COMPARISON OF PACKED SCHOOL LUNCHES OF BOYS AND GIRLS IN PRIMARY SCHOOLS IN EAST LONDON

Dissertation submitted in fulfilment of the requirements for the degree Master of Applied Science in Food and Nutrition in the Department of Food and Nutrition Consumer Sciences, Faculty of Applied Sciences at the Durban University of Technology.

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2015

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

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DEDICATION

I dedicate this dissertation to my daughters, Olivia and Danielle, and my parents who encouraged me through this process and for their unconditional love and support.

ABSTRACT

Objective: To determine the contribution of packed school lunches to the daily food intake of girls and boys in two Primary Schools in East London.

Methods: The study was conducted among 199 girls and boys aged 9-13 years. Three 24-Hour recalls and a Food Frequency Questionnaire were completed during an interview with the participants to gather data on dietary patterns over a period of three consecutive days. Additionally, the contents of one lunch box per participant were recorded and weighed. Anthropometrics and socio-demographics were also completed during the interview.

Results: The three 24-Hour Recall nutrient measurements revealed a low energy intake in 91 percent for the girls and 77 percent for the boys who were consuming below the recommended Estimated Energy Requirement for energy. The lunchboxes contributed one-third of the daily nutrient intake of the children. The 24-Hour recall revealed an energy-dense, carbohydrate-based diet. The contribution of total fat (30-32%) to the total energy is higher than the World Health Organization (WHO) recommendation of 15-30 percent. The daily fruit and vegetable intake (215.1g and 216.9g), according to the 24-Hour recall and lunchbox analysis respectively, was insufficient compared to the WHO-recommendation of >400g /day. Although the mean intake of most of the nutrients was sufficient, a large number of the participants did not meet requirements for the age group. The risk of overweight was high (24% for girls and 29.2% for boys) with 1.5 percent falling into the obese category.

Conclusion: The results of the study indicated a high-fat and carbohydrate intake and a very low fruit and vegetable intake. The girl participants had better food choices for the lunchboxes but the majority of the participant's daily intake did not meet the basic requirements of a balanced diet. The risk of overweight in the age category is an increasing problem among low- and high-income countries. Nutritional education should concentrate on healthy food choices in school lunchboxes as a large part of the day is spent at school.

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LIST OF ABBREVIATIONS

AI	Adequate Intake
ACAORN	Australian Child and Adolescent Obesity Research Network
ADA	American Dietetic Association
AIDS	Acquired Immune Deficiency Syndrome
ALA	Alpha-linolenic acid
AMDR	Acceptable Macronutrient Distribution Ranges
BED	Binge Eating Disorder
BMI	Body Mass Index
BN	Bulimia Nervosa
CARE	International Relief Agency
CBNP	Community Based Nutritional Programme
CDL	Chronic Diseases of Lifestyle
CM	Centimetres
CVC	Cardiovascular Disease
DDS	Dietary Diversity Score
DHA	Docosahexaenoic acid
DNA	Deoxyribonucleic acid
DoH	Department of Health
DRIs	Daily Reference Intakes
DOSH	Division of Occupational Safety and Health
DUT	Durban University of Technology
EAR	Estimated Average Requirement
EDNOS	Eating Disorder Not Otherwise Specified
EER	Estimated Energy Requirement
EPA	Eicosapentaenoic acid
ETU	Education and Training Unit
FAO	Food and Agriculture Organisation
FFQ	Food Frequency Questionnaire
FBDG	Food Based Dietary Guideline (FBDG)
FGDS	Food Group Diversity Score

FVS	Food Variety Score
g	Gram
g/dl	Grams per decilitre
GAIN	Global Alliance for Improved Nutrition
GDP	Gross Domestic Product
GM	Genetically Modified
H/A	Height-for-age
HCBC	Home and Community-based care centres
HGSFP	Home-grown School Feeding Programme
HIV	Human Immune Deficiency Virus
IFSNP	Integrated Food Security and Nutrition Programme
INP	Integrated Nutrition Programme
IMCI	Integrated Management of Childhood Illnesses
IoM	Institute of Medicine
ISSA	International Social Security Administration
kg	Kilogram
kJ	Kilojoules
LIFDC	Low Income Food Deficit Countries
m^2	Square Meter
mcg	Microgram
MDG	Millennium Development Goals
mg	Milligram
ml	Millilitre
MRC	Medical Research Council
NAR	Nutrient Adequacy Ratio
NDoH	National Department of Health
NDP	National Development Plan
NEDA	National Eating Disorder Association
NEP	National Education Programme
NFCS-FB	National Food Consumption Survey – Fortification Baseline
NGO	Non-Governmental Organisation
NICUS	Nutrition Information Centre of the University of Stellenbosch

NSLP	National School Lunch Programme
NSNP	National School Nutrition Programme
NFCS	National Food Consumption Survey
PAL	Physical Activity Level
PEM	Protein Energy-Malnutrition
PPP	Purchasing Power Parity
RDA	Recommended Dietary Allowance
SA	South Africa
SADA	South African Department of Agriculture
SANHANES	South African National Health and Nutrition Examination Survey
SSA	Sub-Sahara Africa
SASSA	South African Social Security Agency
SD	Standard Deviation
SNAP	Supplemental Nutritional Assistance Programme
STATSSA	Statistics South Africa
SUN	Scaling up Nutrition Movement
TB	Tuberculosis
UL	Tolerable Upper Intake Level
UNICEF	United Nations International Children Fund
UNDP	United Nations Development Plan
UNSCN	United Nations Standing Committee on Nutrition
USDA	United States Department of Agriculture
VAD	Vitamin A deficiency
WC	Waist Circumference
W/A	Weight for age
WFP	World Food Programme
W/H	Weight for Height
WHES	World Hunger Education Service
WHO	World Health Organisation
WHR	Waist/Hip Ratio
WHtR	Waist-to-Height Ratio

LIST OF SYMBOLS

>	Greater Than
<	Less Than
≤	Less Than
±	Plus Minus
≥	Greater Than
%	Percentage
=	Equal To
*	Estimated Energy Requirements
AI	Adequate Intake
♀	Female
♂	Male

CHAPTER 1 – THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

The signs of health and prosperity used to be reflected in weight gain and fat storage (Toss, 2011). A global problem threatening health has emerged caused by the rise in living standards, leading to weight gain and obesity. Overweight leads to obesity and the appearance of chronic disease affecting adults and children alike. This phenomenon, "globesity", is occurring in developed and developing countries worldwide and is at an epidemic level. Overweight and obesity previously featured mostly among high-income countries, but are increasing drastically among the low- and middle-income countries, particularly in urban areas. The projection for 2015 is that 2.3 billion adults will be overweight and more than 700 million obese (World Health Organisation (WHO) 2006).

Obesity and overweight have shown a dramatic increase in Africa over the past 20 years. Viewed as a worldwide problem and not only associated with Africa, the consequences of overweight and obesity to health and overall quality of life for children are extensive and continue to progress well into adult life. According to the World Health Organisation, the overweight and obesity levels in Africa are the fastest growing in the world and have doubled since 1990. The magnitude of childhood obesity calls for a population-level approach as the problem expands into an epidemic with severe consequences, not only for the general health and well-being of people, but also for the health systems in countries trying to cope with the problem (Gunnarsson, Mériaux, Hellström & Marild 2008: 102; De Onis, Blössner & Borghi 2010: 1257).

It has been reported that childhood obesity is increasing worldwide and in Africa it is estimated to have increased from 8.5 percent in 2010 to 12.7 percent in 2020 (De Onis *et al.* 2010: 1257). The National Food Consumption Survey (NFCS) in 2005 reported that one in twenty children (4.5%) aged one to nine years and 16 percent of thirteen year olds in the 2005 NFCS were wasted while stunted growth was present in almost 21.6 percent of the children. Stunting is still prevalent in the 0-3 year age group, but levels of undernutrition have improved in children younger than ten years of age since 2005, according to South African National Health and Nutrition Examination Survey (SANHANES) (Shisana *et al.,* 2013). Seventeen percent of the children in the one to nine age group and 16 percent of thirteen

year-olds in the 2005 NFCS were overweight and obese (Body Mass Index ≥ or = 25). This increases to 26.4 percent in 19 year-olds (Steyn *et al.* 2009: 142). Overweight and obesity prevalence has increased significantly in the 2-14 year-olds since the 2005 NFCS and in the 10-14 year age group, overweight and obesity were the highest in girls (16.7% and 5.6%) compared to the boys (7.5% and 2.7% respectively) (Shisana *et al.* 2013).

It is noted that high blood pressure, diabetes and high cholesterol levels are risk factors for children who are overweight (WHO 2006). Another consequence of overweight and obesity is sleep apnoea which places children at risk of major learning and memory dysfunction. In girls it causes hormonal disturbances and abnormalities, earlier onset of menstruation with a strong link to breast cancer and other disorders, such as depression, eating disorders and substance abuse (Department of Health Australia, 2007). The impact of obesity on mortality is evident in all ages and shortens life expectancy. The risk factors associated with overweight and obesity are diabetes mellitus, cardiovascular disease, stroke, hypertension and certain cancers. As heart attacks and strokes are rare among children, these factors predispose children to these diseases in adult life (National Stroke Foundation Australia 2014). The risk of co-disorders such as heart attacks increases as the BMI increases. Worldwide heart attacks kill 17 million people each year with diabetes mellitus being the next major cause of death (WHO 2006). Obesity also increases the risk of musculoskeletal disorders – especially osteoarthritis and some cancers (endometrial, breast, and colon). The risk of premature death and disability in adulthood is high for obese children (WHO 2006).

1.2 PREVALENCE OF MALNUTRITION GLOBALLY

Society's prosperity depends on adequate nutrition from an early age. Diet plays a special role because of the importance of specific micronutrients for growth and development. Some progress has been made in combating undernutrition and malnutrition. The first Millenium Development Goal (MDG) is to eradicate hunger, malnutrition and food insecurity by 2015 and reduce the proportion of people suffering from hunger (WHO 2006).

The Global Hunger Index as established by the International Food Policy Research Institute (IFPRI) in 2013 ranked South Africa in 9th position out of 120 countries. However, the data reported the South African Hunger Index to be 5.8 percent with 2.9 percent undernourished, 8.7 percent underweight and 4.7 percent mortality among children younger than 5 years

(International Food Policy Research Institute (IFPRI) 2013). The number of hungry people in Africa grew to 239 million and in Sub-Saharan Africa (SSA) the index has been rising by 2 percent per year since 2007. In 2012 the index reported a rise from 13 million to 16 million for the number of hungry people in developed regions. The deadline for achieving the eight Millennium Development Goals in 2015 is directly affected by six goals related to malnutrition (Food and Agriculture Organisation of the United Nations (FAO) 2012; World Hunger Education Service (WHES) 2012).

The Eight Millennium Development Goals for 2015 are:

1. Eradicate extreme poverty and hunger.
2. Achieve universal primary education.
3. Promote gender equality and empower women.
4. Reduce child mortality.
5. Improve maternal health.
6. Combat HIV/AIDS, malaria and other diseases.
7. Ensure environmental sustainability.
8. Develop a global partnership for development.

(FAO 2012).

Stunting, wasting and micronutrient deficiency is associated with malnutrition. The different forms of malnutrition are not necessarily found in one individual but, for example, a stunted child may also be wasted and have micronutrient deficiencies (Cobham *et al. 2*012).

The four most frequently used anthropometric indicators of nutritional status in children are; height-for-age, weight-for-age, weight-for-height and BMI-for-age. These are used to determine stunting, underweight and wasting and, in more recent developments, the addition of excess weight and obesity. Obesity is affecting children of all levels of society and is not only restricted to the low- and middle-income countries. Children are at an increased risk because of a diet high in saturated fats, refined sugars and salt, combined with a sedentary

lifestyle. They are at a greater risk than before of obesity and related chronic ailments such as heart disease, diabetes and cancer (United Nations Children's Fund (UNICEF) 2012a).

The UNICEF Conceptual Framework (2004a) illustrates the global problem of malnutrition among children and divides malnutrition into 3 categories, which will be discussed in detail in Chapter 2.

Malnutrition is also influenced by health status, food taboos as well as growth and personal choice related to diet. Neglect and abuse can also be linked to inadequate intake (UNICEF 2004a; Vorster & Hautvast 2002: 5). Malnutrition is the consequence of food insecurity and these conditions are linked to the standard of living and whether basic needs are fulfilled (UNICEF 2007a; WHO 2001a).

Poor income levels, low micronutrient intake and low energy levels are linked to hunger and malnutrition and affect children's growth patterns negatively and cause devastating and irreversible damage (Labadarios 2005: 119; UNICEF 2007a). The lack of nutritious food, repeated infection and illness, has an effect on the development of the body and on intellectual development. Stunting affects approximately 170 million children. One third of schoolchildren in developing countries are iodine deficient and this is associated with a loss of 10-15 IQ points. Nutritional well-being is dependent on the provision and access to food, adequate care for women and children, the availability of basic health services and a healthy environment (Cobham *et al.* 2012; Schubl 2010: 22). Ideal nutrition needs the availability, control and management of sufficient resources and is only effective if driven by education. In turn, these resources may influence the socio-economic, cultural, technological, political and cultural factors (Jamison *et al*. 2006; Oosthuizen, 2010). A decline in the health and nutritional status of children is the best indicator of the problems of malnutrition which are complex and difficult to understand (De Onis *et al.* 2000). Wasting (weight-for-height $\leq$ -2SD) globally in the under-five age group was at 51 million whereas 17 million were severely wasted in 2013 (WHO 2013a). South-central Asia, Asia and SSA are experiencing severe malnutrition and death from wasting (Figure 1.1).

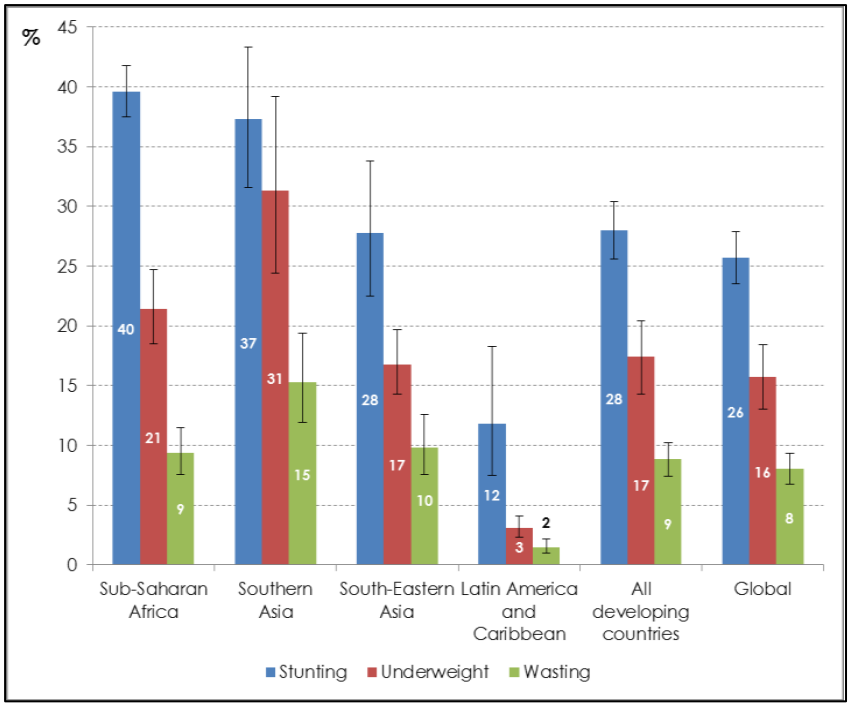

Figure 1.1: Prevalence of stunting, underweight, wasting during 2011 by MDG region (UNICEF- WHO 2011)

Asia has high levels of malnutrition, wasting and stunting and 17 million children are affected by overweight (WHO 2012). In South Africa mortality percentages due to malnutrition among the 0-14 age group is 3.5 percent for boys and 3.8 percent for girls (Statistics South Africa (STATSSA) 2010). However, in the under fifteen age group it is estimated that 450 000 children are HIV positive. The mortality rate for the under five age group has decreased from 56 percent in 2009 to 42 percent in 2011 (Bradshaw, Dorrington & Laubscher 2012: 1). Adequate nutrition contributes to the decrease of malnutrition levels and the under-five mortality rates and is essential for achieving the Millennium Development Goals (UNICEF 2012a).

Inadequate food intake, low birth weight and the prevalence and management of childhood diseases are interlinked and cause increased vulnerability to diseases among children. Food insecurity is caused mainly by low income at household level and it is also prevalent in higher income members of society (World Bank 2008a). Among the poor, the consumption of inexpensive foods of low nutritive value is supplied by street vendors and tuck shops. Among the more affluent members of the community, food choices are more extensive due to higher incomes and accessibility, but the lack of nutritional knowledge contributes to inadequate food choices. Various factors contribute to obesity and overweight, such as

urbanisation, eating away from home and peer pressure. This results in the occurrence of non-communicable diseases in greater numbers in South Africa where a mix of undernutrition and overnutrition can be found. The National Food Consumption Survey (2005) reported high levels of stunting and underweight among 1-9 year olds but, in contrast, 17.1 percent of the sample was overweight or obese (Abrahams *et al.* 2011: 1752). The South African National Health and Nutrition Examination Survey (SANHANES) in 2013 reported a higher prevalence of overweight among girls than boys while the highest levels were in urban and peri-urban environments compared to the rural areas, with low levels of 6.3 and 2.5 percent respectively (Shisana *et al.* 2013).

1.3 PREVALENCE OF MALNUTRITION IN AFRICA

The World Food Summit of 1996 defined food security as "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Folaranmi 2012). Food insecurity includes inadequate amounts of good quality food available, inaccessibility by individuals to sufficient resources to acquire suitable food for a nutritious diet, insufficient clean water, sanitation and healthcare to achieve a state of well-being with all physiological needs met and the inaccessibility of adequate food supplies for everyone (Folaranmi 2012; Nkuepo 2012: 1). When food is secure, the consumption of low density nutritious food increases due to a larger variety and more readily available foods and this results in poor food choices and thus contributing to malnutrition.

In many African countries, the availability of nutritious food is a problem, especially in East African countries such as Somalia, Kenya, Ethiopia, Djibouti and South Sudan. Food crises in these regions have led to a state of emergency and, with the help of western institutions, tons of food is supplied to these regions (Nkuepo 2012: 1). The prevalence of stunting in under-5 age group in Africa has increased by more than 14.5 million, to 60 million, and could reach 64.2 million by 2020. Forty percent of stunted under-5 year old children in Africa are from Ethiopia, Nigeria and the Democratic Republic of the Congo. The acute food crisis in the Sahel region of West Africa has now 1 million at risk for children under the age of five and who are liable to experience for severe acute malnutrition (FAO 2012).

Poverty and food shortages are the main causes of malnutrition in the world and occur in a vicious cycle. Numerous factors such as conflict, disease epidemics, climate change, (including droughts) and these contribute to malnutrition and exacerbate poverty in Africa. Violent conflicts, such as disputes over water and grazing resources, the abduction of women and livestock and quarrels over borders have displaced people and disrupted transport services and trading and thus have resulted in a lack of access to food. Conflicts in SSA have contributed to 88 percent of the global death toll between 1990 and 2007 and have seen the number of refugees and internally displaced people rise to nine million. Economic recovery in Rwanda and Uganda, where conflict has ended, has been extensive, and this has seen the reduction of extreme poverty and malnutrition. Despite the rapid economic growth rate in SSA over the past decade, it has not resulted in poverty reduction and the regions have the highest concentration of the ultra poor in the world (Folaranmi 2012).

HIV, AIDS and malaria contribute to food and nutritional insecurity and the spread of the virus by forcing extremely poor people to take up unsafe practices to provide food (Gillespie & Kadiyala 2005). During 2004, 121 million SSA's lived on less than US$ 0.50 a day. SSA has the highest proportion of unemployed and under-employed people in the world with approximately 300 million living on less that US$ 1.00 per day. Basic staple foods for daily consumption among the poor become unaffordable and luxury items such as meat and fish are out of reach. SSA showed a decline of 10 percent in poverty by 2008, but the region has holds the largest share of populations living in extreme poverty (Folaranmi 2012; Atinmo *et al.* 2009: S40).

Poverty affects farming households as insufficient funds result in fewer agricultural activities and no funds are available for investment into productive assets and agricultural technologies. The importation of food to make up the food deficits also suffers because of the extreme poverty that result from the insufficient demand. Climate changes have severely affected regions in SSA and have greatly contributed to poverty. The farmers are dependent on rain for crop growth as only 4 percent of the agricultural land is irrigated. The rural farmers are affected greatly because of the inability to adapt to climate change which is linked to acute poverty levels. Erratic weather patterns are often characterised by prolonged droughts, followed by floods. Food shortages caused by droughts in the Sahel region of West Africa and the Horn of Africa have resulted in the death of tens of thousands of people (FAO 2010). Progress in the SSA region varies at the country level, but it still remains the region with the

highest percentage (30%) of undernourished people. Undernourishment increased in the Democratic Republic of the Congo to 60 percent in 1992, but data from 2005-2007 reported that the Congo, Ghana, Mali and Nigeria had already achieved MDG 1 and Ethiopia and others were close to reaching the goal (FAO 2010).

1.4 PREVALENCE OF MALNUTRITION IN SOUTH AFRICA

Under-five mortality in South Africa (SA) in 2005 was estimated to be approximately 60 000 per year (Labadarios, Dhamsay & Hendricks 2008: 101). The National Food Consumption Survey (NFCS) and the National Food Consumption Survey Fortification Baseline (NFCS-FB) reported greater vulnerability due to poor nutritional status in the age group one to three years (Labadarios *et al.* 2008: 101). The lack of clean water and sanitation and adequate living conditions increased the risk of mortality among children. In 2012, South Africa ranked 35 out of 44 countries for the under-five mortality rate from malnutrition, with 24 percent of children suffering from wasting and malnutrition (Africa Public Health Info 2012).

In South Africa under- and overnutrition co-exist as part of the nutritional transition and malnutrition has become a public health issue. The initiation of various nutritional and primary health care programmes over the past 10 years has shown some improvement in malnutrition and child health. One in five children suffers from stunting and one in ten from underweight. Overweight was represented by 10 percent and obesity by 4 percent of the children aged 1-9 years. The iodine and folic acid status appears to be adequate throughout the country although almost one third of women and children were anaemic, two out of three children and one out of four women had a poor vitamin A status and 45.3 percent of children had an adequate zinc status. The HIV and AIDS pandemic together with inadequate nutritious food intake, food insecurity and lack of quality basic services continue to be part of the situation (Labadarios *et al.* 2008: 101). During the last 12 years, three national nutritional surveys were conducted: The 1999 National Food Consumption Survey (NFCS) the 2005 National Food Consumption Survey-Fortification baseline (NFCS-FB-1) and the SANHANES-1 (2013). The result from the three surveys confirmed that stunting and underweight remains the most common nutritional disorder among children 1-9 years of age (Labadarios *et al.* 2008: 101; Shisana *et al.* 2013).

As shown in Figure 1.2, the national average age group (1-9 years) stunting in South Africa has decreased from 21.6 percent to 18 percent with the best improvement reflected in the rural areas (26.5% to 20.3%). There has been a decrease in stunting of 23.4 percent in 1-3 year old children, 16.4 percent in the 4-6 year age group and 12 percent in the 7-9 year age group.

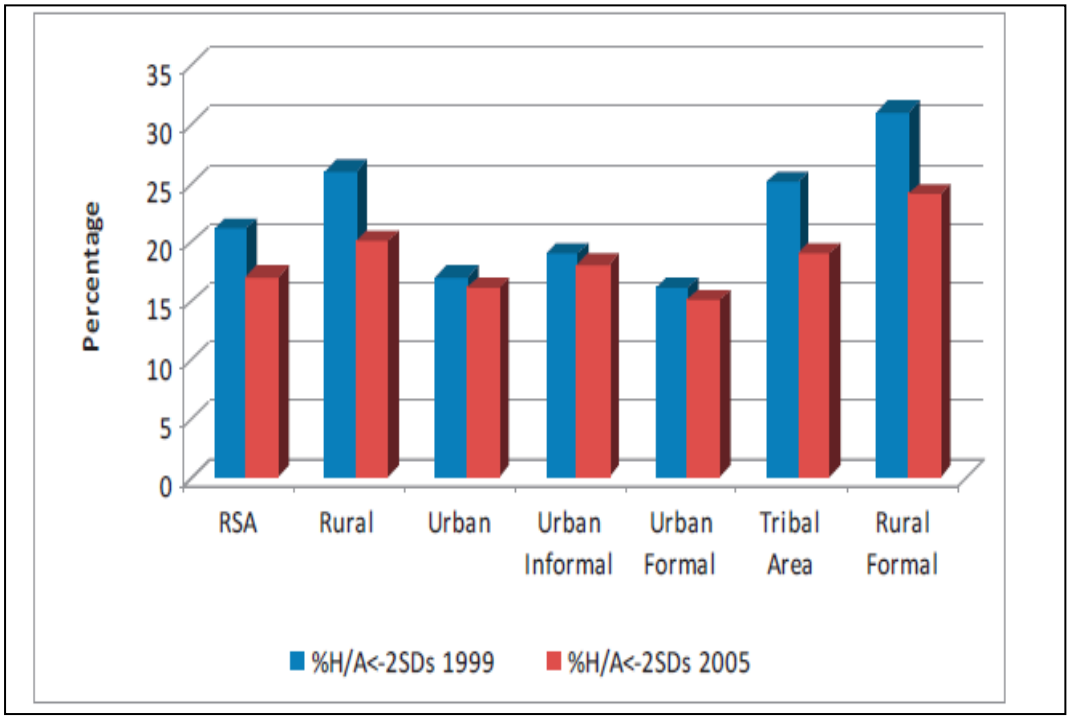

Figure 1.2: Comparison of stunting for children 1-9 years old nationally and by areas of residence: South Africa 1999 and 2005 (Global Alliance for Improved Nutrition 2009).

The SANHANES-1 (2013) reported the highest prevalence of stunting (26.9% and 25.9%) in the 0-3 year age group for boys and girls and the lowest prevalence in the 7-9 year age group (10% and 8.7%, respectively). There has been a decrease since 2005 in undernutrition in children younger than ten years, with the exception of stunting among the 0-3 year age group (Shisana *et al.* 2013).

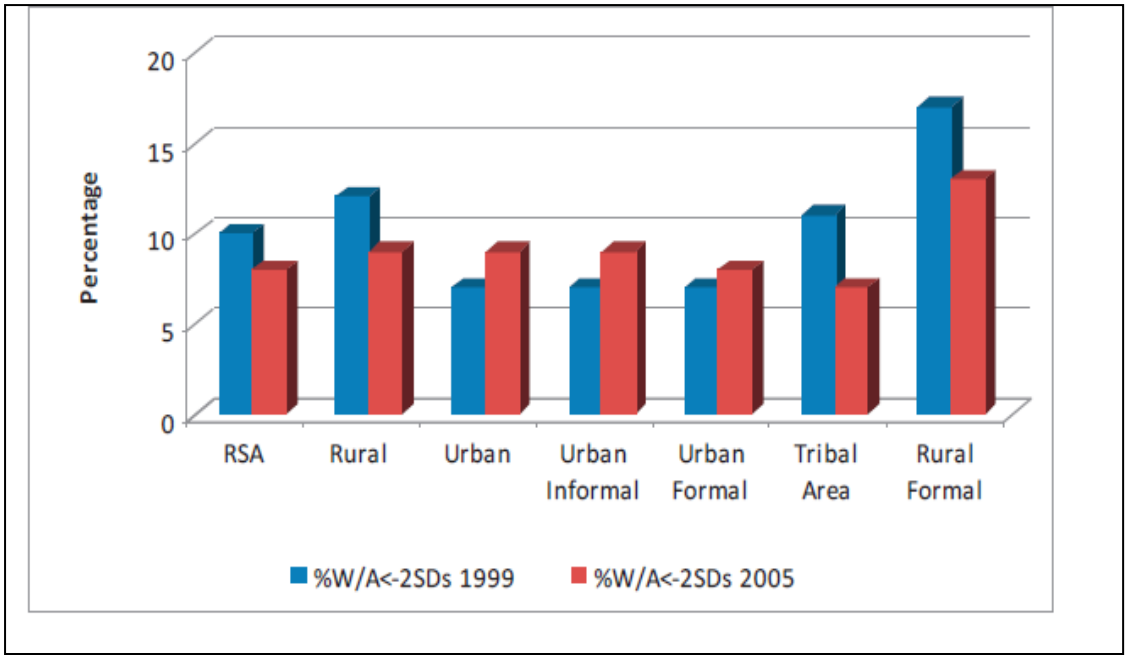

Figure 1.3: Comparison of underweight for children 1-9 years old nationally and by areas of residence: South Africa 1999 and 2005 (Global Alliance for Improved Nutrition 2009).

Figure 1.3 reflects the data for the prevalence of underweight children from NFCS (1999) and the NFCS-FB-1 (2005). The prevalence of underweight children showed an increase in urban areas and a decrease in rural areas although the national statistic remains at 9.3 percent. The greatest improvement in South Africa (1-9 years) has been in formal rural areas where percentage has dropped from 18 percent to 12.9 percent (Development Bank (DBSA) 2008a).

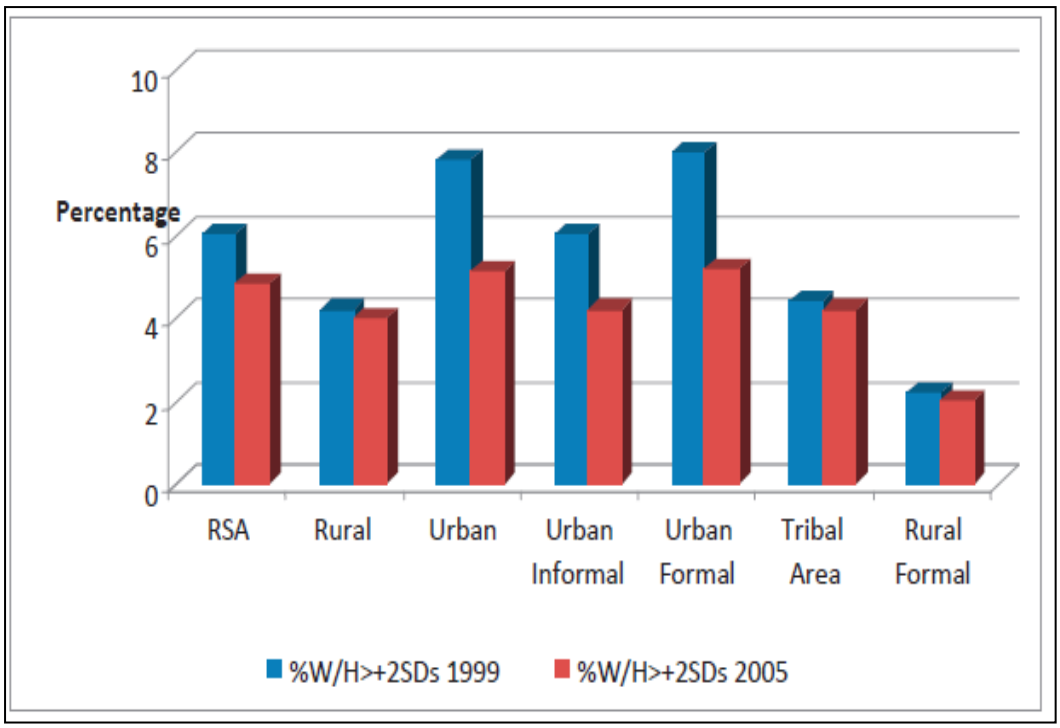

Figure 1.4: Comparison of overweight for children aged 1-9 years nationally and by areas of residence: South Africa 1999 and 2005 (Global Alliance for Improved Nutrition 2009).

Overweight in children, based on weight for height z-scores, remains a concern in the age group one to three years with 19.3 percent of obese children living in rural areas and 15 percent in urban areas (Chopra, Whitten & Drimmie 2009). A study by Goon *et al.* (2013: 582) among school children 9-13 years of age revealed considerably higher levels of excessive body fat and a significantly higher percentage body fat among girls compared to boys (Goon *et al.* 2013: 582).

Table 1.1 below indicates research conducted into the Dietary Intake in Children in South Africa from 2000-2013. The aim of this table is to use previous studies as a comparison to the present study being conducted concerning anthropometric indicators, dietary and lunch box content assessment in children.

Table 1.1 is a summary of studies concerning the indicators mentioned above. Malnutrition is still a serious problem among children as various studies over the last 10 years show results for underweight, stunting, overweight and obesity. Micronutrient deficiencies are present in various degrees in all the studies. Nutritional inadequacy is prevalent to various degrees in most of the studies. Reddy *et al.* (2012: 262) in a national cross sectional study (2002-2008) states that obesity has increased amongst adolescents from 6.3 percent to 11 percent for males and 24.3 percent to 29 percent for the females. Increased socioeconomic status was associated with higher rates of obesity. The higher socioeconomic status reported higher levels (64.7%) of lunch boxes brought to school compared to lower socioeconomic status groups (39%) (Temple, Steyn Myburgh & Nel 2006: 252; Abrahams *et al.* 2011; Shishana *et al.* 2013).

Table 1.1: Research conducted into the Dietary Intake and Anthropometrics of Children age 9-13 years in South Africa, 2000-2013.

AUTHORS	PARTICIPANTS	METHODS	RESULTS
Toriola, Moselakgomo, Shaw & Goon, 2012	Number: 1 172 children Age: 10-16 years Gender: Male 541 Females 631 Area: Nongoma and Ceza districts in Zululand, KwaZulu-Natal	Anthropometric measurements using the Centre for Disease Control and Prevention (CDC) body mass index (BMI) cut-off points. Height and body weight were measured using standard techniques. Results were analysed with student t-test statistics, with probability level set at p-value ≤ 0.05.	Rural and Urban Risk of overweight: Girls (11%) Boys (9.1%). Obesity: Boys (5.5%) Girls (4.4%). Underweight: Boys (4.6%) Girls(5.2%)
Oldewage-Theron & Egal, 2010	Number: convenience sample of 142 school pupils Age: 9-13 years (27% of the total number of pupils). Area: public school (n = 540) in QwaQwa. Gender: Female 49.3% and male 50.7%	A nutrition knowledge questionnaire to determine the current nutrition knowledge, and a 24-Hour Recall to determine food and nutrient intakes. Anthropometric measurements included weight and height, measured using standard methodologies.	Stunted: 11.3% Severe stunting: 2.8% BMI-for-age: 12% overweight Girls 15.7% Boys 8.3% Respondents not meeting 100% of EAR protein (53.1%), carbohy-drates (17.1%) thiamine 14.3%)

AUTHORS	PARTICIPANTS	METHODS	RESULTS
Oosthuizen, Oldewage-Theron & Napier, 2011	Number: 2 schools (91 control group and 81 experimental group). Age: 9-13 years Area: Peri-urban community North West Province Gender: Boys and Girls	Testing of nutritional knowledge pre- and post intervention. Validated 24-hour recall questionnaire. Food models to assist in the estimation of portion sizes and identification of food items. Analysis using the computer software programme Food Finder 3. A list of the 20 most commonly consumed food items, based on weights consumed. Paired t-tests were conducted to assess significance in dietary intake and food choices after the intervention.	Correlations linked protein intake to knowledge of proteins, and vitamin C intake to knowledge of fruit and vegetables. Fruit and vegetable intake remained very low. Refined sugars and fat were still consumed among the experimental group. The diet for both groups was based on carbohydrates. The intake of legumes, fruit and vegetables remained low. The lack of variety in intake results in a diet that does not meet the daily requirements of children.
Labadarios *et al.*, 2008	Number: 3120 children. Age: 1 - 9 years Area: National South Africa (NFCS) Gender: Boys and Girls	Socio-demographic, 24-hour recall, quantitative food frequency, food procurement and household inventory. The Hunger Scale Questionnaire Anthropometric status assessment included height, weight as well as mid upper arm and head circumference (the latter two are not presented in this report).	Total overweight: 10% Total obese: 4% less than 67% of the RDAs: □Energy, Calcium,□Iron, Zinc, □Selenium, Vit A, D, C, E □Riboflavin, □Niacin, Vit B6. Total fat less than 30% of total energy intake Protein 15% and carbohydrates 36% of total energy intake. Vit A 55-68% less than half of the recommended level; Vit C recommended level attained only by urban children; Calcium 95% below the recommended level; Phosphorous adequate; Iron 41-63% below recommended level; Riboflavin – more than half intake below 50% of recommended level; Niacin 1/3 of children – intake less than 50% below the recommended level; Vit B6 – 22-36% intake below 50% of recommended level.

AUTHORS	PARTICIPANTS	METHODS	RESULTS
Puckree *et al.*, 2011	Number: 50 children from 6 public schools and only 120 participants gave consent. Age: 10-12 years Area: eThekwini district in KwaZulu-Natal Gender: 48 boys and 72 girls	A questionnaire consisting of open and close-ended questions collected demographic and lifestyle information. Body mass index (BMI) was calculated from height and weight data.	Applying the World Health Organization criteria, 66% children underweight, 28% were of normal weight 5% were overweight. 64% (10-11 years) 70% (12-year-olds). 41% were female. 51% were Indian. Only one child was obese. BMI was related to dietary patterns and activity levels during and outside school hours.
Reddy *et al.*, 2012	Number: collected data from nationally representative cross-sectional samples of students in grades 8 through 11 (n=9491 in 2002 and 9442 in 2008) Age:13 - 17 Area: Nationally Gender: 2002 – 4757 (46,6%) boys and 5458 (53,4%) girls 2008 – 4870 (49,1%) boys and 5058 (50,9%) girls.	The 2002 and 2008 South African National Youth Risk Behaviour Surveys shared a provincially stratified, 2-stage cluster sample design Self-administered questionnaires covering a broad range of socio-demographic characteristics and risk behaviours. Anthropometrics -heights and weights.	Overweight -male adolescents from 6.3% (2002) to 11% (2008). Female adolescents from 24.3% (2002) to 29% (2008). Increased socioeconomic Status associated = higher rates of overweight and obesity. Rates were significantly higher among urban youths than among rural youths.
Temple *et al.*, 2006	Number: 476 Age: 12 – 16 years Area: Cape Town Gender: Boys and girls	Questionnaire requesting information on eating habits at school, foods brought to school and food purchases and breakfast consumption before school and healthy and unhealthy food choices.	41-56% brought food to school (inconsistent). 69.3% purchased food at school tuck shop. 6.8% bought from both outlets. High socio-economic status students were twice as likely to bring food to school. High socioeconomic status 64.7% to bring lunch boxes compared to 31% of low socioeconomic status.
Shisana *et al.*, 2013	Number: 6 306 households; 25 532 individuals and 19 319 school children Age: 0-19 years Area: National South Africa Gender: Male and Female	Socio-demographic questionnaire; Health and Nutritional questionnaire for adults and children; Physical examination and Anthropometric measurements (Height and Weight); blood pressure and pulse rate and blood samples	Overweight girls 16.5% Overweight boys 11.5% Underweight girls 76.4% Underweight boys 83.8% Overweight E Cape 12.4% Obesity E Cape 3.7% Lunch box to school urban 47.6% and rural 34.6% Male 35.1% and Female 40% bring lunch boxes to school.

AUTHORS	PARTICIPANTS	METHODS	RESULTS
Abrahams *et al.*, 2011	Number: 717 children from 16 primary schools. Area: Western Cape Gender: Boys and girls	Nutritional knowledge questionnaire 24 Hour Recall Anthropometric measurements	Brought lunch box 69% and 49% purchased at least one item from tuck shop/vendor. Lower BMI percentiles (P = 0.002) and BMI-for-age (P=0.034) for learners carrying a lunch box. 2% underweight 19% stunted 21 % were overweight/obese (BMI≥25kg/m^2).

1.5 AIM OF THE STUDY

The aim of the study was to compare packed school lunches and the dietary intake patterns of boys and girls aged 9-13 in two Primary Schools in the Municipal area of East London in order to provide guidelines for future interventions.

1.6 SPECIFIC OBJECTIVES

The specific objectives for this project were formulated as follows:
Measuring the dietary intake patterns of boys and girls of nine to thirteen years old in the Municipal area of East London by:

- Measuring the socio-demographic profile of the families by means of a socio-demographic questionnaire.
- Determining the anthropometric status of the children, including weight, height and determining the Body Mass Index (BMI).
- Determining the pupils' dietary intake by completing three 24-Hour Recall questionnaires.
- Determining the food variety intake of the children by completing a Food Frequency Questionnaire.
- Determining the nutrient content of the packed lunches by weighing and measuring food items to determine the nutrition contribution made to the daily food intake by the packed school lunch.

1.7 STRUCTURE OF THE DISSERTATION

Figure 1.5 illustrates a summary for each chapter presented by the researcher.

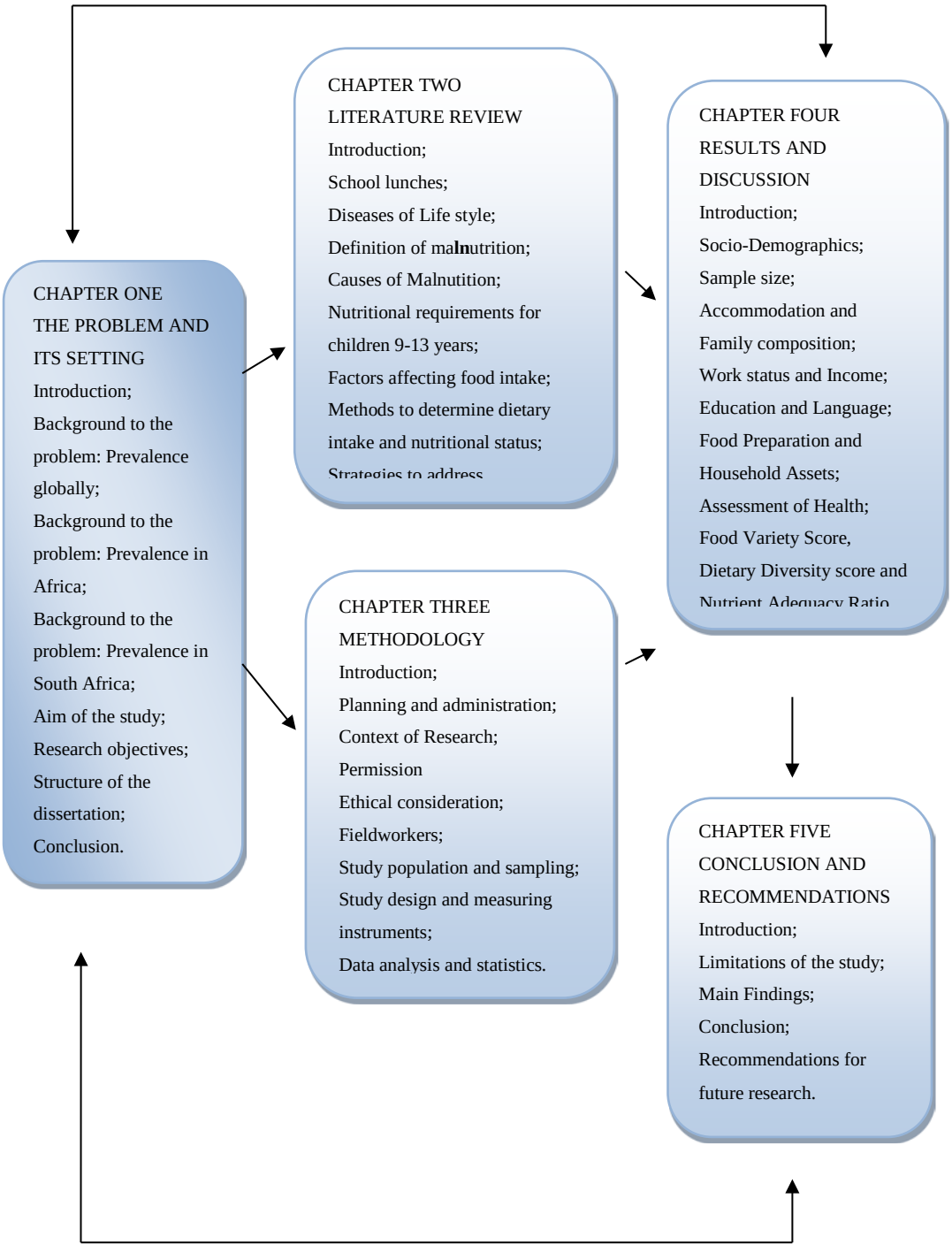

Figure 1.5: Dissertation Structure

1.8 CONCLUSION

The research consists of a theoretical structure and a descriptive study. The dissertation consists of five chapters that are presented in Figure 1.5 and which outlines the content of each chapter.

- Chapter One – The problem and its setting
- Chapter Two – Literature review
- Chapter Three – Methodology
- Chapter Four – Results and discussion
- Chapter Five – Conclusion and recommendations

Chapter Two outlines the problem of malnutrition researched with reference to children globally, in African and in South Africa.

CHAPTER 2 – LITERATURE REVIEW

2.1 INTRODUCTION

Weight gain and fat storage have been viewed for centuries as signs of health and prosperity. The major nutritional concern in times of regular food shortages has been the need to meet the daily requirements for an adequate energy intake. Obesity is a chronic disease and is becoming more prevalent as the standard of living continues to rise. Obesity affects children and adults in developing and developed countries (WHO 2000a).

In 2005 the World Health Organisation predicted that 1.6 billion adults (age 15+) would be overweight and at least 400 million adults would be obese. By 2015 this would increase to 2.3 billion adults with more than 700 million being obese. Children under the age of 5 globally totalled 20 million in the overweight category (Popkin 2011: 232). The American Heart Association reported an increase in obesity rates from 4.0 percent to 19.6 percent in the 6-11 year age group and from 6.1 percent to 18.1 percent in the 12-19 year age group. Twenty-three million children in America between the ages of 2-19 years are overweight or obese. Obesity rates in America in the age group five to seventeen have increased 5 times since 2009 (American Heart Association (AHA) 2013). The incidence of underweight in the population has now been overtaken by an overweight population like never before in human history (Popkin 2011: 232). Low- and middle-income countries are now joining the high-income countries in the overweight and obesity statistics (WHO 2006).

2.2 SCHOOL LUNCHES

2.2.1 Packed School Lunches

South Africa has a high prevalence of obesity which is estimated to be 20.9 percent nationally. The increase of non-communicable diseases (NCD's) associated with overweight and obesity has increased among adults as well as children and these are increasingly being recognised as major causes of morbidity and mortality, especially in the low-income sectors (Abrahams *et al*. 2011: 1752). Urbanisation in South Africa has made fast-food, sugar-sweetened beverages and sweet and salty snacks more available and accessible and may contribute to obesity and hypertension. Good nutrition and education are keys to the health

development, performance and future livelihood of children (Wenhold, Kruger & Muelhoff 2008: 442).

Taking into account that South Africa does not offer lunch programmes as in America and other parts of the world, the lunch box provides the snack and midday meal of the day and is brought from home. The National School Feeding Programme (NSFP) feeds children from underprivileged areas where a lunch box would not be provided by caregivers and most likely because of poverty. A child's school lunch is the second most important meal of the day, breakfast being the most important need (Feeley, Musenge, Pettifor & Norris 2012: e1). Lunch boxes play an important role in the dietary intake of children who skip breakfast, or have no cooked meal in the evening, and studies report that children who take lunch to school are more likely to consume adequate nutrients and are less likely to have an above average BMI compared to learners who make use of the school tuck shop and vendors for something to eat (Abrahams *et al.* 2011: 1752). The lack of breakfast because of time constraints and the tendency for the fast food to replace breakfast, makes it even more important to provide a nutritious packed lunch to school (Bell 2005: 6). In modern families, where both parents work, children often do not take lunch to school because it is not prepared for them, or they have to make their own and, therefore, rely on fast food and the school tuck shop to supply them with something to eat. Replacing these meals with snacks, consumed inside and outside the home, exacerbates the nutrient imbalance (Douglas 1999: 181). School children in South Africa traditionally used to take their sandwiches to school in the morning, but the school lunch box has changed over the years. The sandwich has been replaced by a variety of foods not necessarily nutritionally adequate for growing children. The combination of foods included in the lunch box and the significance thereof in the overall dietary intake must be taken into account when selecting items to be included in the lunch box. The Daily Recommended Allowance for a packed lunch should be 25 percent for seven to ten year olds and 20 percent for 11-14 year old (Labadarios & Steyn 2001: 5).

Another important factor to take into account regarding packed lunches is that the nutritional and energy requirements for boys and girls aged 9-13 differ for various reasons. With the onset of adolescence, the steady growth of childhood speeds up abruptly and dramatically and the differences in the growth patterns between male and female become distinct. Hormones direct the intensity of the adolescent growth spurt, profoundly affecting every organ, including the brain. In general, the growth spurt begins at age 10-11 for females and at 12-13

for males, taking about 2 and a half years. Nutritional and energy requirements will differ depending on the growth spurt, but other factors will also have to be taken into account, i.e. activity level (Whitney & Rolfes 2010: 561). Feeley *et al.* (2012: e1) reported that school lunch boxes become less important as children grow older (13, 15 and 17 year olds). The amount of food increased with age and it was reported that girls had a larger variety and more food than the boys. Popular choices were bread, cheese, fruit and fruit juice. Vitamin A, vitamin C, folate, iron, calcium and zinc are important in the diet of growing children and are often inadequate (Williamson 2009: 268).

In South Africa the school day ends between 13:30 and 14:30 and then the extra mural activities start. Pupils, therefore, need a nutritionally adequate lunch box until their return home. In various countries of the world, the authorities recognise this fact and in several places the Government has undertaken to provide the child with 1/3 of his daily protein requirement or 1/3 of this daily kilojoule requirement during school (Conway *et al.* 2002: 422; Napier & Hlambelo 2014: 59). Conway *et al.* (2002: 422) and Regan *et al.* (2008: 205) found that many primary school learners in the USA and New Zealand prefer to take lunch boxes to school on a daily basis. The general findings on the few studies conducted on nutritional content of lunch boxes concluded that lunch boxes lack diet quality and are nutritionally inadequate, with high fat and sugar contents. They are low in protein, calcium and vitamin C (Griffin & Barker 2008: E218). Evans *et al.* (2010: 474) found diluted drinks to be popular and frequently included in the lunch boxes. Few fruit juices and milk-based drinks were consumed. Including high fat and sugar content food in the lunch box adds to the overweight problems among children, hence their nutrition is inadequate (a form of malnutrition).

Internationally, researchers found that unhealthy energy-dense packaged foods, such as chips and biscuits, were common items in lunch boxes, while most sandwiches contained ingredients with a high fat content (Conway *et al.* 2002: 422; Regan *et al.* 2008: 205; Bell & Swinburn 2004: 258). Conway *et al.* (2002: 422) found that, among American children, over half of the population studied had packed lunches exceeding the 30 percent total fat intake recommended. Fruit intake was very low and vegetables were absent in 95 percent of the lunches. Douglas (1999: 181) conducted a study in Northern Ireland among eleven and twelve year old students, where the lunch displayed high levels of saturated fat, low fibre, iron and folate. Vitamin C and calcium were sufficient, but if fruit and cheese were excluded

from the analysis it would reduce dramatically (Douglas 1999: 181). Studies in Northern Ireland and Australia found sandwiches, crisps, chocolates and carbonated drinks to be popular items in a packed lunch with sandwiches containing ingredients with a high fat content (Douglas 1999: 181; Bell 2005: 6). Conway *et al.* (2002: 422) found that girls' lunchboxes had lower fat and sugar content as well as less saturated fat and cholesterol compared to that of the boys. In a study conducted by Rees, Richards & Gregory (2008: 420) it was found that packed lunches from home had double the amount of sugar, 50 percent more sodium and saturated fat compared to those that had a school lunch that had to adhere to guidelines for food based and nutrient standards. The packed lunches from home in Rees *et al's* study provided the children with more calcium, iron and fruit. Cultural and economic differences influence the type and quality of school lunches (European Food Information Council (EUFIC), 2012).

Parents are relying more on pre-packed foods and fast foods which do not necessarily provide the correct nutrition for growing children, or they supply children with money for the tuck shop which is not a wise option as tuck shop food is often high in sugar, salt and fat. The behaviour, performance, achievement, and obesity-levels of school children are directly linked to the nutritional status of their overall diet – including the contents of their school lunch boxes (Dresler-Hawke, Whitehead & Coad 2009: 3).

The South African National Health and Nutrition Examination Survey (SANHANES) reported that 51.1 percent of children did not take a lunch box to school compared to 37.6 percent who did and 11.4 percent who sometimes brought a lunch box. Children in the rural informal setting were less likely to bring a lunch box (25.3%) compared to urban (47.6%) and informal urban areas (40%). Where school feeding programmes were in place, it was reported that the lunch box supplemented the food provided and various reasons were given for not bringing a lunch box to school, such as no money, no food available, nobody to help with the lunch box, fear of food being taken at school by other children and no pretty container. Studies conducted among the South African youth found that between 8.6 and 17.4 percent of children took a lunch box to school daily. Other studies indicate higher incidences of packed lunch food for school of between 45 percent and 55 percent and as high as 60 percent from disadvantaged communities (Temple *et al.* 2006: 252; Shisana *et al.* 2013).

Overweight is a form of malnutrition. Although it does not necessarily mean a lack of food, the food provided is lower in quality and, therefore, micronutrient deficient.

2.2.2 Tuck Shops

Urbanisation brings about changes in dietary habits and traditional meal patterns. A wide variety of food prepared outside the home is on offer to cater for busy urban lifestyles. This includes street food and food served in restaurants and kiosks. A wide variety of food is available, but it does not necessarily mean that it is of better nutritional quality and safe to eat, as many suppliers operate as informal street vendors. This informal food sector also provides an income for many families (FAO 2004). Cape Town schools reported that unhealthy foods brought to school were the preferred choice and outnumbered the healthy foods while 70 percent of purchases made at the school tuck shop were for an unhealthy option. Neither improved nutritional knowledge nor higher socio-economic status can be credited for changing the purchasing habits of children from the school tuck shop (Swart, Sanders & McLachlan 2008).

School tuck shops generally only sell sweets, drinks and foods such as toasted sandwiches, hamburgers, meat pies, cakes, ice cream, biscuits and popcorn. These constitute unhealthy foods because of the sugar and fat content. Wiles, Green & Veldman (2013: 37) confirmed that carbonated drinks and snacks with high sugar and fat content are popular items bought by school children in South Africa and the United States of America. South Africa has no school lunch programme with canteens funded by government, such as in America and other countries, so children bring lunch boxes, or are supplied a meal at underprivileged schools funded by the government via the National School Nutrition Programme (NSNP) implemented in 1994 (Moeng & De Hoop 2008: 287).

The Heart Foundation of South Africa launched the school tuck shop support programme in 2008 and this has recently been changed to ‘Fuelled4Life’ which is a revamped and easier-to-use version of the ‘Food and Beverage Classification System’ (Heart and Stroke Foundation, 2013). This was closely aligned with the highly unpopular NAG 5 (National Administration Guideline) that was removed in 2008 (NAG 2013). School trustees and principals ultimately decide which foods are sold in the tuck shops at their schools.

Choices from the school tuck shops in general tend to be very high in sugar and fat and drinks are carbonated in nature and high in sugar. This results in an inability on the part of the human body to cope with liquid energy. This can lead to weight gain from sugar-rich beverages rather than nutrient dense food. The school tuck shop provides an unlimited supply of instantly available fast food, rich in fat, simple carbohydrates and energy (Marraccini *et al.* 2012: 369).

2.2.3 National School Nutrition Programme (NSNP)

School feeding is part of the first three Millennium Development Goals which are to eradicate extreme poverty and hunger, support primary education, and advance gender equality and empower women by 2015. The Primary School Nutrition Programme (PSNP) was started by President Mandela in 1994. The South African School Feeding Programme, which was introduced in 2002 and transferred in 2004 from the Department of Health, Social Development, Land Affairs and Agriculture, to the Department of Education (DoE), is a small part of the Integrated Food Security Strategy for South Africa. The school feeding programme is the answer to problems of inadequate nutrition, hunger and food security and aimed to feed ± 8 million learners daily by 2012 (Moeng & De Hoop 2008:287; Govender 2012). The National School Nutrition Programme (NSNP) benefits learners from the poorest schools across South Africa. Hunger and a nutrient deficient diet compromise the ability to learn and be successful at school. The objectives of the programme are to promote and support food production and improve food security, with the addition of improved nutrition education in schools and communities. These gardens would supplement feeding at the schools and teach learners to grow vegetables (Department of Basic Education 2014). During the 2008 evaluation of the NSNP it was reported that 90 percent of the schools had vegetable gardens, but these were poorly maintained and did not contribute to the feeding of the children. Many obstacles exist in the vegetable gardens initiatives. These include pests, poor soil, lack of resources, theft and a lack of support of the School Governing Body (UNICEF 2008).

2.3 DEFINITION OF MALNUTRITION

Under-nutrition and over-nutrition forms part of malnutrition as illustrated in Figure 2.1 (Faber & Wenhold 2007: 393). Mal-absorption of nutrients or the inability of the body to use

nutrients properly to maintain health is the result of diets including the wrong types of food and the body's response to a wider range of infections. Malnutrition includes an inadequate or excess intake of all nutrients as well as frequent infections and disorders (WHO, 2009). Dietary, anthropometric, biochemical and physical observations for signs of malnutrition are used to determine the nutritional status of an individual (Faber & Wenhold 2007: 393; Labadarios 2005: 119).

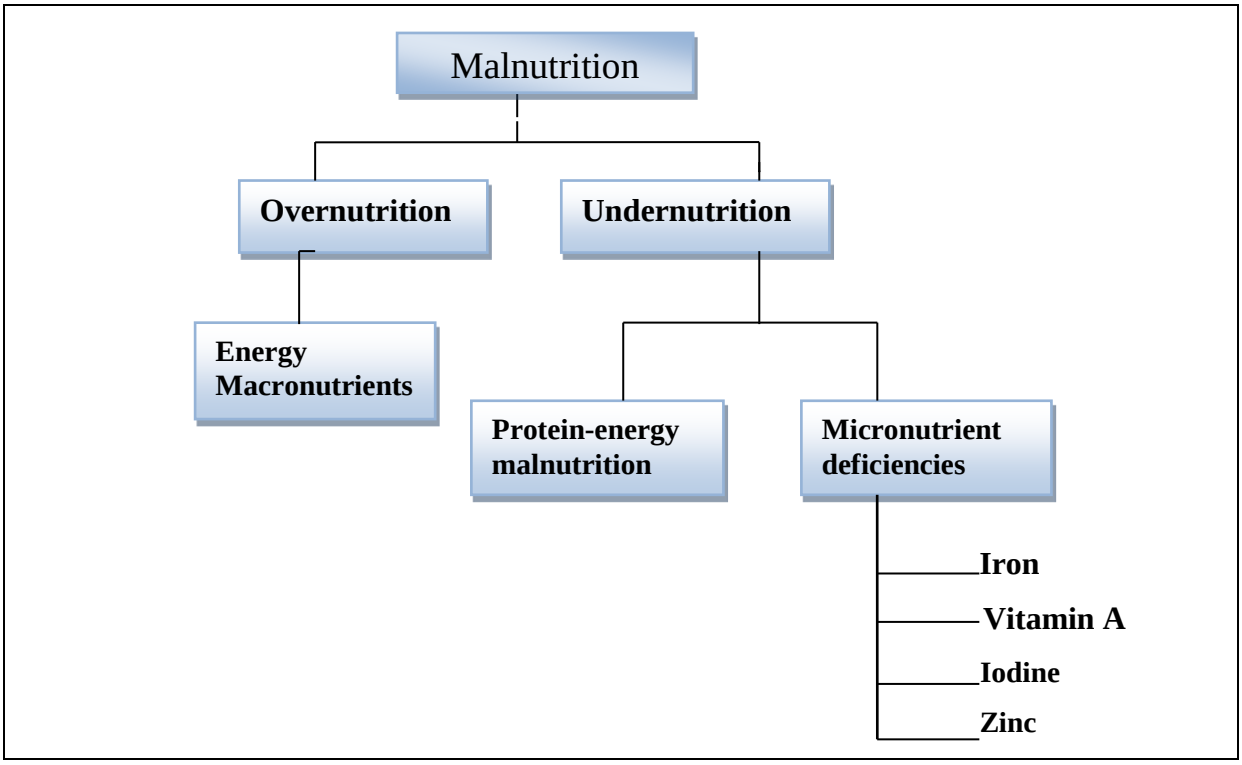

Figure 2.1: Classification of malnutrition (Faber & Wenhold, 2007)

2.3.1 Over-Nutrition

Over-consumption of nutrients and food is relative to the amounts required for normal growth, development and metabolism and is a form of malnutrition which can affect health adversely. Over-nutrition can develop into obesity, which increases the risk of serious health conditions, including cardiovascular disease, hypertension, cancer, and type-2 diabetes (Parks 2011).

2.3.1.1 Obesity

Obesity and overweight, which is the abnormal or excessive accumulation of fat, is measured by body mass index (BMI). BMI is a person's weight (in kilograms) divided by the square of his or her height (in metres). BMI's over 25 are considered overweight and over 30 obese (WHO 2012). The preferred method for determining a child's weight status is to use an age- and gender-specific percentile for BMI (Centre for Disease Control (CDC) 2012). The BMI categories used for adults are not suitable because a child's body composition varies with age and gender. BMI percentiles are obtained by plotting a child's BMI number on the BMI growth chart. Overweight (weight-for-height ≥+2SD) globally among the under-five age group had increased by 54 percent in 1990 from a low 7 percent (UNICEF-WHO-The World Bank 2012). According to the SANHANES-1 survey, overweight and obesity were higher in girls (16.7% and 5.6%) than boys (7.5% and 2.7%) for the age group ten to fourteen years. However, in spite of the age groups not matching the NFCS (2005) survey of one to three and four to six years, it was close enough to be compared. The prevalence of overweight for both genders combined has increased from 10.6 percent to 18.2 percent and obesity has remained unchanged at 4.5 percent and 4.7 percent respectively over the last decade (Shisana *et al*. 2013).

Developed countries showed an increase in child overweight reaching a high 15 percent in 2011. There has been an increase in Africa from 4 percent to 7 percent in 2011. Asia has high levels of malnutrition, wasting and stunting, and also has 17 million children affected by overweight. Adequate nutrition contributes to the improvement of malnutrition and the under-five mortality rates and is essential for achieving the Millennium Development Goals (UNICEF-WHO 2011).

2.3.1.2 Diseases of Lifestyle

With the increase in industrialisation and people living longer, there appears to be an increase in lifestyle diseases. Childhood overweight and obesity can have a harmful effect on the body in many ways. Obese children are likely to suffer from high blood pressure and high cholesterol, which are risk factors for cardiovascular disease (CVD). This risk increases for impaired glucose tolerance, insulin resistance and type 2 diabetes. Breathing problems, such as sleep apnoea and asthma, occur in overweight and obese children, as well as joint

problems and musculoskeletal discomfort because of the extra weight. Obese children and adolescents have a greater risk of fatty liver disease, gallstones, and gastro-oesophageal reflux (heartburn), as well as of social and psychological problems, such as discrimination, depression and poor self-esteem which can continue into adulthood. An obese child is most likely to become an obese adult, with the associated risk of heart disease, diabetes and some cancers, and the effect of overweight is more severe in adulthood (CDC 2012). Table 2.1 indicates the causes of chronic diseases of lifestyle and how the risk factors increase with increased bodyweight and that the lifestyle diseases become more severe with overweight.

Table 2.1: Causes of Chronic diseases of lifestyle (United Nations International Children's Fund (UNICEF) 2007a).

Underlying socio-economic, cultural, political and environmental determinants	Common modifiable risk factors	Intermediate risk factors	Main Chronic diseases
Globalisation	Unhealthy diet/Dietary intake	Raised blood pressure	Heart Disease
Urbanisation	Physical inactivity	Raised blood glucose	Stroke
Population ageing	Early Life Influences	Abnormal blood lipids	Cancer
		Overweight/obesity	Diabetes
	Non-modifiable risk factors		Osteoarthritis
	Age		Morbidities in children
	Heredity		

2.3.2 Undernutrition

Hunger, combined with interaction from infections, is the cause of undernutrition and includes being underweight for one's age, stunted, wasted and micronutrient deficient. Poverty, food insecurity, lack of knowledge and lack of distribution of adequate resources causes micronutrient deficiency which is thus under-nutrition. The result of under-nutrition - either overall growth failure or specific micronutrient deficiencies - depends on the actual nutrient that is deficient in the body (UNICEF 2006a). Body Mass Index (BMI) in relation to age is used to identify the nutritional status of a child by dividing the weight, in kilograms (kg), by the height squared (^{2}), in metres (m) per age (WHO 1998). Under nutrition is associated with restricted development of the brain, the nervous system, the metabolism of the body as well as discrepancies in behaviour (Martins & Toledo Florência 2011: 1817).

2.3.2.1 Protein Energy Malnutrition

The lack of energy and protein is the cause of protein energy malnutrition (PEM) and the most acute form is kwashiorkor, also known as nutritional oedema. The body starts to swell at the feet and the swelling escalates as it moves up the body. Other symptoms are mental changes, abnormal hair, dermatitis, anaemia, diarrhoea and often evidence of other micronutrient deficiencies. Acute malnutrition in an individual may present itself in the form of wasting (marasmus), either moderate or severe, based on body measurements and is characterised by rapid loss of fat and weight loss in the muscles. A severe form of acute malnutrition is marasmic-kwashiorkor and is a mixed form of both marasmus and kwashiorkor and is characterised by the presence of both wasting and bilateral pitting oedema (Grigsby 2003). Interventions need to be targeted at pregnant women and children from birth to 18 months of age (FAO 1996; World Hunger Education Service (WHES) 2012). The severity of PEM is affected by political, economic, seasonal and climate conditions, education and sanitation levels, food production and prevalence of disease (FAO 2004; Okwu, Ukoha, Nwachukwu & Agha 2007: 1).

2.3.2.2 Micronutrient Deficiencies

Micronutrients are essential elements required in small amounts and enable the body to produce enzymes and hormones in addition to other substances essential for proper growth and development (Richard & Roussel 1999: 573 ; WHO 2010). Micronutrients include the vitamins and minerals that are essential for a wide range of body functions and processes. Micronutrient deficiencies appear in many forms depending on the type of micronutrient that is deficient. Micronutrients can be categorised as either Type I or Type II nutrients based on the effect a deficiency has on the body (UNICEF 2007b).

Type I nutrient deficiencies result in specific deficiency diseases; they do not always affect growth, but will affect metabolism and immune competence before signs are apparent. This category of nutrients includes vitamins A, B1, B2, B3, B6, B12, C, D, iron, calcium, copper, iodine, folic acid, and selenium (UNICEF 2007b).

Type II nutrient deficiencies result in reduced overall growth. Individuals with Type II nutrient deficiencies are stunted in growth and display no visual signs as 'normal'

individuals. Mild cases of Type II nutrient deficiency are identified by a reduced growth rate. Severe cases of Type II nutrient deficiency are characterised by weight loss (WHO 2007b).

The lack of access to Vitamin A, iodine and iron are the three micro deficiency diseases of most public health significance. Vitamin C, Vitamin B3 (Niacin) and Vitamin B1 (Thiamine) are also micronutrients that contribute to deficiency diseases among the poor and hungry of the world. Micronutrient deficiency diseases are characteristic of emergency affected populations and rarely occur in stable populations or non-emergency affected populations. These diseases are associated with situations where people are dependent for their food needs on a general ration that is limited in quality and diversity, and who have no other sources of food from which to access these micronutrients (UNICEF 2007b; Nutrition Information Centre of the University of Stellenbosch (NICUS) 2007a).

Vitamin A deficiency causes xerophthalmia (eye disease), impairs the immune system and increases the severity and mortality risk of measles and diarrhoeal disease (UNICEF 2007b). Vitamin A and B are important for normal growth, eyesight, immunity, behavioural and cognitive outcomes (Wenhold, Kruger & Muehlhoff 2008: 441). Vitamin B3 or Niacin deficiency causes Pellagra. Populations dependent on maize and with a low dietary diversity are at risk from the disease. The disease affects the skin, gastro-intestinal tract and nervous systems. For this reason, it is sometimes called the disease of the 3Ds: Dermatitis, Diarrhoea and Dementia. If left untreated it can result in death (UNICEF 2007b; NICUS 2007a).

Vitamin B1 or Thiamine deficiency causes Beri-beri. Populations dependent on polished rice as the staple food and with low diet diversity are at risk of the disease. There are 3 main types of the disease. Wet Beri-beri and Dry Beri-beri affect adults, while infantile Beri-beri affects infants. Dry Beri-beri, Wet Beri-beri, Infantile Beri-beri and Vitamin C (also called Ascorbic Acid) deficiency leads to Scurvy. Populations with a low intake of fresh fruit and vegetables are at risk. Typical signs include: swollen and bleeding gums, minute haemorrhages (bleeding) in the skin and slow healing of wounds (UNICEF 2007b; NICUS 2007a).

Minerals are inorganic compounds which cannot be made by living systems. They may be classified as macro minerals and micro minerals. Macro minerals are available in larger amounts than micro minerals which are only required in small amounts. Minerals fulfil vital

roles in the body, such as maintaining the structure of bones and teeth, to help control many of the body's processes as parts of various compounds, and as dissolved ions in body fluids (Institute of Medicine (IoM) 2000).

Iron is a trace mineral and essential for the production of blood haemoglobin. Iron is important for skeletal development, cellular immunity, and cognitive function (Wenhold, *et al.* 2008: 441). Lack of iron eventually results in iron-deficiency anaemia, typical signs of which are paleness, tiredness, headaches and breathlessness. A blood haemoglobin level of less than 7.0g/dl is an indicator of severe anaemia. Pale conjunctivae (eye lids), palms and tongue are typical signs of anaemia (UNICEF 2007b).

Iodine deficiency goitre is the most common form of severe iodine deficiency, a swelling of the thyroid gland. An estimated 750 million people are affected by goitre. Cretinism (both mental and physical disability) is the most severe form of iodine deficiency and affects over 11 million people (UNICEF 2007b).

Zinc is a trace element that is essential for the normal growth and development of infants and children and deficiencies are mainly seen in children with mal-absorption and poorly supported immune function. Zinc is a part of many enzymes and is essential for protein deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) synthesis and cell division and supports immune function. Calcium requirements for growing children are high and iodine is necessary for normal growth and intellectual development (Whitney & Rolfes 2010: 439).

2.3.2.3 Eating Disorders

Eating disorders are associated with over concern with body weight and shape. It is a determined change in eating behaviour which results in a distorted consumption or absorption of food and has negative influences on physical and psychosocial health (Fairburn & Walsch 1995). These eating disorders may persist for a short period of time or may become part of the person's life for many years (National Institute of Mental Health (NIMH), 2011). This behaviour is becoming increasingly common among adolescents and young adults across cultural boundaries. The increase in eating disorders is also associated with the onset of the disease at a younger age (Mould *et al.* 2011: 137).

Anorexia Nervosa, Bulimia Nervosa, binge eating and Eating Disorders Not Otherwise Specified (EDNOS) are classified as eating disorders. Obesity can also be classified as an eating disorder, namely as compulsive overeating and emotional overeating (Whitney & Rolfes 2010: 296; NIMH 2011; Ekern 2012).

Anorexia Nervosa (AN) is characterised by self-starvation and excessive weight loss and is a potentially life-threatening eating disorder. This disorder impacts negatively on physical and emotional functioning as well as on the development of a healthy self-esteem. The restricted anorexia nervosa sufferer does not display regular binge-eating or purging behaviour, but the binge-eating/purging type has the extreme of the restricted anorexia nervosa (Whitney & Rolfes 2010: 296; NIMH 2011; Ekern 2012).

Binge Eating Disorder (BED) is a type of eating disorder with a combination of symptoms similar to those of Bulimia Nervosa or Compulsive Overeating. Uncontrolled bingeing coupled with the consumption of large quantities of food in a short period of time (less than 2 hours) is typical behaviour for BED. This uncontrolled eating is followed by self-induced vomiting and is done with the goal of undoing or compensating for the effects of bingeing (especially preventing weight gain), or dealing with the shame/guilt feelings after a binge (Whitney & Rolfes 2010: 303; NIMH 2011; Ekern 2012).

Bulimia Nervosa Disorder (BN) is a disorder characterised by binging and compensatory behaviour alternately, such as self-induced vomiting designed to undo or compensate for the effects of binge eating (Whitney & Rolfes 2010: 300; NIMH 2011; Ekern 2012).

Eating Disorders Not Otherwise Specified (EDNOS) is when a person does not have to be diagnosed with Anorexia, Bulimia or BED to have an eating disorder. An eating disorder can include a combination of signs and symptoms, but not meet the full diagnostic criteria for AN or BN (Whitney & Rolfes 2010: 303-304; NIMH 2011; Ekern 2012).

Obesity and overweight due to overeating indicate that there is some form of 'connection' between the sufferer's emotions and their eating habits. This connection is a negative one, and is usually characterised by dependence on food for emotional regulation or manipulation. In certain cases, food becomes some form of drug, altering the mind emotional state of the person. The sufferer's behaviour is thus influenced in accordance with their feelings. It can

be just as destructive as cigarettes, alcohol, or other drugs. The process might be a bit more subtle and develop over a longer period of time, but the consequences are also destructive. There are two types of overeating, namely compulsive overeating and emotional overeating (Whitney & Rolfes 2010: 271; NIMH 2011; Ekern 2012).

Compulsive overeating is when food becomes more of a drug in the sufferer's life and this is identified as a Compulsive Overeating Habit. Emotional eating is compulsive overeating by an individual who sometimes hides behind his or her physical appearance to avoid social contact. It is the use of food and eating as a way to hide and cope with feelings and emotions, to fill a void, or to cope with stresses in daily life. This may cause the person to use behaviour-like binging and eating as a way to forget the pain and to express the desire for affection (Whitney & Rolfes 2010: 271; NIMH 2011; Ekern 2012).

2.4 CAUSES OF MALNUTRITION

2.4.1 UNICEF Conceptual Framework for Malnutrition in Children

The nutritional status of a child is assessed through dietary, anthropometric, biochemical and physical observation for signs of malnutrition, which is a lack of proper nutrition. Deficiencies in the amount and nutritional value of the food consumed cause the growth pattern of a child to become disrupted (Faber & Wenhold 2007: 393; Labadarios 2005: 119). Malnutrition is understood and explained with the aid of the framework (Figure 2.2) developed by the United Nations Children's Fund (UNICEF) (2004a). The causes of malnutrition are categorised as 'immediate', referring to poor dietary intake, psycho-social stress and trauma and diseases, such as diarrhoeal and acute respiratory conditions, which further complicate malnutrition; and 'underlying', referring to household food insecurity, lack of knowledge and education, caring practices and health services, as well as an unhealthy environment. The 'basic causes' that contribute to malnutrition are human and environmental resources, economic systems and political and ideological factors.

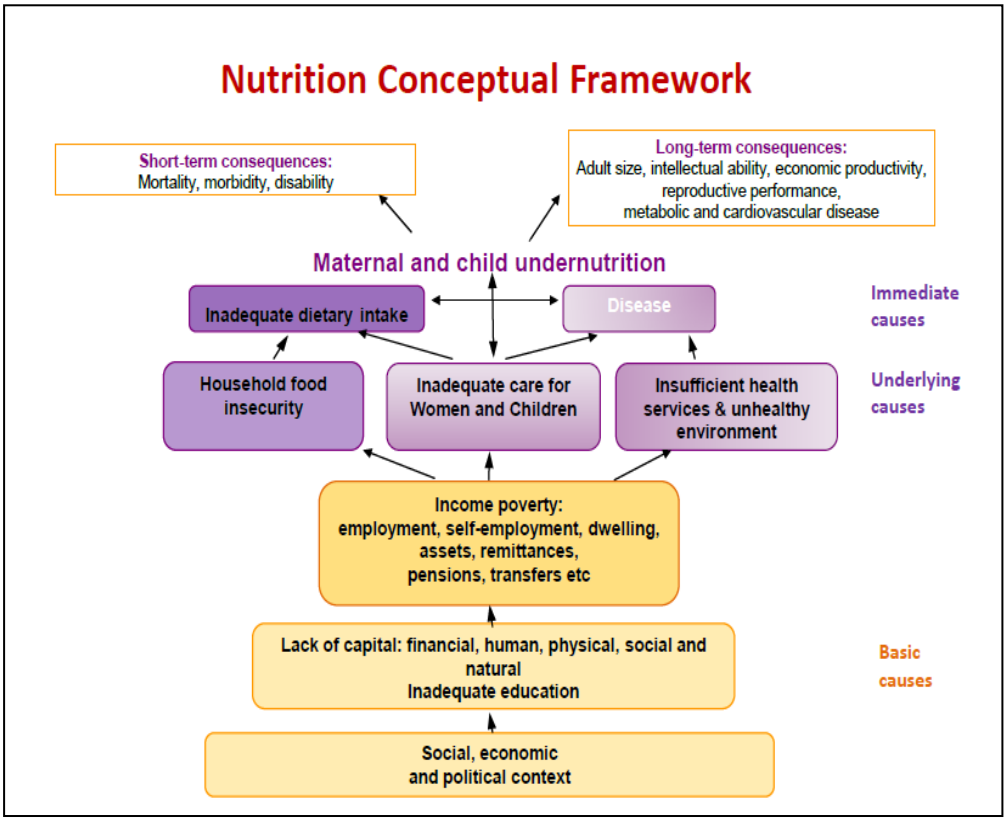

Figure 2.2: Immediate, underlying and basic causes of malnutrition (UNICEF 2004b)

Malnutrition is also influenced by health status, food restrictions, growth and personal choice related to diet. Neglect and abuse can also be linked to inadequate intake (UNICEF 2004b; Vorster & Hautvast 2002: 5). Malnutrition is the consequence of poor food consumption, poor care and unhealthy facilities, and indirectly, through agricultural barriers, a lack of employment opportunities and women's status in society (WHO 2001; UNICEF 2007a). Malnutrition in children is the result of much food insecurity, which stems from poor food quality and quantity, severe repeated infections, or combinations of all three. These conditions are linked to the standard of living and whether basic needs can be met (WHO 2001; UNICEF 2007a). Malnutrition can causes physical, cognitive and psychological impairment which, over time, causes permanent learning disabilities (UNICEF, 2007a).

2.4.2 Immediate Causes of Malnutrition

2.4.2.1 Inadequate Dietary Intake

The immediate cause of malnutrition and the level of nutritional status of children can be directly attributed to food insecurity in the household. The insufficient nutrient supply from the daily food intake results in more, and severe, incidents of malnutrition among children. Insufficient food and a diet short of certain vitamins and minerals can leave infants and children vulnerable to specific conditions and a host of infections that can lead to physical, sensory or intellectual disabilities. Vitamin A deficiency is estimated to affect 250 million children and inadequate dietary intake accounts for the high levels of morbidity and mortality seen in developing countries (UNICEF, 2012a). The South African National Food Consumption Survey-Fortification Baseline (NFCS-FB), measured by means of a series of questions to determine the sensitive index, found that 52 percent of households experienced hunger and a further 28 percent were at risk of hunger (Swart, Sanders & McLachlan 2008). Food insecurity is a worldwide problem with about 870 million people estimated to have been undernourished between 2010 and 2012 (FAO 2012).

2.4.2.2. Effect of Diseases on Nutritional Status of Children

Malnutrition is the result of poor food quality, quantity and severe repeated infections. After malnutrition, diarrhoea is the second leading cause of death of children under the age of five with 23.5 billion cases reported each year. Nearly one in five child deaths – about 1.5 million each year is due to diarrhoea. It kills more young children than AIDS, malaria and measles combined. Malnourished and young children are more vulnerable to diarrhoea and pneumonia. Children with poor nutritional status and poor overall health and living in poor environmental conditions are more likely to suffer from diarrhoea and dehydration than healthy children. Poor hygiene and contaminated food or drinking-water also contributes to the spreading of the infection. Severe dehydration is life-threatening and more so in the malnourished or those with impaired immunity (WHO 2009; UNICEF 2009). People infected with HIV have a compromised immune system and are more susceptible to other infections. In 2010 in South Africa, 34 million people, including 330 000 children, were living with HIV. Premature mortality in South Africa is because of AIDS and will reduce life

expectancy by 20 years by 2015 (Chopra *et al*. 2009; UNAIDS 2011; Mohammadi-Moein, Maracy & Tayeri 2013: 1040).

Tuberculosis (TB) kills about 2 million people each year and in South Africa TB infection is regarded as one of the most serious health problems, which is increasing because of HIV and AIDS. The burden of TB disease in South Africa affects 15-20 percent of children. Low and middle-income countries have the highest percentage of deaths from TB, including 64 000 child deaths worldwide in 2011. South Africa has two major problems in the prevention of TB. HIV increases the susceptibility of infected people to TB and there is the development of a multi-drug resistant TB, which is the result of incomplete or interrupted treatment. TB is difficult to diagnose in children and exposure to TB from any source and poverty and malnutrition contributes to the high mortality rate of this disease among children (Healthlink 2000; WHO 2013a; WHO 2013b).

2.4.3 Underlying Causes of Malnutrition

2.4.3.1 Insufficient Household Food Security

Food security is associated with availability, supply stability, access, the utilisation of food and enough food at all times (Food and Agriculture Organisation (FAO) 1996; Labadarios *et al*. 2011b: 33). Factors that influence food security are; the size and composition of the family, gender equity, income, food distribution often according to customs within the household, availability and access, poverty and the absence of the breadwinner (Department of Health (DoH) 2003: 11; Mason *et al.* 2001; Mwaniki 2006; UNICEF 2009). Poor agricultural production and the destruction of infrastructure and markets as well as the loss of livestock and insufficient land available for food production directly affect the income. Food insecurity contributes to practices such as reducing consumption of food and increasing credit to try and survive. This, in turn, impacts on work performance and productivity, which leads to lower income as well as food of lower quality and quantity (FAO 1996). When food is provided in the family with low energy value, children will have to eat more often and this becomes difficult in a family with food insecurity. Growth problems, weight loss and deficiencies will occur in households where there is not enough food, resulting in decisions as to who will receive food (FAO 1996).

The contribution of human causes, such as conflict, to the short and long-term food shortages since 1992 has increased from 15 percent to more than 35 percent. During 1990 in Central Africa, the proportion of hungry people increased from 53 percent to 58 percent (World Food Programme (WFP) 2012).

Approximately 26.4 million people were internally displaced in 2011, not only because of conflict and civil war, but by natural disasters such as floods, cyclones droughts and earthquakes. Countries such as Colombia, Iraq and South Sudan have some of the largest populations of IDPs (United Nations High Commissioner for Refugees (UNHRC) 2013). The displacement of people brings about a shortage of food and changes in daily lifestyle. Refugees are dependent on food rations and food parcels from International Relief Organisations. The global relief organisation CARE includes WHO, UNICEF and WFP, all working together to end poverty in the world. They assist with feeding thousands of displaced families, growing food and distributing seeds and feeding 600 000 school children (CARE 2012).

2.4.3.2 Urbanisation

Life in urban environments has an impact on household food and nutritional security (UNICEF 2012). As the world's population increases, the urbanisation of people from rural areas to cities increases and this brings about poverty. Half the population of the world is predicted to be living in urban environments by 2020 and this brings about a pressing need to provide services and city planning towards a healthy lifestyle, hence addressing poverty and malnutrition. Urban living is producing more poor and undernourished people compared to the rural areas. Not all people living in urban areas are malnourished because of hunger, but children who are apparently well fed, in other words receive sufficient calories for the day's activities, can suffer from micronutrient malnutrition. Urbanisation has brought about an increase in obesity as people change the traditional food practices and way of living (Hoffman 2001; UNICEF 2012b). Micronutrient deficiencies place children at an increased risk of death, blindness, stunting and lower IQ (UNICEF 2012b). Poor living conditions, overcrowding, poor sanitation, lack of proper housing and security of tenure are some of the problems that come with moving to the city for many people. The result of these problems comes in the form of diseases, hunger and malnutrition which threaten the nutritional status of children living in these areas (UNICEF 2012b). Poverty and lifestyle illnesses, such as

diabetes, obesity and heart disease, start to emerge (FAO 2010). Countries such as China, India, Bangladesh, Nigeria, Egypt, Indonesia and Philippines are just some who have between 25-50 percent urbanisation (UNICEF 2012b).

2.4.3.3 Poverty

Poverty numbers in SSA had increased to 313 million by 2002 and poverty is now a worldwide problem. The financial crises around the world led to a world recession and duly affected South Africa as well. Recession impacts on employment and causes rising food prices which lead to an increase in poverty. Poverty among children in South Africa is at 40 percent with adult poverty at 45 percent. Droughts, conflict and lack of access and availability to food contribute to poverty. Poverty brings about problems with availability of sufficient nutritious food for the very poor nations of the world (UNICEF 2009).

The hunger statistics for children 0-17 years from 1999 to 2011 are reflected in Table 2.2. The first Millennium Goal is to eradicate poverty and hunger and the statistics showed a steady improvement since 1999 and bring South Africa closer to the achievement of this goal by 2015.

Table 2.2: Hunger Statistics 1999-2011 (Hall 2013)

CHILDREN 0-17 YEARS	% Hunger
NFCS 1999	52%
SA LABOUR FORCE SURVEY 2003	29.7%
NFCS-FB 2005	22.1%
GENERAL HOUSEHOLD SURVEY 2010	17.1%
STATISTICS SA 2011	13.7%

According to the National Food Consumption Survey (FCS) 1999, 75 percent of children experienced food insecurity and poverty which led to inadequate food intake and disease, resulting in PEM and eventually death. These are social issues that need to be addressed to ensure food security for children (Crowther 2008). Interventions, such as school feeding programmes, food parcels and other food aid strategies implemented by governments, should

be seen as short-term solutions while attempts are made to improve the food insecurity within the family situation (FAO 1996).

One of the pillars to accessing food is economic access. Economic access is determined by disposable income, food prices and the provision of, and access to, social support. Food prices and people's purchasing power determines the economic access to food. The domestic food price index, defined as the ratio of food purchasing power parity (PPP) to general PPP, captures the cost of food relative to total consumption. The ratio has been on an increasing trend since 2001, but is now found to be at levels consistent with longer-term trends for most regions (Van der Berg 2002).

Fin24 South Africa reported that the increase of food prices over the previous five years of seven basic food items has increased accumulatively by 49 percent from January 2008 to April 2013. Basic food items such as bread, meat, milk, cheese, vegetables, sugar and cooking oil were selected for the comparison. Bread, which is a staple food for the poor, had risen in price 69 percent in the previous five years. The steady rise in the Consumer Price Index (CPI) has increased the cost of living. Inflation in South Africa is at almost 6 percent (2013) and economists are predicting a rise to 9 percent by the end of 2013 because of the weaker rand, high electricity and fuel prices, increased labour costs, droughts and international food price hikes. The impact of inflation on the poor can be contained by expanding targeted social assistance programmes (government social grants) and avoiding counterproductive policies, such as price controls and export restrictions. Inflation affects the very poor and vulnerable of society more as the little money that is for food will now buy less and ultimately hunger levels in society will increase (South African Press Association (SAPA) 2013; Jacobs 2012: 1).

2.4.3.4 Insufficient Health Services and Unhealthy Environment

Health conditions and health services, as well as inadequate dietary intake and poor caring practices, are important factors in managing malnutrition. Communicable diseases can also lead to malnutrition, for example, diarrhoea, measles and malaria. Poor sanitation and the lack of water, especially clean water, lead to unhealthy environments and the spread of diseases and infections which directly relate to malnutrition (WHO 2000a). Inadequate treatment and poor health services are responsible for the high levels of diarrhoea and acute

respiratory infections. Inadequate living conditions coupled with poor hygiene and poor ventilation contributes to diseases (Borgen 2013).

The nutritional status of children and food security for the family that is threatened by armed conflict could lead to an increase in micro-nutrient deficiencies. Conflict upsets the daily life of people as health care services, sanitation, water and power supplies come under threat as these are required for healthy living. In severe cases of conflict the people are exposed to severe trauma and, in many cases, are forcibly displaced. Food insecurity becomes more prevalent as well as the need for health services during these times (FAO 1996). Living in camps or shelter for the displaced by conflict brings sanitation problems and an increased risk of diseases, so stress and trauma prevails among these people. This situation requires adequate health services (FAO 1996).

Food preparation and water storage as well as inadequate access to firewood and water become major problems for the family. The living circumstances force caregivers to spend more time searching for necessities than caring for the children. Health services affected by conflict may collapse as staff are either fleeing the area or drafted into the military. Fewer trained medical personnel are available for the displaced because of the conflict (FAO 1996). UNICEF concluded from a survey done in Kenya (2006) during a severe drought that malnutrition was worsened by the lack of good childcare practices and hygiene knowledge (Carter 2006).

2.4.3.5 Education and Ignorance

The lack of proper education and illiteracy among caregivers, parents and children contribute to the growing malnutrition epidemic. Children are not equipped to make correct food choices and are dependent on caregivers and parents to make choices. UNICEF found that lack of nutritional knowledge to feed children and the benefits of breastfeeding contribute to malnutrition (UNICEF 2007c). The food choices are often a reflection of the poor income status of the family. The lack of food and nutritional knowledge not only affects the daily feeding of children, but inadequate feeding during illness (especially infectious diseases and diarrhoea), improper food distribution among family members because of cultural traditions, poor maternal care and high birth rates are directly linked to malnutrition. The caregivers should follow good hygiene practices to avoid infections, such as diarrhoea, spreading

(Abate, Kogi-Makau & Muroki 2001: 56; De Lange 2010; Gulati 2010: 131). Women are the main caregivers and are responsible for the caring of children and ultimately for food security and food production. Women's own well-being and decision-making power, as well as knowledge and abilities concerning food, are vital for children's nutrition. Countries such as the Maldives and Sri Lanka, or states such as Kerala with high female literacy, are the ones which show low prevalence of underweight or stunted growth among children (Gulati 2010: 131). Thus, the improvement of maternal education lessons the prevalence of stunting, wasting and underweight for all ages. Obesity and undernutrition can also coexist within families (UNICEF 2006c). The prevalence of overweight among children in urban areas is linked to maternal education (Oosthuizen 2010). Nutrition education could be a strategy that improves the quality of life and addresses malnutrition.

2.4.4 Basic Causes of Malnutrition

2.4.4.1 Politics and Economics

The World Bank (2008b) estimated that the 'Triple F' crisis (food, fuel and finance) has resulted in the number of global poor escalating to 1,345 million in developing countries. These people live on $1.25 per day or less. The statistics for 2010-2012 show that one in eight people of the estimated 852 million poor are undernourished and living in developing countries (FAO 2012). Africa and Sub-Sahara Africa continues to lag behind in alleviating poverty. The high incidence of HIV and AIDS, civil war, poor and corrupt governance, changing weather patterns, famine and the dependence of the farmer on the climate and environment aid food insecurity. Poor infrastructure limits the markets to which farmers can take their produce and still make a profit. Transport costs and initial capital investment, limited information, market standards, limited produce differentiation and handicapping policies are factors that hamper the small farmer. Globalisation brings about the liberalisation of markets and contributes to the food insecurity as heavily subsidised food enters the country and causes indirect competition with the producers in developing and developed countries (Mwaniki 2006: 1).

Multiple factors influence access to food in South Africa and it is a struggle to determine and identify appropriate policies to improve individual and household access to food. Policy makers fail to identify appropriate interventions and successfully translate policy into

successful, workable programmes. The existence of weak links between governments, the private sector and civil society organisations contribute to the unsuccessful implementation of these policies. Other factors that drive up the cost of food in South Africa are the electricity supply constraints and rising oil prices which, in turn, affect the price of food and particularly the staple foods of the poor, namely wheat and maize. The strong bond on all levels of the commodity chains and economic networks places financial strain on the rural communities as the benefits of cheaper food are not available. This will force the poor to allocate a larger share of income to food and, in turn, will result in less food variety, poorer quality and a drop in energy intake of the daily diet. The unendingly rural and urban poor, the landless, female and child-headed households will suffer because the problems are not being addressed in South Africa (Altman, Hart & Jacobs 2009; FAO 2009). The FAO Food Commodity Price Indices (FPI) report monthly changes in international prices of major food commodities. In February 2013 the FPI remained unchanged as reported by the FAO. The price of dairy and fat/oil had increased, but this was balanced out by lower prices for cereal and sugar (FAO 2013).

2.5 FACTORS AFFECTING FOOD INTAKE

2.5.1 Cultural Beliefs and Traditions

Culture and food are linked in societies to social, economic and religious aspects of daily life. The lack of attention to cultural influences on diet may partially explain why interventions geared to diet modification are often unsuccessful or short-lived. Food is affected through culture by income, education, politics, socialisation, ethnicity, health, geographical location and religious beliefs. Culture also influences when, how, and which food will be prepared. Food can also play a role in ethnic identity and food choices (Benavides-Vaello 2005: 27).

Ethnicity and food beliefs, preferences, behaviours and cultural influences can be linked to the higher obesity levels among children and adolescents in the U.S minority populations. Demographic, social-structural, and environmental variables need to be taken into account when assessing obesity in minority populations. The influence of ethnic differences may place children at risk during gestation when the mother is obese and may have maternal diabetes. Overfeeding practices in infancy and childhood and adolescence where consumption of high calorie food and beverages, coupled with inactivity may also lead to

obesity. Neighbourhoods with less exposure to healthy foods and more availability of fast food, especially ethnic food, could accept this way of food consumption as acceptable social and cultural behaviour. Lifestyle, attitudes about physical activity and food choices are being acknowledged as a direct response to the environment in which it is practised and recognised as important in the study of childhood undernutrition and the influence of ethnicity in childhood obesity (Temple *et al.* 2006: 252; Kumanyika 2008: 61).

2.5.2 Religion

A person's food beliefs are strongly influenced by the socialisation process, superstition and religion. Religious groups often include food as an important component of the expression of their faith and food customs often link with particular religious and spiritual rituals; births, weddings and funeral ceremonies. The role of food in binding a religious community together is linked to all and governed by regulations and norms which, in turn, may differ from one religion to the next (Meyer-Rochow 2009: 18). Certain human life cycle phases are managed by dietary guidelines and regulations, such as preparation for a special event such as for a battle. Fasting and religious practices, such as no consumption or meat or certain vegetables in the diet, or not eating or drinking during the day for a period of time, can put the body under tremendous strain and children are usually one of the groups excluded from fasting. If no liquids are consumed during the day it can lead to dehydration. Fasting in some religions affects the daily intake of food as food may only be consumed after sunset (Kumanyika 2008: 61).

2.5.3 Culture

In India beliefs are firmly rooted in the family traditions and practices, such as reducing the food intake when illness occurs, thus children are deprived of adequate nutrition. In India the cultural belief is that food that is not from vegetarian origin aggravates and produces heat in the body and this concept was followed without any scientific proof. This leads to unnecessary food restrictions in the home environment and, especially when the child is ill; this can lead to severe malnutrition and repeated illnesses. Education and counselling is no guarantee that practices about myths and taboos will change. Muslims in India believe that rice causes fever, but do believe in colic medication and the feeding of a newborn baby with

nutritious solutions to prevent initial weight loss until breast feeding can be fully restored (Benakappa & Shivamurthy 2012: 27).

Food taboos include food for special events and the protection of health, during pregnancy as a way to monopolise a resource and as an expression of empathy, as well as the creation of identity and cohesion within a group. Restrictions on what is acceptable to consume as food and the use of potential food from the environment may cause many people to go hungry. The nutritional status of a community can be affected by the food restrictions. Restricting the consumption of certain foods and declaring them taboo can be seen as a form of intimidation and suppression by leading people in the society (Meyer-Rochow 2009: 18).

2.5.4 Peer Pressure

Lunch hour is seen as a social hour and food choices and meal habits are influenced by peers. The desire for children and adolescents to fit in and be accepted into a social group can be achieved through the consumption of, or in some cases, the restriction of food. Peer influence can be very strong and overbearing and can lead to obesity and eating disorders as the desire for acceptance becomes strong (Holden 2012; Moreno *et al.* 2007: 288). Spending large amounts of time with peers makes the child subject to peer-pressures which influence bad eating habits. Children copy peers in order to be accepted into a group. The development of poor eating habits, such as not finishing the school lunch, throwing away packed lunches, refusing to eat the crusts of sandwiches, throwing away half-eaten fruit and general wastage of food is the result of unsupervised time with peers. For the child with good eating habits trying to eat healthily will be a continual struggle because of the limited availability of healthy ready-to-eat food (Harris 2010).

2.6 NUTRITIONAL REQUIREMENTS OF CHILDREN AGED 9-13 YEARS

Dietary diversity with good representation of food groups is a requirement for optimal health and hence will result in a diet which displays nutrient adequacy (Labadarios *et al.* 2011: 33). Nutritional requirements start to differ between the genders with the onset of puberty. Hormones direct the intensity of the adolescent growth spurts. In general, this begins at the age of ten to eleven for girls and twelve to thirteen for boys (Whitney & Rolfes 2010: 560). The differences in the development of boys and girls are seen in the skeleton system, lean

body mass and fat stores. In females, body fat makes up a larger percentage of the total body weight while in males the lean body mass (muscle and bone) increases compared to females. Boys grow taller and add more weight than girls and energy and nutrient needs are greater during adolescence. The nutritional needs peak in adolescence, then level off and sometimes even diminish as adulthood is reached and the demand for nutrients is not only for energy, but especially for protein, iron, zinc, and calcium. Energy requirements are influenced by current rates of growth, gender and body composition. Physical activity and illnesses, allergies and self-imposed dieting may lead to low nutrient and energy intakes. Some of these factors may increase or decrease the demand for nutrients. Boys grow generally faster than girls and are in need of high energy for the development of a greater proportion of lean body mass (Whitney & Rolfes 2010: 560; Wenhold *et al.* 2008: 441). Children infected by aids have a higher energy requirement than the average child because they usually suffer from malnutrition, so the energy requirements increase by about 10 percent (WHO 2011).

2.6.1 Dietary Reference Intake (DRIs)

Dietary reference intake (DRI) is an overall term designed to encompass the four specific types of nutrient recommendations for healthy individuals; adequate intake (AI), estimated average requirement (EAR), recommended dietary allowance (RDA), and tolerable upper intake level (UL). These are used for nutrient recommendations for the United States and Canada (IoM, 2006). Dietary assessment data need to be evaluated against appropriate standards. In South Africa evaluation of the energy and nutrient levels are measured against the recommendations made by the U.S Institute of Medicine and the proper use of the Dietary Reference Intake (DRI), Estimated Average Requirements (EAR), Recommended Dietary Allowances (RDA), and Adequate Intakes (AI) (IoM 2006; NICUS 2007a).

The DRI framework includes:

- The objective to formulate recommendations to meet a variety of uses.
- The contribution by nutrients in the risk reduction of chronic disease.
- The inclusion and review of other food components.
- The use and the rationale for functional end points.
- The assessment of estimates of upper safe levels of nutrient intake.

There are categories of DRIs with a set of four nutrient-based reference values, of which each type of DRI refers to the average daily nutrient intake. It is, therefore, the average mean intake over time that is the nutritionally important reference value (NICUS 2007a).

According to the American Dietetic Association (ADA) 2004, the Acceptable Macronutrient Distribution Ranges (AMDR) reflect the percentages of energy intakes for children; Carbohydrates 45-65 percent of total energy, Fat 25-35 percent of total energy (4-19 years) and Protein 10-30 percent. The DRIs for vitamins and minerals consist of four values that reflect both the lower and upper daily intake limits beyond which adverse health effects may occur. The ADA also includes an average or recommended daily value that meets the health needs of most of the population. DRIs are intended to apply only to people who appear healthy. The values for each nutrient are measured against a specific reference goal. Examples of these goals include preventing symptoms of a nutrient deficiency disease, maintaining normal growth, maintaining a specific level of the nutrient circulating in the blood, or preventing symptoms associated with nutrient excess (IoM 2006; NICUS 2007a; Wenhold *et al.* 2008: 441).

The other four reference values which form part of DRIs are as follows:

- **EAR** (Estimated Average Requirement) is defined as the intake that meets the estimated needs of a nutrient of 50 percent of individuals in a specified gender group, at the given life-stage and is used for assessing groups of people. The EAR is used as the basis in setting the RDA. If sufficient scientific evidence is NOT available to establish an EAR, no RDA can be set.

- **RDA** (Recommended Dietary Allowance) is the average daily amount of a nutrient considered adequate to meet the known nutrient needs of nearly all individuals in a given life stage and gender group and is used to assess individuals.

- **AI** (Adequate intake) is the average amount of a nutrient that appears sufficient to maintain a specified criterion; a value used as a guide for nutrient intake when an RDA cannot be determined. It is used in a case where the scientific evidence is inadequate to

set an experimentally derived intake level or approximation of observed mean nutrient intakes in a group of healthy people.

- **UL** (Tolerable Upper Intake Level) is the highest level of nutrient intake that is considered unlikely to pose any risk of adverse health effects to almost all individuals in the general population (NICUS 2007a).

2.6.2 Macronutrients

Macronutrients are nutrients that are required in significant amounts in the diet, especially fats and carbohydrates. Macronutrients are directly connected to the risk of chronic diseases. Macronutrients such as carbohydrates, fats, proteins and water make up a large portion of the daily intake of food. Energy is measured in calories and is essential for the body to grow, repair and develop new tissues, conduct nerve impulses and regulate life process (NICUS 2007a).

Children can consume moderate levels of these nutrients without being adversely affected, but diets with chronically low or too high intake of macronutrients increase the risk of disease. This result in diseases and illnesses, for example, risk of coronary heart disease, diabetes, cancer and obesity. There has been no defined level of intake at which chronic disease may develop or be prevented as other factors may also contribute to chronic disease, not only dietary intake (NICUS 2007a).

An AMDR is a range of intake for a particular energy source that is associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients. The role of AMDRs in chronic diseases and in ensuring sufficient intake of essential nutrients is the key factors taken into consideration when determining the ranges. Consumption below or above the range could potentially mean an increase in the risk of chronic diseases and also an increase in the risk of inadequate intake of essential nutrients. This could potentially have an effect on long-term health. A maximal intake of 25 percent or less of energy from added sugars has been recommended. This maximal intake was set so as to ensure an adequate intake of micronutrients that are not present in foods and beverages that contain added sugars (IoM 2006; NICUS 2007a).

Table 2.3: DRIs for Macronutrients boys and girls 9-13 years (IoM 2006; NICUS 2007a; Wenhold *et al.* 2008: 441).

NUTRIENT (g) day	REQUIREMENT		MAJOR FUNCTIONS IN THE BODY	FOOD SOURCE
	Boys	Girls		
Protein g/day	34	34	Protein promotes growth and repairs cells in the body.	Milk and milk products, meat, poultry, soy, fish, beans, peas and lentils.
[a] Nitrogen equilibrium + protein deposition				
Carbohydrates g/day	100 [a]	100 [a]	Supplies the body with primary source of energy.	Wheat products, potatoes, sweet potatoes, legumes.
AI Fat g/day	* not deter-mined	* not deter-mined	Supplies body with energy.	Butter, cream, margarine, lard, oils – sunflower, soy, peanut, walnut, sesame etc. Avocado, bacon, mayonnaise.
NUTRIENT (g) day	REQUIREMENT		MAJOR FUNCTIONS IN THE BODY	FOOD SOURCE
	Boys	Girls		
AI [a] Fibre g/day[b]	31	26	Prevents constipation and assists in maintaining normal blood glucose levels.	Whole grain products, vegetables, fruit, legumes and nuts.
[a] intake level shown to provide the greatest protection against coronary heart disease (14g/4186.8kJ) x median energy intake level (4186.8kJ/day) [b] based on 14g/4186.8k J of required energy *not determined DRI: Set of values for the dietary nutrient intakes of healthy people.				

2.6.2.1 Energy

The average dietary energy intake to sustain an energy balance in healthy, normal weight individuals of a specific age, gender, weight, height, and level of physical activity, and with consistent good health, is the Estimated Energy Requirement (EER). The EER for children and pregnant and lactating women needs to be sufficient for growth or secretion of milk at a

rate consistent with good health (NICUS, 2007a; IoM, 2006). The NFCS of 1999 indicates that the mean energy intake nationally was approximately half of what is recommended for older children aged 6-9 years and significantly lower among rural children (Labadarios, Dhamsay & Hendricks 2008: 101).

The Basal Metabolic Rate (BMR), physical activity level and energy needs for growth need to be considered for determining the Estimated Energy Requirements for adolescents, children and infants >1 year old. A good indicator of energy adequacy is relative body weight (i.e. loss, stable, gain) (NICUS 2007a; IoM 2006).

Table 2.4: DRIs reference weights and heights for children (NICUS 2007a).

Gender	Age	Median Body Mass Index, kg/m^2	Reference Height, cm	Reference Weight, kg*
Boys	9-13 years	18.5	147	40
Girls	9-13 years	18.3	148	40
* Calculated from body mass index and height for age 4 through 8 years and older				

Table 2.4 depicts the reference weights and heights used to determine the DRI's for energy requirements for children in the age group 9-13 years.

Table 2.5: The DRIs for energy by active individuals [kcal (kJ)]: (NICUS 2007a).

Gender	Age in years	Active PAL EER kcal/day (kJ)
Boys	9-13	2 279 (9 572)
Girls	9-13	2 071 (8 698)

Table 2.5 depicts the DRIs for energy for active children between the ages of nine-thirteen years. Any energy above the EER would be conducive to weight gain (NICUS 2007a).

Table 2.6: Physical Activity Coefficients (PA values) for use in EER equations (Health Canada 2010).

	Sedentary (PAL 1.0-1.4) Typical daily living activities (e.g., household tasks, walking to the bus)	Low Active (PAL 1.4-1.6) Typical daily living activities PLUS 30 - 60 minutes of daily moderate activity (ex. walking at 5-7 km/h)	Active (PAL 1.6-1.9) Typical daily living activities PLUS At least 60 minutes of daily moderate activity	Very Active (PAL 1.9-2.5) Typical daily living activities PLUS At least 60 minutes of daily moderate activity PLUS An additional 60 minutes of vigorous activity or 120 minutes of moderate activity
Boys 3 - 18 y	1.00	1.13	1.26	1.42
Girls 3 - 18 y	1.00	1.16	1.31	1.56

Table 2.6 indicates the values for physical activity levels for the use in EER equations for children in the age group 9-13 years (NICUS 2007a).

According to the first National Youth Risk Behaviour Survey of 2009, the decline in physical fitness among South African youth is a cause for concern, as nearly 40 percent of children and youth are getting little or no moderate to vigorous activity each week. The interest in physical activity and sport is declining with one in four adolescents indicating no, or little, interest. However, the most commonly reported leisure time activity is cell phone use. The average time in sedentary activities has been reported to be as high as 9 hours per day. Among the disadvantaged children as many as 87 percent walked to school compared to the advantaged group. The result of this survey warrants public health to focus on improving the situation and the implementation of basic prevention strategies, particularly in children and youth (Lambert & Kolbe-Alexander 2000; Swart *et al.* 2008).

2.6.2.2 Carbohydrates

The current rate of growth, gender, body composition and physical activity are factors to consider when determining the energy needs of children. This increases with adolescence, especially with boys who grow faster and develop greater lean body mass than girls; hence they need a higher energy requirement. Although girls start growing earlier than boys, the energy requirements for girls' peak sooner and decline earlier than for boys (Whitney & Rolfes 2010: 560). The risk factors for obese children and adults are increased with a high-

energy dietary intake. Overweight is a problem of significance in South Africa and 17 percent of one to nine year olds are overweight and obese (BMI ≥ or = 25) as are 16 percent of thirteen year olds, and this proportion increases to 26.4 percent in nineteen year olds. Obesity affects urban and rural areas of high-income countries as well as low- and middle-income countries. Lack of exercise, coupled with a diet high in saturated fats, refined sugars and salt, puts the children at an increased risk from chronic diseases, such as cardiovascular disease, diabetes, allergies and cancer (Steyn, Lambert, Parker, Mchiza and De Villiers 2009: 145; Oosthuizen 2010; UNICEF 2012a).

The RDA for carbohydrates is 100g per day for age group 9-13 and although a UL is not set for sugars, a maximal intake level of 25 percent or less of energy from added sugars is suggested. AMDR as a percentage of energy intakes for children is 45-65 percent for carbohydrates (American Dietetic Association (ADA) 2004; NICUS 2007a).

2.6.2.3 Protein

Adolescents' requirements for protein are influenced by the growth spurts and the building and maintaining of lean body mass. Girls between the ages of eleven to fourteen years require a higher protein requirement per unit of height compared to the boys in the fifteen to eighteen year age range. However, girls aged nine and ten and boys in the age group nine to thirteen do not require a higher protein intake as it does not correspond to the usual timing of peak height rates of eleven to fourteen years and fifteen to eighteen years respectively. Inadequate protein intakes over a period of time affect linear growth, sexual maturation and a reduction in the accumulation of lean body mass (Stang & Story 2005). Proteins could be used as an energy source instead of building and maintaining the body as seen in rural black children (Vorster *et al.* 1997). The result is stunting (low height-for-age) and it occurs when the Z-score is below the median by more than -2SD (WHO 2007a). The RDA for boys and girls aged nine to thirteen years is 34g/day of protein (NICUS 2007). Acceptable Macronutrient Distribution Ranges (AMDR), as a percentage of energy intakes for children, is 10-30 percent for protein (ADA, 2004; NICUS, 2007a).

2.6.2.4 Fats

Fat provides energy generally since it serves as an essential dietary nutrient and the most concentrated source of energy of any food item. The palatability of food is enhanced and acts as a carrier for fat-soluble vitamins (Wellman & Kamp 2008: 286). AMDR as a percentage of energy intake for children (4-19 years) is 25-35 percent for fat (ADA 2004). Many food sources are available such as butter, margarine, vegetable oils, whole milk, visible fat on meat and poultry products, invisible fat in fish, shellfish, some plant products such as seeds as well as nuts, and bakery products (Wellman & Kamp 2008: 286; Ritz 2001: 561). Unsaturated fats (monounsaturated and polyunsaturated) are also found in many foods, examples being: canola oil, olive oil, peanut oil, sunflower oil, avocados, and many nuts and seeds. Sources of polyunsaturated fats include a number of vegetable oils (soybean oil, corn oil and safflower oil), oily fish (salmon, tuna, mackerel, herring and trout), and most nuts and seeds. The polyunsaturated fats are either from the omega-3 (for example, seafood) or the omega-6 (for example, most vegetable oils) family. Omega-3 (n-3 polyunsaturated) fatty acids are essential fats that the body needs to function properly and must be taken in by means of food. It means getting EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) from seafood, such as salmon, tuna, sardines, mackerel or shellfish, and ALA (alpha-linolenic acid) from sources such as walnuts, flaxseed, and canola and soybean oils. Omega-3 fatty acids, particularly EPA and DHA, have been shown to benefit the heart of healthy people, and those at high risk for, or who already have, cardiovascular disease (American Heart Association 2013).

Sufficient intake of the ‘good fats’ will ensure improved brain function, prevent blood clotting, help lower blood pressure, inhibit the thickening of arteries, reduce inflammation in tissues and can actually help control weight gain by improving the body's ability to respond to insulin by stimulating leptin production. The ‘good fats’ are also effective in the treatment of autoimmune diseases, skin diseases, depression, and possibly increased cancer incidence (American Heart Association 2013).

2.6.3 Micronutrients

Micronutrients are very important essential elements required in small amounts by the body for the production of enzymes and hormones as well as other substances essential to proper growth and development (WHO 2010). The lack of iodine, vitamin A and iron represents a major threat to health and development of healthy individuals, particularly children and pregnant women in low-income countries (WHO 2010).

2.6.3.1 Vitamins

Vitamins are very important nutrients required in small amounts. They are mostly not manufactured by the body and must be obtained from daily food intake. There are 13 major vitamins and each has a specific function in the body, such as normal metabolism, growth and physical well-being. These are found in a wide range of foods and are essential for biochemical processes with the cells and tissues of the body. Fat-soluble vitamins can be stored in the body while water-soluble vitamins must be replaced daily by means of food. Table 2.7 indicates the nine to thirteen year age group's vitamin requirements (IoM 2006).

Table 2.7: Vitamin requirements for the age group 9-13 years (IoM 2006; NICUS 2007a; Wenhold *et al.* 2008: 441).

NUTRIENT mg/day	REQUIRE-MENT		MAJOR FUNCTIONS IN THE BODY	FOOD SOURCE
	Boys	Girls		
WATER SOLUBLE VITAMINS				
EAR Thiamin (mg)	0.7	0.7	• Helps the body convert food (carbohydrates) into fuel (Glucose). • Helps the body metabolise fats and protein. • Necessary for healthy skin, hair, eyes, and liver. • Help the nervous system function properly. • Are necessary for optimal brain function.	Asparagus, lettuce, mushrooms, spinach, sunflower seeds, tuna, green peas, tomatoes eggplant and Brussels sprouts. Whole grain, fortified or enriched grain products, moderate amount in all nutritious food and lean pork.
EAR Riboflavin (mg)	0.8	0.8	• Maintain the mucous membranes located throughout the digestive tract. • Necessary for proper formation of red blood cells. • Helps the body produce antibodies. • Benefits skin, hair, finger and toenails, and the connective tissues.	Mushrooms, and calf liver, spinach, lettuce, asparagus, chard, mustard greens, broccoli, turnip greens, chicken eggs, yogurt and cow's milk and milk products, whole grain or enriched bread and cereal products.
EAR Niacin (mg)	9.0	9.0	• Cell respiration • Helps in the release of energy and metabolism of fats, proteins and carbohydrates. • Proper circulation and healthy skin • Functioning of the nervous system • Normal secretion of bile and stomach fluids • Synthesis of hormones, treatment of mental illnesses.	Meat, poultry, fish, whole grain and enriched cereal grains, nuts and all protein-containing foods.
EAR Vitamin B6 (mg)	0.8	0.8	• Nerve function • May help prevent heart disease.	Lean meats, potatoes, legumes, bananas, fortified cereals.
EAR Vitamin B12 (mg)	1.5	1.5	• Cell growth and division • Red blood cell formation • Nerve function • May help prevent heart disease.	Lean meats, low fat milk, eggs, cheese and lean pork.
AI Pantothenic Acid (mg)	4.0	4.0	• Metabolism of carbohydrates, proteins, and fats. • Supply of energy from foods. • Synthesis of essential lips, sterols, hormones, neurotransmitters, and prophyrin.	Mushrooms, cauliflower, broccoli, calf's liver, turnip greens, sunflower seeds, tomato, strawberries, yogurt, eggs, winter squash and sweet corn.

Table 2.7: (Continued) Vitamin requirements for age group 9-13 years (IoM 2006; NICUS 2007b; Wenhold *et al.* 2008: 441).

NUTRIENT (mg)/day	REQUIRE-MENT		MAJOR FUNCTIONS IN THE BODY	FOOD SOURCE
	Boys	Girls		
WATER SOLUBLE VITAMINS				
EAR Vitamin C (mg)	39	39	• Immune function • Wound healing • Antioxidant	Red peppers, oranges, orange juice, broccoli, sweet potatoes, tomatoes and tomato sauce.
EAR Folate (mcg)	250	250	• Red blood cell formation • Cell growth and division • May help prevent heart disease.	Fortified cereals, green leafy vegetables, beans, beets, oranges, orange juice, seeds and liver and lean pork.
AI Biotin (mcg)	20	20	• Used in energy and amino acid metabolism, fat synthesis and fat breakdown. • Helps the body use blood sugar.	Swiss chard, tomatoes, lettuce, and carrots, almonds, chicken eggs, onions, cabbage, cucumber, cauliflower, goat's milk, cow's milk, raspberries, strawberries, halibut, oats and walnuts.
AI – Adequate Intake, EAR – Estimated Average Requirement				
FAT SOLUBLE VITAMINS				
EAR Vitamin A (µg)	445	420	• Promoting vision. • Participating in protein synthesis and cell differentiation (and thereby maintaining the health of epithelial tissues and skin). • Supporting reproduction and growth.	Cornflakes fortified Spinach, Broccoli Sweet potatoes Carrots, Tomato juice, Pumpkin Liver, Butternut Mango Turnip greens.
AI Vitamin D (mcg)	5	5	• Needed by the body for the absorption and use of calcium, and vitamin D also regulates the body's use of phosphorous. • It increases the amount of calcium absorbed from the small intestine and helps form and maintain bones.	Milk and other dairy products fortified with Vitamin D, salmon, cod liver oil, mackerel, fortified breakfast cereals, eggs, milk and tuna.
EAR Vitamin E (mcg)	9	9	• Antioxidant (stabilisation of cell membranes, • regulation of oxidation reactions, • protection of poly-unsaturated fatty acids and vitamin A.	Vegetable oils and products made from vegetable oils such as margarine and salad dressings. Wheat germ oil, seeds and nuts, whole grains, liver, egg yolk.
AI Vitamin K (mcg)	60	60	• Antioxidant (stabilisation of cell membranes, • regulation of oxidation reactions, • protection of poly-unsaturated fatty acids and vitamin A.	Green vegetables such as turnip greens, spinach, cauliflower, cabbage and broccoli, and certain vegetables, oils including soybean oil, canola oil and olive oil.
AI – Adequate Intake, EAR – Estimated Average Requirement				

The National Food Consumption Survey (NFCS) (1999) revealed that one in two children aged one to nine had an inadequate intake of micronutrients, including vitamins A, B6 and C, riboflavin, niacin, folate, calcium, iron and zinc. Two out of three children had poor levels of vitamin A. The effects of vitamin A deficiency are serious in childhood because this is a time of relatively high vitamin A requirement and is associated with stunting and wasting in children. Treatment with vitamin A results in the recovery from eye infection and a gain in weight and an increase in lean body mass (Wenhold *et al.* 2008: 441). The NFCS (1999) and NFCS–FB (2005) showed no improvement in the vitamin A deficiency levels from the 1994 comprehensive national survey on the nutritional status of preschool children in South Africa, undertaken by the South African Vitamin A Consultative Group (SAVACG) in collaboration with the Department of Health, UNICEF and Sight and Life International, as one in three children had a marginal vitamin A status (<20mcg/dl). The highest deficiency results came from the non-urban areas and were children with poorly educated mothers. Since 2003 bread, flour and maize meal have been fortified and the national high-dose vitamin A supplementation programme has been implemented in most provinces since 2001 (Swart *et al.* 2008). A shortage of Vitamin B6 plays a role in neurotransmitter systems of learning and memory and thus supports the findings that deficiencies of B vitamins are linked to behavioural and cognitive problems. Micronutrient deficiencies usually do not occur in isolation, so children with multiple nutrient undernutrition usually live in disadvantaged communities and grow up in a socioeconomic deprived environment (Wenhold *et al.* 2008: 441).

2.6.3.2 Minerals

Minerals are inorganic compounds and must be obtained from food as the body does not manufacture minerals. Macro minerals are required in larger amounts and are known as bulk elements and micro minerals in smaller trace amounts. Most of our minerals come from plants that absorb the minerals from the soil and some from animal sources and water. Minerals are essential in adequate amounts as they perform many vital roles in the body, such as maintaining the bones and teeth, controlling many of the body's processes as parts of various compounds, and as dissolved ions in body fluids. Sources of minerals are plants that absorb minerals from the soil and some are also obtained from animal sources and water (NICUS 2007c). Table 2.8 illustrates the differences between macro minerals and micro minerals required by children in the age group 9-13 years (NICUS 2007c).

Table 2.8: Mineral Requirements for the age group 9-13 years (IoM 2006; NICUS 2007c; Wenhold *et al.* 2008: 441).

NUTRIENT Per day	REQUIREMENT RE		MAJOR FUNCTIONS IN THE BODY	FOOD SOURCE
	Boys	Girls		
MACRO MINERALS				
AI Calcium (mg)	1300	1300	• For strong bones and teeth. • Improvement of muscle • Nerve function. • Normal blood clotting. • May lower blood pressure.	Low fat dairy products, calcium fortified juice, dark leafy green vegetables, broccoli, eggs
EAR Phosphorus (mg)	1055	1055	• Important role in energy metabolism, affecting carbohydrate, fat, and protein.	Red meat, poultry, fish, and dairy products and cereal grains
EAR Magnesium (mg)	200	200	• Energy utilisation. • Muscle contraction. • Nerve function. • May lower blood pressure.	Whole wheat bread, low fat dairy products, lean meats, beans
AI Sodium (g)	2.2	2.2.	• Involved in body water balance and acid-base balance and is the major extracellular mineral.	Table salt
EAR Iron (mg)	5.9	5.9	• Transport of oxygen and carbon dioxide. • Immune function.	Organ meats, shellfish, lean meats, poultry, fish, beans, egg yolks, whole grain and enriched breads and cereals
EAR Iodine (mcg)	73	73	• The production of thyroid hormones, necessary for maintaining normal metabolism in all cells in the body.	Iodinated salt and seafood
EAR Zinc (mg)	7.0	7.0	• Immune function • Protein synthesis • Maintaining taste perception • Transport of vitamin A • Wound healing,	Protein containing foods: low fat dairy products, beans, peanut butter, meats, fish, poultry, whole grains and vegetables
EAR Selenium (mcg)	35	35	• Mineral antioxidant in human nutrition. • Role in reducing muscular oxidative stress.	Seafood, meat, whole grains, vegetables (depending on the soil content).
AI Chromium (mcg)	25	21	• Helping cells use glucose	Whole grain breads and cereals, and meats
AI – Adequate Intake, EAR – Estimated Average Requirement				

Iron deficiency is associated with loss of appetite, higher morbidity and growth retardation and school-age children show poor cognitive function and educational achievement (Wenhold *et al.* 2008: 441). Since 1994 iron levels among children appear to have deteriorated, but have not reached levels of severe public health significance (≥40% prevalence) in any of the provinces. Inadequate iron intake resulted in anaemia levels of 27.9 percent and zinc levels of 45.3 percent among children which correlates with stunting level (Chopra, Whitten & Drimmie 2009). The SANHNES reported that moderate and severe anaemia was much lower (2.1%) when compared with that of 6.4 percent from the NFCS (2005) (Labadarios 2005: 119; Shisana *et al.* 2013). Low levels of zinc are characterised by growth retardation, loss of appetite and an impaired immune system which correlates with stunting in children (National Institute of health (NIH) 2013).

The National Food Consumption Survey (1999) results showed that the majority of children consumed a diet deficient in energy and of poor nutrient density and unable to meet their nutritional needs. The rural areas reported worse results than urban areas. The RDAs for energy, calcium, iron, zinc and vitamin A were unsatisfactory. However, with the 2005 NFCS-FB-I, biochemical analysis determined the state of these micronutrients. Zinc deficiency remained inadequate among young children and is not yet at levels that require national nutrition intervention (Swart *et al.* 2008). Stunted children respond with an increase in height after supplementation and there is an increase in lean body mass of undernourished children (Wenhold *et al.* 2008: 441). Adequate status of folic acid was reported in the 2005 NFCS-FB. In the Northern Cape, iodine consumption has reached excessive levels and needs careful monitoring. In the under-5 age group there had been a decrease from 63.6 percent to 43.6 percent in the prevalence of vitamin A deficiency (VAD) since NFCS (2005). Rural areas showed an increase in VAD prevalence compared with the NFCS (2005). In spite of food fortification and the Vitamin A supplementation, the results have moderately improved and should be continued, despite recent evidence that vitamin A status may have only a modest effect on child mortality. The SANHANES had no updated report on the RDAs for folic acid, zinc and energy intake for comparison (Shisana *et al.* 2013).

Rivera & Sepúlveda-Amor reported that Mexico conducted a National Nutritional Survey (NNS) in 1999 and the results indicated serious micronutrient deficiencies (Rivera & Sepúlveda 2003). One in four children under the age of five were anaemic while a quarter to half of the children had one or more micronutrient deficiency. A large scale micronutrient

supplementation programme was implemented as a result of the NNS (1999) and aimed to prevent anaemia and micronutrient deficiencies (Rivera & Sepúlveda 2003). Included was a subsidised milk distribution programme, fortification of food such as milk, a vitamin A programme for fortification of wheat flour and corn flour, immunisation programmes and the introduction of nutritional education (Rivera & Sepúlveda 2003).

Inadequate levels of protein and vitamins, including thiamine, riboflavin, niacin and vitamin C, were reported in The Australian National Children's Nutrition and Physical Activity Survey (Department of Health Australia, 2007). Although the EAR for calcium and magnesium were inadequate it was unlikely for the group to suffer from micronutrient deficiency as most nutrients were at adequate levels. The sodium intake was higher than the recommended amount (Annison 2007). Food Aid Beneficiary (FAB) programmes were coordinated and run by the World Food Programme in Niger, Ethiopia, Kenya, Uganda, Rwanda, Zambia, and Zimbabwe due to there being extreme poverty and hunger in these countries, resulting in micronutrient and protein energy malnutrition. Zinc, calcium and vitamin A deficiency is endemic throughout Africa, while iron and most other vitamins are lacking in the diets of the population of these countries. FAB programme nutrition is based on the deficiencies within these populations to try and provide the necessary nutrition to improve the nutritional status (Drorbaugh & Neumann 2009: 990).

2.7 METHODS TO DETERMINE DIETARY INTAKE AND NUTRITIONAL STATUS

All foods and beverages classified as food and consumed by mouth are generally considered to be part of the dietary intake of an individual. The inclusion of dietary supplements and condiments are not always included as part of the dietary intake. When omitting these items from dietary assessments it is usually because of identification problems, quantification or lack of information about the composition of the item (Rutishauser 2005: 1100).

2.7.1 Questionnaires

Different questionnaires are available for the collection of dietary intake and other data related to population studies. The 24-Hour Dietary Recall data sheet and the dietary record intake are open-ended questionnaires where no directive is given about the type of food or

portion sizes for the specific food consumed (Cameroon & Van Straveren 1988; Gibson 2005).

- **24-Hour Dietary Recall**

A quick and easy method of gathering information about food and portion sizes consumed during the preceding 24 hours is to use the 24-Hour Dietary Recall questionnaire. This questionnaire reveals the type of eating pattern followed by the individual. The 24-Hour Dietary Recalls are administered to a sample population to determine the overall diet quality in order to identify the nutritional deficiencies in the diet. This is then followed by recommendations to improve the health status of the sample population (Brown 2008). This type of questionnaire can assist in the gathering of relatively accurate information as the participants rely on memory recall (Walsh & Joubert 2007: 141). The questionnaires are administered by a trained interviewer who should be knowledgeable on the terminology as well as local, traditional foods and beverages for the successful outcome of the nutrient analysis. The 24-Hour Recall questionnaire can be applied to different ethnicities within the population (Rankin, Hanekom, Wright & MacIntryre 2010: 65). The requirement for the successful application of the questionnaire is well trained interviewers as respondent's often have difficulty in recalling what food they consumed as well as portion sizes. The limitations of the questionnaire relate to it not representing usual dietary intake and cannot be used to describe the dietary intake of an individual. It is also not appropriate for children younger than 7 years of age unless used with, and in conjunction with, interviewing the caregiver. It should be used for classification of dietary intake, for example, percentage of respondents consuming more or less than the reference values. It is not appropriate to be used for the correlation of dietary intakes with biochemical markers. The collection of quantitative dietary intake data requires the administering of repeated 24-Hour Dietary Recall questionnaires and is used for individuals within a group, or groups of individuals. The results from the questionnaire are used for the classification of individuals into high/low consumers, or those meeting/not meeting reference values. The differences in dietary intake between weekdays and weekends thus require that all days should be represented (Australian Child and Adolescent Obesity Research Network (ACAORN) 2010).

- **Food Frequency Questionnaires**

Food frequency questionnaires (FFQ) aim to assess the frequency with which food items or food groups are consumed during a specific time or period (Gibson 2005). Specific combinations of foods can be used as predictors for intakes of certain nutrients or non-nutrients. The FFQ should feature simple, well-defined foods or food categories and open-ended questions should be avoided (Gibson 2005). The FFQ used consisted of 9 nutritious food groups each, including foods representative within the food group that those respondents would possibly consume on a daily basis. The questionnaire could be divided into 9, 11, or 13 nutritious groups as the study requires (Wrieden, Peace, Armstrong & Barton 2003: 1; WHO 2011). Using a validated questionnaire is important when dietary intake data are collected. Expanding on the questionnaire with more detailed lists of food for the selected population ensures improvement on the validity (Oldewage-Theron & Kruger 2008: 115; Australian Child and Adolescent Obesity Research Network (ACAORN) 2010). This questionnaire can be completed by the parent or the child provided good literacy and numeracy skills exist (ACAORN 2010).

- **Quantitative Food Frequency Questionnaire**

A Quantitative Food Frequency Questionnaire (QFFQ) requires the respondent to recall the frequency and quantities of food consumed over a period of time from one month and up to one year (Wellman & Kamp, 2008; Gibson, 2005). It is one of the longest structured food recalls and presents a clearer indication of the customary food intake rather than the 24-Hour Recall. QFFQs require the assistance of visual aids, food models, food pictures, and real food items, in addition to household utensil measures to identify the type and amount of food consumed (Katzenellenbogen, Joubert & Karim 2007). The development of the QFFQ is very time-consuming and needs a study group to be compiled. Furthermore, it does not provide information on intakes at different meal times and is not to be used in young children (Wolmarans & Wentzel-Viljoen 2008: 797). Valid food frequency questionnaires have been developed for the collection of dietary intake data from different age and ethnic groups in South Africa (MacIntyre, Venter, Vorster & Steyn 2001: 45; Lombard *et al.* 2013: 3118).

- **Food Diary**

The Food Diary is the most accurate instrument to record daily intake and needs to be administered correctly to determine the respondent's dietary habits (Gibson 2005; Wellman & Kamp 2008: 285). The respondent is required to document the daily food intake for 3 to 6 days, and this is compared with the individual dietary reference intakes/allowances. The limitations of the food diary are that it is very time-consuming, especially the conversion of food intake to grams. It is difficult if the respondent is not literate and therefore, extensive training is required for the interviewer. According to research, to obtain unbiased estimates for energy intake in normal weight children between the ages of 4-10 takes seven days. However, in adolescents and older children this method has shown underreporting by 20 percent. A 3-day record is long enough to gain insight into regular food intake without being too labour intensive for caregivers or too invasive for toddlers, and is still sufficient to determine differences in nutrient intake between groups and comparison with RDIs (ACAORN 2010).

- **Health Surveys**

The health status of a sample population can be determined by means of health surveys. Health surveys can also determine the prevalence of health-related problems, behaviour and lifestyle factors, and any service needs and interests required. The data from the survey are analysed by the researcher who designs programmes and strategies for improving the health status of the sample population surveyed (Puoane, Sanders & Mason 2008: 901).

- **Socio-demographic Surveys**

A validated socio-demographic questionnaire is used as an assessment tool and is used to collect data pertaining to the social status of individuals or groups of people. It is important in measuring the social well-being of the participants. Various demographical factors are taken into account, such as age, gender, occupation, level of education and income level in order to measure the impact of these variables and determine the level of poverty in the community (Napier 2006).

2.7.2 Anthropometric Evaluation of Nutritional Status

Anthropometric indicators are used to assess the compromised health or nutritional well-being of individuals and at population level. The information is analysed and then used to screen for possible interventions and for evaluating the response after the intervention has taken place. The nutritional status of a country, region, community, or socio-economic group can be assessed by means of anthropometrics. The nutritional status could reveal the cause and cost of malnutrition. This valuable information is used in the planning and targeting of health and nutritional interventions (De Onis & Blössner 2012; D'Souza, Sheela & Jebasing 2013: 23).

Weight-for-height, height-for-age, weight-for-age and BMI-for-age are the most commonly used anthropometric indicators for infants and children and can be used to compare indicators based on weight, height, age and gender with reference data for 'healthy' children (Gibson 2005; Lee & Nieman 2010). Weight and height depend on both age and gender and are often used as indicators of malnutrition. Factors, such as physical characteristics, to determine malnutrition are exacerbated by prevailing factors other than nutrient intakes, such as genetic variation. Thus it is possible to use physical measurements to assess the adequacy of diet and growth in children and infants despite the intervening factors. Malnutrition is then identified by comparing indicators to the 'healthy' reference group, and identifying the acute differences (WHO 1995; De Onis *et al.* 2007: 660).

Anthropometric indices are constructed by comparing relevant data. There are three ways of expressing these comparisons:

- Z-score (standard deviation score): the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population.
- Percent of median: ratio of a measured or observed value in the individual to the median value of the reference data for the same sex and age or height.
- Percentile: rank position of an individual on a given reference distribution, stated in terms of what percentage of the group the individual equals or exceeds (De Onis *et al.* 2007: 660-7; WHO 2007a; WHO 2007b; WHO 2013a).

- **Wasting or Weight-for-Age (W/A)**

This information reflects body mass relative to age. Growth is monitored and used to evaluate any changes in the extent of the malnutrition over a period of time by means of W/A. Anthropometric indicators are based on comparisons with a 'healthy' reference population. The most commonly used international reference standard (as recommended by the WHO) is based on data from the weights and heights of a statistically valid population devised by the National Centre for Health Statistics (NCHS) (World Bank 2006). Low weight-for-age is an indication of underweight for a specific age and has the advantage that it reflects both past (chronic) and/or present (acute) undernutrition. W/A is a combination measure of height-for-age and weight-for-height, making interpretation difficult. The term 'lightness' means low W/A when compared to a child of the same gender and age in the reference population. However, a severe deficit in W/A is referred to as 'underweight' (Cogill 2003; WHO 2007a; WHO 2013a).

- **Weight-for-Height (W/H)**

Age is not required when measuring body weight relative to height. W/H is used for measuring short-term changes and current nutritional status and is used for the screening of children at risk. Low W/H is referred to as 'thinness' when compared to a child of the same gender and age in a reference population. Extremely low W/H is referred to as 'wasting' and could be caused by starvation, or severe disease such as diarrhoea or chronic disease. The absence of data on wasting does not mean the nonexistence of current nutritional problems such as low height-for-age (Cogill 2003; WHO 2007a; WHO 2007b; WHO 2010). Wasting (low weight-for-height) is represented by a low body mass relative to age and is classified when the z-score is below the median by -2SD. Severe wasting occurs when low weight-for–age by a percentile is lower than -3SD (WHO 2006).

- **Stunting or Height-for-Age (H/A)**

When decreased linear growth is reported, it indicates past undernutrition or chronic malnutrition and/or chronic or frequent illness. H/A is not able to measure short-term changes in malnutrition. When a child has low H/A compared with a child of the same

gender and age in a reference population it is referred to as 'shortness'. When the H/A is extreme it is referred to as 'stunting' and occurs when the z-score is below the median by more than -2SD (WHO, 2006). H/A is used as a population indicator rather than determining individual growth (Cogill 2003; WHO 2007a, WHO 2007b).

- **Underweight (BMI-for-Age)**

This measure is a composite of stunting and wasting and is recommended as the indicator to assess changes in the magnitude of malnutrition over time. Body mass index (BMI) for age, is used to classify the nutritional status of a child, whether stunted or overweight. BMI is calculated by dividing the weight in kilograms (kg), by the height squared (^{2}), in metres (m) (WHO 1998), per age. When using BMI for children and adolescents the interpretation must be done in relation to the BMI-for-age reference charts. Age should be considered when applying BMI to children and adolescents. Table 2.9 reflects the z-scores for measuring the child's nutritional status with Standard Deviation (SD) values as developed by the WHO (WHO 2007). A discrepancy in behaviour and development of the brain's composition, neurochemistry, and metabolism is linked to undernutrition (Oosthuizen 2010).

Table 2.9 provides a summary of definitions of growth problems in terms of z-scores. Notice that an indicator is included in a certain definition by being plotted above or below a particular z-score line. If it is plotted exactly on the z-score line, it is considered to be in the less severe category. For example, weight-for-age on the -3 line is considered 'underweight' as opposed to 'severely underweight'. Growth problems are identified by comparing the points plotted on the child's growth charts with the z-score lines to determine whether they indicate a growth problem. Measurements in the shaded boxes are in the normal range.

Table 2.9: Growth indicators for Children 5-19 years (WHO 2007a, 2007b)

Z SCORE	Growth Indicators			
	Length/Height-for-age	Weight-for-age	Weight-for-length/height	BMI-for-age
Above 3	Very Tall Possible endocrine disorder. Referral necessary	Possible growth problem. Use Weight-for-length/height or BMI-for-age for assessment.	Obese	Obese
Above 2			Overweight	Overweight
Above 1			Possible risk of overweight Plotted point above 1 shows possible risk. A trend towards the 2-z score line shows definite risk.	Possible risk of overweight Plotted point above 1 shows possible risk. A trend towards the 2-z score line shows definite risk.
0 (Median)				
Below -1				
Below -2	Stunted Possible for a stunted or severely stunted child to be overweight.	Underweight	Wasted	Wasted
Below -3	Severely stunted Possible for a stunted or severely stunted child to be overweight.	Severely underweight Referred to as very low weight in IMCI training manuals.	Severely wasted	Severely wasted

Bodyweight can be adjusted for height to provide an indicator of Body Mass Index. The most commonly-used cut-off with z-scores is -2 standard deviations, irrespective of the indicator used. This means children with a z-score for underweight, stunting or wasting, below -2SD, are considered moderately or severely malnourished (Cogill 2003). The WHO recommends cut-offs of 'overweight' and 'obesity' at +1SD and +2SD of the reference data, respectively for over 5 years (Wang & Lobstein 2006: 11). The different cut-off points are used to determine a child's weight status category (Refer Table 2.9). The measurement in children and adolescents is usually approximate, obtained by indirect measurement, based on a range of methods and undertaken in a range of settings. The results are then presented using one of the several different criteria to define obesity, which are based on various reference tables and charts. The direct measurement of body composition requires techniques such as underwater weighing and magnetic resonance imaging, so it is less practical for use in the clinic and school environment. The waist, hip and other size measurements, such as skin-fold thickness and body weight, are easier to obtain, but less accurate (Wang & Lobstein 2006: 11; WHO 2007a; WHO 2007b).

- **Waist-to-Height ratio (WHtR)**

Body fat is not only the amount of fat present, but also where it is situated on the body. BMI correlates with high BMI and is associated with cardiovascular disease risk factors independent of BMI. Waist circumference (WC), also known as central obesity, is a better predicator than BMI for the risk of cardiovascular disease, type 2-diabetes and metabolic syndrome. Internal organs are coated with excess fat and greatly increase the risk of chronic disease. Using waist circumference to determine high percentages of fat around the waist and internal organs in children has proved to be an improvement on BMI. A study conducted by Li, Ford, Mokdad & Cook (2006: e1390) revealed that between 1988-1994 and 1999-2004 the mean waist circumference and waist-height ratio and the prevalence of abdominal obesity among United States children and adolescents had greatly increased. Waist circumference alone cannot be used to classify a child for being at risk as measurements for increased risk have not been identified (Steyn & Damasceno 2006). The risk factors increase with a waist circumference that is greater than the 90^{th} percentile – 2 or more risk factors. The 90^{th} percentile is used in studies and is based on the association between trunk fat and waist circumference, according to Taylor, Jones, Williams & Goulding (2000: 490).

The WHtR is calculated using a child's height and waist circumference where waist size is divided by height to provide a ratio. Waist circumference is measured midway between the lowest rib and the superior border of iliac crest, in accordance with the WHO (2008) recommendations. Central obesity is defined as having both age- and gender-specific WC percentile ≥90th and WHtR cut-off of ≥0.5 (Mushtaq *et al.* 2011: 105). WC increases with age among both boys and girls and there is no gender disparity in WC values consistent with previous literature by Eisenmann (2005: 1182), McCarthy, Jarret & Crawley (2001: 45), McCarthy & Ashwell (2006: 988) and Aeberli *et al.* (2011: 13227).

2.8 STRATEGIES TO ADDRESS MALNUTRITION

2.8.1 Healthy Home Environment

Lifestyle is the product of a series of small day-to-day decisions and is strongly influenced by the environment, both physical and social. Parents and caregivers have very little control over some aspects of the environment, such as advertising, but other environments such as the home, are within the caregiver or parent's control. The role of the parent is challenging as the promotion of unhealthy and fast food on a daily basis can make it difficult to create an environment that fosters, supports and promotes healthy eating. Parents can set the example by having family mealtimes, preparing healthy food and portioning for each member of the family and packing a healthy lunch box for school. Children should participate in preparing meals and lunch boxes – the promotion of healthy behaviours in children can only be successful if a healthy home environment and parental role modelling is present. Socioeconomic factors of the caregivers, including the education levels and profession, have some influence on the dietary habits of the family. The healthy home environment with balanced meals and healthy lunch boxes can make a difference in the struggle against malnutrition, whether under- or overnutrition (Grode & Henderson 2009; Østbye *et al.* 2013: 1314).

2.8.2 Food Based Dietary Guidelines

Promoting appropriate diets and healthy lifestyles, as well as nutrient-based dietary guidelines, has not been effective, as the diet-related diseases have increased globally (Maunder & Meaker 2007: 401; Department of Health (DoH) 2003: 11; Vorster, Love & Brown 2001: S3). The Nutritional Society of South Africa has been motivated to adapt food-based dietary guidelines. The newly developed Food-Based Dietary Guidelines for healthy South Africans are based on the consumption of existing locally available foods and aim to address identified nutrition-related public health problems (DoH 2003: 11). The South Africa Food Based Dietary Guidelines (FBDG) are aimed at promoting healthy eating for all people in South Africa and the reviewed guidelines were adopted in 2012. The guidelines are food-based and not nutrient-based and recommend a food consumption pattern that South Africans, seven years and older should follow. This applies to all children in this category

whether under, over or adequately nourished (Labadarios & Steyn 2001: 5; Meyer 2012). Table 2.10 shows the updated guidelines.

Table 2.10: Revised Food Based Dietary Guidelines (FBDG) (Vorster, Badham & Venter 2013: S5).

For adults and children over the age of seven years
Make starchy food part of most meals
Fish, chicken, lean meat or eggs could be eaten daily
Have milk, maas or yoghurt every day
Eat plenty of vegetables and fruits every day
Eat dry beans, split-peas, lentils and soya regularly
Use salt and foods high in salt sparingly
Use fat sparingly; choose vegetable oils rather than hard fats
Use sugar and food and drinks high in sugar sparingly
Drink lots of clean, safe water
Be Active!

Migration and urbanisation resulted in people not consuming indigenous vegetables, but rather relying on cultivated vegetables. Urban living also results in diets that are not nutrient dense, but are more energy dense causing the double burden of over- and under nutrition in one household. The South African Based Dietary guidelines are compiled by experts on how to address diet related issues and can also be used in the public health sector for nutritional strategies (Vorster *et al.* 2013: S5).

2.8.3 Food Fortification

One in five children in the age group 1-9 years was stunted and one out of ten was underweight, as reported by the National Food Consumption Survey in 1999. The majority of the children's diet was deficient in energy and of too poor a nutrient density to meet the recommended daily micro-nutrient requirements such as energy, Iron, Zinc, Selenium, Vitamin A, Vitamin D, Vitamin C, Vitamin E, Riboflavin, Folic Acid, Niacin, Vitamin B_6 and Calcium. The meals consumed in the family were the same for children and adults and no provision was made for the specific nutrient requirements of the children (Labadarios

2000). These results were used as the basis to implement fortification in SA. Food Fortification is a quick and efficient way of counteracting the micronutrient deficiencies in the diet. It is the addition of micronutrients to accessible and affordable foods that are regularly consumed by a significant proportion of the population at risk (Faber & Wenhold 2007: 393). It has been implemented in many countries with great success. Food fortification is the addition of one or more essential nutrients for the purpose of enhancing the foods' contribution to nutrient intake and the health and well-being of the individual (Nutrition Information Centre of the University of Stellenbosch (NICUS) 2003; WHO 2006; Global Alliance for Improved Nutrition (GAIN) 2012a). The following nutrients, namely Vitamin A, Niacin, Riboflavin, Folic Acid, Vitamin B6, iron and zinc, have been added to maize and bread since October 2003 (Pretorius & Schönfeldt 2012).

2.8.4 Bio Fortification

The nutrient enrichment of staple food crops through modern plant breeding is called 'bio fortification'. Bio fortification does not use industrial fortification methods such as iodine in salt and vitamin A and D in margarine. Bio fortification is more cost effective than the fortification of foods or supplementation programmes. Food-based approaches such as bio fortification – designed to increase micronutrient intake through the diet – represent the most desirable, long-term and sustainable methods of preventing micro nutrient malnutrition and will feed nine billion people in a few years. The challenge is to satisfy the physiological needs of the poor (Mayer, Pfeiffer & Beyer 2008: 166).

Studies in Asia, Sub-Saharan Africa and Latin America have shown that by using modern plant breeding practices, a more effective, cheap and sustainable way has been found to supply these needed nutrients through the enrichment of the staple food grains (FAO 2011). Bio fortification research projects run by World Health Organisation involve an iron-bio fortification of rice, beans and sweet potato, zinc-bio fortification of wheat, rice, beans, sweet potato and maize and provitamin A carotenoid - bio fortification of sweet potato, maize and cassava. Beta carotene can be converted by the human body to vitamin A and thus save the eyesight of a quarter billion children (Nestle, Bouis, Meenakshi & Pfeiffer 2006: 1064; Hossain & Mohiuddin 2012: 25). In India research is being done on rice for bio fortification and also genetically modified to include B-carotene into the endosperm of the rice grain. The

research into bio fortified crops hopes to have the desired outcome of improved nutritional intake (FAO 2011).

2.8.5 Micronutrient Supplementation

Supplementation is when adequate doses of a micronutrient are distributed to all children of a specific age in communities to address micronutrient deficiencies. It may be administered through the existing health service infrastructure and/or community based health programmes. Supplementation is a short-term solution and in South Africa vitamin A supplementation forms part of the routine immunisation of children (i.e. the Expanded Programme on Immunization (EPI), maternal health and the Integrated Management of Childhood Illnesses (IMCI) (Faber & Wenhold 2007: 393).

2.8.6 Genetically Modified Food

South Africa plants genetically modified (GM) crops, also known as Biotech crops, as it is important for sustainable food production. The country has to keep up with the population growth and demand. GM foods produce larger crops. The benefits from the use of GM crops include drought-tolerant, insect, virus and herbicide resistant crops (Den Hartigh 2009).

2.8.7 Nutrition Education

Nutritional Educational Programmes (NEP) have been considered to manage malnutrition and encourage changes in behaviour. The Department of Health (DoH 2008) in SA, through the Integrated Nutrition Programme (INP), encourages Nutrition Education (NE) as a main focus area. The focus of the NEP is on the building of the long-term capacity of communities to be self-sufficient in terms of their food and nutritional needs while, at the same time, protecting and improving the health of the most vulnerable parts of the population – women and young children (DoH 2008). The NEP allows communities to be empowered through information which will improve the nutritional practices consistent with individual needs and available resources. NEPs communicate information concerning food choices, preparation and preservation of food with a good nutritional value so as to improve eventual lifelong healthier eating habits (DoH 2003; FAO 2008). Bringing nutritional education into the classroom can assist in the reinforcing and the interpreting of healthy eating initiatives and

additional homework projects relating to nutrition can encourage family and community involvement (Wenhold *et al.* 2008: 441).

South Africans need guidelines that are positive, practical, affordable, sustainable and culturally sensitive to help choose an adequate diet. Nutritional Education (NE) is a strategy for the management and change of behaviour with reference to malnutrition. The Nutritional Education Programme (NEP) must take into consideration the eating habits of children and focus on behavioural change, such as eating snacks (Cross, Babicz & Cushman 1994: 1398). It should consider the interests and requirements of the scholars, teachers and school and must focus on information that is relevant and vital to improve the nutritional status of the children. The outcome of the NEP is the promotion of skills and behaviour development related to food preparation, preservation, storage and all cultural obligations towards food and eating (Pérez-Rodrigo & Aranceta 2003: 582). The chosen communication method is very important and will ultimately determine the success of the programme. Implementation of good food habits and practices from an early age can permanently influence a child's nutritional status (FAO 1996). NE can be promoted through dramatisation, healthy lunch options in cafeterias, the use of audiovisual aids and school gardens. Food guides, including the FBDGs can be used to assist and will depend on the level of the food supply and the effectiveness of food practices (FAO 1996).

2.8.8 Integrated Nutritional Programme (INP)

The INP was developed in 1994 and the main focus area of Nutritional Education was established by the DoH (2008). The Nutrition Education Programme (NEP) focuses on specific groups and is simplified to fall in line with the levels of literacy within rural communities. The intention of the NEP must consider the limited resources within the community (FAO 2006). The main aim of the INP is to prevent and manage malnutrition and ensure optimum nutrition for all South Africans. It consists of focus areas such as; disease-specific nutrition support, treatment and counselling, primary school children and those under the age of six, children from poor households suffering from chronic lifestyle and communicable diseases, at risk pregnant and lactating women and the at-risk elderly. To achieve success, the different sectors need to work together to address all the malnutrition causes (Saitowitz & Hendricks 2001).

An area of focus for the delivery of nutritional services is a community-based programme (CBNP) which aims to strengthen the household security, improve nutritional knowledge and the care of women and children and promoting a healthy environment. A second area of focus is the Health Facility-Based Nutritional programme (HFBNP) which focuses on undernutrition, micronutrient deficiencies and chronic diseases of lifestyle. Food supplementation, nutritional education and growth monitoring all form part of the second focus. The third focus is directed towards nutritional promotion through policy development, improved communication, advocacy and appropriate legislation. This programme includes the promotion and protection of breastfeeding, marketing of infant foods and food fortification (Saitowitz & Hendricks 2001). The Integrated Food Security and Nutrition Programme's vision is to achieve widespread access to adequate, safe and nutritious food for all South Africans at all times. The Nutritional Programme should adequately meet the dietary and food preferences for an active and healthy life and the food supplied should be ample, affordable, safe and nutritious (FAO 2008). The goal is to eradicate hunger, malnutrition and food insecurity by 2015 (FAO 2006).

2.8.9 School Feeding

School feeding is part of the first three Millennium Development Goals which are to eradicate extreme poverty and hunger, support primary education, and advance gender equality and empower women by 2015. Malnutrition prevents children from accessing the school system early and those who have less schooling and smaller physiques tend to earn less as adults (Alderman, Hoddinott & Kinsley 2004). Feeding schemes around the world are known as the National School Lunch Programme (NSLP) and are used in the USA, Britain and other countries in Europe. Various improvements have been made to feeding schemes which are funded by the Governments. In South Africa, State School Feeding was terminated in 1959, and reintroduced by President Mandela as the Primary School Nutrition Programme (PSNP) replacing the National School Nutrition Programme (Iverson *et al.* 2011: 3). In 2008 it was expanded to 18,000 Primary Schools and the rollout for Secondary Schools started in 2010. The programme's aim is to provide one decent meal a day to enable children to concentrate on school work. The PSNP runs in schools noted as previously disadvantaged and with very high poverty rates amongst the community (Khumalo 2008).

The South African School Feeding Programme (2002) was transferred to the Department of Health, Social Development, Land Affairs and Agriculture and, in 2004, to the Department of Education (DoE), as a small part of the Integrated Food Security Strategy for South Africa. The National School Nutrition Programme aims to foster better quality education by enhancing children's active learning capacity, alleviating short-term hunger, providing an incentive for children to attend school regularly and punctually, and addressing certain micro-nutrient deficiencies, hunger and food insecurity (WFP, 2006). The school feeding programme aimed to feed ± 8 million learners daily by 2012 (Moeng & De Hoop 2008: 287; Govender 2012). The United Nations' World Food Programme (WFP) and World Vision see school meals as an effective way to improve school attendance and reduce AIDS. Malnourished children are more susceptible to infections and diseases and concentration is reduced (Engelbrecht 2005; WFP 2006).

The systematic review of school feeding programmes by Kristjansson *et al.* (2007: 1) based on 18 studies concludes that school meals have limited health benefits for disadvantaged children measured by indicators of physical growth and cognitive abilities. There are 3 types of school feeding programmes: school feeding programmes which provide cooked meals at school; school feeding programmes with pre-packaged food items, for example, a snack or a drink; and take-home rations in the form of cereal and oil. Families who send their children to school and benefit from school feeding programmes with cooked meals can see the benefits. Political leaders around the world use school feeding programmes as a visible community safety net. The benefits of feeding children or families with additional food through these programmes are visible to the participants and are successful with the help of the politicians who show the support for these projects (Lawson 2012).

School feeding programmes can thus be a powerful tool with many benefits, such as education, gender equality, food security, poverty reduction, nutrition and health, and agricultural development. It alleviates short term hunger, thereby improving children's cognitive functioning and attention span (Buttenheim, Alderman & Friedman 2011: 1). The recession worldwide, which is responsible for food and fuel increases, has highlighted the important role school feeding programmes play in the lives of children living in poverty and food insecurity. The World Food Programmes for Education have reported a yearly increase of 14 percent in school enrolment in WFP-assisted schools within thirty-two Sub-Saharan African countries (Gelli, Meir & Espejo 2007: 2; WFP 2006).

The Home-grown School Feeding Programme (HGSFP) was introduced in Kenya in 2009, but with limited success due to infrastructural challenges and financial constraints. The programme has become more viable since 2011 after the initial problems experienced (Langinger 2011: 30). Under the National School Nutrition Programme (NSNP) the establishment of vegetable gardens at schools was encouraged with the assistance of the public sector. During the 2008 evaluation of the NSNP it was reported that 90% of the schools had vegetable gardens, but these were poorly maintained and did not contribute to the feeding of the children. Many obstacles exist in the vegetable gardens, such as pests, poor soil, and lack of resources, theft and lack of support from the School Governing Body (UNICEF 2008).

2.8.10 Government Initiatives

2.8.10.1 Food Parcels

The Division of Occupational Safety and Health (DOSH) National Food Emergency Scheme was introduced by Government in 2002 and is aimed at distributing food parcels to the most vulnerable sections of the population. The scheme is part of the government's Integrated Food Security and Nutrition Programme (IFSNP) and is a short-term measure. The distribution of food parcels is part of the services rendered by the Department of Social Development and their Home and Community-based care centres (HCBC). These parcels are available to orphans and children made vulnerable by HIV and AIDS, child-headed households, people with disabilities, female-headed households and HIV and AIDS affected households. The HCBC not only provides food parcels, but supports these recipients, there being approximately 30 percent of the South African population benefitting from such food parcels (Moeng & De Hoop 2008: 287).

2.8.10.2 Grants

Social grants are another form of support provided by Government to alleviate malnutrition and support the poor and vulnerable of the country. The social assistance (means-tested cash benefits to vulnerable people) is available to South African citizens through the following social grants:

- Old Age grant: for women 60 years and older; men 65 years and older.
- Disability grant: for people who have been assessed as permanently or temporarily disabled.
- Child support grant: for primary caregivers of children younger than 14 years and born after 1993.
- Foster care grant: for caregivers of children who have been placed with them by the court.
- Care dependency grant: for parents, primary caregivers, or foster parents of a child under the age of 18 years who requires and receives permanent care or support services due to his or her physical or mental disability.
- War veteran's grant: for people who served in the First World War (1914-1918), Second World War (1939-1945), or Korean War (1950-1953).
- Grant-in-aid: for people receiving an old-age grant, disability grant, or war veteran's grant and are unable to care for themselves and need full-time care from someone else. (South African Social Security Agency (SASSA) 2013).

In Europe similar grant systems are in place, but focus more on old age, disability, a form of family allowance and unemployment. Some are flat rates for the amount allocated while others are related to the income level. Very few are means-tested cash benefits as in South Africa (International Social Security Administration (ISSA) 2013). In 2004 Brazil introduced the largest social grant scheme in the world to assist poor families. The programme has been credited for the upliftment of 20 million poverty stricken people in a short period of time. Sixteen other Latin American countries have implemented this programme and in New York a programme exists to deal with urban poverty. The programme is a cash grant and, in exchange, the children in the family must attend school and participate in other associated development support measures, such as vaccinations, nutritional monitoring, prenatal and post natal tests. The programme also offers vocational training as part of the upliftment of the community. The only requirement is that the income must be below 52 dollars per month (Fakir 2011).

2.8.10.3 Food Stamp Programme

The Department of Health and Senior Services in the United States of America (2010) has developed the Food Stamp Programme, known in New Jersey as the Supplemental Nutritional Assistance Programme (SNAP). The Food Stamp programme is a benefit programme that provides nutritional assistance to the families and individuals who are food insecure. The benefits are issued by means of a card which can be accessed electronically (Murphy 2013).. The programme is designed to increase the food purchasing power of low-income households. The families are assisted by government organisations, nutrition educators and neighbourhood and church organisations to make sure the most vulnerable in society have access to the benefits. SNAP is the largest programme in the domestic hunger safety net. In 2013 one in seven Americans was receiving federal aid although the government is said to be cutting funding to the food stamp programme (Murphy 2013). Other forms of assistance across the world are in the form of stamps, vouchers and cheaper prices for poorer families in US, Egypt, Sri Lanka and the Philippines. South Africa and countries in the European Union have opted for the social grant system. A food voucher programme was under investigation in South Africa in 2003 (Petros 2003).

2. 8.10.4 Millennium Development Goals

South Africa is one of the countries that adopted the Millennium Development Goals aimed at eradicating extreme hunger and poverty (first Millennium Development Goal) and which aim to halve the number of people suffering from hunger and living on less than one dollar a day. Poverty hits children the hardest as they are the most vulnerable and it affects their development mentally, physically, emotionally and spiritually. Every 3.6 seconds of every day one person dies of starvation and it is usually a child under the age of five. Providing the necessary basic education, health care, nutrition and protection assists children in getting the best start in life and improve survival, so that they may live productive lives. Healthy children with good survival rates need primary health care (UNICEF 2012b). The Millenium Development Goals aim to achieve the following by 2015:

- Provisions of education are fundamental in the prevention of poverty as income increases, rational decisions about the future and improved decision-making takes place and ultimately provides improved protection against HIV and AIDS.

- The funding of supplementation programmes, such as iron and vitamin A, as part of vaccination campaigns and by means of fortification of food.
- Improving clean water supply and sanitation in schools and communities and promoting safe hygiene practices will have a positive impact on the mortality rate. With the support of UNICEF, governments and partners get assistance for implementing the delivery of water and sanitation to displaced communities.
- Improving the inequalities between ethnic or religious groups and ensuring a safe and protective environment for children in countries with conflict, abduction, sexual violence and exploitation and the fight for shelter, education and survival (UNICEF 2012b).

2. 8.10.5 National Development Plan 2030

The National Development Plan Vision for South Africa (2030) recognises that by alleviating poverty, malnutrition is addressed. Factors that could assist in the eradication of malnutrition are greater employment opportunities and the expansion of these opportunities through education, vocational training and work experience, public transport and access to information, strengthening and broadening the health care services and broadening the district based health programmes and health education (National Planning Commission 2011).

The National Development Plan for South Africa also recognises the critical issue of promoting health and wellness and the prevention and managing of lifestyle diseases, particularly major non-communicable diseases among the poor, such as cardiovascular disease, increased cholesterol levels and diabetes. The success of prevention treatment for these lifestyle diseases depends on the success of the Health System. Currently principles of primary health care and the district health systems guide the South Africa's Health System. The Government's priority is to improve the community-based health care and the overall health system in South Africa which, in the end, will assist in reducing malnutrition (National Planning Commission 2011). The Scaling up Nutrition movement (SUN) is part of the process to try and achieve the Millennium Goals, especially by alleviating hunger and poverty. The Scale up Nutrition Road Map is supported by multiple global stakeholders in an effort to reduce hunger and undernutrition as part of achieving the Millennium Goals set in 2000 (United Nations System Standing Committee on Nutrition (UNSCN) 2012).

2.9 ECONOMIC IMPACT OF MALNUTRITION

2.9.1 Impact of Malnutrition on the Country's Health System and Economy

The economic growth and the prevalence of poverty within a country are affected by malnutrition. The Copenhagen Consensus reported that investing in nutritional interventions gave higher returns compared to 17 other potential developmental investments (World Bank 2006). Malnutrition contributes to poverty in 3 ways, namely; loss in productivity, reduced cognitive function and the lack of schooling and losses due to increased health costs (World Bank 2008b). The high levels of malnutrition impair the economic growth of South Africa and are linked to poverty and food insecurity. In 2007 the social assistance grants were introduced and by 2012 nearly 16 million people benefited at a cost of R136 billion for the 2013 financial year. The Minister of Finance indicated that social grants should not be seen as a substitute for jobs as the number increasingly grows each year. Social grants form a large part of the income of more than half of South African households and the main source of income for 22 percent (Cloete 2012; Kahn 2013). Underemployment, the unemployment rate and poverty can be linked to malnutrition, undernutrition and food insecurity which affects more children than adults (United Nations Development Plan (UNDP), 2010). The consequences of being malnourished as a child are the cause of 20 percent less income as an adult. Gross Domestic Product (GDP) is affected by up to 3 percent because of micronutrient deficiencies (Global Alliance for Improved Nutrition (GAIN) 2012b).

The nutritional situation in South Africa is due to the influence of undesirable dietary habits, practices, attitudes, perceptions and socio-cultural influences and the lack of nutritional information and knowledge. Individuals need the knowledge and skills to supply and prepare a variety of foods in the right quantities and combinations to ensure good health and well-being (DoH 2008). Promoting health and wellness is critical to preventing and managing lifestyle diseases. Food companies should assist government agencies in the control of quality and in the processes of food fortification. The success of the eradication of malnutrition has been disappointing, despite well-tested approaches. The world's progress towards the Millennium Development Goals (MDGs) has been inadequate and has failed to decrease the poverty levels in the world satisfactorily. Some success has been achieved in countries such as Mexico by means of cash transfers and the provision of improved health and nutritional services. This has resulted in an increase in the use of nutritional services by

the poor which ultimately will have a positive effect on the nutritional status of the community. Countries such as Bangladesh, Honduras, and Madagascar have successfully used government-nongovernment partnerships to lower malnutrition levels through community-based approaches (World Bank 2008b).

The South African government recognises the state of poverty and food insecurity at household and national levels and has developed a comprehensive approach in addressing the issue. South Africa is food secure, which means South Africa is producing enough and has been able to pay for food imports due to the surplus of agricultural products. However, attention must be paid to the shift in preferred staple food which is a result of the urbanisation of the population. Food insecurity needs to be addressed through job creation and agricultural productivity. There has been a shift from the traditional staple food to higher consumptions of wheat, rice, potatoes and animal proteins. The approach from government is to use various corrective measures, such as social grants, free primary health care for all, compulsory education, subsidised housing that fulfils the basic needs of a household, transportation and home ownership (United Nations Development Programme (UNDP) 2010).

The improvement of nutritional knowledge, strengthened household food security, supportive care for women and children and promoting a healthy environment is what the Community-Based Nutrition Programme (CBNP) strives to achieve (DoH 2008). The community workers of the programme are vital to its success as contact with the families and the community is established. The prevalence of diet related chronic disease and obesity among the poor is the focus of the CBNP. The incorporation of health promotion activities to influence lifestyle is seen as a way to improve health. Shop owners and vendors who provide fast foods within the community are involved in the drive for consumption of healthy food. The community and the assistance of facility-based activities are required to improve the nutrition among the poor communities (Puoane *et al.* 2008: 901). Persistent malnutrition is contributing to the failure of the first MDG to halve poverty and hunger, and to meet other goals in maternal and child health, HIV and AIDS, education, and gender equality. Consideration needs to given to the reasons for failing to reaching this goal and the development of economic and social improvements that depend on nutrition (Statistics South Africa (STATSSA) 2010).

2.9.2 Role of the Recession on Malnutrition

The most vulnerable in society, the poor, are affected by the global financial and economic crisis. The financial crisis aggravates hunger and malnutrition as food prices soar and the global economic crisis worsens. The poorest populations of the world and the Low Income Food Deficit Countries (LEFDCs) are severely affected by the influence the economic crisis is having on food consumption and nutritional status in households. The reduction of food expenses and non-staple food is a way that poor households use to cope with the financial crisis. This affects the quality of the micronutrient content of the food being consumed, portion sizes and energy intake. Factors contributing to malnutrition are the rise of unemployment, civil unrest, conflicts, and the increase of working hours to feed the family as well as an increase in the number of people in the family that have to be fed because of retrenchments. The Plan and Overseas Development Institute, a Non-Governmental Organisation (NGO) that fights poverty in developing countries, reports that women eat less; girls are forced to leave school and earn an income, and that there are very high unemployment rates for women compared to men. The report also points out that countries need to consider gender equality and propose specific solutions, such as promoting local sustainable food production and programmes that meet the needs of girls. It also includes incentives for families to keep the children in school and offers subsidised child care (Stavropoulou & Jones, 2013). From 2010 to 2013, the governments of developed and developing countries tightened their budgets and implemented strict monetary policies and reforms as debts increased. Countries such as Greece, Portugal, Italy and Spain are sinking deeper into recession, despite the strict monetary policies and reforms. A cut in subsidies, cuts in social programmes such as social grants, old age pensions reforms and an increased consumption tax on basic goods and services, are some of the methods used to implement austerity measures. It is clear that the vulnerable in society are affected more by recession and that it impacts on the achievement of Millennium Development Goal 1 (MDG1) and has an effect on the other MDGs, especially MDG4 and 5 (Stavropoulou & Jones 2013).

2.10 CONCLUSION

It is clear that a variety of factors influence malnutrition and dietary intake. These factors influence the health status of all levels of society, especially children who are vulnerable to malnutrition and mal-development.

CHAPTER 3 – METHODOLOGY

3.1 INTRODUCTION

This chapter provides a description of the research design and methodology employed in this study. A description of the participants and sampling procedure is provided and a brief overview of the procedures used to gather the data is included. The process of the research and the data analysis of the study are explained. Proper planning, research design, and measuring instruments were critical components in gathering good quality data. When selecting the research methods the following factors were taken into account in order to meet the research objectives:

- The need for absolute intake versus relative estimates
- Population characteristics (age, gender, motivation, education, cultural diversity)
- Available resources, including food models and food composition data if nutrients are to be calculated.

The purpose of this chapter is, therefore, to explain how data (Anthropometrics, 24-Hour Recall, Food Frequency and lunch box analysis) were collected in order to obtain the socio-economic, nutritional intake and the dietary intake patterns of boys and girls aged 9-13 in two Primary Schools in the Buffalo City Metropolitan Municipal area of East London using reliable instruments. The main objective of the study was to determine the socio-demographic background, anthropometric status and macro- and micronutrient status as well as the dietary intake patterns of those children.

3.2 PLANNING AND ADMINISTRATION

The researcher randomly selected two schools from the list of possible boys' and girls' schools in the Municipal area of East London. Single gender schools were selected as good choices for the purpose of comparing results between genders. Single gender schools will result in objective and clear results as these schools are of the same quintile category, namely 5, which are categorised as wealthy, successful learning institutions (Department of Basic Education 2014). The two Primary Schools were then approached and the study objectives

explained to each Principal. The Principals were in full agreement with the benefits of the research project for their respective schools. Letters of permission (Annexure A and B) were obtained from each school and once permission was granted, letters were sent to each child in the school informing the parents of the research.

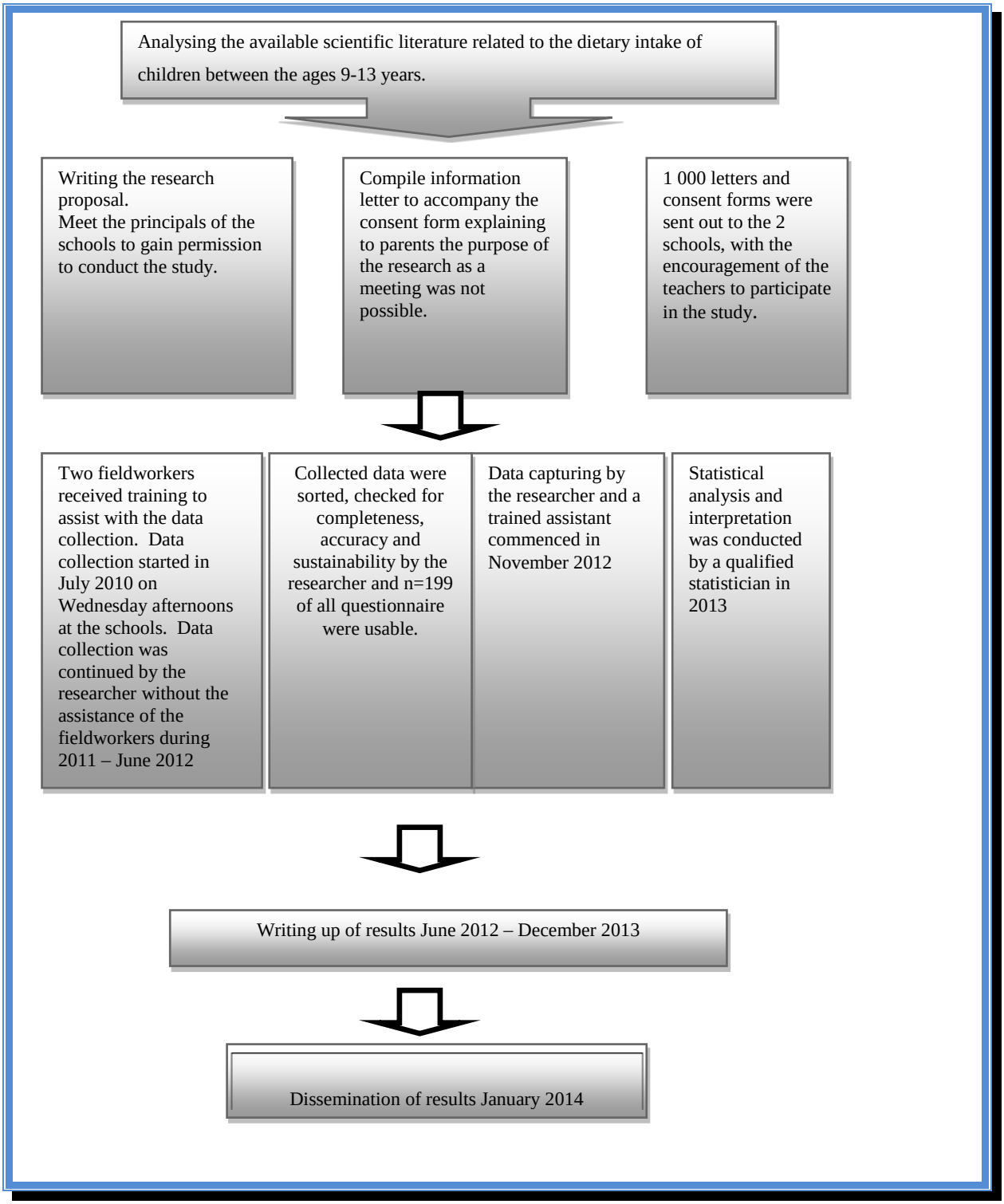

Figure 3.1: Research Process

3.3 CONTEXT OF RESEARCH

South Africa has nine provinces, one of which is the Eastern Cape, the capital being Bisho. The research project took place in the Buffalo City Metropolitan Municipal area of East London. The town has a population of 704,855 and has densely populated residential and industrial areas, which include extensive shopping centres, religious buildings and a large harbour (Buffalo City Metro 2012). The municipal area is diverse in the representation of different races and thus the study included respondents of different races and religions. The study was conducted in 2 single gender primary schools in the Central BCM Municipality. The two schools combined had a pupil total of around 800 from grades four to seven. The study was conducted on Tuesdays after school at the convenience of the pupils as extra-mural activities had to be considered. The schools do not qualify for the government's feeding scheme as the schools fall into the 5^{th} quintile category (Refer paragraph 3.2) (Department of Basic Education 2014).

The girls' school made a point of emphasising healthy eating very strongly by calling on the parents to support the initiative of only packing healthy food options. The teacher would check every day to make sure that only healthy nutritious food was provided. The school also introduced the 9:00am snack to assist with concentration and this was usually a piece of fruit, vegetables or dried fruit and nuts. The lunch box programme has been in place for many years, as well as the 9:00am snack, and has been very successful in supporting the learning process. The school tuck shop in the girls' school joined the Heart Foundation in February 2010 and successfully converted to selling healthier options to the girls. The programme assisted the school in making the necessary changes and offers free advice and assistance on a regular basis (Heart and Stroke Foundation SA 2013).

Letters were sent out to parents explaining the research and requesting participation in the research project by completion of the consent form (Annexure C).

Figure 3.2: Map of Eastern Cape (SA Venues, 2013).

3.4 PERMISSION AND CONSENT

The research proposal was submitted and approved in 2010 by the Faculty of Applied Sciences Research Committee (FRC) at the Durban University of Technology (DUT) prior to the commencement of the study. Ethical clearance was obtained from the FRC as part of the proposal approval.

Permission to conduct this study in this community was requested and obtained from the principals of the two schools involved in the study and results will be presented to them at the end. The information letters, with the consent forms attached, were sent to parents and the signed forms had to be returned to the school which had given permission for the children to participate in the study. The principals did not recommend a meeting as the turnout is usually very poor. The study was explained individually to the children who had to agree to participate before any data were collected. The respondents were assured that personal information would be kept confidential and be locked away in the Department of Food and

Nutrition cupboards for the period of five years and thereafter it would be disposed of by shredding. Only the researcher and the supervisor would have access to this information.

3.5 RESPONSIBILITY OF FIELDWORKERS

Two fieldworkers were recruited and trained by the researcher in a training session. English was the medium of instruction for the training session and the training manual for the fieldworkers to refer to later if needed. The Fieldworkers Guide (Annexure I) was also written in English. The fieldworkers training included how to approach the participants, code of conduct, and administration of the 24-Hour Recall, FFQ questionnaire and the use of food samples to assist in estimating portion sizes and to assist in the children's recall. Training was also done for the completion of the socio-demographic questionnaires by parent or guardian present. The fieldworkers were trained in a role-play situation on how to take anthropometric measurements. The fieldworkers were expected to show respect, friendliness, and patience, which are important when dealing with children. Punctuality and reliability were also discussed as an important aspect of successful fieldwork since participation depended on time that the participants had available. It was important to complete questionnaires accurately and in a short space of time as school children were very busy with extra-mural activities after school. The significance of the research was discussed with the fieldworkers to inform them of the objectives and importance of the research. A large percentage of the interviews were conducted by the researcher as reliability, competency and trustworthiness were important in collecting the data and as the fieldworkers were not always available for the interviews. In order to ensure reliability of the data, the interviewer followed appropriate methodological criteria such as suspension of personal prejudices and biases, systematic and accurate recording of the observations, establishment of trust and rapport with each respondent and creating optimal conditions with respect to the location or setting for the collection of data. Analysis of the school lunch boxes was conducted by the researcher.

3.6 STUDY POPULATION AND SAMPLING

Negotiations with the pupils' parents were undertaken to gain participation for this study. Consent forms were sent out to all the 9-13 year old pupils from Clarendon Primary School for Girls and Selborne Primary School for Boys in East London and who bring daily packed

lunches to school. Only children with consent from parents were able to participate in the study. The sample population consisted of 99 boys and 100 girls. The age group of 9-13 years was chosen as it corresponds to the DRI age category present in the primary schools.

The sample was calculated using a power calculation of 196 out of a population of the indicated 737 boys and girls in the schools (Cole, 2006). The figure was rounded off to 200 with approval received and the sample size was 100 girls and 99 boys after one boy 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 a decimal

(0.6 used for sample size needed)

C = confidence interval, expressed as a decimal = .06 (three units on both sides of the normal).

The inclusion criteria were the following:

- Boys and girls.
- Children between the ages of 9-13 years.
- Children who brought lunch boxes to school daily.

The exclusion criteria were the following:

- All boys and girls who fell outside the age range.
- All respondents who did not bring a lunch box to school daily.
- All children outside the selected schools.

The sample size was 199 pupils after one respondent withdrew at a later stage. As the participation was voluntary only pupils with consent forms could be included and thus non-random and quota sampling applies. The same fieldworker attended to the same pupil and parent in the completion of the three 24-Hour Recall, FFQ and Socio-demographic questionnaires and anthropometrics in order to ensure validity of research data.

3.7 STUDY DESIGN AND MEASURING INSTRUMENTS

The study design for the survey was cross-sectional, whereby a variety of variables were measured by means of different types of questionnaires. The fieldwork was conducted in a classroom or office made available to the researcher and fieldworkers at the school or, in some cases, participants were visited at home. Interviews took an average of 45-60 minutes and no refreshments were provided as children had refreshments for after school activities. The procedures during an interview and data collection process are represented in Figure 3.3.

INTERVIEW PROCEDURE
Greeting of participant and parent by fieldworker.
Fieldworker explains to the mother/guardian about the socio-demographic.
Food Frequency questionnaires to be completed.
Fieldworker interviews the participant and parent – 3 days of 24-Hour Recall.
Fieldworker does the anthropometric measurements – weight and height.
Fieldworker checks the questionnaires for completeness.

Figure 3.3: Data collection process

Various types of questionnaires were used as measuring instruments for all variables of the study. During the fieldwork stage, Socio-Demographic (Annexure D), Food Frequency (Annexure E), 24-Hour Recall (Annexure F) and Anthropometric Data (Annexure G) were collected which will be discussed in detail below. Lunch box information was collected via a form designed by the researcher to capture the information (Annexure H). The questionnaires were checked every day after the fieldwork to ensure that all the sections were completed in order to have a full and reliable database of all the participants.

3.7.1 Socio-demographic survey

The socio-demographic questionnaire developed by Napier (2006) was adapted for the community and used in this study. The questionnaire was completed by a trained fieldworker with the parent in a one-on-one interview. Its purpose was to measure the socioeconomic profile of participants. The main categories included personal information, accommodation

and family composition, living situation, water supply, toilet facilities, environmental sanitation, problems with pests, highest education, employment status, household individuals who contribute to income to purchase food, money to purchase food, frequency of purchasing food, meals consumed per day, where most meals are consumed, cooking activities and household assets. One hundred and ninety-nine questionnaires were completed.

3.7.2 Dietary intake

Three 24 Hour-Recalls were used to gather data for dietary intake in order to do a nutrient analysis, which was then used in conjunction with a food frequency questionnaire for validity testing. The parent and the child were interviewed to collect this data.

3.7.2.1 24 Hour-Recall

The previously validated 24-Hour Recall questionnaire developed by Oldewage-Theron *et al.* (2005: 13) was used in this study. This is a dietary assessment questionnaire that records the eating patterns, food items and quantities consumed over a 24-Hour Recall period. It is a 'multiple pass' method which is repeated for 3 non-consecutive days, one weekend (Sunday) and two week days (Monday and Tuesday). The 24-Hour Recall questionnaire was conducted within one interview for a consecutive three day (72-Hour Recall) food consumption assessment (Oldewage-Theron *et al*. 2005: 13) and the average over the three days was used to measure adequacy of nutrient intake. During the individual interviews conducted by the fieldworkers, food models in portion sizes were simultaneously used to determine accurate portion sizes and to explain food items to the respondents. This assisted in speeding up the process and assuring reliability of the responses. The nutrient intake for the girls and boys was calculated separately and compared to the DRIs. The top twenty food items consumed by the group as a whole were also determined. Both respondent and guardian were present during the interview.

3.7.2.2 The lunch box analysis

Lunch boxes were collected at 7:30 on a Tuesday morning on the same day of the interview. A calibrated kitchen scale (MICRO-CW, Scales 2000) measuring from 20g-30kg in 1g increments was used to measure the lunchbox contents. The lunch boxes were taken to a

kitchen area where the researcher weighed each item individually with the scale set on 00, using greaseproof paper and plastic gloves to the handle the food. The measurements were captured on a form developed by the researcher (Annexure E). The contents of each lunch box were photographed for future referencing. Lunch boxes were returned to the pupils before break.

3.7.2.3 Food Frequency Questionnaire – FFQ

Structured questionnaires, such as food frequency questionnaires, are designed to collect information on the type of food and the variety of consumption over a period of time. The FFQ used consists of 9 nutritious food groups each, consisting of foods representative within the food group that the respondents could possibly consume on a daily basis. The questionnaire could be divided into 9, 11, 13 food nutritious groups as the study required (Wrieden *et al.* 2003; WHO 2011). Using a validated questionnaire is important when dietary intake data are collected. Expanding on the questionnaire with more detailed lists of food for the selected population ensures improvement on the validity (Oldewage-Theron & Kruger 2008: 115; Australian Child and Adolescent Obesity Research Network (ACAORN) 2010). This questionnaire can be completed by the parent or the child provided good literacy and numeracy skills exist (ACAORN 2010). The questionnaires standardised in previous studies (Oldewage-Theron & Kruger 2008: 115) were implemented in the study, to determine the food variety of the sample population. The FFQ was also completed with the assistance of the caregiver and the participant.

A study by Oldewage-Theron & Kruger, (2008: 115) proved that dietary diversity indicators, namely the Food Group Diversity Score (FGDS) and Food Variety Score (FVS) measured by a FFQ, are good indicators of dietary adequacy (Steyn *et al.* 2009: 145). The information given was not quantified but reflected the items consumed over the previous seven days. The questionnaire was completed by a trained fieldworker in a one-on-one interview with the child and the parent.

3.7.3 Procedures for conducting Anthropometric Measurements

The anthropometric measurements for this study were weight and height for the purpose of determining the Body Mass; (BMI)-for-age, height-for-age and weight-for-age of each

participant (Annexure D), in order to determine underweight, stunting, wasting, overweight and obesity in the children (WHO 2008).

3.7.3.1 Weight

The fieldworker or researcher conducting the interview was responsible for measuring and recording the participants' weight and height. Each participant was dressed in school uniform without a blazer or a jersey. Shoes were removed prior to being weighed.

- Weight was determined to the nearest kilogram on a good quality, electronic standardised medical scale (Scales 2000, model: portable physician scale – PPS).
- The scale was place on an even uncarpeted surface, with the spirit level indication in the middle.
- The scale was switched on and the fieldworker waited until the zero indication (0.0) appeared on the display panel.
- The participant was placed on the scale standing upright on the middle of the scale, facing straight ahead with feet flat and slightly apart.
- The participant had to stand still until the measurement was recorded.
- The participant then stepped down and repeated the process for a second recording.
- The two weight readings had to be within the nearest 0,1kg and an average of two measurements was recorded if the same reading had not been obtained (WHO 1995).

3.7.3.2 Height

The height measurements were conducted as follows:

- A stadiometer was used to measure height.
- The participant had to remove his/her shoes.
- The participant was positioned facing the fieldworker with shoulders relaxed, arms relaxed at the sides, legs straight and knees together, buttocks and heels touching the wall, feet flat with heels touching each other.
- The participant had to look straight ahead before the headpiece was slid down onto the head. The headpiece was placed in the centre of the crown of the head.

- The fieldworker then had to record the participant's height in mm in the space provided on the anthropometric form. This whole procedure was repeated with each participant. The two readings should not have varied by more that 5mm and these measurements were taken to the nearest 0,5cm. The procedure was repeated with the next participant (Gibson 2005; Lee & Nieman 2010).

3.8 DATA ANALYSIS AND STATISTIC

Once the fieldwork was complete, questionnaires were sorted and checked for completeness and accuracy by the researcher. Descriptive statistics (frequencies, means, standard deviations and confidence intervals), where applicable, were determined with the assistance of a statistician. The variables in line with the objectives of the study and statistical methods are described in Table 3.1.

Table 3.1 Analysis of data

OBJECTIVE	VARIABLE(s)	STATISTICAL ANALYSIS
To determine the demographic characteristics of the household	Age, gender, socio-economic status, income and household composition	Descriptive statistics, SPSS version 20.0
To determine the dietary intake of the children	Dietary intake for 24 hours at a time (24 Hour-Recall) x 3 days	Food Finder software (MRC 1991), mean, minimum, maximum and standard deviation compared to DRIs.
To determine the nutrient content of the packed lunches	Individual analysis of lunch boxes, boys and girls separately	Food Finder software (MRC 1991), mean, minimum, maximum and standard deviation compared to DRIs, T-test to test for significance between groups.
To determine the food variety intake of the children	Food variety over 7 days (FFQ)	Descriptive statistics, SPSS version 20.0, t-test for significance between groups.
To determine the anthropometric status of the children	Weight, height and age	Anthroplus (WHO 2010)

3.8.1 Socio-Demographic Questionnaire

The completed socio-demographic questionnaires were sorted and checked for completeness and accuracy by the researcher and (n=199) were usable. Descriptive statistics were drawn to

indicate frequencies for the different variables. Tables were drawn up with percentages of the different variables included in the questionnaire. Data were presented in terms of frequencies and percentages for the various categories.

3.8.2 Dietary Intake

3.8.2.1 24-Hour Recalls

The data were captured and analysed by a nutrition professional using the MRC Food Finder® Version 3.0 software, based on the South African Food Composition Tables of South Africa (Langenhoven, Kruger, Gouws & Faber 1991). This programme was developed to present a theoretical analysis of the nutrient content of food items consumed. The nutrient intake and the top-20 food items most commonly consumed by the participants for one weekend day and two week days were recorded. Statistical analysis was performed. Correlations were drawn with certain variables (daily mean energy, total protein, total fat carbohydrates, dietary fibre, vitamin C, vitamin A, calcium, iron and zinc) and statistical significances were calculated. Tables and graphs illustrated the results by means and standard deviation for interpretation of the prevalence of nutrient deficiencies that could be deduced from the questionnaire. The association of the nutrient intake and nutritional status were compared to the DRIs (NICUS 2003; 2007) for the age group 9-13 years. The Nutrient Adequacy Ratios (NARs) were determined by calculating the percentage of the average intake over the three days with the DRIs for each nutrient.

3.8.2.2 Lunch Box Content Analysis

Lunch box data analysis (n=199) was captured and analysed by a nutrition professional using the MRC Food Finder® Version 3.0 software, based on the South African Food Composition Tables of South Africa (Langenhoven *et al.* 1991). This programme was developed to analyse the nutrient content of food items consumed. The contribution of the lunch boxes to the daily intake of the children was compared to the 24-Hour Recall data collected on the same day (Tuesday).

3.8.2.3 Food Frequency Questionnaire

The completed FFQ data were sorted and checked by the researcher for accuracy and completeness and (n=199) were usable. The data were captured on an Excel® spreadsheet by the researcher and then analysed by using the SPSS for windows version 20.0 software program with the assistance of a statistician.

The different Dietary Diversity (DD) measurements, referred to as dietary variety, were calculated as follows:

(1) Overall variety score (simply the count of food items)
(2) Variety score between all nine food groups
(3) A variety score within every food group. (Hooshmand & Udipi 2013: 1).

These scores were calculated for a reference period of seven days for this study and were used together to reflect DD in different ways. The dietary diversity score (DDS) consisted of a simple count of single foods and food groups, similar to previous studies in developing countries (Clausen, Charlton, Gobotswang & Holmboe-Ottesen 2005: 86). The nine nutritious food groups recommended by the FAO were used for the classification of broad food intakes. A 'low variety' was indicated when less than 30 foods were consumed in a period of 7 days, compared to a 'medium variety' with 30-60 foods, while 'high variety' contained with more than 60 foods consumed in the same period (Matla 2008). All the dietary diversity scores (FVS, FGDS and DDS) were calculated from the seven-day FFQ (n=199). Descriptive statistics, including frequencies, means and standard deviations, were determined. Tables were drawn up to present the FGDS indicating the number of food groups consumed by the participants. The FVS was also presented in table form to indicate the number of foods consumed by the group over a period of seven days and how this presented itself in each food group. Data were presented in terms of frequencies and percentages for the various categories. The NARs were correlated with the FGDS to indicate if the nutrient intake improved when the Food Group Diversity improved in each group.

3.8.3 Anthropometric Measurements

All weight and height (average of 2 readings) measurements were captured on an Excel® spreadsheet. For purposive data analysis, participants' raw anthropometric data were converted into z-scores using the new WHO growth standard reference values. Data was analyzed using WHO Anthroplus computer software (WHO 2010) which indicates that height-for-age (stunting) occurs when the z-score is below the median by more than <-2SD and weight-for-age (underweight) is when the z-score is more than <-2SD below the reference median. 'Overweight' includes the risk of overweight when the z-score is more than >+1SD and overweight when the z-score is more than >+2SD above the reference median. Obesity is when the z-score is >+3SD above the reference median (Centre for Disease Control (CDC) 2012; WHO 2008).

Weight-for-age reference data are not available beyond age 10 because this indicator does not distinguish between height and body mass in an age period where many children are experiencing the pubertal growth spurt and may appear as having excess weight (by weight-for-age) when in fact they are just tall (WHO 2007a).

3.9 STATISTICAL SIGNIFICANCE

To determine the statistical significance, the statistician used Statistics version 12 with Independent t-tests. The independent t-test is an inferential test designed to establish whether the null hypothesis should be accepted or rejected. It looks at the differences between two groups on some variable of interest (University of Glasgow 2013).

The statistically significant differences between the boys and girls for the daily mean energy, total protein, total fat, carbohydrates, dietary fibre, vitamin C, vitamin A, calcium, iron and zinc were calculated. A $p \leq 0.05$ was considered to indicate statistical significance and $p \leq 0.01$ as strongly significant.

3.10 CONCLUSION

This chapter has presented an overview of the research as a methodological approach to identify the nutritional status and dietary intake patterns encountered by school children in

the age group 9-13 years from East London. The principles and procedures were described, as well as the roles and ethics involved in the research study.

CHAPTER 4 - RESULTS AND DISCUSSION

4.1 INTRODUCTION

The purpose of the study was to determine the socio-economic conditions, dietary intake and food consumption patterns and anthropometric status of children between the ages of 9-13 in the Buffalo City Metropolitan Municipal area of East London. This chapter reports on the result of the processed data as tabulated, interpreted and evaluated. A total of 199 respondents participated in the study. The sample included 100 girls and 99 boys.

4.2 STUDY RESULTS

4.2.1 Socio-Demographic

The socio-demographic results present the study population categorised in percentages according to sample size, accommodation and family composition, work status, income, education, language and assets.

4.2.1.1 Accommodation, Family Composition, Living Status and Facilities

The results presented in Table 4.1 indicate, for both boys and girls who completed the questionnaires, that 94 percent of the respondent's roles in the family were mothers; followed by fathers (5 percent for girls and 4.0 percent for boys). Grandmothers (2%) in the case of the boys played a role in the care of children. The majority of the respondents (90% girls and 87.9% boys) lived in an urban area and a small percentage (4% girls and 9% boys) lived on a farm.

Table 4.1: Role in the family and living area type

Variables		
Role in the family of parent/guardian interviewed	**Girls (n=100) %**	**Boys (n=99) %**
Mother	**94.0**	**94.0**
Grandmother	0.0	2.0
Father	5.0	4.0
Other i.e. aunt	1.0	0.0
Living Area in Buffalo City Municipal boundaries		
Town/City	**90.0**	**87.9**
Farm	4.0	9.1
Township	5.0	1.0
Rural Village	0.0	1.0
Other Small Holding	1.0	1.0

Table 4.2: Family size, type of house and number of rooms per household

Variables		
Household size	**Girls (n=100) %**	**Boys (n=99) %**
One to Five members	**80.0**	**84.8**
Six-Ten	20.0	15.2
Type of house		
Brick	**100.0**	**100.0**
Number of rooms		
1-2	2.0	5.0
3-4	23.0	**94.0**
4-5	**75.0**	1.0

Table 4.2 shows that most of the respondents shared their house with one to five people (80% girls and 84.8% boys) and all of the respondents (n=199) lived in a brick house with more than 93.9 percent of the boys in a house with three to four rooms and 75 percent of the girls in a house with more than four rooms.

Table 4.3: Living status

Variables		
Living Status	**Girls (n=100) %**	**Boys (n=99) %**
Homeless	3.0	0.0
Living with relatives	6.0	5.0
Rented house/flat	13.0	25.2
Own house/flat	**77.0**	**67.7**
Employees Properties	1.0	2.0
	100.0	**100.0**

According to Table 4.3, a large percentage of the respondents own their house, 77 percent for girls and 67.7 percent for boys, and all the respondents have access to clean safe water (refer to Table 4.4). The 3 percent of girls that are homeless indicated that the residence is an attachment or outer building of another property.

Table 4.4: Access to facilities

Variables		
Water supply	**Girls (n=100) %**	**Boys (n=99) %**
Tap in house	**99.0**	**99.0**
Borehole	1.0	1.0
Toilet Facilities		
Flush/Sewage	**100.0**	**100.0**

In addition, 100 percent households had access to flush toilets (see Table 4.4). The results in Table 4.5 indicate that a large number of the households experience no problems with respect to structure, size, repairs and pests. However, a small percentage indicated that the house was too small (11% girls and 5% boys) and some experienced damp in the households (8% girls and 2% boys). The presence of household pests was ants (40% and 39%) followed by mosquitoes (28% and 30%) and geckos (24% and 32%) respectively for girls and boys.

Table 4.5: Problems with housing and pests

Variables		
Problems with housing	**Girls (n=100) %**	**Boys (n=99) %**
No Problems – none of the below mentioned problems	**70.0**	**72.0**
Too small	11.0	5.0
Renovations	3.0	10.0
Repairs	8.0	11.0
Damp	8.0	2.0
Problems with household pests		
Mice/Rats	5.0	7.0
Cockroaches	22.0	7.0
Ants	**40.0**	**39.0**
Flees	7.0	10.0
Mosquitoes	28.0	30.0
Geckos	24.0	32.0
Frogs	11.0	19.0
Snakes	5.0	7.0
Bedbugs	1.0	0.0

4.2.1.2 Work Status, Income and Food Security

The results in Table 4.6 represent the work status and income as the majority of the sample and, in this, case mothers for girls and boys, were employed (85% and 75.8%) and 88 percent and 94.9 percent earned more than R7000 per month. One hundred and seventy-one respondents of both groups together willingly disclosed their income earned on average between R24 817.85-R33 295 per month. Twenty-eight respondents declined to declare their income. It should be noted that the income for this study did not include social grants.

Table 4.6: Work status and Household Income

Variables		
Work Status of Guardian interviewed	**Girls (n=100) %**	**Boys (n=99) %**
Unemployed	2.0	4.0
Employed	**85.0**	**75.8**
Housewife	12.0	18.2
Student	1.0	2.0
Household Income per month		
>R2500	1.0	1.0
R2500-R3000	1.0	0.0
R3001-R3500	0.0	0.0
R3501-R4000	2.0	1.0
R4001-R4500	0.0	0.0
R4501-R5000	2.0	1.0
R5001-R6000	1.0	1.0
R6001-R6500	1.0	0.0
R6501-R7000	4.0	1.0
>R7000	**88.0**	**94.9**

As Table 4.7 indicates, households had enough money to access food, but may not necessarily purchase nutritious food. Seventy-eight percent and 71.7 percent of the respondents have enough money to purchase food and 9 percent and 16.2 percent seldom while 10 percent and 7.1 percent sometimes have a problem with money for food in the girl and boy groups respectively. The majority of the respondents in the girl group (50%) purchased food once a week and 21 percent every day while the boy respondents indicated 50.5 percent bought food daily and 30.3 percent once a week. The supermarket is the place of choice for purchasing food (98% girls and 99% boys) due to easy accessibility. Fifty-seven percent in the girl group and 82.8 percent of the boy group spent more than R500 per week on food. Twenty percent of the girl group spent between R251-R500 per week on food.

Table 4.7: Food Security

Variables		
Not enough money to purchase food	**Girls (n=100) %**	**Boys (n=99) %**
Always	1.0	2.0
Often	2.0	3.0
Sometimes	10.0	7.1
Seldom	9.0	16.2
Never	**78.0**	**71.7**
Frequency to purchase food for daily consumption		
Everyday	21.0	**50.5**
Once a week	**50.0**	30.3
Once a month	24.0	13.1
Other: not any of above mentioned	5.0	6.1
Where food is purchased most often		
Supermarket	**98.0**	**99.0**
Wholesaler	2.0	1.0
Amount of money spent on food per week		
R0-R50	1.0	0.0
R51-R100	1.0	1.0
R101-R150	1.0	0.0
R151-R200	3.0	0.0
R201-R250	7.0	2.0
R251-R500	20.0	2.0
>>R500	**57.0**	**82.8**
Do not know	10.0	12.2

4.2.1.3 Education and Language

The results presented in Table 4.8 indicate that 56 percent and 34.3 percent of the caregivers were in possession of a Post-school qualification, namely university, and 20 percent and 37.4 percent had had College or FET training for the girl and boy caregivers respectively. The language of choice is English with 66 percent of the girls and 63 percent of the boys who spoke English, followed by Xhosa (30%) among the girls and 27.3 percent for Afrikaans among the boy respondents of the sample population.

Table 4.8: Level of Education and Language

Variables		
Level of Education of caregivers/guardian interviewed	**Girls (n=100) %**	**Boys (n=99) %**
Standard 8	1.0	5.0
Standard 10	23.0	23.3
College/FET	20.0	**37.4**
Other Post School not mentioned above	**56.0**	34.3
Home Language		
Xhosa	30.0	8.1
English	**66.0**	**62.6**
Afrikaans	3.0	27.3
Malayalam	1.0	1.0
Hindi	0.0	1.0

4.2.1.4 Food Preparation and Procurement

The results in Table 4.9 indicate the strong role mothers play in the family. A large number of the respondents were responsible for food preparation (80% girls and 86.9% boys), and for the decision on the type of food purchased (83% girls and 87.9% boys). The decision on the amount of money spent on food rested with the mothers for the girls group (65%) and with the fathers in the boy group (82.8%).

Table 4.9: Food Preparation and Procurement

Variables		
Responsible for food preparation in the household	**Girls (n=100) %**	**Boys (n=99) %**
Father	9.0	9.1
Mother	**80.0**	**86.9**
Grandma	2.0	2.0
Aunt	3.0	2.0
Domestic Help	6.0	0.0
Who decided the type of food purchased in household		
Father	14.0	9.1
Mother	**83.0**	**87.9**
Grandma	1.0	1.0
Aunt	2.0	1.0
Uncle	0.0	1.0
Who decides on the money spent on food		
Father	32.0	**82.8**
Mother	**65.0**	14.2
Grandma	1.0	1.0
Aunt	2.0	1.0
Uncle	0.0	1.0

According to Table 4.10, the majority of the caregivers of the households consumed three meals per day (44% and 63.6% for the girls and boys respectively) and most of the meals were consumed at home by 87 percent and 98.9 percent respectively. The children consumed most of the daily meals at home (93% and 92.9%).

Table 4.10: Meals Consumed

Variables		
Number of meals consumed by caregiver per day	**Girls (n=100) %**	**Boys (n=99) %**
1	7.0	10.1
2	37.0	17.2
3	**44.0**	**63.6**
>3	12.0	9.1
Place of consumption of caregiver meals		
Home	**87.0**	**98.9**
Work	13.0	1.01
Place of consumption of children's meals		
Home	**93.0**	**92.9**
School	7.0	7.1

Table 4.11 indicates that in the respective girl and boy groups 90 percent and 98.9 percent of the respondents own an electric stove, 88 percent and 93.9 percent a microwave, 94 percent and 83.8 percent a radio, 99 percent and 97 percent a television, 100 percent and 97 percent a refrigerator, 79 percent and 85.9 percent a freezer, 100 percent and 98 percent a bed base and mattress, 100 percent and 95.9 percent a lounge suite, 88 percent and 82.8 percent a dining room suite, 100 percent and 98 percent an electric iron and 100 percent and 97 percent own an electric kettle.

Table 4.11: Household Assets

Variables		
	Girls (n=100) %	**Boys (n=99) %**
Electrical Stove	90.0	89.9
Gas Stove	39.0	100.0
Microwave	88.0	93.9
Primus or Paraffin stove	4.0	0.0
Hotplate	23.0	100.0
Radio	94.0	83.8
Television	99.0	97.0
Refrigerator	100.0	97.0
Freezer	79.0	85.9
Bed Base with Mattress	100.0	98.0.
Mattress only	3.0	100.0
Lounge Suite	100.0	95.9
Dining Room Suite	88.0	82.8
Electrical Iron	100.0	98.0
Electrical Kettle	100.0	97.0

The results in Table 4.12 report that 86 percent and 84.8 percent of the respondents use electricity and 10 percent and 14.1 percent use gas for fuel in the respective girls and boy groups. The most popular material for cookware is stainless steel (73% and 59.6%) among the two groups respectively.

Table 4.12: Fuel and pots used to cook food

Variables		
Main type of fuel used for food preparation	**Girls (n=100) %**	**Boys (n=99) %**
Electricity	**86.0**	**84.8**
Gas	10.0	14.2
Wood	3.0	1.0
Paraffin	1.0	0.0
Type of material used to cook food		
Cast iron	18.0	21.2
Aluminium	9.0	19.2
Stainless steel	**73.0**	**59.6**

4.2.2 Anthropometric and Dietary Indicators

4.2.2.1 Anthropometric Data

Anthropometric data is about measuring the height and the weight of a child and is used to indicate malnutrition. The results in Table 4.13 indicate that 100 percent of the boys and 97 percent of the girls were normal height-for-age (≥-2 to <+3SD). However, among the girls, two percent were severely stunted (>-3SD). Overall, the group maintained a normal height-for-age. The BMI-for-age scores for the boys indicated that 29.6 percent (n=29) of the boys and 24 percent (n=24) of the girls were at risk of overweight (>+1SD) followed by 16.4 percent (n=18) of the boys and 19 percent (n=19) of the girls who were in the over-weight category with only two boys and one girl being obese (>+3SD), according to the WHO Anthropometric classification data for children (WHO 2008).

Table 4.13: Anthropometric data of the girls and boys

Growth indicators	Classification	Girls =100%	Boys =100%
	Stunting (Height-for-age)		
< -3SD	Severely Stunted	2	0
< - 2SD	Stunted	1	0
≥ -2 < +3SD	Normal height-for-age	97	100
	Wasting/Thinness (BMI-for-age)		
< -3SD	Severely wasted	0	0
< -2SD	Wasted	2	2
≥ -2SD and <+1SD	Normal BMI-for-age	54	50
> +1SD	Risk of overweight	24	29.6
> +2SD	Overweight	19	16.4
>+3SD	Obese	1	2

Figure 4.1 illustrates the BMI–for-age for the girls; the red line indicates that the curve is shifted to the right meaning the group of girls is leaning towards overweight compared to the WHO (green line) indicator (20%) (Mean: 2.4, -±1.97).

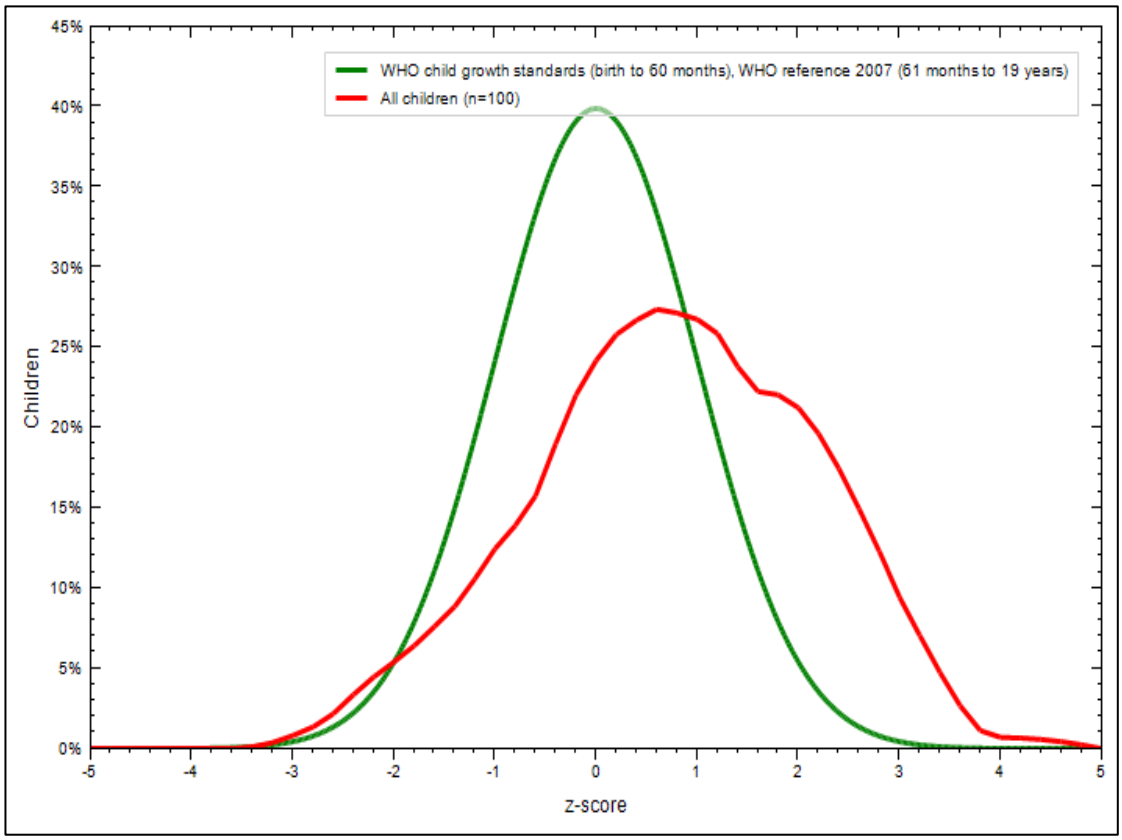

Figure 4.1: BMI-for-age WHO child growth standards (n=100), girls.

The BMI-for-age for the boys is indicated by the red line in Figure 4.2. This indicates that 30 percent of the boys are leaning towards overweight with a mean of SD 2.1, compared to the WHO growth standard curve in green (Mean: 2.1, -±0.77).

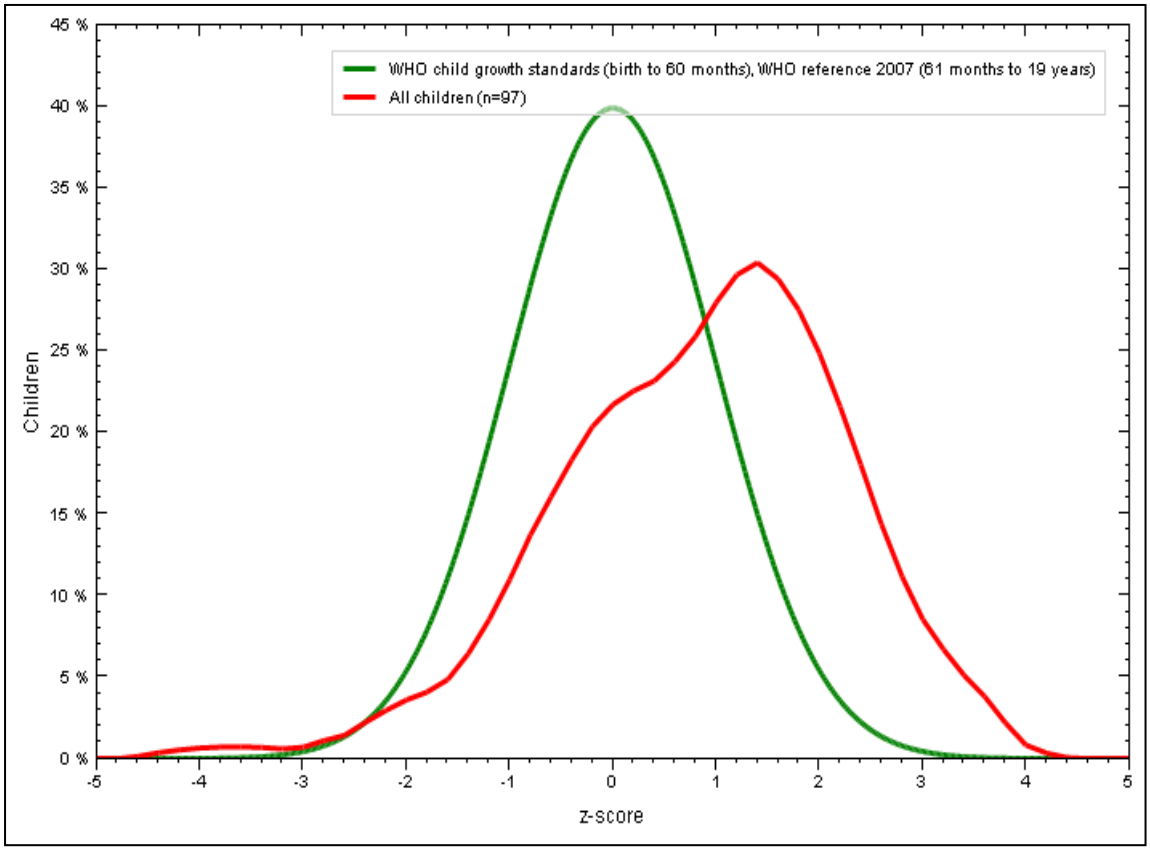

Figure 4.2: BMI-for-age WHO child growth standards (n=99), boys.

4.2.2.2 Dietary Intake Nutrient Analysis and Top 20 Food Items

In Table 4.14 the mean and median (for nutrients with large SD) of three 24-Hour Recalls nutrient analysis, indicate that 91 percent of the girls and 75.8 percent of the boys did not meet the recommended EER/DRI of 8698 (median 6725) for the girls and 9572 for the boys (median 7897). The mean EER for energy for girls, 6643kJ (median 6725), and boys, 8086kJ (median 7897), is below the recommended DRI/EER of 8698kJ and 9572kJ respectively.

Protein intake indicates 97 percent of the girls and 98 percent of the boys consumed >100 percent of the RDA for protein. The mean intake of carbohydrates for the girls is 200.6g (SD±56.3) and the boys 229.5g (SD±82.9), this being higher than the recommended EAR of 100g per day for girls and boys. Only 3 percent (n=3) of the girls consumed <100 percent of

the EAR compared to 2.0 percent (n=97) of the boys consuming <100 percent of the EAR. The intake of dietary fibre by both the girls (15.5g) and boys (18.1g) was deficient as the AI for the age groups is recommended at 26g and 31g respectively.

Table 4.14: Dietary Intake Nutrient Analysis measured using the average of three 24-Hour Recall Questionnaires (IoM 2006).

Nutrients p/day	Girls (n=100) Mean ± SD	% Girls <100 of DRI	Boys (n=99) Mean ± SD	% Boys <100 of DRI	Dietary reference intakes
Energy (kJ)*	6 643±1 628.92 (Median 6 725)	91	8 086±3 350.78 (Median 7 897)	77	♀8 698EER ♂9 572EER
Carbohydrate (g)	200.6±56.3	3	229.5±82.9	2	♀♂100gEAR
Total Protein * (g)	55.5±15.7	3	73.4±25.6	0	♀♂34gRDA
Total Dietary Fibre* (g)	15.5±5.8	96	18.1±5.3	93	♀26gAI ♂31gAI
Calcium (mg)_*	563.2±227.6 (Median 522.9)	100	667.9±206.2 (Median 622.5)	95	♀1300AI ♂1300AI
Iron (mg) *	9.4±3.1	8	11.3±3.3	7	♀5.7EAR ♂5.9EAR
Magnesium (mg)	199.6±61.9	57	235.8±90.2	36	♀♂200EAR
Phosphorus (mg)	877.7±259.4 (Median 848.8)	82	1091.5±430.0 (Median 1067.6)	47	♀♂1055 EAR
Zinc (mg) *	7.2±2.2	51	9.6±3.7	28	♀♂7.0 EAR
Selenium (mcg)	35.8±15.4	51	50.57±15.79	24	♀♂ 35 EAR
Vitamin A RE (µg)	669.3±451.0 (Median 135.4)	31	711.1±158.2 (Median 605.3)	31	♀ 420 EAR ♂ 445 EAR
Thiamin (mg)	1.1±0.3	12	1.2±0.3	6	♀♂ 0.7 EAR
Riboflavin (mg)	1.5±0.6	8	1.8±0.4	7	♀♂ 0.8 EAR
Niacin (mg)	16.1±4.7	4	19.4±3.8	4	♀ ♂9.0 EAR
Vitamin B6 (mg)	1.2±0.4	22	1.4±0.3	10	♀ ♂0.8 EAR
Folate (mcg)	133.6±46.7	99	232.4±76.0	61	♀ ♂250 EAR
Vitamin B12 (mcg/day)	2.8±1.4	10	3.7±0.8	5	♀♂ 1.5 EAR
Pantothenate (mg)	4.4±2.3	43	5.6±1.2	39	♀♂4.0AI
Biotin (mcg)	21.6±8.1	43	25.8±8.2	20	♀♂20AI
Vitamin C (mg) *	92.7±84.9 (Median 65.7)	28	63.1±3.1 (Median 43.9)	57	♀♂39 EAR
Vitamin D (mcg)	2.5±1.6	91	3.3±0.4	83	♀♂5AI
Vitamin E (mg)	7.1±3.9	73	9.8±1.9	50	♀♂9 EAR

♀ Girls ♂ Boys

[a] PAL= Physical Activity Level

* Statistical significant difference at $p>0.05$

EER (Estimated Energy Requirements) Active PAL[a] EER for healthy moderately active children 9-13 years
AI (Adequate Intake) used where EAR (Estimated Average Requirement) not available
RDA (Recommended Dietary Allowance)

The mean of the three 24-Hour Recalls presented in Table 4.14 indicates the deficiencies of both macro and micronutrients, including total energy as well as calcium, dietary fibre,

magnesium, phosphorous, thiamine, riboflavin, niacin, Vitamin B6, folate, Vitamin B12, biotin, Vitamin C, Vitamin E and Vitamin A. The majority of the respondents did not meet the AI for dietary fibre (26g and 31g) with a mean intake of 15.5 and 18.1 for the girls and boys respectively. The results also indicated that 100 percent and 95 percent of the respondents did not meet the AI for calcium (1300mg). The mean intake for calcium was 563.2mg with a median of 522.9 for the girls and 667.9mg with a median of 622.5 for boys. Iron intake seems to be adequate, but 8 percent and 7.1 percent of the two groups did not meet the EAR of 5.7mg and 5.9mg.

More than 50 percent of the girls did not meet the EAR for the following nutrients: magnesium (57%) 199.6mg (SD±61.9), zinc (51%) with 7.2mg (SD±2.2), selenium (51%) with 35.8mcg (SD±15.5), folate (99%) with 133.6mcg (SD±46.7), vitamin D (91%) with 2.5mcg (SD±1.6), and vitamin E (73%) with 7.1mg (SD±3.9). The median for Vitamin C was 65.7mg and 43.9mg for the girls and boys respectively. A similar difference in the median for Vitamin A with 135.4 and 605.3 for girls and boys highlights the deficiency of this nutrient.

A similar trend was observed for the boys with low levels of zinc (28.3%) with 9.6mg (±3.7), folate (61.6%) with 232.4mcg (±76.0), vitamin C (42.4%) with 63.1mg (±3.1), vitamin D (83.8%) with 3.3mcg (±0.4), vitamin E (50.5%) with 9.8mg (±1.9), as indicated in Table 4.14. The nutrient that had an overall mean nutrient adequacy ratio of 100 percent for the girls was calcium while the boys had no 100 percent adequacy ratio in any nutrient, with only 5 percent of the respondents for calcium at 667.4mg (±206.2), 93.9 percent for iron at 11.3mg (±3.3) and achieving 100 percent of the DRI. The medians for calcium of 522.9mg and 622.5mg for girls and boys respectively, indicates the low consumption of the mineral.

The boys had a higher average daily nutrient intake at a statistically significant level of p=0.05 for mean energy, total protein, total fat, dietary fibre, calcium, iron, magnesium, phosphorous and zinc. The girls reflected a significantly higher vitamin C intake (p=0.04) than the boys. The vitamin A intake between the groups was not significant (p=0.57), as indicated in Table 4.14.

Table 4.15: Contribution of the lunchbox to the daily intake of girls (n=100) compared to the 1 day (Tuesday) 24-Hour Recall.

Nutrient/day		DRIs	Lunch box mean intake ±SD	% Lunch box contribution to daily intake (24-Hour-Recall
Energy (kJ)	EER	8 698	2 820.0±1 219.1	44.4
Total Protein (g)	RDA	34	19.2±8.8	63.1
Carbohydrates available (g)	EAR	100	82.3±40.9	44
Total dietary fibre (g) *	AI	26	8.1±3.9	70.7
Calcium (mg)	AI	1 300	185.6±152.9	33.9
Iron (mg)	EAR	5.7	2.9±1.5	32.0
Magnesium	EAR	200	93.5±52.9	54.6
Phosphorous (mg)	EAR	1 055	323.8±157.1	38.8
Zinc (mg)	EAR	7	2.8±1.5	41.4
Vitamin A RE (µg)	EAR	420	172.1±340.2	30.0
Thiamine (mg)	EAR	0.7	0.4±0.3	43.8
Riboflavin (mg)	EAR	0.8	0.4±0.1.5	26.1
Niacin (mg)	EAR	9	5.0±3.2	33.1
Vitamin B6 (mg)	EAR	0.8	0.3±0.3	29.2
Folate (mcg)	EAR	250	88.1±61.6	42.2
Vitamin B12 (mg)	EAR	1.5	0.6±0.7	20.5
Vitamin C (mg) *	EAR	39	46.3±77.2	54.4
Vitamin D (mcg)	AI	5	0.8±1.3	28.1
Vitamin E (mg)	EAR	9	4.1±4.0	56.7

* Statistically significantly higher intake in the girls for the lunch box at $p>0.04$

The nutritional contribution made by the one day lunch box is reflected in Table 4.15 (girls) and 4.16 (boys). A balanced lunch box should provide no more than 1/3 of the daily nutritional requirements (Jeffrey *et al.* 2007). The girls' lunch boxes contributed 44.4 percent and for the boys 36.2 percent of the daily energy intake and this is above the 1/3 recommended level. A lunch box can include extra food for after school as many pupils do not return home at the end of the school day, due to high physical activity during the day and after school when sport activities take place. Carbohydrates are at 44 percent and 38.1 percent respectively for girls and boys. A sandwich are the popular choice for the lunch box and, in addition, fruit such as apples, is popular and supplies carbohydrates. The girls' lunch boxes recorded a higher fibre content (70.0%) compared to the boys (33%). Nutrients that contributed more than 50 percent to the daily intake for the girls were magnesium (54.6%), vitamin E (56.7%), and vitamin C (54.4%).

Although the girls displayed a higher mean lunch box intake for total dietary fibre, iron, magnesium, phosphorous, zinc, folate, Thiamine, Niacin, B6, vitamin A and vitamin C, only total dietary fibre (p=0.00) and vitamin C (p=0.04) were statistically significantly higher than the boys. The boys had a higher average daily nutrient intake for mean energy, carbohydrates and calcium, but none were statistically significantly higher than the girls, as indicated in Table 4.15 and Table 4.16.

Table 4.16: Contribution of the lunch box to the daily intake of boys (N=99) compare to the 1 day (Tuesday) 24-Hour Recall

Nutrient/day		DRIs	Lunch box mean intake ±SD	% Lunch box contribution to daily intake (24- Hour-Recall
Energy (kJ)	EER	9572	2 982.7±1521.1	36.2
Total Protein (g)	RDA	34	19.1±13.7	26.0
Carbohydrates available (g)	EAR	100	91.9±47.9	38.1
Total dietary fibre (g)*	AI	31	6.6±3.7	33.0
Calcium (mg)	AI	1300	206.8±232.0	27.9
Iron (mg)	EAR	5.9	2.7±1.5	23.3
Magnesium mg	EAR	200	70.0±40.6	28.2
Phosphorous (mg)	EAR	1055	292.4±205.0	26.8
Zinc (mg)	EAR	7.0	2.6±2.2	26.9
Vitamin A RE (µg)	EAR	445	117.7±102.9	17.5
Thiamine (mg)	EAR	0.7	0.3±0.2	22.6
Riboflavin (mg)	EAR	0.8	0.5±0.8	29.1
Niacin (mg)	EAR	9	4.3±3.3	23.6
Vitamin B6 (mg)	EAR	0.8	0.3±0.2	21.5
Folate (mcg)	EAR	250	77.5±48.4	32.0
Vitamin B12 (mg)	EAR	1.5	0.5±0.8	13.4
Vitamin C (mg) *	EAR	39	27.9±50.7	47.3
Vitamin D (mcg)	AI	5	0.6±0.7	18.6
Vitamin E (mg)	EAR	9	3.6±2.7	40.7

*Statistically significantly higher intake in the girls compared to the boys for the lunch box at p>0.05

In Table 4.17 (girls) and Table 4.18 (boys) the daily food intake is ranked from the highest to the lowest to present the top 20 items consumed.

Table 4.17: Top 20 food items ranked by the mean intake portion size by the number of respondents as measured by three consecutive 24-Hour Recalls (n=100)-Girls.

3 – 24-Hour Food Recall = 72-Hour Food Recall						
Rank	Food Item	Reported frequency over 3 days	Mean (g) intake over 3 days	Total Intake (g) over 3 days	Per Capita intake (g) per individual over 3 days	Per Capita Intake (g) per individual for 1 day
1	Bread/Rolls, All	373	7446.7	22340	223.4	74.5
2	Milk	300	11793.3	35380	353.8	117.9
3	Sugar	231	800.0	2400	24	8.0
4	Margarine	162	465.7	1397	14	4.7
5	Cold Drink, Squash	158	14275.0	42825	428.3	142.8
6	Cheese	150	1383.3	4150	41.5	13.8
7	Apple	114	5577.0	16731	167.3	55.8
8	Rice	94	3511.7	10535	105.4	35.1
9	Butter	92	279.3	838	8.4	2.8
10	Cold Drink, Carbonated, e.g. Cola, Cream Soda, Tonic	84	7606.7	22820	228.2	76.1
11	Chicken, Meat and Skin, Frozen, Roasted	67	1245.7	3737	37.4	12.5
12	Tea	61	5009.3	15028	150.3	50.1
13	Sauce, Tomato	57	301.0	903	9.0	3.0
14	Chicken, White Meat, Frozen, cooked, moist	54	1223.3	3670	36.7	12.2
15	Yoghurt, Fruit, Low Fat, Sweetened	50	1742.7	5228	52.3	17.4
16	Coffee	47	3740.0	11220	112.2	37.4
17	Breakfast Cereal – Corn Flakes	45	665.0	1995	20.0	6.7
18	Carrots	44	1205.3	3616	36.2	12.1
19	Peanut Butter; Smooth Style	44	310.7	932	9.3	3.1
20	Snack, Savoury, eg. Niknaks, Fritos, Ghost Pops	44	416.3	1249	12.5	4.2

Tables 4.17 and 4.18 indicate the top twenty most popular food items and the average daily intake of the sample population who consumed these foods on two weekdays and one weekend day included in the 24-Hour Recall. The top five food items frequently consumed

over 3 days included bread/rolls (373 times) with a per capita intake of 223.4g for the girls and 399 times with a per capita intake of 280.2g for the boys indicating that the respondents consumed bread more than twice a day followed by milk which ranked second with a per capita intake of 353.8g (frequency 300) and 553.5g (frequency 361) for girls and boys respectively followed by milk, ranking second, with a mean intake of 11793.3g (frequency 300) for the girls and 54792g (frequency 361) for the boys.

Sugar ranked number 3 with the girls with 24g per capita (frequency 231) and number 4 with the boys with 21.7g (frequency 235) over the three days. Rice is also popular, ranking at number 8 and 9 (105.4g and 120.7g per capita intake) over 3 days for the two groups. Other sources of carbohydrates included apples, carrots and savoury snacks.

Protein appeared for the first time at number 6 for both groups in the form of cheese, 41.5g and 41.2g with a frequency of 150 and 128 times over the 3 days for girls and boys. Roast chicken appear at number 11 (37.4g) and 10 (45.6g) for the girls and boys and moist chicken appeared only in the top-20 food list of the girls at number 14 (36.7g) with a frequency of 54.

Fruit yoghurt was ranked 15^{th} (52.3g) and 14^{th} (63.2g) amongst the girls and boys with a frequency of 50 and 54 respectively. The only fresh vegetables featured were carrots with a frequency of 44 (36.2g) among the girls and no vegetables were indicated for the boys. Portion sizes were inadequate as apples were 55.8g and 46.1g and were the only fruit appearing in the top 20 for the 3 - 24-Hour Recalls for both groups ranking at number 7 and 8 respectively. Consumption was far below the recommended daily allowance by the World Health Organisation of ≥400g, or five or more portions, of fruit and vegetables a day (WHO, 2010).

Carbonated drinks ranked at number 7 and 10 with a frequency of 84 and 104 respectively. The per capita intake per individual over 3 days was 228.2g for girls and 304.5g for boys which equals to approximately a glass of cool drink. Savoury snacks appeared at number 20 (44 frequency) for the girls and 15 (51 frequency) for the boys. These snacks contained high amounts of salt and fat.

Table 4.18: Top 20 food items ranked by the mean intake portion size by the number of respondents as measured by three consecutive 24-Hour Recalls (n=100) Boys.

3 – 24-Hour Food Recall = 72-Hour Food Recall						
Rank	Food Item	Reported frequency over 3 days	Mean (g) intake over 3 days	Total Intake (g) over 3 days	Per Capita intake (g) per individual over 3 days	Per Capita Intake (g) per individual for 1 day
1	Bread/rolls, all	399	9245.0	27735	280.2	93.4
2	Milk	361	9245.0	54792	553.5	184.5
3	Margarine	238	18264.0	2360	23.8	8.0
4	Sugar	235	786.7	2149	21.7	7.2
5	Cold Drink, Squash, Diluted	146	716.3	41950	423.7	141.3
6	Cheese, All	128	13983.3	4082	41.2	13.7
7	Cold Drink, Carbonated,	104	10048.3	30145	304.5	101.5
8	Apple	92	4564.7	13694	138.3	46.1
9	Rice	89	3984.3	11953	120.7	40.3
10	Chicken, Meat and Skin, Frozen, Roasted	68	1504.0	4512	45.6	15.2
11	Peanut Butter; smooth style	65	533.3	1600	16.2	5.4
12	Tea, Brewed	59	4880.0	14640	147.9	49.3
13	Coffee, instant	54	4226.7	12680	128.1	42.7
14	Yoghurt, Fruit, Low Fat, Sweetened	54	607.0	6260	63.2	21.1
15	Snack, Savoury, Average, e.g. Niknaks, Fritos and Ghost Pops	51	371.7	1821	18.4	6.1
16	Mayonnaise	47	371.7	1115	11.3	3.8
17	Ham, Sliced/Canned, Regular	46	460.0	1380	14	4.7
18	Breakfast Cereal – Weet-Bix	41	862.7	2588	26.1	8.7
19	Vienna Sausage, Beef & Pork, canned	41	795.0	2385	24.1	8.0
20	Breakfast Cereal-Corn Flakes Plain	39	510.0	1530	15.6	5.2

The lunch boxes were collected without prior notification to make sure they contained the regular foods and had not changed in any way because of the data collection. Tables 4.19

and 4.20 reflect the top 20 food items ranked by mean intake and portion size by the number of respondents, as measured in one lunch box.

Table 4.19: Top 20 food items ranked by the total intake portion size by the number of respondents as measured by one lunch box (n=100) Girls.

Lunch Box Top 20 Food items						
Rank	Food Item	Reported Total Intake	Mean (g) intake	Reported Frequency	Total Per capita intake (g) for 3 days	Total Per Capita intake (g) for 1 day
1	Bread/rolls	8424	2808.0	86	84.2	28.08
2	Margarine	818	272.7	69	8.2	2.73
3	Apple	3797	1265.7	36	38.0	12.66
4	Cheese	720	240.0	24	7.2	2.40
5	Yoghurt, Fruit, Low Fat, Sweetened	2000	666.7	20	20.0	6.67
6	Naartjie/Tangerine	2162	720.7	18	21.6	7.21
7	Peanut Butter	326	108.7	16	3.3	1.09
8	Crackers	428	142.7	13	4.3	1.43
9	Ham Sliced	256	85.3	12	2.6	0.85
10	Mayonnaise	162	54.0	10	1.6	0.54
11	Sauce Tomato	122.5	40.8	9	1.2	0.41
12	Banana	836	4278.7	8	8.4	2.79
13	Cold Drink, Squash, Diluted	3375	1125.0	8	33.8	11.25
14	Health Bar, Energy (e.g. Snacker, Gilly, Noogy)	236	78.7	8	2.4	0.79
15	Marmite, yeast Extract	40	13.3	8	0.4	0.13
16	Snack, Savoury eg. Niknaks, Fritos, Ghost Pops	225	75.0	8	2.6	0.75
17	Jam/Marmalade	72.5	24.1	6	0.7	0.24
18	Strawberry	339	113.0	6	3.4	1.13
19	Apple juice, Liquifruit/Ceres	1100	366.7	5	11.0	3.67
20	Fruit Roll, Dried, Mixed	138	46.0	5	1.4	0.46

Bread, in other words, the sandwich, is the most popular form of carbohydrate in the lunch box, both for girls and boys. Bread was consumed eighty-six times by the girls and boys with a mean of (2808.0g and 2261.7g) and ranked at number 1. Margarine ranked 2nd and 3rd in both groups with a frequency of 69 (mean 272.7g) and 60 (mean 219.0g) for the girls and

boys respectively. The mean intake of fruit appearing in the girls' lunch boxes was ranked at number 3 (apples) (1265.7g), number 6 (naartjies) (720.7g) and number 12 (bananas) (4278.7g), while for the boys, apples appeared at number 3 (1519.7g) with fruit juice at number 18 (483.3g). The girls consumed 3 different fruits with a frequency of 36, 18 and 8 respectively and the boys only consumed 2 different fruits (31 and 7 times), indicating low consumption of fruit with no vegetables appearing in the lunch boxes. Cheese was at number 4 for both groups and was consumed 24 times, with a mean of 240.0g for the girls and 23 times with a mean 233.3g for the boys, either as a filling for the sandwich, or as a protein on its own. Peanut butter had a frequency of 16 with a mean of 108.7g for the girls and 17 times with a mean of 116.7g for the boys as a filling for the sandwich.

Table 4.20: Top 20 food items ranked by the total intake portion size by the number of respondents as measured by one lunch box (n=99)- Boys

Lunch Box Top 20 Food items						
Rank	Food Item	Reported Total Intake	Mean (g) intake	Reported Frequency	Total Per capita intake (g) for 3 days	Total Per Capita intake (g) for 1 day
1	Bread/rolls	6785	2261.7	86	68.54	22.9
2	Margarine	657	219.0	60	6.64	2.2
3	Apple	4559	1519.7	31	46.05	13.4
4	Cheese	700	233.3	23	7.07	2.4
5	Cold Drink, Squash, Diluted	8000	2666.7	20	80.81	26.9
6	Vienna Sausage	839	279.7	19	8.47	2.8
7	Peanut Butter	350	116.7	17	3.54	1.2
8	Snack, Savour, e.g. Niknaks, Fritos, Ghost Pops	382	127.3	13	3.86	1.3
9	Yoghurt, Fruit, Low Fat, Sweetened	1300	433.3	13	13.13	4.4
10	Jam/Marmalade	155	51.7	11	1.57	0.5
11	Crackers, Refined, High Fat e.g. Tuc, Bacon Kips	318	106.0	10	3.21	1.1
12	Ham sliced	320	106.7	10	3.23	1.1
13	Sauce, Tomato	140	46.7	10	1.41	0.5
14	Sweets, Hard Boiled and Soft Jelly Type	373	124.3	9	3.77	1.3
15	Biltong, Beef	170	56.7	8	1.72	0.6
16	Cookies, Plain, Commercial	516	172.0	8	5.21	1.7
17	Mayonnaise	210	70.0	8	2.12	0.7
18	Fruit Juice 100%	1450	483.3	7	14.65	4.9
19	Cold Drink, Carbonated (e.g. Cola, Cream Soda, Tonic	1910	636.7	6	19.29	6.4
20	Energade	3500	1166.7	6	35.35	11.8

Health bars had a frequency of 8 (78.7g) among girls only and crackers, refined and high fat, had a frequency of 13 (142.7g) and 10 (106.0g) within the respective groups.

Table 4.21: Percentage of energy distribution of macronutrients from the average of three 24-Hour Recalls and lunch boxes (WHO 2010).

Dietary Factor	WHO Goal % of total energy	24-Hour Recall % contribution to total energy Girls n=100	24-Hour Recall % contribution to total energy Boys n=99	Lunch Box % contribution to total daily energy intake - Girls n=100	Lunch Box % contribution to total daily energy intake - Boys n=99
Total fat	15-30%	30.6	32.6*	14.4	12.2
Total carbohydrates + fibre	55-75%	55.3	52.1	23.2	20.7
Protein	10-15%	14.2	15.4	4.9	4.0
	Recom-mended intake	24-Hour Recall Girls intake g/day	24-Hour recall Boys intake g/day	Lunch Box Girls intake g/day	Lunch Box Boys intake g/day
Fruit and Vegetables g/day per capita intake (WHO 2010)	≥400	215.1	216.9	95.8	81.4
Dietary fibre g/day (AI)	Boys >31 Girls>26	15.5	18.1	8.1	6.6

* Statistically significant between the boys and the girls p=0.01 daily fat intake

In Table 4.21, the results of the energy distribution of the macronutrients from the 24-Hour Recalls, according to the World Health Organization dietary factor goals (2003), indicates that the total carbohydrate intake for both girls and boys is within the range of 55-75 percent. Total protein intake was within the range of 10-15 percent, with a slightly higher result (15.4%) for the boys than the girls (14.2%). The total percentage fat intake for the boys (32.6%) was above the recommended level of 15-30 percent by the World Health Organization (WHO 2010). The daily low intake of fruit and vegetables is reflected in the amount consumed, this being 215.1g and 216.9g for girls and boys, which is far below the recommended daily allowance of ≥400g, or five or more portions of fruit and vegetables a day (WHO 2010). The total intake of fibre was far below the recommended 26g/day for girls and 31g/day for boys, according to the World Health Organization dietary factors goals (2010), with girls only consuming 15.5g/day and boys 18.1g/day for the 24-Hour Recall. The

fibre contribution in the lunch boxes was 8.14 percent for the girls and 6.57 percent for the boys.

The fat contribution in the lunch boxes provided a total daily energy intake of 14.4 percent and 12.9 percent respectively. Furthermore, the lunch boxes contributed 54.5 and 56.1 percent to the daily energy intake from carbohydrates and 11.6 and 10.9 percent from protein for the girls and boys respectively.

Table 4.22: Percentage of energy distribution of macronutrients in the lunch boxes for the girls and boys (WHO 2010).

Nutrient	WHO Goal % of total energy	% Energy contribution % Girls	% Energy contribution Boys
Total Fat	15-30%	33.9	33.0
Total carbohydrates + fibre	55-75%	54.5	56.1
Total Protein	10-15%	11.6	10.9

Table 4.22 indicates the fat contribution to energy intake in the lunch boxes at 33.9 percent and 33.0 percent for the girls and boys respectively, higher than the WHO guidelines. Carbohydrates make up a large percentage of the energy intake (54.5% and 56.1%) and can be attributed to the sandwiches, fruit and fruit juices included in lunch boxes. The boy's lunch boxes are supplying more than a third of the daily energy intake while those of the girls are below the one-third level. The high fat content reflected in the lunch box analysis is because of the consumption of high fat content food brought from home. Protein contributed a mere 11.6 percent and 10.9 percent of energy to the lunch box content. However, the total energy contribution of the girls' (2820kJ) and boys' (2982.7kJ) lunch boxes is below the one-third of the recommended daily intake (2899kJ and 3190.6kJ) respectively of the total daily EER.

4.2.2.3 Food Variety Score, Dietary Diversity Score and Nutrient Adequacy

The nine nutritious food groups with a count of the single foods within the groups were reported in the food variety score summarised in Table 4.23 for the girls and Table 4.24 for

the boys. However, the total range of individual food items consumed by an individual during the seven-day data collection period was between 11 different foods with a maximum of 66 different foods (43%) for the girls and between 10 different foods with a maximum of 53 different foods (27.3%) for the boys.

The food groups with the most variety were the vegetables and fruit groups with 11 different and 15 different food items for the girls and 10 different and 12 different food items for the boys respectively, as shown in Table 4.23 and Table 4.24. Five different vegetables and four different fruits were consumed by a small number of boy respondents (21.21%, n=21). It is important to note that 39.4 percent (n=39) boys consumed between 0-3 different vegetables and 0-3 different fruits (52.5%, n= 52) in the 7 days. Two girls (5.1%) had no vitamin rich fruit and vegetables and five boys (5.1%) had only one vegetable. Eleven boys had only one fruit while 11 (11.1%) did not consume any vitamin A rich foods within the 7 day period. Three different vegetables (0-3) were consumed by 17 percent, three different fruits (0-3) by 25 percent and 0-2 different vitamin A rich foods by 28 percent of the girl respondents.

Cereals, roots and tubers were also consumed by 30.3 percent and 27 percent for the boys and girls respectively. A food variety score of nine for the boys and girls was achieved for the cereal group. Six different foods were consumed by 30.3 percent of the boy respondents while 20.2 percent consumed 7 different foods. Among the girl respondents, only one had nine different foods, while 27 percent consumed five different foods, followed by 21 percent with six and 20 percent with seven different foods. In the egg diversity group, a large number of respondents, 81.8 percent boys and 87 percent girls, consumed eggs. The legumes and nuts group were consumed by 38.4 percent of the boys and 65 percent of the girls, while at least two dairy food products were consumed by 44.4 percent of the boys and 36 percent of the girls. The low consumption of dairy is reflected in the dietary analysis of the 24-hour recalls which indicated a very low calcium intake, far below the recommended DRI of 1300mg (refer to Table 4.14).

Table 4.23: Household food consumption as measured by the Food Variety Score over a period of seven days by the girls (n=100).

Cereal, Roots and Tubers diversity Group (n=9)	Legumes and nuts Group (n=3)	Flesh Foods (Meat, poultry, fish diversity Group (n=12)	Egg Diversity Group (n=1)	Dairy Products Diversity Group (n=7)	Other Vegetable Diversity Group (n=11)	Other Fruits (and juices) Diversity Group (n=15)	Vitamin A Rich Fruit and Vegetable Diversity Group (n=8)	Oils and Fat Diversity Group (n=7)	Total individual Items Eaten From all groups (n=66)
0= 0	0= 35	0= 2	0= 13	0= 0	0= 0	0= 3	0= 2	0= 2	0-10 = 0
1= 1	1= 40	1= 3	1= 87	1= 12	1= 2	1= 5	1= 7	1= 17	11-15= 4
2= 2	2= 15	2= 6		2= 36	2= 7	2= 6	2= 19	2= 23	16-19= 3
3= 9	3= 10	3= 14		3= 28	3= 8	3= 11	3= 31	3= 23	20-25= 11
4= 16		4= 19		4= 15	4= 11	4= 23	4= 19	4= 18	26-30= 19
5= 27		5= 21		5= 8	5= 19	5= 9	5= 14	5= 15	31-36= 43
6= 21		6= 22		6= 0	6= 15	6= 16	6= 3	6= 1	37-42= 10
7= 20		7= 7		7= 1	7= 15	7= 6	7= 2	7= 1	43-48= 5
8= 3		8= 4			8= 9	8= 6	8= 3		49-53= 3
9= 1		9= 1			9= 3	9= 5			54-66= 2
		10= 0			10= 6	10= 2			
		11= 0			11= 5	11= 3			
		12= 1				12= 4			
						13= 0			
						14= 0			
						15= 1			

Low food variety – 0-3 groups or < 30 individual foods
Medium food variety – 4-5 groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods (Matla 2008).

Table 4.24: Household food consumption as measured by the Food Variety Score over a period of seven days for the boys (n=99).

Cereal, Roots and Tubers diversity Group (n=9)	Legumes and nuts Group Group (n=5)	Flesh Foods (Meat, poultry, fish diversity Group Meat Group (n=10)	Egg Diversity Group (n=1)	Dairy Products Diversity Group (n=5)	Other Vegetable Diversity Group (n=10)	Other Fruits (and juices) Diversity Group (n=12)	Vitamin A Rich Fruit and Vegetable Group (n=5)	Oils and Fats Diversity Group (n=5)	Total individual Items Eaten From all groups (n=53)
0= 0	0= 61	0= 3	0= 18	0= 1	0= 2	0= 0	0= 11	0= 1	0-10 = 1
1= 1	1= 27	1= 3	1= 81	1= 8	1= 5	1= 11	1= 33	1= 9	11-15= 2
2= 8	2= 8	2= 3		2= 44	2= 2	2= 18	2= 33	2= 37	16-19= 13
3= 0	3= 1	3= 20		3= 30	3= 16	3= 20	3= 11	3= 39	20-25= 27
4= 13	4= 1	4= 22		4= 13	4= 11	4= 21	4=10	4= 11	26-30= 23
5= 21	5= 1	5= 23		5= 3	5= 21	5= 8	5= 1	5= 2	31-36= 22
6= 30		6= 11			6= 14	6= 10			37-42= 4
7= 20		7= 8			7= 9	7= 6			43-48= 4
8= 5		8= 3			8= 14	8= 2			49-53= 3
9= 1		9= 5			9= 3	9= 0			
		10= 1			10= 2	10= 2			
						11=0			
						12=1			

Low food variety – 0-3 groups or < 30 individual foods
Medium food variety – 4-5 groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods (Matla 2008).

The flesh foods group also featured strongly with a food variety score of 12 different foods for the girls and 10 for the boys. One boy respondent consumed 10 different foods and one girl consumed 12 different foods from the flesh foods. A large number of boy respondents

(23.3%, n=23) consumed 5 different foods from the meat group. Three (3.0%) boys and two of girls had no meat products within the seven-day period.

Five different types of fats were consumed by two boys (2.0%) and seven different fats by one girl respondent (1.0%). Three different fats were consumed by 39.3 percent (n=39) boys and 23 percent (n=23) girls consumed between 2-3 different fats. Only four boys and two girls (2%) did not consume any fat within the seven-day period (refer to Tables 4.25 and 4.26).

Table 4.25: Summary of Food Variety Score within the Food Groups - Girls (n=100).

Food Group	Mean	SD	Range of Scores
Cereals, Roots and Tubers	5.3	1.494	1-9
Legumes and Nuts	1.5	0.752	1-3
Flesh Foods	4.8	1.830	1-12
Eggs	1.0	0.000	0-1
Dairy Products	2.8	1.192	1-7
Vegetables Other	**5.9**	**2.451**	**1-11**
Fruit Other	**5.5**	**2.894**	**1-15**
Vitamin A Rich	3.5	1.555	1-8
Oils and Fats	3.0	1.414	1-7
Total Food Items	32.1	8.800	11-66

Low food variety – 0-3 groups or < 30 individual foods
Medium food variety – 4-5 groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods (Matla 2008).

A summary of the food variety within food groups is presented in Table 4.25 and Table 4.26, representative of girls and the boys, and the means of 32.1 (SD±8.800) and 27.7 (SD±8.117) respectively for all the food within the nine food groups in a period of seven days, indicates a medium and low Food Variety Score (FVS) respectively.

Table 4.26: Summary of Food Variety Score within the Food Groups – Boys (n=99).

Food Group	Mean	SD	Range of Scores
Cereals, Roots and Tubers	**5.6**	**1.430**	**1-9**
Legumes and Nuts	1.5	0.891	1-5
Flesh Foods	4.8	1.882	1-10
Eggs	1.0	0.000	0-1
Dairy Products	2.6	0.930	1-5
Vegetables Other	5.3	2.140	1-10
Fruit Other	3.9	2.164	1-12
Vitamin A Rich	2.0	1.034	1-5
Oils and Fats	2.6	0.883	1-5
Total Food Items	27.7	8.117	10-53

Low food variety – 0-3 groups or < 30 individual foods
Medium food variety – 4-5 groups or 30-60 individual foods
High food variety – 6-9 food groups or >60 individual foods (Matla 2008).

The other vegetable group reported the highest individual mean FVS (±SD) of 5.88 (±2.451) among the girls followed by the other fruit 5.51 (±2.894) and cereals, roots and tubers with a mean of 5.30 (±1.494). Among the boys, the cereal group reported the highest individual mean FVS (±SD) of 5.57 (±1.430), followed by other vegetables 5.28 (±2.140) and flesh foods with a mean of 4.78 (±1.882).

Table 4.27: Summary of Food Group Diversity (n=100) – Girls.

Number of Food Groups Consumed n=9	Frequency	Percentage
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	3	3.0
7	7	7.0
8	34	34.0
9	**56**	**56.0**
Total Food Items	100	100.0

In Tables 4.27 and 4.28 the food group diversity is summarised as the majority of the respondents, girls (100%, n=100) and boys (100%, n=99), could be classified with a high Food Group Diversity score, as 6-9 food groups were consumed during the 7 days by both the groups. Fifty-six of the girls and 28 of the boys in the sample consumed all nine nutritious food groups during the seven day data collection period.

Table 4.28: Summary of Food Group Diversity (n=99) – Boys.

Number of Food Groups Consumed n=9	Frequency	Percentage
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	5	**5.1**
7	13	13.1
8	**53**	**53.5**
9	28	28.3
Total Food Items	99	100.00

Figures 4.3 and 4.4 – Girls, illustrates the relationship between the food group diversity score (FGDS) and nutrient adequacy ratios (NARs) of energy, protein, selected minerals and vitamins. The NARs were calculated by working out the percentage of the average intake in relation with DRI. For all the nutrients, there was an increase in Nutrient Adequacy Ratio (NAR) as FGDS increased. For protein, iron and zinc, the NAR increased as the food group consumption increased from six to nine food groups. However, energy and calcium still remained below 100 percent, but showed a small increase of between six and seven food groups consumed, although this should be read with caution as only three girls and five boys respectively consumed from only three food groups – there is no real increase in the nutrients between the consumption of seven to nine food groups.

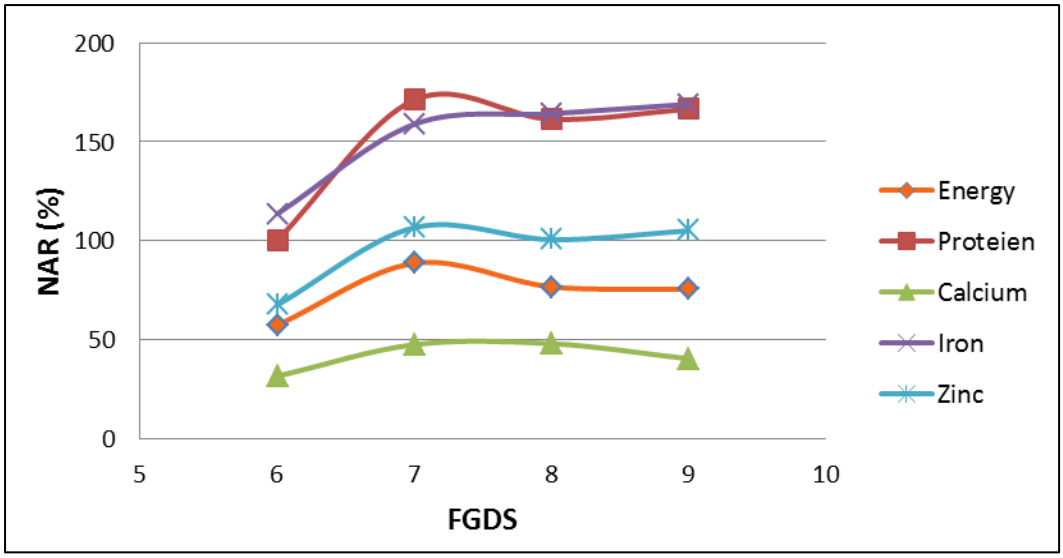

Figure 4.3: Girls: Mean Nutrient Adequacy ratio (NAR Expressed as %) of Energy and Nutrients at Different levels of the Food Group Diversity Score (FGDS).

The intake ratio for vitamin C, Vitamin B6 and Riboflavin was already above the 100 percent adequacy, whereas folate remained below 100 percent of the nutrient adequacy ratio, but indicated a slight increase, with an increase in food group consumption specifically between six and seven food groups; however it should be interpreted with caution as only 3 and 7 girls consumed from six and seven food groups.

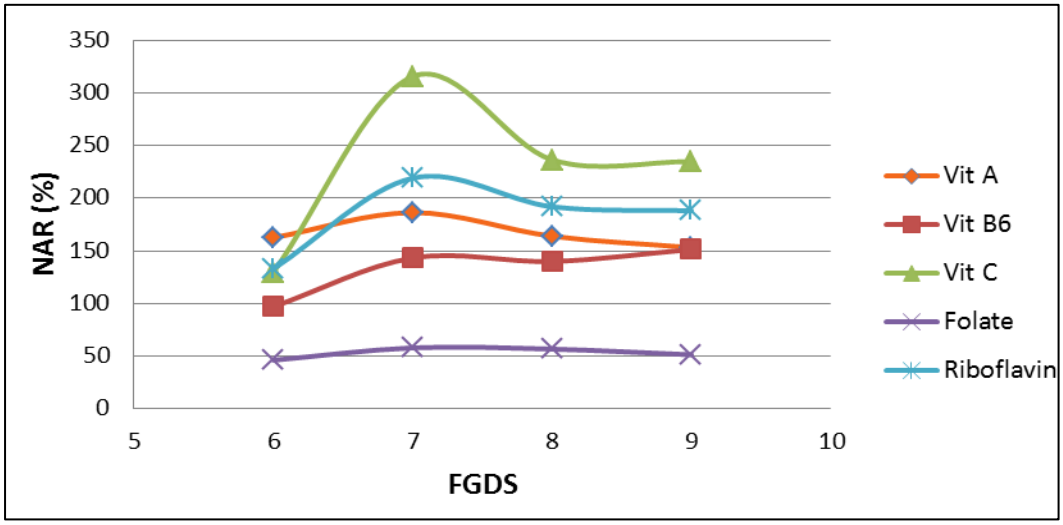

Figure 4.4: Girls: Mean Nutrient Adequacy Ratio selected Vitamins at Different Levels of the Food Group Diversity Score (FGDS).

Figure 4.5 and 4.6 – Boys, illustrates the relationship between the food group diversity score (FGDS) and nutrient adequacy ratios (NARs) of energy, protein, selected mineral and vitamins. For protein, iron and zinc, NAR reached above 100 percent and showed a slight increase as the consumption of food groups increased. Energy and calcium remained below 100 percent and did not show an increase with greater consumption of food groups.

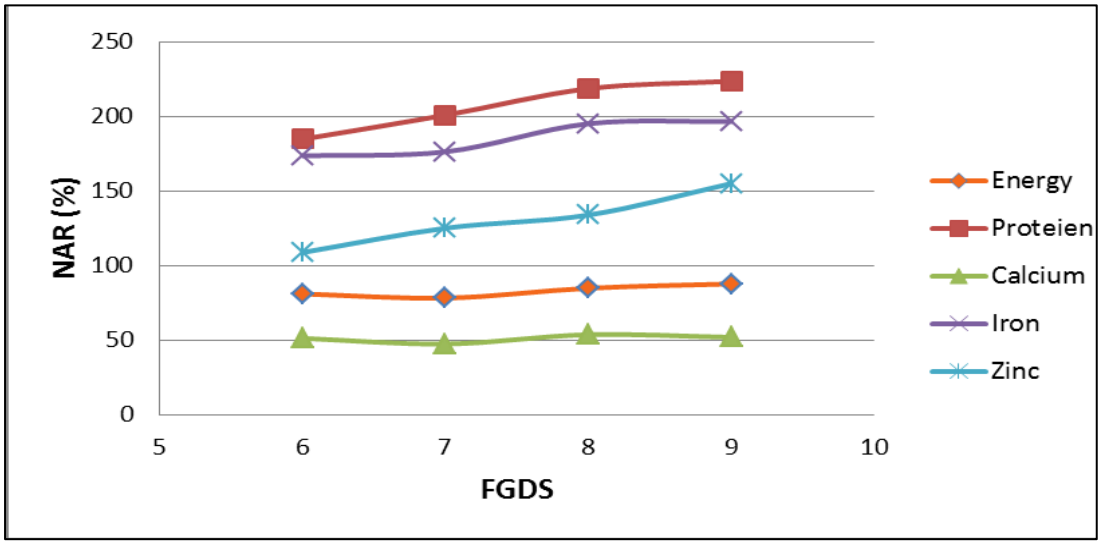

Figure 4.5: Boys: Mean Nutrient Adequacy ratio (NAR Expressed as %) of Energy and Nutrients at Different levels of the Food Group Diversity Score (FGDS).

The intake ratio for vitamin C, vitamin B6 and riboflavin reached 100 percent nutrient adequacy and folate remained borderline with a gradual increase when reaching 7-8 food groups.

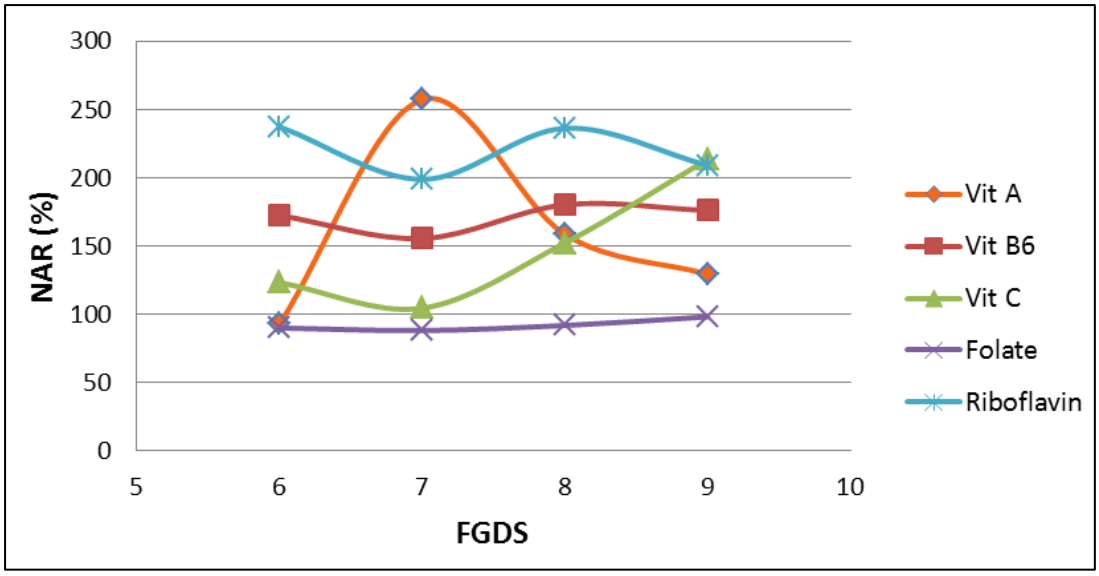

Figure 4.6: Boys: Mean Nutrient Adequacy Ratio selected Vitamins at Different Levels of the Food Group Diversity Score (FGDS).

The boys had a higher average daily nutrient (24-Hour Recall) intake at a statistically significant level of p=0.00 for mean total protein, total fat, dietary fibre, iron, magnesium, phosphorous, zinc, folate, thiamine, niacin, vitamin B6, vitamin A and vitamin C. The girls reflected a significantly higher vitamin C intake, (p=0.04) than the boys. The intakes of vitamin A for girls and boys were not significant (p=0.57) as indicated in Table 4.14.

4.3 DISCUSSION

The wealth of data collected in this research illustrates the most comprehensive nutritional status and dietary intake patterns of children aged 9-13 years of age attending two Primary Schools in the Municipal area of East London. A household questionnaire was used to collect socio-demographic information. This revealed adequate living conditions with all respondents living in a brick house, predominantly in the urban areas of East London. Sanitation and access to clean water was adequate and available to all respondents. General living conditions were good and all the households reported good roads and houses with few problems compared to the NFCS-FB 2005 which reported that six out of ten households had tap water (Labadarios *et al.* 2008b: 254). Poor sanitation and the lack of water, as well as the lack of clean water, led to an unhealthy environment and the spread of disease and infection which relate directly to malnutrition (WHO 2000b). A high percentage of pests present in the community could be as a result of the inadequate disposal of refuse, which formed a breeding

ground for these household pests. Ants (39% and 40%) and mosquitoes (28% and 30%) were the main problems reported and these can be especially associated with the summer rain season and sub-tropical weather, which enhances the breeding of pests. Other problems pests were geckos and cockroaches. Pests can cause diarrhoea, making it difficult for the body to absorb nutrients.

High employment rates (85% and 75.8%) and a good income from parents willing to disclose this information were recorded with an average income for both groups combined between R24 817 and R33 295 per month respectively. Education levels among the parents/guardians were high with seventy-six percent of the girl guardians and 72 percent of the boy guardians having a post school education. Education is also an indication of food security as education is linked to better employment and improved living conditions (FAO 2006). Better employment opportunities in the urban areas can be reconciled with income levels and education levels when compared to the rural areas and it can also be concluded that families could be sufficiently sustained compared to the finding of the NFCS-FB 2005 which reported low incomes between R1-R500, poor education and high unemployment rates (Labadarios *et al.* 2008a: 254).

The mother featured as the main caregiver for meal preparation, shopping for food and deciding on how much money to spend on food. The majority of the respondent and caregiver meals were consumed at home and they had 3 meals per day. Among the boy group, the father featured strongly as the person who decided on the amount of money to be spent on food. Both groups reported having enough money to purchase food. All the respondents had good cooking utensils and a stove as well as other electrical equipment for the preparation and storage of food. The majority of the respondents made use of electricity, with gas being the second choice for the preparation of food. How the income was spent, the preparation of meals and the purchasing of the food was provided by the mother who could be linked to the type and quality of food consumed by the respondents. The preparation, storage and methods of preparation of the meals were mostly done by the mother of the family. It can thus be concluded from the food and socio-demographic data recorded that sufficient, well-prepared meals were provided to the respondents. This is in strong contrast to the results of the NFCS-FB where it was reported that in one-third of households, the male (father, husband) was the head of the household and made the important decisions with regards to the spending of money and purchasing of food (Labadarios *et al.* 2008b: 254).

The nutritional status of the children was determined using the two nutritional indicators, namely; BMI-for-age and height-for-age for this age group, using the WHO growth indicators presented as z-scores. The overall nutritional status of the participants found that 2 percent of the girls were severely stunted (<-2SD), the risk of overweight (>+1SD) was 24 percent, overweight (>+2SD) was at 19 percent and 1.5 percent fell into the obese (>+3SD) category. The majority of the girls and boys were normal height-for-age (≥-2 to <+3SD). The boys results showed 29.6 percent falling into the risk of overweight category (>+1 SD) with 16.4 percent overweight (>+2SD) and only 1 percent being obese (>+3SD) according to the World Health Organization Anthropometric classification data for children (WHO 2008). The NFCS-FB 2005 survey indicated that 10 percent of children, nationally, were classified as overweight and 4 percent as obese. Abrahams *et al.* (2011: 1752-1758) reported lower BMI's among children who bring lunch boxes to school and a study by Temple *et al*. (2006: 252) reported that higher socio economic status children were more likely to bring a lunch box to school. This was indeed the case in the East London study as the children did bring lunch boxes to school. Temple *et al.* (2006: 252) reported on a study in different socioeconomic areas in Cape Town that among the higher socioeconomic areas, children declined to bring lunch boxes to school as the school tuck shop was the preferred choice (Temple *et al.* 2006: 252). Rural children were less likely to bring a lunch box to school for various reasons such as food insecurity and the provision of a meal by the government feeding programme (Abrahams *et al.* 2011: 1752).

A study by Goon *et al.* (2013: 582) amongst school children aged 9-13 years revealed considerably higher levels of excessive body fat and a significantly higher percentage of body fat among girls compared to boys and among different ethnic groups with black children being more overweight than white children (Goon *et al.* 2013: 582). The Primary Schools' Anthropometric Survey and The Health of the Nation Study, estimated between 1994 to 2004, an increase in overweight from 1.2 percent to 13 percent and obesity from 0.2 percent to 3.3 percent. Overweight and obesity differ markedly between age groups, different genders and ethnic groups as the mean z-score of 2.4 for girls and 2.1 for boys indicates in this study (Rossouw, Grant & Viljoen 2012: 5). Data has shown that progressing towards adulthood is a high risk period for weight gain and the poor eating habits that have developed do not meet NFCS dietary recommendations (Wenhold *et al.* 2008: 254). Many participants

in this study were at an age close to adolescence and 24 percent and 29.6 percent of the girls and boys respectively were at risk of becoming overweight.

This study provides some information on the daily food intake of children in a stable socio-economic environment. The mean energy intake of 91 percent for the girls and 75.8 percent for the boys was, to some extent, inadequate and thus did not meet the recommended EER. The contribution to energy intake from the lunch boxes was slightly below the 1/3 of the total recommended daily intake for girls (2 820kJ) and the boys (2 982.7kJ).

In this study, the fat consumption of 30.6 percent and 32.6 percent of the total energy intake as measured by the 24 Hour recalls and lunch box was above the recommended level by the WHO of 15-30 percent (WHO 2010). This was reflected in the top 20 intake data of the 24 Hour recalls and the lunch boxes for the two groups respectively where margarine, cheese, peanut butter, mayonnaise and savoury snacks were frequently consumed. The high fat items ranked higher on the lunch box list than on the 24 hour intake list, indicating that the lunch boxes were energy dense and supplied almost half of the daily fat intake consumed by the respective groups (14.4% and 12.2%). This is considerably lower than in the study by Conway *et al.* (2002: 422) where a study among American children reported that over half of the population studied had packed lunches exceeding the 30 percent total fat intake recommended. High sugar content items such as diluted juice squash, tea and coffee, jam, fruit juices and carbonated drinks appeared frequently in the 24 hour intake list. Sweets, carbonated drinks, jams, biscuits and fruit juices appeared on the lunch box data list. Sugar appeared in the 3rd and 4th position for the 24 hour intake list with high frequencies of 231 and 235 for girls and boys respectively.

Carbohydrate-rich foods appeared frequently in the 3-24 Hr Recalls such as bread (1st), apples (7th), rice (8th), breakfast cereals (17th) and savoury snacks (20th) among the girls. Boys reported bread (1st), apples (8th), rice (9th) savoury snacks (15th) and breakfast cereals (18th and 20th) as popular food items. The mean intake of carbohydrates for the girls is 200.6g (SD±56.3) and the boys 229.5g (SD±82.9), this being higher than the recommended EAR of 100g per day for girls and boys. The WHO recommended goal of 55-77 percent was achieved in this study as the respective groups reported 55.3 percent and 52.1 percent of total carbohydrates consumed for the 3-24 hour recalls and lunch boxes (WHO 2010). These findings were consistent with the view that the diet of the South African Youth is

characterised by a high intake of carbonated drinks and high fat food items purchased from tuck shops as reported by Douglas (1999: 181) and Bell (2005: 258) in studies done in Northern Ireland and Australia as well as in a study conducted by Griffin and Barker (2008: E218) in the United Kingdom. Feeley *et al.* (2012: e1) reported on a study in South Africa amongst adolescents where items such as cheese, bread and fruit were the most popular and represented >50 percent of the lunch box food. In this study these items were also reported to be popular, but left-over food did not feature in the East London study, as reported in the study in Durban, South Africa by Napier and Hlambelo (2014:59-63).

The general findings on studies conducted on nutritional content of lunch boxes concluded that lunch boxes lack diet quality and are nutritionally inadequate, with a high fat and sugar content and are low in protein, calcium and vitamin C (Griffin & Barker 2008: E218). In the East London study, the protein intake was adequate with only 3 girl respondents consuming below the RDA. Lunch boxes provided more than half of the RDA with a mean of 19.24 SD±8.81 and 19.07 SD±13.65 for the girls and boys respectively. The study further indicated a low intake of milk, fruit and vegetables. The calcium intake of the East London study reported 100 percent of the girls and 95 percent of the boys did not meet the AI for calcium (1300mg). The 24-hour recalls for the 3 days reported milk with a per capita intake of 117.9g and 184.5g and cheese 13.8g and 13.7g for the groups respectively. The low calcium consumption was also reflected in the top 20 lunch box items with cheese with a frequency of 150 and 128 and yoghurt with a frequency of 50 and 54 for the girls and boys respectively. A study by Larson *et al*. (1997: 432) in the United States confirmed the findings of the low consumption of milk, fruit and vegetables and which is associated with low calcium and vitamin A and C intakes. In the East London study, fruit and vegetable intake in both groups (215.1g and 95.8g) was much lower than the recommended intake of >400g/day. The mean intake of vitamin C was adequate, but 28 girls and 57 boys did not meet the EARs. The mean iron intake was adequate with 8 girls and 7 boys not meeting the EAR. The B vitamins are important for cognitive development and behavioural outcomes in children and adolescents. The mean intake for the B vitamins was adequate, but a small percentage of the groups did not meet 100 percent of the DRIs for these vitamins.

Protein intake measures indicate that 97 percent of the girls and 98 percent of the boys consumed >100 percent of the RDA for protein. Only 3 percent (n=3) of the girls consumed <100 percent of the EAR compared to 2.0 percent (n=97) of the boys consuming <100

percent of the EAR. The intake of dietary fibre by the girls (15.5g) and boys (18.1g) was deficient as the AI for the age groups is recommended at 26g and 31g respectively. The boys had a higher average daily nutrient (24-Hour Recall) intake at a statistical level of p=0.00 for mean total protein, fat, dietary fibre, iron, magnesium, phosphorous, zinc, folate, thiamine, niacin, vitamin B6, vitamin A and Vitamin C. The girls reflected a significantly higher vitamin C intake, (p=0.04) than the boys. The vitamin A intake between the groups were not significant (p=0.57). Lunch boxes should contribute about a third of the daily requirements and in this study all the participants brought food from home and the lunch boxes contributed 44.4 percent (girls) and 36.2 percent (boys) respectively to the daily intake. This should, therefore, reflect a balanced daily intake for the girls and boys from the various food groups.

A medium Food Variety Score (FVS) for both groups was recorded and although the majority of the children consumed 3 meals per day and an additional lunch box, the nutrient intake, when compare to the EAR, indicated that the group consumed deficient intakes for the majority of the nutrients. The Food Group Diversity Score (FGDS) indicated a high FGDS (6-9 food groups) thus indicating a good food variety. However, this is not reflected in the FVS; both a good FVS and FGDS are needed for nutritional adequacy. The contribution to energy intake from the lunch boxes for the girls (2 820kJ) and the boys (2 982.7kJ) was slightly below the 1/3 of the total recommended daily intake. Although the girls displayed a higher mean lunch box intake for total protein, dietary fibre, iron, zinc, vitamin A and vitamin C, only total dietary fibre (p=0.00) and vitamin C (p=0.04) were statistically significantly higher than that for the boys.

The children in this study brought lunch boxes to school on a daily basis. Studies in Cape Town reported that 41 percent of children brought food to school and high socio-economic status students were twice as likely to bring food to school compared to the children from a low socioeconomic status (Temple *et al.* 2005: 252). Conway *et al.* (2002: 422) and Regan *et al.* (2008: 205) found that many primary school learners in the USA and New Zealand prefer to take lunch boxes to school on a daily basis. The lunch box top 20 food items included bread, margarine and milk as the most popular choices. The top 20 food consumption list of the lunch box indicated that the majority of food items consumed were carbohydrates with a low frequency of small portions of vegetables and fruits. The most common items in the lunch box in order of popularity were bread, milk, margarine and sugar, followed by apples and cheese. A study conducted in the Western Cape reported that the most popular item in

lunch boxes was bread based items and only 9 percent of the learners consumed fruit and/or fruit juice (Abrahams *et al.* 2011: 1752).

The general findings on the few studies conducted on the nutritional content of lunch boxes, concluded that lunch boxes lack diet quality and are nutritionally inadequate, with a high fat and sugar content, but low in protein, calcium and vitamin C (Griffin & Barker 2008: e218). The contribution of fat from the lunch boxes was very high (14.4% and 12.2%) and this alone almost supplied the daily requirement of 15-30 percent of total energy recommended (WHO 2010). A study conducted in the North West Province in the age group 9-13 reported a high consumption of carbohydrates, as well as a high refined sugar intake. Vegetables and fruit consumption was reported to be very low (Oosthuizen, Oldewage-Theron & Napier 2011: 75). Amongst the boys the top 20 food items were savoury snacks and high fat and salt crackers which contributed to the high fat intake, and carbonated drinks with a high sugar content. This is in line with studies in Northern Ireland and Australia which found that sandwiches, crisps, chocolates and carbonated drinks were popular items in a packed lunch while sandwiches contained ingredients with a high fat content (Douglas 1999: 181; Bell 2005: 258).

4.4 CONCLUSION

This chapter presents the results of the study conducted with primary school children in the age group 9-13. The results identified various nutrition related shortages faced by the age group for the daily food intake and the content of the lunch boxes. The respondents in this study had good living conditions, good caregivers and opportunities for good food preparation. There was no lack of money to purchase food and food choices were mainly made by the mother of the family. The variety of food consumed was good and this indicated that adequate food was purchased and prepared as 3 meals a day were reported. The content of the lunch boxes was adequate and reflected good food choices compared to the boys with less healthy options and energy dense food items. The girl respondents had better food choices in their lunch boxes due to the strict control at their school for it is a school rule to supply an additional snack in the form of vegetables, fruit or yoghurt. This was consumed at 9 o'clock in the morning as this was the time when children needed additional energy. This contributed to an improved attention span in class and assisted children who skipped breakfast. The girl respondents had been subjected to lunch box control since Grade 1 in an

attempt to teach good eating habits, although this was not an official school policy. The respondents in this study come from an urban area with access to good living conditions and food and attended an ex-model C school which does not fall into the quintile for food programmes from the government. All the children had adequate, and a good variety, to eat every day and brought a lunch box to school, but indicated some small deficiencies in nutrients. Adequate quality food can be linked to the data recorded on income, education and caregivers in this study which was of a high standard.

CHAPTER 5 – CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In the previous chapter the results of the data were presented and discussed, with reference to Chapter 2 in relation to the objectives of this study. A discussion of the findings follows in order to identify the objectives needed for the formation of an adequate intervention programme with nutrition as the main objective. The limitations encountered during the study will also be discussed in this chapter.

5.2 LIMITATIONS OF THE STUDY

The limitation of this study is as follows:

- Three 24-Hour Recalls were conducted on one day, when the children were assisted by parents/guardians to recall food consumed over the previous three days. This method, however, has caused over- or under-reporting.

- The Food Finder ® Version 3.0 software does not include fortified bread and maize meal porridge.

5.3 MAIN FINDINGS

Malnutrition is a global problem in children and adults and is still a problem in most African countries. The risk of malnutrition in South Africa and developing countries includes food security, poverty, urbanisation, family unit and cohesion, physical environment, pregnancy, breastfeeding and weaning practices, education ignorance and psychological factors, parasitic infections and alcohol intake (Kleynhans, MacIntyre & Albertse 2006: 163). Addressing food security and undernutrition, energy and micronutrient deficiencies remain a serious issue that has not been addressed successfully in Africa. The Millennium Development Goals focus on malnutrition and micronutrient deficiencies and many countries in Africa are struggling to attain the goal of eradicating malnutrition and hunger by 2015 (Vorster, Kruger & Margetts, 2011: 429). Malnutrition is not only about stunting, wasting and underweight,

but includes overweight and obesity. The NFCS 2005 reported that overweight and obesity has increased from 16 percent to 26.4 percent among 13-year olds (Steyn *et al.* 2009: 145). The impact of obesity is evident in all ages, shortens life expectancy and is associated with diabetes mellitus, cardiovascular disease, stroke, hypertension and certain cancers.

One hundred and ninety-nine children participated in the study with parental consent. The socio-demographic variables that were identified in this study were socio-economic status, living conditions and education. The mothers formed a large percentage of the sample that was responsible for food preparation and purchasing and deciding on how much money to spend. The majority had enough money for food and shopped at the supermarket weekly. The majority of the groups had post school qualifications which could contribute to the non existence of severe malnutrition in this study. The group had access to proper sanitation, water, housing and transport. This community does not suffer from food insecurity caused by a lack of resources and education.

The results of this study illustrated that stunting was not the most outstanding anthropometric feature in boys and girls, but that the respondents were normal for height and age. The risk of being overweight was high in both boys and girls as 19 percent of the girls and 16.4 percent of the boys were overweight. Only 3 children were obese.

The findings of this study confirmed that the 24-Hour Recalls and lunch boxes were lacking in fruit and vegetables and very few of the lunch boxes contained all the necessary nutrients for a balanced diet. Essential micronutrients, such as vitamin C, vitamin A, folate and B-group vitamins which are supplied by fruit and vegetables in the daily diet are essential for healthy growth and are at low levels in this study. The lunch box content of the girls indicated improved choices compared to the boys. Strict control in the girls' school about the content of the lunch boxes and the constant education about healthy eating has had a positive influence on eating habits. The boys consumed a variety of energy dense foods as no control exists and this may lead to overweight, cardiac diseases, heart attack or type 2 diabetes in adulthood. Analysing the lunch boxes of both girls and boys aged 9-13 years gave the researcher an understanding of the learners and that these learners may be at risk for many diseases that are related to malnutrition. Some of the learners may become victims of deficiency diseases such as anaemia and osteoporosis. Adolescents are vulnerable to growth spurts and high nutritional requirements and often display poor eating habits and risky

behaviours (Wenhold *et al.* 2008: 441). Eating habits established in childhood often continue into adulthood and bad eating habits make the adolescents susceptible to chronic diseases and obesity. Good nutrition and well established eating habits are important in the prevention of chronic diseases (Labadarios *et al.* 2008a: 101).

Table 5.1 reflects a summary of the results between the girls and boys.

Table 5.1 Comparison of Results

TEST/TOOLS	VARIABLE TESTED	RESULTS	
		GIRLS	BOYS
Food Finder Software (MRC 1991) mean, minimum, maximum and standard deviation compared to DRI's	Dietary intake for 24 Hours x 3 days	Significantly higher intake of Vitamin C	Higher average daily nutrient intake at a statistically significant level of p=0.00 for mean energy, total protein, total fat, carbohydrates, dietary fibre, calcium, phosphorous, iron and zinc.
Food Finder Software (MRC 1991) mean, minimum, maximum and standard deviation compared to DRIs T-test to test for significance between groups	Individual analysis of lunch box content for girls and boys separately	Only total dietary fibre (p=0.00) and vitamin C (p=0.04) were statistically significantly higher than the boys.	Higher mean lunch box intake for total energy, carbohydrates and calcium. None were statistically significantly higher than the girls.
Descriptive statistics, SPSS version 20.0, t-test for significance between groups	Food Variety over 7 Days (FFQ)	11-66 Individual foods consumed Medium food variety	10-53 Individual foods consumed Low food variety
	Food Group Diversity	6-9 food groups High Food Group Diversity Score	6-9 food groups High Food Group Diversity Score
	Fruit and Vegetable intake ≥400g/day	Fruit and Vegetable intake 215.1g	Fruit and Vegetable intake 216.9g
AnthroPlus (WHO)	Weight, height and age		
		Girls	Boys
	Severely stunted Stunting Normal Height for Age Normal BMI-for-age Risk of overweight Overweight Obese	2% 1% 97% 54% 24% 19% 1%	0% 0% 100% 50% 29.6% 16.4% 2%

5.4 RECOMMENDATIONS

RECOMMENDATION 1: Nutritional Education Intervention and parent participation

A study conducted by Oosthuizen (2010) on primary school children showed a significant change immediately after the intervention with regards to nutritional knowledge. There were very little changes in the dietary patterns although knowledge concerning daily requirements was improved. The level of poverty, cultural obligations and the lack of influence the children have on food choices and preparation, may also have contributed to the lack of significant changes in dietary practices. However, the study conducted among the primary school children in East London could reveal different results if a nutritional education intervention takes place, as the additional problems of Oosthuizen's study do not exist in this group. Positive results are possible in school-based approaches as learning takes place in a structured environment and many hours a day are spent at school (Shariff *et al.* 2008: 119). The Nutritional School Nutrition Programme (NSNP) exists only in underprivileged communities where the need is the greatest. A few years ago, the girls' school implemented a programme of encouraging a snack break at 9 o'clock in the morning to improve concentration and also to provide an opportunity for those children who do not eat breakfast before coming to school to consume a snack. The school started monitoring the content of the school lunch boxes to encourage parents not to provide snack food with a high sugar and fat content. The school tuck shop joined the Heart Foundation programme and removed the high sugar foods and refined carbohydrates. Additionally, certain foods, such as energy drinks, are only available after school when it is time for sport. However, at the boy's school, no 9 o'clock snack break exists and their tuck shop has had no intervention. This should be considered by the school governing body as a matter of urgency as most of the choices on offer at the tuck shop are high in fat and sugar, similar to the lunch box analysis.

Nutritional education could be in the form of a voluntary workshop where the children have additional education on nutrition in the form of learning to pack lunch boxes with the emphasis on nutritional choices. The possibility of using time on the timetable, normally used for life skills, could be utilised for the purpose of teaching about lunch boxes and healthy eating. Children should be guided on how to read labels so as to make better food choices. Running workshops for children to learn how to make lunch boxes themselves and what can be made for the lunch box to make it healthy will be a challenge as the majority of

parents leave it to domestic workers to prepare the lunch boxes. Involving the learners in the planning process of a nutritionally-regulated tuck shop will greatly improve the support for the tuck shop as the opinions of the learners will likely result in a successful venture. Through the involvement and the education of parents, support can be gained since parents have influence on learners' nutrition-related perceptions and dietary behaviours. Parents could also participate in the workshop as encouragement for the children. Workshops run for parent and child together could have a positive outcome if reinforced and encouraged at school. Targeting the parent with ideas to make the lunch box fun and nutritious, as well as easy, could bring about changes.

The school tuck shop has a great influence on the choices the children make if no lunch box is packed for school. The researcher will consult with the tuck shop managers and advise them on healthy food, snack and beverage options. This will prevent tuck shops from selecting items based on their own perceptions of what is good and healthy and limit the access to the unhealthy food options for the learners. Wiles *et al.* (2013: 37) recommended educating tuck shop managers regarding appropriate quality and quantity of ingredients used in the preparation of homemade tuck shop items, while Temple *et al.* (2011: 252) recommended that the South African Food Based Dietary Guidelines (FBDG) can be used to guide tuck shop owners and to educate learners about healthy food choices. Displaying the healthy options and marketing these items among the children will increase the sales (Wiles *et al.* 2013: 37). The development of vegetable gardens can promote the intake of vegetables and can also supply the tuck shop. This is especially good for preparatory and primary schools.

Many tuck shops sell fat, salt and sugar laden foods which contribute to obesity, the risk of chronic diseases of lifestyle, and affect the learning ability of school children. A food policy that should be developed that stipulates which items are not suitable for consumption during school hours. Such a policy cannot be forced onto learners, but should rather be used as a guideline to encourage learners to bring healthy food to school in their lunch boxes. It is thus recommended that the boys' school join the Heart Foundation School Tuck shop programme just as the girls' school had done in 2010. The service is free and assists the school tuck shops in encouraging good eating habits and, in addition, cognitive learning can improve (Heart and Stroke Foundation of South Africa 2013). A similar programme has been implemented by the Heart Foundation in New Zealand and is based on the same principles as

those running in South Africa. It is experiencing great success in changing the food choices children make. In New Zealand, a programme run by a school food and beverage retail service provider, namely Fruit for Learning, has successfully changed the meals provided to schools and has focused all its resources and efforts on developing practical, nutritionally balanced, effective and sustainable solutions for school tuck shops in New Zealand. The result is a tuck shop brand that has become a benchmark in the industry (Libelle Champion School Tuck Shops).

RECOMMENDATION 2: Increasing physical activity

Swart *et al.* (2008) state that physical fitness among South African youth appears to be on the decline and studies suggest that about 40 percent of children and youth are getting little or no moderate to vigorous activity each week. It is estimated that more than 25 percent of children surveyed watch more than 3 hours of television per day. Both rural and urban areas are affected by television time. Schools in the urban areas require compulsory sport participation in the form of one winter and one summer sport. This ruling depends on the school and governing body guidelines and how well they are enforced. The schools participating in this study had this ruling motto: that a healthy mind and body goes hand-in-hand with being active and thus benefitting from improved academic results. Sport in these schools is compulsory.

It is recommended that schools make sure they offer an activity for the non-sport pupils – those who do not wish to participate in competitive sports. These can be casual tennis, swimming, rowing, netball, rugby, water polo, power walking, aerobics, etc. and this will offer the overweight, obese and non-sporting pupils an opportunity to participate in a healthy activity.

RECOMMENDATION 3: Policy makers

The school tuck shop is normally run either by the school or by an outside person running it as a profitable business. The school governing body has the authority to conduct and monitor the daily running of the school and, therefore, is involved in the tuck shop. The school governing body could therefore be approached to get involved in compiling a tuck shop policy and provide valuable input in making the necessary changes towards healthy eating.

The involvement of tuck shop managers in promoting healthy food, snack and beverage options is important so as to prevent the selling of food which, according to the perceptions of managers, is good and healthy for the learners. According to Wiles *et al.* (2013: 37), tuck shop managers should be educated in the use of the appropriate quality and quantity of ingredients used in the preparation of items in the shop. However, Temple *et al.* (2006: 252-258) suggests the use of the South African Food Based Dietary Guidelines (FBDG) for the education of tuck shop owners and learners, so that healthy food choices can be made for the lunch boxes. Schools should be encouraged to join the School Tuck Shop programme started by the Heart Foundation of South Africa. Alternatively, Woolworths Holdings Limited has a Healthy School Tuck Shop Guide which is available to schools so as to assist them with making the food on offer healthier (Woolworths Holdings Limited 2012).

Recommendations to Government

- The Department of Health should develop guidelines for school tuck shops in consultation with the Heart Foundation of South Africa's Tuck Shop Programme and implement this in conjunction with the Department of Education as a policy to improve the nutritional status of children.

- Attention should be given to the incorporation of well-planned nutrition education topics, with the emphasis on healthy eating and living, especially packed lunches. The use of the FBDG's should form part of the nutrition education.

Recommendations for School Governing Bodies

- The establishment of a lunch box policy to improve the nutritional status of the learners.

Recommendations to Tuck Shop Owners, Parents and Learners

- The educating of the tuck shop owners on nutrition and the FBDGs as well as offering assistance with ideas, preparation of food and offering healthier options for the children at school.

- Educate learners about nutritious lunch boxes by offering workshops to teach them to pack their own and to offer ideas, as well as educate learners on reading food labels when making choices.

- In conjunction with the workshops, compile a recipe book based on the FBDGs with ideas and recipes to assist parents with lunch boxes.

5.5 RECOMMENDATIONS FOR FURTHER STUDIES

Further research should be conducted to determine the success and the impact of the workshops on the nutritional status of learners. This study was limited as it only included two schools from the central area and further research should include a variety of schools from the school district to establish a true reflection of the whole population of East London.

Further research in the field of school nutrition in South Africa should be continued in order to obtain data from larger samples of learners to further explore the health and nutrition related perceptions, attitudes and behaviours of South African school learners.

Questions that could be considered could be:

- To what extent can South African primary school learners make good food choices when selecting from a variety of healthy and unhealthy food items offered at a school tuck shop?
- Is there a direct relationship between childhood obesity and unhealthy foods eaten during school hours, in the South African context?
- Do learners in a school with a nutritionally-regulated shop eat healthy food at home?

5.6 CONCLUSION

In conclusion, the present study revealed that the majority of the respondents consume carbohydrate based food items and that the lunch boxes did not meet the basic requirements of a balanced diet, resulting in a deficiency in certain nutrients, particularly in respect of

energy fibre, calcium and vitamin C. The 24-Hour Recalls revealed that the majority of the respondents did not meet the basic requirements of a balanced diet, resulting in a deficiency of most micronutrients.

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ANNEXURE A

Clarendon
Preparatory • Primary • High School

Clarendon Primary

Cheltenham Road, Selborne, East London, 5201
Tel: (043) 722 5128 • Fax: (043) 743 1230 • E-mail: cprimsec@iafrica.com
http://clarendonschools.co.za

2 December 2009

Dear Mrs Wilkinson

Our Governing Body has agreed in principle to your proposal of conducting the research for your thesis at our school early in 2010.

We shall arrange a suitable date with you for the meeting where you will be able to present your proposal to our parent body.

We look forward to working with you on the important topic of 'What Children Eat' as we are currently involved in a healthy lifestyle drive.

Yours sincerely

[redacted]

Pam King
ACTING PRINCIPAL

ANNEXURE B

Selborne Primary School

Crewe Road
East London
5201

P.O. Box 19522
Tecoma
5214

Tel: (043) 726 5341 Fax:(043) 726 5956
E-mail: office@sps.ecape.school.za
Website: www.sps.ecape.school.za

10 February 2010

Dear Mrs Wilkinson

FIELDWORK AT OUR SCHOOL

Thank you for your interest shown in our school.

We are willing to have you conduct your research at our school from July to November and look forward to assisting you in this regard.

Yours sincerely

[redacted]

D J VOKE
Headmaster

ANNEXURE C

DURBAN UNIVERSITY of TECHNOLOGY

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

INFORMED CONSENT: NUTRITIONAL STATUS OF PRIMARY 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.

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: **……..**
……
……

Parent Telephone number : **……**

Parent Cell number: ……..

E-Mail: Please print: ……

Parent Cell number: ……..

E-Mail: Please print: ……

ANNEXURE D

DURBAN UNIVERSITY of TECHNOLOGY

Food and Nutrition Consumer Sciences

SOCIO-DEMOGRAPHIC QUESTIONNAIRE: AFRICAN COMMUNITY

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

1. GENERAL INFORMATION

Subject number:……

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

Where do you live?

……

2. PERSONAL INFORMATION

2.1 Your role in the family

1	2	3	4	5
Mother	Grandmother	Father	Grandfather	Other, specify…aunt……..

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

2.3 How old are you? _____ years

2.4 Gender:

1	2
Male	Female

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

1	2	3	4	5	6	7
Town/City	Farm	Squatter camp	Rural village	Hostel	Township	Other, specify SMALL HOLDINGS……..

3.2 Do other people live in your house?

1	
2	

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	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?

1	2
Yes	No

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

1	2	3
< 1 year	1-5 years	>5 years

3.7 In what type of house are you staying?

1	2	3	4	5
Brick	Clay	Grass	Wood	Zinc/shack

3.8 How many rooms does your house have?

1	2	3
< 2 rooms	3-4 rooms	> 4 rooms

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

1	2
Yes	No

3.10 How are you currently living?

Homeless		1
Living with relatives		2
Living with friends		3
Hostel accommodation		4
Squatter home		5
Rented house/flat		6
Own house/flat		7
Employees Properties		8
Other, specify……		9

3.11 Do you have the following facilities at home?

3.11.1 Water

Tap in the house		1
Tap outside the house (in yard)		2
Borehole		3
Spring / river / dam water		4
Fetch water from elsewhere		5

3.11.2 Toilet facilities

None		1
Pit latrine		2
Flush / sewage		3
Bucket system		4
Other, specify…….		5

1 2

3.11.3	Waste removal	Yes	No
		1	2

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		1
Cockroaches		2
Ants		3
Flees		4
Mosquitoes		5
Geckos		6
Frogs		7
Snakes		8
Bed Bugs		9

4. WORK STATUS AND INCOME

4.1. Are you currently employed?

1 2

Yes	No

If YES, go to Question 4.5.

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

1	2	3	4	5
Unemployed	Retired	Housewife	Student	Other, specify……

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

1	2
Yes	No

4.4. How long have you been unemployed?

1	2	3	4
< 6 months	6-12 months	1-3 years	> 3 years

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

1	2	3	4
Permanent position	Temporary position	Fixed term contract	Other, specify……..

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

1	2
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?

1	2	3	4	5	6
< R2500	R2500-	R3001-R3500	R3501-	R4001-R4500	R4501-

7	8	9	10
R5001-R6000	R6001-R6500	R6501-R7000	> R7001

4.9. Please specify the total monthly income in the household ……±.Please complete if willing

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

1	2	3	4	5
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?

People	0	1	2	3	4	5	6	7	8	9

4.12. How often do you buy food?

1	2	3	4
Every day	Once a week	Once a month	Other, specify…2-3 times per week

4.13. Where do you buy food?

1	2	3	4	5
Tuck shop	Street vendor	Wholesalers	Supermarket	Other, specify……

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

Taxi		1
Bus		2
Train		3
Own vehicle		4
Other Specify		5

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

1	2	3	4	5	6	7	8
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?

1	2	3	4	5	6
None	Primary School	Standard 8	Standard 10	College/FET	Other post school University

5.2 What language is spoken mostly in the house?

1	2	3	4	5
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?

1	2	3	4	5
Walk	Bus	Taxi	Lift	Other, specify……Car……

5.7 Do they take lunch to school?

1	2
Yes	No

5.8 If yes in 5.7 how often do they bring lunch?

1	2	3	4	5
Once a week	Twice a week	More than two a week	Every day	Only 1st week after pay day

5.8 Do they eat all their lunch?

1	2
Yes	No

5.10 If no in 5.9 what do they do with it?

1	2	3	4
Throw it away	Give it to my friends	Exchange it	Take it back home

5.11 What do they bring for lunch?

1	2	3	4	5
White bread sandwich	Brown bread sandwich	Whole wheat bread sandwich	Left over's	Tuck money

5.12 What does your lunch contain?

_____
_____
_____
_____

5.13. Have you ever gone on a diet?

1	2
Yes	No

5.14. How many times a week do you eat fast foods?

1	2	3	4	5
0	1-2	3-4	5-6	>7

5.15. How many servings of the food listed below do you eat each week?

Soda _____
Apple munch _____
Candy/sweets _____
Ice cream _____
Frozen sweet aid _____
Gulp _____
Ice lollies _____

ASSETS

	1 Father	2 Mother	3 Sibling	4 Grandma	5 Grandpa	6 Aunt	7 Uncle	8 Cousin	9 Friend	10 Other domestic
Tick one block for every question:										
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?

1	2	3	4	5
0	1	2	3	> 3

6.7 Where do you eat most of your meals?

1	2	3	4	5
Home	Friends	Work	School	Other, specify……..

6.8 Where do your children eat most of their meals?

1	2	3	4
Home	Friends	School	Other, specify……..

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

	Yes	No	Quantity
Electrical stove			
Gas stove			
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			

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

1	2	3	4	5	6
Wood fire	Paraffin	Electricity	Gas	Coal	Other, specify……

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

1	2	3	4	5
Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

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

ANNEXURE E

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

PLEASE INDICATE THE FOOD YOU ATE DURING THE PAST SEVEN (7) DAYS BY AN (X)

GROUP 1: Flesh Foods (Meat, Poultry, Fish) Diversity	**Y**	**N**
Meat (Chicken)		
Meat (Beef)		
Meat (Mutton)		
Meat (Pork)		
Meat (Goat)		
Dried Meat (Biltong)		
All Mince		
All Tribe/Offals/Runners and Heads		
Fish (fresh / whole)		
Tinned Fish (Pilchards/Tuna)		
Processed Meats (Viennas / Polony, Russians, Boerewors Sausage)		
Seafood (Prawns, Mussel's, Calamari, Crab, Shrimp, Crayfish)		
GROUP 2: Eggs Diversity	**Y**	**N**
Eggs		
GROUP 3: Dairy Products Diversity	**Y**	**N**
All Milk		
Evaporated milk (Unsweetened)		
Condensed milk		
Maas/ Inkomasi		
All Cheese		
Custard		
Ice Cream		
GROUP 4: Cereals, Roots and Tubers Diversity	**Y**	**N**
All Rice		
Maize (Pap, Mealie Rice, Mealie Meal, Samp, Porridge, Corn on the cob, Popcorn,		

Sweet Corn)		
Macaroni/Pasta/Spaghetti		
All Bread (White/ Brown/ Whole Wheat)		
Dumpling/Steamed Bread/Fat Koek		
Scones/Biscuits		
Breakfast Cereals (Corn Flakes, Oats, Weet Bix, Matabela)		
All Tubers/Roots (Amadumbe, Sweet Potato)	**Y**	**N**
Potatoes		
GROUP 5: Legumes and Nuts	**Y**	**N**
All Beans Dried		
Dried Peas		
Lentils		
Peanuts and Nuts		
Soya		
GROUP 6: Vitamin A Rich Fruits and Vegetables Diversity	**Y**	**N**
Pumpkin		
Carrots		
Wild Leafy Vegetables Fresh and Dried		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		
Mango		
GROUP 7: Other Fruits (and juices) Diversity	**Y**	**N**
Deciduous Fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		
Plum		
Sub – Tropical Fruit	**Y**	**N**
Lemon		
Orange		
Naartjie		
Banana		

Pineapple		
Avocado		
Kiwi fruit		
Watermelon		
Guava		
Paw- Paw		
Juices	**Y**	**N**
Juice (100% pure juice e.g. Ceres/Liquifruit)		
GROUP 8: Other Vegetables Diversity	**Y**	**N**
Onions		
Cabbage		
Beetroot		
Tomatoes	**Y**	**N**
Green beans (fresh)		
Peas (fresh)		
Cauliflower		
Chili (red/green)		
Lettuce		
Green\ Yellow\ Red Pepper		
Frozen Vegetables (Mixed)		
Ginger & Garlic (Fresh)		
GROUP 9: Oils and Fats Diversity	**Y**	**N**
Butter		
Sunflower oil		
Margarine		
Lard		
Salad dressing/oil		
Potato Crisps		
Coffee Creamer (Cremora, Ellis Brown)		

ANNEXURE F

24 – HOURS RECALL

Subject ID 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					

Time	Place (Home,	Description of food and Preparation	Amount	Amount in	Code

(approximately	school, etc)	method.		g (office use Only)	(office use only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					

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:					

ANNEXURE G

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric Measurements

Section A:

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

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

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

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

ANNEXURE H

Lunch box analysis

Participant: no. Date: _____

Time	Place	Description of food and preparation method	Amount	Ar (o
	School			

ANNEXURE I

DURBAN UNIVERSITY of TECHNOLOGY

FACULTY: APPLIED SCIENCES

DEPARTMENT OF FOOD AND NUTRITION CONSUMER SCIENCES

NATIONAL DIPLOMA: CONSUMER SCIENCES FOOD AND NUTRITION

Fieldworker Guide

2010

CONTENTS **PAGE**

1. INTRODUCTION

Welcome to Fieldwork, this is a stimulating opportunity to work with the Department of Food and Nutrition researchers and their communities around Durban. Research fieldwork in communities cannot be conducted without the assistance of fieldworkers.

Fieldworkers are the key to the success of community studies. They act as interviewers, collect physical measurements or observe features in the participants. Often in community studies fieldworkers can also enter people' s homes and interview them there. Data collection in the community is often hard work; if people are not available repeat visits need to be made. Fieldworkers should be well trained in the survey methods being used in a specific study, to ensure reliable data. As part of Work Integrated Learning all 3rd year Food and Nutrition Consumer Sciences students must take part in data gathering of one or more research project in the department.

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.

2. ENQUIRIES

The following staff members are concerned with field work:

Senior Lecturer/Researcher	:	DR C. Napier S9 Level 3, Room 312
Tel. No.	:	031 373 2326
E-mail	:	carinn@dut.ac.za
Research Assistant	:	Mrs. T. Govender S9 Level 3, Room 314
Tel. No.	:	031 373 2961
E-mail	:	researchFN@dut.ac.za

3. FIELDWORK REQUIREMENTS

- All 3rd year students will be expected to attend a fieldworker training course separately or as part of Nutrition 3.
- Each student must complete at least 10hours of fieldwork in one or more of the current research projects in the department of Food and Nutrition Consumer Sciences, a time sheet will be signed by the researcher in charge of the project to control the hours worked.
- Fieldworkers will **not** be remunerated for the 10 hours of fieldwork completed, any fieldwork completed by a fieldworker over and above the10 hours will be paid at a rate per hour.
- The researcher in charge of the project will complete an assessment sheet for mark allocation for this part of the Work Integrated Learning (WIL) Module.
- Fieldwork marks adds up to 10% of the final mark for WIL.

- Students can be expected to do any of the following tasks as part of their 10 hours:
    - Fieldwork in a community
    - Data capturing
    - Participating in a community upliftment project
    - Assisting with other research activities, e.g. Departmental Research Day

Details regarding the logistics will be discussed at the training session and each researcher will inform participating students of dates, times and venues.

4. ASSESMENT CRITERIA

DEPARTMENT OF FOOD AND NUTRITION CONSUMER SCIENCES

SUBJECT: Work-integrated Learning

LECTURER/RESEARCHER ASSESSMENT: Academic Service Learning component

Student name: _____

Student number: _____

ASSESSMENT CRITERIA	Very good 10 - 9	Good 8 - 6	OK 5	Poor 4 - 3	Unacceptable 2 - 0	Your mark
Arrived timeously						
Professional appearance						
Approached task in an organised manner						
Worked effectively as a team member						
Patience and respect shown towards subjects						
Anthropometrical measurements were correctly applied (if applicable)						
Accurate and detailed recording of information						
All details included in completion of forms						
Followed the task through to the end						

Number of hours completed: _____

General comments:

_____

_____

_____

Researcher Signature: _____ Date: _____

Print name: _____

5. FIELDWORKER CODE OF CONDUCT

5.1 BEHAVIOUR

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.

7. 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.

5.2 CONDUCTING THE INTERVIEW

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.

6. INTERVIEW EXAMPLE

24-HOUR FOOD 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

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
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
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

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
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

The researcher 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 J

COMPREHENSIVE LANGUAGE SERVICES

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4 March 2015

TO WHOM IT MAY CONCERN

This is to certify that the dissertation written by Jeanne Wilkinson and entitled:

COMPARISON OF PACKED SCHOOL LUNCHES OF BOYS AND GIRLS IN PRIMARY SCHOOLS IN EAST LONDON

was copy edited by the undersigned. At the same time a reconciliation of citations and the accompanying Reference List was undertaken. The writer was provided with the corrections/amendments which required action. The corrected document was subsequently proof-read and a number of additional corrections were advised.

The undersigned takes no responsibility for corrections/amendments not carried out in the final copy submitted for examination purposes.

[redacted]

Dr. Alan Weimann