NUTRITIONAL STATUS AND DIETARY INTAKE OF ADOLESCENT GIRLS IN MANDLENKOSI HIGH SCHOOL-LINDELANI

BY

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DECLARATION

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ABSTRACT

Background: Assessing the nutritional status of adolescents could be a catalyst in addressing malnutrition at an early age and at a school level.

Objectives: The study was conducted to examine the nutritional status and dietary pattern of adolescent girls attending school in Lindelani, KwaZulu-Natal.

Methods*:* Adolescent girls were selected from a randomly selected high school. A total of 157 adolescent girls aged 13 to 18 years were surveyed for socio-demographic indicators, nutritional status and dietary intake. Data were collected by interviewing the adolescent girls and the parents using pre-designed and pre-tested questionnaires. Weight and height were measured and socio-demographic data collected by means of a questionnaire. Dietary intake data were gathered by using two 24hr recall questionnaires and a QFFQ.

Results: The findings indicated that adolescent girls in Lindelani face two distinct nutrition situations, underweight and overweight. The nutrient intake was compared with the dietary reference intake (DRI). The prevalence of undernutrition (7.6%) among the participants assessed as stunting (height-for-age) was based on the usual pattern of food intake. The results revealed that 92.4% of the girls were of normal height for age (>-1SD to +3SD), 10.8% were overweight (>+2SD to <+3SD) and 1.9% were obese (>+3SD). Consumption of high carbohydrates based food items was prevalent and carbohydrate intake correlated positively with the BMI-for-age Z-score. The income of the household was assessed, however, there was no statistically significant correlation (p=0.442) between BMI-for-age (Z-scores) and the caregivers level of income. For the intake of protein and dietary fibre, at least 40 and 144 participants, respectively, did not meet the dietary recommended intake measured by the 24hr recall. The study explains that not only is there under and over nutrition in this group but also inadequate micronutrient intake, especially of essential nutrients such as vitamin A, vitamin C, iron and calcium. A substantial proportion of the girls did not consume adequate folate. The households that reported to have had adequate food at all times were only 29.3%.

Conclusion: The results show a lack of dietary variety, which may contribute to the nutrient deficiency. Both undernutrition and overnutrition was prevalent among the girls. The majority of the population had a lower energy intake than recommended. Intervention strategies are needed to improve the dietary intake of adolescent girls and overcome the crisis of malnutrition.

ACCRONYMS

AI	Adequate intake
AIDS	Acquired Immune Deficiency Syndrome
ARVs	Antiretroviral drugs
BMI	Body Mass Index
BP	Blood pressure
Ca	Calcium
CBOs	Community Based Organisations
CHO	Carbohydrates
CVD	Cardiovascular disease
DALY	Global disability-adjusted life-years
DBSA	Development Bank of Southern Africa
DNA	Deoxyribonucleic Acid
DoE	Department of Education
DoH	Department of Health
DOSD	Department of Social Development
DRIs	Dietary Reference Intake
DUT	Durban University of Technology
EAR	Estimated Average Requirement
HIV	Human Immunodeficiency virus
FAO	Food Agricultural Organisation
FBDGs	Food Based Dietary Guidelines
Fe	Iron
FE.CT	Further Education and Training
FF	Food fortification
G	Gram
GDP	Gross Domestic Product
HDL	High-density lipoprotein
HD	Heart Disease
Hr	Hour
IDA	Iron deficiency anaemia

IDD	Iodine deficiency disease
IMCI	Integrated Management of Childhood Illness
INP	Integrated Nutrition Programme
IOM	Institute of Medicine
IRS	Insulin resistance syndrome
Kcal	Kilocalorie
Kg	Kilogram
KZN	KwaZulu-Natal
LDL	Low density lipoprotein
Mcg	Microgram
Mg	Milligram
NAR	Nutrient Average Requirements
NCDs	Non Communicable Diseases
NFSC	National Food Consumption Survey
NFCF-FB	National Food Consumption Survey- Fortification Baseline
NGOs	Non Governmental Organisations
NICUS	Nutrition Information Centre University of Stellenbosch
NNSDP	National Nutrition and Social Development Programme
NSNP	National School Nutrition Programme
NSP	Nutrition Supplementation Programme
MDGs	Millennium Development Goals
MUAC	Mid-Upper-Arm circumference
PEM	Protein Energy Malnutrition
PSNP	Primary School Nutrition Programme
PUFAs	Polyunsaturated fatty acids
QFFQ	Quantitative Food Frequency Questionnaire
RDA	Recommended Dietary Allowance
RDI	Recommended Dietary Intake
SA	South Africa
SAFBDGs	South African Food Based Dietary Guidelines
SADHS	South African Demographic and Health Survey
SANFFP	South African National Food Fortification Programme
SAVACG	South African Vitamin A Consultative Group

SDs	Standard Deviations
S-DQ	Socio-demographic questionnaire
SFP	School feeding programmes
SGB	School Governing Body
SPSS	Statistical Package for Social Sciences
Stats SA	Statistics South Africa
TB	Tuberculosis
TRG	Total goitre rate
TV	Television
UL	Upper intake level
UIE	Urinary iodine excretion
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Fund
USA	United States of America
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
WC	Waist circumference
WHO	World Health Organisation
WHtR	Waist-to Height ratio
Zn	Zinc

DEFINITION OF TERMS

Body Mass Index (BMI): Body weight in kilograms divided by height in meters squared (kg/m2). This is used as an index of "fatness" among adults. Both high BMI (overweight, BMI greater than 25) and low BMI (thinness, BMI less than 18.5) are considered as malnutrition.

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

Malnutrition: Various forms of poor nutrition caused by a complex array 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.

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.

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CHAPTER ONE

1.1 INTRODUCTION

Malnutrition is a global and a daunting health challenge (Leenstra, Petersen, Kariuki, Oloo, Kager and ter Kuile, 2005:41); its warning signs are only visible during the advanced stage and confirmation about severity needs to be detected by suitable (biochemical) indicators (Faber and Wenhold, 2007:393). The term malnutrition refers both to undernutrition and overnutrition. Undernutrition is perceived by stunting (short-for-age), wasting (thin-for-height), and underweight (low weight-for-age). Both undernutrition and overnutrition are prevalent in low income countries and are related to food paucity and unequal distribution of wealth throughout the world. The causes of malnutrition are many, diverse and interrelated with political, social, cultural or economic factors (Fotso, 2006). The other factors contributing to malnutrition as stated by Uthman and Aremu (2008) are education status of the population, season and climatic changes, urbanisation, family disunity, alcohol intake, prevalence of infectious diseases and the effectiveness of nutrition programmes.

Malnutrition as stated by the World Bank (2006:1) undermines economic growth, perpetuates poverty and deprives the children's right to enjoy life to their full potential, making them vulnerable to abuse and exploitation (Smith and Ashiabi, 2007:838). The findings by Reddy, Resnicow, James, Kambaran, Omardien and Mbewu (2008:203) showed that about 3 million children born in South Asia died before reaching the age of five as a result of malnutrition. Undoubtedly, several researchers confirm that the seriousness of malnutrition finds its way during pregnancy to the second year of life and the outcome is generational and irreparable (Atinmo, Mirmiran, Oyewole, Belahsen and Serra-Majem, 2009:39).

In 1995, the National Household Survey was conducted in South Africa, the result revealed an astounding total number of 2.3-2.5 million of the South African population as being undernourished, the majority were between age 5 to 15 years of age. Yet again in 1999, the National Food Consumption Survey (NFSC) was conducted amongst children, 1-9 years, of age, 10.3% were underweight, 21.6% were stunted, 3.7% were wasted and notably, underweight was severe and deeper in rural areas, commercial farms and informal settlements (Labadarious, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay,

Jooste and Dannhauser, 2005b). Hence, the need for adequate nutrition was emphasized by Oyakale and Oyakale (2009:118) as a primary and a prerequisite vehicle for children's healthy living and total development. In 2005 the National Food Consumption Survey-Fortification Baseline (NFCS-FB-I) survey reflected that stunting and underweight remained the most common nutritional disorders affecting children respectively at a national level in South Africa since 1999 National Food Consumption Survey (Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste and Dannhauser, 2008:255).

1.2 BACKGROUND TO THE PROBLEM

Many authors cited and acknowledged that adolescence is the most critical period of life with intense growth and development, physiological, psychological, emotional, social and transformation (Goldberg, da Silva, Lopes Peres, Berbel, Heigasi, Ribeiro, Suzuki, Josué and Dalmas, 2009:14). Basset, Chapman and Beagan (2007:325) described adolescent stage as a period whereby a set of health related behaviours and attitudes developed and positively and/or negatively influence future life of teenagers. Socio-cultural values, body image, peer acceptance, family economic status, increased level of food eaten away from home, parental guidance and continual television viewing are food consumption influences at this stage (Goldberg et al, 2009:14). According to Goldberg et al (2009:325) food habits, attitudes and dietary patterns established in childhood continue to adulthood. Therefore, adoption of healthy eating habits and lifestyle at an early age would help delay the onset of these health related diseases in future (Oogarah-Pratap, 2007:442). Globally, over two million deaths of children under the age of five as highlighted by Pridmore and Hill (2009) are the result of stunting, wasting and foetal growth restriction.

The freedom of choice children have in food selection encourages poor nutritional food behaviour (Hamilton-Ekeke and Thomas, 2007:458). Healthy eating is not only crucial for physical and mental growth, but health in general, attendance and performance in school (Dapi, Omoloko, Janlert, Dahlgret and Haglin, 2007) and prevention of chronic disease (Chandler, 2006:111). Smith and Ashiabi (2007:837) stated that children from an impoverished background perform more poorly at school than those who are from well to do families.

In 2006 the Health Report stated that 43% of all South Africans are without food at least once a year due to unemployment deprivation and 60% experience a shortage of income (Day and Gray, 2006). Unemployment is a setback and cause of malnutrition. In 2004, 33% of blacks in South Africa were unemployed which is higher than other races (Klasen and Woolard, 2008:4).

Poverty is a worldwide concern since people who live in poverty are often exploited and most probably, have no say of what is happening in their communities (Smith and Ashiabi, 2007:837). Smith and Ashiabi (2007:838) further mentioned the danger surrounding poverty stricken youth; the situation exposes them to abuse, exploitation, teenage pregnancy, drugs and alcohol abuse. Grant and Hallman (2006:3) indicated that more than 30% teenagers of up to 18 years old have given birth.

1.3 PROBLEM STATEMENT

In South Africa, malnutrition still exists. Approximately one third of women nationally are reported to be overweight or obese, children suffer from malnutrition and about 33% of preschool children have a poor vitamin A intake (Faber and Wenhold, 2007). The World Health Organisation (WHO) suggests that developing countries should pay close attention to this persistent epidemic of overweight and stunted children since these are risk factors for chronic disease in adulthood (Jinabhai, Taylor and Sullivan, 2004:3). The majority of teenagers compromise their health through peer pressure, and the need to conform to the standards set and accepted by peers (Bassett et al, 2007:326).

Teenagers have a trend of skipping breakfast, thereby increasing the level of snacking during the day (Mullie, Clarys, De Ridder, Deriemaeker, Duvigead and Hebbelinck, 2006:316). Lack of time to prepare food, lack of parental guidance on what to eat and laziness are all reported as reasons for skipping breakfast (Mullie et al, 200:316) thus resulting in malnutrition. Snack consumption between meals, with no consideration of the quality and nutrient content of the food is a common practice amongst teenagers (Klonaridou, Papadopou and Fahantidou, 2006). The most favourite snacks are food rich in sugar and fat (Oogarah-Pratap, 2007:443 and Klonaridou et al, 2006) and this leads to a poor balanced diet

consumption (Hamilton-Ekeke and Thomas, 2007:458). Bassett et al (2007:325) agreed with Mullie et al (2006:316) that adolescents' diet lacks fruit and vegetables. Oogarah-Pratap (2007:443) and Casazza and Ciccazo (2006:73) confirmed that little is known about diets rich in fruit and vegetables and their effect on reducing the perpetuation of non communicable diseases (NCDs).

1.4 UNICEF FRAMEWORK

The causes of malnutrition in South Africa range from abstract such as inadequate access to resources to more specific, immediate ones such as inadequate and inability to access food due to affordability. The United Nation's Children Fund (UNICEF) conceptual framework of the determinants of malnutrition (Figure 1.1) best illustrates the multiple factors that contribute to malnutrition. This framework is used to discuss the causes of malnutrition in South Africa.

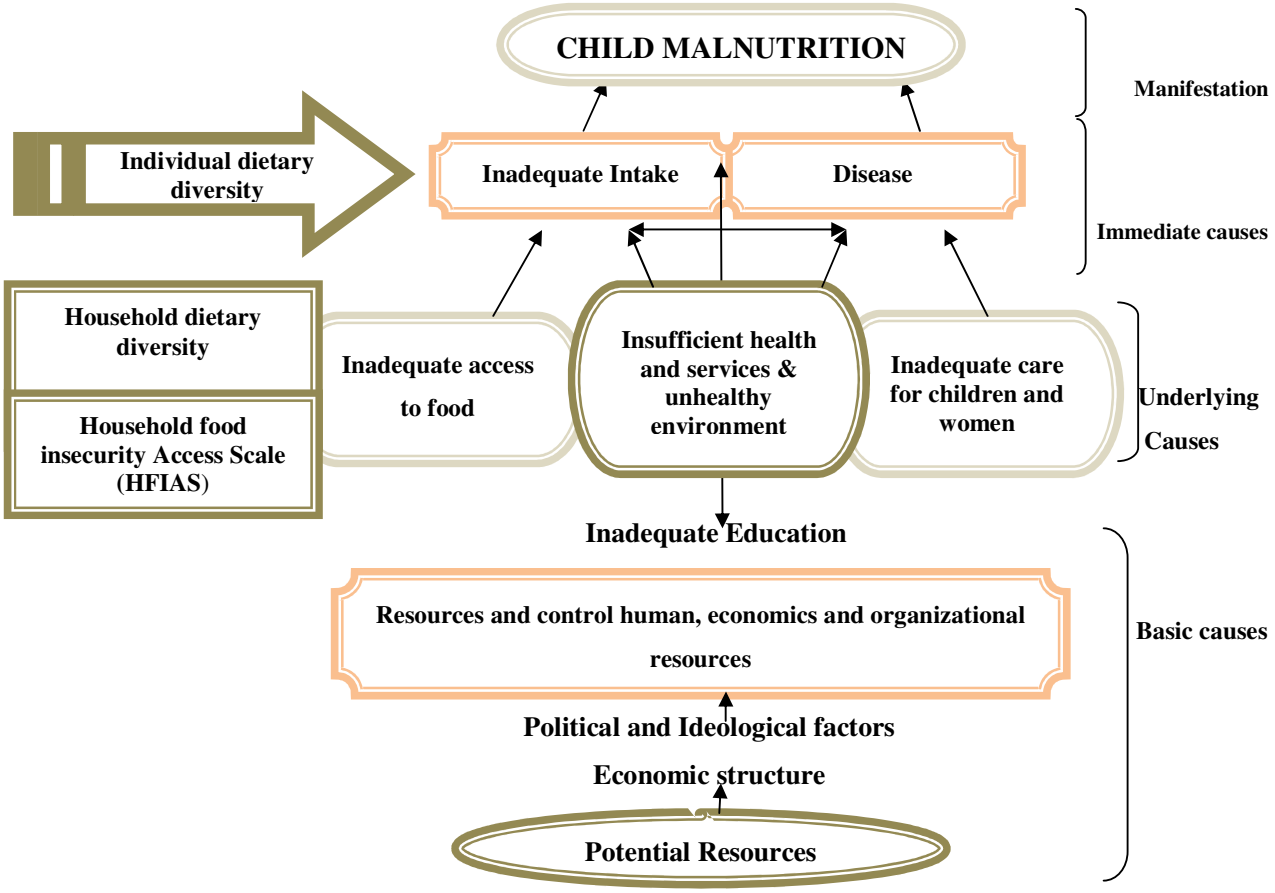


Figure 1.1 UNICEF framework: Adapted from UNICEF (1990:22)

1.5 FACTORS CONTRIBUTING TO MALNUTRITION

The causes of child malnutrition are diverse, multidimensional and interrelated. According to Bokeloh, Gerster-Bentaya, Weingärtner and Rottenburg (2005:6), the UNICEF framework indicated that many factors are directly and indirectly linked to the development of malnutrition. These factors can be classified as immediate, underlying and basic causes as outlined in the UNICEF conceptual framework (Figure 1.1).

1.5.1 Immediate causes

The immediate causes of malnutrition are regarded as inadequate food intake and illness:

- Inadequate Intake: Due to sickness, inability to prepare food, food availability, cost of food, poor feeding practices.
- Disease: diabetes and stroke are on the rise in SA (FAO, 2006:2).
  In 2002, 265 people died due to cholera (known as the disease of poor) in SA provinces.
  In 2005 there was an outbreak of typhoid in Delmas, 3346 had diarrhoeal infection (Hemson, Dube, Mbhele, Nnadozie and Ngcobo, 2006:6).
- More than 2 million estimated deaths caused by vaccine-preventable diseases every year (UNICEF, 2005a:2).

1.5.2 Underlying causes

Household food security depends on several factors such as financial and physical accessibility to food on a consistent and sustainable source. Food can be abundantly available but for financial insecure individuals there would still be no access to food. The ability of a household to access food is directly linked to economic status (Musvaire, 2009:12).

Inadequate access to food: Poverty, urbanisation, food security, drought and gender inequality.

- Inadequate care for children and women: Inadequate immunization, unsafe food and water, smoking, alcohol and drugs, Insufficient time devoted to care, inappropriate breastfeeding practices and inappropriate introduction of complementary foods (Traill, 2006:332).
- Insufficient health services and unhealthy environment: Two in five of 2.6 billion worldwide have no access to improved sanitation, of the same population; 2 billion live in rural areas (UNICEF, 2006:3; UNICEF, 2010:6).

- Poor access to health care: 9 million children aged under 5 years died in 2008, 40 % were related to diarrhoea and pneumonia (Wardlaw, Salama, Brocklehurst, Chopra and Mason, 2009:1).

1.5.3 Basic causes

Poverty and lack of basic resources contribute to malnutrition. Hendricks and Bourne (2010:46) confirmed that 64% children lived in poor income families. The basic causes include the following:

- Potential resources: in individual's area of living, food production, income for food purchases.
- Political factors: Strong political commitment and partnership is vital. Programmes require clear role and responsibility and well coordination for each department.
- Inadequate education: through insufficient knowledge to provide adequate care (UNICEF, 1990). These causes of malnutrition will be discussed in more detail in Chapter 2.

1.6 MALNUTRITION

1.6.1 The impact of malnutrition globally

Poverty, malnutrition and hunger in South Africa date back to the Apartheid regime policies. In the past, black people were marginalized and forced to settle in the former homelands with limited access to resources such as land and very few viable livelihood options (Musvaire,

2009:11). Such is visible within the country in the poorest segments of the population by high levels of stunting (Black, Allen, Bhutta, Caulfield, de Onis, Ezzati, Mathers and Rivera 2008:246). Kleynhans, MacIntyre and Albertse (2006) recorded 33% stunted children below the age of five, 27% underweight globally, and 9% wasted in developing countries. By 2020 16 million more children will be malnourished globally; the situation can be reversed provided developing countries maintain agricultural productivity regardless of recession crisis (von Braun, 2009:10). In the Global Food Index 2008, von Grebmer, Fritschel, Nesterova, Olofinbiyi, Pandya-Lorch and Yohannes (2008:6) revealed that 923 million people globally go without food every day, 907 million of these live in developing countries.

Maternal and child undernutrition were reported as the underlying causes of 3.5 million deaths, (35%) of the disease burden in children younger than 5 years and (11%) of total global disability-adjusted life-years (DALYs) (Black et al, 2008:243). Cardiovascular disease which is tied to overweight caused the death of 18 million people globally in 2007 (Hossain, Kawar and Nahas, 2007:213). The United States is not in isolation, the Department of Agriculture (USDA) has shown that the number of food insecure households has increased from 10.5 million in 1999 to 13.5 in 2005 (Ashiabi and O'Neal, 2007:76). As a result non communicable diseases are expected to escalate to 60% and cause 73% of all deaths by 2020. Of the 2.7 million deaths worldwide in 2000, 1.8% of the total global disease burden was the result of poor intake levels of fruit and vegetables (de Sa and Lock, 2007:4). Nakato (2010:7) estimated that on average, one child dies every second as a result of hunger. The author further mentioned that 36 million people worldwide died in 2006 alone because of hunger and diseases related to micronutrient deficiency. AbouZahr and Boerma (2010) in the Bulletin of the World Health Organisation stated that the mortality rate has declined substantially by 30% globally.

In Africa, as stated by Kleynhans et al (2006:163), 47 million children are stunted, 35 million are underweight, and 11 million are wasted. According to Horton, Alderman and Rivera (2008:3) the number of stunted children have increased to 56.9 million in two years, with 5.6 million severely wasted. Similarly, one in four children in the developing countries are underweight and more than one third of child deaths globally are attributable to undernutrition (United Nations, 2009:12). In the summary of global health risks, it is pointed out that approximately 4.1 million (39%) of 10.4 million children died of micronutrient

deficiencies in 2004 in low and middle income countries (WHO, 2009c). The 2003 Kenyan Demographic Health Survey revealed that 20% of children under the age of five were underweight and 4% severely underweight (Kimutai, Malece-Obimbo, Kamenwa and Murila, 2009:331). The report from the Development Bank of Southern Africa (DBSA) (2008:4) stated at least 32% of the global burden of disease would be eradicated if malnutrition and micronutrient deficiency would be addressed at a global level.

1.6.2 The impact of malnutrition in developing countries

A report from developing countries has shown that 31% of children under the age of five are underweight, 38% are stunted and 9% are wasted (Ugwuja, Nwosu, Ugwu and Okonji, 2007:349). According to Wardlaw et al (2009:2) 129 million children up to 5years of age in developing countries were underweight. Furthermore, over 16% as stated by Smith and Ashiabi (2007:838) are nutritionally disadvantaged while 13% have no access to education. Noted by Horton et al (2008) is that malnutrition is decreasing in Asia; however, the Southern part of Asia is still afflicted as 38-51% of children are undernourished. This region together with Sub-Saharan Africa shows an estimation of 17-25% of children less than five years that are vitamin A deficient. Of the 2 billion iron deficiency sufferers worldwide, the majority are found in South Asia (Horton et al, 2008:8). In the low and middle income countries of East Asia, out of the 55 million children under five years, 35.3% are stunted, 3.6% are severely wasted and 20.7% are underweight (Bhutta, Bawany, Feroze and Rizvi, 2008:10). An estimation of 178 million (32%) children under the age of five in developing countries had a height-for age Z score of <-2 in 2005 (Black et al, 2008:245). The statement made by von Grebmer, Ruel, Menon, Nestorova, Olofinbiyi, Fritschel and Yohannes (2010:21) indicated that about one in three children were stunted and 195 million of children under the age of five were affected. The World Bank (2006:5) figured that micronutrient deficiency accounts to 30% of the developing world's population. Iron deficiency anaemia, one of the most prevalent problems of micronutrient malnutrition, occurs in many developing countries and 50% death cases of children less than 5 years has been reported by Nojilana, Norman, Dhansay, Labadarios, van Stuijvenberg and Bradshaw (2007a:741). About 3.5 billion people, mostly women of reproductive age and young children living in developing countries suffer from iron deficiency (Beinner, Velasquez-Mele´ndez, Pessoa and Greiner, 2010:49; Baltussen, Knai and Sharan, 2004:2678).

Approximately 2 billion people in developing countries especially marginalized population groups are badly affected by micronutrient malnutrition resulting in over five million deaths reported every year (Welch and Bouis, 2009:3; Bouis and Welch (2010:19).

1.6.3 The impact of malnutrition in Sub Saharan Africa

Sub-Saharan countries are the victims of poverty and malnutrition and the only region where child deaths are rising (Van de Poel, Hosseinpoor, Speybroeck, Ourti and Vega, 2008:282). Chopra and Darnton-Hill (2006:544) affirmed that 4.8 million deaths of the children below the age of 5 every year are the consequences of malnutrition. Atinmo et al (2009:41) announced that 300 million people struggled to live every day and it is mostly children who cannot keep up with the struggle for too long. In Burundi, Comoros, the Democratic Republic of the Congo, and Eritrea, half the population suffer from chronic hunger (Halweil and Nierenberg, 2011). The child mortality rate has fallen by 30% globally. In the African continent, the decline has reached 1.8% since 2000 to date as compared to 0.9% in 1990s (AbouZahr and Boerma, 2010).

Protein energy malnutrition (PEM) is another public health concern contributing to high mortality rate that is prevalent in Sub-Saharan Africa, where 1.7-1.9% of children suffer from PEM in Africa (Kimutai et al, 2009:331). Hypo-phosphataemia, known as the common cause of electrolyte abnormalities has a serious repercussion associated with death as metabolic disturbance increases dehydration (Kimutai et al, 2009:331).

The nutrition transition whereby traditional types of food are substituted by Western types of food has contributed to an outbreak of NCDs and Raschke and Cheema (2007:662) predicted that it will impact on 70% of people in developing countries by 2020. This drastic change has caused populations to indulge in highly refined products, food additives, high salt and fat which are likely to increase the prevalence of obesity, diabetes, high blood pressure and heart diseases (Raschke and Cheema, 2007:662). Hence the escalating number of people with diabetes is likely to rise from 84 million to 228 million by 2030 in developing countries (Raschke and Cheema (2007:215).

Malaria is another cause of malnutrition in Sub-Saharan Africa. An estimation of 1 million deaths of children below the age of 5 had been reported despite the provision of 30 to 63 million insecticide-treated mosquito nets produced in 2006. Malaria indirectly contributes to child malnutrition, in the sense that the child vomits and loses appetite which in turn affects the child nutritional status (UNICEF, 2007a:2). The child's diet that is lacking in zinc accelerates the rate of diarrhoea, pneumonia and malaria deaths by 13-21% (United Nations Development Programme (UNDP), 2010:18).

1.6.4 The impact of malnutrition in South Africa

Figure 1.2 elucidates the severity of undernutrition prevalence in children less than 5 years by province between year 2001 and 2010 with KZN as the leading province (Statistics South Africa (Stats SA) 2010. The data is provided by District Health Information System in the Department of Health (UNDP, 2010:32).

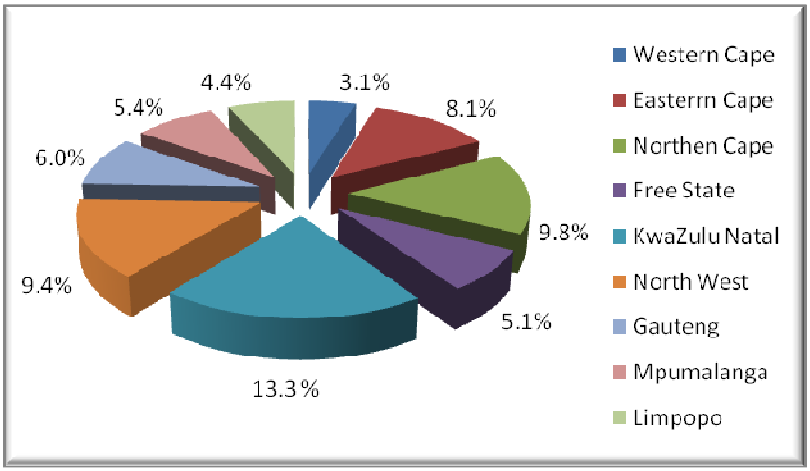


Figure 1.2: **Malnutrition prevalence in South Africa:** (UNDP), 2010.

South Africa like many developing countries is in a nutrition transition. Malnutrition with a number of underweight and stunting prevalence had been reported (DBSA, 2008:3). Unemployment and income inequality (42.5% to over 50%) amongst blacks as compared to the white population (4.6% to 6.3%) explains the persisting effect of undernutrition in South Africa (Chopra and Darnton-Hill, 2006:546). Brinkman, de Pee, Sanogo, Subran and Bloem (2009:1) supported the fact that the increase in food item prices especially cereal has led to a

reduction of quality and quantity of food consumed amongst poor households who spend a large portion of the income on food.

The findings of the NCFS conducted in 1999 reflected that stunting was the most common nutritional disorder affecting one in five children and 20% constitute children living in informal urban areas (Labadarios, Steyn, Maunder, MacIntryre, Gericke, Swart, Huskisson, Dannhauser, Vorster, Nesmvuni and Nel, 2005a:533). Limpopo had the highest stunting rate of 34%, Gauteng had the lowest rate (12%) as documented in the South African Vitamin A Consultative Group study (SAVACGs), (SADHS, 1996). The outcome by the Youth Risk Behaviour Survey 2002 revealed that 17.2% of South African youth are obese or overweight (WHO, 2009b:6). South Africa is ranked as a middle income developing country, however, a large group of the population remains poor, the economy has not been strong enough to bridge the gap created during the Apartheid era and there are health outcomes that are worse than those in many lower income countries (Witten, Jooste, Sanders and Chopra, 2004). In SA, infant and child mortality has shown an increase rather than decline since the Millennium Development Goals baseline was set in 1990 specifically and KZN has been impacted by diarrhoea and pneumonia (UNDP, 2010:63).

Vitamin A seems to cause alarm globally; Nojilana, Norman, Bradshaw, van Stuijvenberg, Dhansay and Labadarios (2007b:748) reported that 127 million preschool children and 7.2 million pregnant women were vitamin A deficient. According to the SAVACG national survey conducted in 1994 and 1995, two provinces (Limpopo and KwaZulu-Natal) were severely affected (Nojilana et al, 2007b:749). The NFCS-FB-I conducted by Labadarios et al (2008:261) in 2005 indicated the prevalence of vitamin A deficiency in six out of 10 women in KwaZulu-Natal with similar findings in children. In comparison of the two surveys (SAVACG and NFCS-FB-I), the results indicated that the vitamin A deficiency is increasing in all provinces irrespective of age and ethnic group. To combat deficiency, the Child Health Week campaign was effectively launched in 2009 to offer services such as vitamin A supplementation, de-worming, immunisation and growth monitoring as a means to control diseases and death of SA children between one and four years of age (UNICEF, 2009a:14).

Table 1.1 Adolescent studies conducted between 2000 and 2011 in South Africa

Author and reference	Study population	Measuring instruments	Summarised results
1. Jinabhai, Taylor, Reddy, Monyeki, Kambaran, Omardien and Sullivan (2007). Sex differences in under and over nutrition among school-going Black teenagers in SA: an uneven nutrition trajectory.	5322 school going black teenagers, 13.0-17.9 years, from grade 8-11	Youth Risk Behaviour Questionnaire, Anthropometric measurements, height and weight	20.9% girls were overweight, shorter less stunted and had higher BMI than boys. Boys (21.9%) were more stunted than girls (9.4%), but stunted girls were at greater risk of overweight than boys. Boys (18.4%) have higher prevalence of underweight than girls (2.6%)
2. Chemaly**,** MacIntyre and Abrahamse (2004). Calcium intake and knowledge among white adolescent girls in Gauteng, South Africa.	Adolescent white Girls (15-17) year	Food Frequency Questionnaire, Anthropometric measurements, 7-day weighed record	74% of the subjects were within the normal BMI range, 21.5% were underweight and 4.5% were obese. Chronic energy deficiency existed in 16 participants with BMI levels below 18.5 kg/m2, resulting in moderate to severe thinness in 6% of the participants
3. Reddy, Resnicow, James, Kambaran, Omardien and Mbewu. (2008). Underweight, overweight and obesity among SA adolescents: results of the 2002 National Youth Risk Behaviour Survey	9224 grade 8-11 students selected from in 207 schools in all 9 provinces.	Socio-demographic questionnaire, anthropometric measurements for height and weight	Underweight (9.0%). Grade 8 higher rate of being underweight than grade 11. 16.9% overweight. Grade 11-overweight compared to grade 8, especially blacks & white than coloureds.

Table 1.1 Adolescent studies conducted between 2000 and 2011 in South Africa (Cont)

4. Kruger, Kruger and McIntyre (2005a). The determinants of underweight and obesity among 10-15 years old school children in the North West Province, SA- the THUSA BANA (Transitional and Health during Urbanisation of South Africans; BANA children) study	1257, 10-15 year old, boys and girls (black, white, Indian and coloured)	Anthropometric measurements, standardised questionnaire regarding physical activity over 24hr, 24hr recall, socio-demographic questionnaire	Most children's weight was within normal range (92.1%). Only 7.8% were either overweight or obese. Girls were overweight/ obese (10.0%) than boys (5.6%). The highest prevalence of overweight/obesity was found among white children (14.2%), compared with black (7.1%), Indian (6.4%) and coloured children (2.9%).
5. Temple, Steyn, Myburgh and Nel, (2006). Food items consumed by students attending schools in different socio-economic areas in Cape Town, South Africa	476 students between 12-16 years of age, mostly from grade 7-10 of various ethnic group	Self completion questionnaire	77% eat breakfast before school, 41%-56% brought food to school, 69.3% bought food at school tuckshop, 70% purchase unhealthy food items.
6. Kimani-Murage, Kahn, Pettifor, Tollman, Dunger, Gómez-Olivé and Norris (2010). The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children	3511 children and adolescents (boys and girls) 1-20 years of Mpumalanga Province, South Africa.	Anthropometric measurements, self-administered questionnaire	The prevalence of combined overweight and obesity was substantial among adolescent girls, increasing with age and reaching approximately 20-25% in late adolescence
7. Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste and Dannhauser, 2005b. National Food Consumption Survey-Fortification Baseline (NFCS-FB-I)	Children aged 1–9 years and women of reproductive age (16–35 years) in South Africa	Socio-demographic, Knowledge Attitude and Behaviour questionnaire Anthropometric	Stunting and underweight in 1 of 10 children reported. Four women nationally had a poor vitamin A status. Almost one third of women were anaemic

The studies in Table 1.1 reflect the findings of South African Studies and the nutritional status of adolescents. It is also important to note that some of the studies assessed food items

consumed by students attending schools while some studies assessed impacts of malnutrition in SA. The general consensus is that malnutrition exists and the situation is prevalent, despite the statement made by President JZ Zuma in a country report (UNDP, 2010:4) that 'SA is still committed to the 2000 declaration' in making MDG 1 a priority. This is evident when evaluating studies done in the last five years. Table 1.1 indicates a summary of various studies on the malnutrition situations in SA. The findings elucidated various situations of malnutrition in the country. The results found by Jinabhai et al (2007) revealed that (9.4%) of girls between 13 and 19 were stunted. The study done by Reddy et al (2008) found that 9.0% of the same age were underweight especially the one in grade 8. The South African Youth Risk Behaviour Study (SAYRBS), 2002, found the prevalence of overweight to be 17% nationally and the prevalence of obesity was 4%. The Cape Town study by Temple et al (2006) has shown that the majority of the school children (70%) purchase unhealthy food, a possible contributing factor to malnutrition and obesity. Childhood obesity is a serious and alarming problem in the world, hence (16.9%) of the total population study conducted by Reddy et al (2008) depicted such.

1.7 MOTIVATION OF THE STUDY

Lindelani is a small informal settlement situated on the outskirts of Kwamashu Township in KZN. The area was ravaged by political violence and indifferences in the early 1990s. There are two high schools in the area, both with no tuckshop on the school premises.

Despite the attempt made to alleviate poverty, Dr Zola Skweyiya, the former Minister of Social Development mentioned in his foreword that much more work needs to be done as there are situations in the country where children literally take turns to eat due to food scarcity. He further suggested that the poverty reduction possibility lies with the extension of the child support grant to 18 years. He added that expenditure on a child's nutrition is an investment in a healthier, more literate and ultimately more productive nation. He also highlighted that (39%) of South Africa children were already receiving child support grants in 2002/2003 Strategic plan (Department of Social Development, 2002).

Shahid, Siddiqui, Bhatti, Ahmed and Khan (2009:11) was concerned that women and child health is often ignored; however, it is a unique period requiring special attention. The number

one goal for the Health Report of South Africa is poverty reduction and hunger by year 2015. A recommendation has been made that the increased knowledge in eating a healthy balanced diet is needed to encourage youngsters to choose a healthy diet and lifestyle (Hamilton-Ekeke and Thomas, 2007:458). Räihä, Tossavainen and Turunen (2006) suggested the implementation of national food and nutrition policies to improve dietary habits of children worldwide.

The known fact is that malnutrition undermines economic growth and perpetuates poverty but governments, especially in developing countries fail to come up with practical solutions to deal with it. Investing in children's health is not a waste, but empowers the nation. Once the child's basic needs are met (Health and Nutrition), school performance, attendance and participation in class activities will improve (Brinkman et al, 2009:1). The outcome will be healthy families and communities. Story, Kaphingst, Robinson-O'Brien and Glanz (2008:257) commented on the role that schools can play in impacting on children's and adolescents' dietary intake since up to two meals and snacks are consumed at school. In addition, schools are appropriate environments to ensure that nutrition programmes are implement and administered effectively. The present study was, therefore, undertaken to determine the nutritional status and dietary intake of adolescent girls' age 13-18 years in Lindelani, a sub area of Kwamashu Township in KwaZulu-Natal, South Africa to determine the need for nutrition intervention.

1.8 AIMS OF THE STUDY

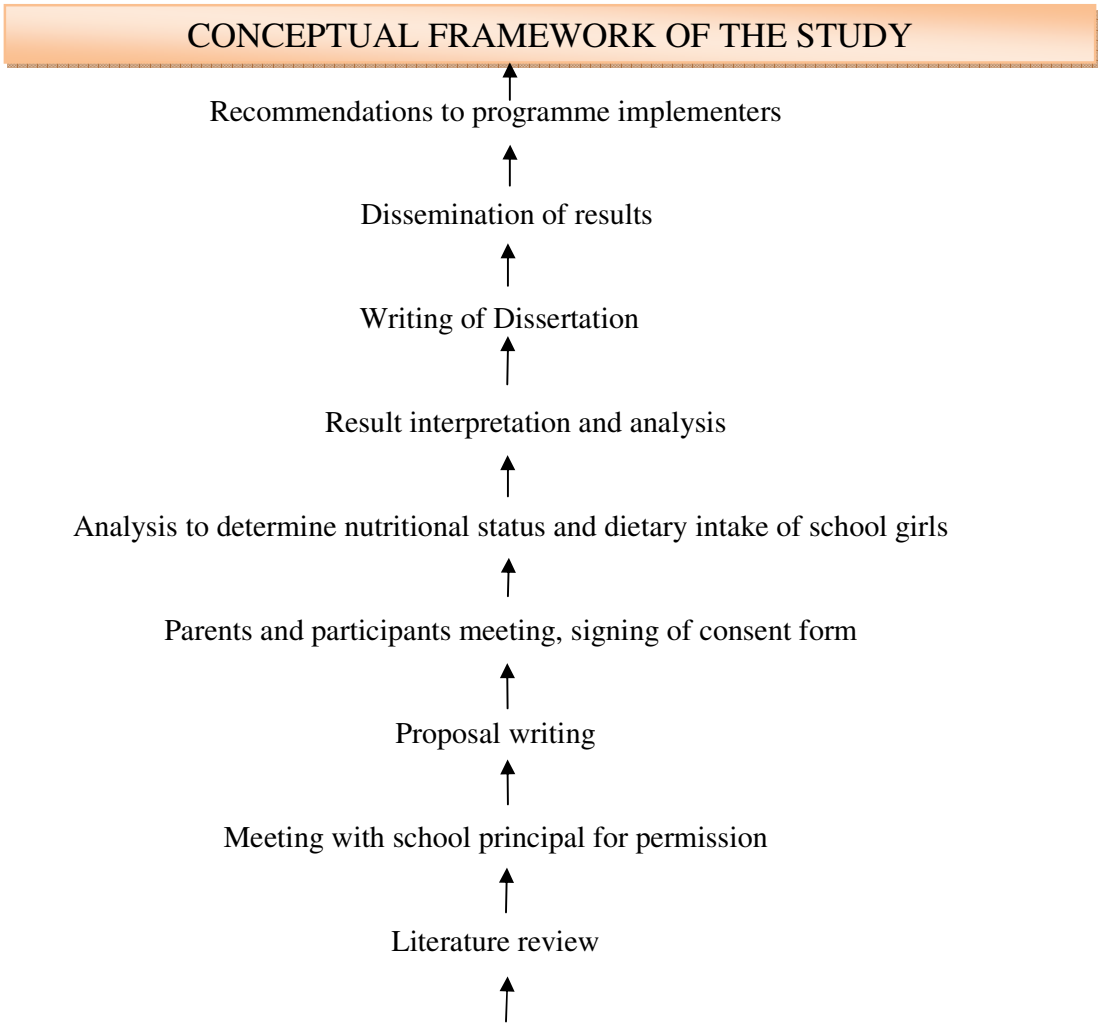
The present study aimed at investigating dietary patterns, nutrient intake and nutritional status of the adolescent girls in Mandlenkosi High School in Lindelani. Findings of this study could be critical to formulate the appropriate intervention programmes to solve nutritional problems among adolescent girls in schools. In providing possible solutions for the research problem, various objectives have been formulated, including the following:

- To measure the nutritional status of children between 13-18 years in Lindelani near Kwamashu township using anthropometric indicators.
- To determine the dietary intake of adolescent girls by completing the Quantitative Food Frequency Questionnaire and 24hr recall.

- To determine the socio-demographic status of the children by completing a socio-demographic questionnaire.
- To make recommendations to programme implementers with the view to address malnutrition in schools.

1.9 CONCEPTUAL FRAMEWORK OF THE STUDY

The framework below indicates the various stages integrated in the study survey. The process was followed step by step to the end of the dissertation.



1.10 STRUCTURE OF THE DISSERTATION

The dissertation is structured as follows:

Chapter 1:	Background and the purpose of the study are highlighted. A brief overview of malnutrition globally is given. The research question is presented and the importance of the study is provided.
Chapter 2:	A literature review is given and the theoretical framework of malnutrition internationally and locally will be explored. The causes of malnutrition and strategies to address it are examined.
Chapter 3:	The methodology used to collect data from all relevant stakeholders and instruments used are presented. The chapter will describe in detail how the study was undertaken.
Chapter 4:	Includes documentation, analysis, interpretation and discussion of results with specific reference to socio demographic data, eating pattern, food commonly consumed and anthropometrics.
Chapter 5:	The final chapter draws conclusion from the current study. Study recommendations for further research are made where possible.

1.11 CONCLUSION

Malnutrition is the main threat to health and well being globally. The improvement of human health and nutrition is largely determined by good government policies that protect the environment and people by ensuring the availability of basic resources such as water, food and shelter-as widely as possible. South Africa has a responsibility to achieve internationally agreed goals to reduce malnutrition and child mortality by 2015. Therefore, addressing childhood malnutrition is a prerequisite to reach that target. However, several researchers agreed that the diet quality of children and adolescents has declined with increased energy intake from fast food and decreased intake of fruit and vegetables. The adolescents in particular encounter various nutritional challenges which would impact on the growth spurt to adulthood. In general, maintaining good nutritional status is both a human right and a necessary component to address malnutrition at household level. Well-nourished children become a pride of the nation, produce good results in school, grow into healthy adults and in

turn give their children a better start in life (UNICEF, 2006). Needless to say that the adolescents are largely a neglected population as the attention is more on children under the age of five and pregnant women. Therefore, parental guidance in food choices at this unique period is essential to ensure that healthy eating behaviours are learned and maintained through adolescence to adulthood. The UNICEF framework (Figure 1.1) presents a useful understanding of how the development of the diseases interlinked to each other in the manifestation of malnutrition.

CHAPTER 2

LITERATURE REVIEW

2.1INTRODUCTION

The purpose of this chapter is to provide an overview of the literature on the topic of the nutritional status and dietary intake of adolescent girls in Lindelani. This chapter will review literature on the importance of child nutrition and the nutrition situation of adolescent girls in SA. An overview of previous survey findings of child nutritional status in South Africa will be provided. Most nutrition-related studies have investigated the nutritional status of younger children in the country, but not much has been reported about nutritional and health status of adolescents. Poor nutritional status during adolescence is an important determinant of health outcomes at a later stage of life. South Africa like many other countries in Sub-Saharan Africa continues to combat the problem of malnutrition. The malnutrition that prevails is mainly a consequence of inadequate food consumption, lack of knowledge on food processing and preparation and poor dietary habits. Malnutrition is, therefore, an ultimate manifestation of the interaction of various factors in society.

Political changes in South Africa since the end of the Apartheid era have placed the country on a new pledge of removing social discrimination and the promotion of wealth redistribution. However, poor nutrition, hunger and poverty are still rooted unavoidably in many and households even more so in the rural disadvantaged households. Despite the governments' intervention programmes such as social grants, school nutrition programmes and food fortification, child malnutrition continues to persist (DBSA, 2008:3). The results obtained by the NFCS and the 2005 NFCS-FB1 both confirmed the depth of stunting and underweight as the common nutritional disorder affecting children in SA (NFCS, 1999 and NFCS-FB, 2005). Many researchers have proved with evidence in different studies that malnutrition is a global challenge which requires immediate attention, more so in developing countries.

2.2 DEFINING MALNUTRITION

Diet and health are the most significant immediate risk factors of child malnutrition but both are rooted in underlying household issues such as food security, poor sanitation, maternal and childcare practices (Lesiapeto, Smuts, Hanekom, Du Plessis and Faber, 2010:202). Malnutrition is not necessarily a shortage of food, but micronutrient deficiency, poor sanitation, infectious diseases, lack of exclusive breastfeeding also impact on it. It is also described as the disorder due to inappropriate intake of adequate nutrients necessary for the bodily function. Malnutrition has become endemic in both poor and richer countries; the economically disadvantaged in these countries are the victims of the circumstances. According to the World Health Organisation (WHO, 2006), the two main causes of malnutrition have been PEM and micronutrient deficiencies. Malnutrition is a matter of urgency; it hinders peoples' productivity, economic growth and poverty eradication (DBSA, 2008:4). Children generally suffer as their requirements for nutrients are high. A Member of Parliament, Minister in the Presidency, Mr T. A Manuel acknowledged in his foreword during a country report that South Africa is ranked a lower middle income country (UNDP, 2010:3) but blacks are the poorest group of the population (Jinabhai et al, 2007:948). In 1994 when the democratic government took over, malnutrition was an area of concern in SA (Labadarios, Steyn, Mgijima and Dladla, 2005c). MacKeown, Pedro and Norris (2007:635) declared Africa as the leading continent with malnutrition prevalence, with little or no improvement of the situation. According to Müller and Krawinkel (2005), 300 000 deaths a year are directly linked to malnutrition, mostly affected are inhabitants in developing countries. In South Asia 3 million of 38 million children born die prematurely due to malnutrition (Anwer and Awan, 2003:2). More than 20 million infants are born with low birth weight globally and more than 95% are born in developing countries (UNICEF/WHO, 2004:7). In agreement with the statement, Oyekale and Oyekale (2009:118) argued that malnutrition prevalence in children deteriorates remarkably and Millennium Development Goals will not be achieved in 2015 as agreed.

It is a tragic fact that in an age of technology and scientific knowledge, there are many people in many parts of Africa whose health and quality of life suffer through a lack of food. Not ignoring other factors, food insecurity is the leading cause of malnutrition and poor health, although further analyses of the situation reveal that ignorance, illiteracy and attitudes are

other factors which perpetuate malnutrition (David, Kimiywe, Waudo and Orodho, 2008:131). Shih (2007:4) described malnutrition as the overall term encompassing undernutrition and overnutrition which is either shortage, excess or imbalance of body building and energy giving nutrients. When these nutrients are not consumed sufficiently, the body's ability to function efficiently is compromised, while the immune system becomes weaker, resulting in the victim being vulnerable to diseases that may eventually lead to a premature death (Chesire, Orago, Oteba and Echoka, 2008:472). People suffer from secondary malnutrition, an illness that prevents proper absorption or digestion of food (Weingärtner, 2004). The DBSA (2008:25) stated that South Africa, like many other developing countries, is experiencing the double burden of disease as both under and over nutrition prevail.

2.2.1 Overnutrition

A balanced and healthy diet is important at all stages of life, but more so during childhood. Overnutrition is the direct result of a high kilojoule intake together with a lack of physical activity (Kuzwayo, 2008:166) and the leading cause of overweight and obesity with serious implications of non-communicable diseases, such as type 2 diabetes, heart disease (HD) and hypertension (Kruger, Puoane, Senekal and van der Merwe, 2005b:491). Overnutrition is associated with excessive weight in relation to height. Both over-and undernutrition are prevalent in low-income countries. The unequal distribution of wealth and resources has caused an increase in overnutrition even in countries where hunger is endemic (Chopra, Galbraith and Darnton-Hill, 2002:952). In 2003, The South African Demographic and Health Survey (SADHS) showed overnutrition prevalence among South Africans (DoH, 2004). The mortality and morbidity rate is less among teenagers, however, poor eating habits leading to overweight, obesity and anorexia are on the rise during this period (Jinabhai et al, 2007:944). Hossain et al (2007:214) stated that 90% of type 2 diabetes are a result of an overweight condition.

2.2.1.1 Obesity

Being overweight during adolescence is likely to continue into adulthood (Xie, Gilliland, Li, and Rockett, 2003:30). Prevention of overweight and obesity in children and adolescents is a

serious concern that needs priority because of its adverse health consequences (Ahn, Juon and Gittelsohn, 2008:1). The rapid increase in obesity prevalence implicates environmental factors. A study by Clark, Goyder, Bissell, Blank and Peters (2007:132) found that dietary habits formed in childhood are likely to continue into adulthood, so an unhealthy diet in childhood has a negative implication for health throughout the life course. According to Van Loan (2009:120), data from the National Health and Nutrition Examination Survey (NHANES) in the United States show that 66% of the population are classified as overweight or obese. Rodrı´guez and Moreno (2006:296) described obesity as the imbalance between energy intake and energy expenditure over a long period of time without engaging in physical activities. Obesity is increasing rapidly in both high and low income countries. Popkin (2006:289) asserted that even the poor nations have access to a relatively high fat diet. The WHO approximation global figures for 2010 as cited by Wiles, Green and Veldman (2011:129) indicated that 42 million children are overweight. A healthy diet and physically active life are important at all stages of life, but more so during childhood. The International Obesity Task Force reported an alarming 155 million overweight and obese children globally (Hossain et al, 2007:213). Obesity is diet-related, hereditary and highly preventative before causing NCDs (Burns, 2004:8). According to Senekal, Mchiza and Booley (2008:490), the rise in obesity is mainly due to the increase in sedentary lifestyles, refined foods, high intake of saturated fats and energy dense food. Long hours of television viewing also increase the rate of obesity in children and youth. Approximately 25% of SA children are reported to spend three or more hours daily on television screening (Steyn, Lambert, Parker, Mchiza and De Villiers, 2009:146). Studies have found that children who watch more television and play less sport are more likely to be overweight or obese. Giugliano and Carneiro (2004:17) added other factors associated with obesity as early weaning, eating disorders, insufficient food intake, passive overeating, socio-cultural and economic influences. On the contrary, as the average income increases in transitional countries, so does the consumption of fat, including industrially processed hydrogenated fat.

The World Health Organisation listed overweight and obesity as one of the leading risk factors associated with mortality and morbidity in developing countries (Kruger et al, 2005b:492). According to Neira and De Onis (2006:8), the accumulation of body fat can contribute to cardiovascular disease (CVD) and blood pressure. Mchiza, Goedecke, Steyn, Charlton, Puoane, Meltzer, Levitt and Lambert (2005) emphasized the importance of

prioritizing prevention and management of obesity, together with ways and means of dealing with the pandemic. Choyhirun, Suchaxaya, Chontawan and Kantawang (2008:108) asserted that 70- 80% obese adolescents are likely to become obese adults, with an increased risk for heart disease, hypertension, diabetes and cancer.

2.2.1.2 Diseases of lifestyle

Adolescence is the time to learn and adopt healthy habits to avoid many health and nutritional problems later in life. Several studies confirmed that a sedentary lifestyle, unhealthy diet, poor eating habits and physical inactivity are risk factors for diet related diseases. Regular exercise at least three times a week is recommended for healthy living. Most NCDs are generally diseases of a lifestyle and kill more people than any other disease each year and can easily be avoided by the adoption of a healthy lifestyle (Keller and Lang, 2007:867). Furthermore, the lifestyle diseases are expensive to treat and place a heavy burden on a country's health budget. Hossain et al (2007:214) stated that 1.56 billion people are expected to have hypertension by 2025. Findings quoted by Naidoo, Coopoo, Lambert and Draper (2009:7) indicated that physical inactivity was the cause of non-insulin depended diabetes mellitus in the Western Cape.

According to Brown and Ogden (2004:261), eating habits acquired in childhood continue through to adulthood. The recommendations made by Etelson, Brand, Patrick and Shirali (2003:1362*)* encourage that parents play a role in shaping and monitoring dietary preferences and physically activity patterns of children at an early age for a future healthy lifestyle. According to Naidoo et al (2009:7), only 40% of SA children and youth engaging in little to moderate physical activity, less than 60% of high school learners participate in vigorous exercise and more than 30% are totally inactive. Rapid urbanisation as it happens in African countries caused the paradigm shift. As the lifestyle and eating patterns changes, the NCDs increase as high fat and sugar diet intake increases (Senekal et al, 2008:490).

2.2.2 Undernutrition

Undernutrition has been an inherent characteristic of impoverished populations throughout the world. Extensive research clearly indicates that diet plays an important role in the

prevention of chronic diseases. Undernutrition is a condition where there is insufficient food intake to meet energy and nutrient needs (Reddy et al, 2008:203). Undernutrition as explained by Shekar, Somanathan and Du (2007:29) exists as a result of food deficit and lack of dietary diversity. The most recent report by U.N. Food and Agriculture Organisation is that 925 million people are undernourished (Halweil and Nierenberg, 2011:3). Factors associated with undernutrition have serious effects on child brain development and intelligence level (World Bank, 2006:10). The outcomes of undernutrition can include irreversible changes in child development (Altman, Hart and Jacobs, 2009:351). Undernourished children have lowered resistance to infection, and more likely to die from common childhood ailments like diarrhoeal diseases and respiratory infections. South African disadvantaged children had been known as the vulnerable population suffering from stunting as a form of undernutrition, despite the initiative to improve the populations' nutritional status through supplementation, fortification and nutrition education (Jinabhai, Taylor and Sullivan, 2006:26). Undernutrition is defined as a Z score below -2SD and severe undernutrition as a Z scores below -3SD. Child undernutrition can manifest itself in different ways, depending on the cause, severity, and duration. The three main measures of child under nutrition are:

- stunting – low height for age
- wasting – low weight for height
- underweight – low weight for age (von Grebmer et al, 2010:22)

Other researchers described undernutrition as a 'hidden hunger' indicating that most of the time the sickness is undetected (Faber and Wenhold, 2007:393). According to Vieira, do Carmo Castro Fransceschini, Fisberg and Priore (2007:366), poor nutrition compromises the functioning of the immune system making the sufferer vulnerable to infectious diseases and limiting the body's ability to absorb nutrients appropriately. The consequences of under nutrition are perceived in premature death of children due to malfunctioning of the body system (Halweil and Nierenberg, 2011:4). Thus De Onis, Blossner, Borghi, Frongillo and Morris (2004:2600) made an announcement for quick reaction to be taken in reducing children's death. Worldwide, undernutrition prevalence is perpetuated by political violence, food insecurity, diseases and provincial and national government failure to deliver basic human needs (Hoffman and Lee, 2005). In the years 2000-2002, approximately 852 million people were undernourished globally (Müller and Krawinkel, 2005:279). The pandemic had

been acknowledged and targeted to receive special attention by 2015, and by then underweight prevalence of children up to 5 years will be reduced by 50% (de Onis et al, 2004:2600). In some countries, stunting as stated by Black et al (2008:246) is more prevalent where a large proportion of rural poor population live. Despite the endeavour made to alleviate poverty, many are still victims of hunger and poverty which opens a doorway to malnutrition (Tanumihardjo, Anderson, Aufer-Horwitz, Bode, Ememaker, Haqq, Satia, Silver and Stadler, 2007:1966).

In Pakistan, poor and illiterate families spend less money on girls' health, and purposefully delay girls' physical development so that parents have enough time to find a groom for their daughters (Anwer and Awan, 2003:6).

2.2.2.1 Protein Energy Malnutrition (PEM)

The most life threatening form of malnutrition is severe protein energy malnutrition which is further broken down into three categories: kwashiorkor, marasmus and marasmic kwashiorkor (Beck, 2007:6). While poor growth can be due to a variety of nutritional deficiencies and underlying diseases, an insufficient intake of protein is thought to be the most important cause. As described by Müller and Krawinkel (2005:280), PEM is the imbalance of nutrients supplied and nutrients requirement needed to support growth. A diet lacking in macronutrients (energy rich foods) carbohydrates, protein and fats (which are required in large quantities by the body) leads to PEM (Shih, 2007). PEM is a problem particularly existing between the ages of six months and two years, and coincides with the period of most rapid growth and mental development in children. Most children suffering from energy malnutrition are likely to be stunted or wasted teenagers (Anwer and Awan, 2003:2). The school aged children are the vulnerable group mostly affected by PEM and physical retardation and mental development are often reported with either non-enrolment or inability to finish school (Chesire et al, 2008:472). To maintain a healthy balanced diet the energy giving nutrients should be consumed in correct proportion. The symptoms of PEM manifest itself in children younger than 2 years old as a result of early weaning practices, absence or a low protein diet (Müller and Krawinkel, 2005:280). Protein energy malnutrition can result in marasmas and kwashiorkor, hence, in Burkino Faso, misola and spirulina have

been used to improve the status of undernourished children (Simpore, Kabore, Zongo, Dansou, Bere, Pignatelli, Biondi, Ruberto and Musumeci, 2006:2).

Kwashiorkor (oedematous malnutrition) is defined as protein energy malnutrition with the presence of oedema due to a diet deficient in protein (Beck, 2007:5). Oedematous malnutrition is not easily detected due to swelling as a result of water retention under the skin (Nyeko, Kalyesubula, Mworozi and Bachou, 2010:2). The victim will be irritable, withdrawn and have a poor appetite. The skin will have patches and later crack and peel off (WHO, 2008b:12).

Marasmus (non-oedematous malnutrition), the child's body is severely wasted to the extent that the internal organs are too weak to function, bones and skin become visible as a result of muscle and fatty tissues loss. Body weight may be reduced to less than 80% of the normal weight for the height (WHO, 2008b:12). Diagnosis is seen through subcutaneous fat and muscle loss. Children with marasmus have a thin, wasted appearance with minimal body fat and a WHZ below -3SD and tend to have a good appetite when offered food (Beck, 2007:5).
Marasmus is different from kwashiorkor; however, in cases of severe undernutrition features of both are apparent (WHO, 2008b:13). The **marasmic kwashiorkor** is characterized by wasting and oedema, hair and skin changes, triangular face and an extended abdomen (Müller and Krawinkel, 2005:280). PEM is also prevalent amongst women at child bearing stage; the effect is seen in low birthweight as a result of maternal undernutrition (Shekar et al, 2007:17).

2.2.2.2 Micronutrient deficiencies

Micronutrient malnutrition affects all age groups, but young children and women of reproductive age tend to be among those most at risk of developing deficiencies. The micronutrients consumed in small amounts by South African children may have the negative impact on the children's growth, development and general health (DBSA, 2008:22). Micronutrient deficiencies as mentioned by Cogill and Richardson (2008:27) occur when individuals have inadequate access to essential micronutrients or when the human body becomes unable to absorb or retain micronutrients due to disease or infection. Noted by Black (2003:79) is that micronutrient deficiencies not only weaken the immune system and health but also hinder the country's progress socially and economically. Micronutrient deficiencies

during childhood affect growth, compromise immunity and, in severe cases, lead to brain damage, chronic disabilities and mortality (Ma, Jin, Li, Zhai, Kok, Jacobsen and Yang, 2007:633). Without addressing micronutrient deficiencies, the vicious cycle of inter-generational undernutrition, chronic diseases, and poverty continues.

Many researchers consider the ages of six months to two years as an opportunity to act against malnutrition (Muller and Krawinkel, 2005:280). Vitamins and minerals are essential nutrients required in small amounts in the diet to help regulate and control functions in cell metabolism and protect the body against sickness (Dittoh, Abizari and Akuriba, 2007:618), however, insufficient intake of these nutrients leads to deficiencies which are of critical concern worldwide. According to Welch and Graham (2004), even a shortage of one of these nutrients may cause poor health. Black (2003:79) outlined micronutrient deficiencies as a risk factor which compromises the lives of low and middle income groups by weakening individuals' immune system, making them prone to infectious diseases, growth and mental development. Caulfield, De Onis, Blössner and Black (2004:193) stated that low weight for age and micronutrient deficiencies are closely related. In 2005, over 30% of children under the age of five years in developing countries were stunted, 30% were underweight and 10% were wasted, while millions died from diseases directly related to micronutrient deficiencies, especially iodine, iron, zinc and vitamin A deficiencies (Ruel and Hoddinott, 2008).

2.2.2.2.1 Vitamin A

Vitamin A is an essential nutrient that is required in small amounts for the normal functioning of the visual system, the maintenance of cell function for growth, immune function and reproduction (Weingärtner, 2004:11). Witten et al (2004) stated that vitamin A deficiency is the underlying cause for Xerophthalmia (total or partial loss of eyesight). Keratomalacia is also reported as another form of vitamin A deficiency (Gopalan, 2008:1). Vitamin A deficiency leads to problems associated with appetite, poor child growth and impaired immune response (Faber and Wenhold, 2007:395). Primarily, the cause of vitamin A deficiency is poor dietary intake of vitamin A rich diet (Story and Stang, 2005:31). In South Africa, Chopra, Whitten and Drimmie (2009:3) articulated that 60% of children and 25% of women are vitamin A deficient. Every year 10.8 million deaths have been reported in developing countries as a result of weak immune system caused by vitamin A deficiencies

(Gadaga, Madzima and Nembaware, 2009:508). The national survey of 2005 found that six out of 10 women in KwaZulu-Natal had a poor vitamin A status. The prevalence of vitamin A deficiency at national level has increased when compared to the 1995 National Food Consumption Survey (Labadarios et al, 2005b:261). In FAO (2005) it is noted that vitamin A deficiency has increased the risk of death from diarrhoea and malaria by 24%.

2.2.2.2.2 Vitamin C

Vitamin C deficiency (scurvy) was diagnosed in the early 1900s, with symptomatic signs such as swollen and loose teeth, gum disease, hair loss, skin haemorrhages and eye and mouth dryness. Scurvy is a disease that occurs when one has a severe lack of vitamin C (ascorbic acid) in one's diet. Vitamin C is known as a remedy for reducing common cold incidence in people under heavy acute physical stress, although it had no significant effect in the ordinary people's lives (Hemilä and Louhiala, 2007:2). Although vitamin C deficiency is reported as a problem of poor and undernourished populations, Chan, Brimble, Lau and Chan (2010) believed that it is a disease well known in the past but is rarely diagnosed in the modern society. The bleeding under the skin and in muscles and joints, poor wound healing, convulsions, fever, loss of blood pressure and death in severe cases had been reported as a result of deficiency (Lewis, 2010:17).

2.2.2.2.3 Vitamin D

Vitamin D deficiency is now recognized as a pandemic yet it is generally unrecognized and untreated (Lee, O'Keefe, Bell, Hensrud and Holick, 2008:1950). In children, rickets is a known symptom and oesteopenia, osteoporosis and fractures in adults have been reported. Other symptoms related to vitamin D deficiency are hypertension, infectious diseases and cancers (Holick and Chen, 2008:1080). Lee et al (2008:1950) noted that sufficient vitamin D is essential for optimal function of many organs and tissues throughout the body, including the cardiovascular system. Ample intake of vitamin D has been associated with the prevention of bone disease (Lee et al, 2008:1951

2.2.2.2.4 Zinc (Zn)

Zinc (Zn) is an essential nutrient that is necessary for proper immune function and growth. Zinc deficiency, as stated in the Copenhagen Consensus, is hard to measure but tends to correlate with iron deficiency and low animal food intake (Horton et al, 2008:3). The dearth of zinc in the diet may cause growth failure in children (Caulfield et al, 2004) anorexia, poor immune response and severe skin lesion (Okolo, Okonji, Ogbonna, Nwosu and Ocheke, 2002:204). Children with zinc deficiency are inclined to diarrhoeal infection, pneumonia and malaria attack (Black et al, 2008:249) obviously caused by poor dietary choices and feeding practices (DBSA, 2008:27). Low levels of Zn in breast milk and type of food introduced during weaning may lessen the zinc consumption level in malnourished children (Okolo et al, 2002:204). The paucity is prevalent at 1-9 years of age; food diversification and supplementation need to be considered as an option to address the deficiency (DBSA, 2008:27). During pregnancy and delivery, shortage of zinc may cause premature rupture of membranes, and pre-term delivery with foetal growth retardation and congenital abnormalities (Gibson, 2006:52). The levels of zinc deficiency found in the 2005 NFCS-FB-I indicated that 45.3% of children between 1-9 years had inadequate zinc status. Inadequacy was more prevalent in children in rural formal and urban formal areas with Western Cape as the leading Province (Labadarios et al, 2005b:264).

2.2.2.2.5 Iron

Iron deficiency anaemia (IDA) is the most prevalent problem of micronutrient malnutrition affecting children, adolescents and pregnant women in developing countries (Nojilana et al, 2007:741). According to Labadarios et al (2005c:262), one in seven children nationally had a poor iron status. Iron is crucial for blood formation; therefore insufficiency leads to anaemia (NICUS, 2003). Iron deficiency is known to reduce the oxygen supply to the foetus and causes intrauterine growth retardation (Gadaga et al, 2009:513). More often, iron deficiency manifests itself in a form of anaemia which is usually due to poor iron intake. Other symptoms of IDA include tiredness, reduced concentration, irritability and making one susceptible to diseases and infection due to weakening of the immune system. The paucity of iron in the diet leads to reduced physical endurance even in the absence of anaemia (WHO, 2006:43). The risk factors for anaemia, particularly during pregnancy are known to vary by

geographic areas and by seasons (Hoque, Hoque and Kader, 2009:69). High rates of anaemia in pregnancy in the rural population of KZN were observed, 9-12% pregnant women were found to have IDA in the year 2000 (Hoque et al, 2009:69). In the case of the children the NFCS-BI found that the Free State, Mpumalanga, Limpopo and the Western Cape were highly affected with poor iron status (Labadarios et al, 2005b:262). Among school going children IDA is characterised with poor appetite, resistance to common childhood illnesses, morbidity and growth failure (Wenhold, Kruger and Muehlhoff, 2008:453). In severe cases mental retardation and maternal and perinatal mortality have been reported (Baltussen et al, 2004:2678). In Zimbabwe and in most countries like South Africa, women are supplied with iron supplements during pregnancy to deal with iron deficiency (Gadaga et al, 2009:513). Iron deficiency has caused China to lose 3.6 million of the gross national production in economic development (Ma et al, 2007:632).

2.2.2.2.6 Iodine

Iodine deficiency is problematic in countries where salt is not iodized and inhabitants have no access to fish and other seafood. When salt iodisation was introduced in 1954, South Africa was counted amongst many countries with iodine deficiency in most of provinces hence there was a need for a salt iodisation programme through fortification, supplementation or diversification (Jooste and Zimmermann, 2008:8). Seal, Creeke, Gnat, Abdalla and Mirghani (2005) stated that the African continent benefited as iodised salt has been made available in each and every household. The NFCS-BI found that many households both nationally and provincially have increased the use of salt with iodine content (Labadarios et al, 2005b:260). According to Gadaga et al (2009:505), shortage of iodine in the diet causes the thyroid gland enlargement resulting in goitre, the only indicator for iodine deficiency disease. The iodine deficiency is accurately measured using urinary iodine excretion (UIE) indicator although the total goitre rate (TRG) can be used as the primary indicator to measure the severity of ID in the system (Kapil, 2009:57).

2.2.2.2.7 Calcium

Children's bodies need sufficient calcium to support an accelerated growth spurt during the preteen and teenage years (NICUS, 2003). Milk intolerance, allergy and malabsorption may

result in low consumption (Nyeko et al, 2010:2). An insufficient calcium intake lead to weak bones which eventually increases the risk of uncontrolled heart beat, cramps, bone fractures and osteoporosis in adulthood (Nicklas, 2003:342). Low milk intake for a long period has been associated with the shorter figure with additional body fat (Wenhold et al, 2008:450).
A number of B vitamins insufficiencies have been known to cause pellagra and brain dysfunction such as Korsakoff syndrome (Kaplan, Field, Crawford and Simpson, 2007:748).

2.2.2.2.8 Vitamin B_1

Vitamin B_1 (Thiamine) deficiency causes beriberi and manifests itself in heart failure, oedema, brain and nerve disease, or both (Lewis, 2010:17). The deficiency can cause extreme tiredness, irritability, constipation and loss of appetite. Growth retardation and weak muscle are also reported as symptoms of B_1 deficiency.

2.2.2.2.9 Vitamin B_6

Vitamin B_6 deficiency symptoms include eczema and seborrheic dermatosis in the ears, nose and mouth; cheilosis, glossitis and angular stomatitis and hypochromic and microcytic anemia (Perveen, Yasmin and Khan, 2009:1).

2.2.2.2.10 Vitamin B_{12}

Vitamin B_{12} deficiency includes paresthesias of the hands and feet, decreased deep-tendon reflexes, unsteadiness and potential psychiatric problems such as hallucinations and psychosis. Dietary deficiency of vitamin B_{12} may be prevalent in strict vegetarians as it is not naturally present in plant food (Perveen et al, 2009:1).

2.3 NUTRITIONAL NEEDS OF ADOLESCENT GIRLS

Escott-Stump and Earl (2008) described a proper balanced diet as a diet containing all essential nutrients in the correct amounts to meet all the nutritional needs required for a person's life, maintenance, repairing, physical and mental development.

2.3.1 Dietary Reference Intake (DRIs)

Dietary Reference Intake adopted the Food and Nutrition Board of the Institute of Medicine to provide quantitative estimates of nutrient intakes to be used for planning and assessing diets for healthy people. The DRIs contain four categories of recommendations for nutrient reference values: Recommended Dietary Allowance (RDA), Adequate Intake (AI), Tolerable Upper Intake Level (UL) and Estimated Average Requirement (EAR) (Story and Stang, 2005:21). RDIs replace the RDAs which were previously used on food labels. DRIs are used to assess and plan diets for healthy individuals and groups of individuals (de Sousa, Da Costa, Nogueira and Vivaldi, 2008:1275).

2.3.2 Estimated Average Requirements (EARs)

The EAR is a daily nutrient intake value that is estimated to meet the requirement of half (50%) of the healthy individuals in a specified age and gender group. The EARs are used to determine dietary adequacy of populations but not for individuals (Story and Stang, 2005:21).

2.3.3 Recommended Dietary Allowances (RDAs)

The RDA is the average daily intake level that is required to meet the nutrient requirement of nearly all (97-98%) healthy individuals in an age and gender-specific group. The RDA is applicable to individuals not a group.

2.3.4 Adequate Intake (AI)

The AI is the recommended intake value based on observed or experimentally determined estimates of nutrient intake by a group of healthy individuals that are assumed to be adequate. The AIs are used when the RDA cannot be determined (Story and Stang, 2005:1).

2.3.5 Upper Intake Levels (UL)

The maximum level of daily nutrient intake that is likely to pose no risk of undesirable health effects for almost all individuals in the general population. However, as intake increases above the UL, the potential risks of adverse effects may increase (Story and Stang, 2005:1).

2.4 MACRONUTRIENT REQUIREMENTS FOR ADOLESCENT GIRLS

Nutritional deficiencies have far reaching consequences, especially in adolescent girls. To sustain life and maintain health, humans require different nutrients. Carbohydrates, proteins fats and fibre are known as macronutrients and are required in large amounts as they are energy giving foods (Story and Stang, 2005:27). Anyika, Uwaegbute, Olojede and Nwamarah (2009:1596) noted that adolescents remain a neglected population; consequently, the needs of this group are often ignored. To ensure proper growth, development and maturation adolescents need an adequate energy intake (Petrie, Stover and Horswill, 2004:621). Story and Stang (2005:27) referred to teenagers' basal metabolic rate, physical activity and pubertal growth as the factors influencing their energy needs.

2.4.1. Carbohydrates (CHO)

CHO (sugars, starches, dietary fibres) are the main sources of energy. CHO are found in abundance in foods of plant origin such as cereals, vegetables, legumes and fruits (Salas-Salvadó, Bulló, Perez-Heras and Ros, 2006:45). The adolescence period requires a higher energy intake owing to the rapid physical growth (Story, Neumark-Sztainer and French, 2002:40; Elmo, 2009). Skeletal development, sexual maturation and growth spurts increase the demand for energy requirements, as well as replacing energy lost in physical and mental activities (de Sousa et al, 2008:1275). The DRI for energy is based on the level of physical activity, however, the EARs for adolescents is 100g/day (Institute of Medicine (IOM), 2003). Physically active adolescents require additional energy to meet the daily caloric needs. The teenager's source of CHO includes soft drinks, milk, ready-to-eat cereal and sugary foods such as cakes, cookies, doughnuts, sugars, syrups and jams (Story and Stang, 2005:27). Adolescents' source of CHO and preference is energy foods high in saturated fat and salts with no nutritional value resulting in minimum consumption of balanced diet from all food

groups (Goldberg et al, 2009:14). Elmo (2009) recommended that family meals should be an opportunity for parents to demonstrate healthful choices and be an example of healthy eating.

2.4.2 Protein

Proteins are building block of amino acids and are classified as complete (animal protein) and incomplete (plant origin) protein. The incomplete proteins lack one or more amino acids, therefore need to be complemented (two plant type proteins eaten together), when eaten to provide function necessary to perform. Protein sources from plants are legumes, nuts, grains and certain types of vegetables. Animal sources of protein are red meat, poultry, fish, eggs and milk. Protein is needed to maintain and build muscles, skin, bones, blood and repair worn out tissues to support growth, especially for the maintenance and development of lean body mass (Petrie et al, 2004:622). The national data as revealed by Story and Stang (2005:27) suggest that on average, teenagers consume twice as much the recommended intake of protein. According to (IOM, 2003), 46g/d is the sufficient dietary requirement intake (DRI) necessary for growth and physique development.

2.4.3 Fat

The adolescent's fat and sugar intake is a concern in many countries as it appears to exceed the recommended amount (Story and Stang, 2005:28). Gibbons (2002:115) recommended that 25% to 30% of total daily fat kJ should be derived from unsaturated fat and less than 10% of saturated fat. There is no AI or RDA set for total fat (Petrie et al, 2004:620). Dietary fat plays a significant role as an energy source and a significant cell structural component during the adolescent period. Relationships between fat and obesity had been reported, however, fruit and vegetable rich dietary intakes may have compound nutritional benefits (Gibbons, 2002:115). According to Nishida, Uauy, Kumanyika and Shetty (2004:247), 6-10% of daily energy intake should come from polyunsaturated fatty acids (PUFAs) as this type of fat has the ability to reduce the incidence of cardiovascular diseases. Joyce, Wallace, McCarthy and Gibney (2008:156) have confirmed the existing relationship between dietary fat intake and CVD. The sources of saturated fat intakes mostly consumed by adolescents include milk, beef, cheese, margarine and foods such as cakes, cookies, doughnuts and ice

cream (Story and Stang, 2005:28). High intake of saturated fat and cholesterol increases the risk of atherosclerosis and ischemic heart disease (Hu, 2010:1).

2.4.4 Dietary Fibre

The insufficient dietary fibre intake contributes to non communicable diseases (Anderson, Baird, Davis Jr, Ferreri, Knudtson, Koraym, Waters and Williams, 2009:188). Adequate amounts of fibre not only lessen the possibility of the NCDs but aid in maintaining normal blood glucose as well as bowel movement. There are two types of dietary fibre, defined by their physical behaviour in water:

TYPE	EXAMPLES
Insoluble fibre Soluble fibre	Cellulose, lignin and some hemicelluloses: abundant in wholegrain cereals gums, mucilages and pectins: contained specially in fresh vegetables, legumes and fruit, and the beta-glucans, present in oats, barley and some yeasts.

Evidence has confirmed that ample fibre intakes have potential health benefits, in preventing NCDs (Nishida et al, 2004:248) 14g/1000kcal is the AI recommended for Adolescents (IOM, 2003).

2.4.5 Water

Water is an essential nutrient and critical for the function of all organs for all ages and for maintaining health in general (Kant and Graubard, 2010:887). Therefore, water intake should not rely on thirst alone. According to UNICEF (2006:3), water is a scarce resource which is subject to abuse and pollution, the most likely pollutant is human faeces that have not been disposed correctly. However, water is a necessity as the body cannot generate enough itself to fulfil its need and many metabolic reactions that occur in the body are dependent on it (Kondracki and Collins, 2009:16). Maintaining adequate water intake is necessary to replace water lost during perspiration especially in hot weather and during physical training

(Negoianu and Goldfarb, 2008:1041). Insufficient water intake can cost lives and children need to be hydrated frequently, especially when there is an outbreak of fever or diarrhoea accompanied with vomiting. Severe dehydration of about 20% water loss in the body may lead to death (Kant and Graubard, 2010:887). Bourne, Harmse and Temple (2007:303) concluded that water is a healthy alternative compared to artificial and soft drinks, which are likely to add more and unnecessary kilojoules. Other researchers argued that water intake is not only referred to tap or bottled water but any fluids consumed as beverages and high water content food such fruits and vegetables. Foods are responsible for about 20% of the fluids consumed by most people (Valtin, 2002:994). The widely beliefs about how much plain water needs to be consumed daily is not confirmed. Valtin's (2002:994) version is that despite the extensive search of the literature there is no scientific evidence of 8 glasses of water a day as health columnists and writers in the popular magazines recommended.

2.5. MICRONUTRIENT REQUIREMENTS AND FOOD SOURCES OF ADOLESCENT GIRLS

The nutritional status is often poor during early life and gets worse as the adolescent growth spurt occurs. Micronutrients are vital for general wellbeing and each nutrient is essential as the deficiency of one nutrient may cause the dysfunction of the body. The micronutrients are required in smaller amounts compared to macro nutrients; they do not provide energy but are essential for good quality life (NICUS, 2003). Steyn, Wolmarans, Nel and Bourne (2007:307) highlighted the alarming (two billion) number of people suffering from micronutrient deficiencies in developing countries, mostly women and children. The global progress reported 35% of people lacking adequate iodine in the world, 40% iron sufferers in the developing countries and more than 40% children with vitamin A deficiency (World Bank, 2006:7). Micronutrient deficiency as articulated by Ma et al (2007:632) does not only negatively affect the health of people, but also delays the social and economic development of the countries. The common nutrition problems affecting the youth population worldwide as stipulated by Shahid et al (2009:11) include under nutrition, iron deficiency anaemia; iodine deficiency and vitamin A.

2.5.1 Vitamin A

The body tissues require vitamin A for growth and for repairing worn out tissue, as well as appropriate functioning of the immune system (Weingärtner, 2004:13). Rotondi and Khobzi (2010:297) reported vitamin A deficiency as a global health concern alarm affecting about 250 million preschool children and many of these children go blind every year (Rotondi and Khobzi, 2010:297). Vitamin A is necessary for reproduction, growth and immune function (Story and Stang, 2005:31). The estimated average requirement for adolescents is 485 micrograms per day (IOM, 2003). Sufficient consumption is important for the prevention of night blindness, loss of appetite, measles and diarrhoea. Parasitic infections, for example, ascaris lumbricoides and giardia lamblia may interfere with the absorption thus affecting the status and the effectiveness of vitamin A (Nojilana et al, 2007b:748).

Sources: The best sources of vitamin A are animal source foods, in particular, liver, eggs and dairy products, which contain vitamin A in the form of retinol that can be readily used by the body. Fruits and vegetables contain vitamin A in the form of carotenoids, the most important of which is β-carotene (Gopalan, 2008:1).

2.5.2Vitamin B_6

The Estimated Average Requirement for vitamin B_6 in this age group is 1.0 milligram per day (IOM, 2003).

Sources: The rich sources of vitamin B_6 are fortified cereals, dried beans, liver, chicken, pork, fish, organ meats, milk, eggs, avocados, bananas and potatoes (Perveen et al, 2009:1).

2.5.3 Vitamin B_{12} (Cobalamin)

Two micrograms per day is the dietary requirement of vitamin B_{12} for adolescents (IOM, 2003). Vegetarians as cited by Perveen et al (2009:1) should consider other means for supplementation since vitamin B_{12} is not naturally present in plant food and, therefore,

dietary deficiencies are likely to occur in individuals on a strict vegetarian diet. However, vitamin B_{12} is essential for red blood cell formation and nervous system function.

Sources: Organ meats, meat, fish, eggs, poultry and milk

2.5.4 Vitamin C

Vitamin C is crucial to produce connective tissue which binds the body cells together. The crucial role of vitamin C is the absorption of iron and in haemoglobin formation (Kabir, Shahjalal, Saleh and Obaid, 2010:637). The EAR is 56 milligrams per day for vitamin C and 45 micrograms per day for 9-13 year olds and 65 milligrams per day for girls ages 14-18. However, 10 milligram per day of vitamin C is known as a preventative dose for scurvy (Lykkesfeld and Poulsen, 2009:1).

Sources: Readily available sources (90%) of vitamin C are fruit and vegetables such as guavas, citrus fruits, pawpaw, tomatoes, green and red peppers, spinach, cauliflower, bean sprouts. At most adolescents' intake of vitamin C comes from ready-to-eat cereals, oranges and grapefruit juices (Story and Stang, 2005:31).

2.5.5 Vitamin D (Calciferol)

Shortage of vitamin D during teenage years may hinder bone mineralization and absorption of calcium in the small intestines (Sullivan, Rosen, Halteman, Chen and Holick, 2005:971). The intake of vitamin D is recommended for calcium absorption and bone growth during childhood and the adolescent period (Gordon, DePeter, Feldman, Grace and Emans, 2004:531).

Lehtonen-Veromaa, Möttonen, Leino, Heinonen, Rautava and Viikari (2008:418) commented on the prevalence of vitamin D insufficiency in winter as compared to other seasons. The average intake of vitamin B_{12} for adolescent girls required is 5 microgram per day. Vitamin D plays a vital role in the maintenance of skin and membranes.

Sources: The primary food sources for vitamin D are fortified dairy products, fortified foods, liver, milk and fatty fish such as tuna, salmon, mackerel and herring and oils from fish, including cod liver oil (Holick and Chen, 2008:1080).

2.5.6 Iron (Fe)

Iron requirements are higher during the adolescence phase for replenishment of blood lost during menstruation (O'Connor, O'Brien, O'Sullivan and O'Connor, 2009). Iron is also needed for haemoglobin formation, the substance which carries oxygen (O^2) from the lungs to the parts of the body. Iron also helps in fighting illnesses, functioning and development of the brain. The EAR for iron is 8 milligrams per day for 9-13 year and 15 milligrams per day for girls between 14 and18 years of age (Story and Stang, 2005:29).

Sources: According to the World Health Organization in 2002, Fe was rated the ninth risk factor of disability-adjusted life years, and the solution is depended on the increase of Fe rich diet (Hoppe, Sjöberg, Hallberg and Hulthén, 2008:638). Green leafy vegetables, legumes, whole grains, eggs, poultry, red lean meat, fortified foods are rich sources of Fe.

2.5.7 Calcium (Ca)

The calcium requirement during the adolescent period is higher than any other stage owing to the growth spurt and framework development and approximately 45% of the peak bone mass is attained at this stage (Story and Stang, 2005:29). Enough Ca is needed for the prevention of cancer, strong bones and teeth and aids in the absorption of vitamin B_{12}. The AI for calcium intake for adolescent is 1300 milligrams per day; however, there is an uncertainty as to how much is the limit (Chemaly et al, 2004:102). Story and Stang's (2005:29) concern is that that only 9% or 2 out of 10 adolescent girls meet the calcium requirements.

Sources: Milk and other dairy products are among the best natural sources of calcium and most milk and some yoghurt are fortified with Vitamin D (Nicklas, 2003:342). Other sources include selected low oxalate vegetables, legumes, nuts and fortified foods.

2.5.8 Phosphorus (P)

Phosphorus and calcium are both essential for metabolism and formation of bones. In addition, phosphorus is important for cellular function and in cellular structure. Shortage of calcium can be detrimental to life owing to the number of functions it performs in the body. The EAR of phosphorus required for adolescents is 1055 milligrams per day (IOM, 2003).

Sources: egg yolk, meat, cheese milk wholegrain and cereals.

2.5.9 Iodine

The EAR for iodine is 95 micrograms per day (IOM, 2003). In countries like the USA and Europe, a considerable amount of salt is used during bread making to improve iodine status (Jooste and Zimmermann, 2008:8). Seafood is the most important sources of dietary iodine, thus populations further away from the sea are likely to develop IDD, identified as the presence of goitre. In the SAVACG survey, results indicated that at least 10.6% of the rural schools were iodine deficient (Witten et al, 2004).

Sources: iodised salt, seafood

2.5.10 Zinc

The 7.5 milligrams per day is the Estimated Average Requirement for adolescents aged 13-18 years (IOM, 2003). Zinc is fundamental in the normal functioning of the immune system, essential for cellular division and growth. During pregnancy zinc is required for optimal growth and development of the foetus and for maternal tissue expansion (Chandyo, Strand, Mathisen, Ulak, Adhikari, Bolann and Sommerfelt, 2009:594). Zinc deficiency is not receiving immediate attention, however, it contributes to high mortality rate in developing countries most probably because measuring zinc status is problematic as it is referred to as ‘hidden hunger’ (Stein, Nestel, Meenakshi, Qaim, Sachdev and Bhutta, 2006:492).

2.6 CAUSES OF MALNUTRITION

Poor nutritional status during adolescence is an important determinant of health outcomes at a later stage of life. According to Mukhopadhyay, Bhadra and Bose (2005:213), the common causes of malnutrition among adolescents in the poor community are less access to food and inadequate knowledge about dietary requirements. In addition, the following factors such as food security, gender inequality, social and economic status, healthcare facilities, availability of water, proper sanitation, women's education status and housing that contribute to the nutritional status of any community need to be taken into consideration (Anwer and Awan, 2003:6). Adolescents are considered as a low risk group for poor health and nutrition and often receive little or no attention (Mulugeta, Hagos, Stoecker, Kruseman, Linderhof, Abraha, Yohannes and Samuel, 2009:5). The causes of malnutrition as described by UNICEF in Chapter one will be discussed in the next section (UNICEF, 1990).

2.6.1 Inadequate dietary intake

Dietary patterns are defined by Cutler, Flood, Hannan and Neumark-Sztainer (2009:323) as the distribution of foods by frequency and/or amount in the habitual diet. Alam, Roy, Ahmed and Ahmed (2010:87) stated that inadequate dietary intake is associated with family income, education and food-shortage from time to time. Several other factors such as loss of appetite, religious restrictions or beliefs, sickness, chewing related to dental problems and weight loss obsession add to inadequate intake. These aforementioned factors are common during teenage years.

Hill (2002:259) reported that teenage girls are not meeting the RDI for B-vitamins, fibre and other minerals. This indicates poor milk, meat and fruit and vegetables consumption. Breakfast skipping is another health compromising behaviour and unhealthy lifestyle adopted by most adolescent girls (Keski-Rahkonen, Rissanen, Virkkunen and Rose, 2003:842). Breakfast is an essential meal to provide energy to perform daily activities. The continual trend of adolescent's poor eating habits increases the consumption of high fat content, low, refined starch and added and such a diet is associated with weight gain (Ebbeling, Sinclair, Pereira, Garcia-Lago, Feldman and Ludwig, 2004:2828). Long hours of television viewing also encourages children and adolescents to consume more of highly advertised food, mostly

high in fat, sugar and salts than a healthy diet (Boynton-Jarrett, Thomas, Peterson, Wiecha, Sobol and Gortmaker, 2003). The following authors, Neumark-Sztainer, Hannan, Story, Croll and Perry (2003:317), believe that family meals improve adolescents' dietary quality, though practicality might be impossible due to parents' busy schedule. However, it remains essential to establish sensible dietary patterns for children at an early age which will form the basis of a healthy diet throughout life (MacKeown et al, 2007:636).

2.6.2 Sickness / illness

Childhood undernutrition is prevalent and continues to persist throughout adolescence but little attention is given to adolescents possibly for the belief that adolescents are a low risk group (Malhotra and Pass, 2007:8). Defourny, Minetti, Harczi, Doyon, Shepherd, Tectonidis, Bradol and Golden (2009:1) indicated that 146 million children in developing countries are underweight, an indication of a nutrient deficiency diet. The WHO declared that underweight is the single largest risk factor contributing to the global burden of disease in the developing world. Adolescents' diet falls short in calcium, iron, vitamin and minerals; thus WHO (2003) recommended the consumption of at least 400g of fruit and vegetables a day to prevent non-communicable diseases and micronutrients deficiency. Diet related diseases such as anaemia obesity and hypertension develop at an early age and find their way in both poor and rich families. The parental incapacity to know what food is best for their children to prevent diseases and malnutrition is attributable to this (WHO, 2006:9). According to Steyn et al (2009:145), 60% of global deaths are caused by chronic diseases of lifestyle (CDL) with four out of five being in the low and middle income countries. The CDLs are deadly yet are often ignored in South Africa because of the overwhelming prevalence of communicable diseases such as HIV/AIDS and tuberculosis (Mayosi, Flisher, Lalloo, Sitas, Tollman and Bradshaw, 2009:1). Inaccessibility to food is seen by Ivers, Cullen, Freedberg, Block, Coates and Webb (2009:1097) as the contributing factor that drives families into social crisis, migration and displacement, which subsequently puts them at increased risk of HIV infection and its consequences. The frequent infection caused by sickness and illness leads to loss of appetite, respiratory infection and malabsorption of nutrients, thus malnutrition prevail (Faber and Wenhold, 2007:395). HIV in particular increases the body's nutritional needs (World Bank, 2006:77), however, some HIV infected people are taking antiretroviral (ARVs) drugs on an empty stomach and toxicity has been reported if taken in by undernourished individuals

(Loevinsohn and Gillepsie, 2003). The HIV/AIDS infected person has nutrient absorption problems and it interferes with the body's ability to fight opportunistic diseases (De Waal and Whiteside, 2003:1236)

2.6.3 Insufficient household food security

Adequate nutrition is vital for building children's immune systems and cognitive development. Nord, Andrews and Carlson (2005:4) defined food insecurity as a persistent lack of access to adequate food in needed quantity and quality due to physical, social and economic hindrances. South Africa is known to be food secure; however, large numbers of households within the country are food insecure (Altman et al, 2009:345). Adults assume that cutting meal sizes, skipping meals and even going without food would better the situation and compensate food security. Hunger and poverty propelled the FAO World Food Summit to set goals to reduce poverty in poverty stricken populations by 2015 (Shetty, 2006). In households affected with HIV/AIDS, poverty can be more severe, as people with HIV/AIDS often leave their jobs due to sickness. Also, HIV infection reduces the efficiency of nutrient absorption and utilization partly because of frequent diarrhoea due to compromised immunity (Ivers et al, 2009:1097).

2.6.4 Education and ignorance

Malnutrition violates a child's human right to lead a healthy life. Malnourished children have lowered resistance to infection. Nutritional knowledge influences quality of life and impacts positively on individuals' nutritional status. Dietary knowledge and access to resources are critical to improve health and nutrition in a sustainable way. People perish due to a lack of knowledge and are often unaware of the health and nutrition programmes available. David et al (2008) believed that when the mind is adequately fed with necessary information to produce good food is more effective and useful in fighting hunger and poverty. Briggs, Safaii and Beall (2003) strongly believe in nutrition education as one of the fundamental tools in promoting health, improving eating habits and fighting diseases. Chopra and Darnton-Hill (2006:547) declared that women need to be empowered and capacitated with the relevant knowledge to provide basic motherhood needs such as hygiene, breastfeeding and weaning guidelines. When mothers are educated as affirmed by Chopra and Darnton-Hill (2006:547),

these women are in a rightful position to monitor, provide, care and seek medical attention for the health of the children. Walsh, Danhauser and Joubert (2003:89) added that inadequate food intake and unhygienic dietary practices are due to food ignorance and poor knowledge. O'Brien and Davies (2007:571) acknowledged that people are aware of what they should be eating but do not adopt proper eating habits. These authors further commented on the fact that knowledge alone does not lead to behaviour change, therefore, suggesting never ending awareness campaigns to introduce practical guidelines of healthy eating. The South African Department of Health initiated and implemented the Integrated Nutrition Programme in 1995 to address the issue of malnutrition through nutrition education (DBSA, 2008:4).

2.6.5 Lack of Nutrition Education at school level

Nutrition education as David et al (2008:131) described it, is the process through which people gain the knowledge, attitude and skills that are necessary for developing good dietary habits. Children spend one-third of the day at school, thus providing a practical environment for education about healthy food choices (Foster, Sherman, Borradaile, Grundy, Vander Veur, Nachmani, Karpyn, Kumanyika and Shults, 2008:794). Peres-Rodrigo and Aranceta (2001:131) argue that schools have the potential to reach out to children at a critical age when eating habits are still forming and pave a way for healthy behaviour and dietary habits to adulthood. The study by Neira and de Onis (2006:10) indicated that schools can positively influence the lives of most children and offer numerous opportunities for teaching children about healthy diets and physical activity. Children who are already at risk due to health nutritional problems come to school tired, hungry and unable to cope with learning demands or benefit from the lessons. Steyn (2010:63) stated that the curriculum-based nutrition programmes would significantly improve children's nutrition knowledge and dietary behaviour; hence the necessity for schools to develop school wellness policies and limit access to unhealthier food should be every schools priority. The need to educate the public about nutrition, as part of the overall effort for poverty eradication and food insecurity, was recognized at the World Food Summit, held at FAO Headquarters in 1996.

2.6.6 Poor maternal knowledge and child feeding

Undernourishment among mothers is a major reason why babies are born with a low birth weight (Chopra, 2004:12).The lack of knowledge about the safety of exclusive breastfeeding and about the risks of replacement feeding in environments with poor sanitation and economic constraints causes mothers to face difficult challenges about how to feed infants (Thairu, Pelto, Rollins, Bland and Ntshangase, 2005:3). However, exclusive breastfeeding stimulates babies' immune systems and protects children from diarrhoea and acute respiratory infections (ARI) and improves the response to vaccination.

2.6.7 Insufficient health services and unhealthy environment

Malnutrition occurs largely due to inappropriate family practices related to diet, health care and hygiene and/ or sanitation. Many people lack access to basic sanitation and a lack of safe drinking water still remains a great risk to health in developing countries and a determinant of cholera, dysentery (Cole and Neumayer, 2006:923), and other diseases associated with an unhealthy environment. Poor sanitation is a global challenge, as 1.1 billion people globally are reported to have no access to safe water, which explains why hygiene related disease are so high in the developing world (Eisenberg, Scott and Porco, 2007:846; Ashbolt, 2004:230). The worldwide diarrheal infection (88%) reported is due to unsafe water, poor sanitation and hygiene (Obi, Momba, Samie, Igumbor, Green and Musie, 2007:229). The WHO/UNICEF (2010:6) reported 2.6 billion people without proper sanitation in the world, with the largest number in South Asia, Eastern Asia and Sub Saharan Africa. China and India are counted among the countries that have made remarkable progress in improving water and sanitation. Of one hundred and three billion of the Chinese population, (89%) used clean water from improved sources and 88% of the 1.2 billion of Indian population (WHO/UNICEF 2010:10). On the contrary, the WHO (2009b:2) viewpoint is that SA has made a noticeable progress of about 88.6% households that have access to piped-borne water, 60.4%% to flush toilets, 61.6% to waste removal services and 80% to electricity. However, most South African rural population either have poor or no water infrastructure (Obi et al, 2007:229), and continue to suffer a lack of basic services such as flush toilets.

Rural villagers are susceptible to animal and human excretion contamination (Ashbolt, 2004:230) that is washed down to the river water used by many households. In other countries, for example Kenya, available toilet facilities are such that about ten families on average share one pit latrine, even existing sewerage are not properly administered resulting in blockages and causing stagnant water which ultimately attracts flies, rodents and mosquitoes (Muoki, Tumuti and Rombo, 2008:388.) Khanal (2012:9) argued that the significant progress that has been made towards achieving MDGs by 2015, and the percentage of the population without safe running water will be notable reduced. The cholera outbreak in Limpopo Province in 2008 was due to high incidence of poor sanitation, more than fifty people died. Yet gain in 2009, all South African provinces were afflicted by cholera which left about twelve thousand people severely affected (UNICEF, 2009a:16).

Stamoulis, Pingali and Shetty (2004:160), produced data showing that internal migration impacts negatively and puts more pressure on public services like safe water, sanitation, transport and medical care services. More often, poor households are far away from health facilities, travel long distances and curb unnecessary cost to obtain health care and medical attention. A further study by Woolard (2002) showed that poor people have problems in accessing health care due to lack of transport fare, food and clothing. A similar picture was seen in New Guinea where the condition has gone as far as closing down important infrastructures like clinics attributed to a lack of maintenance and services (Cammack, 2008:20). According to Blaauw and Gilson (2001:4), South Africa spends 8.5% Gross Domestic Product (GDP) on health care; however 60% of expenditure caters to benefit only 23% of the population with medical aids, the rest still depends on the public sector for primary health care services. The 2009 household survey indicated a remarkable decrease from 12.6% in 2002 to 6.6% in 2009 of people having no toilets in SA with the exception of the Eastern Cape (18.9%), Limpopo (8.8%), Northern Cape (8.7%) and the Free State (7.5%) as the only provinces still having the highest percentage (Stats SA, 2009:6).

2.6.8 Poverty

Household food insecurity is a major cause for under nutrition that is affecting large sections of the population. Poverty reflects insufficient resources relative to needs and the underlying socio-economic cause of malnutrition. Poverty is described by Sonn (2008:182) in

colloquium proceedings as the inability to access sufficient resources to maintain socially acceptable minimum standards of living, which in turn lead to fewer opportunities to participate in social and economic life with little capability to get out of the situation. South Africa is known to export different foods including subtropical, citrus and deciduous fruits, yet a greater number of South African population are food insecure or under nourished and unable to meet daily food requirements (Laker, 2007:311).

The data from the UNICEF (2010:3) shows that high level of inequality in SA in terms of the economic and social factors remain and have increased the intensity of poverty despite its high level of per capita GDP. Two-thirds of nearly 19 million South African children live in poverty, with either unemployed, sickly, single or elderly parents. Three quarters of rural areas inhabitants live below the poverty line (Chopra, 2004:3). This condition is placing ordinary South Africans, already struggling to meet their basic household needs, in a severe situation. The SA government strategy to implement social grants assisted in dealing with poverty which was expected to reach at least 9 million children under the age of 15 by 2009 (UNICEF, 2009a:5). Kuzwayo (2008:184) disclosed figures in relation to poverty, mentioning Limpopo (77%) and Eastern the Cape (72%) as the leading provinces with the highest number living below the poverty line. Despite the attempt to eradicate poverty, many countries like Malawi still suffer from micronutrient deficiency and 73% have inadequate food intake. According to Devereux, Baulch, Phiri and Sabates-Wheeler (2006), the Millennium Summit held in the United Nations (UN) in September 2000 acknowledged the alarming figures of (1.2 billion) people who still live in poverty, hence the goal for poverty reduction by 2015 in every part of the world was established (Shetty, 2006:6). Sadly, the author considered the setting of hunger and poverty reduction as a futile exercise as more often fails to succeed.

Reports by UNICEF (2005b:5) confirmed the slow progress towards achieving MDGs as outstanding promises are not yet fulfilled. The number of people in developing countries living in extreme poverty on less than $1.25 a day in 2005 fell from 1.8 billion in 1990 to 1.4 billion in 2005 (UN, 2009:7). However, high proportions of the population in Sub Saharan Africa still live below the poverty line (Rasouli, 2010:3). The country report on MDGs indicated that the proportion of people experiencing absolute poverty in SA has declined and the country has effectively halved the population living below the poverty line of a $1 per

day, an indication of achieving MDG1 of halving poverty by 2015 (UNDP, 2010:27). However, Chopra (2004:3) declared that more than three quarters of rural area population live below the poverty line.

2.6.9 High rate of unemployment

The level of unemployment contributes to poverty and malnutrition (Burns, 2004:5). The broad unemployment rate is estimated to be between 30-40% and has been steadily increasing since 1995, making South Africa's unemployment rate one of the highest in the world (Hodge, 2009:1). The increases in food prices lead to diminished food quantity and quality of essential nutrients (Von Grebmer et al, 2008:27). In 2009 South Africa was among the top 10 countries with the highest unemployment rates in the world (Tebandeke and Premkumar, 2011:69). Between 2008 and 2009, about 45000 jobs were lost in South Africa (Rasouli, 2010:16). The majority of people living below the poverty line are unable to adopt healthy habits due to high cost of food (Maillot, Darmon, Darmon, Lafay and Drewnowski, 2007:1815). According to Altman et al (2009:345), employment has been attended to since the 1990s, but not enough to address income poverty meaningfully; however, income security is a key factor in addressing food insecurity. However, President Zuma, in the State of the Nation Address, 2012, highlighted that the rate of unemployment came down from 25% to 23.9% because of the new jobs created in the previous year.

2.7 FACTORS CONTRIBUTING TO MALNUTRITION

2.7.1 Tuckshops

According to the American Dietetic Association, children generally eat one third of daily food intake at school globally, thus making the school a perfect site to promote healthy eating habits (Fernandes, Bernardo, Campos and de Vasconcelos, 2009:316). Other countries like New Zealand have at least 60% school children consuming food from the school tuckshop (Utter, Schaaf, Mhurchu and Scragg, 2007). Wiles et al (2011:130) quoted in World Health Organisation that schools should serve food that meets nutritional standards with healthy options such as water, milk, fruit juice, fruit sandwiches with healthy filling and low fat snacks. However, less nutritious food is still sold in many school tuckshops (Rideout, Levy-

Milne, Martin and Ostry, 2007:246). Supposedly, schools should be an environment where healthy eating is promoted and encouraged, however, some school tuckshops sell food of low nutritional value, high in fats and sugar (Naidoo et al, 2009:7). Nonetheless, Wiles et al (2011:130) opposed that the unhealthy choice of one meal during the day may lead to childhood obesity.

Many countries have guidelines on what food should be sold in schools, nonetheless, little is known if guidelines are ever implemented and monitored effectively (Young, de Boer, Mikkelsen and Rasmussen, 2005:88). In studies involving schoolchildren Kruger and de Villiers (2011:122) stated that many tuckshops in South African schools are making proceeds for the school management. It has been noticed that children in SA schools depict unhealthy eating habits. The sale of nutrient compromised food by school canteens is a message to children that it is acceptable to eat unhealthy food (Utter, Scragg, Percival and Beaglehole, 2009). Not much information is available about food sales in South African schools with the exception of two schools in Limpopo and in Cape Town (Temple et al, 2006:254). Young et al (2005:85) writing about consumption of fruit and vegetables among youth confirmed that it is fairly low and the level of consumption declines even further as they grow up. According to Temple et al (2006:253) in reference to the study conducted before, confirmed that 10% of students carry lunchboxes, 22% bought lunch which is high in fat and sugar in the school tuckshop. Story et al (2008:257) discovered that 9 out of 10 schools sell competitive food and the majority of offerings are obviously high fat or high sugar content foods and beverages. Tuckshop food suppliers should acknowledge that most children buy from tuckshops almost daily and, therefore, should try to make available nutritional quality food. Tuckshop owners confirmed that school children purchased food items frequently at least three times a week (Wiles et al, 2011:131).

2.7.2 Parents influence on children's food intake

As defined by Videon and Manning (2003:366), adolescence is the era of emerging independence including deciding when and what to eat. The recent study by Clark et al, (2007:132) indicates that children's diets may be influenced by parents, friends, school, the media and their own tastes and preferences. The authors further noted that parental influence is thought to be more in early childhood as parents act as providers, enforcers and role

models to their children. Parents as cited by Hamilton-Ekeke and Thomas (2007:457) as having a responsibility to cultivate eating habits which will form the basis for adult eating patterns. However, the increasing demand of the labour force makes it difficult for mothers to monitor their children's eating habits (Bassett et al, 2008:325). Parents may directly influence child behaviour towards eating by having control of what food should be offered (Jones and Fabrianesi, 2007:588). Neumark-Sztainer, Hannah, Story and Perry (2004:913) recommend fruit and vegetables for children, however, that choice may restrict energy intake and adequate nutrition which is vital during the childhood phase for a well developed physique.

2.7.3 School feeding programmes

In South Africa, school feeding programme date back to the 1940s when free milk was supplied in coloured and White schools. The main aim was to provide children with an early morning healthy snack to encourage school attendance and improve learner's ability to learn (Chopra and Tomlinson, 2007:17). However, van Stuijvenberg (2005:213) posits that school-feeding programmes only focused on relieving short term hunger without considering the importance of alleviating hunger through preventing micronutrient deficiencies and the quality of food supplied to school children. As a result micronutrient deficiencies exist in South African schools despite the existence of SFPs. Although SFPs across the world are known to have recurring problems, many countries operate such programmes effectively and combine them with nutrition education and school gardening (Bokeloh et al, 2005:160). Some of the common problems of school feeding programmes globally are cited as:

- irregular supplies
- high level of unhygienic standards where food is prepared and the serving method

Figure 2.1: School feeding programme in operation

- Food lost through spoilage or theft
- Disruption of teaching for meal preparations and serving
- Inferior food items
- Burdensome on reporting and monitoring
- Logistical difficulties of transporting large quantities of food with poor transportation infrastructure and communication systems.
- Delivery not according to requirements
- The lack of water, electricity and storage facilities
- Children approaching puberty and adolescent stage do not eat even when hungry because of peer pressure (Kiti, 2008:113) in (Colloquium proceedings).

2.7.4 Food eaten away from home

French (2005:910) commented that food most students purchased outside the school other than school meals are high in fat than food eaten at home. A related problem is that meals eaten outside the home tend to have a higher energy density with poorer nutritional quality and are served in larger portion sizes than food prepared at home (Rodrı´guez and Moreno, 2006:298; Story et al, 2008:260). Unfortunately, convenience or readily prepared foods are prepacked; compelling eaters to have less say over portion size and nutritional content served (French, 2005:910). Soft drinks and desserts are now served in portions that are two or more times larger than the standard serving size. An increase of soft drinks consumption hugely contributes to daily energy intake and contributes to obesity (Wenhold et al, 2008:450). Popkin (2006:293) commented that water and milk appear to be substituted by calorically sweetened beverages such as fizzy drinks. Wenhold et al (2008:450) associated long term low milk intake with shorter physique and poor bone structure. Presently, Story et al (2008:260) reported that Americans consume about 32% of their calories from food away from home and almost half (47.9%) of all food expenditures are spent eating out.

2.7.5 Peer pressure

Food consumption in the adolescent stage of life is influenced by many factors including media, financial feasibility, gaining new body image and many more. Adolescent years are a time when the adolescent tries to establish their own identity yet desperately seeks to be

socially accepted by peers (Anyika et al, 2009:1596). Adolescence is a nutritionally vulnerable developmental stage because growth rate accelerates. Teens eating behaviour in terms of nutrient intake and food consumption may vary across different ethnic and socio-demographic subpopulations. According to Benavides-Vaello (2005:32), socio-environmental factors, family, peers and media, are believed to influence individuals' food habits and food choices. Media has a persuasive influence on children's food choices. The advertising of fast food directly encourages teenagers to overeat (Steyn et al, 2009:146). Peers and friends can also play a role influencing each others' food selection and behaviour or types of foods children and adolescents prefer to consume (Elmo, 2009:6). Basset et al (2008:326) said peer pressure, acceptance and conformity accelerate as teenagers assume independence in purchasing food away from home. Peer approval and identity compel teenagers to conform to the standard approved and acceptable to peers (Story et al, 2002).

2.7.6 Eating disorders

The South African society is in a process of drastic change, and one of the greatest changes that have been observed is in the life-style of the black population groups where paradigm shift from traditional lifestyle to a Western lifestyle is observed. Eating disorders were predominantly perceived to be a White, Western higher socio-economic phenomenon. However, as Western cultural values have been embraced, eating disorders appear to have become prevalent across racial, ethnic and socio-economic groups (Mould, Grobler, Odendaal and De Jager, 2011:137). The aforementioned authors further noted that black females are becoming more dissatisfied with the appearance of their bodies and have started to adopt unhealthy attitudes about being thin. The consequence of food behaviour characterized with insufficient nutrient intake results in eating disorders such as anorexia and bulimia nervosa. An individual with anorexia nervosa has a relentless preoccupation with dieting and weight loss that results in severe emaciation and sometimes death (Gowers and Bryant-Waugh, 2004:63). Typically eating disorders begin during teenage years, which progresses to an out-of-control stage (Mould et al, 2011:138). For teenagers, the intense desire for slim body size and shape influences the eating behaviour and subsequently leads either to **anorexia** or **bulimia** eating disorders. Kreipe (2006:2) described eating disorders as intake restrictions and extreme exercise, abstaining from food for a number of days, self inducing purging after eating, or use of laxatives immediately after eating large amounts of

food. The refusal to eat appears to be associated with psychological variables. It is a serious problem associated with premature death or life-long medical and psychosocial morbidity. More often, anorexic people avoid treatment and are unable to see the truth of the medical consequences of the disorder (Kaye, Fudge and Paulus, 2009:573).

2.7.6.1 Causes of eating disorders

- Genetics
- Depression
- Media (Cooke and Sawyer, 2004:27).

2.7.6.2 Warning signs of eating disorders

- Cooking for others yet not eating
- insisting on different meals to the family
- avoiding eating in public
- visits to the bathroom after eating
- frequent weighing
- constant focus on dieting, food or exercise
- meal skipping
- Fad dieting and use of laxatives (Jaworowska and Bazylak, 2007:240).

2.7.7 Urbanisation

Economic pressures and political factors have resulted in mass migration from rural areas to urban centres to improve the socio-economic conditions (Serfontein, Venter, Kruger, MacIntyre and Pisa 2010:22). Urbanisation as described by Kimani-Murage et al (2010:2) is an episode that leads to nutrition transition that brings significant dietary changes from a traditional diet rich in fibre and low in fat which originate from plant sources, to Western diets which are highly refined. Leon (2008) found, similar to Stamoulis et al (2004:160), that urbanisation is associated with diet and lifestyle changes characterized by increased consumption of high calorie and low nutrient diet, ready-to-eat-food, high sugar and salt content food items which subsequently increases the risk of obesity and other NCDs as compared to rural diets. The group mostly affected by malnutrition and the shift from rural to urban in South Africa are the native Africans. People in some rural areas have free access to

green leafy vegetables where it can be harvested from either unplanted land or home gardens and urban people are deprived of that opportunity. This rapid movement has produced massive slums in many developing country cities, where inhabitants lack secure tenure and may not have access to basic human services. Dannhauser, Bester, Joubert, Badenhorst, Slabber, Badenhorst, Du Toit, Barnard, Botha and Nogabe (2000:303) reported on the same situation that South Africans moved to cities to settle in informal settlements along the roadsides in search of better opportunities. In low-income neighbourhoods, high population density, poor housing structures, non-functional or non-existent garbage collection and health facilities are everyday challenges facing the people in this population group (Muoki et al, 2008:387). The speedy influx of people from rural areas to cities affects the economy to the extent that the government falls short in providing basic services and job opportunities to the increasing number of urban population (Fotso, 2006:2).

Urbanisation has been a complex phenomenon for food habits and health patterns. Rapid urbanisation often results in complex societal changes that can have beneficial and adverse impacts on population health. In the past the traditional African diet was based on harvested products and hunted animals. This form of diet was rich in fibre, carbohydrates and low in fat and sugar. That has subsequently changed due to urbanisation and socio-economic transition (Mbhenyane, Makuse, Ntuli, Mbhatsani and Sayed, 2008:2002). Raschke and Cheema (2007:663) believed that the abandonment of the traditional habits negatively impacted the diet which was known to be ideal, especially in the prevention of NCDs. What has been observed in SA is that people uncultured their own traditional food and ways of cooking and succumbed to the Western eating lifestyle, thus increasing mortality and morbidity (Viljoen, Botha and Boonzaaier, 2005:46). Low income city dwellers may be left with little choice but to continue to buy food in small quantities at a higher cost per-unit.

The African population has been sustained by indigenous fruit and vegetables especially in the rural populations for many centuries (Laker, 2007:311). Nowadays, African farmers who normally relied on growing basic food crops for food for the micro-environment were monopolized and encouraged to grow products such as flowers and fruits for exportation, compelling Africans to depend on low quality food imports (Raschke and Cheema, 2007:666). The decline in farming among Africans resulted in decreased wealth and loss of assets, which quickly increased food insecurity and poverty. The evidence has proved that

diabetes as a diet related disease is rare in communities where traditional lifestyle has been preserved, however, adoption of a Western lifestyle has increased overweight and obesity from 10 to 25% in these countries (Hossain et al, 2007:213). The rapid urbanisation specifically in SA has caused an increase in obesity owing to the types of food consumed (Faber and Kruger, 2005:238), as well as dietary and activity pattern change (Kruger et al. 2005a:352).

2.7.8 Food choices

According to Anderson, Porteous, Foster, Higgins, Stead, Hetherington, Ha and Adamson (2004:650), bad dietary practice in childhood will negatively impact on growth, development and diet related diseases. Individual behaviour to make healthy choices can occur only in a supportive environment with accessible and affordable healthy food choices. According to Alam et al (2010:93), adolescents are not the sole decision-makers in choosing what is to be eaten but parents, particularly mothers, often make decisions. Children need to be sensitized about diet and nutritional needs at an early age. Li and Wang (2008:94) described childhood and adolescence as a vital stage for the formation and attainment of dietary habits throughout life. Adolescents eating choices have been known to be unhealthy with not much care on the effect it has on life (Bassett et al, 2008:352).

Teenagers meal consumption may be influenced either by psychological and environmental factors such as hunger, mood, preferences and convenience (Bassett et al, 2008:352). Story et al (2002) like many authors, consented that adolescents' food choices are not meeting dietary guidelines, it consist of low fruits and vegetables, calcium rich food, yet rich in fat. Breakfast omission and irregular meal consumption is another common habit among adolescents, consequently promoting inadequate energy and nutrient intake (de Chermont, Prochnik Estima, Da Costa, Sichieri, Pereira and da Veiga, 2009:735). More often, teenagers eating and cultural traditional habits are replaced by high consumption of convenience food, thus the total energy intake has increased remarkably (Koletzko, Gue´ronnie`re, Toschke and Kries, 2004). Mostly, Raschke and Cheema (2007:669) affirmed that dietary choices are dependent on the socio-economic status of the family, thus financial deficient populations have less access to high quality food. The socio-economic variables influence the adolescents' eating habits, lifestyle and social behaviour (Goldberg et al, 2009:15). The escape from traditional

eating patterns has a negative impact on the economy and health considering the high level of fat and portion sizes served nowadays (Koletzo et al, 2004). Adolescents' attitude towards food is based on the hypothesis that healthy food does not taste good when compared to unhealthy meals (Baker, Rees, Stanopoulous, Bakhshi and Surujlal-Harry, 2007:15).

According to Videon and Manning (2003:366), adolescents' eating patterns are developed and shaped mostly by preferences and availability of food, body weight perception and parental and peer influences. It is now widely recognized that media have an influence on children's poor food choices (Briggs et al, 2003:506). Brown and Landry-Meyer (2007:34) believed that the family and school system are two relevant environments that are the most influential in shaping a child's life in relation to development of good eating habits.

2.7.9 Cultural beliefs, traditions and religion

Globalisation allows inhabitants to interact with different cultures and religions from all over the world. According to Mitchell (2004:7), culture is dynamic, continually changing and a difficult concept to define. Every culture has its own food preferences, eating patterns and style of cooking. Cultural groups often socialize teenagers to adopt certain types of eating habits. What people eat is determined by many factors, especially locally available foods. The cultural beliefs and nutritional related behaviours are intertwined and people automatically partake in purchasing and preparing food in a traditional way in order to preserve traditions (James, 2004:351). Culture also influences when, how and which foods to be prepared. Special foods for special occasions are important to a culture's identity. Often, food choices and food habits are embedded in culture and religion. The cultural and religious beliefs determine what should be eaten in communities; however, the food chosen in a cultural perspective does not always provide the optimum nutrient intake required (Mbhenyane et al, 2008:211). Culture and religion influences how food is prepared and mothers use such opportunities to introduce culture, meanings and traditions of ethnic meal preparation to teenage girls (Benavides-Vaello, 2005:27). Different cultures have different traditions, beliefs and values. Traditions are often associated with social events such as death, births and weddings. Each tradition performs its own rituals that often involve food in terms of fasting, feasting or observing certain religious days. Food taboos exist in many cultural groups that prescribe what is to be eaten (Mbhenyane et al, 2008:209).

Religious beliefs have great influence in many people. Some religions forbid certain foods, such as food of animal origin. In such instances, children are often socialised in a way to follow the belief system of the family. Other religious groups have certain superstitions and taboos about food such as the belief that fertilised eggs are more nutritious. So children growing up with such a belief will continue with this in their choice of food. Some churches forbid church members to eat certain traditional foods; others persuade members not to eat breakfast on Sundays in preparation for the Holy Communion (Viljoen et al, 2005:58). According to Kim (2007:122), religious teachings encourage healthy diet habits and an increase in physical activity as a form of worshiping God. Somehow people need to be encouraged and convinced that African traditional foods remain the best diet for good health and lowers the risk of food related diseases (Vorster and Bourne, 2008:242).

Social and gender discrimination in countries like Pakistan shows that girls are served smaller amounts of food than boys and are completely deprived when there is insufficiency, whereas boys are served special and quality food. In addition to that, girls' health is often ignored and less money is spent on health (Anwer and Awan, 2003:6).

2.7.10 Divorce

An increase in divorce increases poverty because two adults generally have greater opportunities to avoid poverty because of the combined income (Cancian and Reed, 2009:21). Divorce has led to one party contributing to food purchasing and caretaking thus reducing the amount of money spent on food (McQuaid, Fuertes and Richard, 2010:12). The calculations indicate that the poverty rate is 39.9% in female headed households with children compared to 7.5% of household with both parents and children (Cancian and Reed, 2009:24). More than 50% of Child Support Grant recipients come from female-headed households (Rasouli, 2010:12).

2.7.11 Pregnancy

Today's youth is faced with multiple social challenges. Teenage pregnancies are increasing more than expected. The statistics showed that 11.9% of South African teenagers were pregnant with black girls as the highest ethnic group (12.7%) in 2003 (Berry and Hall, 2009).

The situation has led to 15 million infants mothered by adolescents every year (Gupta and Jain, 2008:516). Consequently, early motherhood causes unnecessary stress and puts teenagers' life and health at risk at an early age. The increase of teenage pregnancy exposes the mother and child to dietary energy and nutrients risks because of socio-economic conditions of many households and partly contributes to a family's vicious cycle of poverty and malnutrition (Wenhold et al, 2008:455). Malhotra and Passi (2007:8) found that under-fed girls are at risk of being stunted mothers who are likely to suffer birth complications and to deliver low birth weight babies. As teenage pregnancy rate increases, school dropouts and grade repetition also increases, minimizing job competency opportunities (Gupta and Jain, 2008:519)**.** Grant and Hallman (2006) noted that South African girls progressed well in primary school, deviate at high school with most possibly pregnancy as the prime cause of the delay. Economics and nutrition are challenges for pregnant teenagers, and are most likely to give birth to low weight infants with a high risk of mortality (Moran, 2006). Teenage pregnancy increases the economic burden to parents since children's fathers are likely to be teenagers themselves, having no money to support the child. Iron deficiency, resulting in anaemia, is highly prevalent in women in developing countries and increased iron requirements in pregnancy are not often met by changes in diet or absorption (Baltussen et al, 2004:2678). To address the effects of teen pregnancy and prevent the intergenerational cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception (Mulugeta et al, 2009:6).

2.7.12 High Food Prices

Food is an essential commodity for people to live sustainable and healthy lives. A global crisis of high food costs is devastating for the working class and has led to a reduction in the quality and the quantity of food. The rising food prices, particularly of maize, a staple diet of the poor South Africans, pose serious problems for the urban and rural poor habitants (Altman, 2009:347). In general, higher food prices have nutritional implications and are associated with increased the risk of malnutrition, especially among children (WHO, 2010:13). The 2007 financial crisis deepened the challenge of poverty and made poor and needy households poorer by further lowering the income and many lost jobs (Von Braun, 2009:10). South Africans lost nearly a million jobs in 2009 alone due to the economic recession (Steytler and Powell, 2010:2). Brinkman et al (2009:1) accentuate that the victims

are households who spend a large percentage of their income on food purchasing. The UN Secretary General, Ban Ki-Moon, stated that economic hardship has made millions of people settle in vulnerable employment and increased the number of employed people who though employed cannot afford to provide for themselves and the families. Such populations rather buy cheaper food to eat without considering the impact it has health wise. In 2007 and 2008 there was extreme increase in food and fuel prices (Rasouli, 2010:18). Shortages of food due to food price increase may lead to reduced portion size and number of meals and reduced variety of food, poor nutrient intake and favouring certain household members over others for food consumption (Bhutta et al, 2009:1). The consequences of high food prices, is that when the basic human nutritional needs are not met, people become vulnerable to illness, school children's performance becomes poor and people become less productive (Brinkman et al, 2009:1). In 2008, world prices of wheat, maize and milk tripled that of the beginning of 2003, and rice was a staggering five times higher, while beef and poultry prices doubled. In such circumstances families can reduce food expenditures by eating less, skipping meals; or switch to lower-quality food or less diversity diets (Cohen and Garrett, 2009:11). Between October 2010 and January 2011 the food price index increased by 15%. This crisis posed an increase in the undernourished population from 848 million to 963 million between 2003-2005 and 2008 (von Braun, 2009:6).

2. 7.13 Climate change

Theoretically, climate change such as floods and heavy rains, tsunamis and natural disasters are increasing and cause panic to populations to such an extent that people leave homes. Apart from disastrous effects, climate change has long term consequences on environment and agriculture (University of KwaZulu-Natal, 2011:30) thus the onset of famine. Climate change may cause a fall in agricultural yields by 50% in 2020 if no precautionary measures are taken (Rasouli, 2010:17). As climate change further increases climate variability, temperature and the risk of droughts and floods and threatens the agricultural productivity, production costs will rise (von Braun, 2009:8). President Jacob Zuma in his statement on 8 January 2008 spoke about the climate change threat and the burden it places on the poor people of SA and suggested immediate resolution with regard to the reduction of greenhouse gas emissions (Roberts, 2008:535).

2.7.14 Displacement

South Africa as stated in the Situational Analysis of Children is still recovering from the effects of Apartheid where black children were left without food, shelter and health services while families were destroyed by political violence (UNICEF, 2009b:26). The shortage of food compels the population to wonder in search of greener pastures. Many of the very poorest people live in areas so remote that it was impossible to reach out to national and world food markets. Similar situations occurred for most Zimbabweans due to political and economic crisis (Carver, 2002:6). Children younger than five years either accompanied by siblings or adults found themselves on a journey to SA, and sometimes had to cope in the desert without parents (UNICEF, 2009a:9). More often, the camp sites have no proper sanitation, no access to clean water and no food nearby (Carver, 2002:8). Von Grebmer et al (2008:9) reported that about three million people were refugees in Darfur because of the civil war that ravaged the country for many years. People had to be supplied with food in refugee camps as working in the fields was impossible.

2.8 METHODS TO DETERMINE DIETARY INTAKE AND SOCIO-DEMOGRAPHIC INFORMATION

2.8.1 Socio-demographic questionnaire

Socio-demographic questionnaire provided information on factors relevant to the household regarding the environment in which the child lived. Information gathered is based on age, gender, employment status, living conditions, et cetera.

2.8.2 Quantitative Food Frequency Questionnaire (QFFQ)

QFFQs are lists of foods that are important contributors to the population's intake and nutrients. It is a reflection of a longer period of consumption. Food and beverage portion sizes are quantified in terms of grams or millilitres (Rankin, Hanekom, Wright and MacIntyre, 2010:67). Existing adapted or compiled lists adjusted to meet the objectives and the target population of the study project can be used. The questions are based on the type of

food, preparation method, frequency of meals the respondent consumed on the day the particular food is consumed in a month period. The lengths for QFFQs vary depending on the type of assessment and are more useful in assessing groups than individuals (Wolmarans, Kunneke and Laubscher, 2009:59).

2.8.3 Food Frequency questionnaire (FFQ)

A Food Frequency questionnaire is a list of questions on food whereby the participants respond by providing the frequencies and the amount of foods eaten per day, per week or per month. The advantage of using FFQ is that it can be easily used in population with low literacy level. However, the disadvantage of this method is underreporting as the recall relied on the participant ability to remember food consumed over a long period of time (Rankin et al, 2010:67).

2.8.4 24hr Recall

In South Africa, the 24hr recall method has been used for the collection of dietary intake data in several large epidemiological studies to determine dietary intakes of the population (Wolmarans et al, 2009:59). According to Rankin et al (2010:69), the use of the 24hr recall method was developed by Weihl in 1942. The method is still a valid method used to determine dietary intake of adolescents and is appropriate for use in different ethnic groups. It is a dietary recall in which the respondent is asked to remember and report all food and beverages consumed in the previous 24 hours or on the previous day. The recall is usually conducted by personal interview with well trained interviewers as much of the dietary information is collected by asking probing questions. The 24hr recall method requires participants to recall all food and beverages consumed during the previous 24 hours. It is a reflection of current dietary consumption (Wolmarans et al, 2009:59). The interviewee is expected to remember the exact food consumed in the last 24 hours. The procedure can be repeated depending on the type of study; however, numerous 24hr recalls done may provide a realistic idea of the individual's usual intake. The information gathered is analyzed by experts in the field. In general, 24hr recall is used to determine the dietary intake and assess the trends and dietary habits of a large group. Usually, 24hr recall and QFFQ are used concurrently to improve the accuracy of intake estimation (Joubert and Ehrlich, 2008:294). A

limitation of this method is that it is inclined to underreport dietary intake as the recall depends on the participants' memory.

2.8.5 Food record

Food records are written accounts of the actual intake of food and beverages consumed during a specified time period. According to Rankin et al (2010:66), food records is a better option to be used for dietary assessment as the researcher cannot solely depend on participants' accuracy in remembering portion sizes. Therefore, food records are used as a reference method to determine the validity of other dietary assessment methods used in the study. With food records, participants record all types of food and beverages consumed for a period of between one to seven days (McPherson, Hoelscher, Alexander, Scanlon and Serdula, 2000). A food record can either be a weighed food record or an estimated food record. A weighed food record requires the subject or caregiver to weigh all foods and beverages consumed by the subject during a specified period of time (Gibson, 2005:45). For reliability and validity purposes, participants need to be trained to measure correctly and accurately and report the intake of different dishes. The food record is considered accurate provided the information is recorded instantly after consumption, or on the same day. Numerous food records from non-consecutive days and different seasons are necessary to conclude on estimates of habitual intake. Food records are more appropriate for small groups (Joubert and Ehrlich, 2008:297). With food records, error due to memory loss is reduced because the information is collected at the time of consumption (McPherson et al, 2000). However, the interviewee may be burdened by providing recording food consumed on daily basis (Rankin et al, 2010:67).

2.8.6 Diet history

A diet history is used to assess a person's usual dietary intake and the factors influencing intake over a period of time. If an individual does not have a constant eating pattern, the method is not appropriate. This method is an all inclusive method of getting diet related information. Diet histories are effective in small groups or in individuals (Joubert and Ehrlich, 2008:296).

2.9 METHODS TO DETERMINE NUTRITIONAL STATUS

2.9.1 Anthropometric indicators

The WHO (1995) mentioned that anthropometry is and has been used during adolescence in many situations related to nutritional status. Anthropometry encompasses a variety of human body measurements, such as weight, height and size, including skinfold thicknesses, circumferences, lengths and widths. Anthropometry is a key component of nutritional status assessment in children and adults**.** Anthropometric measurements are used to construct indices for malnutrition that are then compared to reference values or standards (Faber and Wenhold, 2007:393). Anthropometric indicators are taken for individuals as another form of nutritional assessment and are a valuable tool to assess both forms of malnutrition (under nutrition and over nutrition). These are purposely used to assess health and nutritional status (Joubert and Ehrlich, 2008:299) along with monitoring the effects of nutrition interventions. The person responsible for taking the measurements should be trained. Anthropometry encompasses a variety of human body measurements, such as weight, height, and size, including skin fold thicknesses, circumferences, and is a basic element used in assessing nutritional status assessment in children and adults. It is a better reflection of children's general health status, dietary adequacy and growth and development over time (McDowell, Fryar, Ogden and Flegal, 2008:1).

2.9.1.1 Height measurements

Height measurements are helpful when used concurrently with other anthropometric assessment measurements. The height measurements can be obtained using either a direct or indirect approach. A measuring rod or stadiometer also called a height board is the direct approach method where an individual measured would stand flat. Indirect method is a more valuable and better option for an individual who cannot stand or stand straight due to age, sickness or paralysis. Indirect methods include arm span (a person stands straight with arms wide open), recumbent length (using a tape measure while a person is in bed), suitable for people who are in a coma or critically ill, infants, children younger than 3 years and knee height measurements (WHO, 2008b).

2.9.1.1.1Method to measure height

- Height board must be the on level ground
- Shoes, socks and hair grips have been removed
- The back of the head, shoulder blades, buttocks, calves and heels should all touch the vertical board
- Legs should be straight, with the head looking straight ahead
- The horizontal line from the ear canal to the lower border of the eye socket runs parallel to the baseboard (WHO, 2008b:23).
- Measurements taken twice and average is used

2.9.1.2 Weight measurement

The scale should have the following features:

- Solidly built and durable
- Electronic (digital reading)
- Measures up to 150 kg
- Measures to a precision of 0.1 kg (100g)
- Allows tarred weighing, which means the scale must be zero (0) rated before standing on it (WHO, 2008b:15).

2.9.1.2.1 Method to measure weight

- The scale should be placed on a flat, hard, even surface, preferably not on a loose carpet or rug
- To turn on the scale, cover the solar panel for a second. The number 0.0 appears and is an indication that the scale is ready
- The person being measured should stand in the middle of the scale, feet slightly apart (on the footprints, if marked), and remain still until the weight appears on the display.
- Record the weight to the nearest 0.1 kg (WHO, 2008b:18).
- Measurements taken twice and average is used

2.9.1.3 Body Mass Index

BMI is a number that associates a person's weight with his or her height/length (WHO, 2008b:27). BMI is a validated measure of nutritional status and is the commonly used indicator to measure both over nutrition and under nutrition in adults and adolescents (Nambiar et al, 2008: 148). According to Yan, Bingxian, Hua, Jianghong, Jun, Dongliang, Yujian, Ling, Yanying, Kaiti, Xiaohai and Da (2007:748) diagnosis of obesity and overweight in children and adolescents is not easy because it is age and gender based.

The formula used to calculate BMI is as follows: weight in kg divided by length in metres squared (Weight in kg ÷ height in metres^2). A BMI over 18.5 indicates adequate nutrition; below 16 is an indication of energy deficiency, BMI between 25 and 30 indicates over nutrition, whereas >30 BMI indicate obesity (McCarthy and Ashwell, 2006:988). BMI has been widely accepted to measure body fatness although it has some restrictions as it falls short in measuring fat distribution, however, early detection of overweight and obesity is vital for the onset prevention of NCDs later in life (Yan et al, 2007:748). Wenhold et al (2008:445) also added that BMI is not so accurate when used in measuring obesity and overweight in stunted children, additional measurements are recommended in that scenario especially when the focus is on the excess body fat measurements, for example, in detecting subcutaneous fat, skinfolds are measured.

2.9.1.4 Waist-to Height ratio (WHtR)

Li, Ford, Mokdad and Cook (2006:1391) supported by Nambiar, Truby, Abbott and Davies (2008:148) communicated a new version that has been recommended that the waist-height ratio (WHtR) can be used to predict the abdominal obesity and cardiovascular diseases in adults and children. Nambiar et al (2008:148) asserted that the WHtR is calculated by dividing the waist circumference (WC) at the level of the umbilicus by height, both measured in centimetres (waist/height) on the basis of standard anthropometric measurements. A ratio of 0.50 has been proposed as a boundary for indicating whether the amount of upper body fat accumulated is excessive and poses a risk to health (McCarthy and Ashwell, 2006:989). A WHtR less than 0.5 or less is considered to be normal in adults. The waist-height ratio is said to be advantageous to BMI, as its calculation includes waist circumference (WC). In addition

WC is a better indicator of visceral fat than BMI in children (Li et al, 2006:1391). The method used to calculate this new index is to divide WC by height which was both measured in centimetres. Numerous studies have proved that WHtR is a better option to BMI in its ability to predict childhood morbidity, however, in children and adolescents it is not yet decided upon whether is the best method of adjusting WC for height (Nambiar et al, 2008:148).

2.9.1.5 Height-for-age

Stunting, reflected by low height-for-age, is a measure of chronic malnutrition. Stunting is a failure to reach linear growth potential because of inadequate nutrition or poor health (World Bank, 2006). Horton et al (2008:3) defined stunting as more than 2 standard deviations (SD) below the population standard for height-for-age. Stunting is generally considered to reflect chronic malnutrition. This indicator can help identify children who are stunted (short) due to prolonged under nutrition or repeated illness and an indication that the child had been long receiving inadequate nutrients to support growth (Müller and Krawinkel, 2005:280). Height-for-age is irreparable in children more than 2 years of age and correlates with a number of long term factors such as protein insufficiency, low energy intake and micronutrient defect mainly of zinc and iron (Faber and Wenhold, 2007:394). Other factors such as improper feeding practice and continual exposure to infection may contribute to stunting (Anwer and Awan, 2003:3). Usually, this is a good indicator of long term undernutrition among young children (World Bank, 2006). Stunted children have poor school performance caused by impaired mental development (Faber and Wenhold, 2007:394).

2.9.1.6 Weight-for-height

Underweight (weight-for-age) is a low weight for age. It implies wasting and is an indicator of undernutrition (World Bank, 2006). Müller and Krawinkel (2005:280) described it as a recent or current severe process leading to significant weight loss, usually a consequence of acute starvation or severe disease (Müller and Krawinkel, 2005:280). The underweight is used to assess whether a child is underweight or severely underweight, but it is not appropriate to classify a child as overweight or obese. This indicator is the most commonly used anthropometric indicator; it compares the weight of a child to the weight of a normal

child of the same height (Joubert and Ehrlich, 2008:299). Generally, underweight is caused by diets with insufficient nutrients necessary to maintain healthy living and high rates of infectious disease (de Onis, 2008:8). The weight-for-age index expresses the weight of a child in relation to his age for the children up to 10 years of age. The index is an indicator of failure to grow. Wasting describes a considerable weight loss in children, and a measure of acute malnutrition (Faber and Wenhold, 2007:393), usually due to severe starvation and/or severe disease.

2.9.1.7 BMI-for-age

The BMI-for -age is a good indicator for assessing over nutrition in children and adolescents. However, Deshmukh, Gupta, Bharambe, Dongre, Maliye, Kaur and Garg (2006:141) considered weight for age as uninformative and even misleading in the absence of corresponding information on height for age. A BMI-for-age above the 85th percentile for the appropriate age and gender is recommended as a cut off point for risk of overweight and above the 95th percentile as overweight (Wenhold et al, 2008:445). Yan et al (2007:748) accentuated that BMI used and accepted is a reasonable measure of body fatness, however, drawbacks has been identified that it cannot effectively determine fat distribution. It indicates wasting and an indicator for under nutrition. Low BMI-for-age indicates a measure of both chronic and acute malnutrition (Faber and Wenhold, 2007:394).

2.9.1.8 Waist circumference (WC)

Waist circumference measurements are used to assess the abdominal fat content. The WC is measured around the waist through a point one third of the distance between the xiphoid process and the umbilicus, using a non-stretchable tape measure (Hammond, 2008:402). An easy and effective way for detecting abdominal obesity in both adults and children is through using waist circumference. It is a better indicator of visceral fat in children than using BMI (Li et al, 2006:1391). Waist circumference has been attributed as a better indicator in predicting risk of heart conditions in both adults and children (Yan et al, 2007:749).

2.9.1.9 Mid-Upper-Arm circumference (MUAC)

MUAC is measured in centimetres halfway between the acromion process of the scapula and the olecranon process at the tip of the elbow (Hammond, 2008:403). MUAC is used for the assessment of nutritional status. It is a good predictor of mortality and in many studies, MUAC predicted death in children better than any other anthropometric indicator. The MUAC is best used in children between six and fifty nine months of age and assessing acute energy deficiency in adults during famine (Bob-Manuel and Udoaka, 2009).

2.9.1.10 Head circumference

Head circumference is useful in children under the age of three. Paper or a metal tape measure marked in tenths of a centimetre is used. The head is measured at a greatest circumference, above the eyebrows and pinna of the ears and around the occipital prominence at the back of the skull (Hammond, 2008:403).

2.10 STRATEGIES TO ADDRESS MALNUTRITION

The global dietary data suggest that children's diets in general are not regular and not meeting dietary recommendations of health authorities (Campbell, Crawford and Hesketh, 2006), hence development of the FBDGs to educate the South African population. Other cheaper means to deal with the prevalence of micronutrient malnutrition is food fortification and vitamin and mineral supplementation. Economic growth and productivity will drastically change and effectively improve child and maternal survival, psychological and intellectual capabilities (The World Bank, 2006:71).

2.10.1 South African Food Based Dietary Guidelines

Traditional nutrient and CHO dense diets such as grain, legumes, fruits and vegetables are being neglected for fatty nutrient empty foods. The paradigm shift is evident in developing countries such as South Africa where populations relocate from rural to urban areas. The South African Food Based Dietary Guidelines were introduced in 1997 as part of the nutrition promotion focus area. The quantity and quality of dietary intake must be sufficient, and

nutrients must be consumed in appropriate combinations for the human body to be able to absorb specific nutrients. Health problems (nutrient deficiency diseases, obesity, cancer, heart conditions, diabetes) people suffer are closely related to the diet followed by a large percentage of people. To address nutrition related problems, South African dieticians developed FBDGs based on locally available foods to be followed to improve peoples' lives. The FBDGs are dietary goals orientated in terms of food rather than nutrients (Maunder and Meaker, 2007:402). The guidelines are concise, understandable and applicable to all consumers irrespective of race, culture or ethnic background.

The World Health Organisation (1998) suggested that FBDGs be country specific to meet the specific needs of the population. Originally, the FBDGs were proposed by the FAO and WHO; South Africa adopted and tested the proposal in KwaZulu-Natal and Western Cape Provinces (Steyn et al, 2006:66). The dieticians and other health professionals were trained to communicate the FBDGs; nonetheless, workforces especially at community level were unavailable to deliver the message. The FBDGs were perceived as a solution to poverty reduction, therefore, Keller and Lang (2007:872) suggested that the FBDGs be included in the National Integrated Nutrition Programme (INP), the Agricultural Policies for Household Food Security and the Poverty Alleviation Programme.

The Food Based Dietary Guidelines

- Enjoy a variety of foods.
- Be active.
- Make starchy foods the basis of most meals.
- Eat plenty of fruit and vegetables.
- Eat dry beans, peas, lentils and soya often.
- Meat, fish, chicken, milk and eggs can be eaten every day.
- Eat fats sparingly.
- Use salt sparingly.
- Drink lots of clean, safe water
- If you drink alcohol, drink sensibly (Gibney and Vorster, 2001) and (USDA, 2005).

The FBDGs were adopted in South Africa by the DoH in 2003 and are used as the basis for a healthy eating plan. Food Based Dietary Guidelines carried the messages that are action oriented and expressed dietary goals in terms of food rather than nutrients. The FBDGs are tested to ensure that consumers are able to understand and apply in daily food preparations correctly. FBDGs are cultural sensitive and consider the socio-economic conditions and cultural food available in the environment in which population lives (Behr and Ntsie, 2008:339) and provide dietary guidance in terms that are understandable to most consumers.

2.10.2 Integrated Nutrition Programme (INP)

The INP is the outcome of the recommendations made by the Nutrition Committee appointed by the Minister of Health to develop a nutrition strategy for South Africa. The initial aim of the INP is to solve nutrition problems and promote good nutrition for all South Africans. Malnutrition, according to DoH (2008), remains the most common cause of children's death throughout the world. The INP was conceptualised based on the recommendations made by the Nutrition Committee which was appointed in August 1994 by the Minister of Health to develop a nutrition strategy for all South Africans. The INP as it is known aims to facilitate a coordinated inter-sectoral approach to solving nutrition problems in South Africa (DoH, 2008:1). The INP priority area is micronutrient malnutrition control; however, the gap between policy and implementation is evident in the lack of programmes to deliver micronutrients to those most affected. The INP is the main policy addressing child malnutrition in South Africa and indeed resulted in some positive outcomes, however, community participation, political motivation from all key stakeholders, as well as technical expertise to design, implement, monitor and evaluate programmes are contextual factors prohibiting the success of the programme (Musvaire, 2009:19). Thus far, there have been several achievements linked to the INP such as salt iodisation and food fortification which subsequently reduced iodine deficiency disorders especially in South African children (Musvaire, 2009:23). The INP of the Department of Health (DoH) also plays a significant role in monitoring child growth by providing the best possible nutrition especially in preventing and controlling the level of malnutrition for all South Africans (Faber, Schoeman, Smuts, Adams and Ford-Ngomane, 2009:185).

The Integrated Nutrition Programme of the DoH had priority target groups for nutritional intervention while providing nutrition education to all people. The target groups were:

- Children under six years
- At risk pregnant and lactating women
- Primary school children from poor households
- Persons suffering from chronic diseases of lifestyle or communicable diseases such as HIV
- At risk elderly persons (Hendricks and Bourne (2010:48) and DoH (2008).

The INP focuses on specific areas to prevent malnutrition. The goal of the INP was to enable all women to exclusively breastfeed children for the first four to six months of life, and thereafter to continue breast-feeding in addition to the introduction of appropriate complementary foods for up to 24 months of age and beyond (DoH, 2008). Some programmes under the INP were delivered through primary health care facilities, and one such programme was the Nutrition Supplementation Programme (NSP). The INP intended to give nutritional advice to less-resourced communities, and poverty stricken households were identified and referred to the government's poverty alleviation programmes. Weight loss in children due to worm infestation was treated at the clinics with de-worming medication. The Primary School Nutrition Programme was made available at specifically identified sub-economic schools. The schemes were governed by DoH jointly with the Department of Education. The provincial government aimed to reach 125000 children at 847 primary schools in the KZN province by 2004 with its school feeding programme (University of Cape Town (UCT), 1997 and DoH, 2008).

2.10.3. Nutrition Supplementation Programme (NSP)

Child malnutrition is a major problem in South Africa despite implementation of various policies and programmes. The NSP is a rehabilitation programme intended to last for a maximum of 6 months and was aimed at undernourished inhabitants. The NSP plan formed part of the INP of South Africa (Andreson, Wandel, Eide, Herselman and Iversen, 2009:91). The programme is a state-subsidised nutrition intervention implemented to address malnutrition prevalence in the Northern Cape and other provinces. The NSP scheme is a short-term intervention aimed at addressing acute malnutrition (Hendricks, Roux, Fernandes

and Irlam, 2003:431) by helping underweight children gain weight and empower parents to tackle the malnutrition pandemic (Andreson et al, 2009:90). The main focus of the NSP is the provision of nutrition supplements according to age-specific criteria. Evaluations for NSP were conducted with unsatisfactorily outcomes regarding the effectiveness and quality of the programme. Dual assessments conducted in the same area and a number of problems with regard to implementation and compliance were found (Andreson et al, 2009:90).

Schoeman, Hendricks, Hattingh, Benadé Laubscher and Dhansay (2006:1008) further noted that funds are made available for nutrition-related provincial case management guidelines and implementation of the Integrated Management of Childhood Illness (IMCI) strategy aimed at addressing the nutritional needs of children less than 6 years of age at primary health care facilities. Nevertheless, child malnutrition in South Africa continues despite the implementation of these national nutrition policies and primary healthcare programmes initiated by the DoH (Oldewage-Theron and Egal, 2010:149).

2.10.4 National School Nutrition Programme (NSNP)

The NSNP is a poverty alleviation programme, targeting poor schools situated in the most disadvantaged areas of the country. The NSNP was introduced as a Primary School Nutrition Programme (PSNP) on 24 May 1994 in President Mandela's State of the Nation Address (van Stuijvenberg, 2005:213) under the Reconstruction and Development Programme (RDP). The objective of the programme was that the meal meets 30% of the daily energy needs of a primary school child. The PSNP was launched as an educational intervention with an attempt to improve the quality of life for all South Africans children, particularly the poor and those who had been marginalised. The PSNP was used as a spring-board for the development of other community-based nutrition projects. Since the inception of the NSNP as PSNP, the children who benefited from the programme were learners of the public primary schools. In 2004 the programme was transferred from the DoH to the Department of Education (DoE) and the name was changed to National School Nutrition Programme (NSNP). The main reasons for the transfer were that school feeding has educational outcomes and that the Department of Education is functionally responsible for schools. Catering only for primary school learners, and excluding learners in combined and secondary schools, was viewed as discriminatory by the Parliamentary Committee on conditional grants. However, the Fiscal

and Finance Committee survey of 2006 recognized the need to take the programme further to high schools. Therefore, the National Treasury reviewed and decided to increase the NSNP budget primarily for schools that were neglected before. Following that, the NSNP was launched in quintile (Q) 1 secondary schools in April of 2009, and extended to Q2 and 3 public secondary schools in April 2010 and 2011 respectively. Providing nutritious meals to learners was a key output of the programme (DoE, 2009:6).

The aims of the National School Nutrition Programme are as follows:

- To improve school attendance, late coming and produce quality results.
- Improve the quality of life through health and nutrition education though micronutrient supplementation and parasite eradication.
- To enhance broader development initiatives, especially in the area of combating poverty, and to link the NSNP into a broader Integrated Nutrition Programme and other RDP programmes (DoE, 2008:4).

Although the implementation of the programme was a success, Labadarios et al (2005), argued that its effectiveness is critical, as many school children are fed, yet the quality of food served is compromised. Tomlinson (2007) agreed with the above author that the programme does not seem to be benefiting the target population (children) nutritionally as expected. In addition, van Stuijvenberg (2005:214) was concerned that although micronutrient deficiencies were addressed in the NSNP, but less was said about the amount of micronutrients to be provided. This was confirmed by the survey done by the Medical Research Council (MRC) in primary school children of KwaZulu-Natal which depicted micronutrient deficiency in most children attending the school (van Stuijvenberg, 2005:213).

Regrettably, NSNP is highly politicized and is subject to corruption which makes service delivery impossible and there is little or no evidence that the programme has a positive impact on nutrition for participating children. The quality of food and control of food safety is often poor. Undoubtedly, when and if the corruption is minimised, the programme could have positive outcomes in keeping children in school (Tomlison, 2007).

2.10.5 Food fortification (FF)

Food fortification is different from other programmes, in that it entails the addition of nutrients to foods. Fortification is a nutritional intervention programme with a specifically defined target such that fortified food products are expected to become a main source of the specific added nutrient (WHO, 2009a). Food fortification refers to the deliberate addition of micronutrients to processed foods in order to provide health benefits. Micronutrient food fortification is a short and medium-term strategy of addressing the "hidden hunger" (micronutrient malnutrition). Food fortification programmes have been designed to restore nutrients removed during food processing (Allen, 2006:1055) and a deliberate increase of one or more essential micronutrient in food to improve its nutritional quality. The fortification of wheat and maize flour is commonly practiced in many countries as a cost-effective strategy to control and prevent micronutrient deficiency (Faber, Kvalsvig, Lombard and Spinnler Benadé, 2005:1032). According to the World Health Organisation Report in Geneva, Switzerland, food fortification is currently taken as an appropriate approach to address micronutrient deficiency, especially vitamin and mineral intake in populations (WHO, 2009a:1). The SA Department of Health (DoH) initiated and made recommendations for food fortification, and engaged the National Food Consumption Survey to provide statistics on the severity and causes of malnutrition in South Africa (Labadarios et al, 2005a:534). Motivated by the findings in October 2003 the decision was taken to fortify maize meal and bread with vitamin A, iron, zinc, folic acid, thiamine, niacin, vitamin B6 and riboflavin as these are widely consumed staple food in South African (Steyn, Nel and Labadarios, 2008:23). This was found to be a proper and cheaper method to eliminate micronutrient deficiency without interfering with the normal food pattern (Steyn et al, 2007:308). According to Darnton-Hill and Nalubola (2002), food fortification was used to target specific health conditions: goitre with iodized salt; rickets with vitamin D-fortified milk; beriberi, pellagra and anaemia with B-vitamins and iron (Fe) in enriched cereals. However, the effectiveness of the food fortification programme is dependent on the working partnership between government and food industries regarding practicality and affordability in accordance with the implementation of the strategy to be used (Kruger, Hendricks and Poaune, 2008:683).

Criteria for selection of foods for fortification

- the type of food should be food that can be eaten by all target populations
- the daily food consumption should be sufficient for each person and with small day-to-day variation in consumption
- the fortified food should be stable under standard conditions of storage and use
- the added nutrients should be physiologically available from the food
- the added nutrients should not put recipients at risk of excessive intake or poisonous effects
- the fortification process should not change the organoleptic (e.g. taste and appearance) quality of the food
- the fortification should if possible not push up the price of the food at all or substantially, and
- The fortification process should be economically feasible through an industrial process (NICUS, 2003).

2.10.5.1 Recent flour fortification recommendations

Particularly, wheat flour is rich in vitamins and minerals; however, most of these nutrients are lost during the milling process. Then the nutrients lost are replaced. Currently, flour is fortified with iron, zinc, folic acid, vitamin B_{12} and vitamin A. The rationale behind fortification is the benefit as flour is consumed by large population groups. It is believed that flour fortification would drastically reduce mortality and morbidity especially in the population with low folate intake (Bowley, 2010:2).

2.10.6 Nutrient supplementation

Nutrient supplementation is an addition of micronutrients to certain types of food to prevent or reduce a deficiency. Supplementation is a temporal measure used to lessen micronutrient deficiencies while long-term measures like food diversification and food fortification are not yet implemented. Nutrient supplementation is often the fastest way to control deficiency in

individuals or population groups that have been identified as being deficient. It is commonly used in populations that are far reached or not sufficiently covered by food diversification and food fortification programmes (Kruger et al, 2008:685). The insufficient intake of essential nutrients is an everyday challenge for many countries, particularly, the African continent, consequently the fortification of maize and bread flour was implemented to improve the intake of these nutrients (Steyn et al, 2006:66). Faber et al (2005:1032) suggest the use of nutrient supplements when the nutrient average requirement cannot be met through a normal diet provided that it is affordable for most of the population. Ferrous sulphate is inexpensive and is a widely used iron supplement as a treatment for iodine deficiency anaemia (IDA). Nutrient supplements are effective and provide resistance to diseases when used as prescribed and when vitamin A and iron are used in concurrently are found to be more effective in minimizing the prevalence of IDA. Vitamin A supplements for severely undernourished children, measles and continual diarrhoea is known to be effective and recognized as one of the most cost effective interventions for improving child survival (UNICEF, 2007a:1). The mortality and morbidity level may be noticeable reduced by 30% when vitamin A is administered in areas affected effectively (Nojilana et al, 2007:748).

2.10.6.1 Delivery Strategy of Vitamin A

Finding a suitable method to deliver vitamin A supplements was a challenge. In the 1990s delivery of vitamin A supplements was linked with Polio National Immunization days (NIDs), however, as the polio condition gradually diminished, it was made impossible for vitamin A supplementation to reach out to other regions. Other possible avenues were invented as an effort to incorporate vitamin A supplements with other health services. Capsules were supplied by UNICEF to most deserving countries from its donated supplies or through direct country procurement. The United Nations International Children's Fund and World Health Organisation recommended high dose supplements for women in post partum era so that all infants receive the necessary immune-boosting protection of vitamin A in the first six months of life. Coverage had been improved, 58% children were receiving two recommended annual doses with the exception of poor rural areas which are sidelined due to the country's failure to establish effective delivery channels (UNICEF, 2007a: 15)

2.10.7 Food diversification

Food diversification is a long term dietary and sustainable food-based approach to address malnutrition (Faber, Oelofse, Van Jaarsveld, Wenhold and van Rensburg, 2010:30). Dietary diversification or modification has been acknowledged as a strategy to prevent deficiencies of zinc simultaneously with other micronutrients. Food diversification is culturally friendly, economically reasonable, and sustainable, even in poor resource settings. (Gibson and Anderson, 2009:108). According to Savy, Martin-Prével, Danel, Traissac, Dabiré and Delpeuch (2007:132), dietary diversity is essential as no single food item consists of all nutrients sufficiently to ensure healthy and balanced diet.

2.10.8 Organic food

The organic food is grown without pesticides, herbicides, inorganic fertilisers, antibiotics and growth hormones and certain criteria used for production are different from country to country (Honkanen, Verplanken and Olsen, 2006:420). Wang and Sun (2003) found that organic farming has been branded as an effective way to improve food safety and environmental quality, however, its production and processing is determined by the market demand of the organic food products. The prime idea for organic food purchase is to obtain maximum value for money as Magkos, Arvaniti and Zampelas (2003:358) announced that organic food is healthier, tastier and more nutritious than conventional food. Consumers have lost some trust in conventional food due to crises such as mad cow disease, foot-and-mouth epidemic and due to concerns regarding the use of pesticides and insecticides in farming (Onyango, Hallman and Bellows, 2007:399). However, Honkanen et al (2006:421) found that purchasing of organic food is declining due to high price, making it less affordable for low income earners.

2.10.9. Nutrition education

Poor nutritional status during adolescence is an important determinant of health outcomes. Health and nutrition knowledge and healthy habits of female adolescents as explained by Alam et al (2010:87) have critical roles to play in maintaining future family health and

nutrition. Providing equality of opportunities in education encompasses taking care of the nutritional needs of all children for ensuring optimum growth and preventing learning disabilities. Nutrition education programmes aimed at increasing the level of awareness and knowledge about nutrition, application and long lasting practice (Barba and Feliciano, 2002:375). A lack of nutrition knowledge can have adverse effects on the choice of food, eating behaviour and habits. Parents with good nutrition knowledge are more likely to make healthy food choices for their children (Clark et al, 2007:132). The study findings by Hamidu, Salami, Ekanem and Hamman (2003:124) showed that 80% of malnourished children in Maiduguri, Nigeria are either born by mothers with no formal education or attended primary education. However, WHO (2010b:2) denied that malnutrition occurs in poor households only. The argument is that sometimes richer people do not always know what food or feeding practices are best for children and family members, thus causing malnutrition to persist even in households with adequate resources. Nutrition education aimed at transforming the children's mentality and making them aware of the risk associated with poor eating behaviour, thus equipping them with skills, knowledge and values necessary for healthy living and can be used as an appropriate instrument to improve individuals' food choices, attitudes related to food and nutrition (Wenhold et al, 2008:460). Dannhauser et al (2000) added that nutrition education which is based on individual needs coupled with human resources will automatically produce effective and long lasting results necessary for development of good dietary habits. Nutrition education should be directed to other avenues like nutritional needs during pregnancy, birth spacing and emphasis on the adoption of exclusive breastfeeding habits. In addressing nutrition education in South Africa, several nutritional programmes including the National Nutrition and Social Development Programme (NNSDP), PEM Scheme and the PSNP were implemented by both government and non government organisations. These programmes were focused on undernourished children (Greyvenstein, Hanekom, Kruger and Reitsma, 1999:107).

The data have proved that empowering people with information is an effective tool and key element in fighting hunger and poverty (David, et al, 2008:131). Pérez-Rodrigo and Aranceta (2001:132) also encouraged that nutrition education needs to be embedded in the school curriculum, not mainly centred on providing nutritional information, but also empowering learners with lifelong skills such as food hygiene, preparation, storage and preservation methods. School gardening, extra-curricular activities like visiting farms, food factories,

cooking clubs, restricting food types sold in school tuckshops can also be used effectively to promote nutrition education in schools (Wenhold et al, 2008:461). Kuzwayo (2008:228) added that nutrition education should entail a combination of activities such as the provision of relevant information, broadening people's capacity to absorb and embrace knowledge and assisting them in developing, adopting and implementing health eating practices. Behr and Ntsie (2008:336) concluded by saying that nutrition education should convey the message intended to, embrace attention, comprehension, relevance, credibility and acceptability.

Nutrition education is a valuable tool for promoting good nutrition in schools and communities. The guidelines to assist in promoting and accomplishing this are listed below:

- children need to be socialised at an early age about good nutrition and daily dietary practices
- educational programmes should be adapted to convey relevant messages to relevant target groups in terms of age, learning ability, availability and acceptability of food and culture
- help individuals to make a life commitment to good nutrition
- continually and gradually encourage school children to apply dietary knowledge on daily food choices
- Creating awareness programmes on the causes of malnutrition (University of Cape Town (UCT), 1997:68).

2.10.10 Government Grants

Child malnutrition is a major problem in South Africa despite implementation of various policies and programmes. Social grants have played an important role in improving household food security in South Africa (Altman et al, 2009:346). In 1998 social grants increased from 2.5 million recipients to 13 million in 2009 (UNICEF, 2009a:5). The government initiated support grants, child support grants and care dependency grants for children under the age of 18 that are physically and mentally disabled (Faber and Maunder, 2008:268). Approximately 28.3% of South Africans receive social grants with 31.6% blacks as the majority (Stats SA, 2009:19). Recently, South Africa allocated 3.5% of its GDP in 2010/11 to social assistance programmes specifically for children (Child Support Grant,

Foster Child Grant and Care Dependency Grant) and four different ones for adults (Devereux, 2010:4). The grants reached just over 8.1 million children by end January 2008 (Giese, 2008:17). In most families, social grants are the only source of income (Kimani-Murage et al, 2010:2). The amount of the Child Support Grant was set at R210 per month per child in 2008 and given to caregivers for children younger than 14 years (Faber and Maunder, 2008:268). Statistically, child support grants are the highest recipient covering more than 8 million and significantly reduce child hunger and poverty in many households (Devereux, 2010:4). However, child support grants are paid to the parents or caregivers meaning children with no parents cannot receive assistance. Again children with no birth certificate cannot access the grant. More than 30% children are entitled to receive grants but are excluded as a result of the registration process (UNICEF, 2009a:11).

2.10.11 Food assistance

The food assistance plan is frequently used to assist vulnerable households during periods of economic crisis (Barba and Feliciano, 2002:375). Food assistance as quoted in the World Bank (2006:74) is in a form of food subsidies and school feeding programmes. The amount of food that each state receives is based on the number of unemployed and the number of people with income below the poverty level in the country (USDA, 2010). Food subsidies are the most expensive way for addressing malnutrition and are poorly targeted. The effectiveness of the aforementioned food assistance rarely works as a nutrition intervention. Other types of food assistance available are dependent on the type or severity of the problem to be addressed. A general distribution is aimed at meeting immediate needs such as alleviating malnutrition and famine prevention. Also, a supplementary assistance is normally used to prevent severe malnutrition, as well as therapeutic feeding which offers medical and nutritional support in order to save lives. Possible causes of the problem could be the food scarcity as a result of drought, forced migration and movement due to natural disaster (Cogill and Richardson, 2008:6)

2.10.12 Food parcels

In 2000, the Department of Social Development (DoSD), National Food Emergency Scheme in SA was introduced with the aim of issuing food parcels to the population mostly affected

by starvation. It was a short term approach to reach out to the most deserving group, people who spend less than R300.00 on food per month (Moeng and de Hoop, 2008:290). In the past food parcels were distributed by clinics as a long term strategy to address malnutrition in South Africa. Later on, a NGO took over the project to relieve clinics (Behr, 2008:37). Food parcels recipients were identified by NGOs and community based organisations (CBOs). Each recipient was required to complete an application form at the nearby DoSD office and it took about 35 days for the recipient to receive a food parcel with the value of R300.00 (Moeng and de Hoop, 2008:290). Poor coordination of relief measures was evident in the distribution of food parcels in the Limpopo Province in the February 2000 flood. Most people were sent home without food. Resources such as food and blankets were not always enough for both communities of Manele and Mavambe affected by floods. There were no food parcels distributed in Mavambe and the report was contradictory as to when and what was provided during peoples' stay in the place of safety. Due to poor planning and lack of assistance from the government, the community together with business people took upon themselves to assist the affected people (Khandlhela and May, 2006:285).

2.10.13 Home gardens

Home gardening is one strategy for addressing malnutrition and micronutrient deficiencies at the household level, however, lack of access to land may be the most critical obstacle to creating home gardens useful to the poor (Mitchell and Hanstad, 2004:4). Many families are not aware that vegetables and fruits are nutritional. Nonetheless, home gardens are the major sources of vegetables for many rural communities (von Braun, 2009:7). Home gardening had been long practised by rural inhabitants as South Africans have been motivated to utilize the residential land for home gardening (Wenhold, Faber, van Averbeke, Oelofse, Jaarsveld, Rensburg, Heerden and Slabbert, 2007:328). According to Faber and Wenhold (2007:397) many countries have adopted home gardens' initiative to enhance the cereal-based diet of rural households. The consumption of vegetables such as sweet potato, carrots and green leafy vegetables has been known to improve vitamin A status (Musotsi, Sigot and Onyango, 2008:376). In the Progress Report, Rasouli (2010:4) made a call to all leaders to encourage rural women's access to land, and seriously consider investing in agriculture. In South Africa predominantly African people practise smallholding agriculture (Wenhold et al, 2007:327) and as a result the term smallholder agriculture is often used when referring to the farming

that is practised by African people in this country. Vegetable cultivation and animal farming can be a long term approach to supplement food and income in underprivileged households (Cohen and Garrett, 2009:8). However, Halweil and Nierenberg (2011:5) mentioned that the African nations assign only 10% of the national budgets to agriculture.

2.10.14 Nutrition improvement during pregnancy

Adolescents who fall pregnant with poor nutritional status are likely to give birth to smaller infants because of the competition for nutrients between the growing adolescent and the growing foetus (Anyika et al, 2009:1596). Children who suffer from malnutrition in utero life and in the first two years after birth suffer from wide range of long-term consequences (FAO, 2005:20). The UN (2009:12) reported that pre and post pregnancy nutritional status is crucial in determining the birth weight of the baby. Malnourished mothers are likely to give birth to low-birth weight babies who are at greater risk of dying in infancy or suffer from stunting during childhood (FAO, 2005:20). Likewise, the risk of complications and death increased if women were underweight before pregnancy. Under nutrition is an ongoing process which often creeps in during pregnancy up to at least the first two years of child's life (World Bank, 2006:56). Therefore, the World Bank (2006:16) recommends that the under resourced government should focus on the window of opportunity (pregnancy through the first two years of life) because that is where irreversible child damage occurs. Alfani and Zeljic (2008:7) confirmed that pregnant woman can have several micronutrient deficiencies leading to complications including death during and after delivery.

2.11 PROGRESS TOWARDS ACHIEVING MDGs IN SOUTH AFRICA

The United Nations System Millennium Development Goals are the world's targets for addressing extreme poverty while promoting gender equality, education and environmental sustainability within a specific period of time (Chopra, Lawn, Sanders, Barron, Abdool Karim, Bradshaw, Jewkes, Abdool Karim, Flisher, Mayosi, Tollman, Churchyard and Coovadia, 2009:1). The world is coming closer to 2015, the deadline for evaluating the progress towards achieving the MDGs. The political framework has been established to attain this global ambition. The MDGs relate in some way to food, nutrition and health and are beginning to influence international nutrition trends for the better although much remains to

be done (Wahlqvist, 2008:366). Progress towards the other seven MDGs is highly dependent on the success of the outcomes in achieving the first goal, so malnutrition is an underlying factor of all the MDGs (Muller and Krawinkel, 2005:281). The progress made had been hindered by the 2007-2008 global food prices, staggering economic growth and lack of resources.

Due to high cost of food the hunger and poverty prevalence has mounted from 16% in 2006 to 17% in 2008 in developing countries (UN, 2009:4). Jinabhai et al (2006:26) emphasised the importance of regular assessment in order to monitor the progress, nevertheless the achievement of MDGs is conditional on country's commitments to the goals and targets (Rasouli, 2010:38). The appraisal made by MEC, Trevor Manuel, revealed that South Africa is making satisfactorily progress in achieving most of the MDGs five times more before 2015, although Chopra et al (2009) viewed progress as deficient. The then deputy president, J. Z. Zuma added in his speech that SA was committed to the eight MDGs with MDG 1, as the country's priority by creating decent jobs with sustainable source of income (UNDP, 2010:4). South Africa is a middle income country and is not eligible to receive foreign assistance, so the achievement of the MDGs is solely depended on the government and other stakeholders' resources. However, the significance of addressing childhood malnutrition is a prerequisite for achieving internationally agreed goals to reduce malnutrition and child mortality.

The MDGs targets for 2015 include:

- halving extreme poverty
- providing universal primary education
- promoting gender equality
- reducing child mortality
- improving maternal health
- halting the spread of HIV and AIDS, malaria and other diseases
- ensuring environmental sustainability
- Developing a global partnership for development (FAO, 2005).

The following MDGs are interlinked and one cannot be achieved without addressing the other; hence the fundamental approach on investing in all eight of them is essential. The three MDGs described below are in synergy and directly affect each other if treated in isolation.

- Goal 1 aimed at halving the hunger and poverty of all South African earnings less than R6.50 a day. Malnutrition is the outcome of poverty; therefore good nutrition is the key element in achieving the MDGs. The persistent malnutrition globally hinders the progress in achieving the MDGs (World Bank, 2006:34). South Africa is making progress in poverty reduction with the aid of the Child Support Grant implementation (UNICEF, 2010:9). The emphasis on MDGs 1 to eradicate poverty by 2015 is an indication of the important role good nutrition has on overall development of children.

- Goal 4 is to reduce the mortality rate of children under the age of five by two thirds. In 2007, the global under-five mortality rate was 67 deaths per 1000 live births compared to 93 deaths in 1999. The death of infants from preventable or treatable causes declined from 12.6 million to 9 million (UN, 2009:24).

- Goal 5 aimed at improving maternal mortality rate by three quarters. The target is to achieve universal access to reproductive health by 2015. Thus far 536 000 women and adolescents die as a result of pregnancy complications at child birth or six weeks after birth (UN, 2009:26). Almost 99% of aforementioned deaths occur in developing countries. Maternal mortality is one of the health indicators that show the gap between the rich and the poor.

2.12 POLITICAL IMPACT OF MALNUTRITION

Politically, the issue of poverty eradication in South Africa has been prioritized with the purpose of providing the best possible malnutrition solution to all South Africans with immediate attention given to people in rural areas (DBSA, 2008:23). The Apartheid regime had caused males to leave homes to provide cheap labour in mines and industries while family members remained in rural areas. Access to land was prohibited; people were deprived of the opportunity to do what they know best, agriculture and farming. That was the beginning of rural poverty, the labour migration system, female headed homes and disunited

families. The situation still defines typical South African rural homes (Collison, Tollman, Kahn and Clark, 2003:2). In the executive summary of the situational analysis of children in SA (2009) public declaration has been made that despite the circumstances of the past, the new South African government needs to integrate numerous national policies and programmes aimed at eradicating poverty. Nonetheless, other regions like Zululand and the Umkhanyakude districts in KwaZulu-Natal province are still backwards and severely deprived of resources necessary for human survival (Schoeman, Faber, Adams, Smuts, Ford-Ngomane, Laubscher and Dhansay, 2010:140). Governments' failure to implement policies pertaining to the health system is heavily criticised while poverty and insufficiency undermines humanitarian help (Schoeman et al, 2010:140). The whole scenario places a heavy burden on women and children, for instance, poor health care infrastructure, ecological risk factors and food insecurity are the common and everyday challenges of the populations especially in rural areas. The success in the poverty reduction battle, economic growth of the country, stable communities depends on the quality of governance.

2.13 THE IMPACT OF MALNUTRITION ON THE ECONOMY

In 2009 South Africa was in economic havoc and counted as one of the top 10 countries with the highest unemployment rates in the world (Tebandeke and Premkumar, 2011:69). According to the World Bank (2006), malnutrition leads to death or disease that in turn reduces the nation's productivity. Investing in good nutrition is the basic necessity for the human capital and, as such, contributes enormously to economic development of the country. A large portion of the South African population suffers from malnutrition and consequently is unable to contribute to the growth of the economic environment. Malnutrition, has a detrimental effect on a country's economy, it slows down economic growth, accelerates poverty while people lose jobs due to the inability to perform duties, poor mental functioning, poor level of education and poor skill competency. According to Tebandeke and Premkumar (2011:67), the recent data show that South Africa lost 900 000 jobs in the beginning of 2009 due to the recession. As a result of the unemployment catastrophe, poverty acceleration prevails. The malnourished population becomes the state's responsibility. It is apparent that poverty drains government funds as the government has to supply free medication and food supplementation. As a result of malnutrition and a lack of employment, crime escalates and directly affects the economy, for example, foreign investors become reluctant to invest in the

country and tourism. Illnesses due to malnutrition lead to decreased income earnings lessening the buying power, thus not contributing to the economy of the country. All these factors are intertwined with poverty. Undoubtedly, once the issues of unemployment and poverty are addressed or attended to, the country's' economy would take a positive turn. It is against this background that the South African government initiated and implemented the social grants systems in addressing poverty for previously disadvantaged groups. The grant recipients were 2.5 million in 1998 and increased to 13 million in 2009 (UNICEF, 2009a:5).

As micronutrient deficiencies and undernutrition accelerate in developing countries, obesity is also on the increase placing more pressure on government funds. The spreading of communicable and non communicable diseases hits hard on medical demands, transportation and funerals, resulting in reduced affordability of quality food (Raschke and Cheema (2007:669). Once a child become malnourished, the need for extra and costly health services than other children increases. The economic costs of increased health care required for malnourished children include both the increased number of days for hospitalization and extra parental care (Benson, 2005:5). Approximately 9% of the nation's GDP is spent on health care (Benatar, 2004:81). Obesity is another health crisis, claiming up to 7% on average of government health care funds in treating obesity as well as other chronic diseases associated with it.

According to Brinkman et al (2009:2) the intensity of hunger, malnutrition and nutritional status was felt in many developing countries, as the majority of the population struggled to access food due to high food prices. Authenticated by Bhutta et al (2009:12) high food prices may result in maternal and child undernutrition. Brinkman et al (2009:6) further reported that an increase in food prices and reduced income has reduced dietary diversity and energy intake in many households. In some families, adults skip meals; reduce food portions and decrease the frequency of meal intakes a day, allowing children to take precedence. Such lead to decline in micronutrient consumption status, increase the risk of infections, nutrient deficiency, poor school performance and reduced work productivity. Malnutrition also leads to fewer years of completed schooling due to various factors such as frequent absenteeism, dropout, grade repetition and more government funds spent on one child repeating the same grade (World Bank, 2006:26). More often, malnourished children end up not developing to the maximum ability as a result of impaired cognitive development.

2.14 CONCLUSION

In 2009, children in South Africa were about 19 million of which two thirds live in poverty (UNICEF, 2009a:5). The majority were poorly nourished, underfed and exposed to parasitic and infectious diseases. Inadequate health care centres, food insecurity and poor sanitation are some of the factors contributing to malnutrition. According to Bhutta et al (2009:11) chronic diseases are common in undernourished children. Since 1990, South Africa is amongst the few countries where child mortality rate has been increasing and continue to die of preventable diseases (UNICEF, 2009a:2).

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to explain how data were collected in order to determine the nutritional status and dietary intake in the community of Lindelani in KwaZulu-Natal using reliable instruments. The questionnaire design, sample selection, data collection, administration of data and capturing are explained. The type of data analyses that were used in the study are also presented in this chapter. Measurement instruments used were socio-demographic (S-DQ), Quantitative Food Frequency Questionnaire (QFFQ) and 24hr recall questionnaires. Anthropometric measurement namely weight, height and Body Mass Index (BMI) were measured. A conceptual framework was developed for the study by identifying from the literature potential exposures and outcomes that should be measured. Validity, reliability and ethical aspects will be discussed in this section.

3.2 ETHICAL CONSIDERATIONS

The ethics committee of Durban University of Technology (DUT) approved the study. The study concept was approved by DUT, stating the aims and objectives of the study was presented to the school principal (Annexure A). The purpose of the study was explained to the principal of the selected school and the permission was sought to carry out the survey on the adolescent girls. The permission was granted by the school to conduct interviews in the consumer studies classroom. Letters about the nature and the purpose of the study (Annexure B) were sent home to parents in order to make an informed decision about their children's participation in the research project. Participants were fully informed about the study in their home language and signed an informed consent form. Confidentiality of information was assured to the parents and the children. Information sessions were held with parents who also signed consent forms and opportunity to ask questions in areas of concerns were given, answers were provided accordingly. All voluntary participants were requested to sign a consent form. Prior to the study temporal identification numbers were allocated to each

participant in order to ensure confidentiality. Anonymity was maintained throughout the analysis and in report writing and confidentiality was maintained and strictly adhered to throughout this study. Those who did not consent were not approached further.

3.3 EMPIRICAL STUDY DESIGN

3.3.1 Phases of the study

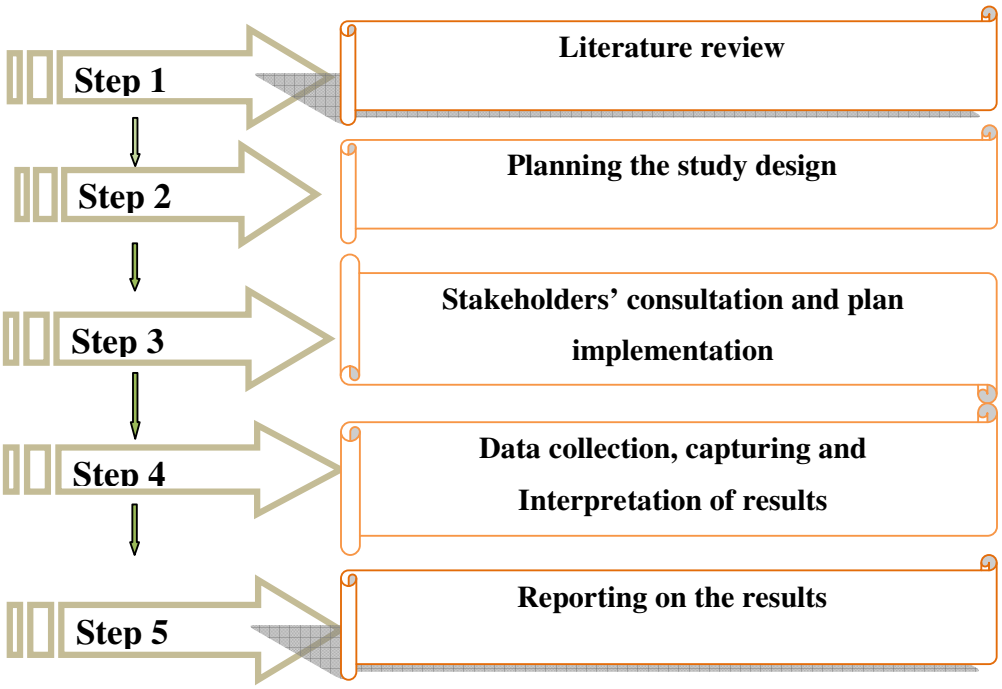


Figure 3.1: Phases of the study process

Phase 1: The first stage in the process was the literature review; this involved checking the available literature on the topic and completing the proposal

Phase 2: The research plan was then developed

Phase 3: All stakeholders (school principal, parents, educators, learners, SGB) were consulted and informed about the research project and permission requested

Phase 4: Data were collected, captured and analysed by the researcher

Phase 5: The writing of the dissertation was phase five.

3.4 STUDY TYPE

This study was undertaken in a high school in an area approximately 35 kilometres north of Durban. The school is situated in Lindelani on the outskirts of Kwamashu Township (Figure 3.3). The school is a day school and it consists of boys and girls. The participants were black girls from the same school. All children eligible (girls aged 13–18 years) were invited to participate. The study was of a descriptive nature with a cross sectional design. A quantitative approach was employed to collect data using questionnaires during personal interviews. The interview process took 45 minutes to an hour to complete each questionnaire. Anthropometric measurements were collected at the same time. Survey procedures were designed to protect participants' privacy and allow for anonymous participation. Data collected were checked for correctness and recorded at the end of each day.

3.6 PARTICIPANTS SELECTION CRITERIA

3.5.1 Inclusion Criteria

Inclusion of a student in the study was determined by parental consent. The following criteria were used for participation in the study:

- All adolescent girls of age group 13-18 years were considered eligible for this study.
- Learners of Mandlenkosi High school
- Learners who willingly signed consent forms
- Participants with correctly completed consent forms.

3.5.2 Exclusion Criteria

The inclusion criteria in the study were based on returning correctly completed forms. In the study the following were excluded:

- All girls above the age of 18 were excluded from the study

- Pregnant girls were not allowed to participate, however, only when it is obvious that the learner is pregnant, for ethical reasons, learners were not asked the pregnancy status, but were excluded.
- All learners with incorrectly completed forms and one with no parents' signature were eliminated.
- Boys were not included in the study.

3.6 STUDY VARIABLES

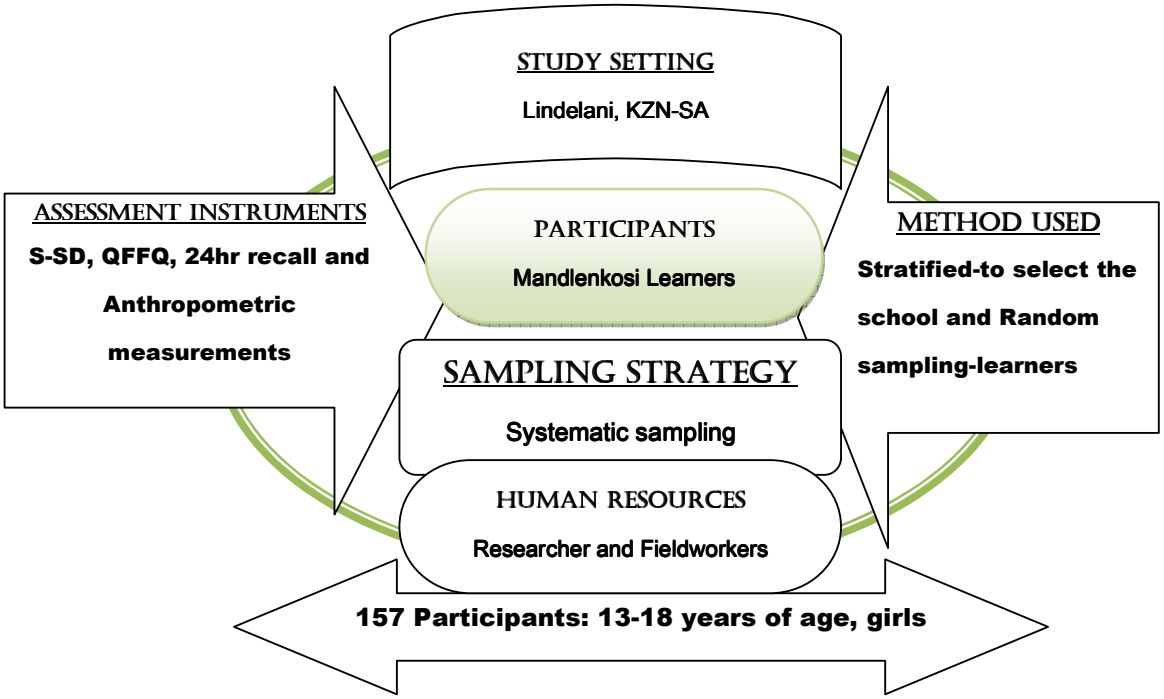


Figure 3.2 Model of the study variables

The study variables indicate sampling strategy (systematic sampling) study setting, sample size, assessment instruments, exclusion of the study which was critical for the correct selection and human resources needed during fieldwork. The element of a given population may be described in terms of the individual attributes on a given variable.

The sample was calculated using a power calculation and 161 out of a population of 406 girls in the school was indicated (Cole, 1997). The sample size was 157 after 4 girls withdrew from the study

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

Since the sample was n=157 an acceptable margin of error (Z) of 1.96 at 95% Confidence Interval was used.

3.7 SAMPLING STRATEGY

The sample size was determined as per standard method recommended by the WHO Expert Committee (1995) for studies on nutritional status. Stratified random sampling methods were used to select the school. Names of all the high schools in Lindelani were written on pieces of paper and placed in a box. The box was shaken and Mandlenkosi High school was picked randomly. One hundred and sixty one participants were randomly selected from the 406 girls in the school, as indicated by the power calculation with a confidence interval of 6 and a confidence level of 95%. School girls who fulfilled the selection and participation criteria were enrolled into the study. The sample was defined as teenage girls of Mandlenkosi High School between 13 and 18 years of age.

Figure 3.3 Information session held with participants

This strategy allowed an equal chance for all participants to participate in the study. Data collection took place during lunch breaks (12-1pm), after school (15-16pm) and Sundays (9am-12pm). Refreshments were served to each participant as soon as they had finished answering the questionnaires and had their measurements taken.

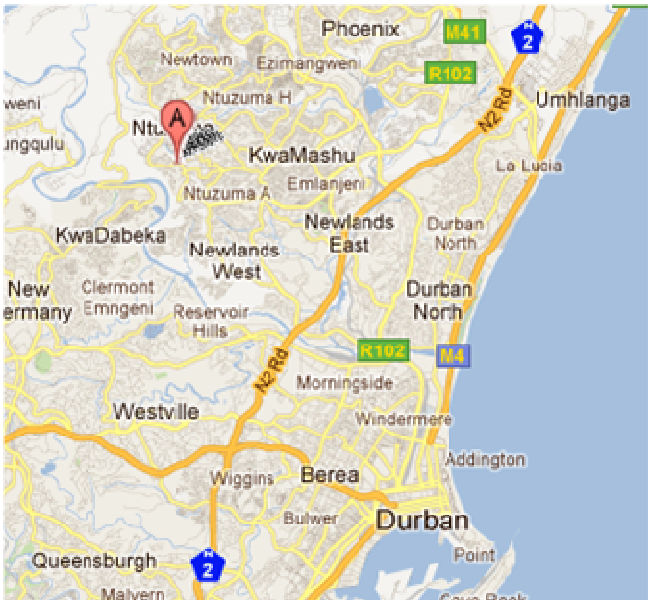


Figure 3.4 Location of Mandlenkosi High school in Lindelani (Map)

3.8 SELECTION OF FIELDWORKERS

Field workers were trained third year and B Tech Food and Nutrition Consumer Science students of the Durban University of Technology. All four student fieldworkers were female Zulu speakers (local language) so that participants can be interviewed in the language better understood by all in order to avoid any language barriers. A training manual and questionnaire samples were given to the fieldworkers prior to the fieldwork in order to prepare them for it and for reference purpose (Annexure C).

3.8.1 Fieldworkers training

The objective of the training was for the fieldworkers to understand the principles related to the use of each assessment tool, namely the S-DQ, QFFQ and 24hr recall. English was the medium of instruction for the training session and the training manual to refer to later if needed were given to each fieldworker. All fieldworkers were trained in a one day workshop at DUT prior to assisting in the administration of questionnaires. The study concept and the importance of recording data correctly were explained. The fieldworkers were trained in how to complete S-DQ, QFFQ and 24hr recall with the aid of food samples to assist the participants to make portion size estimations. The fieldworkers were also trained in a role play situation on how to take anthropometric measurements. During data collection, the researcher was present to supervise the process. All guidelines and instructions on how to execute the task efficiently and effectively were provided by the researcher, with special emphasis on the importance and objectives of the study.

3.8.2 Responsibility of the fieldworkers

Fieldworkers' responsibilities were to assist the researcher in the distribution and completion of questionnaires, weighing and measuring participants. The fieldworkers were expected to show respect, friendliness and patience which are important when dealing with teenagers. Care was taken to conduct the interviews in a non-judgmental manner. Punctuality and reliability was an essential key to successful fieldwork since participation depended on time availability. The questionnaires had to be completed accurately and in full. All the completed

forms were checked for mistakes before the participant leaves in order to rectify it immediately.

3.9 ADMINISTRATION OF QUESTIONAIRES

Questionnaires that requested information on socio-economic status, personal characteristics and dietary intake were designed and pretested before used in the present study. Parents were asked to furnish daughters date of birth, family size, monthly family income and expenditure on food, their academic qualifications and occupation. The dietary intake data were furnished by the participants themselves. Data on anthropometric variables were collected and completed on a pre-designed questionnaire. Each questionnaire was checked for the validity of the temporal identity number and that all variables had responses. The completion of questionnaires, weighing and measuring was done in the Consumer Studies classroom. During the field working stage, S-DQ, QFFQ, 24hr recall and anthropometric data were collected in a manner which will be discussed in detail below.

3.9.1 Socio-demographic questionnaire

A household questionnaire was used to collect socio-demographic information. The information on the questionnaire included ethnicity, family income and parents' education, personal details such as family settings, type of housing, access to electricity, water source, sanitation, family structures and lifestyle were based on self-report and was obtained during individual interviews. Both parent and a learner were interviewed (Annexure D). An existing validated socio-demographic questionnaire was adapted and used for this specific community in a focus group discussion with 20 community ladies (Napier, 2006). The interview session lasted an average of thirty to forty five minutes per learner.

Figure 3.5: Parent/learner interview session

3.9.2 Dietary Assessment

For the purpose of the study it was necessary to assess dietary intake in a manner that limited participants burden and that was appropriate for the considerable ethnic, cultural, and regional diversity of the study cohort. Food consumption was assessed with the 24hr dietary recall and QFFQ.

3.9.2.1 24hr Recall

A structured 24hr recall was used (Annexure E). Food consumption was assessed with the 24hr recall method. During the interview, samples of local household dishes and utensils (different sizes of bowls, plates, cups, glasses and spoons) were displayed to the participant and mother. Also, food models were used simultaneously to explain food items and to get the nearest possible approximation of serving sizes of the cooked food participants consumed. The 24hr recall method requires participants to recall all food and beverages consumed during the previous 24hrs, food samples were used during the completion of these questionnaires to assist the participants in estimating portion sizes. The participants were asked to state the method of preparation for all the foods consumed on the day. One 24hr recall was completed for food consumed during the week and one completed for food consumed over the weekend. The weekend dietary intake may be different and therefore may not be the representative of the usual dietary pattern for most days. The questionnaire was completed in an interview situation.

3.9.2.2 Quantitative Food Frequency Questionnaire

A quantified food frequency method requires participants to recall average amounts of food consumed on a daily, weekly or monthly basis and was used as a reference measure to the 24 hour recall questionnaire. A quantified food frequency questionnaire (describing intake in terms of energy and nutrients) was used to gather data on each participant's diet over a month period. The questionnaire was adapted from one developed and validated in an African population (Oldewage-Theron and Kruger, 2008). All participants completed the QFFQs (Annexure F) in an individual interview with the assistance of a fieldworker or the researcher. The participants were asked to provide detailed information regarding the types and amounts of all foods, beverages and nutritional supplements consumed over a month period, the cooking method used (where applicable), the brand name of foods (where appropriate) and details of recipes and any leftovers. The questionnaire comprised of 197 questions and was the largest portion of interview. Each learner took forty five minutes to an hour to complete the QFFQ. The interviews were arranged at the participants' convenience. All related foods were grouped together and listed accordingly with preparation methods. Participants were asked to indicate their frequency of consumption of items per day, per week, or per month and the questionnaire contains a specific column in which the respondent can indicate that a food item is eaten less frequently than once a month. Participants experienced problems in identifying portion sizes; therefore food samples such as chicken, milk, tomato, soft porridge etcetera, were presented to determine portion sizes.

Figure 3.6: Examples of food models used

The participants were shown various standardized utensils such as serving plates, cups, spoons and models of different foods to get the nearest possible approximation of serving sizes of the cooked food consumed.

3.10 ANTHROPOMETRIC MEASUREMENTS

Various anthropometric indices were used to pinpoint nutritional status of adolescent girls. Age, gender, weight and height were recorded. The researcher assisted by the fieldworker was responsible for measuring and recording of the results (Annexure G). Anthropometric measures were taken with the participant in light clothing without shoes. Age, gender, weight and height were recorded on the data sheet. Measurements of weight and height were obtained twice from all participants and the average was then used to indicate stunting, wasting, overweight and obesity.

3.10.1 Weight measurements

A portable weighing scale was used to measure the weight in kilograms nearest to 0.5 kg. Participants were measured using a calibrated scale (Scales 2000, Portable Physician Scale (PPS) placed on an even uncarpeted floor. The scale used during the survey was first calibrated with a standard weight and checked on a daily basis. The following method was used:

- The scale was calibrated using a 1 kg weight and measured correctly.
- The scale was placed on an even and uncarpeted surface area in the Consumer Studies centre.
- The scale was turned on and the researcher waited until it read 0.0 kg (WHO, 2008b:18).
- The participant was asked to remove socks and shoes as well as any additional clothing that could contribute extra weight (i.e. jerseys, jackets, coats, sweaters).
- The participant was asked to stand in the middle of the scale with body weight equally distributed on both feet and with hands at their sides.
- The participant was asked to stand flat footed; feet slightly apart in a relaxed position facing the researcher looking straight ahead.

- The participants were to stand still until the measurements were recorded and step aside from the scale and wait for zero reading to appear on the scale for second measurement.
- The weight which flashed once on the screen at the end of the measurement process was taken as the final weight.
- The weight was recorded to 2 decimal places in kilograms.
- The weight measurement was carried out twice and an average value was calculated and recorded.

3.10.2 Height measurements

The height of each participant was measured at the time of data collection using a portable stadiometer with a sliding headpiece. The height measurements were measured to 2 decimal places. Procedure for height measurements were as follows:

- The stadiometer was placed on an even, uncarpeted surface.
- The participant was asked to remove socks and shoes
- The participant was asked to stand with heels together, arms to the side, legs straight, shoulders relaxed and head in the Frankfort horizontal plane.
- Shoulder blades, buttocks and heels had to be touching the measuring rod.
- The sliding headpiece was then lowered upon the highest point of the head with adequate pressure to compress the hair.
- The sliding headpiece was then held in place and the reading was taken.
- The height measurements were read to 2 decimal places in metres and 2 readings were taken. An average value was calculated from the 2 readings.

3.10.3 Body Mass Index (BMI)

Height and weight measurements for determining BMI were obtained by fieldworkers and the researcher. The BMI is commonly used to establish whether an individual is overweight or obese, as well as to predict body composition and health risk (Nambiar et al, 2008:148). The anthropometric measurements of the adolescent girls were used for calculating the BMI which was expressed as ratio of weight (kg) to height in metre square. In the case of children

under 19 the BMI is used in relation to the age of the child to indicate wasting, overweight and obesity (WHO, 2008b).

3.11 STATISTIC ANALYSIS

3.11.1 Socio-demographic questionnaire

The data were first checked for completeness and cleaned before being entered into the computer. The data were edited for any discrepancies. For purposive data analysis, the raw anthropometric data were captured on an Excel^{R} spreadsheet by the researcher. The statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) for windows version 17.0. The descriptive statistics (frequencies, means, standard deviations and confidence interval) were determined by the researcher with the assistance of the statistician. Data were presented in tables, frequencies and percentages, as well as standardized methods were used.

3.11.2 Dietary Intake – 24hr recall and QFFQ

The collected data was rechecked and edited for discrepancies and wrong recordings before execution of data analysis. Food data were translated into nutrient data using a program based on the South African food composition tables. The dietary intake and food consumption data from 24hr recall and QFFQ were analysed by a Nutrition specialist using the Food Finder version 3 computer software programme that is based on Medical Research Council (MRC) food composition tables (Langenhoven et al, 1991) to determine the top 20 food items. Means, standard deviations and nutrient intake were calculated and compared with the DRIs (IOM, 2003).

3.11.3 Anthropometric data

All weight and height (average of 2 readings) measurements were captured on an Excel^{R} spreadsheet. For purposive data analysis, participants' raw anthropometric data were converted into Z-scores using the new WHO growth standard reference values. Data were analyzed using Anthroplus computer software (WHO, 2010), indicating height for age

(stunting) and BMI for age (wasting), Z-scores <-2 SD below the reference median. The BMI was calculated using the formula below:

$$BMI = \frac{\text{Weight (kg)}}{(\text{Height})^2 \text{ (m)}}$$

3.11.4 Correlations

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. The P-values were <0.05 indicating that there was significant association between the average household income and the BMI. The P-value was >0.05 indicating that there was no significant association between the education level and daily energy intake and the weight for height of the child.

3.12 VALIDITY AND RELIABILITY OF THE STUDY

Instruments used for measurement are often evaluated for reliability and validity to ensure accurate data.

3.12.1 Validity

Validity indicates the extent to which the measurement instruments measures what it is meant to measure. The measurement instrument lacks validity if the characteristics in the same individual or group are measured repeatedly lower than the real value (Joubert and Ehrlich, 2008:117). It refers to the accuracy of a measurement. When gathering data existing instrumentation can be used or a new instrument can be designed and constructed. Using existing instruments has certain advantages such as saving cost and time, and if the instrument's validity and reliability can be proven then it does not have to be measured again. If an existing instrument is used it is essential that information is available about the construct validity and reliability of the instrument. The instrument chosen for a study must be applicable and usable in the South African context (Mouton, 2001).

3.12.2 Reliability

A research instrument is reliable if it provides a degree of similarity of the results found when the measurement is repeated on the same participants or the same group. Reliability is the consistency of the measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same participants. In short, it is the repeatability of the measurement (Mouton, 2001).

3.13 ASSUMPTIONS

The following assumptions were made while carrying out the research:

- The sample size (n=157) chosen represented the study population
- Responses from the participants represented the true situation on the ground.
- Weekend food intake may be variable and hence may not be representative of the usual dietary pattern for most days.
- Measurements taken with the calibrated scale and stadiometer were accurate.

3.14 CONCLUSION

In this chapter, all the instruments to determine the socio-economic indicators have been discussed. Procedures followed in obtaining the data using the cross-sectional observational survey method were outlined. The instruments in this study were appropriate in gathering the data to achieve the purpose of the study. Regular quality assurance checks were done to ensure that standard methods were being practiced by all interviewers at all times. The interpretation of S-DQ, QFFQ, 24hr recall and anthropometric results will be reported in Chapter Four.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter covers the results and analysis of the study. It is presented according to the specific objectives of the study. The results are shown in tables and graphs. All 157 participants were interviewed. This study investigated nutritional status and dietary intake of adolescent girls in Lindelani. The participants (n=157) were residents in the community and learners at the same local high school. Nutritional status of children, according to DBSA (2008:6) is usually described in terms of anthropometry or body measurements such as weight in terms of age or height. This chapter presents the results of the study according to the investigated data of nutritional status and the dietary intake of adolescent girls. The following results are reported:

- Contribution of socio-demographic factors to malnutrition
- Adolescent girls nutrient intake
- Anthropometric status.

4.2 Sample realisation

The participants were randomly selected from the local school. The sampling procedure resulted in 157 girls participating. An introductory interview was conducted to explain the purpose of the study. Completed data were available for a total number of 157 participants.

4.3 Demographic data

Socio-demographic data were assessed by looking at the family settings of participants, age, gender, and type of housing the participants live in. Parents' age, education level, work status, income and money spent on food were necessary information for the interpretation of results as these are linked to nutritional status and physical wellbeing. The data are presented in terms of frequencies and percentages. Table 4.1 indicates the sample distribution according to socio-demographic findings.

4.3.1 Personal Data

The Socio-demographic questionnaire provided information on factors relevant to the household regarding the environment in which the child lived. Data were presented in terms of frequencies and percentages for the socio-demographic questionnaire.

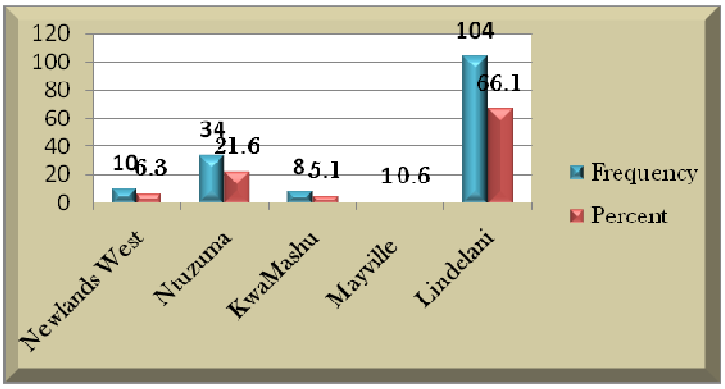


Figure 4.1: Distributions according to the participants' place of residence

Figure 4.1 represents the geographical areas where most of the participants lived. The majority of the participants (66.1%) lived in Lindelani, this area comprised of subareas such as Edamini, Machobeni, Madamfana, Nkomeni, Pholani. Ntuzuma, a nearby township had (21.6%) participants. Learners from Newlands and KwaMashu township (11.4%) either walk, take buses or taxies to school (Figure 4.9). The participants have been residents in Lindelani for a number of years. Only 4% of the of the participants reported the staying period of less than a year (refer Figure 4.2).

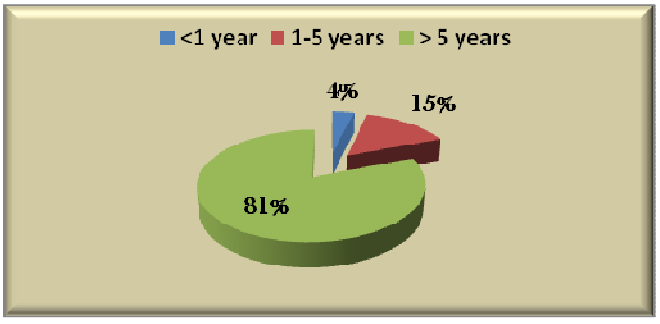


Figure 4.2: The duration of residence for participants in the vicinity of Lindelani

The majority of the participants (81%) have been residents in Lindelani for more than five years.

Table 4.1 Personal data of the caregiver according to gender, age and role played in the family

Variable	**n=157**	**%**
Role in Family	**Frequency**	**Percentage**
Mother	77	49.0
Grandmother	22	14.0
Father	8	5.1
Grandfather	49	31.2
Other (child, aunt, uncle)	1	0.6
	157	**100.0**
Caregivers Age	**Frequency**	**Percentage**
70-79	40	25.5
60-69	8	5.1
50-59	28	17.8
40-49	45	28.7
30-39	35	22.3
24	1	0.6
	157	**100**
Gender	**Frequency**	**Percentage**
Male	9	5.7
Female	148	94.3
	157	**100**

Table 4.1 indicates the age of the caregiver is divided to five categories. A high proportion (28.7%) of the caregivers was in the age range of 40-49 years. Most of the caregivers were women (94.3%).

4.3.2 Accommodation and family setting

Table 4.2 Housing types and infrastructure

Variable	n=157	%
Place of Residents	**Frequency**	**Percentage**
Squatter camp	31	19.7
Rural village	1	0.7
Township	125	79.6
	157	**100**
Number of people live in the house	**Frequency**	**Percentage**
2-5	47	29.3
6-10	100	64.3
10^{+}	10	6.4
	157	**100**
Permanent residence	**Frequency**	**Percentage**
No	7	4.5
Yes	150	95.5
	157	**100**
Type of house material	**Frequency**	**Percentage**
Brick	126	80.3
Clay	11	7.0
Grass	1	0.6
Wood	2	1.3
Zinc / shack	17	10.8
	157	**100**
Number of rooms	**Frequency**	**Percentage**
< 2 rooms	28	17.8
3-4 rooms	55	35.0
> 4 rooms	74	47.1
	157	**100**
Living conditions	**Frequency**	**Percentage**
Living with relatives	14	8.9
Living with friends	2	1.3
Rented house	10	6.4
Own house	127	80.9
Employees accommodation	4	2.5
	157	**100**

A large percentage of the participants were township residents (79.6%), however, the participants describe low cost RDP housing as the township, hence having the majority living in a township. The housing materials mostly used for building were bricks (80.3%), clay (7%), grass (0.6%), wood (1.3%) and shack homes (10.8%). The majority of households (64.3%) had more than six members living in the house placing a huge demand on the

breadwinner (refer Table 4.2). Forty seven percent of the participants lived in 4 roomed houses.

Table 4.3: Socio-economic indicators and housing amenities of the population (n=157)

Variable	**n=157**	**%**
Source of water	**Frequency**	**Percentage**
Tap in the house	70	44.6
Tap outside the house	59	37.6
Borehole	7	4.5
Spring / river / dam water	1	0.6
Elsewhere (neighbours, school, tank)	19	12.1
Tap (inside and outside the house)	1	0.6
	157	**100**
Toilet Facility	**Frequency**	**Percentage**
Pit latrine	65	41.4
Flush / Sewage	89	56.7
Bucket system	3	1.9
	157	**100**
Waste Removal	**Frequency**	**Percentage**
No	7	4.5
Yes	150	95.5
	157	**100**
Tarred Road	**Frequency**	**Percentage**
No	58	36.9
Yes	99	63.1
	157	**100**

The use of clean safe water is evident, however 37.6% of the population use water taps outside the house. Twelve percent neither have taps in or outside the house and are compelled to collect water elsewhere (refer Figure 4.17). A variety of toilet facilities were evident, although 56.7% of the sample population had flush toilets, a large percentage (41.4%) were using pitlatrine type toilets.

The transport type available and used in the community for household chores is illustrated below in Figure 4.3.

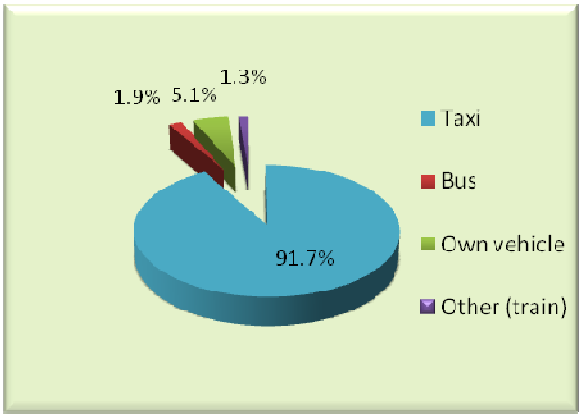


Figure 4.3: Transport commonly used in the community

Although 92% of Lindelani community uses taxis as a mode of transport, 84.7% of the participants walk to school (Figure 4.9). Transport is thus a major item of expenditure for the majority of the households.

Table 4.4 Percentage population reporting problems with faulty housing

Problems with state of the house	Frequency	Percentage
Damp, leaking and small	19	11.8
Need repairs	12	7.5
Too small	28	17.8
Leaking (only)	19	12.1
No problem	79	50.3
	157	**100**

Although Table 4.2 showed that the majority of the participants lived in brick houses (80.3%) and had taps inside their households (44.6%), most houses were not always in a good condition. A small number (17.8%) of participants reported to have small houses, followed by (12.1%) with leaking problems and (11.8%) having all sorts of problems like damp, leaking and small houses at the same time (refer Table 4.4).

Table 4.5: Household with pests infestation problems

Pests infestations in households	Frequency	Percentage
Mice	91	58.0
Cockroaches	85	54.1
Ants	77	49.0
Flies	57	36.3
Mosquitoes	132	84.1
Geckos	79	50.3
Frogs	14	8.9
Snakes	14	8.9
Bed bugs.	7	4.5

Problems experienced by participants include pest infestations which invade the residents' safety and hygiene conditions. Mosquitoes (84.1%) were the most commonly reported followed by mice (58%) and cockroaches in 54.1% of the households.

4.3.3 Work status and income

Table 4.6: Employment of parents/caregivers and economic status of the total sample

Variable	n=157	%
Household members employed	**Frequency**	**Percentage**
No	33	21.0
Yes	124	79.0
	157	**100**
Current work status	**Frequency**	**Percentage**
Employed	124	79.0
Retired	16	10.2
Housewife	10	6.4
Student	7	4.5
	157	**100**
Actively looking for job	**Frequency**	**Percentage**
No	137	87.3
Yes	20	12.7
	157	**100**
Period unemployed	**Frequency**	**Percentage**
None	124	79.0
Less than 6 months	5	3.2
6-12 months	3	1.6
1-3 years	3	1.9
> 3 years	22	14.0
	157	**100**

Table 4.6: Employment of parents/caregivers and economic status of the total sample (Cont)

Current Job	Frequency	Percentage
Not employed	33	21.0
Permanent	86	54.7
Temporal position	28	17.8
Fixed term contract	4	2.5
Other (one / three days a week	6	3.8
	157	**100**
Part time job on weekends/ school holidays	**Frequency**	**Percentage**
No	152	96.8
Yes	5	3.1
	157	**100**

Although the 79% of the caregivers were employed, a relatively large proportion (21%) reported unemployment and 17.8% were holding temporal positions. The type of jobs done by parents/caregivers (Figure 4.4) were ordinary low paid jobs such as domestic workers (73%), which might be a threat to food security. Amongst the unemployed only 12.7% were actively looking for a job during the time of the survey. The rest of the household members (87.3%) were not looking for a job as 10.2% were retired, 6.4% were housewives and 4.5% were students. These results could be linked to the households (71.3%) that spend R250 to R500 on food a month (refer Figure 4.5).

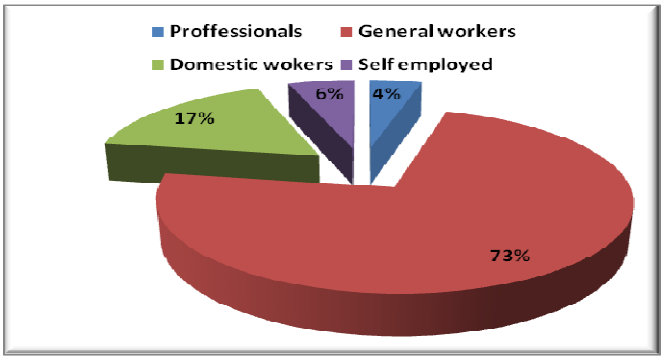


Figure 4.4: Caregivers' employment status

Caregivers' job descriptions were grouped according to the type of job specification. In the sample population a diverse range of occupations was evident however; the majority of the caregivers (73%) were general workers which are low paying jobs. Most participants meant

selling clothes, brooms from door to door as self employed. Others sell roasted mealies and vegetables at bus stops and taxi ranks. Most of the parents/caregivers voluntary disclosed that the other source of income was social grants.

The monthly household food purchasing has been categorised according to the amount spent a month.

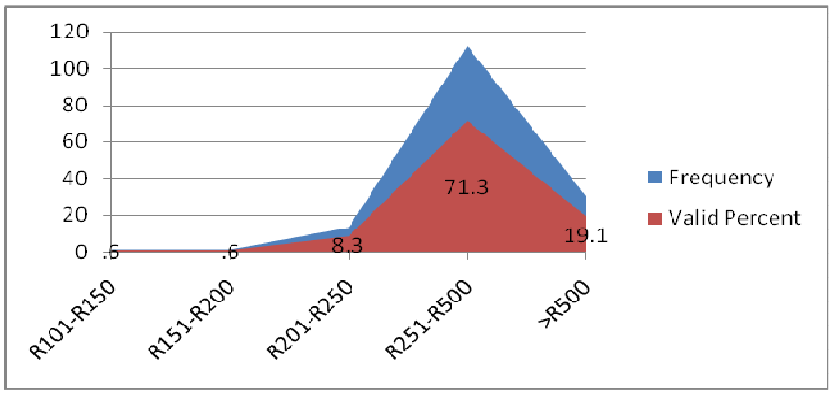


Figure 4.5: Sample distributions according to monthly food expenditure.

There was wide variation in the amount spent on food with the majority of the households 71.3% spending less than R500.00 per month. The amount of money each household spent on food monthly was divided into five socio-economic categories as follows: R101-R150, R151-R200, R201-R250, R251-R500, >R500. The type of job (Figure 4.4) and the source of income for the household as shown in Table 4.6 indicate inadequate food availability. The size of household members (refer Table 4.2) could also influence the amount spent on food.

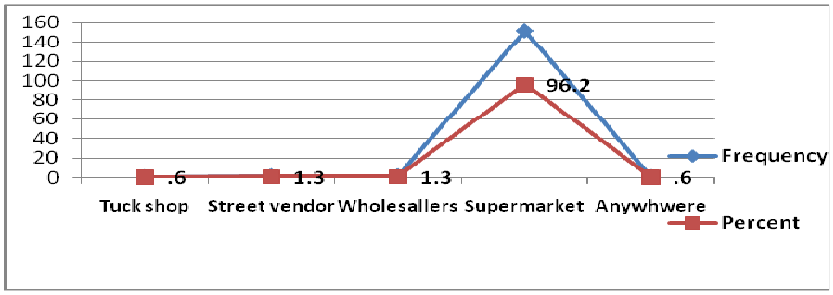


Figure 4.6: Place where food is purchased

The participants indicated that daily food items such as milk, bread, vetkoek and chips were mainly bought at the nearest tuck shop, while fruit and vegetables were mostly bought from vendors because it was cheaper and also more accessible. Figure 4.6 indicates that the majority (96.2%) of the parents reported purchasing groceries at supermarkets. Many households' members revealed that their main source of income other than salaries/wages used for food purchasing was the social grants paid by the government and that enable them to buy food at least once a month (data not shown). This was supported by Altman et al (2009:354) that social grants seem to play a significant role in reducing poverty and food paucity in the poorest households.

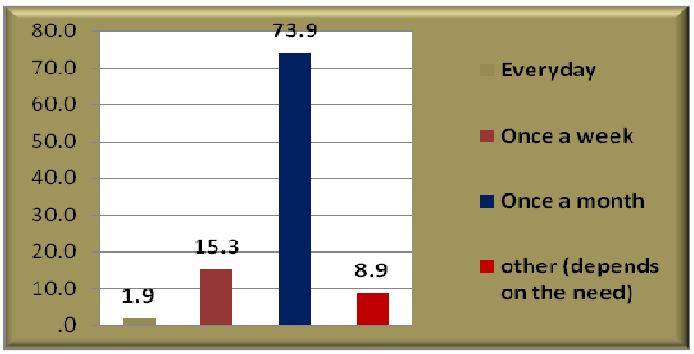


Figure 4.7: Frequency of food purchasing

Daily purchasing was conducted by 1.9% of the households, weekly purchasing by 15.3% and only 8.9% purchased food as the need arises. Monthly food purchasing were reported by 73.9% of the participants (refer figure 4.7).

Table 4.7: Household income and food security

Variable	**n=157**	**%**
Total household income p/m	**Frequency**	**Percentage**
< R500	10	6.4
R501- R1000	34	21.8
R1001-R1500	23	14.7
R1501-R2000	14	8.9
R2001-R2500	28	17.8
>R2500	48	30.0
	157	**100**

Table 4.7: Household income and food security (Cont)

Households disclosed the exact income	Frequency	Percentage
Did not want to disclose	141	89.8
R501-R1000	5	3.0
R1001-R1500	4	2.5
R1501-R2000	1	0.6
R2001-R2500	4	2.4
>R2500	2	1.3
	157	**100**
How often do you not have food	**Frequency**	**Percentage**
Always	4	2.5
Often	9	5.7
Sometimes	80	51.0
Seldom	18	11.5
Never	46	29.3
	157	**100**
Number of people contributing to food	**Frequency**	**Percentage**
1–5	147	93.6
6–9	8	5.0
9+	2	1.3
	157	**100**

More than half of the population (70%) had a monthly income of less than R2500 but most did not want to disclose. A large proportion of the households (51%) confessed that they sometimes go without food. Food scarcity was always a problem in 2.5% households. The results could be associated with the low total income revealed by the majority of the caregivers as only 30% reported income of >R2500 per month. Seventy four percent of households purchased food once a month (Figure 4.7) and 71.3% of the population spent not more than R500.00 on food per month (Figure 4.5). On average, six people shared a household which equals to R83.00 spent on food by each member of the family per month. Only 29.3% of the households reported that they always had enough food to eat.

4.3.4 Education and language

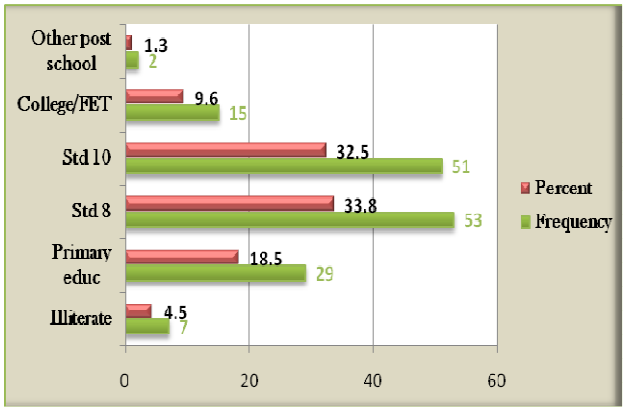


Figure 4.8: Caregivers educational background

The educational level in the area was comparatively low. Five percent of the caregivers had no formal education, 18.5% had primary education and only two with post matriculation qualification.

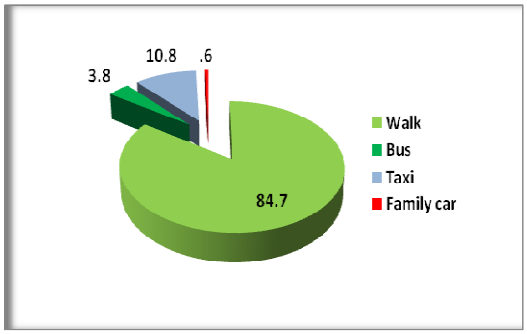


Figure 4.9: Type of transport used by participants to travel to and from school

Mandlenkosi High school is a community school, more than three quarters (84.7%) of learners walk to school with the exception of those who come from Newlands West (6.3%) and Kwamashu Township (5.1%) where buses and taxies are being used (refer Figure 4.9). There was only one child (0.6%) coming as far as Mayville.

Table 4.8: Possession of birth certificate and immunisation

Variable	**n=157**	**%**
Children with birth certificates	**Frequency**	**Percentage**
Do not have	2	1.3
Do have	155	98.6
	157	**100**
Number of children attending school	**Frequency**	**Percentage**
All school going age attend school	**157**	**100**
Children completed immunisation	**Frequency**	**Percentage**
Not completed	2	1.3
Completed	155	98.7
	157	**100**

Two children (1.3%) did not have birth certificates. Most (89.8%) of the sample population eat their meals at home. On average the household members consumed more than three meals per day (refer Table 4.11). Most schools in Lindelani are no fee schools thus encouraging all school age children (100%) to attend school (refer Table 4.8).

Lindelani is a diverse area with different languages spoken and different ethnic group represented by the participants.

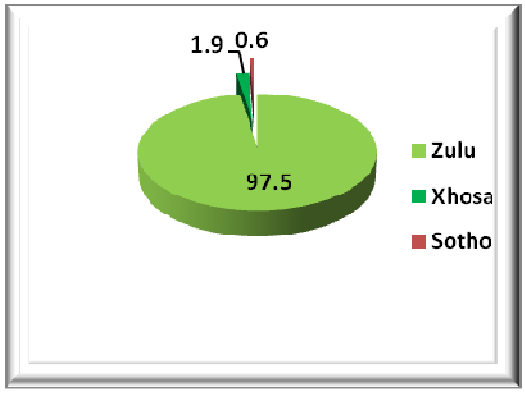


Figure 4.10: Sample distributions according to ethnicity and language spoken

The dominant language spoken by participants is isiZulu (97.5%); hence fieldworkers were all Zulu speakers to avoid language barriers. The ethnic groups represented by the sample were Zulus, Sotho (0.6%) and Xhosas (1.9%).

Table 4.9: Snack items and diet habits

Number of servings per week on fast food	**Frequency**	**Percentage**
Soda - cool drinks		
Not at all	51	32.5
1–3 times	88	56.1
4-5 times	12	7.6
7-10 times	6	3.7
	157	**100**
Apple Munch (frozen flavoured ice block)	**Frequency**	**Percentage**
Not at all	50	31.8
1–3 times	64	40.8
4-6 times	31	19.8
7-12 times	12	7.6
	157	**100**
All sweets	**Frequency**	**Percentage**
Not at all	35	22.3
1-3 times	41	26.1
4-7 times	47	30
8-10 times	16	10.2
11-20 times	18	11.3
	157	**100**
Ice cream	**Frequency**	**Percentage**
Not at all	64	40.8
1-3 times	73	46.5
4-6 times	14	8.9
7-11times	6	3.8
	157	**100**
Frozen sweet aid/isiqeda (homemade)	**Frequency**	**Percentage**
Not at all	35	22.3
1-3 times	43	27.4
4-7 times	67	42.6
8-15 times	12	7.6
	157	**100**
Ice lollies (retail)	**Frequency**	**Percentage**
not at all	118	75.2
1-3 times	30	19.1
4-7 times	9	5.6
	157	**100**
Have you ever gone on a diet	**Frequency**	**Percentage**
No	115	73.2
Yes	42	26.8
	157	**100**

Table 4.9: Snack items and diet habits (Cont)

Frequency of eating fast food	**Frequency**	**Percentage**
Not at all	3	1.9
up to 2 times a week	108	68.8
3-5 times a week	46	29.3
	157	**100**
Participants frequent eating place	**Frequency**	**Percentage**
Home	141	89.8
School	16	10.2
	157	**100**

More than 50% of the participants reported the consumption of sweets as part of their diet. The consumption of ice-cream (52.8%) and soda (63.0%) at least twice a week was reported. The majority (68.8%) of the girls consumed fast food at least one to two times per week.

4.3.5 Assets

Table 4.10: Food decision making and preparation in households (n=157)

Food preparations' responsibility	**Frequency (n=157)**	**Percentage**
Father	5	3.2
Mother	68	43.3
Siblings	66	42.0
Grandma	10	6.4
Other (cousin, uncle, friend, grandpa)	8	5.1
	157	**100**
Decision making on buying food	**Frequency**	**Percentage**
Father	1	0.6
Mother	2	1.3
Siblings	127	80.9
Grandma	22	14.0
Other (cousin, uncle, friend, grandpa)	5	3.1
	157	**100**
Household Head	**Frequency**	**Percentage**
Father	56	35.7
Mother	58	36.9
Siblings	1	0.6
Grandma	25	15.9
Other (cousin, uncle, friend, grandpa)	17	10.9
	157	**100**

Table 4.10: Food decision making and preparation in households (n=157) (Cont)

Food spending responsibility	Frequency	Percentage
Father	25	15.9
Mother	91	58.0
Siblings	2	1.3
Grandma	24	15.3
Other (cousin, uncle, friend, grandpa)	15	9.5
	157	**100**

Generally, women are often responsible for the food selection and food preparation, as well as caring and feeding of children (Lesiapeto et al, 2010:206). Mothers (43.3%) in this community were responsible for the food preparation. Although the siblings (80.9%) were responsible for making decision on the type of food to be purchased, the mothers (58.8%) were responsible for purchasing the food.

Table 4.11: Fuel types and pots material used for food preparation

Variables	**n=157**	**%**
Number of daily meals	**Frequency**	**Percentage**
One	1	0.6
Two	6	3.8
Three	39	24.8
More than three times	111	70.7
	157	**100.0**
Fuel preparation type	**Frequency**	**Percentage**
Wood fire	1	0.6
Paraffin	13	8.3
Electricity	143	91.1
	157	**100.0**
Pots material	**Frequency**	**Percentage**
Cast Iron	7	4.5
Aluminium	33	21.0
Stainless steel	116	73.9
Clay	1	.6
	157	**100.0**

The Lindelani community have access to electricity (91.1%), as most use electricity for cooking, ironing and illumination. The majority of the households (73.9%) use stainless steel cookware to prepare food. Most (70.7%) of the children had more than three meals a day.

Table 4.12: Household assets and appliances

Assets	Frequency	Percentage
Electrical stove	102	65.0
Gas Stove	27	17.2
Primus/paraffin	66	42.0
Microwave	80	51.0
Hot plate	99	63.0
Radio	143	91.1
Television	145	92.3
Refrigerator	134	85.5
Freezer	55	35.0
Bed with mattress	157	100
Mattress only	64	40.7
Lounge suite	105	66.9
Dining room suite	65	41.4
Electrical iron	151	96.2
Electrical kettle	149	94.4

Ownership of assets such as refrigerators, beds with mattress, TVs, electric kettles were evident in many households. The majority (65%) use electrical stoves for cooking whilst (42%) still use paraffin. Although Figure 4.4 indicated low paid jobs (73%), a large percentage of households owned electrical assets, and the most commonly owned included electrical irons (96%), electrical kettles (94.4%) and televisions (92.3%).

4.4 Dietary Intake Results

4.4.1 Nutrient analysis

The dietary intake of the adolescent girls (n=157) was analysed and discussed. The assessment was done using a QFFQ and 24hr recall questionnaires.

Table 4.13 Comparison of the mean nutrient intakes from the QFFQ and the mean intake from the two 24hr recall of the total sample population (n=157) with the DRIs

QFFQ AND 24HR RECALL ANALYISIS							
Nutrient p/d	**Dietary Reference Intakes (DRIs)**	**QFFQ Mean Intake ±SD**	**Nutrient Adequacy Requirement (NAR) Percentage (%)**	**Number of participants not meeting DRIs**	**24hr Mean Intake SD**	**Nutrient Adequacy Requirement (NAR) Percentage (%)**	**Number of participants not meeting DRIs**
Energy (kJ) EER	**9946**	**9483.31 ± 2044.74**	**95.35**	**101**	**7751.00 ±1903.17**	**77.93**	**135**
Protein (g) RDA	**46.00**	**77.88 ± 34.72**	**169.30**	**15**	**59.23 ± 19.90**	**128.76**	**40**
CHO (g) EAR	**100.00**	**281.27 ± 79.96**	**281.27**	**0**	**250.77 ± 63.60**	**250.77**	**0**
Dietary Fibre (g) AI	**26.00**	**19.32 ± 6.55**	**74.30**	**141**	**16.31 ± 5.71**	**62.75**	**144**
Calcium (mg) AI	**1300.00**	**507.84 ± 251.70**	**39.06**	**157**	**359.17 ± 199.12**	**27.63**	**154**
Iron (mg) EAR	**7.90**	**8.68± 2.92**	**109.87**	**64**	**8.76 ± 3.61**	**110.89**	**79**
Magnesium (mg) EAR	**300.00**	**282.69 ± 65.91**	**94.23**	**101**	**227.34 65.71**	**75.78**	**137**
Phosphorus (mg) EAR	**1055**	**970.67 ± 286.66**	**92.00**	**93**	**832.70 ±254.00**	**78.93**	**123**
Zinc (mg) EAR	**7.50**	**9.20 ± 5.23**	**122.66**	**55**	**8.31 ± 19.70**	**110.80**	**72**
Chromium (mcg) AI	**24.00**	**50.61 ±31.59**	**210.88**	**21**	**45.19 ± 30.07**	**188.29**	**39**
Selenium (mcg) EAR	**45.00**	**42.06 ± 25.56**	**93.46**	**107**	**38.16 ± 25.06**	**84.80**	**106**
Iodine (mcg) EAR	**95.00**	**33.69 ± 20.91**	**35.46**	**153**	**26.58 ± 21.29**	**27.98**	**152**
Vitamin A (mcg) EAR	**485.00**	**479.02 ± ±241.92**	**98.76**	**94**	**344.02 ± 458.98**	**70.93**	**130**
Thiamin (mg) EAR	**0.90**	**0.92 ± 0.67**	**102.22**	**83**	**0.92 ± 0.43**	**102.22**	**92**
Riboflavin (mg) EAR	**0.90**	**1.07 ± 0.85**	**118.89**	**77**	**1.41 ± 0.93**	**156.67**	**56**
Niacin (mg) EAR	**11.00**	**15.28± 6.52**	**138.91**	**40**	**14.22 ± 6.70**	**129.27**	**52**
Vitamin B_6 (mg) EAR	**1.00**	**1.25 ± 0.74**	**125.00**	**54**	**1.24 ± 0.60**	**124.00**	**62**
Folate (mcg) EAR	**330.00**	**251.87 ±139.70**	**76.32**	**121**	**231.87 ±124.59**	**70.26**	**124**

Table 4.13 Comparison of the mean nutrient intakes from the QFFQ and the mean intake from the two 24hr recall of the total sample population (n=157) with the DRIs (Cont)

Vitamin B_{12} (mcg) EAR	**2.00**	**2.39 ± 1.28**	**119.50**	**0**	**3.14 ± 3.98**	**157.00**	**77**
Pantothenate Acid (mg) AI	**5.00**	**5.20 ± 2.27**	**104.00**	**79**	**4.88 ± 2.36**	**97.60**	**86**
Biotin (mcg) AI	**25.00**	**20.99 ± 6.61**	**83.96**	**66**	**21.80 ± 24.91**	**87.20**	**121**
Vitamin C (mg) EAR	**56.00**	**33.12 ± 15.68**	**59.14**	**149**	**26.17 ± 20.13**	**46.73**	**139**
Vitamin D (mcg) AI	**5.00**	**4.26 ± 2.28**	**85.20**	**102**	**3.11 ± 2.76**	**62.13**	**123**
Vitamin E (mg) EAR	**12.00**	**11.17 ± 6.94**	**93.08**	**97**	**8.24 ± 5.15**	**68.67**	**126**
Vitamin K (mcg) AI	**75.00**	**57.62 ± 25.62**	**76.83**	**143**	**85.90 ±173.62**	**114.53**	**118**

KJ-Kilojoules
g-Gram
Mcg-Microgram
mg-Milligram
EAR-Estimated Average Requirement
SD-Standard Deviation
RDA-Recommended Dietary Intake
DRI-Dietary Reference Intake

The nutrient intake data (Table 4.13) indicate that the intake of most of the nutrients was below the Nutrient Adequacy Ratio (NAR) presented in percentages especially vitamin A and calcium. According to the QFFQ and 24hr recall the NAR for vitamin A was 98.76% and 70.93% respectively. Inadequate folate (76.32% and 70.26% respectively) intake was also prevalent, but to a lesser degree than calcium and vitamin A. The foods that are contributing to folate intake are oranges, green leafy vegetables, broccoli and pulses are not visible on the top 20 list of food mostly consumed by participants (Table 4.14). The mean dietary intake of vitamin A in this sample was 479.02±241.93mcg and 344.02±458.98mcg per day respectively, and did not meet the DRI of 485mcg (IOM, 2002). Ninety four QFFQ participants and 130 24hr recall participants did not meet the dietary requirements for vitamin A. The low fibre, vitamin A and folate intake levels are related to low and irregular vegetable and fruit intake (Moeng and de Hoop, 2008:310). For 98% of the participants in this study, the calcium intake was less than the DRIs of 1300.00mg per day. Although the mean NAR for iron is slightly above the DRIs (7.90mg), the majority of the participants (64 and 79 respectively) did not meet the DRIs. Similar to zinc, the majority of respondents 55 and 72 did not meet the DRI for zinc (7.50mg); however, this nutrient is essential during the teenage stage for growth and sexual maturation (Kabir et al, 2010:633). The mean intake (250.77g)

for CHO (QFFQ) indicates that on average the participants consume staple food at least two times a day. The analysis of the QFFQ and 24hr recall indicate that all participants meet the DRIs for CHO, however, some participants eat bigger portion sizes and more frequently than the others. The mean intake of protein was above the NARs, but 15 participants (QFFQ) and 40 (24hr recall) were not meeting the DRIs. The paucity of animal protein (refer Table 4:14) in the diet may be responsible for this. The mean intake of vitamin C (33.12±15.68mg and 26.17±20.13mg respectively) was also below the DRIs (56.00mg) per day. This is reflected in Table 4.15, the only fruit appeared at number 20 on the 24hr recall is an apple. The dietary fibre is also very low at 19.32g and 16.31g respectively. This is in line with the inadequate consumption of food sources high in fibre, fruit and vegetables. For total fruit and vegetables, the participants had intakes which were less than 400g, the recommended dietary fibre intake in 24hr recall (Anderson et al, 2004:650).

4.4.2 Food Consumption Patterns

The dietary intake data obtained from the QFFQ and 24hr method reflected the mean energy and nutrient intakes of the adolescents in the sample. The high CHO intake in this study indicated that a large portion of the food consumed by the participants were CHO based.

Table 4.14: A summary of the most commonly consumed food items ranked according to total intake as determined by the QFFQ and 24hr recall (n=157)

QFFQ	Frequency	Total Intake	Mean intake	24hr recall	Frequency	Total Intake	Mean intake
1. crumbed maize meal (phuthu)	345	26473.15	76.73	1. Rice	157	72290.00	460.44
2. Tea	110	15767.03	143.34	2. Crumbed maize meal (phuthu)	171	50370.00	294.56
3. Diluted juice	113	15521.63	137.36	3. Diluted juice	168	43815.00	260.80
4. Rice	120	15011.24	125.09	4. Bread/rolls (brown)	345	39435.00	114.30
5. Bread/ rolls (brown)	184	14357.34	78.03	5. Tea	115	27885.00	242.48
6. Carbonated cold drinks	98	7593.06	77.48	6. Milk-full cream	117	8325.00	71.15
7. Potatoes	195	6251.40	32.06	7. Chicken curry	63	8035.00	127.54
8. Chicken stew with vegetables	112	4753.01	42.44	8. Curried sugar beans	58	7050.00	121.55

Table 4.14: A summary of the most commonly consumed food items ranked according to total intake as determined by the QFFQ and 24hr recall (n=157) (Cont)

9. Chicken roasted/boiled	**126**	**4194.23**	**33.29**	**9. Ice block**	**65**	**6941.00**	**106.78**
10. Potato crisps	**171**	**3653.30**	**21.36**	**10. Beef polony**	**132**	**6679.00**	**50.6**
11. Samp and beans	**122**	**3638.41**	**29.82**	**11. Chicken stew with tomato and onion**	**37**	**6350.00**	**171.62**
12. Coffee (instant)	**29**	**3068.20**	**105.8**	**12. Carbonated cool drinks**	**22**	**5930.00**	**269.55**
13. Sweets and chocolates	**245**	**3002.35**	**12.25**	**13. Mabella**	**25**	**5310.00**	**212.4**
14. Mabella	**64**	**2912.52**	**45.51**	**14. Samp and beans**	**19**	**5230.00**	**275.26**
15. Breakfast cereal (cornflakes)	**84**	**2906.25**	**34.6**	**15. Cabbage cooked with potatoes**	**38**	**4425.00**	**116.45**
16. Milk- full cream	**105**	**2861.08**	**27.25**	**16. Coffee (instant)**	**18**	**4420.00**	**245.56**
17. Cabbage	**128**	**2823.65**	**22.06**	**17. Amasi (sour cream)**	**15**	**4420.00**	**294.67**
18. Amasi (sour milk)	**95**	**2718.50**	**28.62**	**18. Amagwinya (vetkoek)**	**29**	**3980.00**	**137.24**
19. Pasta dishes- macaroni and spaghetti	**67**	**2613.33**	**39**	**19. Snacks (Nik-Naks)**	**135**	**3824.00**	**28.33**
20. Beef stew with vegetable	**89**	**2608.16**	**29.31**	**20. Apple**	**27**	**3760.00**	**139.26**

Table 4.14 indicates the foods consumed in order of the largest quantity to the lowest in terms of total intake. Cereals were the major source of energy on both QFFQ and 24hr recall. The results indicate that the participants' portion sizes on the 24hr recall were large, ranging from 460.44g rice (number 1 on the top 20 consumed list), 294.56g crumbed maize meal (number 2) and 275.26g for samp and beans (number 14). Other sources of energy and added kilojoules highly consumed were carbonated cool drinks (269.55g), diluted juices (260.80g) and vetkoek (137.24g). The frequency of the aforementioned food items was very low and an indication that large portion sizes were consumed by few individuals. This is also reflected in nutrient analysis, although the mean intake for energy on the QFFQ was 9483.31kJ ±2044.74 but 101 participants did not meet the DRIs for energy. Sweets and chocolate appeared number 13 on the QFFQ, the frequency (n=245) indicated overconsumption by certain individuals and unnecessary added kilojoules. This also highlights that more than one sweet was consumed by each participant a day. The distribution of tea and coffee in the top 20 list of food on QFFQ and 24hr recall showed the high intake of added sugar. This can be linked to 1.9% obese participants in Table 4.16.

The girls dietary fibre intakes were <25g per day, the recommended dietary fibre intake by WHO. This is apparent as most cereals consumed were highly refined and the source of dietary fibre was brown bread which appeared at number 4 and 5 respectively on the 24hr recall and QFFQ, curried beans at number 8, cabbage at number 15 and an apple at number 20 of the 24hr recall. Both frequency and portion sizes of fruit and vegetables as a source of fibre were very low. However, chicken and beef stew were often cooked with vegetables. Regardless, the low intake of dietary fibre and fruit and vegetables is evident and clearly reflected in Table 4.15.

Protein intake including beef and chicken were very low. Chicken is widely distributed but beef stew appeared at number 20 on the QFFQ. Chicken curry appeared as number 7 and the mean intake was 127.54g and was consumed only 63 times by 157 girls during the 24 hour period indicating that at least 94 girls did not consume any. Although beef stew with vegetables was consumed by more than 50% of the participants on the QFFQ, the portion sizes were very small (29.31g). Hence, above 50% of the participants do not meet the DRI for Fe on both QFFQ and 24hr recall (refer Table 4.13). The mean frequencies of eating meat were 63 times for chicken curry and 37 times for chicken stew, (no red meat) indicating that not all the children consumed any meat items during the 24 hour period. Milk was consumed by a large number of participants but the mean intake indicates low consumption of this essential nutrient (71.15g and 27.25g) respectively on the 24hr recall and QFFQ. The participants reported consuming milk only with coffee or tea and sometimes with breakfast cereal. Milk and amasi were the only source of calcium that appeared on the top 20 food items as number 6 and 17 on the 24hr recall. Both milk and amasi are visible on the QFFQ and 24hr recall food list. However, the nutrient analysis of 24hr recall reflected that only three participants met the DRI for Calcium (1300mcg per day) refer Table 4.13. The data reveal that the mean daily intake of essential food items in the adolescents diet such as milk and milk products, pulses, green leafy vegetables, other vegetables and fruits were grossly inadequate. Table 4.13 reveals a similar pattern of poor consumption of vitamins with the exception of vitamin $B_{12.}$

Table 4.15: Mean intake of the children from QFFQ and 24hr recall compared with the WHO population nutrient intake goals (WHO, 2003)

GIRLS ENERGY PERCENTAGE DISTRIBUTION			
Dietary Factor Food Nutrient	**WHO Goal**	**QFFQ**	**24hr**
Total Fat g (E)	**15-30%**	**32.14g**	**28.18g**
Total CHO% (E)	**55-75%**	**53.88%**	**58.58%**
Protein% (E)	**10-15%**	**13.96%**	**13.24%**
Fruit and Vegetable g/day	**>400**	**420.20g**	**101.69**
Dietary Fibre g/day	**>25**	**19.32g**	**16.31**

Table 4.15 presents the result of the frequency distribution of energy according to WHO population nutrient intake recommendations. The total energy provided by fat was higher on the QFFQ (32.14g) than the goal recommended by World Health Organisation. The contribution of protein to total daily energy intake was within the recommendations of 10-15%. The total CHO and protein consumption was evenly distributed on the 24hr recall and QFFQ top 20 food items consumed. The intake of these nutrients was within the recommended level of the WHO goal. The mean intake of dietary fibre on the QFFQ (19.32g) and on the 24hr recall (16.32g) were lower than the WHO population nutrient intake goals (>25g). The intake of fruit and vegetables was significantly lower than >400g goal on the 24hr recall as recommended by the WHO. The intake of fruit and vegetables on both QFFQ and 24hr recall might include bias due to inadequate and/or over reporting.

4.5 Anthropometric Assessment

All children were weighed and measured. The height and weight were used to determine the BMI (weight [kg] divided by height [m] squared). The data were categorised according to the standard deviations and Z-scores with the WHO indicators. The anthropometric indicators height-for-age and BMI-for-age were used. The weight-for-age was not used as it is applicable to children under nine years of age. The data obtained were used to indicate stunting, wasting, overweight and obesity.

Table 4.16: Distribution of adolescent girls based on WHO growth indicators (WHO, 2003) n=157

Z-score	Classification	Girls (n=157) %
	Stunting (Height-for-age)	
< -3SD	Severely stunted	0
≥ -2SD	Stunted	7.6 % (12)
>-1SD to +3SD	Normal height-for-age	92.4% (145)
	Wasting/Thinness (BMI-for age)	
< -3SD	Severely wasted	0
< -2SD to >-3SD	Wasted	1.3% (2)
>-2SD to <+1SD	Normal	56% (88)
>+1SD to <+2SD	Possible risk of overweight	30% (47)
>+2SD to <+3SD	Overweight	10.8% (17)
>+3SD	Obese	1.9% (3)

Table 4.16 shows the prevalence of stunting, overweight and obesity in the sampled adolescent girls. Few girls were wasted (<-2SD to >-3SD). One hundred and fifty seven participants were studied, of whom 7.6% were stunted and 92.4% were of normal height. The 7.6% prevalence of stunting (≥-2SD) in the girls suggests chronic under nutrition which might result in slowing maturation (Kabir et al, 2010:636). Anthropometric measurements were converted to height-for-age and BMI-for-age (Z scores). BMI-for age was used to evaluate the obesity status of the sample as a risk factor for the development of diseases associated with weight status. In the present study, 30% of the group were at risk of overweight (>+1SD to <+2SD) whereas 10.8% were overweight (>+2SD to <+3SD) and 1.9% were obese (>+3SD).

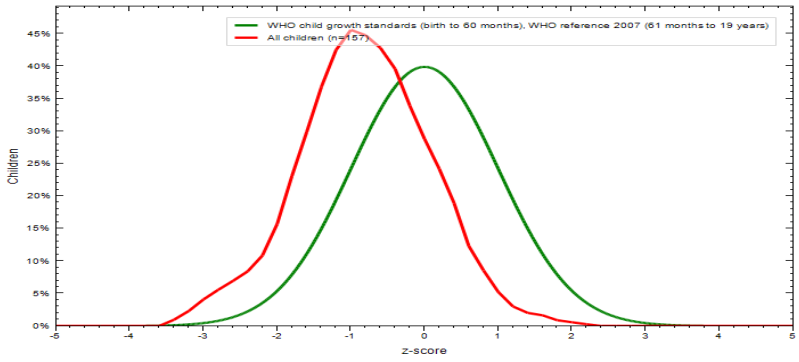


Figure 4.11: Height-for-age of the adolescent girls

The green line (Figure 4.11) represents the World Health Organisation (WHO) child standards. The red represents the participants (n=157). Undernutrition (underweight, stunting, wasting) is defined as a Z score below -2 and severe under nutrition as a Z score below -3. All the outliers to the left were at a risk of underweight (-0.82SD±0.86). Stunting (measured with height-for-age Z-score <-2SD to >-3SD) was prevalent among 7.6% of the girls.

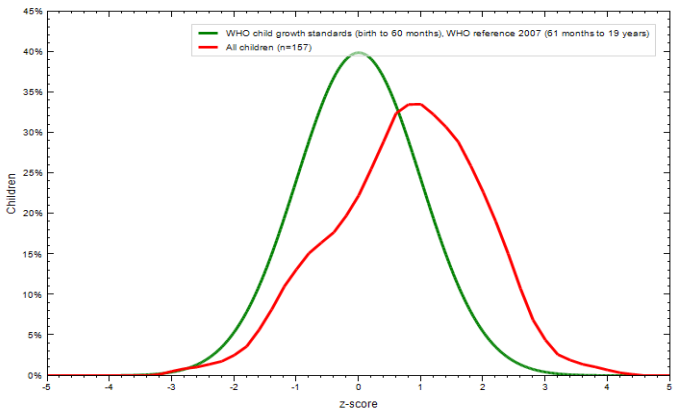


Figure 4.12: BMI-for-age of the cohort of 13–18 year olds

The leaning of the red line towards the right (Figure 4.12) indicates the percentage (0.76SD±1.15) of participants that were overweight (10.8%) and (1.9%) that were obese (>+3SD).

4.6 Correlations

The correlation between the daily energy intake and household income, daily energy and education level, BMI-for-age and household income, BMI-for age and household income were drawn using one way ANOVA tests with $p<0.05$ as significant.

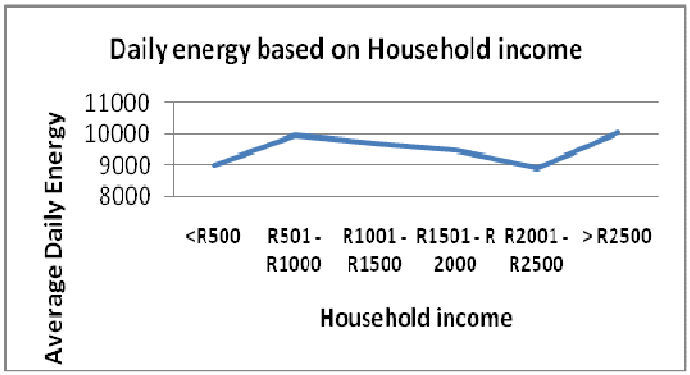


Figure 4.13: Household income versus Daily energy

A possible relationship between daily energy and household income was investigated (Figure 4.13). As the income increases from R500.00 to R1000.00 there is a rapid increase in average daily intake placing the participants within average daily intake decreases at a steeper slope and the participants in this category are at risk of being underweight as they are far below the energy recommended intake. The correlations analysis revealed no statistical significance between daily energy and household income (p=0.252). As the household income increases from R2500.00 and beyond average daily energy increases in a constant rate indicating that the energy intake is slightly above the EAR (refer Table 4.13).

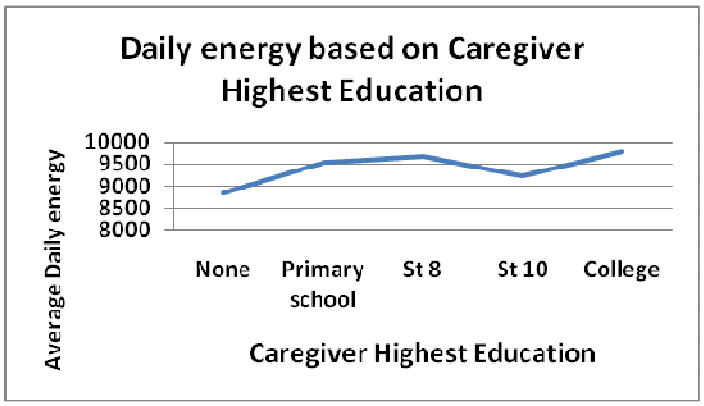


Figure 4.14: Education level versus Daily energy

Figure 4.14 indicates the average daily energy intake of the girls where caregivers have no education or with primary education increases at a constant rate. The slope is steep which reflects a rapid increase in average daily energy as the education level increases, however,

participants within that range do not meet the EAR for energy. The average daily energy begins to diminish as the level of education increases. There were, however, no statistical significant correlation between the two variables (p=0.706).

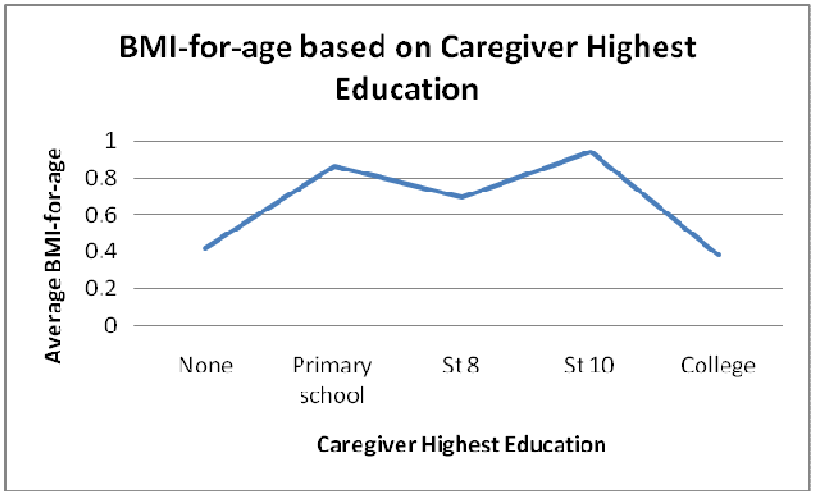


Figure 4.15: BMI-for-age (z-scores) versus education level

The highest education level of parents is often used as an index of household socio-economic status as well as the family income. As the level of education progresses, the BMI for participants in educated households decreases to the level of the households where caregivers had no education at all. Based on these findings, the caregivers' level of education had no statistical significant influence (p=0.405) to the BMI-for-age (refer Figure 4.15) of the girls. However this study did not investigate the caregivers' education status in relation to participants BMI-for-age.

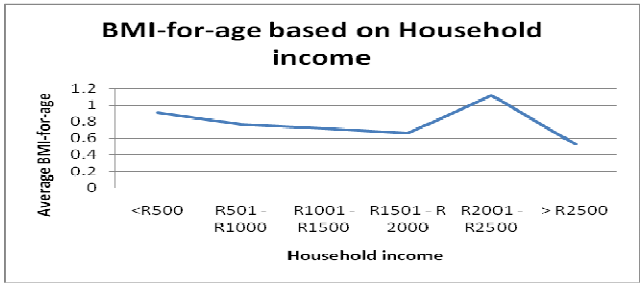


Figure 4.16: BMI-for-age (z-scores) versus Income level

The standard of living is directly related to the amount of household income available for food. This suggests that the higher the expenditure on food the greater the BMI (Swinburn, Sacks, Hall, McPherson, Finegood, Moodie and Gortmaker, 2011:805). As the household income increases (Figure 4.16) from R500.00 to R1000.00, the average BMI-for-age drops from just under 1 to under 0.8. As income increases from R1000.00 to R2000.00 the average BMI for age (Z-scores) further drops at a different rate. Income ranging from R2000.00 to R2500.00 represents the only scenario where average BMI-for-age increases. The BMI-for-age also declined more rapidly, although this was statistically non-significant (p=0.442).

4.7 DISCUSSION

4.7.1 Literature

The general overview of the literature survey indicates that malnutrition is a complex phenomenon with multiple causes, with food accessibility as one of them. High food prices and the global financial crisis have affected several underlying factors of malnutrition (von Braun, 2009:6). A persons' nutritional status depends largely on the quantity and quality of food available on the market. Economic resources of the households determine the food accessibility and the distribution of food within the household. Although food intake influences individual's nutritional status to a great extent it is not the only critical factor responsible for malnutrition, particularly in children under five years of age. Living standards, water and sanitation, weaning practices and mothers' education level are a few contributory factors which have been identified from research conducted (Rasoul, 2010:15).

The present study was undertaken to determine adolescent's nutritional status and dietary intake. The study targeted teenage girls of 13 to 18 years because during this period the girls are at risk of exposure to negative influences and transition is associated with unhealthy dietary changes. Girls' caregivers were interviewed to obtain socio-economic data, dietary intake and anthropometric data. The socio-economic status of the total sample was assessed by looking at the household setting, monthly household income and associated variables. It was also necessary to determine the average amount of money spent on food per month in order to measure financial status influence on nutrient intake. According to UNICEF

(2009b:38), socio-economic conditions influence the nature of the diet and poor populations tend to have diets low in essential nutrients.

4.7.2 Demographic information

The socio-demographic data indicated that the majority of the participants were residents of different subareas of Lindelani and were all learners of Mandlenkosi high school. Most of the teenage girls were from female headed households (36.9%) including grandmothers as breadwinners. According to Rose and Charlton (2001:385), food insecurity is often higher in female headed households in SA. Households headed by women (48%) have a greater chance of being poor as compared to male (28%) headed households (Woolard, 2002:3). This was confirmed by Mabugu, van der Berg, Chitiga, Decaluwé, Maisonnave, Robichaud, Shepherd and von Fintel (2010:12) that more than 50% of South African Child Support Grant recipients come from female-headed households. However, according to UNICEF (2007b:8), when women are involved in food procurement they are better positioned to influence the households' health care practices. The distribution of grandparents in all food procurement catagories (refer Table 4.10) implicates the absence of the biological parents, thus some of the participants are raised or cared for by grandmothers and other relatives. The productivity of the elderly people decreases with age, so the poverty rate is expected to escalate in such families. The recurring high food prices and lower income put poor households in a difficult situation of not having adequate nutritious food (Chopra, 2004:12).

The results indicated that 31% of the participants lived in squatter camps (umjondolo) in a known and commonly used language. However, no standard definition for Reconstruction Development Programme (RDP) houses and squatter camps were formulated and applied in Lindelani, therefore, participants residing in low cost government housing were classified as being township residents and participants residing in shacks or informal houses were classified as being from a squatter camp. Overcrowding defined as the number of persons per sleeping room was evident. On average the four roomed houses accommodate 6-10 family members with only one or no one employed and that indicates overcrowding in some families. Some of the houses were in a poor condition, as some were very small (17.8%) and damp and leaking (11.8%) when raining. Fixing of the houses was problematic owing to the fact that inhabitants were unemployed while others were surviving with the cash payment

from the jobs they do. Children living in informal dwellings are more likely not to have basic services such as safe water and proper sanitation, a situation that can put the health of these children in danger. These types of housing settings are often far from roads with no access to transport, causing children to be late for school and increase irregular school attendance (UNICEF, 2009b:48).

The majority of the parents/caregivers had a low education level (4.5% illiterate, 18.5% primary education, 33.8% with standard 8) and for most households, the major source of income was low paid ordinary jobs (78%) and government social grants. This situation is not optimal and makes it difficult for households to fulfil all or most of the obligations due to the low income of such occupations. The socio-economic condition of the households is, therefore, linked to the occupation and income of the parents/caregivers, which ultimately influences the food intake. The money spent on food by 71.3% (R251-R500) households (Figure 4.5) indicates prevalence of food insecurity for most households and only 29% of the participants reported to never had problems with food availability (refer Table 4.7).

Deshmukh et al (2006:140) reported that lower family income is an important predictor of underweight. More frequently food insecurity limits the choice and access to healthy food (Chopra, 2004:25). The socio-economic status of the population plays an essential role in the quality of life, however, the conditions in which the participants live indicates poverty and food insufficiency. Data from the South African General Household Survey (2007) indicate that 6.3% of adults and 7.1% of children had gone hungry due to an inadequate amount of food available. Based on the result of the present study, one would conclude that participants are living in impoverished conditions.

The majority of the households in this community were still using pit latrine toilets (41.4%) despite the government's initiative for RDP in 1994 (refer Table 4.3). Such environmental factors contribute to the survival of disease borne agents such as parasites, bacteria and mosquitoes (refer Table 4.5). As stipulated in the World Population Data Sheet (2010:5), improved sanitation will lag behind by 13% in 2015 globally. Chesire (2008:477) stated that undernourished children often come from poor families with crowded houses and poor hygiene, and are exposed to infectious diseases**.** The results in Table 4.7 indicated that 51% of the participants sometimes go without food. The findings correlate with Altman's

(2009:349) findings where 10.6% and 12.2% of adults and children respectively were sometimes or always hungry. According to government standards, the maximum amount domestic workers earn is ±R1600.00 in certain areas per month (Department of Labour, 2011) an income that cannot sustain a family of 6-12 household members for a month (Table 4.2).

Figure 4.17: Housing type and water reservoir nearby school

Figure 4.17 indicates conditions in which some of the participants are exposed to no running water in or at the households. Similar to NFCS-FB-I (2005:254) some of the community members (12.1%) collected water from communal taps elsewhere whilst 37.6% had taps outside the house. According to UNICEF (2009a:5), poverty and unemployment are often the effects of underdevelopment and are the primary causes of malnutrition. The findings of the study have important implications for nutritional interventions in schools. It is essential to state that the aim of the study was not to identify specific socio-economic variables associated with nutritional status and dietary intake outcomes, but it should be noted that the majority of the participants have almost all basic electrical appliances.

4.7.3 Nutrient Analysis

The present study provides evidence that the average school child in this black rural community is malnourished. Poor nutritional status during adolescence is an important indicator of health outcome. The results in the present study indicate the paucity of dietary diversity, which therefore contributes to nutrient deficiency. The food intake, in the present study, was low particularly with respect to meat, legumes, milk and milk products. The

majority of the population had a lower energy intake than recommended; however, adolescence is a critical stage of the life cycle which requires increased energy (Alam et al, 2010:87) for growth, daily activities such as sports and a long walk to and from school. The food consumption patterns indicated that most pupils consumed maize at a very high frequency. On both the QFFQ and 24hr recall rice, maize meal and bread are on top of the list, indicating that the CHO and starch form the basis of most meal consumed. The eating patterns of the population in the present study are consistent with findings of Kruger et al (2005:356) where a high consumption of cereal based foods such maize meal, bread and rice were indicated. On the basis of the QFFQ, participants met the nutrient average requirement for energy. The distribution and high intake of diluted juice, nik-naks, ice blocks, vetkoek and carbonated cool drinks in the top 20 food items identified from the 24hr recall are a possible contributor to the intake of energy foods (Table 4.14), however, it may have a negative impact on health and the overweight prevalence in the school children. At any given level of energy intake, a higher intake of sugar threatens the nutrient quality of diets by providing significant amounts of energy without supplying specific nutrients. A generous amount of dietary fibre is known to reduce coronary heart disease; hypertension, diabetes, obesity and gastrointestinal disorders, aids in weight loss and improves the immune system functioning (Anderson et al, 2009:188).

Most of the adolescents in this study had a normal anthropometric nutritional status (92.4%) height-for-age and 56% were in the normal range for BMI-for-age (>-1SD and <+1SD), however, 30% were at risk of overweight/obesity (>+1SD and <+2SD) in addition to 10.8% overweight (>+2SD and <+3SD) and 1.9% obese (>+3SD). These proportions were not much different from what was found in a study done by Jinabhai et al (2007) which identified 20.9% of girls to be obese. The prevalence of overweight recorded may be due to the fact that the participants can decide on what food to eat without much parental control. There was no correlation between the education level of the parents/caregivers and nutrition status of the children ($p=0.405$).

The 24 hr recall reflected the mean daily protein intake in this study as adequate (59.23g) (refer Table 4:13), but the frequency of consumption of some protein rich foods such as meat and pulses was low. Even though meat, milk and beans were consumed by most participants sufficiently to meet protein needs, it was not enough to comply with other micronutrient

needs. Other foods rich in protein such as fish and eggs were not in the top 20 foods consumed reported by the QFFQ or 24hr recall. The proteins from animal sources are very expensive, thus cannot be afforded by most households or be included in the daily preparation of meals. Protein as discussed by Gharib and Rasheed (2011:8) is required for growth of children; however, if it is consumed in excess, it is converted into energy and stored as fat.

Adolescent girls are likely not to consume enough iron (Baltusen et al, 2004:134). Iron requirement increases during growth and is important for blood formation especially for young girls because of the need to replace blood lost during menstruation (NICUS, 2003); however, low consumption is identified in the majority of the participants. The mean intake for the participants of 8.68g± 2.92mg (QFFQ) and 8.76g ± 3.61mg (24hr recall) iron is sufficient to meet iron needs but similar to protein, it is too little to meet with other micronutrient requirements. In this study 64 and 79 participants respectively do not meet the EARs for iron. The results correlate with what Labadarios et al (2008:262) found in the NFCS-FBI that one out of five women had a poor iron status.

In this study the adolescents had a significantly low calcium intake. The mean intakes of calcium with less than 1300mg/day were observed. All the participants (157) did not meet 100% of the EAR for adolescents. Optimal calcium intake during the adolescent growth spurt is critical for adolescents to obtain the full genetic potential for peak bone mass. The results of the present study are in agreement with findings in an adolescent study conducted by Chemaly et al (2004) which have reported the mean calcium intake of 811 mg/day. Although Chemaly et al (2004) and other studies highlighted the variability of mean daily calcium intake in adolescents, most of them reveal that consumption is less than adequate, demonstrating a worrying problem in relation to adolescents and future bone health. In light of these observations, insufficient calcium intake is the result of low consumption of calcium rich foods, such as milk and its derivates, ignored by the frequent and high intake of soft drinks (Story and Stang, 2005:29). Moreover, the high intake of regular soda drinks, sweets and snacks contributes to a surplus kilojoule intake and dental problems with an increased risk of obesity and its consequences. Low milk intake may increase the risk of developing osteoporosis since calcium intake plays a direct role in the formation and structure of bone.

Fibre intake by the participants fell short of the current recommendations (>25g per day) and may be considered inadequate for optimal health promotion and chronic disease prevention. This is possibly due to the low consumption of fresh fruit and vegetables as observed in the QFFQ and 24hr recall data and possibly due to insufficient quantities of other sources of fibre such as whole grains, legumes, and high fibre cereals. Fruits and vegetables are rich in complex carbohydrates, dietary fibre, vitamins, and minerals. An adequate intake of fruits and vegetables is associated with a decreased risk of atherosclerosis, chronic respiratory diseases, cancer of the colon, oesophagus and stomach (Dauchet, Amouyel and Dallongeville, 2009:599). Increasing consumption of fruits and vegetables is a priority for any individual who aims to promote healthy eating habits (de Sa and Lock 2008:558). The intake of legumes, fruits and vegetables, particularly green leafy vegetables was also found to be grossly inadequate which could possibly lead to deficient micronutrient intake. The present study showed that the consumption of these essential nutrients is far below the recommended intake of >400g/day (Table 4.15). Anderson et al (2004:650) emphasized that the present dietary recommendations encourage a minimum intake of 400g fruit and vegetables and that is approximately five portions of about 80g daily. Infrequent intake of fruit and vegetables reflects a lack of protective and healthy foods in the diet. Low dietary fibre, vitamin A and folate levels are related to low and irregular vegetable and fruit intake which are a precursor of these essential nutrients. Cheng, Libuda, Karaolis-Danckert, Alexy, Bolzenius, Remer and Buyken (2010:1375) noted that the consumption of healthy food choices such as fruits and vegetables has been found to decrease in adolescents whereas the consumption of soft drinks increased.

4.7.4 Anthropometry

The DBSA described the nutritional status of children in terms of anthropometry or body measurements such as weight in terms of age or height, which indicates thinness. The height in terms of age would be a measure of stature in which too short in length for age is an indication for long-term and chronic malnutrition (DBSA, 2008:6). Although there is a possibility of under or over reporting of food consumption in a QFFQ and in a 24hr recall due to various reasons related to memory and interview situation, the reported data on energy intake when compared to body mass index of the participants showed a significant trend in the expected direction. The relatively high prevalence of overweight observed among the

participants may be due to the excessive dietary intake of starch and sugary food (Table 4.9). Snacking on sugary food may contribute to overconsumption of energy and may favour weight gain in predisposed individuals. The high consumption of snacks and sweets (Table 4.14) corresponds with the THUSA BANA study in which Kruger et al (2005:356) reported over consumption of sugar-sweetened soft drinks, snack foods that increase energy intake and replace nutrient dense foods in the diet thus contributing to weight gain. The prevalence of stunting (measured with height-for-age z-score <-2SD to >-3SD) (7.6%) observed among the population may be due to the inadequate dietary intake of food over time and/or repeated infections. The evidence of stunting in the girls suggests chronic undernutrition which might result in slowing maturation. The rate of undernutrition in the present study is similar to the findings of Mulugeta et al (2009) who recorded a prevalence rate of undernutrition of 26.5% among school age children in rural communities of Tigray, Northern Ethiopia. According to von Grebmer et al (2010:22), researchers found that the growth faltering, particularly stunting and underweight occurs from birth to age two. The overall nutritional status of the population indicated that 30% were at risk of overweight and 1.9% were obese. The rate of overweight of the present study (10.8%) is similar to the findings of Kruger et al, (2005) who recorded a prevalence rate of overweight of 7.8% and 7.1% obese among black participants in all 9 provinces of SA. A similar study was carried out by Chemaly et al (2004) amongst white school age girls between 15-17 years, 21.5% were underweight and 4.5% were obese. These findings are consistent with the results of a study conducted in South Africa by Reddy et al (2008) among school age children between grade 8-11 that indicated the prevalence of nutritional problem, where 9.0% were underweight and 16.9% overweight. The 1999 NFCS results indicated that South Africa has a history of children that are overweight and obese (17%). In the Demographic Health Survey of 2003 (DoH, 2004), women obesity ranged between 11-41%. The present study outcome is a reflection of epidemic obesity amongst adolescent girls. According to Kimani-Murage et al (2010:10), obesity is a continual trend that increases with age. The data confirm that South Africa as in many other developing nations in transition is experiencing prevalence of both under nutrition and overnutrition.

4.8 CONCLUSION

The poor nutritional status of adolescents especially girls, has important implications in terms of physical work capacity and undesirable reproductive outcome. The results collectively indicate that the majority of the participants belonged to the households of low to moderate socio-economic status. The overall nutritional status of the participants was not satisfactory. A large proportion of the population lived in poverty, even working families. The present study reveals the trend in improvement in accessing the basic services. Nonetheless, the population was found to be food insecure and deficient involves of micronutrients were common, resulting in the prevalence of stunting (7.6%) in Table 4.16. The data provide evidence that the average school child in Mandlenkosi is malnourished. Addressing the nutritional needs of adolescents in schools could be an important step towards breaking the vicious cycle of intergenerational malnutrition. The present study did not find a statistical significant correlation between household income and daily energy intake, education level and daily energy intake, BMI and education level, BMI and household income but studies still indicate that this can play a role. The factors that significantly influenced the nutritional status of the study population were age and gender of the target sample, geographic condition and economic status. In conclusion, the findings are confirming that both under and over nutrition are of public health significance.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter presents a summary of the study, purpose, limitations, conclusion and recommendations based on the analysis of the data. The recommendations for future research are presented in line with the objectives of the study.

5.2 PURPOSE OF THE STUDY

The purpose of the study was to investigate the nutritional status and dietary intake of adolescent school girls in a high school in Lindelani, KZN. The study findings indicated that malnutrition exists and are prevalent in this community and South Africa according to the literature. The results also identified the socio-economic factors which had an impact on children's nutritional status and food intake patterns.

5.3 LIMITATIONS OF THE STUDY

The data obtained from Mandlenkosi High School represented only one school in the area and data is unique only in the school and direct community from where it was obtained.

The sample size in this study was relatively small due to the study confinement to one school. Although the school presented the researcher with a possible sample size of 406 girls, only 157 completed the consent forms and all the assessments

The results from this study cannot be generalized because the sample was limited to Mandlenkosi adolescent girls only. However, inadequate consumption of certain micronutrients was found in this population and taking this information into consideration, it is possible that nutrient intake inadequacies among the general population may also be prevalent.

Data collection time was problematic, lunch time was too short to complete the questionnaire, and afternoons were busy as learners would rush to get transport back home or did not want to stay behind after school. Few parents would arrive on weekends, and so the fieldwork was dragged out for approximately 4 months.

The reliability of the data collected was dependent on the participants' disclosure.

5.4 SUMMARY OF THE STUDY

Malnutrition as stated by Labadarios et al (2005c:100) is one of the fundamental subject matters that the new South African democratic government embarked on to address in 1994. According to Hunt (2005:11), malnutrition has caused 54% of child deaths in developing countries. This is an ongoing tragedy and Chesire et al (2008:471) confirmed that statistically, more than 200 million school children suffered from malnutrition and further announced that about one billion children will be physically and mentally impaired by 2020 if no precautionary measures with immediate action taken. The nutritional status of children is important as it determines health, physical growth and development, academic performance and progress in life. Every child has a right to proper nutrition, which is essential for physical development and quality of life. Malnutrition not only weakens the immune system but also retards the economic and social development of the nation.

Malnutrition is a combination of several factors including insufficient household food security, inadequate maternal and child care and poor health services and sanitary conditions. The late Dr Manto Tshabalala made a statement that children need to grow up in a physically, emotionally and mentally safe environment. However, factors such as unemployment, unequal distribution of resources and political influences give rise to poverty and malnourished children. The current overview of the nutritional status of South African children identified malnutrition as a public health concern. Most children suffer from various forms of both under and over nutrition in most parts of the world (Karp, Cheng and Meyers, 2005:1). Protein energy malnutrition in children has continued to remain a serious problem globally. The lack of access to safe drinking water, inadequate toilet provisions, poor housing and unhygienic behaviour are the major environmental factors associated with acute and chronic child nutrition. South Africa has so far done a great deal in improving housing and

sanitation; in 2006, 55% households had access to flush toilets. However, the target set by former South African President, Thabo Mbeki in his speech on the situational analysis of children in SA, to do away with bucket system by 2007 had not been met (UNICEF, 2009b:40).

- Socio-demographic: The survey indicated that the adolescent girls come from low socio-economic households with insufficient resources. Several studies have shown an association between household socio-economic status and malnutrition. In this study the problem of overcrowding was evident with an average of six members per household. Most households were not always in a good condition, they were small, leaking or needed repairs. In some homes, the girls were raised by grandparents who were the only breadwinners surviving with old age government grants. Food procurement was problematic due to financial constraints which, therefore, lead to food scarcity. The level of education was assessed; few caregivers had post matriculation qualifications. The level of education could have an effect on the high rate of unemployment. Even the employed parents are largely domestic workers, street cleaners and taxi drivers. Children of parents who were unemployed and had minimum years of schooling were at risk of food insecurity. Nonetheless, the majority of the households had electricity and ownership of the basic facilities such as stoves, fridges, television. The majority of the household reported weekly waste removal which should, therefore, minimize rat and other pest infestations.

- Dietary intake: The data indicated that most of the participants followed a three meal pattern. The consumption of foods from the cereal group indicated a diet high in staple foods as a source of energy. The distribution of the CHO intake (maize meal, rice and bread) in this study showed that most of the diets consumed by the adolescent girls in this community were CHO dominated. However, dietary energy intake was inadequate in about 101 participants (64%) as reflected on QFFQ and 135 (85%) on the 24hr recall. The main source of protein was chicken and appeared at number 8 and number 7 on the top 20 food items consumed on the QFFQ and 24hr recall respectively. Similarly, the consumption of chicken may be influenced by affordability as compared to red meat and fish and the intake of these is closely linked to income. The overall survey indicated that the participants' diet was lacking in a

number of micronutrients: - iron, calcium, vitamin A and folic acid in particular. This could be associated with the quality and quantity of the meals the target population consumed, which impacts on the girls' nutritional status. In the absence of adequate dietary intake of iron, the girls become highly prone to anaemia. Generally, socio-economic conditions influence the nature of the diet; as poor populations tend to have diets low in iron and other essential nutrients. This is reflected in the present study as 64 (QFFQ) and 79 participants (24hr recall) did not meet the DRI for iron. The data also indicated the low intake of fruit and vegetables. The lack of nutritional knowledge about dietary diversity may be one of the reasons for poor consumption of fruit and vegetables. The adolescents' intakes of fat and added sugars exceeded guidelines in the study. The apparent result of overweight may be the result of the overconsumption of fatty and sugary foods and a carbohydrate rich diet. The parents/caregivers of the participants were mostly temporally employed and received a low income at the end of the week/month to purchase food. Despite the effort, quantity and quality of the diets of the participants is likely to be compromised. Many families suffer from poverty as reflected by the type of employment of the caregivers, reliance upon social grants and the relatively high levels of spending on food. In some homes grandmothers took care of the children with the little income received from old age pensions. This could have negatively influenced the nutritional status of the adolescent girls.

- Anthropometry: in the present study, 7.6% adolescent girls were stunted and an almost similar proportion overweight. Food supplements are required at an early stage of growth and development to prevent teenage stunting. To address the overweight trend of adolescents and teenagers, physical activity should be encouraged from an early age at school level.

5.5 CONCLUSION

In conclusion, the present study reveals a lower incidence of undernutrition than over nutrition and dietary inadequacy particularly in respect of micronutrient intake. The results of the study suggest that adolescent malnutrition is strongly associated with social and economic

factors. These adolescents reveal the vulnerability of those who have not received appropriate attention to ensure that nutritional needs are met.

5.6 RECOMMENDATIONS

5.6.1 Recommendations for government departments

- Nutrition interventions in addressing the nutritional needs of adolescents especially in rural areas is an important step towards breaking the vicious cycle of intergenerational malnutrition. To reduce child undernutrition, governments should invest in effective nutrition interventions targeted to mothers and children during the window of opportunity. The priority in resources distribution should be directed to the disadvantaged rural populations, impoverished households and communities with a poor sanitation environment. The poverty alleviation programmes in South Africa need to be revived with funding as well as with a feasible strategy to ensure an even distribution of wealth and development of coping strategies to break the cycle of poverty from different geographic areas and poverty stricken regions. Child nutrition, particularly for vulnerable populations, must be given higher priority in national development. In the poverty reduction strategy, targets should be set to improve upon the existing levels of social indicators such as food availability, inflation rate, level of education and employment. The successful resolution of the food crisis should be measured not primarily by declines in food prices, but by significant declines in the number of food insecure people and people who can provide for themselves through empowerment.

- History of research has confirmed that children born of educated mothers are better nourished with decreased maternal death. Education enlightens and gives a better understanding of the cause and prevention of food related diseases. When mothers have poor knowledge of healthy and nutritious food, their offspring are more likely to suffer from malnutrition. Priority should be given in empowering women with skills and knowledge of growing, preparing and serving healthy nutritious food to the household members. Education activities about sanitation and hygiene should be provided to poorly educated mothers in order to make the most of the investment and

to prevent unequal child health gains. The former UN Secretary-General, Kofi Annan, has encouraged the education and empowerment as he believed that both these are the greatest weapon in the war against poverty. A mechanism should be devised for the education of mothers and all household members for bringing about behavioural changes in understanding and managing nutritional activities. It is, therefore, recommended that the DoE conduct health and nutrition programmes aimed at improving the health and nutritional status of adolescent girls in schools.

- Dietary knowledge and access to resources are critical to improve health and nutrition in a sustainable way. Nutrition promotion and education should be a continual effort to raise public awareness of the importance of good nutritional status in children. School environments are preferred for health promotions and are a better platform to develop school wellness policies and limit access to unhealthier food options on the school premises. The school governing body should have more control over what is sold in tuckshops. School meal programme are generally considered to be effective at reducing hunger and poverty. Fortunately in South Africa, children's rights to be fed and to be taken care of are known and respected. The KwaZulu-Natal Province, like many other provinces, has already made a huge progress in providing food in schools particularly on high school level lately. However, the NSNP which is in operation in most South African schools should be closely monitored to reduce common problems associated with feeding. Renowned feeding programmes are profit orientated rather than children's wellbeing and poverty reduction orientated. The government's responsibility should not only be focused on issuing out tenders but also to formulate a proper monitoring strategy to ensure that the quality of food is served according to standards set. Data should be obtained through recording and reporting of effectiveness and efficiency of the SFPs. The departments that coordinate nutrition programmes in schools should be well equipped with nutrition knowledge and skills to administer the correct implementation. The supervision monitoring of the coverage and quality of services provided has to be conducted and supervised by the government's official authorities more frequently. All stakeholders (educators, SGB, learners) should be involved in the planning and promoting of healthful eating and children's nutrition status. School food policies should allow learners together with

the school management team to make decision with regard to school nutrition programme.

- In the past people were hunter gatherers, eating wild fruit and indigenous plants. Not many of these activities still exist probably due to demolition of natural resources. Resources such as land, rivers and trees should be properly managed for the purpose of accessing these natural products. Gardening should be encouraged, in line with the South African government proposal of "one home one garden". By tradition, South Africans practice mixed farming, which involves the production of both crops and animals. Similarly, livestock production should also be encouraged. Agriculture as spelled out in the World Nutrition Situation report 'plays a central role in increasing food availability and incomes, supporting livelihoods and contributing to the overall economy'. On that note, the government should see that water supply for irrigation purpose is made available. The local government should provide safe clean water and good sanitation to prevent communicable diseases in the communities that affect the children.

5.6.2 Recommendations for non-government organisations

Micronutrient malnutrition may reflect inadequate care of the concerned issue at the national level, probably due to poor delivery strategy, lack of infrastructure or because needed resources are kept out of reach of vulnerable groups. Inadequate dietary intake due to food insecurity is considered one of the major causes of micronutrient deficiencies. Efforts to combat micronutrient malnutrition in the developing world should focus on providing vitamin and mineral supplements to pregnant women and young children. In the light of these findings, a high intake of locally available micronutrient rich foods before is recommended.
Furthermore, a suggestion is to start a micronutrient supplementation for the girls from the adolescent period itself to build surplus for present as well as the future demands. Therefore, nutritional supplements must be provided to undernourished girls prior to the onset of menarche so that they are able to achieve their full growth potential. In addition, a high intake of locally available micronutrient rich foods before is recommended.

The results show a high prevalence of micronutrient malnutrition amongst adolescent girls. Seemingly, as it was reported in NFCS of 1999, South African children continue to be affected by low intakes of the essential nutrients. There is a great need to enforce, monitor and evaluate fortification regulations particularly vitamin A and iron levels in maize and wheat flour as South Africa's staple diet. Ongoing evaluation throughout the production process should be implemented.

5.6.3 Recommendations for future research

- Adequate food and nutrition are essential for proper growth and physical development to ensure optimal work capacity, normal reproductive performance, adequate immune reactions and resistance to infections. Nutrition programmes are implemented in most South African disadvantaged schools. However, effectiveness and quality service rendered is questionable. For some school children, food served in schools is the only meal for the day. Further research is recommended on the type and quality of school menus, if not, the school children will continue to suffer the consequences of malnutrition despite the government's endeavour to feed the schools. Therefore, a regular monitoring and evaluation need to form part of INP activities particularly in schools and in communities.

- It is recommended that this study be repeated in a larger sample of schools in non urban areas of KwaZulu-Natal to determine if the same results would be evident.

- Sustainable nutrition education and promotion programmes should be developed to raise public knowledge of the importance of good nutrition in children and adolescents.

- Further research is needed to determine how best to communicate the importance of micronutrient consumption as part of a healthy diet.

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Annexure A

14 WINDORAH
69MONTPELIER
DURBAN
4001
05 MAY 2008

To whom it may concern .

This serves as a confirmation letter that I , B.N. Silangwe 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:

Annexure B

DURBAN UNIVERSITY of TECHNOLOGY

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

Dear Parents

You are invited to attend the meeting at Mandlenkosi on the 19th October 2008 at 12:00 am.
The meeting is about completing the questionnaire regarding your household and eating patterns of your child.

Please confirm your attendance by filling the form below for us to know as snacks will be provided for you

RESEARCHERS

Mrs. N Phetshula

Ms B. N. Silangwe

ATTENDANCE FORM

Fill and tick on the relevant boxes below

I _____ parent of _____
Confirm that:

I will be available for the Sunday meeting ☐

I will not be available for the Sunday meeting ☐

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

D U R B A N
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			

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

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

6.11What 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 Work School Other specify: Not applicable		**1** **2** **3** **4** **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 Work School Other Not applicable		1 2 3 4 5
2.2.1	At about what time did you eat your second meal?			
2.2.2	Where did you eat this meal?	Home Work School Other Not applicable		1 2 3 4 5
2.3.1	At about what time did you eat your third meal?			
2.3.2	Where did you eat this meal?	Home Work School Other Not applicable		1 2 3 4 5
2.4.1	At about what time did you eat your other meals?			
2.4.2	Where did you eat these meals?	Home Work School Other Not applicable		1 2 3 4 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	/	/

This is to certify that the language editing of this dissertation by Ms. N B Silangwe was done by Prof L A Greyvenstein.

Prof L A Greyvenstein 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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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

Silangwe, B. N (Miss) Reseacher and Mandlenkosi educator

D U R B A N
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 : .....