318.00 ± 108.95	1590.00
20	Apple	11	141.82 ± 21.36	1560.00

The two 24-hour-recall top 20 food items presented in Table 4.10 indicate that the majority of items comsumed were carbohydrate based. The top five food items frequently comsumed included white bread (150 times by the group of 61) with a mean intake of 115.77g ±39.88 SD that indicates that the repondents consumed this amount of bread more than twice per day, followed by rice (306.02g ±89.98 SD) 93 times, 276.18g ±67.99 SD cold drink squash (72 times), 284.29g ±76.36 SD maize meal (63 times) and 251.00ml ±36.13 SD tea (40 times). Other souces of carbohydrates were samp and beans and mabella. Protein appeared for the first time at number 7 in the form of chicken (139.13g ±37.04 SD) but was only consumed 23 times during the 24 hours by the group. Fruit and vegetables appeared as mixed vegetables at number 14 (86.59g ±29.86 SD) consumed 22 times and an apple at number 20, it was, however, only consumed 11 times during the day (141.82g ±21.36 SD). Calcium rich

foods appeared at number 10 and 11 as full cream milk (73.59g ±51.04 SD) and maas (354.29g ±129.06 SD), however, the milk was only consumed 39 and maas 7 times respectively.

4.4.2 QFFQ

Table 4.11: The mean intake of the adolescent girls (n=61) as measured by the QFFQ

Nutrient /day (unit of measurement)	DRIs	QFFQ Mean Intake ± SD	Nutrient Average Requirement (NAR)%	Respondents not meeting DRIs n=%
Energy (kJ) (EER)	9946	10402.63 ± 2054.45	104.59	25=40.9
Total protein (g) (RDA)	46	78.48 ± 24.71	170.61	4=6.5
Carbohydrates available (g) (EAR)	100	330.68 ± 85.47	330.68	0
Total dietary fibre (g) (AI)	26	18.31 ± 7.54	70.42	52=85.2
Calcium (mg) (EAR)	1300	540.02 ± 225.46	41.54	56=91.8
Iron (mg) (EAR)	7.9	11.23 ± 3.35	142.15	11=18
Magnesium (mg) (EAR)	300	292.04 ± 82.91	97.35	35=57.3
Phosphorus (mg) (EAR)	1055	1020.10 ± 417.74	96.69	28=45.9
Zinc (mg) (EAR)	7.5	8.26 ± 2.44	110.13	17=27.8
Chromium (mcg) (AI)	24	40.89 ± 19.05	170.38	9=14.7
Selenium (mcg) (EAR)	45	36.68 ± 17.83	81.51	43=70.4
Iodine (mcg) (EAR)	95	35.08 ± 16.42	36.93	57=93.4
Vitamin A (RE) (mcg) (EAR)	485	596.83 ± 425.02	123.06	30=49.1
Thiamine (mg) (EAR)	0.9	1.22 ± 0.33	135.55	8=13.1
Riboflavin (mg) (EAR)	0.9	1.10 ± 0.57	122.22	21=32.4
Niacin (mg) (EAR)	11	17.19 ± 5.09	156.27	8=13.1
Vitamin B_6 (mg) (EAR)	1	1.34 ± 0.36	134.00	8=13.1
Folate (mcg) (EAR)	330	211.59 ± 84.15	64.12	52=85.2
Vitamin B12 (mg) (EAR)	2	2.99 ± 1.21	149.50	11=18
Pantonthenate (mg) (AI)	5	5.62 ± 2.56	112.40	25=40.9
Biotin (mg) (AI)	25	22.54 ± 6.40	90.16	36=59
Vitamin C (mg) (EAR)	56	33.50 ± 19.28	59.82	53=86.8
Vitamin D (mcg) (AI)	5	4.62 ±2.06	92.40	33=54
Vitamin E (mg) (EAR)	12	12.26 ± 8.81	102.17	30=49.1
Vitamin K (mcg) (AI)	75	63.35 ± 32.53	84.47	37=60.6

EAR: Estimated Average Requirement — EER: Estimated Energy Requirement
SD: Standard Deviation — AI: Adequate Intake
RE: Retinol equivalent — RDA: Recommended Daily Allowance
kJ: Kilojoules — g: grams
mg: milligrams — mcg: micrograms

The respondent intake measured by the QFFQ presented in Table 4.11 had a mean energy intake of 10 402.63kJ which is higher than the recommended DRI's (9 946kJ) with a CHO intake of 330.68g, however, 40.9 percent did not meet the recommended DRI's for energy. Protein intake was 78.48g and higher than the recommended 46g (DRIs) and present in mostly animal protein (chicken and tinned fish) and plant protein (beans) as indicated in Table 4.12. The calcium (540.02g) and fibre intake (18.31g) reflects that 91.8 percent of the respondents did not meet DRIs for calcium and 85.2 percent did not meet DRIs for fibre as Table 4.12 indicates a low intake of fruit and vegetables (banana at number 19 on the top 20 list of the QFFQ), calcium is in the form of maas and milk used in tea in very small amounts. Although other dairy products appeared in the top twenty foods there is still a high percentage of respondents that did not meet the recommended DRIs. The overall poor nutrient quality of the diet is illustrated in the Table 4.11.

Table 4.12: Top 20 food intake (QFFQ) of the adolescent girls (n=61)

No	Food item	Frequency consumed	Mean Intake (g) ± SD	Total intake (g)
1	Maize meal, phuthu	61	68.24 ± 61.18	6482.92
2	Diluted juice squash	32	139.36 ± 118.29	4459.62
3	Tea	30	145.21 ± 100.51	4356.35
4	Bread brown/white	51	69.69 ± 48.56	3554.21
5	Cold drink carbonated	24	117.24 ± 136.76	2813.79
6	Rice	25	96.25 ± 63.71	2406.28
7	Potatoes	43	34.69 ± 41.60	1491.87
8	Fried chicken	31	46.4 ± 39.60	1438.34
9	Stew chicken with skin	25	51.98 ± 34.22	1299.43
10	Maas / sour milk	28	44.05 ± 46.21	1233.54
11	Mabella	26	42.37 ± 33.55	1101.62
12	Sweet, chocolate	56	19.63 ± 21.53	1099.31
13	Vetkoek	19	54.92 ± 30.56	1043.46
14	Snack savoury, niknacks	35	29.27 ± 18.77	1024.4
15	Coffee instant	10	98.68 ± 111.39	986.78
16	Samp and beans	35	27.99 ± 18.13	979.58
17	Milk, full cream	28	33.32 ±27.95	932.92
18	Macaroni/spaghetti	21	42.99 ±48.72	902.71
19	Banana	25	35.84 ±20.96	896.02
20	Pilchard in tomato sauce	32	27.62 ±16.12	883.88

Table 4.12 indicates that food choices made by adolescents tend to be high in sugar, sodium, and fat, while relatively low in vitamins and minerals. Soft drinks are the most commonly chosen snacks for these adolescent girls and account for about 4.16 percent of total kilojoules intake (mean intake divided by total intake x100).

4.4.3 Lunchbox

The contribution the lunchboxes makes to the daily intake of the girls in Table 4.13 is about ⅓ of the girls daily nutrient intake.

Table 4.13: Contribution of the lunchbox to the daily intake of adolescent girls (n=61) compared to the QFFQ and 24-hour recall

Nutrient /day	DRIs	Lunch box mean intake ± SD	% Lunch box contribution to daily intake (QFFQ)	% Lunch box contribution to daily intake (24-hour recall)
Energy (kJ) (EER)	9946	3019.56 ± 1126.57	29.03	40.24
Total protein (g) (RDA)	46	20.05±6.97	25.55	32.41
Carbohydrates available (g) (EAR)	100	90.14 ± 60.89	27.26	38.42
Total dietary fibre (g) (AI)	26	6.97 ± 3.56	38.07	41.99
Calcium (mg) (AI)	1300	145.24 ± 152.11	26.90	37.85
Iron (mg) (EAR)	7.9	2.88 ± 1.13	25.65	32.65
Phosphorus (mg) (EAR)	1055	297.93 ± 113.84	29.21	34.85
Zinc (mg) (EAR)	7.5	2.75 ± 0.98	33.29	32.01
Vitamin A (RE) (mcg) (EAR)	485	118.52 ± 93.31	19.86	31.67
Thiamine (mg) (EAR)	0.9	0.28 ± 0.09	22.95	32.56
Riboflavin (mg) (EAR)	0.9	0.20 ± 0.11	18.18	14.71
Niacin (mg) (EAR)	11	4.32 ± 2.98	25.13	28.35
Vitamin B_6 (mg) (EAR)	1	0.29 ± 0.17	21.64	23.20
Folate (mcg) (EAR)	330	93.69 ± 49.66	44.28	39.94
Vitamin B12 (mg) (EAR)	2	0.60 ± 0.45	20.07	20.27
Vitamin C (mg) (EAR)	56	12.33 ± 25.92	36.81	50.29
Vitamin D (mcg) (AI)	5	1.31 ± 1.84	28.35	40.43
Vitamin E (mg) (EAR)	121	2.61 ±3.57	21.29	35.51
Vitamin K (mcg) (AI)	75	10.53 ±15.42	16.62	12.52

EAR: Estimated Average Requirement
EER: Estimated Energy Requirement
SD: Standard Deviation
AI: Adequate Intake
RE: Retinol equivalent
RDA: Recommended Daily Allowance
kJ: Kilojoules
g: grams
mg: milligrams
mcg: micrograms

Various carbohydrate (CHO) rich foods appear on the top 20 food items for the lunchboxes (refer Table 4.14) and these contribute 27.26 percent of CHO to the daily food consumption as measured by the QFFQ and 38.42 percent to the 24-hour recall. The lunchbox contribute 29.03 percent of energy to the daily intake (QFFQ) and 40.24 percent energy to the mean intake of 7 503g (24-hr recall). The protein intake is also two thirds (32.41g) of the EARs (46g) on the 24-hour recall and 21 percent of respondents took in less than 100 percent of their daily needs for protein. None of the children met their calcium needs (1300 mg AI) but the lunchbox contributed 26.9 percent of the mean intake of 383.70g for the day with 37.85 percent contributed to the 24-hour recall. Fourty one percent of respondents took in less than 100 percent of the EARs for iron (7.9mg), however, the lunchboxes contributed 25.65 percent (2.88mg) of the daily intake while contributing 32.54 percent to the 24-hour recall.

The results indicated that 93.4 percent of the population did not consume their daily needs of fibre (26g). The vitamin A contribution of the lunchbox was 118.52mcg (31.67 percent of the daily intake 24-hour recall) and vitamin C 12.33mg (50.29 percent of the 24-hr recall) . The lunchboxes contributed 19.86 percent to the vitamin A and 36.81 percent to the vitamin C intake of the girls as reflected on the QFFQ.

Table 4.14: Top 20 food intake (Lunchbox) of the adolescent girls (n=61)

No	Lunch box	No of respondents	Mean Intake (g) ± SD	Total intake (g)
1	Bread white / brown	54	118.89 ± 38.20	6420.00
2	Polony	35	50.57 ± 15.47	1770.00
3	Rice	5	344.00 ± 60.66	1720.00
4	Diluted juice	6	250.00 ± 0.00	1500.00
5	Margarine	47	14.24 ± 6.91	669.00
6	Apple	3	106.67 ± 83.27	560.00
7	Maize meal	2	275.00 ± 35.36	550.00
8	Cheese	12	42.08 ± 24.07	505.00
9	Tea	2	250.00 ± 0.00	500.00
10	Potato chips (French fries)	3	161.67 ± 76.87	485.00
11	Beans, sugar cooked	4	112.50 ± 18.93	450.00
12	Fried egg	6	75.00 ± 31.46	450.00
13	Chicken bryani	1	365.00 ± -	365.00
14	Chicken fried	3	118.33 ± 71.82	335.00
15	Chicken curry	3	109.33 ± 18.48	328.00
16	Fruit salad	1	205.00 ± -	205.00
17	Scone	2	102.50 ± 53.03	205.00
18	Breakfast cereal	1	160.00 ± -	160.00
19	Peanut butter	6	22.92 ± 6.79	137.00
20	Peach	1	135.00 ± -	135.00

Table 4.14 indicates that the top 20 mostly consumed foods in the lunchboxes are maize meal, bread and rice which are high in carbohydrates this is also reflected on the 24-hour recall (Table 4.10). Fruit features at number 6 and 20 on the top 20 for the lunchbox, but only four girls consumed it, fruit salad at number 16 was only present in one lunchbox. Table 4.12 indicates that banana is consumed by 25 respondents and it is listed at number 19 in the top 20 food. Food high in salts and fats like sweets and chips (french fries) is at number 10 on the top 20 food intems in the lunchboxes and the repondents took in on average 161.67g ± 76.87 (n=3). This is also evident on the top 20 of the 24-hour recall and QFFQ as can be seen in Table 4.10 and Table 4.12. Polony is the most popular bread filling at number two (n=35) on the top 20 foods consumed with a mean intake of 50.57g ± 15.47.

Table 4.15: Mean intake of the children compared with the WHO population nutrient intake goals for prevention of death and disability from NCDs (WHO 2003).

Dietary factor (food nutrient) n=61	WHO Goal	24- Hour Recall n=61	QFFQ n=61	Lunchbox n=61
Total fat % E	15-30 %	29.07	30.17	34.04
Total carbohydrate % E	55-75 %	56.92	57.03	54.67
Protein % E	10-15 %	14.02	12.83	11.29
Fruit and vegetables g/day	> 400	87.95	105.19	83.97
Dietary fibre g/day	> 25	16.60g	18.31g	6.97g

Table 4.15 reflects the fruit and vegetable as well as fibre intake and the energy contribution made by fat, CHO and protein as reflected on the 24-hour recall, QFFQ and in the lunchboxes. The results indicate that the contribution made to energy by fat is towards the high end of the WHO recommendations of 15-30 percent on the 24-hour recall, QFFQ and lunchboxes at 29.07 percent, 30.17 percent and 34.04 percent respectively. The energy contribution made by the carbohydrate intake is within, although low, compared to the WHO requirements of 55-75 percent at 56.92 percent, 57.03 percent and 54.67 percent respectively. The protein contribution is within the WHO goals/recommendations of 10-15 percent at 14.02 percent, 12.83 percent and 11.29 percent. The mean fruit and vegetable intake was much lower than the WHO goals and recommendations of >400g per day at 87.95g 24-hour recall, 105.19g QFFQ and 83.97g lunchbox respectively, the girls consumed 20.99 percent of the daily recommendations for fruit and vegetables from the lunchboxes.

4.5. Significant relationships

The following variables were used to determine significant differrences in this study variables, household income, education level, daily energy intake (24-hour recall) and lunchbox intake in order to understand the impact of various variables on the nutritional status and food intake of the children. The relationship between these variables as per results and findings will be discussed here. Statistical significance is indicated at $p<0.05$. the ANOVA- Bonferron method was used to determine equal variances.

4.5.1 Household income versus Lunchbox energy

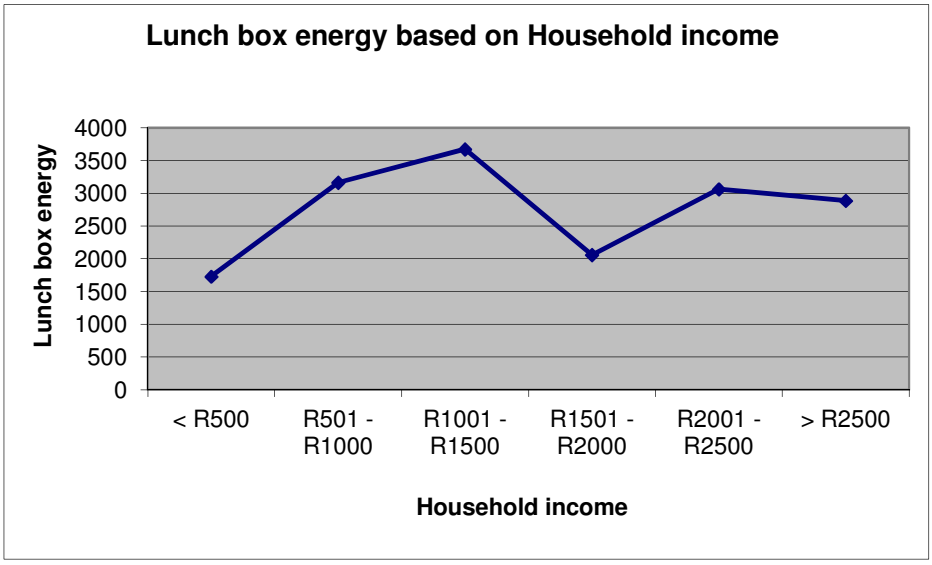

Figure 4.8: Lunch box energy based on household income.

Although an upwards trend can be seen when relating the lunch box energy and household income specifically from an income of <R500 to R1001-R1500, however, there is no statistical significant relationship between the household income and the contribution the lunchbox content made to the energy intake of the girls ($p=0.247$).

4.5.2 Household income versus Daily energy

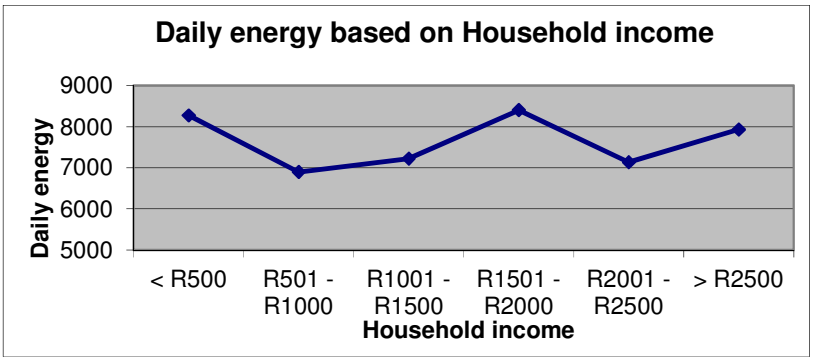

Figure 4.9: Daily energy based on household income.

As in the case of the household income and lunchbox energy, there is no statistical significance (p=0.504) between the household income and the daily energy intake. Figure 4.9 illustrates that the lowest household incomes may have the same daily energy as those with household income of between R1501 and R2000. .

4.5.3 Energy based on household income

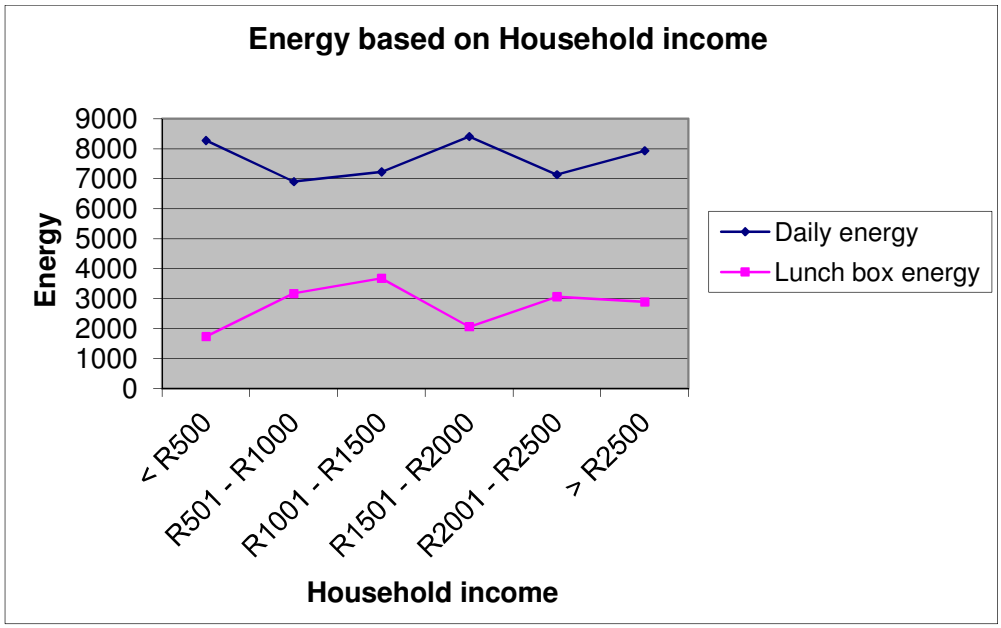

Figure 4.10: Energy based on household income.

Figure 4.10 illustrates that the daily energy intake is statistically significantly greater than the lunchbox energy intake. It is understandable because the lunchbox is 1/3 of what the respondents consumed per day (p=0.00).

4.5.4 Education level versus Lunchbox energy

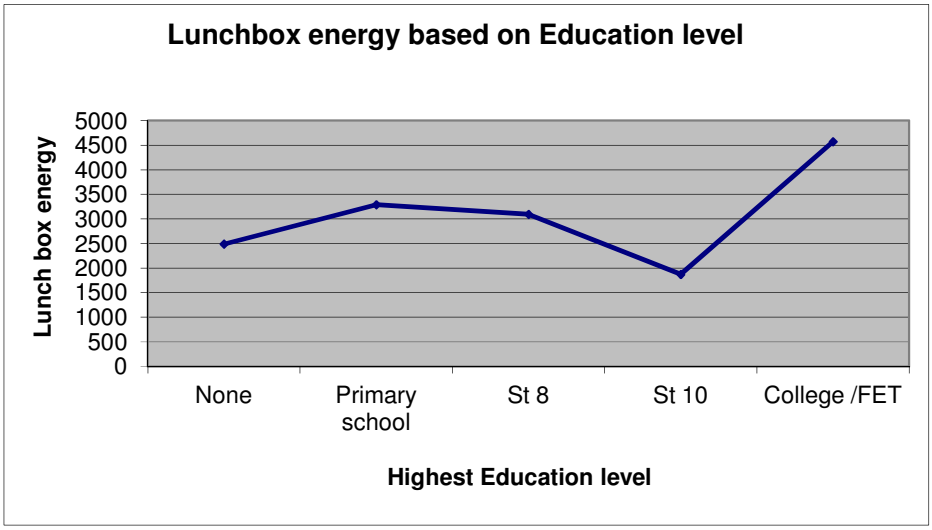

Figure 4.11: Lunchbox energy based on education level

Figure 4.11 indicates that between primary education and secondary education of the caregivers there is no statistical significant difference (p=0.266) in lunchbox energy food packed. However, between standard 10 and college level a great increase in lunchbox energy is experienced. This could be due to the fact that those household caregivers with post school education have been exposed to a variety of food and different eating patterns and apply those eating patterns to the households. There were no correlations between dietary intake and anthropometric status or lunchbox content versus anthropometric status.

4.6 DISCUSSION

4.6.1 Literature

Despite political recovery, child and adolescent malnutrition is still a serious problem in South Africa especially in rural areas. Adolescent girls form a crucial segment of the society, therefore, the dietary intake is a prerequisite at this stage. Adolescence is a period where requirements for all nutrients increase. It is essential that all the nutritional needs are met or

these girls are likely to give birth to undernourished children. Also, eating habits formed at childhood stage are directly related to development of NCDs during adulthood (Gidding, Dennison, Birch, Daniels, Gilman, Lichtenstein, Rattay, Steinberger, Stettler and Horn, 2005:2068). Eating patterns among school teenage girls is highly dependent on frequent consumption of food items that perceived to have low or poor nutritional value (Dresler-Hawke, Whitehead and Coad (2009:3). As children grow up, peer pressure begins to take over parental power and influences eating behaviour. On the other hand, the excessive intake of extra foods and drinks in children's lunchboxes may be influenced by parents' knowledge and attitudes towards food intake. This can all contribute to the fact that 7 percent of the world population is obese (Benton, 2004).

This study provides analysis of the contents of the school children's lunchboxes compared to daily intake, from a sample of 13-18 year olds in one of the high schools in Lindelani, KwaZulu-Natal. Data collectively indicate that the majority of the participants belonged to the families of low to moderate socio-economic status. Children of parents with a low SES are more at risk of becoming overweight compared to children with parents with higher SES (Scholtens, Middelbeek, Rutz, Buijs and Bemelmans, 2010).

4.6.2 Demographic information

A household questionnaire was used to collect socio-demographic information. The living conditions of the paticipants in this community is not ideal as 36.1 percent still use pit latrine toilet facilities and have no tarred roads. Almost 5 percent do not have access to waste removal facilities which attract rodents, flies and other pests and can lead to a harmful environment and poor sanitation. Sanitation essentially relates to physical, chemical, biological and microbial principles of food environment and health. Systematic reviews shows that better sanitation is associated with decreased diarrhoea, infant morbidity, improved nutritional status and lower childhood mortality (Muoki et al. 2008) and New Economic Foundation (NEF) (2008) also indicated that the above problems contribute to communicable diseases which result in malnutrition.

Lack of access to basic services like water and sanitation and low quality housing are regaded as living in poverty even with an income above the poverty line as this can cause diarhoea resulting in malnutrition (NEF, 2008). However a high percentage of pests in a

community can be an indicator of inadequately disposed refuse forming a breeding ground for household pests. Flies are associated with poverty in developing countries (Jinadu, Olusi, Agun and Fabiyi, 1991). Pests can cause diarrhoea which makes it difficult for the body to absorb nutrients and that lead to malnutrition.

However, a US study indicated that poor nutritional value is not associated with low income households or poverty, almost all households in the US study consumed low amounts of fruit and vegetables relative to recommended dietary guidelines (Frazao, Andrews, Smallwood and Prell, 2007). The results of the current study also indicated very limited intake of fruit and vegetables in both the daily intake and lunchbox of the teenage girls. In the US low income respondents usually consume a poor or unhealthy diet associated with eating energy dense food at lower costs but getting higher energy value (Drewsnowski and Darmon, 2005; Drewnowski and Specter, 2004), which is in line with this survey reflecting no statistical significant difference between the energy intake of <R500 to R1001-R1500 income households compared to other higher income households. Economic wealth and the associated influx of people searching for jobs in urban areas of South Africa, coupled with the migrant labour system have led to the widespread practice of children being left in the care of relatives in rural areas (Kleyhans et al. 2006). This study also indicated that 36 percent of caregivers were below 21 years of age which indicated clearly that these teenagers are taking care of themselves and their siblings and this might have a negative impact to the lunchboxes of the girls in Lindelani.

The American study also indicated that children at college or FET level experience a great increase in lunchbox energy density compared to children at primary and secondary school level. Education levels have been seen as a factor that can have an effect on the diet although nutritional knowledge on its own cannot lead to a healthy diet as the present study indicated that higher education levels of caregivers is not statistically significantly related to higher energy dense lunchboxes and energy dense diets are related to an unhealthy diet (Drewsnowski and Specter, 2004). The eating patterns and household situation in this study are similar to that displayed in a study in the United Kingdom where 43 percent of the children were cared for by other people with 15 percent cared for by grandparents. The majority of the caregivers are working and the children are often left to prepare lunchboxes on their own (Baker et al. 2005).

4.6.3 Anthropometry

The nutritional status of the children was determined using the two nutritional indicators namely; BMI-for-age and height-for-age for this age group, using the WHO growth indicators presented as Z-scores. The overall nutritional status of the participants found that 4.9 percent of the children were stunted, 3.3 percent children obese, 11.4 percent overweight and 36 percent at risk of overweight. Despite the households' socio-economic conditions, the majority of the participants were normal for both BMI-for age and height-for-age. The results of the present study are not much different from the result found in by DBSA in 2008 where 51.5 percent women of KZN, Free State and Gauteng were obese and overweight. The results are also similar to Labadarios et al. (2008), who found 4 percent obese and 10 percent overweight prevalence in women and children respectively. A study by Jinabhai's (2007) found that 20.9 percent school going children in SA were overweight but stunted with a higher BMI. A South African study done in the Western Cape by Abrahams, De Villiers, Steyn, Fourie, Dalais, Hill, Draper and Lambert, (2011) also found that 2 percent of learners were underweight, 19 percent stunted and 21 percent overweight which is consistent with the present study.

4.6.4 Nutrient Analysis

The diet quality of adolescents has declined over the years with increased energy intake from unhealthy sources (Cutler, Flood, Hannan and Neumark-Sztainer, 2009). The consumption of readily prepared food whether at home, on the street or at schools has become a very common feature of adolescents eating habits (Cutler et al. 2009). A total of 61 school girls aged between 13 to 18 years were included in the present study. The fibre intake falls below the minimum requirement, the low fruit and vegetable intake indicated on the top 20 food items is contributing to the low fibre intake in the group. The problem of anaemia due to iron deficiency is another problem that can face teenagers. Labadarios et al. (2008) reported that one third of women in SA were anaemic, two thirds of children and one out of four women nationally had a poor vitamin A status and six women out of ten in KZN had poor vitamin A status. The results from this study are in line with country findings as 78.6 percent (24-hour recall) and 49.1 percent (QFFQ) of the girls did not meet the recommended vitamin A intake and 49 percent and 18 percent of iron respectively. Low calcium intake was associated with the minimal intake of dairy products by the teenage girls in both daily dietary intake and

lunchboxes. The risk of osteoporosis is very high for these teenage girls as they grow older since calcium, vitamin D and phosphorus fall below the minimum amounts required.

This study presents some evidence towards the crisis of malnutrion amongst adolescents living in rural African communities. This study provides some information on the contribution of packed lunchboxes to the daily food intake of adolescents. Results indicated that 37.8 percent of the participants from 161 teenage girls brought lunchboxes and this is in line with a study done in Cape Town where only 41 percent of children brought food to school (Temple et al. 2006), in general these lunchboxes were defficient in the mean intake of most DRIs. These results are also in line with the UK study done by Jefferson and Cowbrough (2004) where an avarage of 45 percent in the survey had packed lunches from home. In the present study 56 percent of the participants had no acccess to supermarkets which could contribute to the lack of variety in childrens food lunchboxes. However the nutrition programme which has been started in South African schools had never been started in Mandlenkosi High School yet, during the data collection of lunchboxes and that indicates that there were no meals provided by the school to the learners.

The most common items included in the lunchbox are bread, margarine and polony which is similar to the lunchbox survey done in UK where 69 percent consisted of white bread filled with 27 percent ham, 17 percent cheese or 11 percent chicken. The present study found that very few of the participants had a lunchbox containing all the necessary nutrients for a balanced diet. Although the results indicated nutrient adequacy for energy, consumed energy is 75.48 percent compared to the DRIs the majority (88.5 percent) did not meet the EER. The most common items contained within the lunchbox continue to be bread, polony sandwiches, accompanied by diluted squash. This is reflected in the 20 top foods contributing to energy, fat, salt and sugar as food high in salts and fats like sweets and chips are also evident in the top 20. This eating pattern is similar to that displayed by most adolescents in a UK study by Jefferson and Cowbrough, (2004), where a high intake of fat, carbohydrates, sugar and particularly salt each day from the lunchbox was evident. Fruit salad only appears at number 16 on the top 20 foods and in one lunchbox.

Similar results have been indicated in a study done in the Western Cape by Abrahams et al. (2011) whereby the majority of the learners brought white bread with processed meat or

polony. The nutritional adequacy of a child's daily food intake is not only dependent on the packed lunchbox as this represents only a fraction of the daily intake. The lunchbox plays an important role in the daily dietary intake of school going teenage girls for the daily energy reference. However, Abrahams et al. (2011) discovered that children in 16 of the primary schools in Western Cape who brought lunchboxes to school have a higher nutritional self efficiency compared with those who did not bring a lunchbox to school. This study indicated that the girls have considerable control over the contents of what goes into the lunchbox and are, therefore, free to choose whatever they like without the assistance of the parents.

4.7 Relationships

The results of this study indicated that there was no statistical significant relation between household income with lunchbox energy and daily energy intake of teenage girls. Similar findings were evident in the relation between education level and lunchbox energy. The income and education levels of the caregivers has no statistically significant effect on the girls lunchbox energy intake. The girls' daily food intake as indicated in Figure 4.6 ($p=0.504$) and Figure 4.8 ($p=0.266$) shows no statistical significance to the energy intake. The literature indicates that the education levels of mothers can make a posititve contribution to the nutritional status of the children (WHO, 1998).

4.8 Conclusion

The results provide evidence that undernutrition is a persistent problem among these future mothers. In conclusion, the present study paints a disturbing picture of the dietary patterns of Lindelani children while at school and ignorance of the caregivers on what children consume and brought to school. The foods and beverages consumed by the participants in this survey are commonly of low nutritional value and are often high in sugar, fat and salt. Parents also play a key role in their modelling of healthful eating behaviours at home and in their selection of foods at away locations. Parents can let adolescents know that eating healthful breakfasts and lunches is important and that skipping meals can be detrimental to maintaining a healthful weight. However, in spite of the disturbing picture, lunchboxes have tremendous potential for solving the problem of malnutrition among adolescents, if health promoting interventions are done.

CHAPTER 5

CONCLUSIONS & RECOMMENDATIONS

5.1INTRODUCTION

This chapter aims to summarise the research findings as discussed in Chapter 4. Limitations and recommendations for future research are also presented. This study provides important data on nutritional assessment of meals prepared for adolescents, as well as concerning their dietary eating behaviour, although the group studied was of a small size; therefore, the results may not reflect the general population of KwaZulu Natal.

5.2 PURPOSE OF THE STUDY

The aim of this study was to analyze the lunchbox content of high school girls in Lindelani and evaluate its contribution to the dietary intake.

The specific objectives for this research were formulated as follows:

- To determine the children's nutritional status through anthropometric measurements.
- To determine the socio-demographic profile of the children by completing socio-demographic questionnaires.
- To determine the nutrient content and food group distribution of the lunch boxes of the children.
- To compare the contribution of the lunchbox content to the daily intake of the adolescents.

5.3 LIMITATIONS OF THE STUDY

- Respondents did not turn up in numbers that were expected and parents were reluctant to attend the meetings that were arranged, this delayed the fieldwork. Some of the information was confirmed over the phone calling respondents parents.

- The number of lunchboxes collected (n=61) were collected over a period of six months as not all the respondents brought a lunchbox everyday and as lunchboxes were collected at random intervals to avoid over or under reporting. From the randomly selected 161 girls only 61 brought lunchboxes to school and could be included in the study. This delayed the data collection process. The findings of this study cannot be generalised to the whole Lindelani community since the study was conducted in girls only in this one school.
- There is a paucity of literature available with regards to school lunchbox studies therefore limited sources were used.

5.4 MAIN FINDINGS

5.4.1 Literature

Malnutrition is a continuous global problem in adolescent girls as nutritional diseases are still an issue in most African countries. The risk factors for malnutrition in South Africa and developing countries in general include food security, poverty, urbanisation, family unit and cohesion, physical environment, pregnancy, breastfeeding and weaning practices, education, ignorance and psychological factors, parasitic infections and alcohol intake (Kleynhans et al. 2006). Food security and undernutrition, of particularly energy and quite a lot of micronutrient deficiencies, have not been successfully addressed in Africa, as evidenced by the lack of most African countries to stay on track in reaching the Millennium Development Goals (Vorster, Kruger and Margetts, 2011). However MSF (2008b) also agreed that childhood malnutrition receives insufficient international attention. It has been found that in South Africa, children's dietary intake of the following nutrients was less than 67% of the RDAs: energy, calcium, iron, zinc, selenium, vitamin A, vitamin D, vitamin C, vitamin E, riboflavin, niacin, folic acid and vitamin B6 (Labadarios et al. 2008).

These data were supported by the findings that, at the national level, one out of two households experienced hunger, and one out of four were at risk of hunger and only one out of four appeared to be food secure. Current approaches to address malnutrition have serious limitations. In places where highly-nutritious foods are not available, behaviour change approaches to malnutrition that focus on education about proper food choices, hand-washing and breastfeeding are not enough to address the problem (MSF, 2008b). Greater variety of

food items high in fat and sugar and low in nutrient density are replacing nutritious food. The prevalence of overweight and obesity found in the present study and other studies in South Africa among students is high. Overweight, obesity and underweight are key risk factors in the development of various chronic health related conditions (WHO, 2004). Poor nutritional status may also increase the risk of HIV transmission from mother to child (WHO, 2008b). Current estimates suggest that about 1 million children die every year from severe acute malnutrition (WHO, 2007b). According to Albala, Vio, Kain, and Uauy (2002), obesity is more prevalent in women of a low income level in Chile and was found very low in pre-school and school going children.

5.4.2 Socio-demographic

According to Traill (2006), it is accepted that the prevalence of overweight is most among disadvantaged groups. Traill further explains that urbanization, globalization and economic development have led to dietary and lifestyle changes that promote the eating of high energy-value foods, as well as processed foods and food consumed outside the home. However, the energy expenditure is less which increases problems related to overweight in developing and middle-income countries. This study also indicated an imbalance of income as most of the population sorted under low paying labourers and where combined income of the family is R2500 and less, with only a few professionals and businessmen with an income of above R2500. Income might be a relevant contribution in packed lunchboxes of the girls either negatively or positively. Several studies indicated a correlation between income and malnutrition. Population development and income increase the choice of a tastier diet high in fat and salt compared to traditional diets that are high in fibre and low in fat, leading to a natural preference for energy dense, smooth (refined, highly processed), salty, fatty and sweet convenience foods and snacks (Vorster et al. 2011).

The majority of the population has migrated from rural to this semi urban area, which is faced with many new challenges and problems, including lack of housing or housing with problems, poor sanitation and sewage disposal, lack of adequate energy or fuel sources, lack of access to clean water and high rates of crime and violence and all this can be affiliated with malnutrition. Women's educational status is a factor that affects the child's life expectancy and nutritional status that influences child endurance and improved nourishment (Özdoğan, Ucar, Akan, Yilmaz and Sürücüoğlu, 2012). The study indicated a medium level

of education while education has been identified to contribute to better nutritional knowledge and good food practice. Understanding the importance of packed lunchboxes for the girls depends on the information and provision the caregivers had.

5.4.3 Anthropometric indicators

The results show that the risk of overweight is high. This could increase the number of obese learners in the near future in addition to the identified number of obese learners. This risk of overweight can be due to the fact that the lunchboxes were energy dense and at the same time can place some learners at risk of micronutrient deficiencies due to lack of nutritious food. The whole community of Lindelani is at high risk of obesity as these teenagers will become the mothers of tomorrow and may not know any better.

5.4.4 Dietary intake and nutrient adequacy

In a School Lunchbox survey Jefferson and Cowbrough (2004) found that a serving of fruit was contained in just 52 percent of lunchboxes in schools around the country who took part in the survey. In addition to a lack of fresh fruit and vegetables, the percentage of lunchboxes which included a packet of crisps was 69 percent. The researcher found that very few of the the lunchboxes contained all the necessary nutrients for a balanced diet. This means that the teenagers in this school are not conscious about the diet.

About a third of participants claimed to eat what was in the lunchboxes. Most of the participants gave some to friends but in any case those friends are part of the school community and are facing the risks that were discussed above.

Analysing the lunchboxes of girls aged 13 to 19 years at Mandlenkosi High School gave the researcher an understanding that learners and communities living in the area of Lindelani may be at risk of many diseases that are related to malnutrition. Some may become victims of cardiac diseases or heart attack due to obesity. Secondly, some people may become victims of deficiency diseases such as anaemia and goitre. Contribution of lunchbox to the daily intake indicated adequate amounts of the following micronutrients vitamin D 40.43mcg AI, vitamin C 50.29mg EAR, and vitamin B_{12} 20.27mg EAR, zinc 32.01mg EAR

5.5 CONCLUSION

In conclusion the present study reveals that the majority of the respondents consume carbohydrate based food items and the lunchboxes did not meet the basic requirements of a balanced diet resulting in a deficiency in certain nutrients, particularly in respect of energy, fibre, calcium and vitamin A. The poor nutritional status in the present study could be attributed to the inadequate food intake as indicated in Table 4.10 in Chapter 4. In spite of these limitations, our results can be used to inform existing debates over school eating polices.

5.6 RECOMMENDATIONS

5.6.1 Recommendations to Government

- The Department of Health should conduct nutrition awareness campaigns not only in schools but also to the grater community as this will improve the nutritional status of the girls.

- The Department of Health should develop guidelines for healthy tuckshops at schools and implement this as compulsory guidelines to all schools. This will impact on the nutritional status of the girls.

- Schools should restrict the number of unhealthy foods sold during lunch time by the vendors on school premises and all stakeholders should be involved in planning on what should be sold since these will impact nutritional status of the girls.

- It is also recommended that the Department of Education re-instate nutrition education through the curriculum in Consumer studies from grade 8 which will give learners better nutrition knowledge at an early stage.

5.6.2 General recommendations

- Nutrition education of learners

Nutrition education themes at all ages of learners should be practiced at schools and in the community setting like churches for children to grow up with the culture of healthy eating habits. Parents should practice and reiterate the culture of a healthy lifestyle and good eating practices at home as they are the role models of their children.

- Nutrition education of parents

To improve adolescent's school lunches, parents need to get involved in the schools. Public and private partnerships of parents, teachers, food service staff, health, education groups, and the food and agricultural community should come together at the community level to educate parents and improve what parents know about healthy nutrition at homes and school, for parents to understand the importance of healthy eating patterns for child health.

- Increasing physical activity in adolescents

After school community programmes where adolescents may involve themselves in community sport like netball, dance, music and other physical activity and reduce the time for watching television should be implemented. Improvement of sport activities in schools where children will participate and sport must be taken seriously as a compulsory subject that encourages physical activity where marks will be allocated to learners.

5.6.3 Recommendations for further studies

Further research should be conducted to establish the teacher's abilities to use their own expertise and initiate activities designed to improve the nutritional status of children in schools where they teach.

As this study is limited to this community, similar research should be conducted in other schools or the whole province to establish the true reflection of the whole population.

A study to determine the impact of dietary change as a result of nutrition education aimed at parents and the children could shed some light on the impact that parents have on the food intake of adolescents. An intervention study in the form of a school sport can be implemented to measure the impact on the nutritional status of the school children.

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Annexure A

74 NORDIC COURT
57 BROAD STREET
DURBAN
4001
05 MAY 2008

To whom it may concern .

This serves as a confirmation letter that I , N.Phetshula has been permitted by the principal of Mandlenkosi High School to work with teenage girls of 13-18 years for a research project.

Thanking you in advance.

[redacted]

RESEACHER'S SIGNATURE

[redacted]

PRINCIPAL'S SIGNATURE

SCHOOL STAMP

DEPARTMENT OF EDUCATION & CULTURE
MANDLENKOSI HIGH SCHOOL
08 -05- 2008
P.O. BOX 76871, MARBLERAY, 4037
TEL/FAX: 031 509 5361
H.O.D. SIGNATURE:

DURBAN UNIVERSITY of TECHNOLOGY

Department of Food and Nutrition,
Tel. (031) 373-2326, Fax (031) 373-2795,
P.O. Box 1334, Durban 4000

Dear Parent

Community based integrated nutrition research project

Your child has been identified to participate in a study which is taking place in Mandlenkosi high school. The project is planned to establish nutritional status needs and dietary intake of adolescent girls and address any needs that may be identified.

Granting your child permission to participate in the study will be highly appreciated, as the success of the project is solely dependent on you, your child and us working together as a team.

What is the project all about?

a. The main aim of the project is to determine the nutritional status and dietary intake of adolescent girls in Mandlenkosi high school in order to provide baseline data that can be used by the Department of Education, Health and Social welfare as a basis for putting in place interventions to address malnutrition in schools.
b. To improve adolescents nutritional knowledge regarding healthy eating habits and creating diet related diseases awareness.

Importance of the Project

It has been detected that adolescent girls have poor eating habits, as a result of that, they become malnourished. The project aims to address those problems.

Procedure

The project will continue for 1 to 2 years, we will request your child to remain after school not more than an hour per session, not more than three times. It is understandable that by that time children will be hungry, therefore, SNACKS will be provided to all participants at no cost. The participants will be answering questionnaires regarding daily food intake and measured to establish anthropometric status (weight and height), and these measurements will indicate your child's nutritional status. We will also be checking your child's lunch box at specific dates to give us a better idea of what children bring to school, **please do not change the type of lunch box meals you have been packing** as we would like to have a true reflections of what the children eat. We may send questionnaires home for completion by you, we may also request you to come to the school at a set time to complete some questionnaires regarding your household and the eating patterns of your child.

Participants should be:

a. Mandlenkosi adolescent girls
b. Must be between 13 and 18 years
c. Boys will be excluded

As researchers, we will gladly answer any question related to the study. Your co-operation in this regard will be highly appreciated and we thank you in advance for positive contribution in the study.

If you agree for your child to take part, please complete the attached form and send back to the school.

Yours

Hlambelo, N. (Ms) Reseacher and Mandlenkosi educator

DURBAN UNIVERSITY of TECHNOLOGY

Department of Food and Nutrition,
Tel. (031) 373-2326, Fax (031) 373-2795,
P.O. Box 1334, Durban 4000

INFORMED CONSENT: NUTRITIONAL STATUS OF SCHOOL CHILDREN

I, the undersigned.....(full names in print) have read the details of the project, or have listened to the oral explanation thereof, and declare that I understand it. I have had the opportunity to discuss relevant aspects with the researcher and declare that I voluntarily participate in the project. I hereby give consent for my child to participate in the project.

I the parent/legal guardian of.....(full names of child), grade....., hereby consent that he/she may participate in this research project and that blood samples may be taken from my child .

Signature ..... Relationship.....

Signed at ..... on .....

Witnesses

Name ..... Name .....

Signature ..... Signature .....

Signed at ..... on .....

For subjects under the age of 21 years, signed consent of a parent or legal guardian is essential.

Address of volunteer: .....
.....
.....

Telephone number : .....

FIELD WORKER MANUAL

Why am I here?

The Department of Food and Nutrition Consumer Sciences has a variety of research projects in communities around Durban. Research fieldwork in communities cannot be conducted without the assistance of fieldworkers.

What is a Field Worker?

The field worker is an extremely important person in this project. In fact, this research would not be possible without the field workers. The field workers are the people who must interview the subjects (the people chosen to take part in the research) and get correct and accurate information from them. The subjects must feel at ease with the field worker so that they will not feel threatened or intimidated and will willingly answer the questions to the best of his or her ability.

How should I behave?

In order to be a successful interviewer, a field worker must have (or develop) the following characteristics:

1. Friendliness: the field worker must be able to make each subject feel relaxed and not threatened in any way. The subject must feel that the field worker sees him or her as a person, not just another number that must be dealt with.

2. Respect: the subject must be treated with respect at all times. For example, he must be greeted politely, thanked for his time and co-operation; he must not be forced to answer a question that he is not willing to answer. The field worker must never show if she disagrees with something the subject has said.

3. Patience: each subject has to be asked the same questions in the same way. This means that the field worker must ask the same questions over and over, which can be very tiring and irritating. However, the field worker may never show that she is impatient or irritated even when the subjects are slow to answer or when they do not understand the questions. She must be able to control her own feelings and hide them when necessary.

4. Reliability: the field worker must be reliable, she must pay attention to detail, record all answers accurately, not skip over questions or make up answers herself.

5. Enthusiastic and Motivated: the field worker must be enthusiastic about the research. She should be doing it because she really wants to and not just because it's just a job.

6. Flexible: a good field worker is able to adapt to circumstances. She is aware that things do not always work out as planned and sometimes she will have to work under difficult and uncomfortable conditions.

8. Neat Appearance: the field worker must always look neat and well groomed, but never overdressed. The following guidelines for dress should be followed:
   - wear neat, simple and comfortable clothes

- do not wear badges or emblems of organisations, churches, etc. as these may influence the way subjects answer.
- dress so that the subject will concentrate on the interview and not on the way you are dressed.

How do I interview the subject?

If the subjects in a project are children, the parents and/or caregivers will need to be involved in the interview process to verify information that is needed for the questionnaires. If the subjects are adolescents they can usually remember what they ate and can answer their own questions. If the questions need to be translated the interviewers must be careful not to change the focus of the question.

1. How do I begin?

- Greet the subject politely and introduce yourself.
- Ask what language the subject would prefer to speak.
- Explain what the interview is about. Let the subject ask questions about the research. Reassure the subject that the answers are confidential and that neither the subject nor his or her address will be identified.
- Put the subject at ease. Be flexible and sensitive to the subject. Some subjects may be tense or apprehensive. In such cases, talking about something general, e.g. the weather may put the subject at ease.

2. How do I conduct the interview?

- During the interview direct the questions to the subject, but if it is a child and he or she cannot answer, ask the parent/caregiver for the information needed.
- Ask the questions exactly as they are written on the questionnaire. Try even to keep your tone of voice the same for each subject so as not to lead the subject or to give him an idea of how you want him to answer. You may have to explain a question or use different wording if the subject cannot understand it.
- Ask the questions in the order that they appear on the questionnaire. If the subject refuses to answer the question, record the lack of response and go on to the next question.
- Follow the instructions on the questionnaire. Sometimes it may seem that a subject has already answered a question when he answered a previous one, but the interviewer must still answer the question. For example, the questions about polony and atchaar. Start the question: "We have already mentioned this, but...".
- Do not lead the respondents. Do not try to influence the way the subject answers. Keep your facial expression friendly, but neutral. Never show surprise or shock or approval to the subject's answers. Try to avoid unconscious reactions such as nodding the head, frowning, raising the eyebrows. Never give your own opinions.
- Keep the tone of the interview conversational. Be friendly and courteous. Do not make the subject feel as if he or she is taking an examination or is on trial be familiar with the questionnaire so that you can ask questions conversationally rather than reading them stiffly. The questionnaire is designed to keep the amount of writing to a minimum. However, if a subject gives a long response to an 'other' question, say, 'excuse me while I write that down'. Don't make the subject feel as though you have forgotten he is there.
- Keep control of the interview. Do not let the subject go off into irrelevant conversation. If he or she does, bring him or her gently back to the interview.

- Allow the subject time to think; do not hurry him to answer. However, if he is silent for too long, repeat the question, or 'prompt' him. For example, say 'you have told me how you cook cabbage; now please tell me how you cook pumpkin.
- Follow the instructions on the questionnaire for recording the responses. Record all responses, including negative responses or refusals to answer.
- **Make sure that you have written in the subject's number.**

3. **How do I end the interview?**

   Tell the subject that you have finished the interview.
   Reassure him that everything he has told you is confidential.
   Thank him for his time and cooperation. Direct him to the next stage. Greet him.

Interview for the 24-Hour Recall Questionnaire.

The 24-hour recall is a questionnaire on what the subject has eaten the day before over a 24 hour period. Often the 24-hour recall is used to establish whether the QFFQ is valid or not. It is important to think of the 24-hour recall questionnaire as being a totally separate questionnaire and not a cross-reference to the QFFQ. Therefore, the answers to the questionnaire need to be very detailed. You will need to ask what is eaten and drunk, what type of food or drink is consumed, the brand name, the preparation method and the quantity consumed. Remember to include spreads, sugar and milk to tea / coffee, snacks, sweets, juices, sauces, salts and other condiments.

Example: The subject is asked what she has in the morning on waking up.

I: What do you have in the morning when you wake up?
S: I drink tea and then have porridge.
I: How do you take your tea?
S: With 2 sugars and a little milk.
I: How big is the spoon and is it level or heaped? (*Showing the teaspoon*).
S: It is like that spoon and I also have it heaped.
I: What type of porridge did you eat and how much did you have? (*Showing a bowl or cup*).
S: I had soft mealie meal porridge and I had about 2 of those cups to the fill in a bowl.
I: Do you put anything else in the porridge?
S: Yes, 2 spoons of sugar, like my tea, and a little margarine about 1 spoon.
I: At about what time was this meal?
S: At 6 am.
I: Where did you have this meal?
S: At home.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					
6 am	**Home**	**Tea, rooibos**	**1 cup/mug**		
		With milk, full cream	**little milk – 2 tablespoons**		
		And sugar, white	**2 heaped tsp**		

		Soft mealie meal porridge	2 cups		
		With sugar, white	2 heaped tsp		
		And margarine, hard brick	1 tsp		

Portion sizes

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Stiff porridge	125 g	275 g	425 g	600 g	800 g
Soft porridge	125 g	275 g	425 g		575 g
Samp and beans	100 g	200 g	375 g	600 g	800 g
Rice	70 g	105 g	190 g		310 g
French fries	30 g	90 g	185 g		340 g
Fried beef	15 g	45 g	80 g		120 g
Beef with bone	45 g	75 g	120 g		180 g
Meat stew	55 g	165 g	275 g		385 g
Sausage/ Wors	20 g	50 g	90 g		135 g
Offal	20 g	60 g	100 g		140 g
Pilchards	15 g	45 g	90 g		150 g
Mashed pilchards	15 g	45 g	90 g		240 g
Fried fish	50 g	70 g	105 g		155 g
Cabbage, potato and onion	15 g	45 g	75 g		105 g
Spinach, potato	15 g	45 g	75 g		105 g
Tomato and onion gravy	10 g	30 g	60 g		100 g

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Pumpkin	15 g	35 g	60 g		80 g
Carrots, potato	45 g	65 g	80 g		95 g
Green mealie	50 g	110 g	180 g		260 g
Beetroot salad	10 g	30 g	65 g		85 g
Fat cake	20 g	50 g	70 g		90 g
Bread	15 g	45 g	80 g		120 g
Margarine	2,5 g	7,5 g	12,5 g		17,5 g
Dumpling	20 g	70 g	125 g		175 g
Apple	70 g	130 g	195 g		265 g
Banana	40 g	60 g	95 g		130 g
Canned peaches	30 + 10 g	70 + 15 g	110 + 25 g		150 +35 g
Custard	5 g	20 g	35 g		65 g
Atjar	10 g	45 g	80 g		120 g
Polony	5 g	15 g	30 g		45 g
Peanuts	5 g	20 g	60 g		105 g
Cheese curls	6 g	18 g	38 g		62 g

Other questionnaires

We may also use any of the following questionnaires:

Food Frequency Questionnaire

Socio-demographic questionnaire

Nutrition knowledge questionnaires

Health questionnaires

Smaller questionnaires drawn up by each individual researcher e.g. lunch box content of school children.

Annexure D

DURBAN UNIVERSITY of TECHNOLOGY
Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE: AFRICAN COMMUNITY

This questionnaire covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life that is relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable from any reports or publications.

1. GENERAL INFORMATION

Subject number:.....

Please answer all questions by marking the correct answer with **X**, except where otherwise indicated.

Where do you live?

.....

2. PERSONAL INFORMATION

2.1 Your role in the family

Mother	Grandmother	Father	Grandfather	Other, specify.....

2.2 When were you born? Year: Month: Day:

2.3 How old are you?_____years

2.4 Gender:

Male	Female

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

Town/City	Farm	Squatter camp	Rural village	Hostel	Township	Other, specify.....

3.2 Do other people live in your house?

Yes
No

3.3 How many people are living in your house?

1	2	3	4	5	6	7	8	9	10	10+

3.4. Please **complete** the table below on all members of the household

Name of household member	Age (yrs)	Gender M / F	Family relationship	Level of schooling	Does this person eat and sleep in this house at least 4 days a week?

3.5 Are all members' permanent residents in this house?

Yes	No

3.6 If yes, how long have you been staying permanent in this house?

< 1 year	1-5 years	>5 years

3.7 Has any children in your household died in the past?

Yes	No

Reason: .....

3.7 In what type of house are you staying?

Brick	Clay	Grass	Wood	Zinc/shack

3.8 How many rooms does your house have?

< 2 rooms	3-4 rooms	> 4 rooms

3.9 Are there other houses/shacks within the same yard of the main house?

Yes	No

3.10 How are you currently living?

Homeless	
Living with relatives	
Living with friends	
Hostel accommodation	
Squatter home	
Rented house/flat	
Own house/flat	
Employees Properties	
Other, specify.....	

3.11 Do you have the following facilities at home?

3.11.1 Water

Tap in the house	
Tap outside the house (in yard)	
Borehole	
Spring / river / dam water	
Fetch water from elsewhere	

3.11.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	

Bucket system	
Other, specify.....	

3.11.3	Waste removal	Yes	No

3.11.4	Tarred road in front of house	Yes	No
	Gravel road in front of house	Yes	No

3.12 To what extent do you have problems with the state of your house (e.g. too small, repairs, damp, etc.)?

.....
.....

3.13. Do you have problems with the following?

Mice/ Rats	
Cockroaches	
Ants	
Flees	
Mosquitoes	
Geckos	
Frogs	
Snakes	
Bed Bugs	

3.14. What is the floor inside your house made of?

Cement	
Tiles	
Carpet	
Dirt	
Sand	
Dung	
Other, please state	

4. WORK STATUS AND INCOME

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

4.2. If NO, how would you describe your current status (tick one box only)?

Unemployed	Retired	Housewife	Student	Other, specify.....

4.3. Are you actively looking for paid employment at the moment?

Yes	No

4.4. How long have you been unemployed?

< 6 months	6-12 months	1-3 years	> 3 years

4.5. If YES (question 4.1) is your current job a:

Permanent position	Temporary position	Fixed term contract	Other, specify.....

4.6. Are you doing part time jobs on week ends and school vacations?

Yes	No

4.7 What is the exact title of your current job?
(Including self-employed)

4.8. What is the total income in the household per month?

< R500	R501-R1000	R1001-R1500	R1501-R2000	R2001-R2500	> R2500

4.9. Please specify the monthly income in the household (if willing).....

4.10. How often does it happen that you do not have enough money to buy food?
for you and your family?

Always	Often	Sometimes	Seldom	Never

4.11. How many people e.g. partner, relatives & others (including yourself) contributed to your household income from any source, (including wages/salary from paid employment, money from second or odd jobs income from savings investments, pension, rent or property, benefits and or maintenance etc.) in the last 12 months?

0	1	2	3	4	5	6	7	8	9

People

4.12. How often do you buy food?

Every day	Once a week	Once a month	Other, specify.....

4.13. Where do you buy food?

Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify.....

4.14. What type of transport do you use to get around?

Taxi	
Bus	
Train	
Own vehicle	
Other Specify	

4.15. How much money is spent on food PER MONTH? (Tick only one box)

R 0 – R 50	R 51 – R 100	R 101 – R 150	R 151 – R 200	R 201 – R 250	R 251 – R 300	> R 500	I do not know

5 EDUCATION AND LANGUAGE

5.1. What is your highest education level?

None	Primary School	Standard 8	Standard 10	College/FET	Other post school

5.2 What language is spoken mostly in the house?

Zulu	Xhosa	English	Afrikaans	Other, specify.....

5.3 How many children (in the household) have birth certificates?

None	1	2	3	4	5	6	7	8	All

5.4 How many children have completed their immunisation schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.6 How do the children get to school?

Walk	Bus	Taxi	Lift	Other, specify.....

ASSETS

Tick one block for every question:	Father	Mother	Sibling	Grandma	Grandpa	Aunt	Uncle	Cousin	Friend	Other
6.1 Who is mainly responsible for food preparation in the house?										
6.2 Who decides on what type of food is bought for the household?										
6.3 Who is mainly responsible for feeding/serving the child?										
6.4 Who is the head of this household?										
6.5 Who decides how much is spent on food?										

6.6 How many meals do you eat per day?

0	1	2	3	> 3

6.7 Where do you eat most of your meals?

Home	Friends	Work	School	Other, specify.....

6.8 Where do your children eat most of their meals?

Home	Friends	School	Other, specify.....

6.9 Does your home have the following items and how many?

	Yes	**No**	**Quantity**
Electrical stove			
Gas stove			
Telephone / Cellphone			
Primus or paraffin stove			

Microwave			
Hot plate			
Radio			
Television			
Refrigerator			
Freezer			
Bed with mattress			
Mattress only			
Lounge suite			
Dining room suite			
Electrical iron			
Electrical, kettle			
Car			
Bicycle / Motorbike			

6.10 What type of fuel do you usually use for food preparation?

Wood fire	Paraffin	Electricity	Gas	Coal/Charcoal	Other, specify.....

6.11 What type/s of material are your pots made off (tick all relevant options)?

Cast iron	Aluminium	Stainless steel	Clay	Other, specify.....

Thank you very much for your co-operation. We appreciate the time.

Annexure E

24 – HOURS RECALL

Subject number: _____ Interviewer: _____

Name: _____ Date: _____ / _____ / 20___

Address: _____

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Would you describe the food that you ate yesterday as typical of your habitual food intake?

Yes	1	No	2

If not, why? _____

I want to find out about everything you ate or drank yesterday, including food you pick from the veld. Please tell me everything you ate from the time you woke up to the time you went to sleep. I will also ask you where you ate the food and how much you ate.

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					
During the morning at work or at home					

Annexure E

Time (approximately	Place (Home, school, etc)	Description of food and Preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					

Annexure E

Time (approximately	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
After dinner, before going to sleep					
* Do you take any vitamins (tablets or syrup)		Yes	1	No	2
Give the brand name and dose of the vitamin/tonic:					

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

DIETARY INTAKE INTERVIEW SCHEDULE: AFRICAN COMMUNITY KZN

SUBJECT NUMBER: ..... **INTERVIEWER:** .....

Address.....

INTRODUCTION:

Greeting

Thank you for giving up your time to participate in this study. I hope you are enjoying it so far. Here we want to find out what people living in this area eat and drink. This information is important to know as it will tell us if people are eating enough and if they are healthy.

Please think carefully about the food and drink you have consumed during the past few months. 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 you eat at a time,
- how many times a day you eat it and if you do not eat it every day, how many times a week or a month you eat it.

To help you to describe the amount of a food you eat, I will show you pictures of different amounts of the food. Please say which picture is the closest to the amount you eat, or if it is smaller, between sizes or bigger than the pictures.

I will also ask some questions about where you get your food, where you shop, whether you eat away from home and so on. This information is important because it will tell us which foods are easy to obtain and which are not and how the food is prepared and served.

THERE ARE NO RIGHT OR WRONG ANSWERS.

EVERYTHING YOU TELL ME IS CONFIDENTIAL. ONLY YOUR SUBJECT NUMBER APPEARS ON THE FORM.

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

PART I

INSTRUCTIONS: Circle the number next to the subject's answer **OR write the time in the columns.**

SUBJECT ID NO: .....

EXAMPLE:

1.	**How many meals did you eat yesterday?** **Yesterday = Mon1 Tues2 Wed3 Thurs4 Fri5 Sat6 Sun7**				
2.1.1	**At about what time did you eat your first meal?**				
2.1.2	Where did you eat this meal?				
		Home			**1**
		Work			**2**
		School			**3**
		Other specify:			**4**
		Not applicable			**5**

Please answer the following questions:

1.	How many meals did you eat yesterday? Yesterday = Mon1 Tues2 Wed3 Thurs4 Fri5 Sat6 Sun7				
2.1.1	At about what time did you eat your first meal?				
2.1.2	Where did you eat this meal?	Home			1
		Work			2
		School			3
		Other			4
		Not applicable			5
2.2.1	At about what time did you eat your second meal?				
2.2.2	Where did you eat this meal?	Home			1
		Work			2
		School			3
		Other			4
		Not applicable			5
2.3.1	At about what time did you eat your third meal?				
2.3.2	Where did you eat this meal?	Home			1
		Work			2
		School			3
		Other			4
		Not applicable			5
2.4.1	At about what time did you eat your other meals?				
2.4.2	Where did you eat these meals?	Home			1
		Work			2
		School			3
		Other			4
		Not applicable			5
2.5	Do you eat this number of meals on most week days?		Yes 1		No 2
IF NO: 2.5.1	How many meals do you usually eat a day? Not applicable				
2.6	Do you eat your meals at about the same times as above on most days?		Yes 1		No 2

PART II

INSTRUCTIONS: Circle the subject's answer. Fill in the amount and times eaten in the appropriate columns.

SUBJECT ID NO: .....

I shall now ask you about the type and the amount of food you have been eating in the last few months. Please tell if you eat the food, how much you eat and how often you eat it. We shall start with maize meal porridge.

Do you eat maize meal porridge? YES 1 NO 2
If YES, what type do you have at home now?

Brand name: .....
Don't know 2
Grind self 3

If brand name given, do you usually use this brand?
YES 1 NO 2 DON'T KNOW 3

Where do you buy your maize meal from? (May answer more than one)

Shop	1
Employer	2
Harvest and grind self	3
Other – specify	4
Don't know	5

FOR OFFICE USE

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Maize meal porridge	Stiff ('pap')						e4225 4250	
Maize meal porridge	Soft ('porridge')						e4225 4250	
Do you pour milk on your soft porridge? YES 1 NO 2 If YES, what type of milk (whole fresh, sour, 2 %, fat free, milk blend),milk powder? ..... INSTRUCTION: Show subject examples.								
If YES, how much milk?								
Do you pour sugar on your soft porridge? YES 1 NO 2								
If YES, how much sugar?							9012	
Maize meal porridge	Crumbly (phutu)						e4225 4250	
Morvite								
Mabella Coarse Fine Rice	Stiff						4082	
Mabella Coarse Fine Rice	Soft						4082	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Do you pour milk on your mabella porridge? YES 1 NO 2 If YES, what type of milk (whole fresh, sour, 2 %, fat free, milk blend, powdered milk)? ..... INSTRUCTION: Show subject examples.								
If YES, how much milk?								
Do you pour sugar on your mabella? YES 1 NO 2								
If YES, how much sugar?							9012	
Oats							4032	
Do you pour milk on your oats? YES 1 NO 2 If YES, what type of milk (whole fresh, sour, 2 %, fat free, milk blend, powdered milk)? ..... INSTRUCTION: Show subject examples.								
If YES, how much milk?								
Do you pour sugar on your oats? YES 1 NO 2								
If YES, how much sugar?							9012	
Breakfast Cereals	Brand names of cereals at home now: Don't know						4036	
Do you pour milk on your cereal? YES 1 NO 2 If YES, what type of milk (whole fresh, sour, 2 %, fat free, milk blend, powdered milk,)? ..... INSTRUCTION: Show subject examples.								
If YES, how much milk?								
Do you pour sugar on your cereal? YES 1 NO 2								
If YES, how much sugar?							9012	
Samp	Bought Self ground with fat without fat						4043	
Samp and Beans								
	Are the amounts of samp and beans the same as in the picture? YES NO If NO, do you use more beans than in the picture or less? MORE LESS							
	Are the amount of samp and peanuts the same as in the picture? YES NO If NO, do you use more peanuts than in the picture or less? MORE LESS							
Rice	White Brown Mealie rice						4040 4134 4043	
Pastas	Macaroni Spaghetti Other						4062	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
You are being very helpful. Can I now ask you about meat? CHICKEN, MEAT, FISH Where do you get your chicken from? (May answer more than 1). How many times per week do you eat chicken? ..... Shop, supermarket, spaza Employer Slaughter own Gift Other specify: Do not eat chicken								1 2 3 4 5 6
Chicken:	Boiled, nothing added						1521	
	Boiled with vegetables							
	Fried: In butter/crumbs Not coated						1634 1520	
	Roasted, grilled						1520	
	Stewed						1520	
	What vegetables are in the stew?							
	Don't know							
Do you eat chicken skin? ALWAYS 1 SOMETIMES 2 NEVER 3								
Chicken bones stew								
Chicken feet & or head	How do you cook it?						1609	
Chicken offal	How do you cook it?						1610	
Where do you get your MEAT from? (May answer more than 1). How many times per week do you eat meat? ..... Shop, supermarket, spaza Employer Slaughter own Gift Other specify: Do not eat red meat								1 2 3 4 5 6
Red meat:	How do you like meat? With fat Fat trimmed							
Beef	Fried – with bone							
	Fried – without bone							
	Stewed – with bone							
	Stewed – without bone							
	Grilled – with bone							
	Grilled – without bone							
	Boiled –with bone							
	Minced						1585	
Mutton	Fried – with bone						1522	
	Fried – without bone						1571	
	Stewed – with bone						1511	
	Stewed – without bone						1511	
	Grilled – with bone							
	Grilled – without bone							
	Boiled – with bone							
	Minced						1662	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Pork	Fried – with bone							
	Fried – without bone							
	Stewed – with bone							
	Stewed – without bone							
	Grilled – with bone							
	Grilled – without bone							
	Boiled – without bone							
Beef Offal	Intestines: boiled, nothing added *or with:*						161	
	Stewed with vegetables							
	Tripe						1546	
	Heart						1565	
	Lungs							
	Liver						1515	
	Kidneys						1518	
Goat	Boiled – with bone							
Goat	Boiled – without bone							
	Other specify:							
What vegetables are usually put into meat stews?								
Beef Wors	Fried Grilled						1526	
Bacon							1501	
Cold meats	Polony						1514	
	Ham						1564	
	Viennas /Russians						1531	
Beef	Tongue							
	Other specify:							
Canned meat	Corned beef						1535	
	Other specify:							
Meat pie	Home made Bought						1548	
Hamburger	Home made Bought							
Dried beans/ peas/ lentils (10)	How do you prepare them?							
Dried beans with maize meal(Isigwaqane)								
Soya products e.g. Toppers/Imana/woza seshebo	Brands at home now Don't know..... Show examples						3527	
Pilchards in tomato /chilli/ brine	Whole						2557	
	Mashed with fried onion							
	With Potatoes							
	With vegetables							
Fresh Fish: caught or bought								
Fried fish	With batter/ crumbs						2523	

	Without batter/crumbs						2509	
Grilled Fish								
Other canned fish	Tuna							
Sardines in oil	Whole							
Shellfish	Fried - Prawns							
	Grilled - Prawns							
	Other specify:							
	Pickled fish Other:						2562	
Fishcakes/ Fish fingers	Home made (describe) Frozen Take away						2531	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Eggs	Boiled poached Scrambled Fried						1001 1025 1003	
WE NOW COME TO VEGETABLES AND FRUIT How many times per week do you eat vegetables? ..... Where do you get your vegetables from? (May answer more than 1) Own vegetable garden Employer's farm Own farm Shops, supermarket, greengrocer Hawker Garden or Field (e.g. imifino) Gifts Other specify								1 2 3 4 5 6 7 8
Cabbage	How do you cook cabbage?							
	Boiled, nothing added						8066	
	Boiled with potato and onion and fat							
	Fried, nothing added							
	Boiled, then fried with potato, onion							
	Other:							
	Don't know							
Spinach / imifino / other green leafy	How do you cook spinach?							
	Boiled, nothing added						8071	
	Boiled fat added						8209	
	Boiled with – onion, tomato & fat							
	-onion, tomato & potato						8212	
	- with peanuts							
	Other:							
	Don't know							
Tomato and onion 'chutney'	Home made - with fat - without fat							
	Canned or Fresh						8221	
Pumpkin or Butternut	How do you cook pumpkin?							
	Cooked with margarine/ oil/ butter & sugar							
	Boiled, little sugar and fat							
	Other:							
	Don't know							

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Carrots	How do you cook carrots?							
	Boiled, sugar & fat						8129	
	With potato/ onion							
	Raw, salad Chakalaka						8015	
	Other:							
	Don't know							
Mealies / Sweet corn	How do you eat mealies? On cob –with fat -without fat						8033	
	Off cob –with fat -without fat						8261	
Beetroot salad	Home made Bought						8005	
Potatoes	How do you cook potatoes?							
	Boiled/baked - with skin						8046	
	- without skin						8045	
	Mashed						8187	
	Roasted						8189	
	French fries						8048	
	Salad						8236	
	Potato Stew							
	Other:							
Sweet potatoes	How do you cook sweet potatoes?							
	Boiled/baked - with skin						8057	
	- without skin						8214	
	Mashed						8058	
	Other:							
	Don/t know							
Amadumbe	Boiled without skin							
Salad vegetables	Raw tomato						8059	
	Lettuce						8031	
	Cucumber						8025	
Frozen Mixed Vegetables	Stew							
	Boiled							
Other vegetables specify:								

FRUIT:	
Do you like fruit? YES NO How many times per week do you eat fruit in winter? ...../ in summer?	
Where do you get your fruit from?	
Own fruit trees	1
Farm – employer	2
Farm – own	3
Supermarket/greengrocer/veg market	4
Hawker	5
Field	6
Gifts	7
Other	8

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Avocados	Fresh							
Apples/Pears	Fresh						7001	
Pears	Fresh Canned						7053 7054	
Bananas							7009	
Oranges / naartjies							7031	
Grapes							7020	
Peaches	Fresh Canned						7036 7038	
Apricots	Fresh Canned						7003 7004	
Mangoes	Fresh						7026	
Guavas	Fresh Canned						7021 7023	
If subject eats canned fruit: Do you have custard with canned fruit? YES 1 NO 2								
Custard	Home made Ultramel						0004	
Wild fruit / berries	Specify:						7070	
Dried fruit:	Types:							
Other fruit:								
BREAD AND BREAD SPREADS								
Bread Bread rolls	White						4001	
	Brown						4002	
	Whole wheat						4003	
	Steamed bread							
	Mealie bread							
	Dumpling						4001	
Do you spread anything on the bread? ALWAYS 1 SOMETIMES 2 NEVER 3 If YES, what do you spread?								
Margarine	What brand do you have at home now? ..... Don't know Show examples						6508 6521	
Butter	What brand do you have at home now? ..... Home made Don't know						6502	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Peanut butter							6509	
Jam/syrup/ honey							9008	
Marmite/Fray Bentos etc.							9501	
Fish/meat paste							1512	
Atchar							3004	
Polony							1514	
Other spreads: specify								
Cheese	Type:						0010	
Vetkoek							4057	
Provita, crackers etc.								
FATS: What fats do you use and where do you use them?								
Margarine	Where used: on bread							
	with vegetables** Number of spoons ..... /number in family							
Butter	on bread with vegetables** Number of spoons ..... /number in family							
Holsum / vegetable fat	Where used: Number of spoons ..... /number in family						6508	
Oil	Where used: Number of spoons ..... /number in family						6510	
Dripping	Where used: Number of spoons ..... /number in family							
Mixed fat (amafutha)	Where used: Number of spoons ..... /number in family							

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Lard	Where used: Number of spoons ..... /number in family						6520	
Mayonnaise/ salad dressing	Number of spoons ..... /number in family						6573	
Cream	Fresh/Long life /canned Orley whip						6503	
DRINKS:								
Tea							9514	
Sugar/cup tea							9012	
Milk / cup tea	What type of milk do you use in tea?							
	Fresh / long life whole						0006	
	Fresh / long life 2%							
	Fresh / long life fat free						0072	
	Whole milk powder Brand						0009	
	Skimmed milk powder Brand						0008	
	Milk blend Brand						0068	
	Milk powder Brand.....							
	Whitener Brand						0039	
	Condensed milk						0002	
	Evaporated milk						0003	
	None							
Coffee								
Sugar / cup coffee							9012	
Milk / cup coffee	What type of milk do you use in coffee?							
	Fresh / long life whole						0006	
	Fresh / long life 2 %							
	Fresh / long life fat free						0072	
	Whole milk powder Brand						0009	
	Skimmed milk powder Brand						0008	
	Milk blend Brand						0068	
	Whitener Brand						0039	

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
	Condensed milk						0002	
	Evaporated milk						0003	
	None							
Milk as such	What type of milk do you drink as such?							
	Fresh / long life whole						0006	
	Fresh / long life 2 %							
	Fresh / long life fat free						0072	
	Sour / Maas						0006	
	Buttermilk						0001	
	Whole milk powder Brand						0006	
	Skimmed milk powder Brand						0072	
	Milk blend Brand						0068	
Milk drinks Brand	Nestle Milo Other						0023	
Yoghurt	Drinking yoghurt Thick yoghurt						0044 0020	
Squash	Sweeto SixO Oros/Lecol - with sugar - artificial sweetner Kool Aid Other						9013 9013 9002 9013 9002	
Fruit juice	Fresh/Liquifruit/Ceres Tropica Concentrates e.g. Halls Nectars Flavour							
Fizzy drinks Coke, Fanta	Sweetened Diet						9001 9013	
Mageu							9562	
Home brew							9516	
Umqobhothi							9516	
Beer							9506	
Spirits							9510	
Wine red							9508	
Wine white							9518	
Liqueur							9517	
Other: specify								

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
SNACKS AND SWEETS:								
Potato crisps							4275	
Cheese curls Niknaks etc.							4067	
Peanuts	Raw Roasted						6001 6007	
Raisins							7022	
Peanuts and raisins								
Chocolates	Name						9024	
Candies	Sugars, gums, hard sweets						9009	
Sweets	Toffees, fudge, caramels						9014	
Biscuits	Type							
Cakes & tarts	Type							
Scones							4029	
Rusks							4160	
Savouries	Sausage rolls Samoosas Savoury Biscuits e.g. Bacon kips Other						1534 4196 4162	
PUDDINGS:								
Canned fruit	Type							
Jelly							9004	
Custard	Homemade Ultramel						0004	
Baked pudding							4181	
Instant pudding							4066	
Ice cream Sorbet							6507 6516	
Other: specify								
SAUCES / GRAVIES / CONDIMENTS:								
Atchar							3004	
Tomato sauce Worcester sauce							3027	
Chilli sauce								
Chutney							9524	
Pickles							8176	
Packet soups							3046	
Others:								
INSECTS:								
Specify:								

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
WILD BIRDS OR ANIMALS (hunted in rural areas or on farms)								
Cane Rats								
Ostrich								
Duck								
Goose								
Turkey								
Rabbit								
Other:								
MISCELLANEOUS: Please mention any other foods used more than once/two weeks which we have not talked about:								

SALT USE:

The next few questions are to find out if you use salt, where you use it and how much you use.

Do you add salt to food while it is being cooked?

Always 1	Sometimes 2	Never 3	Don't know 4

Do you add salt to your food after it has been cooked?

Always 1	Sometimes 2	Never 3	Don't know 4

Do you like salty foods e.g. salted peanuts, crisps?

Very much 1	Like 2	Not at all 3

KEEPING FOOD:

Do you keep food from one meal to eat at the next meal?

Always 1	Sometimes 2	Never 3	Don't know 4

If ALWAYS OR SOMETIMES, what foods do you keep?
Do you eat kept food cold or do you reheat it?

FOOD	Reheated	Eaten cold

Do you use any of the following?

	Name of product	Amount/day
Vitamins/vitamins & minerals		
Tonics		
Health foods		
Body building preparations		
Dietary fibre supplement		
Other: specify		

THANK YOU FOR YOUR COOPERATION AND PATIENCE

GOOD-BYE!

Annexure G

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric measurements

Section A:

1. Number/Name of the subject.....

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)
kg	kg	cm	cm

3. Waist circumference	3. Waist Circumference	4. Blood pressure	4. Blood pressure
cm	cm	/	/

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric measurements

Section A:

1. Number/Name of the caregiver.....

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

1. Body weight (kg)	1. Body weight (kg)	2. Height/Length (cm)	2. Height/Length (cm)
kg	kg	cm	cm

3. Waist circumference	3. Waist Circumference	4. Blood pressure	4. Blood pressure
cm	cm	/	/

Annexure H

DURBAN UNIVERSITY of TECHNOLOGY

Assessment of the nutritional status of children – Mandlenkosi High School

LUNCH BOX SURVEY

Number of the child: _____

Content of the lunchbox: _____ Mass: _____

Date: _____

FOOD ITEM	COOKING METHOD	PORTION SIZE

This is to certify that the language editing of this dissertation by Ms H Nomaknosazana was done by Prof L A Grevvenstein.

Prof L A Grevvenstein was a member of the South African Translators Institute, membership number: 1001691. She completed her primary secondary and tertiary education, including a doctoral thesis, in English. She has done the English language editing of many proposals, dissertations, theses and scientific articles

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