Mfeka, Portia Lungisile Nomathamsanqa

19502949

Sociodemographic profile, nutritional status and dietary intake of primary school children in Chesterville, Kwazulu Natal

Dissertation submitted in the fulfilment of the requirements of a Masters of Applied Science in Food and Nutrition: In the Department of Food and Nutrition Consumer Sciences, Faculty Applied Sciences at the Durban University of Technology

February 2017

Supervisor: Professor Napier, Carin

Table of Contents

List of Tables

List of figures

List of annexures

Acknowledgements

- I would like to extend my heartfelt gratitude to my supervisor Professor C. Napier for her patience, guidance and support. The thesis would not have been completed without her guidance, support, assistance and encouragement. Thank you for believing in me even when I didn't believe in myself, may you continue to be an inspiration to others.
- I would like to thank Professor Wilma Oldewage-Theron from the Vaal Triangle University who dedicated her time and flew to Durban on several occasions to assist the M-Tech students whenever possible.
- I am also grateful to Mr. Mayishe, the principal of the H.P. Ngwenya School, the school governing body and the staff for affording me the opportunity to conduct research and to use the school premises.
- My thanks also go to all the girls and boys who took part in the study.
- My sincere gratitude goes to my husband Mbusi "Sweety" and my children, Nokwanda, Khuliso and Zowie for their patience, understanding and support and for my husband`s constructive criticism and for persisting in telling me to "tick it off".
- My love and appreciation also goes to my brother Njabulo Luthuli for his motivation when the going got tough.
- To my sister Ntombifuthi and her husband Vukani Khulu thank you for allowing my children to stay at your house when I had to leave Johannesburg and be in Durban for my studies.
- To Busie and her husband Lindani Dlomo thank you for taking care of my kids while I was in Durban.
- I am grateful to my sister in-law Jackie Molose for her love and support.
- Thank you to Thandeka Mfeka "Mnaks" for the encouragement and support.
- My appreciation goes to my friend Fikile Mhlanzi for her positive attitude and encouragement.
- To my computer genius Mthokozisi Rubushe – thank you for your support and your positive attitude.

- My sincere gratitude also goes to Mike Vermeer, my language editor – thank you very much for editing and proof reading my work.
- Thank you to Chichi Nzimande and Gogo Sophie for looking after my children when they were on holiday and I was at school.
- Thank you to the field workers, especially Kate Mbambo, who worked with me daily to ensure that this project was a success.

Above all I would like to give thanks and praise to Almighty God who gave me the strength to carry on and the courage to persevere with this journey until the very end.

Dedication

This thesis dissertation is dedicated to my late parents Sibongile and Bongani Luthuli who were a great inspiration in my life. Their great contribution to my upbringing and their support was outstanding. May their souls rest in peace.

Declaration

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

Signed: [redacted] Date: 16/08/2017

Statement 1

This dissertation is being submitted in fulfilment of the requirements for the Masters of Applied Science in Food and Nutrition.

Signed: [redacted] Date: 16/08/2017

Statement 2

This dissertation is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by giving specific references. A bibliography is appended. I did not make myself guilty of any plagiarism.

Signed: [redacted] Date: 16/08/2017

Statement 3

I hereby give consent for my dissertation, if accepted, to be available for interlibrary loan, and for the title and summary to be made available to outside organizations.

Signed: [redacted] Date: 16/08/2017

Abstract

Aim: The main aim of this study was to profile the primary school children`s household socio-economic status and evaluate their nutritional status for a healthy and active live in Chesterville, outside Durban in KwaZulu-Natal. The sample comprised of 250 children (147 girls and 103 boys), aged between 4 to 8 years and 9 to 13 years who volunteered to participate in the study and school was randomly selected.

Methodology: A quantitative research method was applied using various nutrition security assessment tools complemented by the socio-economic household profile to determine household`s ability to acquire food. Anthropometric status using WHO growth indicators assessed stunting, wasting and underweight status of the children. This was followed by the 24-hr recall and food frequency questionnaire to probe children`s diet diversity. Descriptive statistics was used to analyse data.

Result: The anthropometric indices showed that 10.3% of the children were severely stunted (<-3SD height-for-age), 33.5% were stunted (<-2SD), 2.9% were severely wasted (<-3SD BMI-for age), 5.3% were wasted (<-2SD) with 68.5% at possible risk of overweight (>+1SD), 24.3% of the children were overweight is (>+2SD) and 5.6% were obese (>+3SD) according to the WHO z-scores. The results indicate the prevalence of obesity which could be a result of the high consumption of carbohydrate dense food in the group surveyed. The parents/ caregivers and the children need nutrition education on healthy eating habits to improve their lifestyle.

The socio-demographic profile of the households indicated that 61% of the parents/ caregivers were unemployed and 39% were employed. Seventy three percent of the households were headed by women, 50% of the parents/ caregivers owned their homes, 63.6% had a tap inside the house and 94% had access to a flush toilet/sewerage system inside the house, 38% had passed grade 8 – the highest level of education, 14.4% of the parents/caregivers earned less than R2000 per month, and 10.4% earned less than R2500 per month. The low-income level, lack of post matric qualification in some of

the parents /caregivers and the high unemployment rate of 61% could be a contributory factor to malnutrition in this community. Most of the parents/caregivers resided in the township and 94% lived in brick houses, while 35.6% lived in a shack that was built outside the house as an extension of the house. Most of the parents/caregivers (88%) purchased their food from a supermarket. Thirty-five-point two percent of the parents/ caregivers indicated not having enough money to spend on food, 32.8% indicated that often there is not enough money to spend on food, and 15% indicted that there is always not enough money to spend on food. Seventy-five-point two percent of the parents/ caregivers purchased their food once a month while 12.4% purchased their food once a week. Township South Africans tend to purchase food instead of growing their own food because of the lack of vegetating space. The lack of buying power and food shortages eventually leads to malnutrition. The lack of higher education in this community decreases the chances of permanent employment as a result the low-income bracket and the inability to purchase food in some occasions.

The food group diversity score showed that 64% of the respondents consumed food from nine food groups. The carbohydrate group had the highest score (6.08±1.322) followed by the vegetable group (4.76±1.383) and the meat group (4.51±1.269). The mean carbohydrate intake was higher than the Dietary Reference Intake (DRI) for girls and boys (>100% of the DRIs). The intake of fruit was lower than the >400g goal as recommended by the World Health Organisation (WHO). The consumption of fibre was low with both girls and boys consuming <100% of the fibre requirements. Iron was consumed by 54.6% of the girls in the required amount of 100% of the DRIs. The energy intake for both girls and boys was 7025.8±16278 and 7205.4± 1860.834 respectively. The girls' consumption of protein was 11.9% and boys' consumption was 11.4% and this is within the recommended 10-15% of the WHO.

Conclusion: The results indicate both overnutrition and undernutrition in children that were part of the survey. The top 20 food intake indicated inadequate eating patterns and that diets consisted of energy dense foods, such as carbohydrates and fats which could be responsible for obesity in the children. The high unemployment and low-income rate and inadequate money to spend on food can contribute to the prevalence of stunting and wasting in the children. Nutrition education and nutrition interventions such as focus on healthier foods, healthier methods of preparing food, a balance diet and physical activity are necessary to improve quality of life and improve health.

Acronyms

AI	Adequate Intake
BAZ	BMI-for-age z-score
BMI	Body Mass Index
Ca	Calcium
CHO	Carbohydrate
CSG	Child Support Grant
DBSA	Development Bank of Southern Africa
DNA	Deoxyribonucleic Acid
DoE	Department of Education
DoH	Department of Health
DOSD	Department of Social Development
DRI	Dietary Reference Intake
DUT	Durban University of Technology
EAR	Estimated Average Requirement
FGDS	Food Group Diversity Score
FVS	Food Variety Score
HIV	Human Immunodeficiency Virus
FAO	Food Agriculture Organisation
FBDG	Food Based Dietary Guideline
Fe	Iron
FF	Food Fortification
g	gram
GDP	Gross Domestic Product
HDL	High-Density Lipoprotein
HD	Heart Disease
IDA	Iron Deficiency Anaemia

IDD	Iron Deficiency Disease
IFSNP	Integrated Food Security and Nutrition Programme
INP	Integrated Nutrition Programme
IOM	Institute of Medicine
Kcal	Kilocalorie
kg	Kilogram
KZN	KwaZulu-Natal
LBW	Low birth weight
LDL	Low density lipoprotein
Mcg	Microgram
MGDs	Millennium Development Goals
MD	Micronutrient Deficiency
Mg	Milligram
MUAC	Mid-Upper Arm Circumference
NAR	Nutrient Average Requirement
NCD	Non-Communicable Disease
NFCS	National Food Consumption Survey
NFCF-FB	National Food Consumption Survey – Fortification Baseline
NFES	National Food Emergency Scheme
NGO	Non-Governmental Organisation
NICUS	Nutrition Information Centre University of Stellenbosch
NNSDP	National Nutrition and Social Development Programme
NSNP	National School Nutrition Programme
NSP	National Supplementation Programme
PEM	Protein Energy Malnutrition
PSNP	Primary School Nutrition Programme
PUFA	Polyunsaturated fatty acid
RDA	Recommended Dietary Allowance

RDI	Recommended Dietary Intake
SA	South Africa
SAFBDGs	South African Food Based Dietary Guidelines
SADHS	South African Demographic and Health Survey
SANFFP	South African Food Fortification Programme
SD	Standard Deviation
S-DQ	Socio-Demographic Questionnaire
SFP	School Feeding Programme
SGB	School Governing Body
SPSS	Statistical Package for Social Sciences
SSA	Statistics South Africa
TB	Tuberculosis
TGR	Total Goitre Rate
TV	Television
UIL	Upper Intake Level
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children`s Fund
USA	United States of America
USDA	Unites States Department of Agriculture
USAID	United States Agency for International Development
WAZ	Weight-for-age Z-scores
WC	Waist Circumference
WHO	World Health Organisation
WtHR	Waist-to-height ratio
Zn	Zinc

Chapter 1 – INTRODUCTION AND BACKGROUND TO THE STUDY

1. Introduction

This chapter gives the background to the research topic, outlines the research question, the objectives of the research, the importance of the study as well as the research plan. The potential audience and the benefits of the research are also presented in this chapter.

1.1 Origins and background to the topic

Globally the importance of nutrition as a foundation for health and active live is underestimated. Nutrition- related health problems in children are increasingly found to be causes of premature mortality and disability. Undernutrition continues to be a problem in many developing countries. The problems of overweight and obesity are rapidly reaching epidemic levels globally in both developing and developed countries. Yet in other countries, the problem of obesity stands alongside the ongoing problem of undernutrition, creating twice the burden of nutrition related ill health among the population (WHO, 2014a).

According to Prado and Dewey (2014) the first years of life are critical for a child's development. It is firmly believed that improvement in the nutrition status of young children and infants not only have a direct impact on short-term health but also on mental and physical development later in life. Previous studies by Singh, Kariwal, Gupta, Singh and Imtiaz (2014) showed that severe malnutrition is an important factor in explaining deficiencies in cognitive development in early childhood in school performance. These nutrition deficits impose costs on both productivity and school performance later in life (Dewey and Begum, 2011). According to Habashi, Wright and Hathcoat (2012) malnutrition undermines economic growth, sustains poverty and deprives children of their right to enjoy life to its full potential.

Prevalence of stunting of linear growth of children younger than 5 years has reduced in the past two decades but is on the increase in both Sub-Saharan Africa and South Asia more than elsewhere worldwide and affected at least 165 million children in 2011; while wasting affected a minimum of 52 million children worldwide according to Black, Victora, Walker, Bhutta, De Onis, Ezzati, Grantham-McGregor, Katz, and Martorell, (2013). De Pee, Grais, Fenn, Brown, Briend, Frize, Shoham and Kiess (2015) stated that the immediate causes of malnutrition, especially in children, are inadequate dietary intake and disease. Underlying causes include limited access to food and health services, an unhygienic sanitary environment and poor caring practices of children, poor personal hygiene and poor eating behavior (De Pee *et al*. 2015).

According to De Boer, Lima, OScharf, Moore, Luna and Guerrant (2012) malnutrition has a strong impact on child mortality by virtue of its synergistic relationship with contagious disease (Mondal, Minak, Alam, Liu, Dai, Korpe, Liu, Haque and Petri 2012). Mild to moderate instead of severe malnutrition are the cause of the majority of malnutrition-related mortalities (Karakochuk, van den Briel, Stephens and Zlotkin, 2012).

1.2 Factors contributing to malnutrition

Nutrition plays an integral part in human development from early foetus life to adulthood. It is important for survival, healthy growth, mental and physical development, performance and productivity. Malnutrition interferes with children's right to survival and development and continues the cycle of intergenerational poverty (Hendricks and Bourne, 2009/2010). Food security can be defined as the human right to be able to access affordable, safe, and sufficient food, to be well nourished and to lead productive lives (Akhtar, Yasmin and Saleem, 2016). South Africa is a multi-ethnic, multicultural country in which a big part of the population is in a process of transition from a traditional rural lifestyle to urban. This transition is followed by a 'nutrition transition' (Vorster, 2001). The situation is exacerbated by the present economic crisis and increased food prices; the poor are facing higher food prices but no greater income and starvation starts (Vorster, 2010).

The United Nations Children's Fund (UNICEF) summarized the factors contributing to child malnutrition in society in their 1997 framework as shown in Figure 1.1 below.

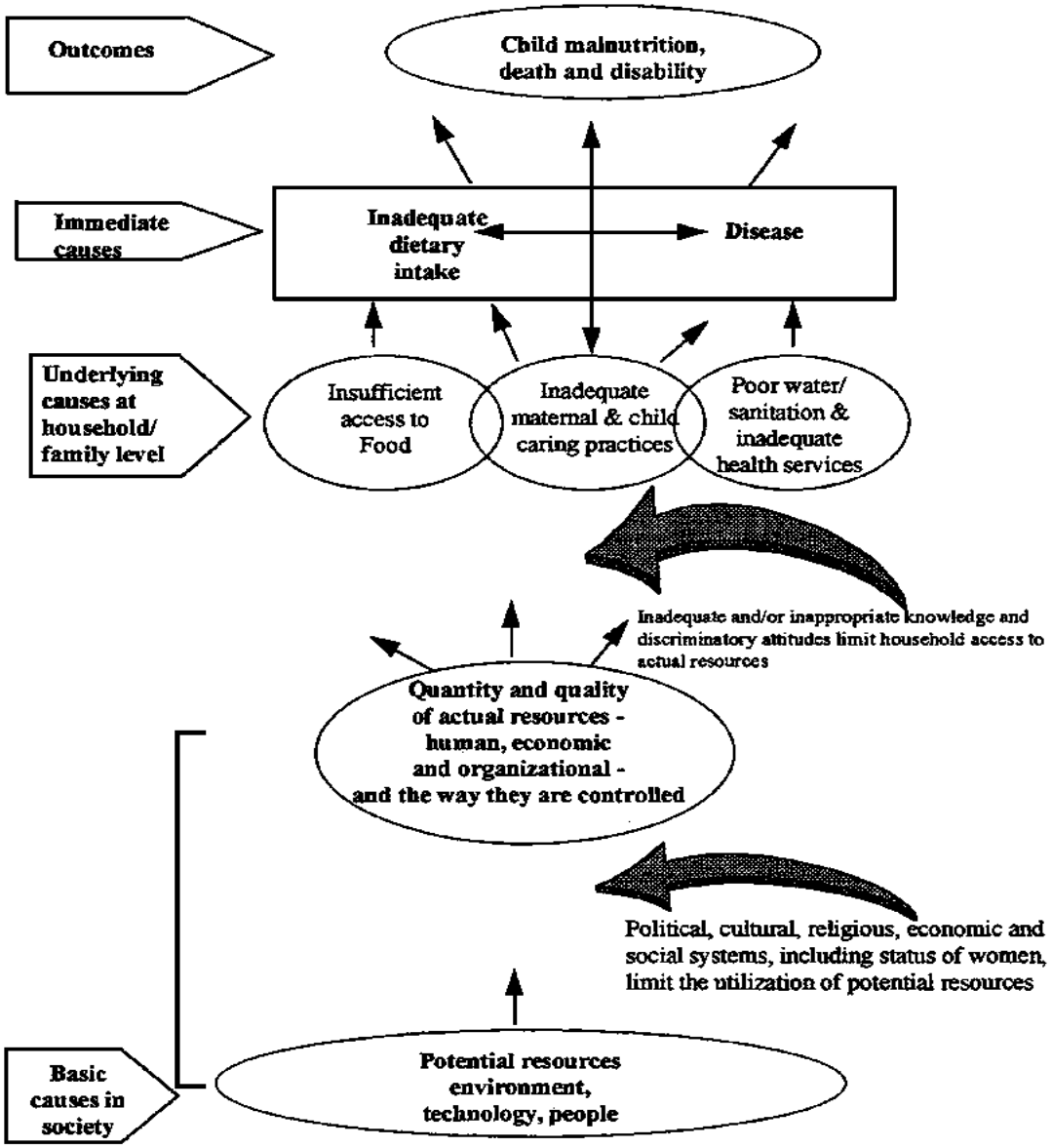


Figure 1.1: Factors contributing to malnutrition: UNICEF Framework of underlying causes of malnutrition (UNICEF 1997)

According to (UNICEF 2015) the UNICEF Framework of Underlying Causes of Malnutrition and Mortality points out three underlying factors that influence nutrition status: public health, food security and mother and child care. Causes are also categorized as immediate, underlying and basic where-by factors on one level influence other levels (Smith and Haddad, 2015).

1.1.1 Immediate causes

The immediate cause of malnutrition is related to inadequate food intake and illnesses. Malnutrition is the result of the inability to prepare food, sickness, the cost of food, poor feeding practices and food unavailability. In 2012 illnesses caused 56 million deaths of the total population worldwide (WHO, 2014a). Maternal, neonatal, communicable and nutrition illnesses were responsible for 24.9% of deaths globally in 2010, down from 15.9 million (34.1%) of a total of 46.5 million in 1990. According to Hendricks (2010) in 2000, the main cause of under-five death in South Africa was HIV and AIDS (40%) while low birth weight, lower respiratory infections, diarrhoea and malnutrition made up for 30% of all under five deaths. Low birth weight is an imperative predictor of malnutrition in children, and is estimated to be in the region of 15.5% nationally. The malnutrition-infection cycle is the key driver of child deaths because children who are underweight are at an increased risk of infectious diseases such as pneumonia and diarrhoea (Hendricks, 2010).

In Sub-Saharan Africa in 2010 maternal, communicable, nutrition and neonatal illnesses still accounted for 76% of premature deaths (Lozano, Naghavi, Foreman, Lim, Shibuya, Aboyans, Abraham, Adair, Aggarwal, Ahn and Almazroa, 2013). The decline was a result of a decrease in death from lower respiratory infections (from 3.4 to 2.8 million), tetanus (from 0.7 to 0.06 million), measles (from 0.63 to 0.13 million) and diarrheal disease (from 2.5 to 1.4 million) (Lozano *et al.,* 2013). According to WHO (2014) there were 5 million children who died from vaccine preventable diseases. Lack of dietary intake and disease can be caused by consuming too few nutrients or to an infection, which can result in increased requirements and stop the body from absorbing those nutrients consumed. Infection and malnutrition are a vicious cycle where insufficient diet can cause weight loss, growth faltering and lowered immunity and this in turn can lead to the increased incidence, severity and duration of disease (Van der Kam, Salse-Ubach, Roll, Swarthoud, Gayton-Toyoshima, Jiya, Matsumoto and Shanks, 2016).

Disease in turn leads to malabsorption of nutrients, loss of appetite and an increased need for nutritional requirements leading back to inadequate diet. The main diseases that add to this cycle of poverty in the developing world are malaria, measles, acute respiratory infections and diarrhoea (Van der Kam, Salse-Ubach, Roll, Swarthoud, Gayton-Toyoshima, Jiya, Matsumoto and Shanks, 2016).

1.1.2 Underlying causes

The major underlying causes of malnutrition are linked to inadequate household food security and the caring capacity of vulnerable groups; additional to the causes related to inadequate quality and quantity or weakness of basic services are education, health, and social services (Smith and Haddad 2015). The high level of food insecurity in the country is exaggerated by the high prices of staple foods such as maize meal and bread due to unsuitable weather conditions, trade restrictions, bio-fuel production and rising fuel prices (Hendricks, 2010).

According to Tomlinson (2013) climate changes have been seen as a current and future cause of hunger and poverty. The increase in flooding and drought and changing climatic conditions needing a change in farming and crop growing practices that may not be easy to maintain are the main issues (Mukherjee, 2017).

Globally 2.6 billion of the total population have no access to proper sanitation and stay in rural areas (UNICEF, 2010:6). In 2011, 6.9 million children under the age of five died, and 29% died from diarrhea and pneumonia due to the fact that the public health budget is not equivalent to the immensity of the problem of poor access to health care (WHO and UNICEF, 2013).

1.1.3 Basic causes

The unbalanced economic situation combined with climatic (drought and floods) and environmental problems, add to the basic causes of poor nutrition. According to Masemola, Van Aardt and Coetzee (2011), in 2011 households in South Africa (SA) had a combined income of about R2 trillion. However, the poor sector of the population, which earns between R0 to R54 344 per annum, only earned R196 billion in 2011, which amounts to only 10% of total household income. Smith and Haddad (2014) state that there is a correlation between higher income and poverty reduction; therefore, when the income is high it is possible to increase the ability to pay for nutrition inputs such as food, water, sanitation and medical care. According to Hendricks (2010) in 2008, 64% of children lived in income-poor households. This indicated a decline in poverty since 2002 and there was an increase in the Gini coefficient from 0.665 in 1994 to 0.666 in 2008, making South Africa one of the countries with the highest degree of income inequality in the world (Hendricks, 2010).

The causes of poverty include poor people's extremely unequal income distribution both in the world and within specific countries, lack of resources, conflict and hunger. Extreme poverty remains an alarming problem in the world's developing regions although some progress has been made that has decreased "dollar-now $1.25-a day" poverty to an estimated 1900 million people in 1981, a reduction of 29% over the period. Children are the most noticeable victims of undernutrition (Can, 2011).

Black *et al.,* (2013) approximated that undernutrition in the aggregate — including fetal growth restriction, wasting, stunting and deficiencies of zinc and vitamin A along with suboptimum breastfeeding — is a cause of 3·1 million child deaths yearly or 45% of all child mortalities in 2011 (Black *et al.,* 2013). Undernutrition enlarges the effect of every disease, including malaria and measles. The approximated proportions of mortalities in which undernutrition is an underlying cause are similar for malaria (57%), pneumonia (52%), diarrhoea (61%) and measles (45%) (Black *et al*., 2013). Malnutrition can be caused by diseases, such as the diseases that cause diarrhoea, by reducing the body's ability to convert food into usable nutrients (Black *et al.,* 2013).

Stunting

- Worldwide, 161 million under-five year olds were estimated to be stunted in 2013.
- The worldwide trend in stunting prevalence and numbers affected is reducing. Between 2000 and 2013 stunting prevalence reduced from 33% to 25% and numbers decreased from 199 million to 161 million.
- In 2013 an estimated half of all stunted children lived in Asia and over one third in Africa. (UNICEF, WHO and The World Bank., 2014).

Wasting and severe wasting

- Worldwide, 51 million under-five year olds were wasted and 17 million were severely wasted in 2013(UNICEF *et al.*, 2014b).
- Worldwide, wasting in 2013 was approximated at almost 8% and nearly a third of that was for severe wasting, totalling 3% (UNICEF *et al.*, 2014b).
- In 2013 an estimated two thirds of all wasted children lived in Asia and almost one third in Africa, with the same proportions for severely wasted children. (UNICEF *et al.*, 2014b).

1.3 The impact of malnutrition globally

In poverty-stricken areas malnutrition is mostly the result of chronic hunger. According to estimates by the Food and Agriculture Organization (FAO) (2015) of the United Nations, currently over one billion people worldwide, equating to one out of every six people, are malnourished. According to Von Grebmer, Bernstein, De Waal, Prasai, Yin, and Yohannes (2015) the negative global impact of undernutrition on individuals and economic growth are well acknowledged and eliminating hunger not only represents one of the vital challenges for humanity but also offers considerable social and economic returns. In 2011–2013 a total of 842 million people, one in eight people in the world, were estimated not to be getting enough food regularly and to be suffering from chronic hunger and were thus not able to conduct an active life. This figure is less than the 868 million reported with reference to 2010–2012. The total number of undernourished people has dropped by 17 percent since 1990–92 (FAO, 2014).

Overweight and underweight have adverse effects on malnutrition and both are linked to negative health outcomes in adolescents and children. The burden of economic and social disparity coexists with malnutrition in children in South Africa (Monyeki, Awotidebe, Strydom, De Ridder, Mamabolo and Kemper, 2015). According to UNICEF, the World Health Organization (WHO) and the World Bank Group (2015) there has been an evident decline in stunting prevalence between 1990 and 2014 globally from 255 million to 159 million. However, the prevalence of overweight increased from 4.8% to 6.1%. Furthermore, one of every thirteen children globally were considered wasted in 2014. In the year 2020, it is estimated that 16 million more children will be malnourished globally; the situation can be reversed provided developing countries maintain agricultural productivity irrespective of the recession crisis (von Braun, 2009).

1.4 Malnutrition in developing countries

It is estimated that about 165 million children under the age of five are stunted and more than half of them live in South Asia; India alone has 62 million stunted children (Khandelwal, Paul, Haddad, Bhalla, Gillepsi and Laxminarayan, 2014). According to Staff (2013), over the past 20 years many developing countries have been trying to deal with the problem of undernutrition especially among children and a new health threat of overnutrition has been surfacing. This form of malnutrition has been increasing worldwide and Africa has been severely affected. The International Association for the Study of Obesity claims that 39% of women in South Africa and Egypt could be suffering from obesity and the WHO predicts that by 2030 close to one fifth of African adults will be obese and we will be facing a double burden (Staff, 2013).

Bouis and Welch (2010) state that more than two billion people in poor households are affected by micronutrient deficiencies; this results in five million child mortality every year. Children in developing countries, as stated by Behrman (2010), Alderman and Bleakley (2013), and Glewwe and Miguel (2007) are disadvantaged nutritionally and have no access to education.

According to Wardlaw, Salama, Brockelhurst, Chopra and Mason (2010), 129 million children up to five years of age in developing countries were underweight and an estimated two billion people in developing countries, especially marginalized population groups, were badly affected by micronutrient malnutrition resulting in over five million deaths reported every year (Welch and Bouis, 2009).

One of the most prevalent problems associated with micronutrient malnutrition is iron deficiency anaemia, which occurs in many developing countries and is responsible for 50% of the deaths of children younger than five years. A quarter of the global population is affected by anaemia, including 468 million (30%) non-pregnant woman and 293 million (47%) children younger than five years. Over and above the economic effects it has on human capital, anaemia's adverse health consequences result in the loss of billions of dollars yearly (Balarajan, krushnan, Ozaltin, Shankar and Subramanian, 2012). A theory referred to as 'the developmental origins of adult health and disease' postulates that experiencing poor nutrition in utero and during early childhood is linked to disease at a later stage in life. Growth failure severe enough to cause stunting (height-for-age less than two standard deviations of a reference population, (HAZ<-2.0)) is the primary result of chronic undernutrition and mostly happens in utero and/ or during the first two years of life, called 'the critical window of growth' (Hoffman, 2014). Iron, vitamin A and zinc deficiencies are common among children in developing countries and often occur in the same individua (Hoffman, 2014).

1.4 The situation in Sub-Saharan Africa

Africa is undergoing a socio-demographic change, with an alarming incidence of diabetes mellitus, obesity and cardiovascular disease (stroke, myocardial tuberculosis, hypertension and malaria infections) (Omeleke, Saidu, Foma, Bashorun and Jafali, 2015).

Food security is defined as a situation that exists when at all times, people have economic and physical access to enough nutritious, safe food that meets their food and dietary preferences for an active and healthy life (Bain, Awah, Geraldine, Kindonga, Bernard and Tanjeko, 2013).

Irrespective of the recent decrease in new infections, the number of people living with HIV and AIDS has continued to increase in Sub-Saharan Africa, making it the region mostly affected by the HIV and AIDS epidemic, and making up 68% of the global burden in 2009 (Owolabi and Olatunji, 2010). The slowed-down progress in the reduction of under-five mortality is believed to have been caused by the epidemic of HIV and AIDS in the region of Sub-Saharan Africa through its impoverishing effects, which work negatively on the health and nutrition of children. The HIV and AIDS epidemic has caused all the countries in Sub-Saharan Africa to make less progress or no progress at all towards meeting the Millennium Development Goal (MDG 4) on child deaths reduction (Jahn, Floyd, Crampin, Mwinuka, Mwaiyeghele, McGrath, Zaba, Fine and Glynn, 2010; UNICEF, WHO, the World Bank and the United Nations Fund for Population Activities, 2010). However, the MDGs were replaced by the Sustainable Development Goals (SDGs) from 2015. The new SDGs were published in September 2015 with the aim of creating sustainable and resilient development. In total, there are 17 SDGs targeted at ending poverty, fighting injustice, fighting inequality and tackling climate change by 2030 reduction (Jahn, Floyd, Crampin, Mwinuka, Mwaiyeghele, McGrath, Zaba, Fine and Glynn, 2010; UNICEF, WHO, the World Bank and the United Nations Fund for Population Activities, 2010.

Another cause of malnutrition in Sub-Saharan Africa is malaria (Tine, Ndiaye, Hansson, Ndour, Faye, Alifrangitis, Sylla, Ndiia, Magnussen and Bygnjerg, 2012). It is estimated that in 2006 one million deaths of children below the age of five were reported due to malaria despite the provision of 30 to 63 million insecticide-treated mosquito nets. Malaria indirectly contributes to child malnutrition as the child vomits and loses their appetite which in turn affects the child's nutrition status. Limited access to a variety of micronutrients, especially in vulnerable groups living in low-income countries, can give rise to malnutrition as well as anaemia (Tine, Ndiaye, Hansson,

Ndour, Faye, Alifrangitis, Sylla, Ndiiaye, Magnussen and Bygnjerg, 2012; Hendricks, Kruger and Puoane, 2016). Protein energy malnutrition (PEM) is another health concern adding to the high mortality rate prevalent in Sub-Saharan Africa, where 1.7%–1.9% of children suffer from PEM in Africa (Kimutai, Maeche-Obimbo, Kamenwa and Murina, 2009).

1.5 Problem statement

In South Africa, the sight of severely malnourished children who are too weak to even sit up is rare. Malnutrition in South Africa is no longer a public health issue but extends to a food and economic challenge beyond the Millennium Developmental Goals (MDGs). Buhl (2010) warns that 85 million children are at risk of acute respiratory disease and other infections and 60 million school-age children (35% to 70%) suffer from iron deficiency disorders because of a lack of vitamin A. More than two billion people in the world are currently estimated to be lacking in key vitamins and minerals such as iodine, vitamin A and zinc. In Africa, micronutrient deficiency (MD) affects millions of people especially the vulnerable groups, which are pregnant woman and children (Herrador, Sordo, Gadisa, Buno, Gomez-Rioja, Iturzaeta, de Armas, Benito, Aseffa and Moreno, 2014).

The crucial role of nutrition as the foundation for healthy growth is underestimated. Poor nutrition leads to disease and disease leads to further deterioration in nutrition status. These results are most dramatically observed in children and infants, who bear the onset of malnutrition and suffer the high risk of death and disability associated with it. Both malnutrition and disability are the most common health problems worldwide. Over one billion people globally are malnourished and one billion live with disability (Kerac, Postels, Mallewa, Jalloh, Voskujil, 2014).

Severe acute malnutrition is when children suffer severe wasting that may be accompanied by abdominal swelling from fluid retention. It is the result of children and infants not having sufficient protein energy and micronutrients in their diet, as well as other health problems such as repeated infections (WHO, 2013). The causes of malnutrition are diverse and many are linked to political, cultural and social factors (Chambers, 2014).

In South Africa, the causes of malnutrition range from rudimentary causes such as inadequate access to resources to immediate ones such as the inability to access food. South Africa has several inconsistent socio-economic factors associated with food and nutrition. On the one hand, it has a sufficient national food supply; the country produces enough food for the entire population (Labadarios, Mchiza, Steyn, Gericke, Maunde, Davids and Parker, 2011). More importantly, it now has one of the most progressive constitutions in the world, which recognizes the right to food and other mainly food related rights. On the other hand, South Africa has to deal with a number of challenges, including malnutrition, food insecurity and starvation. These challenges are exacerbated by the high unemployment rate and poverty (Bain *et al.,* 2013).

The per capita income is not equally distributed, which means that some people do not have access to available food. Leibbrandt, Finn and Woolard (2012) describe the changes in inequality in South Africa in the post-apartheid era, using data from 1993 and 2008. The data are commensurate over time but then outline aggregate changes in income inequalities, demonstrating that imbalances have increased over the post-apartheid period because an increased share of earnings has shifted to the higher income range. Social grants have become imperative as sources of earnings in the lower income range. Income source decomposition indicates that the labour market remains and has been the driver of aggregate imbalance (Leibbrandt *et al*., 2012).

Both aggregate and within-group inequalities are responding to increasing unemployment and increasing earning inequality. The most vulnerable sector of the population needs to fit successfully into an unfavorable labour market due to not having access to social grants and education (Leibbrandt, Finn and Woolard, 2012).

South Africa is ranked as a middle-income developing country although a large group of the population remains poor. The economy has not been powerful enough to bridge the gap formulated during the apartheid era and there are health results to support that (van Ginneken, Lewin, and Berrridge, 2010).

Due to its historical background, characterized by nearly half a century of apartheid, high levels of HIV and AIDS over the past few decades and the recent fast social and economic transition, South Africa has undergone a complicated health transformation (Van Ginneken, Lewin and Berridge, 2010). It is characterized by elevated levels of undernutrition among the black population due to augmented levels of food insecurity manifested at household level. Increased levels of physical inactivity and sedentary lifestyles have also been linked to nutrition change in most studies in South Africa. This has resulted in an increase in the pervasiveness of overweight and obesity among adults, especially women. For example, 55% of black adult women are obese or overweight with the result of an increased burden of non-communicable disease (Kimani-Murage, 2013).

The table below shows a summary of studies conducted in children between the years 2000 to 2015 in South Africa.

Table 1.1 Child studies conducted between 2000 and 2015 in South Africa

Author, reference and study title	Study population	Measuring instruments	Summarised results
Shisana, Labadarios, Rehle, Simbayi, Zuma, Dhansay, Reddy, Parker, Hoosain, Naidoo and Hongoro, 2013 The South African Health and Nutrition Examination Survey (SANHANES) Department of Health, Department for International Development, Human Science Research Council and Medical Research Council of South Africa 2013.	Children 0 to 14 years, 10 to 14 years 6 to 9 years 2 to 5 years	HB tests, nutrition knowledge questions, scoring system, standing height measurement and measuring board (infantometer).	The children didn't have breakfast in the morning, with 33.9% citing not having had anything to eat and 39.2% stating that they were not hungry in the morning. Most of the children (51.1%) don't carry lunch boxes to school. Most of the children indicated they were happy with their weight.
D Casale, C Desmond and L. Richter, 2014. The association between stunting and psychosocial development among pre-school children: a study using the South African Birth to Twenty Cohort data	0 to 5 years	Interviews Data Collection Z-scores	Findings indicate that the impact of stunting on children's development may be relatively camouflaged to the parents who do not expect that their children will achieve specific intellectual milestones during the pre-school years.
Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntshie, Steyn, Schloss, Dhansay, Jooste, and Dannhauser, 2005. National Food Consumption Survey -Fortification Baseline (NFCS-I).	Children aged 1 to 9 years; women of reproductive age (16 to 35 years) in South Africa	Socio-demographic, knowledge, attitude and behaviour questionnaire and anthropometry	Stunting in 1 out of 10 children reported. Four women nationally had a poor vitamin A status. Almost one third of women were anaemic.

Table 1.1 Child studies conducted between 2000 and 2015 in South Africa

Mutius, Schwartz, Neas, Dockery and Weiss, 2001. Relationship of body mass index to asthma and atrophy in children: The National Health and Nutrition Examination Study 111	Children 4 to 17 years	Height and weight; BMI was calculated; skin prick tests	The prevalence of asthma (8.7% v9.3%v 10.3% v14.9%, = p0,0001) and atrophy (48.6% v53.0% v53.2%, p=0.05) rose significantly with increased BMI.
Kruger, Manclntyre, 2006. The determinants of overweight and obesity among 10-15-year-old school children in North-West Province, South Africa – the Thusa Bana (Transition and Health during Urbanisation of South Africans; Bana, children study)	10 to 15-year-old school children	A cross-sectional survey; anthropometric indicators; determinants of overweight/obesity including dietary intake; socio-economic status	Inactivity and increasing age for girls were determinants that influence overweight/obesity
De Onis, Blossner, 2000. Prevalence and trends of overweight among pre-school children in developing countries 1'2'3	160 nationally representative cross-sectional surveys from 94 countries	Overweight was defined as weight-for-height>-2SD from the National Centre for Health Statistics/ World Health Organization. Prevalence of wasted children (-2SDs) were presented	The global prevalence of overweight was 3.3%. Countries with highest prevalence of overweight are Middle East, North Africa and Latin America.
Jinabhai, Taylor, Reddy, Monyeki, Kambaran, Omardien and Sullivan, 2007. Sex differences in under- and overnutrition among school-going black teenagers in SA: an uneven nutrition trajectory.	5322 school-going black teenagers, 13.0 to 17.9 years, from grade 8-11	Youth Risk Behaviour Questionnaire; anthropometric measurements, height and weight	20.9% girls were overweight, shorter, less stunted and had higher BMI than boys. Boys (21.9%) were more stunted than girls (9.4%) but stunted girls were at greater risk of overweight than boys. Boys (18.4%) have higher prevalence of underweight than girls (2.6%)

Table 1.1 Child studies conducted between 2000 and 2015 in South Africa

Chemaly, MacIntyre and Abrahamse, 2004. Calcium intake and knowledge among white adolescent girls in Gauteng, South Africa.	Adolescent white girls (15 to 17) years	Food Frequency Questionnaire; anthropometric measurements; 7-day weight record	74% of the subjects were within the normal BMI range, 21.5% were underweight and 4.5% were obese. Chronic energy deficiency existed in 16 participants with BMI levels below 18.5 kg/m2, resulting in moderate to severe thinness in 6% of the participants.
Reddy, Resnicow, James, Kambaran, Omardien and Mbewu, 2008. Underweight, overweight and obesity among SA adolescents: results of the 2002 National Youth Risk Behaviour Survey	9224 grades 8 to 11 students selected from 207 schools in all 9 provinces.	Socio-demographic questionnaire, anthropometric measurements for height and weight	Of the total sample (9.0%) were underweight. Grade 8 had a higher rate of being underweight than grade 11. Of the total sample 16.9% were overweight. Grade 11 - more overweight compared to grade 8, especially blacks and coloureds not white students.
Kruger and McIntyre, 2006. The determinants of underweight and obesity among 10-15-year-old school children in the North-West Province, SA- the THUSA BANA (Transitional and Health during Urbanisation of South Africans; BANA children) study	257, 10 to 15-year old boys and girls (black, white, Indian and coloured)	Anthropometric measurements; standardised questionnaire regarding physical activity over 24 hours; 24-hour recall, socio-demographic questionnaire	Most children's weight was within normal range (92.1%). Only 7.8% were either overweight or obese. Girls were more overweight/ obese (10.0%) than boys (5.6%). The highest prevalence of overweight/ obesity was found among white children (14.2%), compared with black (7.1%), Indian (6.4%) and coloured (2.9%) children.

Table 1.1 Child studies conducted between 2000 and 2015 in South Africa

Kimani-Murage, Kahn, Pettifor, Tollman, Dunger, Gómez-Olivé and Norris, 2010. The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children	3511 children and adolescents (boys and girls) 1 to 20 years of age in Mpumalanga Province, South Africa.	Anthropometric measurements; self-administered questionnaire	The prevalence of combined overweight and obesity was substantial among adolescent girls, increasing with age and reaching approximately 20-25% in late adolescence.
Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste and Dannhauser, 2008. National Food Consumption Survey Fortification Baseline (NFCS-FB-I)	Children aged 1 to 9 years and women of reproductive age (16 to 35 years) in South Africa	Socio-demographic, Knowledge Attitude and Behaviour questionnaire Anthropometric	Stunting and underweight in 1 of 10 children reported. Four women nationally had a poor vitamin A status. Almost one third of women were anaemic.

1.6 The rationale for this research

Primary school level interventions give opportunities to promote healthy dietary and physical activities for young children and are an entry point to involve parents and community members in eradicating child malnutrition in all forms, for example, obesity, undernutrition, micronutrient deficiencies and other nutrition related chronic illnesses. Better nutrition means stronger immune systems, less illness and good health. Healthy children learn better. Healthy people who are nutritionally balanced are stronger and more productive, and can break the chain of poverty and hunger in a sustainable way.

1.7 Research question

What are the key influencer of primary school children`s dietary intake, diet diversity and nutritional status and the effect there're of on children`s health and active live?

1.7.1 Research objectives

- To assess the school childrens` nutrition status.
- To determine knowledge of food and nutrition.
- To determine the socio-demographic profile of the households by means of a socio-demographic questionnaire.
- To determine the anthropometric status of the children by measuring and weighing the participants to determine Body Mass Index (BMI).
- To determine the food variety consumption of the children by completing the Food Frequency Questionnaire.
- To determine the childrens` dietary intake by completing 2× 24-hr-food recall.

1.8 Importance of the study

Several studies such as Kitsao-Wekulo, Holding, Tatlor, Abubakar, Kvalsvig and Connoly (2013) and Khor and Misra (2012) have shown a relationship between protein-energy malnutrition (PEM) and how it affects cognitive development and school performance. The nutrition status of school-going children impacts their health and cognition and as a result, their educational achievement.

The school selected for this study provides an excellent setting to provide health and nutrition services to disadvantaged children. School-aged children are not commonly included in health and nutrition surveys. The researcher concluded that PEM affects the development of the children's learning capacity with the result that children attain lower levels of intellectual development and academic achievement.

Temporary hunger causes lowered mental and physical activity as well as inattentiveness (feeling sleepy) and has negative results on school performance and learning. Missing breakfast after an overnight fast also affects learning (Garg, Rajesh, and Kumar 2015; Basch, 2011).

Theory suggests that some of the causes of malnutrition are:

- Infectious diseases such as HIV and AIDS, measles, diarrhea and acute respiratory infections play a role in productivity through impact on adult, physical performance and work capacity thus limiting the ability for adults to provide food (Amare, Moges, Mulu, Yifru and Kassu, 2015).
- Lack of nutrition knowledge and information (Bain *et al.,* 2013).
- Undesirable dietary habits and nutrition related practices, attitudes, perceptions and cultural influences (Bain *et al.,* 2013).
- Inadequate food intake (De Boer *et al.,* 2012).
- Household food insecurity (Mengistu, Alemu and Destauu, 2013).
- Lack of resources (Mengistu *et al.,* 2013).
- Economic (Garcia, Sarmiento, Forde and Velasco, 2013).

- Unemployment.
- Single mothers
- Cultural stereotypes, stigmas (Bain *et al*., 2013)
- Social pressures, for example, model looks
- Urbanization – availability of land for vegetable gardens.

On the other hand, some of the suggested benefits of good nutrition in school-going children are:

- Improved health and nutrition of school children
- Improved school attendance and educational performance
- Improved food security at household level by providing school meals
- Girls stay longer at school linked to delayed child-bearing
- Classrooms provide an audience (children) for the encouragement of healthy behaviour especially sexual behavior and practices at an early age.
- Poverty eradication
- Good health knowledge.

The research provides valuable information that will establish the causes of poor nutrition in and around the Chesterville area and parents will get better insight into how to improve the nutrition status of their children.

1.9 Structure of dissertation/thesis chapters

Chapter 1 - Introduction and background to the study

Chapter 2 - Literature review

Chapter 3 - Methodology

Chapter 4 - Result analysis

Chapter 5 - Recommendations and conclusion.

1.10 Audience

The research report will be of interest to and be of benefit to the following groups of readers:

- The Durban University of Technology will benefit by accessing a new network of researchers who can add valuable information to the field of research.
- The researcher will benefit in the publication of the article and will be able to attend conferences and defend and support her findings.
- The Government of South Africa, more specifically, The Department of Health, will possibly benefit from using the survey to deploy relevant intervention strategies in Chesterville.
- The Community of Chesterville will gain valuable information on nutrition and the benefits it has on schooling and improving learner performance and the contribution this has to sustainable community development.

Chapter 2 – LITERATURE REVIEW

This chapter contains the literature reviewed from academic papers and publications on the topic of nutrition and malnutrition amongst children. The literature was reviewed to ensure a thorough understanding of the topic as well as to leverage on the findings of previous similar studies and compare them to the results of this study.

2.1 General status of malnutrition in South Africa

A longitudinal North-West child study investigated changes in overweight and obesity over a three-year period among 574 children between the ages 6 and 9 (282 boys, 292 girls; 407 black, 143 white) in South Africa (SA), taking into account sex, race and school type. Obesity increased over 3-years by 4% from 12.5% at baseline to 16.7% during follow-up. Obesity increased significantly in both white (4.2%) and black (2.0%) children, although total prevalence in the final year was double (27.3%) in white children compared to black children (13.3%). Prevalence in obesity increased more in boys (3.2%) compared to girls (2.4%), although girls indicated a higher overall prevalence (18.5%). Socio Economic Status (SES) effects were significant where children in schools associated with higher social economic status, had the highest rate of increase and the highest prevalence of obesity (Pienaar, 2015).

Children need to eat a variety of foods from all the food groups to ensure maximum intake of vitamins and minerals because choosing a variety of foods within and across food groups improves dietary patterns. Foods within the same group have different combinations of nutrients. Unfortunately, the decisions of what foods to consume is solemnly depending to what the household is able to acquire. One or two meals throughout the week in certain schools is offered by the school feeding scheme programme. Other external factors such as peer pressure, media, especially television where a variety of food is advertised tend to be influential on what children consume. Generally, literature reports a compromised diet amongst the age group (4 to 8 years and 9 to 13 years) due to these influential factors. Poor dietary intake results into poor nutritional status and often affects growth and learning performance of many children. In South Africa, there has been a persistently high rate of undernutrition among the

black population probably due to high levels of food insecurity reported at the household level (Kimani, 2013).

2.2 Malnutrition defined

Malnutrition affects approximately one third of children worldwide (WHO,2017). Assessing children's growth is a useful way of studying a community's nutrition status. Clinical malnutrition is shown by kwashiorkor and marasmus and their known clinical, metabolic and anthropometric features are at the extreme. The hallmark for child malnutrition is growth failure and the most commonly used indicator of growth failure is underweight, described as weight-for-age more than >2SD below the reference mean (Atkinson, Thiara, Tamura, DiGiovanna, Kraemer and Hadigan, 2014). Malnutrition continues to be a public health problem. The challenge of malnutrition particularly affects low income countries especially South Asia and Sub-Saharan African countries. Malnutrition is a challenge across individual countries not only Asia and Sub-Saharan countries, and affects societies as well as individual families. Ethiopia is the second most populous country in Africa, at nearly 84 million. (Alemu, 2013). Too little or too much or an incorrect balance of energy, protein and micronutrients affects anthropometry and functioning, and increases the risk of disease. Malnourishment may apply to normal or overweight individuals but normally refers to underweight. Disease-related malnutrition has detrimental effects physiologically and psychologically, clinically affecting quality of life, delaying recovery from illness and surgery and increasing mortality and morbidity (Pryke and Lopez, 2013).

2.3 Overnutrition

Overnutrition is a form of malnutrition in which nutrients are oversupplied in comparison to the amounts required for normal growth, metabolism and development (Dyer and Rosenfeld, 2011). Overnutrition is associated with systemic and tissue-related insulin resistance – an abnormality that encourages vascular disease and the development of diabetes (Sowers, 2012).

A healthy, balanced diet is crucial in all stages of life, but more importantly during childhood. Overnutrition is linked to excessive weight in relation to height. The non-equitable distribution of wealth and resources has caused an increase in overnutrition in countries where hunger is endemic (Lean, 2011). Overnutrition is a result of a high intake of kilojoules together with a lack of physical activity (Khuzwayo, 2008) and the number one cause of overweight and obesity with detrimental implications of non-communicable disease such as type-2 diabetes, hypertension and heart disease (HD) (Lean, 2011).

2.3.1 Obesity

Obesity caused by excess feeding (overnutrition) has become a problem of epidemic proportions and it is the underlying cause of metabolic disorders and chronic diseases such as cardiovascular disease and diabetes (Sowers, 2012).

Rapidly changing dietary practices and a sedentary lifestyle have contributed to the increasing prevalence of childhood (5-19 years) obesity in developing countries, recorded as being 41.8% in Mexico, 22.1% in Brazil, 22.0% in India and 13.9% in Brazil during 1974–1997, 12.2%15.6% in Thailand during 1991–1993, and 9.8% to 11.7% in India between 2006 and 2009. With the increase in obesity among children and adolescents, conditions that were seen primarily in adults are now becoming more prevalent among younger children, such as hypertension, hypercholesterolemia and insulin resistance (Labree, Van De Mheen, Rutten and Foets, 2011).

Important determinants of childhood obesity include residence in metropolitan areas, false beliefs about nutrition, high socioeconomic status, marketing by transnational food companies, increasing academic stress, and poor physical activity. Childhood obesity has been linked to type-2 diabetes mellitus, subclinical inflammation, coronary artery disease, dyslipidemia, the early-onset of metabolic syndrome and adulthood obesity (Gupta, Goel, Shah and Misra, 2012).

.

Therapeutic lifestyle changes and maintenance of regular physical activity through parental initiatives and social support interventions are important strategies in managing childhood obesity. High-risk screening and effective health educational programs are urgently needed in developing countries (Gupta, Goel, Shah and Misra, 2012).

The World Health Organisation named overweight and obesity as the leading risk factors associated with mortality and morbidity in developing countries (Popkin, Adair and We Ng, 2012). Overweight and obese adolescents tend to have a poor image and low self-esteem. Isolation from peers can lead to stress and poor performance in school and can lead to depression (Gupta *et al*., 2012). A study by Wang and Lim (2012) states that a current estimate of childhood overweight and obesity indicated that in 2010, 43 million children (35 million in developing countries) were overweight or obese, and 92 million children were at risk of becoming overweight. All over the world the prevalence of childhood overweight and obesity increased from 4.2% in 1990, to 6, 7% in 2010. It is estimated that this trend will reach 9, 1% or 60 million in 2020.

The estimated prevalence of childhood overweight and obesity in Africa in 2010 was 8.5% and is expected to reach 12.7% in 2020. In Africa reported increased rates of overweight and obesity of 17.1% among South African children is expected (Wang and Lim, 2012). Obesity is increasing at a rapid rate in both high and low-income countries. Popkin, Adair and Wang (2012) highlighted that even poor nations have access to a relatively high fat diet.

2.3.2 Disease of lifestyle

The rise in obesity worldwide has drawn attention to lifestyle as a prominent cause of disease. Obesity is just one manifestation, albeit an obvious one, of a lifestyle related problem. Some manifestations include different health problems that have resulted from the environment and behaviour associated with our modern way of living (Egger, Binns and Rossner, 2011).

Poor physical activity, poor nutrition and overnutrition, smoking, inappropriate medication, drugs and alcohol abuse, stress, unsafe sexual behaviour, inadequate sleep, risk taking and environmental exposure are significant modern causes of disease (Egger, Binns and Rossner, 2011).

Engaging in regular physical activity is accepted by most people as an effective preventative measure for a variety of health risk factors across all ages, both genders, and across socioeconomic and ethnic subgroups. Across all age groups levels of physical activity remain low and obesity continues to rise. This inactivity crisis is important in the paediatric population as recent data from the Canadian Health Measures Survey suggest that only 7% of children and youth aged between 6-19 years participate in at least 60 minutes of moderate to vigorous physical activity per day thus meeting the current physical activity guidelines from the World Health Organisation (WHO), Canada, U.S, U.K, and Australia (Tremblay, LeBlanc, Kho, Saunders, Larouche, Colley, Goldfield and Gorber, 2011). Vaughn, Hales, and Ward (2013) and Vaughn, Ward, Fisher, Faith, Hughes, Kremers, Musher-Eizenman, O`Connor, Patric and Power (2016) highlight that parents should play a role in shaping and monitoring dietary preferences and physical activity patterns of children at an early age for a future healthy lifestyle.

2.4 Undernutrition

Hidden hunger prevents children from attaining full development of their physical, intellectual and social potential. Undernutrition remains a neglected area globally (Biesalski, 2013). There is some acknowledgment that under-nutrition is linked to poverty and in setting the Millennium Development Goals (MDGs), the only nutrition determinant, underweight, was linked to a reduction of the number of people living below the poverty line (Fanzo, 2012). Under-nutrition is a condition that indicates insufficient food intake to meet energy and nutrient needs (Reddy, Kambaran, Omurdien and Mbewe, 2008).

Food insecurity at household and community level is a serious factor in the development of undernutrition. This results in inadequate energy and micronutrient intake. Poor access to health services deprives mothers/ caregivers of information needed for the optimum growth of children (Kruger, Hendricks and Puoane, 2008).

Maternal and child undernutrition is more prevalent in low-income and middle-income countries, resulting in substantial increases in mortality and overall disease burden (Black, Allen, Bhutta, Caulified, De Onis, Ezzati Mathers, Rivera and Martenal and Child Undernutrition Study Group, 2008). Impoverished communities experience a high rate of undernutrition and increased exposure to infectious diseases caused by overcrowding and inadequate sanitation. Women of childbearing age and children experience devastating health conditions as a result of limited resources, cultural influences and biological vulnerability. Undernutrition and infectious diseases exist concurrently: undernutrition reduces immunological capacity to fight against disease; infectious diseases deplete and deprive the body of crucial nutrients (Black *et al*., 2008).

Undernutrition and infectious diseases further worsen poverty through loss of wages, increased healthcare costs and, most insidiously, impaired intellectual development that can drastically reduce earning potential (Aberman, Meerman and Benson, 2015). Health professionals have recognized the long-term effects of early under-nutrition and inadequate infant feeding on obesity and chronic disease, including diabetes and cardiovascular disease (O`Reilly and Reynolds 2013; Lapillonne and Griffin, 2013).

In 2010, it was estimated that 171 million children (167 million in developing countries) were stunted. Globally, childhood stunting was reduced from 39·7% (95% CI 38·1, 41·4) in 1990 to 26·7% (95% CI 24·8, 28·7) in 2010.This trend is expected to reach 21·8% (95% CI 19·8, 238), or 142 million, in 2020 whilst in Africa stunting has stagnated since 1990 at about 40% and minute improvement is expected, Asia indicated a dramatic decline from 49% in 1990 to 28% in 2010, almost halving the number of stunted children from 190 million to 100 million (de Onis, Blossner and Borghi, 2012). It is expected that this trend will continue and that in 2020 Africa and Asia will have similar numbers of stunted children (68 million and 64 million, respectively). Rates are

much lower (14% or 7 million in 2010) in Latin America. Despite an overall decrease in developing countries, stunting remains a major public health problem in many of them (de Onis, Blossner and Borghi, 2012).

Poverty, food insecurity, ignorance, lack of appropriate infant and young child feeding practices, the heavy burden of infectious illnesses and poor hygiene and sanitation are factors responsible for high maternal and child under-nutrition in developing countries (Ahmed, Hossain, and Sanin, 2013). Under-nutrition can be defined as a Z score below -2SD and severe undernutrition as a Z score below -3SD.

The three main measures of child undernutrition are:

1) Stunting – low height for age

   This parameter is used for assessing 'chronic undernutrition' in children. Prolonged undernutrition causes retardation of growth, both in terms of height and weight, to a comparable degree. Impaired gain in height is called 'stunting' von Grebmer, Torero, Olofinbiyi, Fritschel, Wiesmann and Yohannes, 2010).

2) Wasting – low weight for height

   This index is used in both children and adults in relation to acceptable reference values. In acutely undernourished people (those who have had a prolonged insufficient dietary intake or severe infection within recent weeks), reduction in body weight is relatively rapid but height remains unchanged in adults and changes very slowly in children. Weight-for-height is used to measure for acute 'undernutrition' or 'wasting' and is the index most used in nutritional emergencies as well as in long-term causes of undernutrition such as famine (von Grebmer *et al.*, 2010).

3) Underweight - low weight for age (von Grebmer *et al*., 2010).

2.4.1 Protein energy malnutrition (PEM)

Malnutrition with its two elements of Protein Energy Malnutrition (PEM) and micronutrient deficiency continues to be the main health problem in developing countries. It is universally the most imperative risk factor for illness and death, with millions of pregnant woman and young children especially affected (Stevens, Buettner, Watt, Clough, Brimblecombe and Judd, 2015). Kwashiorkor and marasmus are two types of Protein Energy Malnutrition that have been identified. The difference between the two types of PEM is the presence of edema (kwashiorkor) or the absence of edema (marasmus).

Marusmus involves insufficient intake of protein and calories, whereas a child with kwashiorkor has a fair-to-normal calorie intake with insufficient protein intake. While significant clinical differences between kwashiorkor and marasmus are noted, some studies point out that marasmus represents adaptation to starvation whereas kwashiorkor represents an inability to adapt to starvation. On top of that, PEM children may be affected by micronutrient deficiencies, which, in turn, have an adverse effect on development and growth (Luchuo, Paschal and Ajime, 2013). School-aged children are the group most affected by PEM and physical retardation of growth, mental development and non-enrollment are often reported with the added inability to finish school (Chesire, Orago and Otebaand Echoka, 2008).

In children, protein energy malnutrition is explained by measurements that fall below two standard deviations under normal weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting). Wasting shows recent weight loss, whereas stunting normally results from chronic weight loss. The majority of children under the age of 5 years in developing countries are stunted, an estimated 31% are underweight, 38% have stunted growth and 9% show wasting. Protein energy malnutrition usually shows early in children between 6 months to 2 years of age and is linked to early weaning, and delayed introduction of solid foods, a low protein diet and frequent severe infection (Kulkarni and Metgud, 2014).

Kwashiorkor manifests with changes to hair colour and skin colour, anemia, hepatomegaly, lethargy, severe immune deficiency and early death (Forrester, Badaloo, Boyne, Osmond, Tompson, Green, Taylor, Bryan, Barnette, Soares-Wynter and Hanson, 2012).

Marasmus (non-oedematous malnutrition) is diagnosed when the subcutaneous fat and muscle are lost because of endogenous mobilization of all available energy and nutrients. The body becomes too weak to function, and bones become visible as a result of muscle and fatty tissue loss. The marasmic kwashiorkor is identified by wasting and oedema, hair and skin changes, triangular face and an extended abdomen (Osorio, 2011).

2.4.2 Micronutrient deficiencies

Micronutrient deficiency (MND) such as Vitamin A deficiency (VAD), iron deficiency anemia (IDA), and iodine deficiency disorder (IDD) have been identified as crucial nutritional problems in developing countries affecting people's health, performance and income and as a result becoming major impediments to economic development (Bowley, 2008; Bhatia, Kumar and Arora, 2010).

According to the World Health Organization, World Food Programme and UNICEF, micronutrient deficiencies are an integral worldwide health challenge. More than 2 billion people in the world today are estimated to be deficient in important vitamins and minerals especially Vitamin A, iron, zinc and iodine (Center for Disease Control and Prevention, 2015).

The majority of people living in low income countries are typically deficient in more than one micronutrient. Micronutrient deficiency occurs when people do not have access to micronutrient-rich food such as vegetables, fruit, fortified foods and animal food because they are too expensive to purchase or are locally unavailable (Bhandari and Banjara, 2015).

This is, however, not always the case as in some instances the food matrix (the mix of foods eaten), the presence of anti-nutritional factors (inhibitors), the method of preparation and drug-diet interactions may interfere with the number of micronutrients that become available for the body to use (Bhandari and Banjara, 2015).

Another important aspect of multiple micronutrient undernutrition is the interaction at the physiological and metabolic level; for instance, zinc and calcium may decrease iron bioavailability by hindering iron absorption. Deficiencies increase the risk of infectious illness and death from measles, malaria, pneumonia and diarrhea (Hassan, Umar, Dangogoo and Maigandi, 2011). The people most vulnerable to micronutrient deficiencies are lactating women, pregnant women and young children mainly because their bodies have a greater need for vitamins and minerals and are more susceptible to the harmful results of the deficiencies. For a pregnant woman, she is at risk of dying during childbirth; for a lactating mother, her micronutrient status determines her health status and the development of her breast-fed infant more critically during the first six months of life. For a young child, micronutrient deficiencies increase the risk of death due to infectious disease and add to impaired physical and mental development (Uzogara, 2016).

Deficiencies in micronutrients such as Vitamin A, iron, iodine folate and zinc can have devastating results (Center for Disease Control and Prevention, 2015). Micronutrients play an important role in metabolic processes of the human body, but are needed in small amounts; because of their important role, when micronutrients are not consumed sufficiently from food in the diet, significant health problems can result. An assessment of dietary habits in Swiss schools showed that 10% to nearly 70% of children between 9 and 19 years old did not meet the recommendations for thiamine, vitamin A, vitamin B6, riboflavin, folate, vitamin B12, vitamin E, vitamin C, pantothenic acid and niacin. Young German children and infants aged between six months and five years were found to have consumption of many vitamins below the recommended dosage (Troesch, Biesalski, Bos, Buskens, Calder, Saris, Spieldenner, Verkade, Meber and Eggersdorfer, 2015).

2.4.2 1 Iron

Iron is an important mineral critical for motor and cognitive development. Pregnant women and children are especially vulnerable to the results of iron deficiency (Stoltzfus, 2011). Low hemoglobin concentration (anemia) affects 43% of children under 5 years of age and 38% of pregnant women worldwide. Anemia during pregnancy increases the risk of maternal and perinatal mortality and low birth weight. Maternal and neonatal deaths are a big cause of mortality causing between 2.5 million and 3.4 million deaths globally (Stevens, Finucane, De-Regil, Paciorek, Flaxman, Branca, Pena-Rosas, Bhutta, and Ezzati, 2013). WHO recommends iron and folic acid supplements for reducing anemia and improving iron status among women of reproductive age (Pachon, Spohrer, Mei and Serdula, 2015).

Flour fortification with iron and folic acid is recognized worldwide as one of the most effective and low-cost micronutrient interventions (Center for Disease Control and Interventions, 2015). A low hemoglobin level slows the capacity of blood to carry oxygen and as a result it causes fatigue, impaired cognitive function and behavioral change. Most anemia, identified by low hemoglobin levels in the blood, is as a result of iron deficiency, but can also be as a result of chronic illness or a lack of folate or Vitamin B12. Minimal iron deficiency with exhausted iron stores, but without anemia, can also impair basic functioning of the body. The effects can range from having difficulty staying alert at school or on the job to having too little energy to perform everyday tasks in an efficient manner (Kruger *et al.* 2008). In more severe iron deficiency patients, the patient develops pallor (paleness) of the conjunctiva, palms, tongue and nail beds. Deficiency of iron can be detected as pallor of the inside of the eyelids and lips in dark skinned persons (Pasricha, Drakesmith, Black, Hipgrave and Biggs, 2013).

2.4.2.1 Iodine

Iodine deficiency reduces thyroxine T4 concentrations in the blood resulting in the pituitary gland being stimulated to increase production of the thyroid stimulating hormone TSH. TSH triggers hyperplasia of the thyroid resulting in goitre. This is not a life-threatening condition but extremely high goitres are uncomfortable during swallowing and breathing (Kruger *et al.,* 2008). Iodine is one of the important minerals needed by a foetus for brain and cognitive development, despite the iodine content in most foods and beverages being low.

Eighteen million babies are born mentally disabled because of maternal iodine deficiency and 38 million are born at risk of iodine deficiency. The stunted growth and mental disability that results are called cretinism. (Kruger *et al*., 2008.; Wardlaw and Smith, 2011).

Goitre is a serious condition during pregnancy causing retarded growth and with impaired growth, psychomotor and cognitive development. Cretinism appears in the more critical conditions, (and) it is characterized by stunted growth and mental retardation. Irreversible changes during brain development cause permanent neurological defects and reduced intelligence, with deficient learning ability (Bougma, Aboud, Harding, and Marquis, 2013). Worldwide it is estimated that 2 billion people have insufficient iodine consumption. Fortification of salt with iodine was one of the most successful nutrition interventions to date and 71% of households worldwide have access to iodized salt. Salt iodization has resulted in increased IQ points and significant reduction in the prevalence of iodine deficiency, such as goitres (Center for Disease Control, 2015).

2.4.2.2 Zinc

Zinc is a mineral that encourages immunity, resistance to infection and proper growth and development of the nervous system and is an imperative to healthy pregnancy results. Seventeen-point three percent of the worldwide population is at risk for zinc deficiency as a result of inadequacy even though up to 30% of people are at risk in some regions of the world. Zinc supplementation reduces the incidence of premature births, decreases childhood diarrhoea and respiratory infections, and lowers all causes of mortality and increases growth and weight gain among infants and young children (Center for Disease Control, 2015).

2.4.2.3 Folic Acid

Folate is an important vitamin in the earliest days of foetal growth for early development of the brain, skull and the spinal cord. Making sure that there are enough levels of folate in women before conception can reduce neural tube defects (a serious birth defect) by up to 50%. Supplementation of women from 15-49 years with folic acid and fortification of food such as wheat flour with folic acid are effective interventions for the reduction of birth defects, morbidity and mortality in newborns (Center for Disease Control, 2015).

2.4.2.4 Vitamin C (ascorbic acid)

Vitamin C cannot be made by the body and so it is an important part of the diet. It is essential for the health and repair of various tissues in the body including the skin, bone and cartilage. Vitamin C deficiency is not common but can affect very malnourished people and alcoholics (Lehman, 2016).

Persistent lack of vitamin C in the diet can lead to a condition called scurvy. Vitamin C is needed in small amounts by the body to maintain optimum health. Vitamin C is also known as ascorbic acid. It is needed to make a substance called collagen which is essential for the health and repair of various tissues in the body including:

- Bone
- Cartilage
- Skin
- Ligaments and tendons
- Blood vessel walls
- Teeth. (Lewis, 2010)

Symptoms of vitamin C deficiency include:

- Tiredness and weakness
- Muscle and joint pain
- Easy bruising
- Spots that look like tiny, red-blue bruises on the skin
- Dry skin
- Splitting hair
- Poor healing of wounds
- Tooth loss
- Weight loss (Lewis, 2010).

2.4.2.5 Vitamin D

Vitamin D deficiency can result from insufficient exposure to sunlight, malabsorption of vitamin D, and accelerated catabolism from some medications, and in infant's insufficient amounts of vitamin D can result in rickets, which is a bowing of the legs. In adults, it results in osteomalacia, which presents as a poorly mineralized skeletal matrix (Wardlaw and Smith, 2011; Dieticians of Canada, 2016).

Signs and symptoms of vitamin D deficiency are:

- Children are often found to have started walking late or preferred to sit down for longer periods.
- Adults can experience chronic muscle aches and pains.
- Fatigue

- Weight gain
- High blood pressure
- Restless sleep
- Poor concentration (Lipman, 2014).

Results of severe vitamin D deficiency are as follows:

- In children, bowing of the legs
- In adults, periosteal bone pain diagnosed by firm pressure on the sternum or tibia (Tangpricha and Khardon, 2014).

2.4.2.6 Calcium

Calcium is the most abundant mineral in the body and is found mainly in the bones and teeth. It is a vital dietary element needed in optimum amounts for healthy bones and efficient nerve and muscle function and overall cardiovascular health. It plays a role in maintaining normal blood pressure, regulating blood clotting and preventing cancers of the digestive tract. Deficiency in calcium, also known as hypocalcemia, is characterized by numbness or tingling of the fingers, muscle cramps, lethargy and poor appetite as well as more acute symptoms including mental confusion, skeletal malformation, dermatitis and, in infants, delayed development. Illnesses like osteoporosis (brittle, thin, porous bones that easily break) and rickets are all linked to a calcium deficiency (Weil, 2014).

2.4.2.7 Vitamin B1

Vitamin B1, also known as thiamin or thiamine, is one of the eight B vitamins. All B vitamins help to convert food (carbohydrates) into usable fuel (glucose) which is used to produce energy. Deficiency in vitamin B1 can result in beriberi: symptoms include swelling, tingling or burning sensation in the hands and feet, confusion, difficulty in breathing because of fluid in the lungs and uncontrollable movement of the eyes (Ehrlich, 2011; Dieticians of Canada, 2016).

Thiamin deficiency may be related to heart failure, the reason being that people with heart disease tend to take diuretics (water pills) which help the body get rid of excess body fluids (Mayo Clinic, 2014). Diuretics can cause the body to get rid of too much thiamine. Lack of thiamine can cause dementia in Wernicke-Korsakoff syndrome. Preliminary evidence has indicated that thiamin supplementation along with other nutrients can reduce the risk of developing cataracts (Ehrlich, 2011; Dieticians of Canada, 2016).

2.4.2.8 Vitamin B6 (Pyridoxine)

Vitamin B6, also known as pyridoxine, helps the body make several neurotransmitters, which are chemicals that carry messages from one nerve cell to the next. It is essential for normal brain development and function and assists the body to manufacture the hormones serotonin and norepinephrine which influence moods, and melatonin which assists in regulating the body clock (Weil, 2014; Ehrlichh, 2011; Dieticians of Canada, 2014)

2.4.2.9 Vitamin B12

Vitamin B12 deficiency causes weakness, tiredness, constipation, loss of appetite, weight loss and megaloblastic anemia. Nerve problems such as numbness and tingling in the hands and feet can also occur. Other symptoms of Vitamin B12 deficiency can involve problems with balance, confusion, dementia (poor memory), depression and sores of the mouth and tongue. In infants, symptoms of vitamin B12 deficiency encompass failure to thrive, problems with movement, delays in achieving the typical developmental milestones and megaloblastic anemia (Dieticians of Canada, 2014).

2.4.3 Dietary Reference Intake (DRIs)

According to the Nutrition Information Centre at the University of Stellenbosch the approach of the Food and Nutrition Board of the Institute of Medicine of the United States to formulate the Dietary Reference Intake represents a paradigm shift from avoiding deficiency states, as determined by the clinical manifestation, to maximizing health and improving quality of life. The latter is determined by functional measures including the reduction of risk of chronic disease and by guidelines for groups and individuals. In this regard, a nutrient requirement is defined as the lowest continuing intake level of a nutrient that, for specific indicator of adequacy, will maintain a defined level of nutrition in an individual. The DRI framework includes:

- The objective to formulate recommendations to meet a variety of uses;
- The objective to contribute 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; and
- The assessment of estimates of upper safe levels of nutrient intake (NICUS, 2003).

NICUS (2003) defines the DRI categories as follows: 'the term DRI is a collective term and refers to a set of at least four nutrient based reference values. Each type of DRI refers to the average daily nutrient intake and it is to be understood that some deviation around this value over a couple of days would be expected. It is therefore the average mean intake over time that is the nutritionally important reference value'. DRIs replace the RDAs which were previously used on food labels (NICUS, 2003). DRIs are used to assess and plan diets for healthy individuals and groups of individuals (De Sousa, Da Costa, Nogueira and Vivaldi, 2008).

2.4.4 Estimated Average Requirement (EAR)

EAR (Estimated Average Requirement) is defined as the intake that meets the estimated needs of a nutrient of 50% of individuals in a specific gender group, at the given life stage. The EAR is a dietary intake value and it includes an adjustment for an assumed bioavailability of the respective nutrient. The EAR is used as the basis in setting the RDA. If sufficient scientific evidence is not available to establish an EAR, no RDA is set (NICUS, 2003).

2.4.5 Recommended Dietary Allowance (RDA)

Recommended Dietary Allowance is defined as the intake that meets the nutrient needs of almost all (97%–98%) individuals in that gender group, at the given life stage. It is important to recognize that RDA applies to individuals not groups and is the goal for dietary intake by the individuals (NICUS, 2003).

2.4.6 Adequate Intake (AI)

Adequate intake is used in a case where the scientific evidence is inadequate to set an EAR. In such cases, the AI reference value is used instead of the RDA. The AI is based on experimentally derived intake levels or approximations of observed mean nutrient intake by a group of healthy people, who have normal circulating nutrient blood concentrations, growth, or other functional indicators of health. An AI is seen as an indicator that substantially more research is required in order to have an EAR established and to have an RDA calculated (NICUS, 2003).

2.4.7 Upper Intake Level (UIL)

Tolerable Upper Intake Level is defined as the maximum nutrient intake by an individual which is unlikely to pose risks of adverse health effects in almost all (97%–98%) individuals in a specified group (NICUS, 2003).

2.5 Macronutrient requirements for school-going children

Macronutrient undernourishment leads to general undernutrition with a subnormal body size. The relationship between undernutrition and infection is linked to reduced host response to infection contributing to compromised nutrition status. Infections are linked to anorexia and decreased food intake; fever increases the use of energy, and diarrhea decreases nutrient absorption eventually leading to wasting (Kruger *et al.*, 2008).

2.5.1 Carbohydrates (CHO)

Carbohydrates have received attention for their function in modulating cognitive function due to the brain's preferential dependence on glucose as the primary energy source. However, the impact of various carbohydrates on children's cognitive abilities, especially following an overnight fast, are unclear (Raine, Cohen, Kramer, Hillman and Khan, 2016). Starch and sugars are the main types of carbohydrates. Grains and vegetables (corn, pasta, rice, potatoes and breads) are sources of starch (Pyne and Macdonald, 2016).

2.5.2 Protein

The comparison of proteins with non-proteins points out the importance of proteins in children's diets and tells us what types of interventions might have a bigger impact on height and weight, but there is limited literature focused on the differentiation between protein energy and total energy. A randomized evaluation of children up to two years of age in several European countries indicated that ingesting baby formula with a high protein content (% calories from protein) increased weight, but not height. Proteins and amino acids serve as the main structural component of all cells in the body and function as enzymes in membranes, as transport carriers of some hormones (Puentes, Wang, Behman, Cunha, Hoddinott, Maluccio, Adair, Borja, Martorell and Stein, 2016).

During digestion and absorption dietary proteins are broken down into amino acids which become building blocks of these structural and functional compounds. Nine of the amino acids must be consumed in the diet and these are named indispensable amino acids. The body can manufacture other amino acids required to synthesize specific structures from other amino acids. Protein from animal sources are meat, poultry, fish, eggs, milk (Wardlaw and Smith, 2011).

Cheese and yoghurt provide all nine indispensable amino acids in sufficient amounts and for this reason are called 'complete proteins'. Proteins from plants, legumes, nuts, grains, seeds and vegetables tend to be deficient in one or more of the indispensable amino acids and as a result are termed 'incomplete proteins'. Vegan diets with enough total protein content can be 'complete' by combining sources of incomplete protein, which lack certain indispensable protein (Wardlaw and Smith, 2011).

2.5.3 Fat

Total fat is an energy source and when found in food it is a source of n-6 and n-3 polyunsaturated fatty acids. Consumption in pregnancy and early life affect cognitive performance and growth later in childhood. Total fat intake, alpha-linolenic acid (ALA) and DHA intakes are often low among infants, young children and pregnant and lactating women in developing countries. Breast milk is one of the best sources of ALA and DHA and breastfed infants are less likely to be at risk of insufficient intakes than those not breastfed. Its presence in the diet increases absorption of fat-soluble vitamins and precursors of vitamin A and pro-vitamin A carotenoids. Polyunsaturated fatty acids (n-6/linoleic acid) are an important component of structural membrane lipids involved with cell signaling and precursors of eicosanoids needed for normal skin functioning (Huffman, Harika, Eilander and Osendarp, 2011).

Food sources are nuts and vegetable oils such as soybean safflower and corn oil. Polyunsaturated n-3 (α-linolenic acid) is involved with neurological development and growth. Food sources are soybean, canola and flax seed oil, fish oils, and fatty fish with smaller amounts found in meats and eggs. Saturated and trans-fatty acids and cholesterol have no role other than as a source of energy. The body can manufacture its needs for saturated fatty acids and cholesterol from other sources (Roccisano, Kumaratilake, Saniotis and Henneberg, 2016).

2.5.4 Fibre

Fibre improves laxation and minimizes the risk of coronary heart disease and assists in maintaining normal blood glucose levels (Wardlaw and Smith, 2011). Food sources of fibre are oats, wheat or un-milled rice and functional fibre manufactured or isolated from plants or animals and are indicated to be of benefit to health. There are two types of dietary fibre defined by their physical behaviour in water (Wardlaw and Smith, 2011).

Table 2.1: Sources of fibre

Type	Examples
Insoluble fibre	Cellulose, lignin and some hemicelluloses: abundant in whole grain cereals, gum.
Soluble fibre	Mucilages and pectins contained especially in fresh vegetables, legumes, fruit, beta-glucans, oats, barley and some yeast.

2.5.5 Water

Water is vital for life. Without water humans, can survive only for a few days. Water comprises 75% of body weight in infants to 55% in the elderly and is important for cellular homeostasis and life (Popkin, D'Anci and Rosenberg, 2010). Water forms the basis of blood, digestive juices and perspiration and is kept in lean muscle, fat and bones. The body cannot store water so we need a fresh supply every day to make up for losses from the lungs, skin, urine and faeces (Wardlaw and Smith, 2011).

The amount of water we need depends on our body size, metabolism, the weather, the food we eat and our activity levels. As the child exercises the muscles generate heat, raising the body temperature. When the body gets hot it sweats, and the evaporating sweat cools the body. If the child does not replace the water lost through sweating by drinking more fluids, the body's water balance will be upset and the body may overheat. To keep from dehydrating the child must drink fluids before, during and after exercise (Yeargin 2015). Severe dehydration of about 20% can lead to death (Kant and, Graubard, 2010).

Functions of water in the body:

- Maintains the health and integrity of every cell in the body.
- Keeps the blood stream liquid enough to flow through the blood vessels.
- Helps remove by products of the body's metabolism, excess electrolytes (sodium and potassium), and urea which is a dietary protein waste product.
- Regulates body temperature through sweat.
- Moistens mucus membrane such as that found in the lungs and mouth
- Lubricates and moistens joints.
- Minimizes the risk of cystitis by keeping the bladder clear of bacteria.
- Aids in digestion and prevents constipation.
- Moisturizes the skin and maintains its texture and appearance.
- Carries nutrients and oxygen to cells.
- Absorbs shock inside the eyes, spinal cord and in the amniotic sac around the fetus during pregnancy. The European Hydration Institute (2013) notes that children are susceptible to dehydration especially when they are sick, as vomiting, fever and diarrhea can quickly dehydrate a baby (Kant and Graubard, 2010; Wardlaw and Smith, 2011).

2.6 Micro-nutrient requirements and food sources for children

The nutrition situation in South Africa shows that both under- and overnutrition exists (Acham, Egal and Oldewage-Theron, 2012). At national level, more than half of women are either obese or overweight and on the other hand children suffer from undernutrition (Darnton-Hill and Samman, 2015; Kruger, Steyn, Swart, Maunder, Nel, Moeng and Labadarios, 2012).

Micronutrient malnutrition often called 'hidden hunger' is a serious public health problem in South Africa. Vitamin A, iron deficiency, anaemia, iodine and zinc deficiencies are cited as the most imperative micronutrient problems (Burchi, Fanzo, and Frison, 2011).

The following table 2.2 is a summary of Dietary Requirement Intakes (DRIs) for macro- and micro-nutrients for children between 4 to 8 years old and 9 to13 years old.

Table 2.2: Dietary Requirement Intakes (DRIs) for macro- and micro-nutrients for children between 4 to 8 years old and 9 to13 years old

MACRO-NUTRIENTS	REQUIREMENTS PER DAY (4 to 8 YEARS)		REQUIREMENTS PER DAY (9 to 13 YEARS)	
	Boys	**Girls**	**Boys**	**Girls**
Energy (EER kJ/day)	7316 KJ	6896KJ	9572KJ	8698KJ
• Carbohydrates (EAR)	100g/day	100g/day	100g/day	100g/day
Fibre (AI)	25g/day	25g/day	31g/day	26g/day
Protein (RDA)	19g/day	19g/day	34g/day	34g/day
MICRO-NUTRIENTS				
Calcium (AI)	800mg/day	800mg/day	1300mg/day	1300mg/day
Zinc (EAR)	4.0mg/day	4.0mg/day	7.0mg/day	7.0mg/day
Iron (EAR)	4.1mg/day	4.1mg/day	5.7mg/day	5.9mg/day
Iodine (EAR)	65mcg/day	65mcg/day	73mcg/day	73mcg/day
Phosphorus (EAR)	405mg/day	405mg/day	1055mg/day	1055mg/day
Magnesium (EAR)	110mg/day	110mg/day	200mg/day	200mg/day
Fluoride (AI)	1.1mg/day	1.1mg/day	2.0mg/day	2.0mg/day
Selenium (EAR)	23mcg/day	23mcg/day	35mcg/day	35mcg/day
Chromium (AI)	15mcg/day	15mcg/day	25mcg/day	25mcg/day
Vitamin A (EAR)	275mcg/day	275mcg/day	445mcg/day	420mcg/day
Vitamin C (EAR)	22mg/day	22mg/day	39mg/day	39mg/day
Thiamine (EAR)	0.5mg/day	0.5mg/day	0.7mg/day	0.7mg/day
Riboflavin (EAR)	0.5mg/day	0.5mg/day	0.8mg/day	0.8mg/day
Vitamin D (AI)	5mg/day	5mg/day	5mg/day	5mg/day
Vitamin B_6 (EAR)	0.5mg/day	0.5mg/day	0.8mg/day	0.8mg/day
Vitamin B_{12} (EAR)	1.0mcg/day	1.0mcg/day	1.5mcg/day	1.5mcg/day
Vitamin E (EAR)	6mg/day	6mg/day	9mg/day	9mg/day
Vitamin K (AI)	55mcg/day	55mcg/day	60mcg/day	60mcg/day
Folic acid (EAR)	160mcg dietary FE/day	160mcg dietary FE/day	250mcg dietary FE/day	250mcg dietary FE/day
Nicotinic acid (EAR)	6.0mg NE/day	6.0mg NE/day	9.0mg NE/day	9.0mg NE/day
Biotin (AI)	12mcg/day	12mcg/day	20mcg/day	20mcg/day

(Source: Dietary reference intakes for energy, carbohydrates, fibre, fat, fatty-acid, cholesterol, protein and amino acid 2002).

2.6.1 Vitamin A

Vitamin A (retinol) is mostly found in foods of animal origin such as egg yolk, organ meat and dairy products. Due to the high cost of animal vitamin A sources, the majority of the African and Asian population depend on plant sources for vitamin A which come in the form of provitamin A carotenoids (mostly B-caroten) found in fruits and vegetables (Schonfeldt and Hall, 2013)

According to Comley, Nkwanyana and Coutsoudis (2015), children in South Africa consume insufficient vitamin A. Vitamin A supplementation was introduced by the WHO and international agencies to stop the effects of vitamin A deficiency in children, that is, increased risk of diarrhoea, measles, blindness, impaired functioning of the immune system and the associated increased number of child mortalities. The insufficient consumption of vitamin A by most South African children contributes to subclinical vitamin A deficiency and stunted children. Maize and flour fortification in South Africa started in October 2003 and it has required the addition of iron, vitamin A, zinc, thiamin, riboflavin and vitamin B6 to all maize and wheat flour. Mineral and vitamin enriched foods should be imperative for individuals suffering from illnesses such as HIV and AIDS or TB, but there is little proof demonstrating their effectiveness and efficacy (Rudolph, Kroll, Beery, Marinda, Sobiecki, Douglas and Orr, 2013). Vitamin A is important to support healthy eyesight and immune system functioning. Children who suffer a deficiency face an increased risk of blindness and death from infection such as diarrhoea and measles (WHO, 2014c).

Worldwide, one in three pre-school children and one in six pregnant women are Vitamin A deficient as a result of inadequate dietary intake. Vitamin A supplementation of children between 6–59 months has shown to be highly effective in reducing mortality from all causes in countries where Vitamin A deficiency is a public health concern (Center for Disease Control, 2015).

Vitamin deficiency may include growth faltering, infection, eye disease, blindness and even death since vitamin A plays a major role in maintaining epithelial tissue and immune function. Vitamin A deficiency is most serious in periods of greatest vitamin A requirement which are during infancy, childhood and pregnancy (Hendricks, Kruger and Puoane, 2016). According to Faber, Van Jaarsveld, Wenhold and Van Rensburg (2010) in South Africa, childhood malnutrition as a result of insufficient vitamin A consumption is still the greatest challenge. In South Africa, two out of three children and one out of four women have a poor vitamin A status. The frequency of a poor vitamin A status in children in the country appears to have increased when compared with previous national data.

In addition to the high prevalence of poor vitamin A status, the national vitamin A supplementation programme coverage was found to be only 20.5% for children 1-9 years. Home gardens have made a major difference in decreasing the vitamin A deficiency level in South Africans. Households with home gardens have been said to have children with higher vitamin A intake than children from households without home gardens (Paoane, Sanders and Mason, 2008).

Dietary Reference Intake for vitamin A in children: the EAR for vitamin A in children aged between 4 to 8 years is 400mcg/day for both girls and boys, and 600mcg/day for ages 9 to 13 years for both girls and boys (Institute of Medicine, 2001).

2.6.2 Vitamin C

Vitamin C is a water-soluble vitamin that is necessary for normal growth and development. It is required for the growth and repair of tissue in all parts of our body and produces connective tissue which binds the body cells together. It is also necessary for the absorption of iron and in the formation of hemoglobin (Kabir, Shahjalal, Saleh, and Obaid, 2010). Dietary Reference Intake for (vitamin C) in children: the estimated average intake (EAR) for children 4 to 8 years is 25mg/day for both girls and boys, and 45mg/per day for children 9 to13 years for both girls and boys (Lehman, 2016).

Dietary sources of (vitamin C): sources of vitamin c are oranges, green peppers, watermelon, papaya, grapefruit, cantaloupe, strawberries, kiwi fruit, mango, broccoli, tomatoes, Brussels sprouts, cauliflower, cabbage and citrus juices fortified with vitamin c. Also, raw and cooked leafy greens (turnip greens and spinach), potatoes, winter squash, raspberries, blueberries, cranberries, and pineapples. Vitamin c is heat, light and air sensitive; you will get the most vitamin C if you eat fruit and vegetables in their raw state ((Chernoff, 2013).

2.6.3 Thiamine (vitamin B1)

Thiamine (vitamin B1) is needed for reactions involved in the metabolism of carbohydrates, helping release energy from CHO, amino acids and lipids. Insufficient consumption of thiamine can negatively affect cognition. Acute thiamine deficiency causes beriberi. Beriberi occurs in infants that are human-milk fed whose nursing mothers are thiamine deficient (Wardlaw and Smith 2011). Dietary Reference Intake for thiamine (vitamin B1) in children: the EAR for thiamine in both girls and boys is 600mcg/day for ages 4 to 8 years, and 900mcg/day for both girls and boys, ages 9 to 13 years (Institute of Medicine, 2001).

Dietary sources of thiamine (vitamin B1): soybean sprouts, cooked; green peas, cooked; lima beans, cooked; squash, corn, cooked; corn flour, pasta, egg noodles, cooked; oatmeal, instant, cooked; hot oat bran cereal, cooked; muesli and granola, bread (white, whole wheat, rye and mixed grain); soy beverages; pork, various cuts, cooked; pork, ground, cooked; fish and seafood, mussels, cooked; soy burger, meatless (chicken, fish sticks, meatballs), cooked; nuts (pistachio, macadamia, brazil nuts, hazelnuts, pecans, peanuts) without the shell; tahini/sesame seed butter (Dieticians of Canada, 2014).

2.6.4 Vitamin D

Vitamin D is a fat-soluble vitamin that is important for maintaining normal calcium metabolism and so is needed for bone health. Acute vitamin D deficiency in infants and children results in the failure of bones to mineralize, resulting in a condition called rickets. Fast-growing bones are mostly affected by rickets. In acute cases of vitamin D deficiency, low serum levels and calcium levels (hypocalcemia) may include seizures (Wardlaw and Smith, 2011). Dietary Reference Intake for vitamin D in children: the AI for both ages and both girls and boys is 5mcg/day ((Institute of Medicine, 2001).

Dietary sources of vitamin D: orange juice fortified with vitamin D, skim milk powder, egg yolk, cooked; pork, various cuts, cooked; beef, liver, cooked; fish and sea food, salmon, sockeye/red, canned, cooked or raw; snapper, cooked; white lake fish, cooked; mackerel, cooked; herring, sardines, pacific, canned; cod liver oil (Dieticians of Canada, 2014).

2.6.5 Vitamin B6

Pyridoxine, pyridoxal and pyridoxamine are collectively called vitamin B6 which is a coenzyme in the metabolism of amino acids and carbohydrates. Dietary Reference Intake for vitamin B6 in children: the EAR for both girls and boys ages 4 to 8 years is 600mcg/day, and 1mcg/day for both girls and boys ages 9 to 13 years (Institute of Medicine, 2001).

Dietary sources of vitamin B6: potato with skin, cooked; sweet potato with skin, cooked; carrot juice, banana, durian fruit, prune juice, prunes, canned; wheat bran; oatmeal instant, cooked; liver (turkey, beef), cooked; liver (chicken) cooked; pork, various cuts, cooked; beef, various cuts, cooked; tuna yellowfin/albacore raw or cooked; skinless chicken, cooked (Dieticians of Canada, 2014).

2.6.6 Vitamin B12 (Cobalamin)

Vitamin B12 deficiency has been associated with cognitive development in the elderly but less is known about its effects on children's cognitive development. Rates of vitamin B12 deficiency may possibly be high because animal products are the only source of vitamin B12. Most of the research on the relationship between vitamin B12 deficiency and cognitive development in children is limited to case studies of infants of mothers with pernicious anemia who are unable to absorb vitamin B12 or vegan mothers. These infants are at risk for delayed developmental milestones (Duong, Mora-Plazs, Marin and Villamore, 2015).

Dietary Reference Intake for vitamin B12 in children: the EAR for ages 4 to 8 years for both girls and boys is 1.2mcg/day and 1.8mcg/day for ages 9 to 13 years for both sexes (Institute of Medicine, 2001). Dietary sources of vitamin B12: shell fish (cooked clams), liver (beef), fish (mackerel), crustaceans (crab), fortified soy products (silken tofu), fortified cereals (all bran), red meat (beef), low fat dairy (skim milk), cheese (Swiss), eggs (chicken) (Dieticians of Canada, 2014).

2.6.7 Vitamin E

Vitamin E is an antioxidant. It protects cells against free radicals and it plays an important role in immune function, in DNA repair and in blood clotting (Wardlaw and Smith, 2011:302). Dietary Reference Intake for vitamin E in children: the EAR for ages 4 to 8 years is 7mcg/day for both boys and girls, and 11mg/day for ages 9 to 13 years for both girls and boys ((Institute of Medicine, 2001).

Dietary sources of vitamin E: sunflower seeds, dry, roasted; almonds; spinach, cooked; safflower oil; beet greens, cooked; pumpkin; red pepper, raw, cooked; asparagus, collard, green, cooked; mango, raw; avocado, raw; peanut butter (Wardlaw and Smith, 2011).

2.6.8 Vitamin K

Vitamin K is responsible for blood coagulation and bone growth. At birth, a new-born baby's intestinal tract has insufficient amounts of bacteria to make sufficient vitamin K to allow for effective blood clotting and this is given routinely by injection after birth to ensure blood clotting if the infant is hurt or gets injured (Wardlaw and Smith, 2011:306). Dietary Reference Intake for vitamin K in children: the AI for vitamin K for ages 4 to 8 years in both girls and boys is 55mcg/day and 60mcg/day for ages 9 to 13 years for both girls and boys (Institute of Medicine, 2001).

Dietary sources of vitamin K: kale, spinach, collard greens, Swiss chard, raw and cooked; mustard greens, cooked and raw; turnip greens, parsley, broccoli, Brussels sprouts, endive, cabbage, green leafy lettuce, prunes, stewed, romaine lettuce, asparagus, avocado; tuna, canned in oil; blue/black berries, raw and peas, cooked (Wardlaw and Smith, 2011).

2.6.9 Folic Acid (folate)

Deficiency in folic acid causes a risk of neural tube defects such as spina bifida and anencephaly in newborns. Supplementation during pregnancy can help prevent birth defects and anemia, as folic acid improves iron absorption in the body (Wardlaw and Smith, 2011; Dieticians of Canada, 2016). Dietary Reference Intake for folic acid in children: the EAR for folic acid is 200mcg dietary FE/day for ages 4 to 8 years for both girls and boys, and 300mcg dietary FE/day for ages 9 to 13 years for both sexes ((Institute of Medicine, 2001).

Dietary sources of folic acid: okra, frozen or cooked; spinach, cooked; artichoke, cooked; turnip greens, collards, broccoli, asparagus, cooked; avocado, papaya, orange juice, pasta, egg noodles, enriched, cooked; pasta, white, enriched, cooked; bread, whole wheat, white; beans; cranberry/roman, cooked; soy nuts; liver (turkey, chicken, cooked); liver (lamb, veal), cooked (Wardlaw and Smith, 2011).

2.6.10 Nicotinic acid (niacin)

Niacin is a water-soluble vitamin which is also called nicotinic acid or vitamin B3. Nicitinamide is the derivative of niacin and is used by the body to form the coenzyme cicotinamide adenine dinucletide (NDA) and nicitinamide adenine dinucleotide phosphate (NADP). The late stage of acute niacin deficiency is called pellagra (Wardlaw and Smith, 2011:299). Dietary Reference Intake for niacin in children: the EAR for nicotinic acid for ages 4 to 8 years for both girls and boys is 6.0mg NE/day, and 8,0mg NE/day for ages 9 to 13 years for both girls and boys ((Institute of Medicine, 2001).

Dietary sources of nicotinic acid (Niacin/vitamin B3): beets, brewer's yeast, beef liver, beef kidney, fish, salmon, swordfish, tuna, sunflower seeds, peanuts ((Institute of Medicine, 2001).

2.6.11 Biotin

Biotin (vitamin B7) is needed as a cofactor for carboxylase enzyme that is crucial in the metabolism of fatty acids and amino acids. Overt biotin deficiency is not common but has been documented in patients on prolonged intravenous feeding (parenteral nutrition) without biotin supplementation (Wardlaw and Smith, 2011).

Dietary Reference Intake for biotin in children: the AI for biotin is 12mcg/day for ages 4 to 8 years for both girls and boys, and 20mcg/day for ages 9 to 13 years for both sexes.

Dietary sources of biotin: yeast; bread, whole wheat; egg, cooked; cheese, cheddar; liver, cooked; pork, cooked; salmon, cooked; avocado, raspberries, cauliflower, raw (Zempleni and Kuroishi, 2012).

2.6.12 Calcium

An estimated 99% of calcium in the body is found in bones and teeth. Sufficient consumption of calcium throughout childhood and adolescence is imperative for proper mineralization of growing bones, achievement of peak bone mass and reduction of risk of osteoporosis in adulthood (Wardlaw and Smith, 2011).

Dietary intake recommendations for calcium in children are based on the calcium intake needs to support bone accretion and overall calcium retention (i.e. the dietary intake needed to obtain a positive calcium balance). Calcium intake recommendations are higher in children ages 9 to 13 years to account for increased needs of the mineral during adolescence (Drake, 2011).

Dietary Reference Intake for calcium in children: the AI requirement for ages 4 to 8 years for both girls and boys is 800mg/day and 1300mg/day for ages 9 to 13 years for both girls and boys ((Institute of Medicine, 2001). Dietary sources of calcium: yoghurt, plain, low fat; collards (frozen, boiled); skim milk; salmon, canned; calcium-set tofu; iceberg lettuce; green peas, boiled; soy milk; oranges; almonds; baked beans, canned (Wardlaw and Smith, 2011).

2.6.13 Zinc

The most important effect of zinc deficiency is its impact on children`s resistance to infectious disease including the risk of infection, the reoccurrence of infection and the severity of infection. This is well recorded in the case of diarrhoea. Zinc deficiency is a vital determinant of mortality in children. The mineral zinc is crucial for growth and development, immune function, neurological function and reproduction. Low zinc consumption appears to be a common public health problem. Zinc deficiency has been linked to low activity and depressed motor development among the most vulnerable children (Moran, Skinner, Medina, Patel, Dykes, Souverein, Dullemmeijer and Lowe, 2012).

According to Kumssa, JoAnder, Watts, Young, Walker and Broadley, (2015) in 2011, 3.5 and 1.1 billion people were at risk of calcium (Ca) and zinc (Zn) deficiency respectively. Between 1992 and 2011, the worldwide risk of deficiency of Ca and Zn reduced from 76 to 51% and 22 to 16% respectively.

There is overwhelming evidence for the contribution of zinc deficiency to growth faltering among children; even mild to moderate zinc deficiency could affect growth (Moran, Skinner, Medina, Patel, Dykes, Souverein, Dullemeijer and Lowe, 2012). Dietary Reference Intake for zinc in children: the EAR for zinc in children aged between 4 to 8 years is 5.0mg/day for both girls and boys, and 8.0mg/day for aged 9 to 13 years for both girls and boys (Institute of Medicine, 2001). Dietary sources of zinc: pumpkin seeds; dark chocolate; garlic; sesame seeds; watermelon seeds; wheat germ; squash seeds; chickpeas (Wardlaw and Smith, 2011).

Figure 2.1 Acrodermatitisenteropathica caused by a deficiency in zinc
(Source: http://oxfordjournals.org/our_journals/tropej/online/mcnts_chap10pdf).

2.6.14 Iron

Iron deficiency anemia affects physical growth. A number of observational studies have discovered that children who experience anemia in early life continue to experience lower academic performance during their school-age years, even after the anemia had been dealt with (Lozoff, 2011; Algarin, Nelson, Peirano, Westerlund, Reyes and Lozoff, 2013).

The WHO also estimated that 51% of children under 4 years old in developing countries are anemic as a result of iron deficiency (Kweagwu, Agwu and Madukwe, 2008). Dietary Reference Intake for iron in children: the EAR for iron in children aged between 4 to 8 years is 10mg/day for both girls and boys and for girls aged 9 to 13 years the EAR is 8mg/day and 8mg/day for boys aged 9 to 13 years (Institute of Medicine, 2001).

Dietary sources of iron: beef chuck, lean; beef, corned; beef flank; beef liver; beef round; chicken breast, roasted; chicken leg, meat only, roasted; flounder, baked; pork, lean; ham; pork loin chops; salmon, pink, canned; tuna, canned in water; turkey dark meat, turkey white meat (Wardlaw and Smith, 2011).

2.6.15 Iodine

Iodine and selenium are necessary in the normal functioning of the thyroid gland and insufficient intake of both micronutrients causes hypothyroid cretinism (Bath *et al.*, 2013). Iodine is an important component of at least two thyroid hormones that are required for skeletal growth, foetus growth and neurological development (Wardlaw and Smith, 2011).

Dietary Reference Intake for iodine in children: the EAR for iodine in children aged between 4 to 8 years in both girls and boys is 90mcg/day and 120mcg/day for aged 9 to 13 years for both girls and boys (Institute of Medicine, 2001). Dietary sources of iodine: cheese; cow`s milk; eggs; frozen yoghurt; ice cream; iodine containing multivitamins; iodized table salt; salt water fish; seaweed (including kelp, dulce, nori); shellfish; soy milk; soy sauce; yoghurt (American Thyroid Association, 2012).

Figure 2.2 Goitre (left) and cretinism (right) caused by iodine deficiency
(Source: http://oxfordjournals.org/our_journals/tropej/online/mcnts_chap10pdf)

2.6.16 Phosphorus

Phosphorus is an imperative component of cell membrane and nucleic acids and also involved in several biological processes including bone mineralization. Dietary phosphorus deficiency is uncommon and often observed in cases of near-total starvation or in rare inherited disorders involving renal phosphorus wasting. Phosphorus is a main structural component of bone in the form of calcium phosphate salt called hydroxyapatite (Wardlaw and Smith, 2011).

Dietary Reference Intake for phosphorus in children: the EAR for phosphorus in both girls and boys aged between 4 to 8 years is 500mg/day, and 1050mg/day for children aged between 9 to 13 years in both girls and boys ((Institute of Medicine, 2001).

Dietary sources of phosphorus: cocoa, dark, colas, cottage cheese, ice cream, pudding, yoghurt, crayfish, chicken liver, organ meats, sardines, black beans, garbanzo beans, lentils, split peas, brewer`s yeast, nuts and wheat germ (National Kidney Foundation, 2017).

2.6.17 Magnesium

According to Ahsan, Rahsan, Phil, Ramatullah, Ahsan, Khan and Islam, (2013) magnesium is important for normal muscle and nerve function, maintaining a healthy immune system, maintaining heart rhythm and building strong bones. The element is involved in at least 300 biochemical reactions in the body. Magnesium deficiency is prevalent in severely malnourished children (Cloete, 2015). Dietary Reference Intake for magnesium in children: the EAR for magnesium for aged between 4 to 8 years for both girls and boys is 130mg/day and 240mg/day for children aged between 9 to 13 years for both girls and boys ((Institute of Medicine, 2001).

Dietary sources of magnesium: almonds, dry roasted; spinach boiled; cashews, dry roasted; peanuts, oil roasted; black beans, cooked; peanut butter, smooth; bread, whole wheat; avocado; rice, brown, cooked; oatmeal, instant; milk; raisins; chicken breast, roasted; beef, ground, lean; broccoli, cooked (Wardlaw and Smith, 2011).

2.6.18 Fluoride

Fluoride performs no important function in human growth and development and no signs of fluoride deficiency have been identified. Despite the fact that fluoride is not important for tooth development, its function in the prevention of dental carries has been known for many years (Europian Food Safety Authority, 2013).

According to Wenhold, Kruger and Muehlhoff (2008) a study in a rural Limpopo region with a low incidence of dental caries among the children gave researchers the opportunity to study the diets of children not exposed to risk factors for dental caries and compare them with children in a town in the same province who were at risk. The percentage of caries-free children in the town was 36% compared to 88% in the rural village. Estimated fluoride intake was significantly lower and the mean total for added sugar intake higher in the town than in the rural village, thus the lower sugar, higher fluoride intake among the rural children added to the reduced dental caries experience (Wenhold *et al*., 2008).

Dietary Reference Intake for fluoride in children: the AI for fluoride is 2.2mg/day for both girls and boys aged between 4 to 8 years and 10mg/day for children aged between 9 to 13 years for both girls and boys (Wardlaw and Smith, 2011). Dietary sources of fluoride: drinking water treated with fluoride, tea, sea food, seaweed (Wardlaw and Smith, 2011).

2.6.19 Selenium

Selenium is a trace mineral that is vital for good health but only needed in small amounts. Selenium is included in protein to make selenoproteins, which are necessary antioxidant enzymes called glutathione peroxidase (Rayman, 2012; Dieticians of Canada, 2016).

Dietary Reference Intake for selenium in children: the AI for fluoride in children aged 4 to 8 years for both girls and boys is 30mcg/day, and for children aged between 9 to 13 years for both girls and boys it is 40mcg/day ((Institute of Medicine, 2001).

Dietary sources of selenium: mushrooms (portabella, shiitake, crimini), raw or cooked; couscous, cooked; pasta, egg noodles, enriched and cooked; yoghurt; soy; cottage cheese; brazil nuts, without shell; egg, cooked; tofu; beans, pinto; oysters, pacific, cooked; tuna, light white meat, canned; salmon, cooked; sardines, canned in oil; chicken or turkey; beef, various cuts, cooked; lamb, (Dieticians of Canada, 2016).

2.6.20 Chromium

Chromium acts as a cofactor by facilitating the attachment of insulin to receptors on the surface of the targeted cell as well as within the cell. It creates a complex compound made up of chromium-amino acid-nicotinic acid, which is called glucose tolerance factor (Wardlaw and Smith, 2011).

Dietary Reference Intake for chromium in children: the AI for chromium in children aged between 4 to 8 years for both girls and boys is 15mcg/day and 25mcg/day for children aged between 9 to 13 years of both sexes ((Institute of Medicine, 2001).

Dietary sources of chromium: Brewer's yeast, organ meat, mushrooms, oatmeal, prunes, nuts, asparagus, fruit, vegetables and whole grains and cereal (Chernoff, 2013).

2.6.21 Riboflavin (vitamin B2)

Riboflavin is a water-soluble B vitamin, also called vitamin B2. In the body riboflavin is mainly found as an important component of the coenzyme, flavinadenine dinucleotide (FAD) and flavin mononucleotide (FMN). Living organisms get most of their energy from redox reactions. Other minerals and vitamins metabolism requires riboflavin. Flavocoenzymes take part in the redox reaction in different metabolic pathways. They are vital for the metabolism of carbohydrates, lipids and proteins (Rivlin 2012, Wardlaw and Smith, 2011).

Dietary Reference Intake for riboflavin in children: the EAR for riboflavin (vitamin B2) in children aged 4 to 8 years for both girls and boys is 600mcg/day, and 900mcg/day in children aged 9 to 13 years for both girls and boys ((Institute of Medicine, 2001).

Dietary sources of riboflavin: fortified wheat, puffed; cereal; milk (nonfat); cheddar cheese; eggs, cooked, hard-boiled; almonds; salmon, cooked; chicken, light meat, roasted; beef, ground, cooked; broccoli, boiled; asparagus, boiled; spinach, boiled; bread, whole wheat, bread, white enriched (Manios, Moschonis, Dekkers, Mavrogianni, Grammatikaki and Van dern Heuvel, 2015).

2.6.22 Copper

Copper is involved in the metabolism of iron by working in the formation of hemoglobin and transportation of iron. It assists the body to manufacture red blood cells and keeps nerve cells and the immune system healthy. It assists in the formation of collagen, an integral part of bones and connective tissue. It may also act as an antioxidant, getting rid of free radicals that damage cells and DNA. The biochemical role for copper is mainly catalytic with many copper metalloenzymes acting as oxidisers to accomplish the reduction of molecular oxygen (Wardlaw and Smith, 2011).

Dietary Reference Intake for copper in children: the EAR for children 4 to 8 years is 440mcg/day and for children aged 9 to 13 years for both boys and girls it is 700mcg/day. The RDA for children 4 to 8 years is 440mcg/day and for children 9 to 13 years it is 700mcg/day ((Institute of Medicine, 2001).

Dietary sources of copper: oysters, squid, lobster, mussels, nuts, legumes such as soy beans, enriched cereals such as corn flakes (Wardlaw and Smith, 2011).

2.6.23 Molybdenum

Molybdenum is an important trace element for almost all life forms. It works as a cofactor for many enzymes that catalyze important chemical transformations in the global nitrogen, carbon, and sulfur cycles (Coughlan, 2014).

Dietary reference intake for molybdenum: the EAR for children aged between 4 to 8 years is 600ug/day for both girls and boys and for children aged between 9 to 13 years it is 1,100ug/day (Wardlaw and Smith, 2011).

Dietary sources of molybdenum: pulses, cereal grains and grain products and nuts (Wardlaw and Smith, 2011).

2.6.24 Potassium

Potassium is an important nutrient necessary for the maintenance of total body fluid volume, acid and electrolyte balance and normal cell function. Under normal circumstances most ingested potassium is excreted via urine. Under extreme heat and intense physical activity that produces high sweat, potassium losses are increased and appreciable. Acclimation occurs fast and potassium losses via sweat are reduced fast and as a result the majority of individuals can replace needed potassium through the ingestion of food without the need for supplementation (WHO, 2012). Current evidence suggests that an increased intake of potassium decreases blood pressure (Wardlaw and Smith, 2011).

Dietary reference intake of potassium: the recommended intake for potassium in children 4 to 8 years of age is 1.900mg/day and for children 9 to 13 years of age it is 2.200mg/day (Wardlaw and Smith, 2011).

Dietary sources of potassium: leafy green vegetables, fruit and vegetables, meat, milk, and cereal products (Wardlaw and Smith, 2011).

2.6.25 Sodium

Limiting salt consumption and boosting potassium in children`s diets will decrease the risk of hypertension, heart disease and stroke in future generations (WHO, 2013). WHO recommends a decrease in salt intake to control blood pressure in children. The recommended maximum level of consumption of 2g/day in adults should be adjusted downwards based on the energy needs of children relative to those of adults (WHO, 2012). Too much sodium and too little potassium is linked to high blood pressure, also called hypertension (WHO, 2012). Hypertension is a leading risk factor for heart disease, stroke and other cardiovascular diseases (Wardlaw and Smith, 2011).

Dietary reference intake of sodium: intake of sodium in children 2 to 15 years should be limited to less than 2,000mg/day (WHO, 2013)

Dietary sources of sodium: processed foods, bread and rolls, cured meats, canned vegetables (Wardlaw and Smith, 2011).

2.7 Factors contributing to malnutrition in children

2.7.1 Parents' influence on children's food choices

Children model the behaviours and attitude of adults and siblings around them. When children are young, parents are the main role models in their lives. Children are likely to inherit the same eating habits as their parents therefore it is important that they set good examples of good food choices (eufic, 2012).

Child-specific aspects of the family environment, including mother's child-feeding practices and perceptions of their daughter's risk of obesity may indicate vital non-shared, environmental influence on the daughter's eating and relative weight (Kral and Rauh, 2010).

Parents play a direct role in children's eating patterns through their behaviors, attitudes and feeding styles (Kral and Rauh, 2010). In the majority of familyies women still have the primary responsibility of preparing meals and feeding the children. Changes in employment patterns and family structures leave women with less time to dedicate to this activity. From 1975–2004, labor force participation by woman with children under eighteen years of age increased from 47% to 71% (Savage, Fisher and Birch, 2007).

Both family history and early childhood obesity have been identified as strong indicators of adult obesity risk. The discovery that parental obesity, maternal obesity especially, increases a child's risk of developing obesity indicates that either shared genes, or environment or a combination of both may promote overeating and excessive weight gain in children (Kral and Rauh, 2010).

Parents create food environments for children, and earlier experiences with food and eating can influence children's eating by modeling parents' eating behaviours, food choices and taste preferences (Kral and Rauh, 2010).

A study conducted by (Sleedens, Gerards, Thijs, De Vries and Kremers., 2011) found that overall, children brought up in authoritarian homes ate healthier, were more physically active and had lower BMI levels when compared with children who were raised with other styles such as permissive/ indulgent, uninvolved/ neglectful.

2.7.2 School feeding programmes

School feeding programmes are a well-established provision of social protection programme, by providing children with meals, take-home parcels and snacks. School feeding programmes seek to overcome food and nutritional deficiencies. It can improve enrolment especially girls and learning outcomes (Sumberg and Sabates-Wheeler, 2011). School feeding programmes can provide an incentive for poor families to send their children to school and keep them there at the same time improving their education, keeping the country`s economy healthy and creating a literate society (Bundy, 2009).

The United Nation met in Dakar in 2000 to commit itself to eradicating hunger and the attainment of global primary education. School feeding schemes was one of the interventions used to deal with these challenges. School feeding falls within the ambit of the Millennium Development Goals (MDG), namely MDG1 (to eradicate extreme poverty and hunger), MDG 2 (to achieve universal primary education), MDG 3 (to promote gender equality and empower woman) (Tomlinson, 2007).

Putting a school feeding scheme in place is dependent on the objective aimed to be achieved and also on other factors such as:

1) Legislation
2) Resource constraints
3) Prevailing circumstances.

In South Africa, the National School Nutrition Programme (NSNP) is implemented only in public schools where the vast majority of the learners are identified as being in need.

Criteria for menu options in the South African National School Nutrition Programme are the following. They must:

- Ensure nutritional balance reflecting the messages from the food-based dietary guidelines;
- Meet at least 30% of the RDA for the 7 to 10 years old group;
- Include only socially and culturally acceptable and locally consumed food items;
- Give preference to fortified maize meal and bread baked with fortified wheat flour;
- Encourage the use of indigenous, seasonally available foods;
- Provide a variety of foods to choose from;
- Discourage the use of highly processed foods;
- Ensure the use of real dairy products;
- Have safe drinking water available.

There are three basic rationales for school feeding – child-focused, nutrition- and education-based as shown in Figure 2.3 below.

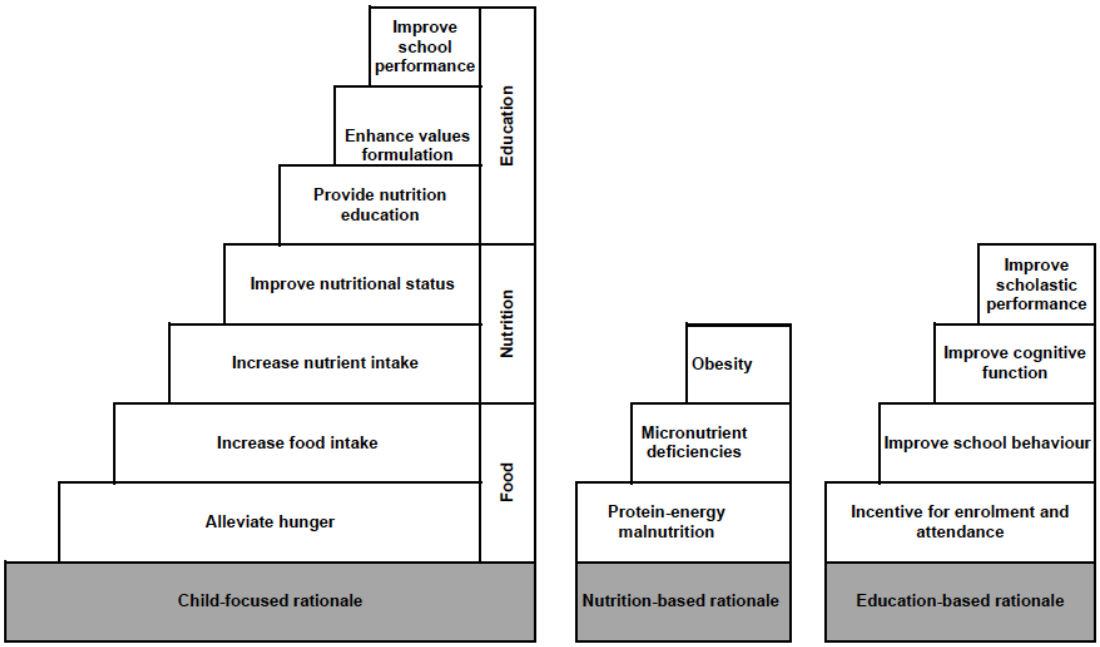


Figure 2.3 Different rationales for school feeding
(Source: Florencio, 2001)

2.7.3 Breakfast

Acham, Kikafunda, Malde, Oldewage-Theron and Egal., (2012) reviewed the role of breakfast in meeting the nutritional needs of African children. Studies have shown that when breakfast was not eaten underachievement was high (68.4%); over and above that significantly higher achievements and better feeding patterns were observed in children from the less poor households.

Achievement was significantly associated with the intake of breakfast and a midday meal especially for boys, and a bigger likelihood of scoring well was observed for better nourished children at school. Two African studies indicated that a school breakfast or morning snack had positive benefits on the behavioral and cognitive performance of undernourished children (Nkhoma, Duffy, Cory-Slechta, Davidson, McSorley, Strain and O'Brien., 2013; Apondi, 2014).

2.7.4 Foods eaten away from home

An article by Entin (2012) states that children and teens ate fast foods and full-service restaurant food routinely and their intake of sugar, salt and calories was far greater than when they ate at home. When children ate at a fast food restaurant rather than at home they consumed 126.9 more calories and when they ate at a full-service restaurant the extra calorie count was 160.49 (Entin, 2012).

Soda consumption has been linked with becoming overweight and obese as well as causing an increase in type-2 diabetes. Foods eaten in fast food outlets and full-service restaurants were linked with an increase in sugar, salt, total fat and saturated fat consumption which are risk factors for overweight, dyslipidemia and hypertension components of the metabolic syndrome (Entin, 2012).

Solutions for preparing and eating more meals at home for children and youth:

Schools

- Implement and maintain the N.C Nutrition Standards for Elementary Schools.
- Enforce policies that stop the sale of commercial foods and beverages during school hours.
- Ensure school meals meet the dietary guidelines.
- Promote school meals as the healthy, low cost option.
- Price healthy foods more competitively than a` la carte foods which are higher in fat and sugar.
- Prohibit the advertising of sugar-sweetened beverages in schools.
- Start a school food garden or a farm-to-school programme.
- Implement policies to encourage providing healthy portion sizes in all situations where food and beverages are served on the school grounds (Story, Khapingst, Robinson-ÓBrien and Glanz, 2008)

Government

- Create policies that provide economic incentives to encourage production and distribution of healthy foods and beverages, including fruit and vegetables (Story, *et al.,* 2008).

Communities

- Conduct community-wide campaigns to support messages about preparing and eating more meals at home to coordinate with school efforts.
- Work with school and community based organizations to ensure summer feeding programmes are implemented for needy families.
- Support community based nutrition education classes to teach students and families how to prepare and eat more meals at home.
- Engage community leaders as role models to promote preparing and eating more meals at home.
- Increase access to community gardens and farmers' markets where fresh fruit and vegetables can be grown or bought.
- Work with farmers to increase the availability of fruit and vegetables that can be sold locally.
- Increase access to a variety of affordable, healthy foods in grocery stores and restaurants in all neighbourhoods.
- Make healthy food choices available in food service establishments.
- Advocate for adequate funding and resources for school food service programmes and nutrition education books.
- Advocate for nutrition standards for all food and beverages available at school (Story *et al*., 2008).

Families

- Plan to buy, prepare and eat more meals at home.
- Encourage children and youth to eat school breakfast and school lunch meals.
- If packing breakfast or lunch, pack healthy foods, keeping food safety in mind. Keep packed hot foods hot and cold foods cold with insulated lunch boxes.
- Fix balanced meals that include lean meat, fish, low fat dairy, fruit, vegetables and whole grains.
- Eat school lunch in the cafeteria with your children using this opportunity to teach them about the healthy selections available to them at school.

- Take healthy foods and beverages to school to support school functions (Story *et al.*, 2008).

2.7.5 Peer pressure

Peer pressure can have a huge impact on food choices people make when eating as part of a group. This is the suggestion of new research presented at the Agriculture and Applied Economic Association's 2013 annual meeting in Washington. It recommends dining with friends who make healthy food choices for people who want to eat better foods when eating out (The British Psychology Society, 2013). Children eat what their friends eat and that desire drives much of human behaviour. It could help to change behaviour; if some friends eat healthily then this domino effect could make the other friends also change what they eat (The British Psychology Society, 2013).

A study was conducted about body size among South African girls attending a primary school (ages 9 to 12 years). White girls had higher body size dissatisfaction scores than Black girls (Mchiza, Goedecke, Steyn, Charlton, Puoane, Meltzer, Levitt and Lambert, 2005; Mciza, 2015). Body image is made up of perception of body size, weight and shape and the accuracy of this perception. Body dissatisfaction seems to be common among teenagers leading to weight loss, weight gain or muscle gain behaviours including dieting and exercise as well as other health threatening practices. According to Wenhold, Kruger, and Muehlhoff, 2008) distorted body image is linked to the development of obesity, dieting practices and eating disorders which have become leading chronic illnesses among teenage girls, including athletes of many high-income countries.

2.7.6 Tuck shops

The rate of obesity in children and adolescents has increased worldwide over the past several decades resulting in increased attention being paid to the role of the school in the promotion of healthier diets for children and adolescents. The availability and accessibility of foods low in nutritional value were found to be the key issues contributing to poor dietary habits during school hours (Kim, Hong, Yun, Ryou, Lee and Kim., 2012).

According to research conducted by Kroone and Alant (2012) it was found that contemporary eating habits in South Africa have followed global food trends of eating highly-processed, ready-to-eat food. In many South African schools, this food is bought from school tuck shops or vendors from the community who sell snacks to the learners at break time. This trend towards eating junk food is not only a South African problem. Previous researchers in the field have shown that junk food is also favoured by most youth in developed countries (Popkin, Adair and Wang, 2012; Gupta *et al.*, 2012; Igumbor, Sanders, Puone, Tsolekile, Schwars, Purdy, Swart, Durao and Hawkes., 2012). One of the challenges with eating this type of food is that it is highly processed and hence the carbohydrate in the food is easily digested to glucose in the body. This causes a quick spike in blood sugar levels, which results in the secretion of insulin from the pancreas. The rate at which blood sugar rises in response to the digestion of carbohydrate is measured by glycemic index (GI). If the blood sugar level rises quickly as a result of consuming carbohydrates the food is said to have a high glycemic index. Foods that take longer to digest and do not raise the blood sugar level quickly are given a low GI rating (Brummer, Duss, Wolever and Tosh., 2012).

A study was conducted by Nestle South Africa in June 2013 to investigate the attitudes and behaviours around primary school tuck shop usage to find a clear understanding of what children in primary schools are eating, the food they have access to and the factors that influence the food options that are offered to them in school tuck shops (Food Stuff South Africa, 2013).

The study was conducted in 20 primary schools in Gauteng, interviewing the opinions of the operators of the tuck shops. It then conducted 652 online interviews nationwide with mothers who have children aged between 6 and 12 years attending a government or private school. The results revealed that the majority of the children consumed fizzy, fattening, 'fun' and frivolous food at school. Overall the audit revealed that the best sellers were fizzy cold drinks (75%) and chips (75%). Eighty percent of parents gave their children on average R10 each to spend at school per day. Thirty-six percent of moms interviewed did not know who decides what should be sold at school tuck shops (Food Stuff South Africa, 2013).

Five percent of tuck shop operators believed that the children ate healthy food and 30% agreed that they ate too much junk food. It seems little effort is made to sell healthy food: only 30% of the tuck shops researched sold fresh fruit and only 28% sold fresh milk. Some of the tuck shops indicated that they have tried selling healthier foods but the children are not interested in buying them (Nestle, 2013).

2.7.7 Eating disorders

The incidence and prevalence of eating disorders in children and adolescents has increased enormously in recent decades making it vital for paediatrics to consider these disorders in appropriate clinical settings. Results of epidemiological tests have shown that the number of children and adolescents with eating disorders increased steadily from the 1950s onwards. In the past decade, the prevalence of obesity in children and adolescents has also increased drastically, accompanied by obsession about dieting and weight loss (Rosen, 2010).

Anorexia nervosa is a disorder linked to lack of appetite for food accompanied by weight and shape gain concerns. It is an illness that can cripple a young girl's ability to get through to the world around her about how she feels. Many people with anorexia nervosa consider themselves overweight even when they are underweight. Eating food, vomiting and weighing themselves becomes an obsession (Lask and Waugh, 2013).

Some people may engage in binge eating followed by extreme dieting, excessive exercise, self-induced vomiting and misuse of laxatives (Lask and Waung, 2013). Bulimia nervosa is characterized by recurrent episodes of eating unusually large amounts of food and feeling a lack of control over overeating. With binge-eating disorder, a person loses control over their eating. Unlike bulimia nervosa, binge-eating is followed by purging or excessive exercise. People with binge-eating problems are often obese (National Institute of Mental Health, 2016).

Eating disorder prevention involves the reduction or elimination of important modifiable risk factors for eating disorders and the promotion of factors that are protective against eating disorders. Prevention can be done with individuals at risk for eating disorders and their caretakers (Le Grange and Lock, 2011)

Possible causes of eating disorders

- Genetics
- Depression
- Media influence (Levine and Murnen, 2009).

Early warning signs include:

- Cooking for others yet not eating
- Insisting on having different meals to the family
- Avoiding eating in public
- Visits to the toilet after eating
- Frequent weighing of oneself
- Constant focus on dieting, food or exercise
- Skipping meals
- Fad dieting and use of laxatives (Funari, 2013).

2.7.8 Urbanisation

Globalization has had an influence on many food systems that affect daily living (Costanza, d'Arge, De Groot, Farber, Grasso, Hannon, Limburg, Naeem, O'neil, Paruelo and Raskin, 2016).

Worldwide, food systems have undergone huge changes including increased affordability and availability of processed food, an unprecedented inundation of the food supply with low cost calorie sweeteners, and more efficient production of fatty oils. These changes in food supply have had an effect on the nutritional status of many people by contributing to an increase in obesity in countries with historical rates of malnutrition. Malnutrition is any state of nutritional imbalance and includes under- and overnutrition and inadequacies in micronutrients (Jensen, Arnett and McKenzie, 2011).

Undernutrition is the preferred word for describing nutrition disorders related to the absence of adequate dietary energy, while overnutrition is used to explain excess dietary energy intake most often related to low energy expenditure or reduced levels of activity. The higher worldwide prevalence of obesity has been associated with the increase in leading causes of death, that is, diabetes and cardiovascular disease (CVD) (Basch, Samuel and Ethan, 2013).

In low and middle-income countries, urbanization is on the increase, the result of people moving in response to better economic opportunities in urban areas or to the lack of prospects in their home villages or farms. This has been underpinned by fast growth of the economically active population working in industry and services since most industries and service enterprises are in urban areas (Tacoli, McGranahan and Satterwaite, 2015).

There has been much migration from rural to urban areas (Satterrthwaite, McGranahan and Tacoli, 2010). Context-specific socio-economic, political, historical and ecological situations have to be taken into consideration over generalized statements regarding the nature and motives surrounding urbanization (Tacoli, 2015).

As the world's population becomes more urbanized, the proportion of people living in poverty in cities increases (FAO, 2010). The majority of the huge changes in dietary patterns during the nutrition transition described by Vorster, Kruger and Margetts (2011) have been confirmed by the comparison of the diet of rural and urban Africans in the THUSA (Transition and Health during Urbanisation of South Africans 2005) study by (Vorster, Fenter, Wissing and Margetts, 2005).

They included a decrease in staple foods rich in starch and dietary fibre, an increase in food from animal origin in total fat and saturated fatty acids, a decrease in plant protein sources such as legumes and an increase in energy dense snack foods, carbonated sweetened beverages, commercially available alcoholic beverages and added sugar, fats and oils in preparation of food (Vorster *et al.,* 2005).

In the North-West province in South Africa, where the THUSA study was conducted, increases in fruit consumption were observed probably due to increased availability and affordability in the area (Hester, Kruger, and Margettes, 2011). Asghari, Yuzbashian, Mirmiran, Mahmood and Azizi (2015) identified the introduction of fast-food chains and a shift to Western dietary habits as causes of increasing obesity prevalence in what they call nutrition transition. These authors suggested that the increases in obesity are caused by higher energy dense foods, larger portion sizes, and increased intake of sugar rich soft drinks (Allender *et al.,* 2011).

Despite the drive for migration to urban areas, the environment seems to be exerting an influence on dietary habits that reaches both the rich and the poor communities of the population and can impact on health and nutrition status. The positive side of urbanization on diet and health includes greater access to education and health-care services and greater availability of diverse foods but these advantages may not reach all urban residents. There are also negative features including diets with a lot of fat and sugars or sweeteners, increased sedentary lifestyle, environmental pollution, unsanitary and crowded living conditions, increased cigarette and alcohol consumption and crime (Sage, 2013).

The past years have seen an increase in convenience food markets in developing countries. Secondary factors such as marketing, advertising, the appeal of new products, new retail outlets including supermarkets and multinational fast food chains contribute to dietary adaptation and convergence (Solomon, Russel-Bennett and Previte, 2013).

The coming into effect of supermarkets and fast food chains while catering for the changing demands of the consumer in terms of convenience, quality and safety brings new challenges. These include the erosion of food culture and a reduction in biodiversity as a result of a newly created demand for standardized, uniform produce (Garnette and Wlikes, 2014).

There has been a loss of livelihood opportunities at different stages of the food sector, including agricultural production and there is alarm that local culture and food traditions are disappearing (Maclntyre *et al.*, 2012).

2.7.9 Food choices

Eating habits developed when young later influence lifelong eating behaviours. Parents can strongly influence children's food choices because they have greater control over children's actions at a young age and outside influences (peers, school) are usually less. Once children start school, the majority have already developed their food preferences (likes and dislikes); as a result, achieving behaviour change can be difficult (Food today, 2012).

The attitudes and eating habits shown by parents have a great influence on the food choices made by children (Vaughn, Ward, Fisher, Faith, Hughes, Kremers, Musher-Eizenman, O`Connor, Patric and Power, 2016). The food likes and dislikes that become firmly embedded during childhood are to a greater degree shaped by the food likes and dislikes of parents. It is not enough to say that television influences the food choices of children (Vaughn *et al.*, 2016).

On average children spend more time watching television than they spend at school or doing other activities other than sleeping, and as a result, children are overwhelmed with commercials, many of which advertise food. The most advertised foods during programmes for children are sweetened breakfast cereals, fast foods, candy, soda and snack food (Harris and Sanborn 2013; Schor, 2014).

It is known that children are responsive to these commercials and in response to media messages children will persuade their parents to buy these foods for them. For many kids watching television leads to weight gain and ultimately obesity caused by snacking and lack of physical activity (Harris and Sanborn 2013; Schor 2014; Kraak and Story, 2015).

During the school age years' children begin to spend most of their time away from home, either at school or at a friend's house and as a result factors outside the home begin to influence food choices, which can have either a positive or negative effect on nutrition (Shin, Valente, Riggs, Hun, Spruit, Chou and Pentz, 2014).

2.7.10 Cultural beliefs, tradition and religion

From long ago dietary practices have been included in the religious practices of people around the globe. Some religions forbid followers from consuming certain types of food and drink, others restrict certain foods and drinks on their holy days and others link dietary and food preparation with rituals of the faith. Practices such as fasting (going without food or drink for a specified time) are explained as tenets of faith by many religions (Mbenyane, Makuse, Ntuli, Mbhatsani and Sayed 2008; Milka, 2014). Food allocation can be gender biased in that priority may be given to boys over girls. Whatever the reason, this automatically helps to meet boys' nutrient intake which is more than that of girls (Mbenyane *et al*., 2008).

When there is a scarcity of food in the household, women get fed the least amount of food after making sure that the rest of the family members have had enough to share (Mbenyane *et al.*, 2008).

According to Mbenyane *et al.,* (2008) food taboos enforced by culture have a gender dimension and, to some degree, an age dimension, for example, certain parts of the beef carcass slaughtered in the homestead are reserved for specific age groups or genders, for example, the heart and the lungs for the herd boy and the hump for the girls.

Different cultures have different customs, taboos and food beliefs that affect their eating patterns. Studies done by the African Population and Health Research Center among residents of two informal settlements in Nairobi, revealed that pregnant woman don't eat some foods as prescribed by their cultural beliefs. Eggs are avoided during pregnancy because they are believed to cause delayed or slurred speech in children. Pregnant women are discouraged from eating avocado, bananas, fish, chicken and beef because it is believed that the unborn baby will overgrow and cause complications during birth (Njeri, 2014)

According to an article by Vitamin Angels there is a tendency not to breast feed babies during their first six months of life. The article states that in the Marsabi district of Kenya 60% of the women gave their babies additional food and water within two weeks of birth. Boys get introduced to camel milk early as an introduction to the herd they will someday tend. The belief is that if a male child is first given his mother's milk, he will not be prepared to fulfil his role in the future (Saam, 2010).

2.7.11 Divorce

Marriage appears to reduce child and adult poverty. Children in non-married families face a greater risk of poverty through childhood and the negative economic results of divorce tend to be higher for women and children than men. Divorce classically results in an acute decline in standard of living for most custodial mothers and their siblings. Economic hardship increases the risk of psychological and behavioural problems among children and can have a negative effect on their health and nutrition (Dougherty, 2011). Among households that had been above poverty before a marital separation,

mothers were more likely to fall into poverty than fathers in the first year following separation (the Heritage Foundation, 2017).

According to an article by Kramer, Myhra, Zuiker and Bauer (2016) on a census report on marriage, children of divorced parents have a greater possibility of experiencing poverty and to live with their mothers. Three quarters of children in divorced families lived with their mothers in 2009 and most of them were living below the poverty line. Gender poverty and the gender pay gap narrowed between 1990 and 2000, but have stayed stable since (Kramer *et al*., 2016).

2.7.12 High food prices

Gains in the public health status over the past few years are currently threatened by the worldwide economic and food crisis, with young children, women and the elderly in the developing world likely to be the most affected. The world food crisis is identifiable by the price index of major food commodities, including staple foods such as rice, corn, wheat, oil, and sugar having gone up overall by 24% in 2007, with increases as high as 87% in oil, 58% in dairy and 46% in rice (Uzogara, 2016). The increase in food prices may have created a complicated food insecurity situation and although not quite the same as famine or drought, the nutritional status of huge sections of the world's population living in poverty and suffering from chronic food insecurity and hunger may have been affected (Christian, 2010). Maternal nutritional status, especially during pregnancy, may be compromised in an economic crisis, resulting in adverse pregnancy outcomes such as low birth weight and preterm birth (Uzogara, 2016).

The economic and financial crisis is inundating the developing world. The cost of food baskets went up in several countries, forcing households to reduce the quality and quantity of food eaten and they are at risk of increased malnutrition. Population groups most affected are the ones with the most requirements, including families with young children, or pregnant and lactating women, and the chronically ill (especially people living with HIV and AIDS and tuberculosis). Vulnerable populations change to cheaper foods that fill their stomachs but add less nutritional value. When nutritional needs are

not met, people become more likely to get ill, perform badly at school and have lower productivity (Brinkman, de Pee, Sanogo, Subran and Bloem,2010).

South Africans lost almost a million jobs in 2009 alone as a result of the economic recession (Steytler and Powell, 2010).

2.7.13 Climate change

There is global agreement that anthropogenic greenhouse gas (GHG) emissions are resulting in climate change (Meinshausen *et al.*, 2009). Climate change is likely to have a number of results for food security in developed countries and these effects are enacted in different ways. Anthropogenic GHG emissions and natural climate change cause other mechanisms that lead to climate variability such as stratospheric volcanic aerosols (Hegerl, Luterbacher, Gonzalez-Rouco, Tett, Crowley and Xoplaki., 2011), which further results in climate change and specific environmental effects which have an impact on agriculture and food processing.

Food stability is dependent on food production, income, markets and transfer programmes (both public and private) and can be hugely affected by shocks as a result of weather conditions, price fluctuations, human induced disasters and political and economic factors (Cohen, Tirado, Aberman, and Thompson 2008). The large and growing populations in developing countries acquire their livelihoods from agriculture and will be vulnerable to climate change. Climate change and variability will have a huge impact on food security and malnutrition. It will lead to stronger and longer droughts and increased frequency of heavy precipitation events over the majority of land areas. Drought and water scarcity diminish dietary diversity and reduce overall food intake and this can result in malnutrition (Cohen *et al.,* 2008).

2.7.14 Displacement

Forced migration is population movement which is often a result of complex confluence of conflict, environmental conditions and famine (Bowles, 2016). Apartheid had

prolonged income poverty and increased income inequalities in obvious ways (Sartorius, Sartoruis, Tollman, Schatz, Kirsten and Collinson., 2013).

African people had been dispossessed of most of their land, faced restricted opportunities for employment or self-employment, were restricted to low-quality public education and health care, and were physically confined to poorer parts of the country or cities (Sartorius, Sartoruis, Tollman, Schatz, Kirsten and Collinson., 2013). However, in overpopulated black settlements, sizeable urban poverty and food insecurity, impacting totally on the general health status of urban blacks, now controls the scene (Nyapokoto, 2014).

According to a report by the Situational Analysis of Children, South Africa is still recovering from the consequences of apartheid where black children lived without food, shelter and health services and families were dismantled by political violence (UNICEF, 2009).

2.8 Methods for collecting data

2.8.1 Socio-demographic survey

This is a method used to gather data pertaining to the social status of a respondent. It is important in measuring the social well-being of the respondent. In measuring poverty in a community, different demographical factors such as gender, occupation, age, level of income and level of education must be collected in order to measure the impact of these variables. A validated socio-demographic questionnaire must be used as an assessment tool (Perea, Suarez-Garcia, Del Rio, Torres-Lagares, Montero and Castillo-Oyague 2013).

2.8.2 Dietary assessment methods

Different types of questionnaires can be used for the collection of dietary intake data. Food frequency questionnaires are structured questionnaires designed to collect

information on the type of food and the frequency of the food consumed. A 24-hour food recall is an open-ended questionnaire (Wolmarans, Kunneke and Laubscher, 2009).

Open ended questionnaires like the 24-hour food recall give no directive about the portion sizes and the type of food consumed. The recall is usually conducted by using a personal interview and probing questions are asked to collect information. It is a dietary recall in which the respondent is expected to remember and report on all food consumed in the previous 24 hours of the previous day (Cameron and van Staveren, 1988; Gibson, 2005). The 24-hour food recall is an indication of current dietary consumption (Wolmarans, Kunneke and Laubscher, 2009).

Quantified food frequency questionnaires can be compiled such that they collect information on the quantities of food consumed. This type of food frequency is called a quantified food frequency questionnaire. The use of a validated instrument is imperative when collecting dietary intake data (Sauvageot, Alkerwi, Albert and Guillaume, 2013).

2.8.3 Food record

Food records are written details of actual food and beverages consumed during a specific time period. According to Rothausen, Tatens, Mattiessen, Frost Andersen and Brockhoff., 2012, respondents have to record all food types and beverages consumed for a period of between one to seven days. Food records are a better option to use for dietary assessment, as the researcher cannot only rely on the respondent's` accuracy in recalling portion sizes (Rankin, Hanekom, Wright and Maclntyre., 2010). Food records are considered accurate if the information is recorded immediately after the food is consumed or no later than a day afterwards.

2.8.4 Quantitative Food Frequency Questionnaire (QFFQ)

The lengths for QFFQs differ depending on the type of food assessment and are useful in assessing groups rather than individuals (Wolmarans, Kunneke and Laubccher, 2009).

Quantitative Food Frequency Questionnaires are lists of food that are imperative contributors to the group`s intake and nutrients. Food and beverage portion sizes are quantified in terms of milliliters or grams (Rankin *et al.*, 2010). Adapted or existing lists can be used to meet the objectives and the target group of the study. The questions are based on the preparation method, frequency of meals and the type of food the respondents consumed on the day over a period of a month.

2.8.5 Food Frequency Questionnaire (FFQ)

Food frequency questionnaires are a list of questions on food where the respondent responds to questions by giving the frequency and the amount of food consumed per day, per week or per month. The disadvantage of this method is possible underreporting as the recall relies on the respondent's ability to recall the food consumed over a long period (Rankin *et al.*, 2010).

2.8.6 24-hour Food Recall

The 24-hour food recall is normally conducted by means of personal interviews conducted by well-trained interviewers, as much of the dietary information is collected by asking probing questions. The 24-hour food recall method requires respondents to remember all food and beverages consumed during the 24-hour period. It is an indication of current dietary intake (Wolmarans *et al.*, 2009). The use of the 24-hour food recall was developed by Weihl in 1942 according to Rankin *et al.*, (2010). The respondent is expected to remember and report on all food and beverages consumed in the previous 24 hours, or on the previous day. The process can be repeated depending on the type of study being conducted; many 24-hour food recalls done may provide an accurate idea of the individual`s normal food intake. Experts in the field analyze the information collected. Combining methods can provide accuracy and facilitate

interpretation of the dietary data. Methods may also be combined for practical reasons. Food records have been combined with 24-hour food recalls, maximizing on the use of resources in past surveys of the United States Department of Agriculture (Lee and Nieman, 2003).

FFQs concentrated on selected nutrients were used in addition to the 24-hour food recall in the Third National Health Examination Survey (NHAANES 111). In South Africa, the 24-hour food recall method has been used for the collection of dietary intake data in several large epidemiological studies to determine dietary intake of the population (Wolmarans *et al.*, 2009).

2.8.7 Dietary history

A dietary history is used to assess an individual`s dietary intake and the factors determining food intake over a period of time. If an individual does not have a constant eating pattern the method cannot be used. Dietary history is an all-inclusive method of getting diet related information. Diet histories are useful in small groups or in individuals (Joubert and Ehrlich, 2008).

Table 2.3 A combination of dietary assessment methods (Adapted by Wolmarans and Wentzel-Viljoen, 2008)

METHOD	ADVANTAGES	DISADVANTAGES
Food records	• Describes usual dietary intake. • Classifies the individual's information as high or low consumer, or those meeting/ not meeting reference values. • Correlates dietary intake with other markers e.g. biochemical, anthropometric. • Often used as a standard; other dietary intake methodologies are validated.	• Questionnaires validated for different genders, age and cultural groups not generally available. • Extensive training required for interviewers. • Literate respondents required. • Respondents may change their diet due to heavy respondent burden. • Time consuming • With estimated records, the conversion of food intake reported in household or other measures to gram is time consuming.
Diet histories	• Collects information on total food intake. • Determines usual meal patterns and food combinations eaten by the individual over a specified period. • Uses a detailed list of food as a checklist to verify dietary intake. • Classifies individual's information as high or low consumer or meeting/ not meeting reference values. • Correlates dietary intake with other markers e.g. biochemical, anthropometric	• An interview of one of two hours by a highly-trained interviewer is necessary. • Difficult to standardize between interviews. • Nutrient intake tends to be overestimated. • A co-operative respondent with the ability to recall the usual diet is required.

Table 2.3 A combination of dietary assessment methods (Adapted by Wolmarans and Wentzel-Viljoen, 2008 (Continued)

One 24-hour food recall	• Used for collection and describing intake of a group of individuals. • To report on mean intake of a group, 24-hr food recalls from many subjects should be collected. The exact number of subjects required for a study can be calculated, making use of specific formulas (Gibson 2005).	• Information depends on the memory of the respondents. • Does not represent usual dietary intake. • Cannot be used to describe the dietary intake of an individual. • Not appropriate for the collection of dietary intake from children less than seven years of age. • Should be used for the classification of dietary intake, e.g percentage of respondents consuming more or less than reference values. • Cannot be used for correlation of dietary intake with biochemical markers. • Extensive training required.
Repeated 24-hour food recall	• Collection of quantitative dietary intake data from individuals or groups of individuals. • To describe habitual dietary intake. • Used for classification of individual as high/low consumer, or meeting/ not meeting reference values.	• Information depends on the memory of the respondent. • Not applicable for the collection of dietary intake data from children less than seven years of age. • Extensive training required for interviewers.
Quantitative food frequency questionnaire	• To describe usual dietary intake. • Classification of individual as high/low consumer or meeting/ not meeting reference values. • To collates dietary intake with other markers.	• Information depends on the memory of the respondent. • Developing the questionnaire is time consuming. • Has to be developed for the specific study group. • Does not provide information on intake at different meal times. • May not be valid for use in the elderly where memory is a factor. • Not applicable for use in young children.

2.9 Methods to determine nutrition status

2.9.1 Anthropometric indicators

The most-used anthropometric indicators are stunting (H/A), wasting (W/H), and underweight (W/A) and mid upper arm circumference (MUAC) in children under five years of age and Body Mass Index in adults. Anthropometry has different body measurements such as weight, height and size, circumference, and skin fold thickness and it is a basic tool used in assessing nutrition status of children and adults (McDowell, Fryar, Ogden and Flegal, 2008:1).

2.9.2 Height

Height measurements are useful when used together with other anthropometric measurement assessment methods. The height measurement can be obtained by using a direct or indirect method. A height board, also known as a stadiometer or a measuring rod, is a direct method where a person being measured would stand on it with feet flat. Indirect methods include arm span, where a person stands straight with arms wide open, and recumbent length (using a tape measure while a person is in bed); this method is suitable for people who are critically ill or in a coma, children younger than 3years, infants, and knee height measurements (WHO, 2008)

The method to be followed when measuring height is:

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

2.9.3 Weight

The scale should have the following features:

- Solidly built and durable
- Electronic (digital reading)
- Capable of measuring up to 150kg
- Capable of measuring to precision of 0.1kg (100g)
- Allow tared weighing, which means the scale must be zero (0) rated before standing on it (WHO 2008).

Method to be applied is as follows:

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

2.9.4 Body Mass Index

Body Mass Index is a number calculated from a child`s weight and height. It is a reliable indicator of body fatness for most children and teens. BMI does not measure body fat directly but research has shown that BMI correlates to direct measure of body fat such as underwater weighing and dual x-ray absorptiometry (DXA). BMI can be considered an alternative for direct measurement of body fat. It is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. The BMI number is calculated the same way for children and adults but the criteria used

to interpret the meaning of the BMI for children and teens are different from those for adults (Ogden, Carroll, Curtin, Lamb and Flegal, 2010).

For children and teens, BMI age and sex-specific percentiles are used for two reasons:

- The amount of body fat will change with age.
- The amount of body fat differs between boys and girls (Sweeting, 2007).

The CDC BMI-for-age growth charts consider these differences and allow translation of a BMI number into a percentile for a child`s sex and age (Centre for Disease Control and Prevention, 2015; Sweeting, 2007). The formula used to calculate BMI is as follows: weight in kg divided by height in metres squared (weight in kg÷ height in m^2). The implications of using BMI are profound. The cut-off points of BMI of <18.5kg/m^2, 18.5-24.9kg/m^2, 25.0-29.9kg/m^2, 30.0-34.9kg/m^2, 35.0-39.9kg/m^2 and 40.0+kg/m^2 explain categories normally referred to as underweight, normal weight, overweight (pre-obese) and obese (grade I, II, III). These cut-off points define the number of people falling into each category, which in turn tells us the prevalence of obesity in the world. The BMI is a measure of the number of people in the world who are in poor health and who possess a condition that is threatening to their life or their quality of life (Blundell *et al.*, 2014).

2.9.5 Waist circumference (WC)

Waist circumference (WC) and waist-to-height ratio (WHtR) are useful tools which can be used to identify abdominal obesity among the childhood and adolescent population. These parameters are dependent on sex, age and ethnicity thereby requiring specific values in each country (Katzmarzy, Shen.Baxter-Jones, Bell, Butte, Dernerath, Gilsanz, Goran, Hirschler, Hu and Maffeis, 2012).

Obesity, especially abdominal obesity, is closely linked to the risk of metabolic syndrome (MS). Excessive intra-abdominal fat accumulation increases the risk of cardiovascular disease (CVD) and type-2 diabetes in children and adults (Goran, Ball and Cruz, 2003).

Waist circumference (WC) is considered a simple, available and inexpensive anthropometric measurement providing relevant information about fat distribution and reflecting the degree of central adiposity in children (Zhang, Liya, Zhao, Jin-Shaun, Chuzun, Zhou and Jing Yang 2012). The WC is measured around the waist through a point one third of the distance between the xiphoid process and umbilicus using a non-stretchable measuring tape (Hammond, 2008).

2.9.6 Waist-to-height ratio (WHtR)

Prevalence of obesity and overweight in childhood is increasing worldwide. Diagnostic criteria to determine obesity are the body mass index and the body weight that are not informative about fat distribution (Rerksuppaphol, 2013; Rerksuppaphol, 2014). Waist-to-height ratio (WHtR) has been proposed as a convenient alternative measure for assessing central fatness in children, on the basis that it is age independent and that in normalizing for growth it might obviate the need for age related reference charts (Zhang *et al.,* 2012). Nambia *et al*., (2008) stated that the (WHtR) is calculated by dividing the waist circumference (WC) at the level of the umbilicus by height, both measured in centimeters (waist/height) on the basis of standard anthropometric measurements.

Studies done by Palaniappan, Wong, Shin, Fortmann and Lauderdale., (2011) and Coutinho *et al.,* (2013) indicate that recent research mainly from Asian countries has shown that even in populations with low rates of obesity and moderate BMI such as Japan and China, the measurement of (WHtR) can be an important early indicator of lifestyle associated disorders and could be an integral public health approach to preventing diabetes and CHD. A thought for the future is that (WHtR) may allow the same boundary value for children and adults. There is increasing evidence that (WHtR) can be used to predict risk in children. The risk of children using (WHtR) cannot be advocated since there is not enough data to encourage this (Blundell *et al.,* 2014).

Waist circumferences of men and women are different. This is due to the fact that men are generally taller than women and they also have a larger waist circumference whereas women are shorter in length when compared to men. This then means that the average (WHtR) values are closer for men and women than average waist circumference values because of the adjustments for height and the same boundary value can be used for both to indicate increased risk. The simple boundary value of (WHtR) = 0.5 shows increased risk for adult men and women (Blundell *et al.*, 2014).

2.9.7 Height-for-age

Growth curves are used for the monitoring and screening of children's and adolescents' health and are cost effective in detecting nutrition disorders. Although growth pattern is mainly determined by genetic factors it also indicates the nutrition status. Therefore, evaluation of nutrition disorders such as stunting (a measure of chronic undernutrition), thinness (undernutrition) and overweight (overnutrition) is of vital importance. It is well researched that overweight has many lifelong health risks, notably chronic non-communicable diseases (NCDDs). Stunting and thinness, on the other hand, are seen as undernutrition indicators and are attributed to many factors such as low birth weight, lack of care, lack of nutrition and other environmental parameters (Mansourian, Marateb, Kelishadi, Motlagh, Aminaee, Taslimi, Majdzadeh, Heshmat, Ardalan and Poursafa, 2012).

Two growth references of the World Health Organization (WHO 2006/2007) and the US Center for Disease (USCDC2000) have been widely used to calculate the anthropometric indicators. They have been developed based on different principles and data and have given different cut-off points for the same anthropometric measures. They could give different results, for example, Onis, Onyango, Borghi, Siyam, Nishida and Siekmann, (2007) recommendations are mainly based on Z-scores while USCDC2000 prefers the percentile of an anthropometric measure.

2.9.8 Weight-for-age

The weight-for-age index represents the weight of a child in relation to his age for children up to 10 years of age. The index is an indicator of failure to grow. Wasting describes a considerable weight loss in children and a measure of acute malnutrition (Blundell *et al.*, 2014) because of severe disease and severe starvation. Weight-for-age is used to assess whether a child is underweight or severely underweight but it is not correct to classify a child as obese or overweight. This indicator is commonly used as an anthropometric indicator. It compares the weight of a child to the weight of a normal child of the same height (Joubert and Ehrlich, 2008).

2.9.9 BMI-for-age

For adults, overweight, obesity and extreme obesity are defined as a body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) of 25.0 to 29.9, 30.0 or more and 40.0 or more, respectively. For children at risk of overweight, it was defined as at or above the 85^{th} percentile but less than the 95^{th} percentile of the sex specific BMI for age, as defined by the growth charts (Janjua, Mahmood, Islam and Goldenburg, 2012).

The BMI-for-age is a good indicator for assessing obesity in children and adolescents. According to Blundell *et al.* (2014) low BMI-for-age (underweight) indicates both chronic and acute malnutrition. Strictly speaking, overweight refers to weight that is in excess of a weight standard, and obesity refers to excess body fat. Body fat is difficult to measure and body weight is often used as a surrogate indicator of obesity. Weight varies with age and sex, not only with height in children (Blundell *et al.*, 2014). To account for variability by sex and age, BMI in children is compared with a sex and age specific reference (Ogden and Flegal, 2010).

2.9.10 Integrated Nutrition Programme (INP)

South Africa has had a history of racial inequality. Poverty among the black group is more than 60%, compared to less than 5% for Indian and white groups. Poverty is severe in non-urban areas, where the rate is 73.7 % (Minujin, 2012).

The inequalities in socioeconomic status have been mirrored in the nutrition status of South Africans: on the one hand, we have stunted, underweight children while on the other hand we have obese adults at risk for chronic diseases of lifestyle. Most of the previous nutrition research in South Africa was based on nutritional disease of lifestyle of the higher socio economic-group rather than the lower socioeconomic group. However, in the new democratic dispensation there has been a change towards research in the area of undernutrition (Altman, Hart and Jacobs, 2009).

According to Armstrong, Lambert and Lambert (2011), to address nutrition problems in South Africa, the Integrated Nutrition Programme was established by government in 1996. This programme aimed to combine direct nutrition interventions, such as nutrition education, micronutrient supplementation and food fortification with indirect interventions such as health care, provision of clean and safe water, parasite control and agricultural production.

The aims of the programme are to:

- Enable mothers to exclusively breast feed their infants from birth to six months and to continue breast feeding after the introduction of solid food up to 24 months of age and later.
- Prevent an increase in mortality due to lifestyle associated diseases.
- Promote the health of women, especially pregnant women and lactating women.
- Reduce the prevalence of malnutrition and hunger problems.
- Improve inter-sectoral collaboration and community ownership of the programme and resources.

- One of the goals of the South African Government's Medium Term Strategic Framework (MTSF) for 2009–2014 is to better the health status of all South Africans. The Strategic Plan of the National Department of Health (NDOH) provides a framework for the 10 Point Plan of the health sector for 2009–2014, which is directed at starting a well-functioning health system capable of generating improved health outcomes (Armstrong *et al*., 2011).

The four focus areas of the Health Department's Negotiated Service Delivery Agreement are:

- Increasing life expectancy
- Decreasing maternal and child mortality
- Combating HIV and AIDS and decreasing the burden of disease from tuberculosis; and
- Strengthening the health system's effectiveness (Armstrong *et al*., 2011).

Malnutrition undermines progress towards the Millennium Development Goals (MDGs) especially those goals that deal with poverty, maternal health, child mortality and education and indirectly to the remainder of the MDGs. Malnutrition increases disease progression among people living with HIV and AIDS and TB and puts extra pressure on health care services. The cost of undernutrition is pervasive, affects generations and contributes to deepening poverty (Statistics South Africa, 2013; Department of Health, 2013).

2.9.11 Current nutrition status in South Africa (age group 4-8 years and 9-13 years)

South Africa is in a nutrition transition in which undernutrition, more obviously, stunting, and micronutrient deficiencies co-exist. Within an increasing incidence of overweight and obesity and the associated results such as cardiovascular disease, diabetes and hypertension, the context of the HIV and AIDS pandemic and food insecurity, and the high prevalence of undernutrition and micronutrient deficiencies, an emergent incidence of overnutrition presents a complicated series of challenges.

Undernutrition has been constant in South Africa from the early 1990s (Muzigaba, Puoane and Sanders, 2016).

Irrespective of our relative high per capita income, South Africa has a rate of child stunting at 18% comparable to other low-income countries in the region, and a higher rate of stunting than lower income countries in other regions. While some indicators show improvements, multiple conditions seem to have worsened over the past decade. The same pattern emerged for the prevalence of underweight with one out of ten children being affected nationally. It is the same with global trends – there is an alarming increase in the prevalence of overweight and obesity among all South Africans. Overweight affects 4.8% of children and is highest (5.5%) in urban formal areas (Hendriks, 2013).

An estimated 26.6% of women are overweight (excluding obesity) and 24.9% are obese. The South African National Youth Health Behaviour Survey reported that 20% and 5% of grade 8 to 11 learners were overweight and obese respectively. Substantial progress has been made with regard to folate and iodine status research on other micronutrient deficiencies among women and children from the National Food Consumption Survey (NFCS) and shows that problems continue and the nutrition status may be getting worse (Department of Health, 2013).

About 63.3% of children between 1 and 9 years were vitamin A deficient and the prevalence of vitamin A deficiency in women of child-bearing age was at 27.2%. The prevalence of anaemia in children and woman was at 27.9% and 29.4% respectively. An estimated (45.3%) of children were found to be zinc deficient. South Africa has successfully achieved the virtual elimination of Iodine Deficiency Disorder (IDD); at both the national and provincial levels there has been a constant increase from 1998 in the percentage of households using and consuming salt with iodine content of more than 15ppm. The Limpopo Province needs special attention given that it had the lowest mean iodine concentration at 20ppm and the lowest percentage of households with iodized salt at (45.3%) (Department of Health South Africa, 2013).

2.9.12 National School Nutrition Programme

Nelson Mandela called for a primary school nutrition programme to be introduced in 1994. From that time, the National School Nutrition Programme (NSNP) has benefited learners from the poorest schools across the country (DoBE NSNP Best School Awards 2013/2014). The NSNP focuses on improving the health and active learning capacity of primary school learners through school feeding (Department of Basic Education, 2011; DoBE, 2011).

Its objectives are to contribute to improving the quality of education and general health and nutrition status of children by:

1. Reducing short-term hunger
2. Improving school attendance
3. Addressing micronutrient deficiencies
4. Controlling parasitic infestation
5. Improving nutrition knowledge and attitudes among primary school children, their parents and their teachers (Department of Basic Education, 2014).

The objectives of the NSNP are:

- To contribute to the enhancement of learning capacity through school feeding programmes.
- To promote and support food production and improve food security in school communities.
- To strengthen nutrition education in schools and communities (DoBE, 2013/2014).

The evaluation of the NSNP in 2000 indicated the importance of school feeding for children's school attendance and as a source of food that increases household food security (Montgomery, 2012; Acheampong, 2014). The strength of the programme has been good co-operation between the Department of Basic Education, Provincial Departments and District Offices and partners that indicate a high level of commitment towards the future of our learners (Department of Basic Education SA, 2013/2014).

It is the stand of the American Dietetic Association (ADA), School Nutrition Association (SNA) and Society for Nutrition Education (SNE) that comprehensive, integrated nutrition services in schools, from kindergarten through to grade 12, are a vital part of coordinated school health programmes and will improve the nutrition status, health and academic performance of our nation's children. Local school wellness teams made up of school and community members work together in identifying local school needs, developing workable strategies to address urgent areas, and integrating comprehensive nutrition services with a coordinated school health programme. To maximize the impact of school wellness policies on strengthening comprehensive integrated nutrition services in schools nationwide, ADA, SNA, and SNE suggest specific strategies in the following important areas: (Briggs, 2010).

- Nutrition education and promotion
- Food and nutrition programmes available on the school campus
- School-home-community partnerships
- Nutrition-related health services (Briggs, 2010).

Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth and intellectual development, and prevent immediate health problems such as anaemia, obesity, eating disorders and dental caries and this may prevent long-term health problems such as coronary heart disease, stroke and cancer. School health programmes can help children and adolescents achieve full educational potential and good health by providing them with the skills, social support and environmental reinforcement they need to adopt long-term healthy eating behaviours (DoBE, 2011).

Strategies most likely to be effective in promoting healthy eating habits among school-age children and providing nutrition education guidelines for a comprehensive school health program are based on a review of research, theory and current practices and they were developed by CDC in collaboration with experts from universities and from national, federal and voluntary agencies (Acheampong, 2014):

- School policy on nutrition
- A sequential, coordinated curriculum

- Appropriate instructions for learners
- Integration of school food service and nutrition education
- Staff training
- Family and community involvement, and
- Programme evaluation.

The Primary School Nutrition Programme was made available at specifically identified sub-economic schools. The provincial government targeted to reach 125 000 children at 847 primary schools in KZN province by 2004 with its school feeding programme (Maile, 2008).

2.9.13 Food fortification (FF)

Often referred to as 'hidden hunger', micronutrient malnutrition is a serious public health problem affecting over two billion people in the whole world. In developing countries micronutrient deficiencies are the cause of preventable blindness, intellectual developmental disabilities, neural tube defects and death during child birth (Biesalski and Black, 2016).

The absence of important vitamins and minerals also has a significant impact on the body's immune system. An immune system weakened by the lack of micronutrients puts children at risk of illness, making it highly likely that they will miss school.

Lowered mental capacity and increased absenteeism as a result of iodine and iron deficiency, leads to lower academic performance with lifelong (Biesalski and Black, 2016).

Food fortification is the process of adding vitamins and nutrients to food and drinks. The word food fortification is used to describe one of two main processes. The first process is food enrichment, which is adding back to foods and drinks nutrients that have been removed during processing. The second process is the adding of nutrients to food that is either not naturally occurring in the food or are added at a higher concentration than what is naturally occurring (Nestle, 2013).

Allen (2006) states that food fortification programmes have been made to restore nutrients lost during processing and to intentionally increase one or more essential nutrients in food to improve its nutritional quality. The South African Department of Health (DoH) conceived and made recommendations for food fortification and engaged the National Food Consumption Survey to give statistics on the causes and seriousness of malnutrition in South Africa. Encouraged by the findings, in October 2003 the decision was taken to fortify bread and maize meal with vitamin A, iron, zinc, folic acid, thiamine, niacin, vitamin B6 and riboflavin as these foods are commonly consumed staple foods in South Africa (Steyn, Nel, and Labadarios, 2008).

The inadequate intake of vitamin A, thiamine, niacin, riboflavin, vitamin B6, vitamin C, vitamin B12, folic acid, calcium, iron and zinc is an everyday challenge for many countries, especially on the African continent, and as a result the fortification of maize meal and bread flour was initiated to improve the consumption of these nutrients (Van Jaarsveld, Faber and van Stuijvenberg, 2015).

In South Africa regulations for obligatory iodization of salt and fortification of maize and wheat came into effect in 1995 and 2003. A percentage of the RDA for fortified maize meal and wheat flour can provide a child of 10 years and older, after consuming 200 grams of raw maize meal or wheat flour with vitamin A (31%), niacin (25%), thiamine (25%), pyridoxine (25%), folate (50%), riboflavin (17% from maize meal, 20% from wheat flour), iron (25%) from unsifted maize meal and 50% wheat flour, and zinc 20% (Kruger, Hendricks and Puoane, 2008).

Important principles for a national programme of fortification are;

- The vehicle used in the fortification process is the food item which is fortified with additional nutrients added, for example, maize meal
- The vehicle should be a staple food item which is used by the majority of people, especially the poor.

- The nutrients added are called the fortificants and they must be added in a manner whereby the food item stays acceptable to the consumers, for example, colour and taste.
- For a national programme to be introduced it is important to determine which would be the best vehicle and which would be the main fortificants (micronutrients) to be added. This is normally determined by a household food consumption survey.
- Legislation and guidelines for industry are required.
- Monitoring and evaluation are essential to ensure that the industry is complying and the consumers are receiving the benefits (Moeng and de Hoop, 2008).

2.9.14 Nutrient supplementation

According to the American Dietetic Association the best nutrition-based method for promoting optimal health and reducing the risk of chronic disease is to wisely select a wide range of nutrient-rich foods. Additional nutrients from supplements can assist some people meet their nutrition needs as specified by science-based nutrition standards such as the Dietary Reference Intake (Marra and Boyar, 2009).

According to the U.S. Food and Drug Administration (2015) a dietary supplement is a product intended for ingestion that contains a ’dietary ingredient’ and can be one or any combination of the following substances:

- A vitamin
- A mineral
- An herb or other botanical plant
- An amino acid
- A dietary substance for use by people to supplement the diet by increasing the total dietary intake.
- A concentrate, metabolite, constituent or an extract (Food and Drug Administration, 2015).

Supplements of vitamin A for acutely malnourished children, or children who have measles or continual diarrhoea have been known to be effective and recognized as one of the most cost-effective interventions for improving child survival (Mayo-Wilson, Imdad, Herzer, Yakoob and Bhutta, 2011).

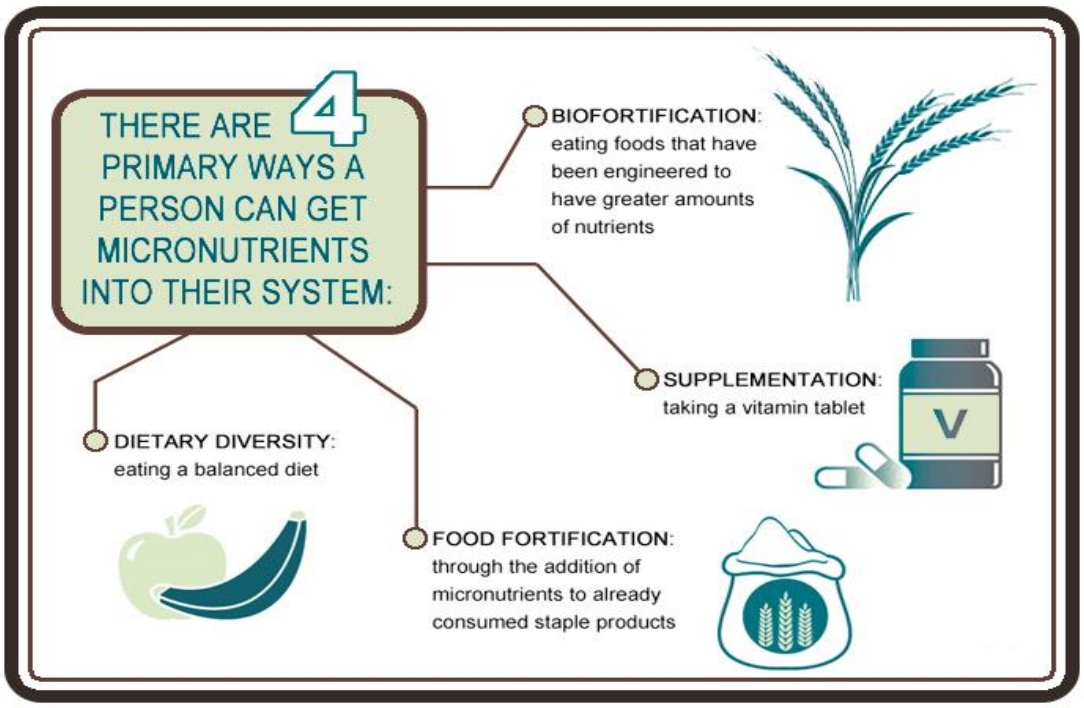


Figure 2.4 4 Four primary ways a person can get micronutrients
(Source: Allen, de Benoist, Dary & Hurrell: Guidelines on food fortification with micronutrients, 2006.).

2.9.15 Delivery strategies for vitamin A

In the last 20 years, multiple studies have shown the relationship between vitamin A deficiency and child mortality. Vitamin A supplementation (VAS) has proven to be successful in reducing vitamin A deficiency (VAD) and has become one of the important interventions for child survival (Haselow, Obadia, Akame, 2004). Vitamin A deficiency impairs immune system functioning and increases the risk of death associated with diarrhoea and measles and accounts for an estimated 600,000 child deaths each year (Black *et al.*, 2008).

Some countries have made excellent gains in vitamin A distribution and still millions of children remain unprotected. The greatest challenge for vitamin A supplementation is finding a sustainable delivery strategy (Black *et al.*, 2008).

The advent of National Immunization Days (NIDs) and vitamin A supplementation programmes in sub-Saharan Africa were at best large-scale pilots. NIDs offer an opportunity to accelerate the coverage of vitamin A supplementation among children under five, increase the profile of the benefits of vitamin A and nutrition in general, and train thousands of front line health workers. According to Comley, Nkwanyana and Coutsoudis (2015) NIDs have been taking place in all of Sub-Saharan Africa and by the year 2000 almost all countries included vitamin A supplementation in NIDs. This helped reach over 80% of children 6–59 months old in almost all countries for at least one annual dose.

The second annual vitamin A dose, essential to maximize reduction in child mortality, was often not delivered because there was no mechanism. Alternative, sustainable delivery mechanisms with the possibility for high vitamin A capsule (VAC) coverage have been and are being sought (Comley *et al.*, 2015).

2.9.16 Food diversification

World-wide diversity of food and food production methods is the answer to the undernutrition and micronutrient deficiencies affecting the world's populations, said the United Nations Food and Agriculture Organization (FAO) ahead of World Food Day (Da Silva, 2013).

Food diversification is a long-term dietary and sustainable food-based method to address malnutrition (Faber, Oelofse, Van Jaarsveld, Wenhold and van Rensburg, 2010:30). Dietary diversity is essential as no single food item contains all nutrients in the correct amounts to ensure a healthy and balanced diet (Freeland-Graves and Nitzke, 2013).

2.9.17 Organic food

The benefits of organic food are that the food is grown without the use of pesticides, herbicides, chemical fertilizers, antibiotics and growth hormones. These foods are less contaminated (Wardlaw & Smith, 2011).

The benefits of organic food are:

- Organic farming lowers water pollution and builds soil fertility.
- By eating organic food, you reduce the chemical load that you take in as it contains no insecticides, pesticides, growth hormones, antibiotics, fertilizers and toxic artificial additives, flavourings, colourings and preservatives.
- The food reaches the consumers in a natural state with its nutrient content intact.
- Organic food is often fresher than non-organic food, because it has no preservatives so it goes straight to the shops.
- Natural food has more flavour (Wardlaw & Smith, 2011).

According to (Aertsen, Mondelaers, Verbeke, Buysse and Van Huylenbroeck, (2011) purchasing of organic food is decreasing as a result of high food prices.

The downside of organic food is:

- Organic food must be thoroughly washed because it might be contaminated by improperly composted animal fertilizer (Gravani, 2009).
- Organic food is not always available. This is because organic farmers rely on natural cycles. Natural disasters like drought, floods and pest infestation can spoil the entire crop.
- Conventional farmers can artificially stretch the natural seasonality of their fruit and vegetables so that you get them all year round (Gravani, 2009).

2.9.18 Nutrition education

The absence of nutrition education can be one of the reasons for inappropriate food choices. In the past nutrition education focused on improving the child's knowledge; today the objectives have broadened to address skills related to food and nutrition, attitudes and values (Wenhold, Kruger and Muehlhoff, 2008). Nutrition education is an important tool for promoting sound nutrition education in schools and communities. The guidelines to assist in promoting and achieving nutrition education are listed below:

- Children need to be socialized at an early age about good nutrition.
- Educational programmes should be made to suit the relevant target groups in terms of age, learning ability, availability and acceptability of food and culture.
- It must help individuals to make a life commitment to good nutrition.
- Continually encourage school children to apply dietary knowledge on daily food choices.
- Create awareness programmes on the causes of malnutrition.
- Empower children to bring about change in communities to address the underlying causes of malnutrition (Ruel and Alderman, 2013).

Since it is a challenge to incorporate nutrition as a stand-alone subject because of the overcrowded curricula, there are many ways that children can learn about food and nutrition within the school context. These include:

- Cross-curricular 'infusion'' (i.e. food and nutrition taught within the existing school subjects, wherever appropriate)
- Extracurricular activities (excursions to farms, food factories, markets, school action days on healthy nutrition, cooking clubs and school health)
- Establish school canteens and school feeding programmes.
- Have tuck shops and food vendors that sell nutritious food in and around the school.
- School gardening initiatives
- Events, collaboration with families and community
- School food policies.

Classroom lessons have an integral part to play in reinforcing and putting in place these initiatives (Wenhold *et al.*, 2008).

2.9.19 Government grants

Even though economic growth and increasing social welfare payments have made a mark in reducing poverty levels, large pockets of poverty remain deeply embedded, mostly among the black population in townships and informal settlements (The World Bank, 2014). Grants are an imperative source of income for poor households. It is well established that social grants reduce poverty (Budlender and Woolard, 2012).

The Child Support Grant (CSG) is a crucial tool of social protection in South Africa, reaching over 10 million South African children per month. The South African Child Support Grant was first introduced in 1998. In the last 14 years, South Africa's social grant programme has evolved to be one of the most comprehensive social protection systems in a developing country (Department of Social Development, 2012).

The results found by the South African Child Support Grant (2012) indicate that the benefits of the grant are as follows:

1. The Child Support Grant generates a positive developmental impact that multiplies its benefits in terms of directly reducing poverty and vulnerability
2. Early enrolment in the CSG substantially strengthens this impact. Encouraging continuous access to the CSG for qualifying children through to adolescence would help to maximize the potential benefits of the grant.
3. Receipt of the grant by teenagers generates a range of positive benefits, not least of which is the reduction of risky behaviours which, in the context of a high HIV and AIDS prevalence, creates a particularly protective impact.

An estimated 28.3% of South Africans receive social grants with 31.6% of the black population forming the majority (Stats SA, 2009:19). The amount of the Child Support Grant was placed at R210 per month per child in 2008 and it was given to caregivers of children younger than 14 years (Faber and Maunder, 2010). The government introduced support grants, child support grants, and care dependency grants for children under the age of 18 years that are physically and mentally disabled (Faber and Maunder 2010:268). For the majority of the families, social grants are the only source of income (Kimani-Murage *et al.*, 2010).

The economic impact of welfare grants on a few KwaZulu-Natal communities, started by the Department of Economic Development, KwaZulu-Natal, revealed that the majority of grant recipients spend their money on commodities that are essential for the household. The pay-points themselves provided enormous trading markets for both local and outside entrepreneurs. A sizable number of people were able to start small businesses using the grant money. These effects also resulted in the creation of jobs on a permanent or temporary basis (Surender, Noble, Wright and Ntshongwana, 2010).

Some countries like Ghana and some North African countries have shown exemplary leadership by meeting their target of halving the proportion of people suffering from hunger and making a huge step towards achieving the first MGD based on stable good governance and sound policies (Folaranmi, 2012). Contradicting the case of Ghana, many African countries believe that their governments are not doing enough as policies and plans to deal with food insecurity have not always been successful. The policies of national government and international institutions over the past years have neglected Statistics South Africa's rural and agriculture development (Folaranmi, 2012).

2.9.20 Food parcels

The Department of Social Development's (DOSD) National Food Emergency Scheme, started by cabinet in 2002, is targeted at distributing food parcels to the most vulnerable section of the population. This is a temporary measure to help poor people spending less than R300 per month on food (Moeng and de Hoop, 2008). The scheme forms part of government's Integrated Food Security Nutrition programme (IFSNP) and was established as a short-term measure.

The majority of the people who receive food parcels are identified by Non-Governmental Organizations (NGOs) and community-based organizations (CBOs). Each household receives a food parcel worth R300 each month. The beneficiaries of the scheme are vulnerable groups as per DOSD criteria. They are:

- Children and child-headed households
- Orphaned children
- People with disabilities
- Female-headed households
- HIV and AIDS affected households.

Beneficiaries of food parcels are expected to fill out a form at their nearest DOSD office in the presence of a welfare officer (Moeng and de Hoop, 2008).

2.9.21 Food assistance

According to the United States of America International Development (USAID), an estimated 842 million people worldwide suffer from chronic hunger, which kills more people every year than malaria, tuberculosis and AIDS put together. Food assistance is one method to mitigate this crisis (USAID, 2014).

The United States is currently the biggest donor of food assistance to Syria. USAID-funded programmes help feed millions of refugees and internally displaced persons affected by the crisis in and around Syria. USAID works with the UN World Food Program (WFP) and other partners to most effectively deliver this life-saving aid (USAID, 2014). Harvests had been poor in Zimbabwe (Mabhungo) and neighbouring villages, which indicated high food prices in the markets. More than 2 million people in Zimbabwe needed food assistance at the peak of the hunger season in March 2014 (USAID, 2014).

According to an article in The Economist, 2014, a new paper by researchers at the International Food Policy Research Institute (IFPRI) found that direct handouts of food were the least effective option. The handouts cost three times as much as vouchers to boost calorie intake by 15% and were four times as costly as a way of increasing dietary diversity and quality.

Distribution costs were high and wastage was also a problem. A minimum of 63% of the food given away was actually eaten, 83% of the cash was spent on food and 99% of the vouchers were exchanged instead of spending them on buying food. (Hidrobo, Hoddinott, Peterman and Moreira, 2016).

2.9.22 Home gardens

Gardening is still the most important method of food production for a majority of the population in the developing world; over and above that, high population density has put a lot of strain on land as more of it is required for settlement. This has resulted in land fragmentation, which has led to negative results in food production, and hence resulted in food insecurity (Musotsi, Sigot and Onyango, 2008).

Home gardening has been identified as one of the means of providing all-year-round access to food for rural households, and can make a significant contribution in providing daily household needs for better nutrition and health. Home gardening has been done to create direct access by households to a diversity of nutritionally rich foods like green, leafy vegetables, roots, tubers, fruit, nuts, legumes, condiments and livestock (Musotsi *et al.*, 2008).

Producing yellow and dark leafy vegetables at household level can provide low-income families with direct access to vitamin A rich foods. The most important benefit of home gardens comes from their direct contribution to household food security by increasing the availability, utilization and accessibility of food products (Food and Agriculture Organisation of the United Nations, Nutrition and Consumer Protection, 2010).

The integration of livestock and poultry into home gardening reinforced food and nutrition security for the families as milk, meat and eggs from home-raised animals provided the main source of animal protein (Galhena, Freed and Maredia, 2013). Many countries were using home gardening initiatives to improve the cereal-based diet of rural households.

Educating people on the importance of fresh produce for their wellbeing and providing them with the skills and means to produce these foods at home (dark, leafy vegetables and orange sweet potato, as an example, are cheap and easy to grow) can play an important role in improving nutrition in the rural community (Health24, 2013).

2.9.23 Nutrition improvement during pregnancy for fetus health

Undernutrition impacts directly on foetus development and on the birth weight of the infant. Nutrients are first utilized for maternal needs and physiological changes, next for the health of the placenta and its development, and lastly for foetal growth. Enough availability of nutrients is the one most imperative environmental factor during the gestation period that will have a bearing on the pregnancy outcome (du Plessis, Labuschagne and Naude, 2008).

Malnourished mothers are prone to give birth to low birth weight babies who are at greater risk of dying as infants or suffering from stunting during childhood (Bhutta *et al.*, 2012). According to the WHO (2013), pre- and post-pregnancy nutrition status is imperative in determining the birthweight of the baby. Micronutrient deficiencies such as iron, vitamin A, calcium and iodine can result in poor maternal health outcomes and pregnancy complications, which can put the baby and mother at risk. Poor maternal weight gain during pregnancy as a result of an inadequate diet increases the risk of premature delivery, low birth weight and defects (WHO, 2013).

2.9.24 Progress towards achieving MDGs in South Africa

According to a report by the United Nations Economic Commission for Africa (EAC) on the progress that Africa is making towards the Millennium Development Goals (MDGs), Africa is not on track to halve poverty statistics by 2015 even though recent figures show substantial progress in this area. The number of people employed is on the increase and undernourishment is decreasing, as is the proportion of employed people living on less than the poverty benchmark of $1.25 per day (Union, 2015; United Nations, 2015). Poverty rates in Africa were reduced to below 50% in 2008 (to 47.5%) for the first time and the number of people living in abject poverty also decreased.

On the negative side, the report made mention of an extremely high proportion of the population that was unemployed, extremely high-income inequalities, and poor, uneven educational outcomes (Union, 2015; Union, 2014).

The MGD Progress Report for Africa reported that climate related shocks caused by extreme weather conditions have killed livestock and worsened Africa's food insecurity, resulting in a high incidence of underweight children, widespread hunger and poor dietary consumption patterns (United Nations MGD Progress Reports-Africa, 2013). The report assesses four goals as being 'on track'' and four as being 'off track':

On track:

- MDG2: Achieve universal primary education
- MDG3: Promote gender equality and empower woman
- MDG6: Combat HIV and AIDS, TB, malaria and other diseases
- MDG8: Develop a global partnership for development.

Off track:

- MDG1: Eradicate extreme poverty and hunger
- MDG4: Reduce child mortality
- MDG5: Improve maternal health
- MDG7: Ensure environmental stability (MDG Progress Report-Africa, 2013).

South Africa is a middle-income country and does not qualify to receive foreign assistance; the attainment of the MDGs is dependent on the government and their stakeholder's recourses. The then Deputy President, J.Z. Zuma said in his speech on the 8th of June 2010 that South Africa was committed to the MDGs with MDG1 as the country's number one priority by creating jobs with a sustainable source of income (UNDP, 2010:4; Jensen, 2010).

The eight MDGs are:

- MDG1: Eradicate extreme poverty and hunger
- MDG2: Achieve universal primary education
- MDG3: Promote gender equality and empower women
- MDG4: Reduce child mortality
- MDG5: Improve maternal health
- MDG6: Combat HIV and AIDS, malaria and other diseases
- MDG7: Ensure environmental sustainability
- MDG8: Develop a global partnership for development.

The MDGs correlate to food, nutrition and health and are starting to influence international nutrition for the better although there is still a lot to be done (Wahlqvist, 2008). When the world looks beyond 2015 towards a new development agenda, countries must stay on course to make as much progress as possible by the target date. The mainland has made considerable progress towards the MDGs as from 2000 and has learned a great deal over the past 12 years. If implementing lessons learned, African countries should be able to overcome challenges and fast track progress over the next three years (Mutasa and Paterson, 2015).

His Excellency President Jacob Gezeyihlekisa Zuma stated that "And while there still seems to be much doom and gloom, statistics indicate that, as far as poverty is concerned, we have made a lot of progress, yet i am acutely aware that the level of poverty among vulnerable groups such as women and children still remains a major challenge. I am, however, convinced that the situation in South Africa is likely to be similar to that in many other emerging economies and that progress being made towards the achievement of MDG1 has been disrupted by global fuel and food prices and the financial crisis" (Statistics South Africa Country Report, 2013).

The MDGs have been replaced with the Sustainable Development Goals (SDGs). The new SDGs came into force in September 2015 with the goal to create sustainable and resilient development. In total, there are 17 SDGs targeting the eradication of poverty, fighting injustice, fighting inequality and tackling climate change by 2030.

- SDG1: Eradicating poverty with the focus on ending poverty in all forms everywhere.
- SDG2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
- SDG3: Good health and wellbeing
- SDG6: Clean water and sanitation for all
- SDG8: Decent work opportunities and economic growth
- SDG13: Take urgent action to stop climate change and its impact (FAO, 2015).

2.9.25 Political impact of malnutrition

For the past five years, political disclosure about the challenges of malnutrition has risen substantially on both a national and an international level and has given birth to stated commitments from many national governments, international organizations and donors (Gillespie, Haddad, Mannar, Menon, Nisbett and Martenal and Group, 2013). One of the underlying reasons why undernutrition remains is because of the lack of credible and sustained government commitment to deal with the problem (Acosta, Fanzo and Institute of Developmental Studies, 2012).

This might change with renewed efforts to end undernutrition such as investing in life-saving nutrition interventions for the most vulnerable, making sure that there is proper funding and building capacity to deliver those interventions with focus at country level (Acosta, Fanzo and Institute of Developmental Studies, 2012).

Why focus on governance of the nutrition sector? Governments need to show capacity, accountability and responsiveness to effectively reduce under-nutrition. Governments need to be able to co-ordinate policy interventions to deal with the multiple causes of undernutrition, such as insufficient sanitation, illness, poor diet, unclean water and poor parental care (Acosta, Fanzo and Institute of Developmental Studies, 2012).

During the Apartheid era, black males had to leave their homes to provide cheap labour in the mines and industries and family members remained in the rural areas. Access to land was prohibited, people were deprived of the opportunity to do what they knew best, that being agriculture and farming. That was the start of rural poverty, the labour migration system, female-headed homes and disunited families. This situation still portrays a typical South African rural home (Nyapokoto, 2014; Graven, 2014).

2.9.26 The economic consequences of malnutrition

Malnutrition slows down economic growth and accelerates poverty through three routes – direct losses in productivity and physical status, indirect losses from poor cognitive functioning and deficit in schooling, and losses owing to increased health care costs. Malnutrition's economic costs are tremendous – productivity losses to individuals are estimated at more than 10% of lifetime earnings and gross domestic product (GDP) lost to malnutrition runs as high as 2% to 3%. Improving nutrition is as much an economics problem as one of social protection, welfare and human rights (Health Systems Trust, 2016).

Experience from other parts of the world, most noticeably Asia and Latin America, confirms that reducing hunger and thereby reducing vulnerability and improving resilience is one of the bigger social and economic developments. This suggests that if more progress was made against hunger in Africa, the continent's most recent growth performance would have been even more impressive, with possibly a strong impact on poverty reduction (Black, Victora, Walker, Bhutta, Christian, De Onis, Ezzati, Grantham-McGregor, Katz, Martorell and Uauy, 2013).

The huge and rising number of food-insecure and malnourished people continues to pose very serious concerns in Africa. In the last two years, global food price increases, followed by economic and financial crises have resulted in more people ending up in poverty and hunger. There is a need to increase awareness among the policy makers and development partners that countries are paying and will continue to pay for the consequences of child undernutrition. Eradicating child undernutrition is a useful investment in the human capital of a country ((Black, Victora, Walker, Bhutta, Christian, De Onis, Ezzati, Grantham-McGregor, Katz, Martorell and Uauy, 2013). According to Zarif, Haider, Ahmed and Bano (2014) malnutrition leads to fewer years of completed schooling as a result of various reasons such as frequent dropout, absenteeism, grade repetition and more government funds spent on grade repetition by children. Statistics South Africa states that nearly 70% of households in the Eastern Cape spent less than R1000 per month on food, whilst 7.6% spent R3500 or more per month in 1996. The Eastern Cape is regarded as the poorest rural area, whilst the Western Cape and Gauteng are the richest urban provinces. Poverty and food and nutrition insecurity are at the highest in the Limpopo and Eastern Cape provinces that have the greatest populations in the rural areas (Khuzwayo, 2008).

Chapter 3 – RESEARCH METHODOLOGY

The purpose of this chapter is to explain how the data was collected using reliable instruments to ascertain the socio-demographic profile and nutrition status of primary school children in Chesterville, KwaZulu-Natal.

3.1 Description of the study area

The stakeholders and study participants resided in the township of Chesterville situated 13km west of the City of Durban in the province of KwaZulu-Natal in South Africa. Chesterville was built in the 1940s and was one of three townships established to provide housing for black people in the greater Durban area. The other two townships were KwaMashu and Lamontville. Lamontville township is situated on the South of Durban on the Umlaas River, next to Mobeni and was the first to be established in the 1930s. KwaMashu township, situated 32 kilometres north of Durban, was the third township to be established in 1959. Housing development in Chesterville was frozen in 1945 and the residents faced the threat of removal for about 40 years (Maylam, 1983; Gigaba and Maharaj, 1996). In 1959 some of the Chesterville residents were moved to kwaMashu township as part of the apartheid urban relocation programme.

The community profile, according to the Planning Unit of the eThekwini Municipality (under local government, Durban is known as eThekwini – hence the eThekwini Municipality) indicated that the total population of Chesterville was 14 007 people and black Africans made up 99% of the population. There were 645 disabled people, constituting 5% of the population. This study focuses on residents in the age group 5-14 years, which constituted 2 651 (19%) people (eThekwini Municipality, 2010).

There were 3 285 (23%) employed people between the ages of 15 to 65 years, 3 490 (25%) people were unemployed and 2 891 (21%) people were not economically active. The table below indicated the household income range of this population.

Table 3.1: Household income (per annum) (eThekwini Municipality 2016)

Household Income		
(Per annum)	**Households**	**%**
No income	683	20
R1 - R4 800	184	5
R4 801 - R 9 600	560	16
R9 601 - R 19 200	731	21
R19 201 - R38 400	729	21
R38 401 - R 76 800	391	11
R76 801 - R153 600	109	3
R153 601 - R307 200	29	1
R307 201 - R614 400	12	0
R614 401 - R1 228 800	1	0
R1 228 801 - R2 457 600	0	0
R2 457 601 and more	0	0

Chesterville is a big township and it is divided into two different sections which the Municipality refers to as wards; it comprised of ward 24 and ward 29. In this study, we focused on ward 24. There were a few major community facilities located in ward 24 and these included: one clinic, one community hall and five schools. There was no SAPS police station, hospital, pension pay point, billing point, metro police station, fire station nor post office.

Table 3.2: Types of dwellings

Dwelling Type				
Number of Households	**Formal**	**Informal**	**Traditional**	**Other**
3433	2500	867	31	35
%	73	25	1	1

There were 3 433 households in the ward, of which 2 500 (73%) were formal, 867 (25%) were informal and 31 (1%) were described as traditional. According to Hall (2015) a traditional dwelling is defined as a hut/ structure made of traditional material such as zinc.

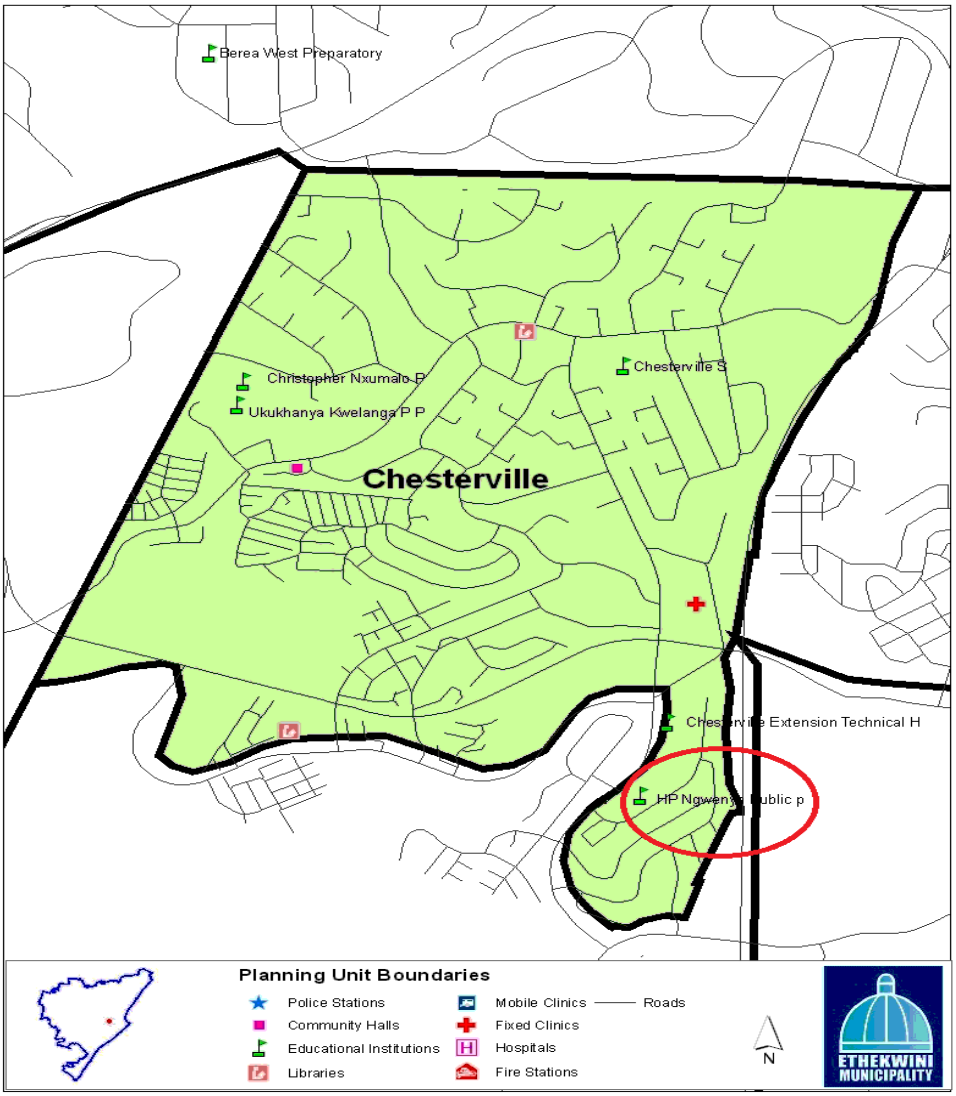


Figure 3.1: Location of Chesterville Township (eThekwini Municipality 2016)

3.2 Permission and consent

The protocol was submitted in accordance with the Medical Research Council guidelines for medical research. Ethical approval was obtained from the Faculty Research Committee (FRC) at the Durban University of Technology (DUT) as part of the proposal approval process (Annexure K). Permission was granted by the School Governing Body to conduct interviews in the school (Annexure A).

The children were asked to give their names if they wanted to participate in the study and parents of all voluntary participants signed consent forms (Annexure B) to allow for participation in the study. Prior to the study, a number was allocated to each participant to ensure confidentiality and anonymity. The children were free to withdraw from the study at any time without any consequences.

3.3 Study design process

Developmental stages of the study

Stage 1: Literature review

Scientific literature was reviewed to indicate the relevance of the study.

Stage 2: Planning the study design

- Writing the research proposal
- Arranging meetings with relevant parties
- Visiting the school to decide together with the HOD (Head of Department) on the classroom to be used.

Stage 3: Stakeholder consultation and plan implementation

- Holding meetings with the Principal and Head of Department (Annexure I).
- Holding meetings with the SGB (School Governing Body) to get permission (Annexure A).
- Setting up meetings with the parents of the participants (Annexure C).
- Setting up a meeting with the learners to collect their consent forms (Annexure B).

Stage 4: Rolling out the study

The study was conducted over a period of two months in November/December on non-examination days and after the learners had finished writing examinations.

Stage 5: Reporting on the results

The results will be discussed in detail in chapter 4.

3.4 Study type

A quantitative research method was applied using a cross sectional survey to collect data on children nutrition status and to conduct interviews with the parents. A descriptive research design was adopted due to the nature of the research problem which is improving the nutritional status of school going children in Chesterville Extension.

A number of quantitative tools such as Food Frequency Questionnaires (FFQ) were completed on a Monday in respect of food consumed over the past seven days; two 24-hour food recalls were completed – one for a week day and one for a weekend day. Anthropometric measurements were collected during school visits and Socio Demographic Questionnaires complemented each other ensuring that a better understanding of the problem under investigation is obtained. The parent interviews were conducted at H.P. Ngwenya Primary School on Saturday mornings between nine in the morning (9am) and twelve middays (12pm). The interviews were done over six Saturdays and during the week to accommodate parents' availability. Interviews were conducted in the school's resource centre.

3.5 Study variables

The study variables are illustrated in figure 3.2 below

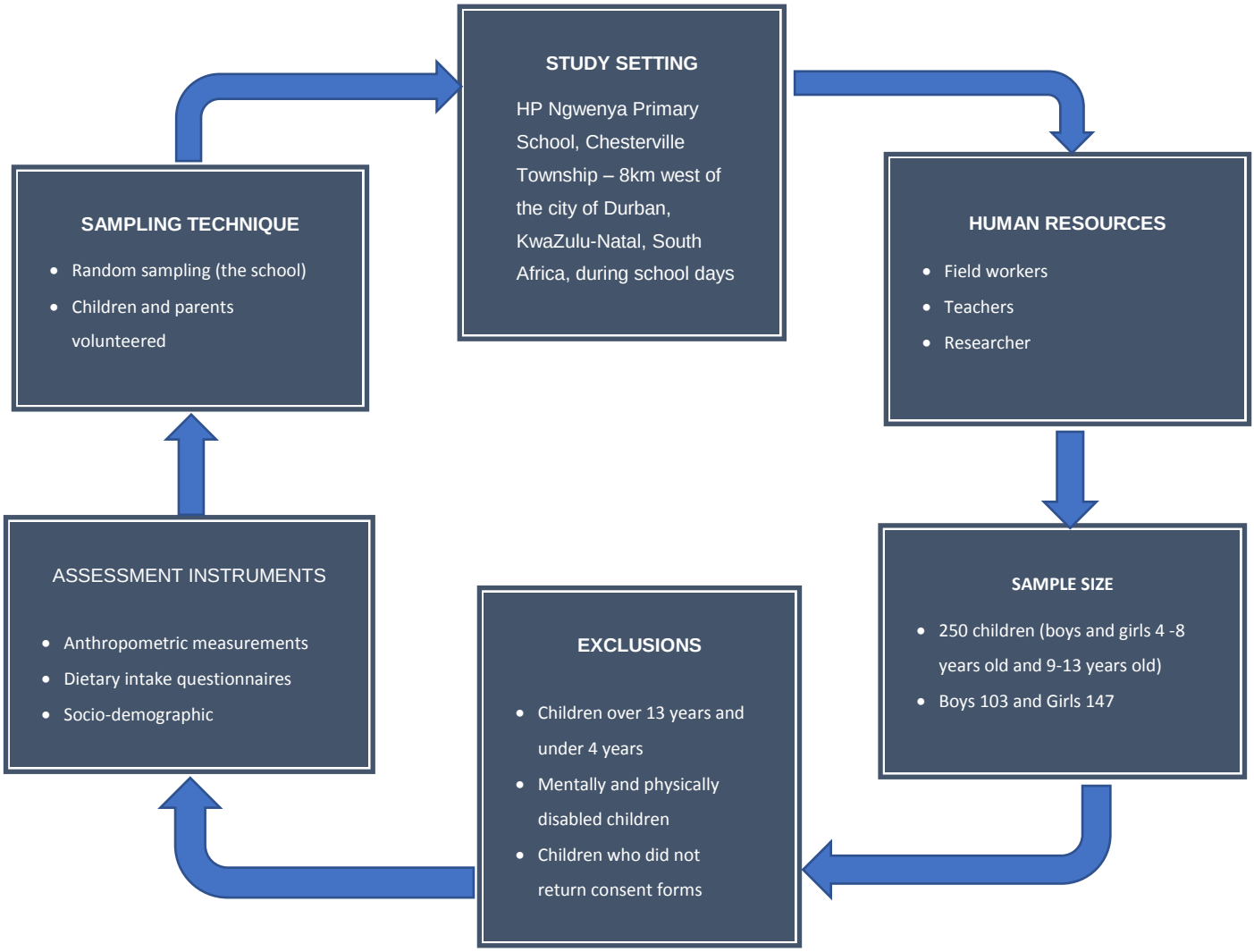


Figure 3.2: The model of the study variable

3.6 Sampling

The sample size was calculated using a power point calculation and 250 children volunteered out of a possible 500 children in the school in Chesterville. The sample was rounded off to 250 to account for possible dropouts (Cole, 2005). The school was randomly selected from all the primary schools in the Chesterville area. Once the school was chosen and permission granted, the researcher then had to identify the age groups

she preferred to work with. The sample comprised of 250 children. It must be noted that drop out occurred and it will be discussed in chapter 4.

3.6.1 Sample size

$$Ss = \frac{Z^2 * (p)(1-p)}{c^2}$$

Where:

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

P= percentage picking a choice, expressed as a decimal (0.5 used for sample size needed)

C= confidence interval, expressed as a decimal =.05 (three units on both sides of the normal).

The sample was defined as primary school children of Chesterville aged between 4 to 8 years and 9 to 13 years.

The following were used as inclusion criteria for the study:

- Children between 6-13 years
- Boys and girls
- Previously disadvantaged schools in the community
- Area (Chesterville, Durban).

The following were used as exclusion criteria for the study:

- Learners who were below and above the age limits.
- Learners who did not return consent forms.
- Disabled learners (for collection of weight and height measurement).

Two hundred and fifty consent forms were received back with signed consent given. All the qualifying learners were invited to be included in the study. Learners who did not return the consent forms were excluded from the study.

Figure 3.3: Learners collecting consent forms

Random sampling techniques were used in this study. Chesterville has four primary schools. The four primary schools' names were written on a separate piece of paper, folded and placed in a hat. Without looking, the researcher picked one piece of paper from the hat. Consent forms were sent to all the parents of the qualifying learners aged four to 13 years.

3.7 Responsibilities of the field workers

Two field workers were recruited from 3rd year and B-Tech students from the Food and Nutrition Consumer Science Department at Durban University of Technology (DUT). A field worker training workshop was conducted at DUT. The training was conducted in English. The training manuals for the field workers to refer to during the study were written in English (Annexure D).

Field workers were trained in the following aspects:

- How to complete a Socio-demographic Questionnaire.
- How to complete 24-hour food recalls with the children using food samples to facilitate estimating of food portions
- How to complete the FFQ.
- How to take anthropometric measurements.
- The importance of showing respect, friendliness and patience towards both children and adults was emphasized to the field workers.
- The importance of reliability and punctuality was emphasized as being key to the success of the fieldwork.
- All questions were to be answered accurately and in full.

3.8 Administering the measurement instruments

The first data collected was the weight and measurements of the children. The weight and height measurements were taken twice per learner and the average of the two measurements was used. The weighing and measuring was done over two days. The learners were given fruit and hot dogs at the end of the measuring process since it was done after they had finished writing their exams and it was done around lunch time.

The second set of data was the 24-hour food recall and the Food Frequency Questionnaire. On Monday learners were asked to recall what food they had consumed

on Sunday; and the week day intake was assessed on Wednesday. If the children could not recall what food they had consumed at home, parents were asked to assist.

The third set of data collected was the Socio-demographic Questionnaire. The interviews with the parents were done in the afternoons and on Saturdays for those parents who were employed on week days. For the parents that were available on week days the interviews were done between 11am and 3pm, each session taking on average between 30 and 45 minutes. On average, the two field workers and the researcher were each able to interview three or four parents a day; on weekends, they managed to interview five or six parents a day.

3.8.1 Socio demographic questionnaire

The socio-demographic questionnaire was written in English, pre-tested and validated (Oldewage-Theron *et al.,* 2005b) (Annexure G). The purpose was to determine the socio-demographic profile of the households, and the categories included were: personal information, and information on type of dwelling, family composition, work and economic status, level of education, language spoken at home, household assets, type of house, number of people living in the household and problems with pests (refer to Annexure D). The questionnaire was fairly long and it took about 30 to 45 minutes to complete.

3.9 Dietary intake

3.9.1 24-hour food recall

Two 24-hour food recalls were used to collect data for the purpose of the nutrient analysis (Annexure F). It was used in conjunction with a food frequency questionnaire for validity testing.

The 24-hour food recall questionnaire was used for dietary assessment and it records eating patterns, food consumed and quantities over a period of 24 hours.

The pre-validated 24-hour food recall questionnaire was conducted over two non-consecutive interview days (Oldewage-Theron *et al.*, 2005).

Individual interviews with the child and parent/caregiver were conducted with the help of the field workers. During interviews food models were used to determine portion sizes and to explain food items to the respondents.

3.9.2 Food Frequency Questionnaire (FFQ)

The Food Frequency Questionnaire (FFQ) collects data on the food variety and food group diversity consumed by each respondent (Annexure H). This questionnaire helps to identify food from nine food groups consumed over a period of seven days based on the Food and Agricultural nutritious food groups (FAO, 2010).

Group 1: flesh foods (meat, poultry and fish) diversity; group 2: egg diversity; group 3: dairy product diversity; group 4: cereal, roots and tubers diversity; group 5: legumes and nuts diversity; group 6: vitamin A rich fruit and vegetables diversity; group 7: other fruit and juices diversity; group 8: other vegetables diversity including onion; group 9: fats and oils diversity group. Actual quantities consumed were not collected with this questionnaire. The information was collected with the help of the trained field workers in an interview situation with the learners.

Figure 3.4: Field workers collecting dietary data

3.10 Procedures for conducting Anthropometric Measurements

Anthropometric measurements were used to measure weight and height (See Annexure E).

3.10.1 Weight

Weight was measured to the nearest gram using a good quality, electronic standardized medical scale (scale 2000, model: portable physical scale- PPS). Each respondent had to be lightly clothed and was requested to remove his/her shoes before being measured.

The scale was placed on a level and stable tiled surface. The scale was switched on and zeroed. The respondents had to stand on the scale in an upright position, facing the field worker and looking straight ahead. Their feet had to be placed flat and facing straight ahead on the scale, and it was important for the respondents to remain still with their feet slightly apart.

Measurements were taken twice and the average of the two measurements used. Before the next respondent could be measured the field worker had to wait for the scale to again read zero (0:0) on the digital display. The results of the weight measurement of each respondent were recorded on a separate anthropometric measurement sheet.

Figure 3.5: Weight measurement being taken

3.10.2 Height

Height was measured according to the following procedure:

- The respondent had to take his/her shoes off.
- The respondent was positioned facing the researcher.
- Shoulders had to be relaxed, with buttocks and heels touching the wall.
- Arms had to be relaxed and held at the side with legs straight, knees together, feet flat and heels touching the wall.
- The respondents were asked to look straight ahead.

The researcher then measured the respondent's height and recorded it on an anthropometric form in the space provided for height measurement. The procedure was repeated for each respondent. The two readings should not differ by more than 5mm and these measurements were taken to the nearest 0.5cm by using a stadiometer (Gibson, 2005; Lee and Nieman, 2003).

Figure 3.6: Height measurement done by a field worker

3.11 Statistical analysis of data

3.11.1 Socio-demographic questionnaire

The data from the socio-demographic questionnaire was captured onto a Microsoft® Excel spreadsheet by the researcher.

These questionnaires were analysed using the statistical package for social sciences (SPSS®) for Windows Version 19.0 software program. Descriptive statistics were determined with the assistance of a statistician. Data was presented in tables in the form of frequencies and percentages.

3.11.2 Dietary assessment questionnaires

The dietary intake data from the 24-hour food recall questionnaire was analysed by a nutrition expert using the Food Finder Version 3 computer program to determine the nutrient adequacy of each subject's diet (Langenhoven, Kruger, Gouws and Faber, 1991; Food Finder 3, 2002). Means and standard deviation were calculated for each nutrient intake and compared against the DRIs. The top 20 food items consumed were also determined. Estimated Average Requirements (EARs) were used as the reference measure and if this was not available, Recommended Daily Allowance (RDA) and adequate intake (AL) were used. Recommended Daily Allowances (RDAs) are indicated for use with individuals and not groups of people (NICUS, 2003).

The top 20 food items consumed were determined and presented in total intake, mean intake and frequency format. Fruit and vegetable intake was compared to the WHO guidelines of >400g/day. The Daily Recommended Intake (DRI) expresses the distribution as the acceptable macronutrient distribution range (AMDR) as per percentage of kilojoules. The Nutrient Adequacy Ratio (NAR) was calculated. Energy contribution to daily requirements, WHO cut-off points are: Protein 10-35%, Fat: 20-35% and Carbohydrates: 45-65% was calculated (WHO, 2003). The Nutrient Adequacy Ratio (NAR) was calculated.

The data from the Food Frequency Questionnaires recorded actual food intake over the past seven days and was captured on a Microsoft® Excel spreadsheet and analysed using SPSS version 19 software for descriptive statistics and data was interpreted with the assistance of a statistician to determine the Food Group Diversity Score (FGDS) and the Food Variety Score (FVS); statistics were presented in frequencies and means.

3.11.3 Anthropometric measurements

The averages of the two weight and height readings and the ages of the children were captured on a Microsoft® Excel spreadsheet.

The weight, height and age data was uploaded on to the Anthroplus software of the (WHO, 2008). Weight-for-age (5-19 years old), height-for-age (5-19 years old) and BMI-for-age (5-19 years old) were calculated to determine wasting, stunting, underweight and overweight in the group.

3.12 Correlations

Bivariate correlations (Pearson correlations – 2 tailed) were drawn between variables to establish a relationship. A $p<0.05$ was used as an indication of statistical significance. The food group diversity score was correlated with macronutrients and certain micronutrients to determine if a relationship existed between an increased FGDS and increased nutrients. Food security scores and BMI, household income and food security, household income and BMI, money spent on food and BMI, household income and money spent on food per month was used as indicated in table 3.1 below.

Table 3.3: Correlations between different variables

Variables
Household income vs Average Energy (KJ)
Household income vs Average Total protein (g)
Household Income vs Average Carbohydrate avail. (g)
Household income vs Average Total dietary fibre (g)
Number of people in the household vs Average Energy (KJ)
Number of people in the household vs Average Total protein (g)
Number of people in the household vs Average Total fat (g)
Number of people in the household vs Average carbohydrate available (g)
Number of people in the household vs Average Total dietary fibre (g)
Number of people in the household vs Unable to purchase food
Number of people in the household vs Meals per day
Number of people in the household vs Money spent on food
Money spent on food vs Average energy (KJ)
Money spent on food vs Average Total protein (g)
Money spent on food vs Average Total fat (g)
Money spent on food vs Average carbohydrate (g)
Money spent on food vs Average dietary fibre (g)
Currently employed vs Household income
Meals per day vs Unable to purchase food
Unable to purchase food vs Gender
Unable to purchase food vs Household income
Unable to purchase food vs Education level of the parents
Unable to purchase food vs Money spent on food
Unable to purchase food vs Average Energy (KJ)
Unable to purchase food vs Average Total protein (g)
Unable to purchase food vs Average Fat (g)

Table 3.1: Correlations between different variables (continued)

Unable to purchase food vs Average Carbohydrate (g)
Unable to purchase food vs Average Total fibre (g)
Average Total fibre vs Gender
Average Total fat (g) vs Money spent on food
Average Total fat (g) vs Household income
Average energy (KJ) vs Gender
Average Total protein vs Gender
Average Total fat (g) vs Gender
Average carbohydrate (g) vs Gender
Average Total dietary fibre (g) vs Gender
Education level of parent's vs Gender
Household income vs Gender
Number of people in the household vs Gender
Money spent on food vs Gender
Currently employed vs Gender
Unable to purchase food vs Gender
Meals per day vs Gender
FGDS vs Education level of parents
FGDS vs Household income
FGDS vs Money spent on food
FVS vs Education level of Parents
BAZ vs Average energy (KJ)
BAZ vs Average carbohydrate

Some results revealed statistical significance and all were analysed and are discussed in chapter 4.

3.13 Conclusion

This chapter discussed all the instruments used to determine the socioeconomic, health and nutrition profile of the children of school-going age. The instruments used were relevant in gathering data to achieve the purpose of the study. Results will be discussed in detail in Chapter 4.

Chapter 4 – DISCUSSION OF RESULTS

The purpose of the study was to determine the socio-demographic status, dietary intake, and nutrition status of children in a primary school in Chesterville Township outside Durban. This chapter will focus on reporting the results obtained in this study, including the analysis of results. This chapter presents the findings obtained by the caregivers included socio-demographic results, dietary intake and food frequency scores. All the children were weighed and measured to determine the anthropometric results. A total of 250 respondents participated in the study; the sample included 103 boys and 147 girls.

4.1 Socio-demographic results

Table 4.1 reflects the role of the parents/caregivers in the family. Forty-nine-point two percent (n=123) of the respondents were the mothers in the family. Fifteen-point six percent (n=39) were grandmothers, with fathers making up 10.8% (n=27) and the other 24% (n=60) represents aunts, uncles and siblings. The majority of the parents/caregivers, 89% (n=223), indicated that they resided in the township with 93.2% (n=233) in sharing a house. Table 4.1 also indicates that 20.8% (n=52) of the households have an average of eight people living in the household, and 85.2% (n=213) of the parents/caregivers indicated that they were permanent residents in Chesterville. The majority of the parents/caregivers 94% (n=235) reported that they were living in a brick house, 35.6% (n=84) lived in a shack outside the house and 49.6% (n=124) owned the house, while 63.6% (n=159) reported having a tap inside the house, 94% (n=235) reported access to flush toilet/sewerage, 91.6% (n=229) reported having a waste removal service and 88.8% (n=222) reported having a tarred road.

Table 4.1: Accommodation and family composition

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Your role in the family		
Mother	123	49.2
Grandmother	39	15.6
Father	27	10.8
Grandfather	1	0.4
Other (Aunt, Uncle, Sibling)	60	24
Gender		
Male	38	15.2
Female	212	84.8
Type of residential area		
Squatter camp	**8**	**3.2**
Rural Village	**1**	**0.4**
Hostel	**5**	**2.0**
Township	**223**	**89.2**
Other, zinc shed	**5**	**2.0**
Do other people live in the house?		
Yes	**233**	**93.2**
No	**17**	**6.8**

Table 4.1: Accommodation and family composition (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Number of people living in the house		
1	11	4.4
2	11	4.4
3	10	4.0
4	38	15.2
5	39	15.6
6	37	14.8
7	35	14
8	52	20.8
9	7	2.8
10	10	4.0
Permanent residents		
Yes	213	85.2
No	37	14.8
Type of house		
Brick	235	94.0
Clay	4	1.6
Wood	8	3.2
Zinc/Shack	3	1.2
No. of rooms in the house		
<2 Room	89	35.6
2-4 Room	92	36.8
>4 Room	69	27.6

Table 4.1: Accommodation and family composition (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Are there other houses/shacks in the yard?		
Yes	84	33.6
No	166	66.4
Do you have water?		
Tap inside the house	159	63.6
Tap outside the house	85	34.0
Fetch water from elsewhere	6	2.4
Type of toilet used at home		
None	5	2
Pit latrine	3	1.2
Flush toilet/sewerage	235	94
Bucket system	7	2.8
Do you have access to waste removal services?		
Yes	229	91.6
No	21	8.4
Tarred road		
Yes	222	88.8
No	28	11.2
Gravel road		
Yes	60	24.0
No	190	76.0

Figure 4.1 indicates that a considerable number of the respondents owned their homes (50%; n=125) and 26% (n=65) of the respondents indicated that they are staying with relatives. Of the 50% (n=125) own the Reconstruction and Development Programme (RDP) houses.

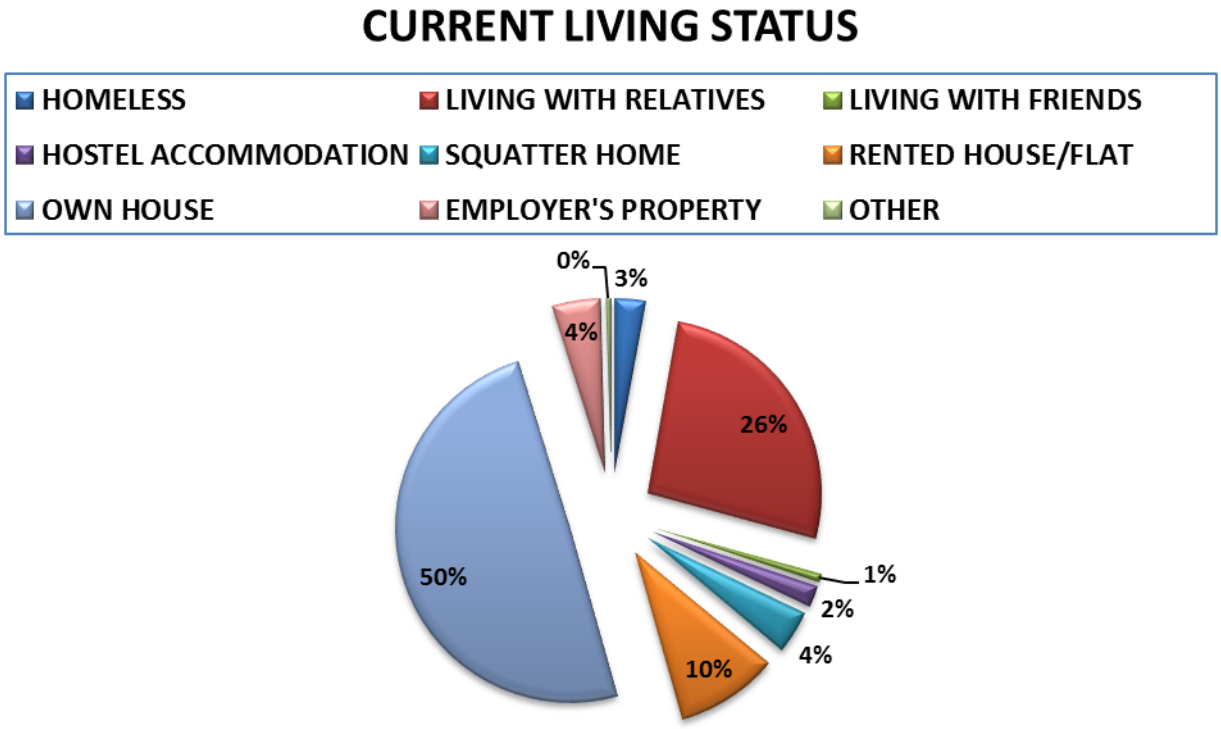


Figure 4.1: Current living status of participants (n=250)

Figure 4.2 presents the percentage income range bracket. About a third of the prents/caregivers (34.8%; n=87) earned in the income range of R501–R1000, followed by R1001–R1500 with a percentage of 20.8% (n=52) and 14.4% (n=36) of the respondents earning between R1501 to R2000, 10.8% (n=27) earned less than R500, 8.4% (n=21) earned between R2001 to R2500 and 10.4% (n=26) earned less than R2500 per month. This was of great significance considering the fact that the households have, on average, eight people living in the house.

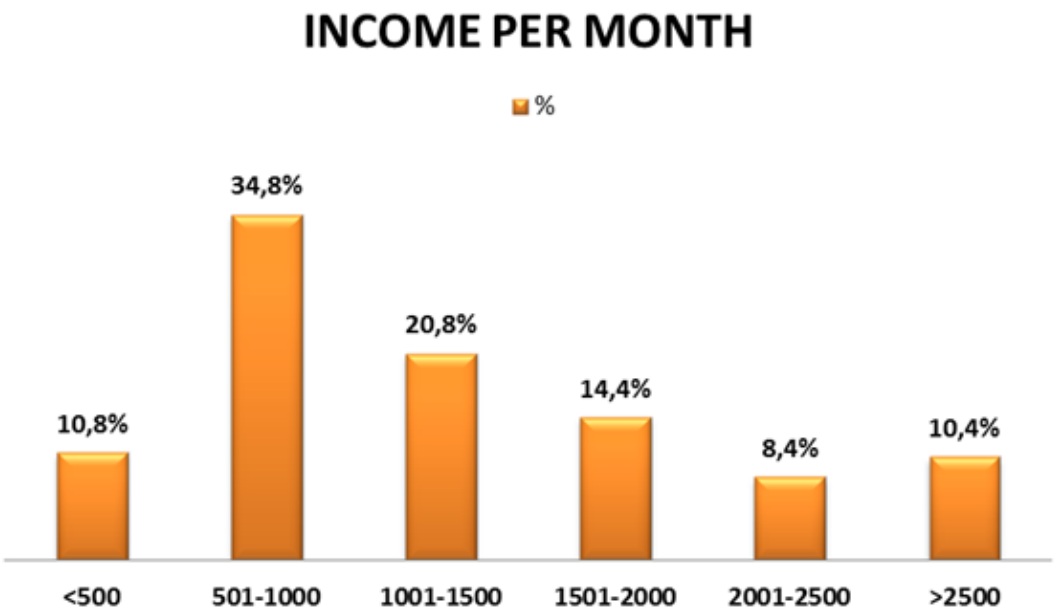


Figure 4.2: Household income per month

Table 4.2 indicates that 44% (n=110) of the parents/caregivers were seeking employment and the majority (55.6%; n=139) of the parents/caregivers were not seeking employment. Some of the parents/caregivers were receiving child grants and fell within the active economic bracket. Thirty-seven percent (n=75) of the parents/caregivers had never been employed while 33.6% (n=84) of the parents/caregivers had been employed for more than 3 months. Only 25% (n=63) of the respondents had permanent jobs, with a considerable number 54.8% (n=146) of the parents/caregivers employed in piece jobs and most of the parents/caregivers (82.8%; n=207) having unemployed spouses/partners.

Just over a third (35.2%; n=88) of the parents/caregivers indicated that sometimes there was not enough money to buy food and 32.8% (n=82) of the parents/caregivers indicated that often there was not enough money to buy food while 15% (n=38) of the parents/caregivers indicated that there was always not enough money to buy food. A considerable number (36.4%; n=91) of the parents/caregivers had one person contributing to the household income.

Table 4.2 furthermore indicates that the majority (75.2%; n=188) of the parents/caregivers purchase food once a month and 12.4% (n=31) purchased food once a week while 10.8% (n=27) purchased food daily. Food is purchased from a supermarket by the majority (88%; n=220) of the parents/caregivers.

Table 4.2 furthermore indicates that the majority (94%; n=235) of the parents/caregivers used a bus as a means of transport and one of the parents/caregivers owned a vehicle. More than R500 per month was spent on food in 45.2% (n=113) of the households. Food shortages due to a limited income were frequent in most of the households. These results indicate that food shortages could be linked to the low total income received by most of the parents/caregivers. A third of the parents/caregivers (34.8%; n=87) earned in the income range of R501–R1000, followed by R1001–R1500 with a percentage of 20.8% (n=52) and 14.4% (n=36) of the parents/caregivers earning between R1501 to R2000; 10.8% (n=27) earned less than R500, 8.4% earned between R2001 to R2500 and 10.4% (n=26) earned less than R2500 per month.

Table 4.2: Work status and income

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Currently employed		
Yes	60	23.4
No	190	76.6
Seeking employment		
Yes	110	44.0
No	139	55.6
Duration of unemployment		
<6 months	12	4.8
6-12 months	24	9.6
1-3 months	36	14.4
>3 months	84	33.6
Other/ N/A	94	37.6

Table 4.2: Work status and income (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Type of current job		
Permanent position	63	25.2
Temporary position	42	16.8
Fixed term contract	8	3.2
Piece jobs….	137	54.8
(Part time job)		
Yes	43	17.2
No	207	82.8
How often do you not have enough money to buy food?		
Always	38	15.2
Often	32	32.8
Sometimes	88	35.2
Seldom	17	6.8
Never	25	10.0
Number of people contributing to household income		
0	59	23.6
1	91	36.4
2	64	25.6
3	17	6.8
4	8	3.2
5	2	0.8
6	4	1.6
7	3	1.2
9	2	0.8

Table 4.2: Work status and income (continued)

How often are groceries purchased?		
Every day	27	10.8
Once a week	31	12.4
Once a month	188	75.2
Other (Specify)	4	1.6
Where are groceries purchased?		
Tuck shop	15	6.0
Street vendor	1	0.4
Wholesaler	12	4.0
Supermarket	220	88.0
Other/Social services.	2	0.8
Type of transport used		
Bus	130	52,0
Train	15	6.0
Own vehicle	1	0.4
Transport D (Walking)	1	0.4
Transport E (Hiking/ Lift)	250	100
Amount spent on food per month		
0-R50	2	0.8
R51-R100	8	3.2
R101-R150	11	4.4
R151-R200	13	5.2
R201-R250	9	3.6
R251-R300	29	11.6
>R500	113	45.2
I do not know	65	26

Figure 4.3 below indicates that 61% (n=153) of the parents/caregivers were unemployed and only 39% (n=98) of the parents/caregivers were employed.

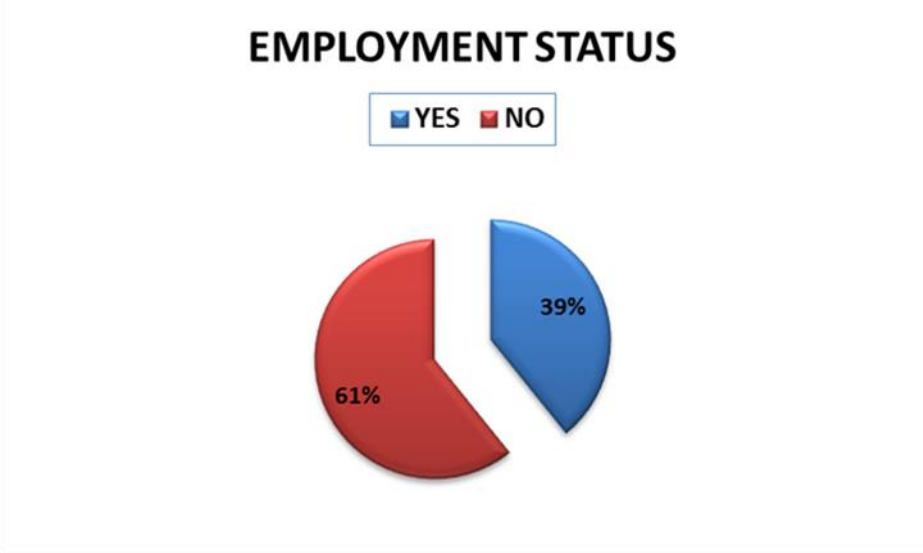


Figure 4.3: Parents/ caregivers employment status (n= 250)

Figure 4.4 shows the percentages of unemployed parents/caregivers with status; 46% (n=118) of the parents/caregivers did not have a job at all and 38% (n=98) indicated being unskilled as a reason for being unemployed, 6% (n=15) were students, 4% (n=10) were housewives, while 4% (n=10) were retired.

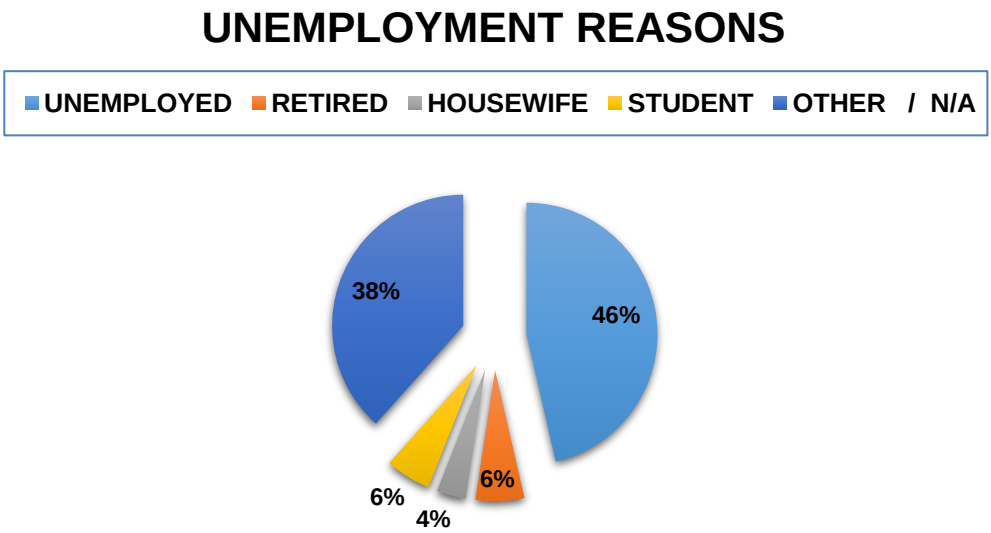


Figure 4.4: Unemployment reasons of participants (n=250)

Figure 4.5 indicates that in most cases the heads of households were women, with 36% (n=90) being mothers, 15% (n=38) grandmothers, 7% (n=18) aunts and 6% (n=15) siblings (sisters).

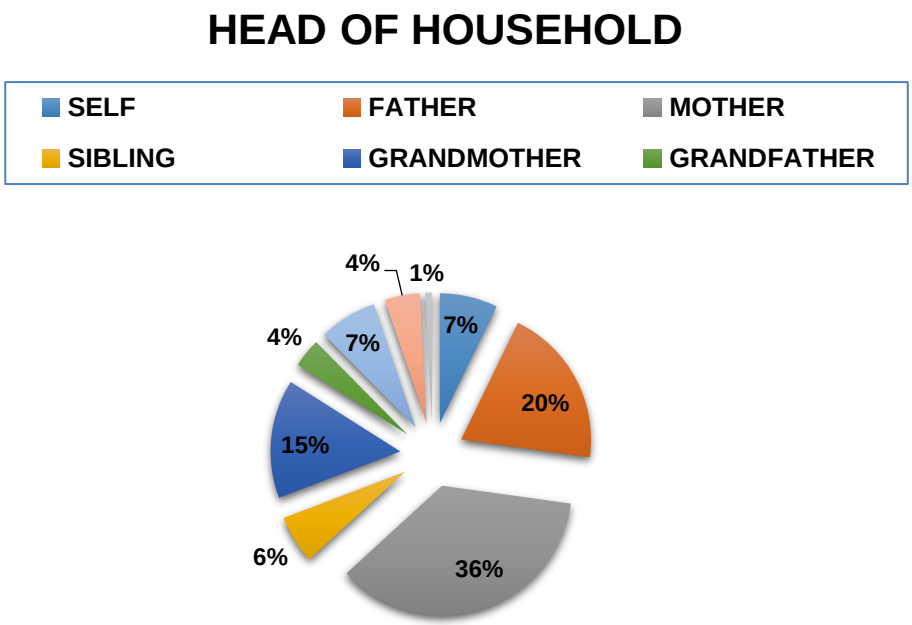


Figure 4.5: Household member seen as the head of the household (n=250)

Table 4.3 indicates that 96% (n=240) of the households speak Zulu. A considerable number of the households had birth certificates for the children 54.8% (n=137) and 57.6% (n=144) of the households had immunization cards. Table 4.3 indicates that most of the children (94%; n=235) walked to school and 4% (n=10) travelled by bus and 29% (n=11.6%) travelled by taxi. Food was prepared by mothers in most (50%; n=125) of the households, followed by grandmothers (11.6%; n=29), aunts (11.2%; n=28), and 10.4% (n=26) by siblings.

The type of food purchased was decided by the mothers in the majority (52.8%; n=132) of the homes, followed by aunts (12.4%; n=31), and grandmothers (11.6%; n=29) and in 9.2% (n=23) of the households the siblings decided on what food to buy. The mothers feed and serve food in 46.4% (n=116) of the households.

Table 4.3 indicates that 50.8% (n=127) of the households had mothers deciding on how much was spent on food, followed by grandmothers at 13.2% (n=33) and aunts at 10.8% (n=27). Food was consumed three times a day by some of the parents/caregivers (62.8%; n=157) and twice a day by 23.6% (n=59) of the parents/caregivers. Most of the meals were consumed at home 90.4% (n=226) and 9.2% (n=23) of the meals were consumed at school.

Table 4.3: Education and language

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Highest education level		
None	11	4.4
Primary school	80	32.0
Standard 8 (Grade 10)	93	37.2
Standard 10 (Grade 12)	50	20.0
College	11	4.4
Other after matric	5	2.0
Home language		
Zulu	240	96.0
Xhosa	5	2.0
English	5	2.0

Table 4.3: Education and language (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Children with birth certificates		
None	1	0.4
1	27	10.8
2	28	11.2
3	21	8.4
4	20	8.0
5	6	2.4
6	9	3.6
8	1	0.4
All	137	54.8
Children with completed immunization cards		
None	17	6.8
1	29	11.6
2	25	10.0
3	21	8.4
4	11	4.4
5	2	0.8
9	1	0.4
All	144	57.6

Table 4.3: Education and language (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Number of children attending school		
None	3	1.2
1	32	12.8
2	38	15.2
3	34	13.6
4	22	8.8
5	8	3.2
6	3	1.2
9	3	1.2
All	107	42.8
Who is responsible for food preparation?		
Self/ learner	18	7.2
Father	16	6.4
Mother	125	50.0
Sibling	26	10.4
Grandmother	29	11.6
Grandfather	6	2.4
Aunt	28	11.2
Uncle	1	0.4
Cousin	1	0.4

Table 4.3: Education and language (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Who decides on what food is bought?		
Self/ learner	17	6.8
Father	10	4.0
Mother	132	52.8
Sibling	23	9.2
Grandmother	29	11.6
Grandfather	6	2.4
Aunt	31	12.4
Uncle	2	8
Who is responsible for cooking and serving the food		
Self	18	7.2
Father	16	6.4
Mother	116	46.4
Sibling	29	11.6
Grandmother	28	11.2
Grandfather	5	2.0
Aunt	27	10.8
Uncle	6	2.4
Cousin	1	0.4
Other	4	1.6
Where do you eat most of your meals (Children)?		
Home	226	90.4
School	23	9.2
Other	1	0.4

Table 4.3: Education and language (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Who decides how much money is spent on food?		
Self/ learner	19	7.6
Father	16	6.4
Mother	127	50.8
Sibling	16	6.4
Grandmother	33	13.2
Grandfather	7	2.8
Aunt	27	10.8
Uncle	4	1.6
Other	1	0.4
How many meals do you eat per day (children)?		
1.0	6	2.4
2.0	59	23.6
3.0	157	62.8
>3	27	10.8
6.0	1	0.4
Total respondents		100

Thirty-seven percent of the parents/caregivers had standard eight as the highest level of education (figure 4.6). This was of great significance considering that in figure 4.5 most of the parents/caregivers had the highest percentage in the income level of R5001–R1000. The contributory factor could be that 39% (n=98) of the parents/caregivers were unskilled as stated in the reasons for unemployment.

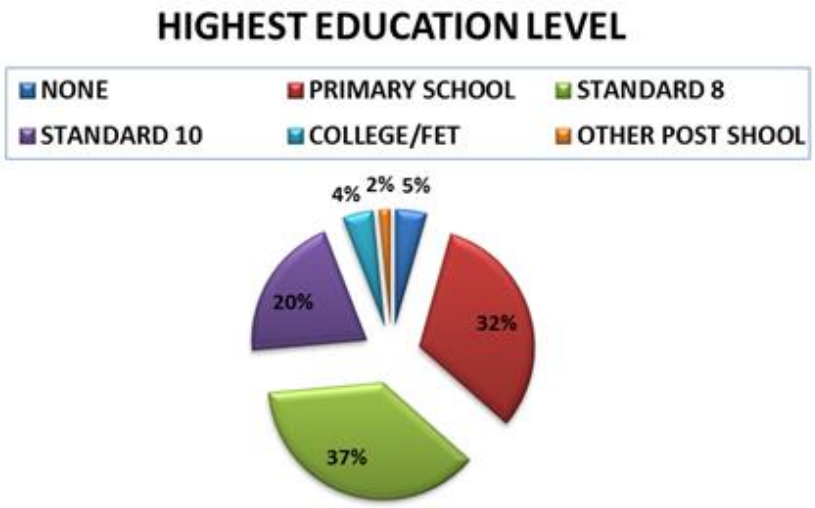


Figure 4.6: Highest education levels of the caregivers

Table 4.4 indicates positive access to household assets although the community did not earn much. The majority of the respondents' households owned electrical assets. The most commonly owned assets included electrical stoves 56% (n=140), hot plates 56% (n=140), radios 90.8% (n=227), electric irons 87.6% (n=219), television sets 90.4% (n=226), refrigerators 80.8% (n=202), and electric kettles 82% (n=205). Non-electrical assets were owned by the majority of the parents/caregivers. These included mattress beds 61.6% (n=154), lounge suites 49.6% (n=124), and aluminum pots 52.4% (n=131) which are mostly used for cooking.

Table 4.4: Assets

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Electric stove	140	56.0
Gas stove	14	5.6
Primus/ Paraffin stove	59	23.6
Microwave oven	98	39.2
Hotplate	141	56.4
Radio	227	90.8
Television set	226	90.4
Refrigerator	202	80.8
Freezer	77	30.8
Bed with mattress	154	61.6

Table 4.4: Assets (continued)

VARIABLE	NUMBER (n=250)	PERCENTAGE (%)
Mattress only	**125**	**50.0**
Lounge suite	**124**	**49.6**
Dining room suite	**73**	**29.2**
Electric iron	**219**	**87.6**
Electric kettle	**205**	**82.0**
Fuel used in food preparation		
Paraffin	**17**	**6.8**
Electricity	**229**	**91.6**
Gas	**4**	**1.6**
Type of pot material		
Cast iron	**3**	**1.2**
Aluminum	**131**	**52.4**
Stainless steel	**116**	**46.4**

4.2 Dietary intake and food consumption pattern indicators

In this section on dietary intake and food consumption the findings of a total number of 235 (94 boys and 141 girls) respondents is discussed, learners who were over the cut-off age limit of 13 years were excluded. Table 4.5 indicates the mean macronutrient intake for both girls and boys and whether they met the DRI requirements**.**

The energy requirement for girls and boys in the nine to 13 years' age group was 8 698kJ and 9 572kJ respectively. The 24-hour recall analysis showed that 84.4% (n=211) of the girls and 90.4% (n=212) of the boys consumed a diet that provided <100% of the DRIs, with girls consuming 7 025.8kJ and boys 7 205.4kJ. Only 14.2% (n=33) of the girls and 14.9% (n=35) of the boys consumed <100% of the DRIs for protein (34g/day) with a mean intake of 49.2g and 48.1g respectively. The mean carbohydrate intake in the sample was 2.5 times higher than the DRIs (100g/day) for all the girls and boys, at 248.2g and 253.8g respectively. Ninety percent (n=212) of the girls (17.6g/day) and 91% (n=214) of the boys (17.5g/day) consumed a diet that had <100% of the fibre requirements of 26g/day and 31g/day for girls and boys respectively.

Table 4.5 also indicates that the majority of the respondents, 68.1% (n=160) of the girls and 79.8% (n=188) of the boys, consumed a diet which included <100% of the vitamin A DRIs with a mean±SD intake of 415.0µg±550.797 and 448.1µg±720.935 respectively. The thiamin intake was at a mean ±SD of 1.0µg±0.390 for girls with 28.4% (n=67) consuming <100% of the DRIs and 30.9% (n=73) of the boys consuming <100% with a mean±SD of 0.1µg±0.449. The mean intakes of riboflavin, niacin and vitamin B6 were low, with 35.5% (n=83) of the girls and 40.4% (n=95) of the boys consuming <100% of the DRIs for riboflavin with a mean±SD intake of 1.2 µg±0.818 and 1.3 µg±0.917 respectively; 32.6% (n=77) of the girls with a mean ±SD of 12.5µg±5.584 and 31.9% (n=75) of the boys with a mean±SD of 12.8µg±6.625 consumed <100% of the DRIs for niacin. The mean±SD vitamin B6 intake was 1.2 µg±0.736 with 26.4% (n=62) of the girls consuming <100% of the DRIs and 34% (n=80) of the boys consuming a diet that had <100% of DRIs for vitamin B6 with a mean±SD of 1.2µg±0.669.

Only 38.3% (n=90) of the girls and 35.1% (n=82) of the boys consumed <100% of DRIs for vitamin B12 with a mean±SD of 3.3µg±4.352 for girls and a mean±SD of 3.8µg±6.459 for boys. Both girls (66.7%; n=157) and boys (66%; n=155) consumed <100% of DRIs for folate with a mean±SD of 220.1µg±113.525 and 219.6µg±111.346 respectively. A considerable number of girls consumed <100% of the DRIs for pantothenate with a mean±SD of 3.5µg±1.504 and for boys with a mean±SD of 3.6µg±1.724. Seventy- five percent of the girls consumed <100% of the DRIs for biotin with a mean ±SD of 2.6 µg±21.993 and 28.7% (n=67) while the boys consumed <100% EARs with a mean±SD of 20.9µg±20.154.

Table 4.5 further indicates that 62.4% (n=147) of the girls consumed <100% of the EARs for vitamin C with a mean±SD of 37.1µg±33.362 and 27.7% (n=65) of the boys consumed <100% of the EARs for vitamin C with a mean±SD of 36.0µg±30.987. The calcium contribution showed that 100% of the girls consumed a diet that met the DRIs for calcium while 1% (n=2) of the boys consumed a diet that had <100% of DRIs for calcium with a mean±SD of 375.6µg±203.340.

Table 4.5 further indicates that 54.6% (n=128) of the girls consumed a diet that had <100% of EARs for iron with a mean±SD of 8.8 µg±3.779 and 19.1% (n=45) of the boys had <100% of EARs for iron and a mean±SD of 8.8µg±3.773.

The mean intake for magnesium was high with a mean±SD of 220.7µg±64.320 but 41.8% (n=98) of the girls consumed less than100% of the DRIs for magnesium and 46.8% (n=110) of the boys with a mean±SD of 212.7µg±64.320 had <100% EARS for magnesium. Although the mean intake for zinc was sufficient compared to DRIs, 47.5% (n=112) of the girls with a mean±SD of 7.4µg±3.304 and 66% (n=155) of the boys with a mean±SD of 6.8µg±2.566 consumed less than 100% of the DRIs. Potassium and iodine were consumed in low numbers by both girls (90.8%; n=213) and boys (94.5%; n=222) who consumed <100% of the DRIs with a mean±SD intake of 757.6µg±212.612 and 748.1µg±216.304 respectively, and iodine with 97.9% (n=230) with a mean±SD of 22.6µg±19.479 and 96.8% (n=227) with a mean±SD of 24.6 µg±19.757 for girls and boys respectively.

Table 4.5: Analysis of two 24-hour food recalls: mean macro- and micro-nutrient intake (n=235) (NICUS, 2003)

Nutrient p/d	Girls (mean ± SD) n=141	Girls (%) <100% Of EAR	Number	Boys (mean ± SD) n=94	Boys (%) <100% OF EAR	Number	DRIs
Energy (kJ) EER	7025.8 ±1626.878	84.4	119	7205.4 ±1860.834	90.4	85	♀8698.0 ♂9527.0
Total protein (g) RDA	49.2 ±14.754	14.2	20	48.1 ±14.001	14.9	14	34g
Carbohydrate (g) EAR	248.2 ±55.441	141	0	253.8 ±69.191	94	0	100g
Total dietary fibre (g) AI	17.6 ±5.813	90.1	127	17.5 ±5.850	96.8	91	♀26g ♂31g

Table 4.5: Analysis of two 24-hour food recalls: mean macro- and micro-nutrient intake (n=235) (NICUS, 2003) (continued)

Vitamin A (µg) EAR	**415.0 ±550.797**	**68.1**	**96**	**448.1 ±720.935**	**79.8**	**75**	**♀420.0 ♂445.0**
Thiamine (mg) EAR	1.0 ±0.390	28.4	40	0.1 ±0.449	30.9	29	0.70
Riboflavin (mg) EAR	1.2 ±0.818	35.5	50	1.3 ±0.917	40.4	38	0.80
Niacin (mg) EAR	12.5 ±5.584	32.6	46	12.8 ±6.625	31.9	30	9.00
Vitamin B6 (mg) EAR	1.2 ±0.736	26.4	37	1.2 ±0.669	34.0	32	0.80
Folate (µg) EAR	220.1 ±113.525	66.7	94	219.6 ±111.346	66.0	62	250
Vitamin B12 (µg) EAR	3.3 ±4.352	38.3	54	3.8 ±6.459	35.1	33	1.50
Pantothenate (mg) AI	3.5 ±1.504	70.2	99	3.6 ±1.724	37.2	35	4.00
Biotin (µg) AI	20.6 ±21.993	75.2	106	20.9 ±20.154	28.7	27	20.00
Vitamin C (mg) EAR	37.1 ±33.362	62.4	88	36.0 ±30.987	27.7	26	39.00
Vitamin D (µg) AI	2.6 ±2.043	87.2	123	3.0 ±2.099	44.7	42	5.00
Vitamin E (mg) EAR	6.7 ±3.736	78.0	110	8.2 ±4.357	59.6	56	9.00
Vitamin K (µg) AI	37.6 ±28.553	75.2	106	38.9 ±38.710	41.5	39	60.00
Calcium (mg) AI	376.6 ±201.350	100	141	375.0 ±203.340	1.1	1	1300

Table 4.5: Analysis of two 24-hour food recalls: mean macro- and micro-nutrient intake (n=235) (NICUS, 2003) (continued)

Iron (mg) EAR	**8.8 ±3.779**	**54.6**	**77**	**8.8 ±3.773**	**19.1**	**18**	**♀8.1 ♂5.9**
Magnesium (g) EAR	220.7 ±60.525	41.8	59	212.7 ±64.320	46.8	44	200
Potassium (mg) EAR	757.6 ±212.612	90.8	128	748.1 ±216.304	94.5	89	1055
Zinc (mg) EAR	7.4 ±3.304	47.5	67	6.8 ±2.566	66.0	62	7.0
Selenium (µg) EAR	23.0 ±16.571	78.7	111	23.1 ±14.472	75.5	71	35.0
Iodine (mcg) EAR	22.6 ±19.479	97.9	138	24.6 ±19.757	96.8	91	73.0

Legend:

♂ - **Boys**; ♀ - **Girls;**

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)

NAR (Nutrient Adequacy Ratio in %)

The fruit and vegetable consumption was lower than >400g goal on the 24-hour food recall as recommended by the WHO with boys and girls consuming 88.35g and 79.29g per capita intake per day respectively (refer Table 4.6). Table 4.6 represents the total fat contribution to energy, which was within the Acceptable Macronutrient Distribution Range (AMDR) recommended by the World Health Organization of 15-30% for both girls (23.97%) and boys (24.96%).

The contribution of protein to the total daily energy was also within the recommendation of 10-15%, with the girls achieving 11.89% and the boys 11.35%. The daily energy contribution from carbohydrates and fibre was within the WHO cut-off points of between 55-75% for girls (64.3%) and boys (64.0%).

Table 4.6: Acceptable Macronutrient Distribution Ranges (AMDRs) and fruit and vegetables and fibre intake of the children (n=235) from 24-hour food recall compared with the WHO population nutrient intake goals (WHO, 2003)

BOYS AND GIRLS ENERGY PERCENTAGE DISTRIBUTION			
Dietary Factor Food Nutrient	**WHO Goal**	**Boys 24hr Recall n=94**	**Girls 24hr Recall n=141**
Total fat% (E)	15-30%	25.0	24.0
Total CHO% (E)	55-75%	64.0	64.3
Protein% (E)	10-15%	11.4	11.9
Fruit and Vegetable g/day	>400	88.4	79.3

4.2.1 Boys top 20 foods consumed

Table 4.7 indicates the Top 20 food items consumed by the boys as measured with two 24-hour recall questionnaires ranked per frequency and reflects the mean daily intake for the group, mean per frequency and mean per capita intake. The reliability regarding the input of the parents/ caregivers on the 24-hour recall was confirmed with the learners. The consumption of carbohydrates was very high and appeared numerous times on the top 20. The most consumed carbohydrate rich food was maize meal porridge (consumed 117 times by the 94 boys), bread and rice ranking numbers 1, 2 and 3 with mean intakes per frequency of 109.96g, 63.83g and 125.22g and a per capita intake of 136.86g, 75.47g and 123.88g per day respectively. Sugar rich items also appeared frequently on the list with sugar ranked at number 3 indicating a high frequency intake (106 times) with a mean intake of 8.85g and a 9.98g per capita intake.

Squash was ranked at number 7 with a mean intake of 143.07g and a per capita intake of 127.85g per day consumed 84 times by the group of 94 boys; ice block (frozen diluted juice) was at number 8 with a mean frequency intake of 24.96g and a per capita intake of 17.26g per day and was consumed 65 times; sweets was at number 10 with a mean intake per frequency of 8.05gg and a per capita intake of 5.05g per day; potato crisps/chips ranked at number 11 with a mean intake per frequency of 16.81g and a per capita intake of 9.65 per day; popcorn was 17th with a mean intake of 16.90g and a per capita intake of 5.21g per day and cornflakes 20th with a mean intake of 48.04g and a per capita intake of 11.76g per day. Protein sources included chicken curry with a low mean intake of 49.85g per frequency and a per capita intake of 17.50g per day ranked at number 14; peanut butter was ranked at number 18 with a mean intake of 9.81g and a per capita intake of 2.82g per day. Sugar beans appeared at number 16 with a mean intake of 55.08g and a per capita intake of 17.58g. Fruit and vegetables were poorly consumed by the group.

Apples are the only fruit that appear in the top 20 food group and are ranked at number 12 with a mean frequency intake of 53.88g and a per capita intake of 22.93 per day. The only vegetable that appears on the top 20 foods consumed by the respondents is beetroot ranked at number 13 with a very small mean frequency intake of 1.75g and a per capita intake of 0.74g per day. Margarine was ranked at number 4 and the mean intake was 8.89g and a per capita intake of 8.79 per day. Polony is a food item high in fat and it appeared at number 9 with a mean intake per frequency of 15.83g and a per capita intake of 9.94g per day.

Table 4.7: Boys' top 20 foods consumed ranked by frequency measured by 2 x 24-hour recalls

BOYS' TOP 20 FOODS CONSUMED (n = 94)					
Rank		**Mean intake for the group (g)**	**Mean intake per frequency (g)**	**Frequency**	**Per capita intake for 1 day (g)**
1	**Maize meal porridge**	12 865.00	109.96	117	136.86
2	**Bread/rolls**	7 085.00	63.83	111	75.37
3	**White sugar**	938.50	8.85	106	9.98
4	**Margarine**	826.50	8.89	93	8.79
5	**White rice**	1 1645.00	125.22	93	123.88
6	**Milk**	4 287.50	49.28	87	45.61
7	**Cold drink, squash**	12 017.50	143.07	84	127.85
8	**Ice block (frozen diluted juice)**	1 622.50	24.96	65	17.26
9	**Polony**	934.00	15.83	59	9.94
10	**Sweets, hard boiled/ soft/ jelly type**	475.00	8.05	59	5.05
11	**Potato crisps/chips**	907.50	16.81	54	9.65
12	**Apple**	2 155.00	53.88	40	22.93
13	**Beetroot salad**	70.00	1.75	40	0.74
14	**Chicken curry**	1 645.00	49.85	33	17.50
15	**Vetkoek, homemade**	1 630.00	52.58	31	17.34
16	**Sugar beans**	1 652.50	55.08	30	17.58
17	**Popcorn**	490.00	16.90	29	5.21
18	**Peanut butter**	265.00	9.81	27	2.82
19	**Tea, brewed**	3 140.00	125.60	25	33.40
20	**Corn flakes**	1 105.00	48.04	23	11.76

4.2.2 Girls' top 20 foods consumed

Table 4.8 presents the Top 20 foods most frequently consumed by girls. The reliability regarding the input of the parents/ caregivers on the 24-hour recall was confirmed with the learners. Similar to the boys' results, the carbohydrate intake was high in this group: bread/rolls were ranked at number 1 with a mean frequency intake of 64.44g and a per capita intake of 94.15g per day; maize meal was ranked at number 2 and rice at number 3 with a mean frequency intake of 109.13g and 125.20g respectively, while the per capita intake for the two items was 146.28g and 167.82g per day.

Squash drinks were ranked at number 6 with a mean intake of 131.81g and a per capita intake of 126.21g; ice block (frozen juice) was ranked at number 8 with a mean intake of 27.04g and a per capita intake of 18.79g per day, while white sugar was at number 9 consumed 93 times by the group of 141 girls with a mean intake of 22.04g and a per capita intake of 14.54g per day. The most consumed protein rich food was chicken curry ranked at number 12 with a low mean frequency intake of 48.29g and a per capita intake of 21.57g per day; beef curry appeared at number 18 with a mean frequency intake of 57.28g and a per capita intake of 11.28g per day, and beef mince was ranked at number 19 with a mean intake of 44.17g and a per capita intake of 11.28g per day. Sugar beans ranked at number 15 with a mean intake of 52.24g and a per capita intake of 18.6g per day. The fruit group was poorly consumed with apples only appearing 14th in the top 20 food groups for the girls ranked with a mean intake of 50.12g and a per capita intake of 19.90g per day. The vegetable group was also poorly consumed with vegetable curry appearing only at number 20 with a mean frequency intake of 48.14g and a per capita intake of 11.95g per day. The fat group was represented by margarine, potato crisps and polony, ranked at numbers 4, 7 and 11th respectively with a mean intake of 9.22g and a per capita intake of 11.51g of margarine per day. Potato crisps had a mean intake of 18.28g and a per capita intake of 14.00g per day; polony appeared 11th with a mean intake of 16.47g and a per capita intake of 9.46g per day.

The mean top 20 food items ranked by total consumption (portion size x number of respondents) was measured by two 24-hr food recall for girls (n=141).

Table 4.8: Girls' top 20 foods consumed ranked by frequency measured by 2 x 24-hour recalls

GIRLS' TOP 20 FOODS CONSUMED (n = 141)					
Rank	**Food Item**	**Mean intake (g)**	**Mean intake per frequency (g)**	**Frequency**	**Per capita intake for 1 day (g)**
1	**Bread/rolls**	13 275.00	64.44	206	94.15
2	**Maize meal porridge**	20 625.00	109.13	189	146.28
3	**White rice**	23 662.50	125.20	189	167.82
4	**Margarine**	1 622.50	9.22	176	11.51
5	**Milk**	7 015.00	47.72	147	49.75
6	**Cold drink, squash**	17 795.00	131.81	135	126.21
7	**Potato crisps/chips**	1 974.50	18.28	108	14.00
8	**Ice block (frozen diluted juice)**	2 649.50	27.04	98	18.79
9	**White sugar**	2 050.00	22.04	93	14.54
10	**Tea, brewed**	10 772.50	122.41	88	76.40
11	**Polony**	1 334.00	16.47	81	9.46
12	**Chicken, curry**	3 042.00	48.29	63	21.57
13	**Sweets, hard boiled/soft jelly type**	567.50	9.30	61	4.02
14	**Apple**	2 806.50	50.12	56	19.90
15	**Sugar beans**	2 560.00	52.24	49	18.16
16	**Samp and beans**	6 175.00	126.02	49	43.79
17	**Morvite**	3 700.00	84.09	44	26.24
18	**Beef, curry**	2 463.00	57.28	43	17.47
19	**Beef, mince**	1 590.00	44.17	36	11.28
20	**Vegetable curry**	1 685.00	48.14	35	11.95

4.2.3 Anthropometric data

All the children were weighed and measured. The height and weight were used to determine the BMI (weight) [kg] divided by height [m] squared). The data was categorized according to the standard deviations and Z-Scores with the WHO indicators. Anthropometric indicators height-for-age and BMI-for-age were used.

Table 4.9 indicates the prevalence of stunting, overweight and obesity in the sampled girls and boys. The number of boys and girls that were severely stunted (<-3SD) is 4.9% (n= 12) and 5.4% respectively. The number of stunted boys was 16.5% (n=41) and 17% (n=43) for girls (<-2SD). Normal height-for-age in boys was 78.6% (n=185) and 77.6% (n=194) in girls (≥-2<+3SD). The number of severely wasted boys was 2.9% (n=7) and no girls were severely wasted (<-3SD).

Almost 4% of boys were wasted 3.9% (n=10) (<-2SD) and 1.4% (n=4) of the girls. A normal BMI-for-age was seen in 55.3% (n=138) of the boys and 46.3% (n=116) of the girls (≥ -2SD and <+1SD); 31.1% (n=78) of the boys and 37.4% (n=94) of the girls (>+1SD) were at risk of overweight. There were 10.7% (n=27) of the boys that were overweight and the girls had a higher percentage of risk of overweight at 13.6% (n=34) (>+2SD). Seven boys (two-point nine percent) and two-point seven percent (n=7) of the girls were obese (>+3SD).

Table 4.9: Anthropometric results (n=250)

Growth Indicators	Classification	Boys (n=103)	Number	Girls (n=147)	Number
	Stunting (height-for-age)				
<-3SD	Severely stunted	4.9%	5	5.4%	2
<-2SD	Stunted	16.5%	16	17%	15
≥-2<+3 SD	Normal height-for-age	78.6%	76	77.6%	117

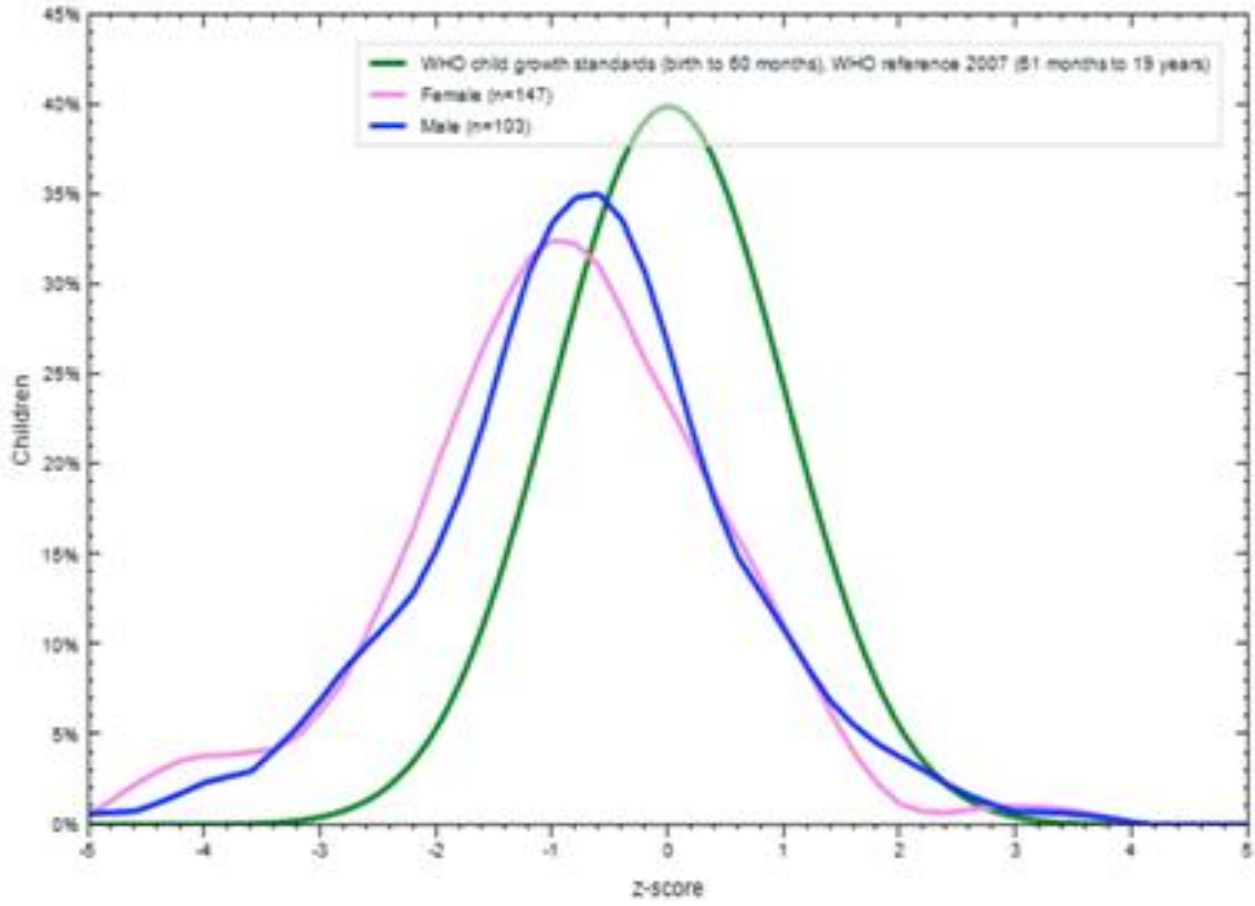
Table 4.9: Anthropometric results (n=250) (continued)

	Wasting/Thinness (BMI-for-age)				
<-2SD	Wasted	3.9%	4	1.4%	2
≥ -2SD and <+1SD	Normal BMI-for-age	55.3%	54	46.3%	81
>+1SD	Risk of overweight	31.1%	30	37.4%	35
>+2SD	Overweight	10.7%	10	13.6%	14
>+3SD	Obese	2.9%	3	2.7%	4
	Underweight (weight-for-age)				
<-3SD	Severely underweight	3.9%	4	1.4%	1
<-2SD	Underweight	2.9%	3	0%	0

The green line in figure 4.7 represents the World Health Organization (WHO) child growth standards. The pink line represents the girls (n=147) and the blue line represents the boys (n=103). Undernutrition (underweight, stunting, wasting) is defined as Z scores below -2 and severe undernutrition as Z scores below -3. All the respondents that lie to the left of the WHO growth standards graph, which is represented by the green line, are at risk of underweight mean±SD -0.92±1.310 for girls and mean±SD 1.280±0.75for boys. The pink line that represents the girls is furthest from the WHO graph, which indicates that girls are more at risk of underweight. Stunting measured with height-for-age z scores <-2SD to >-3SD was prevalent among 16.5% (n=41) of the boys and 17% (n=43) of the girls.

The green line figure 4.7 represents the World Health Organisation (WHO) child growth standards. The pink line represents the girls (n=147) and the blue line represents the boys (n=103). Under nutrition (underweight, stunting, wasting) is defined as Z scores below -2 and severe under nutrition as Z scores below -3. All the respondents that lied to the left of the WHO growth standards graph, which is represented by the

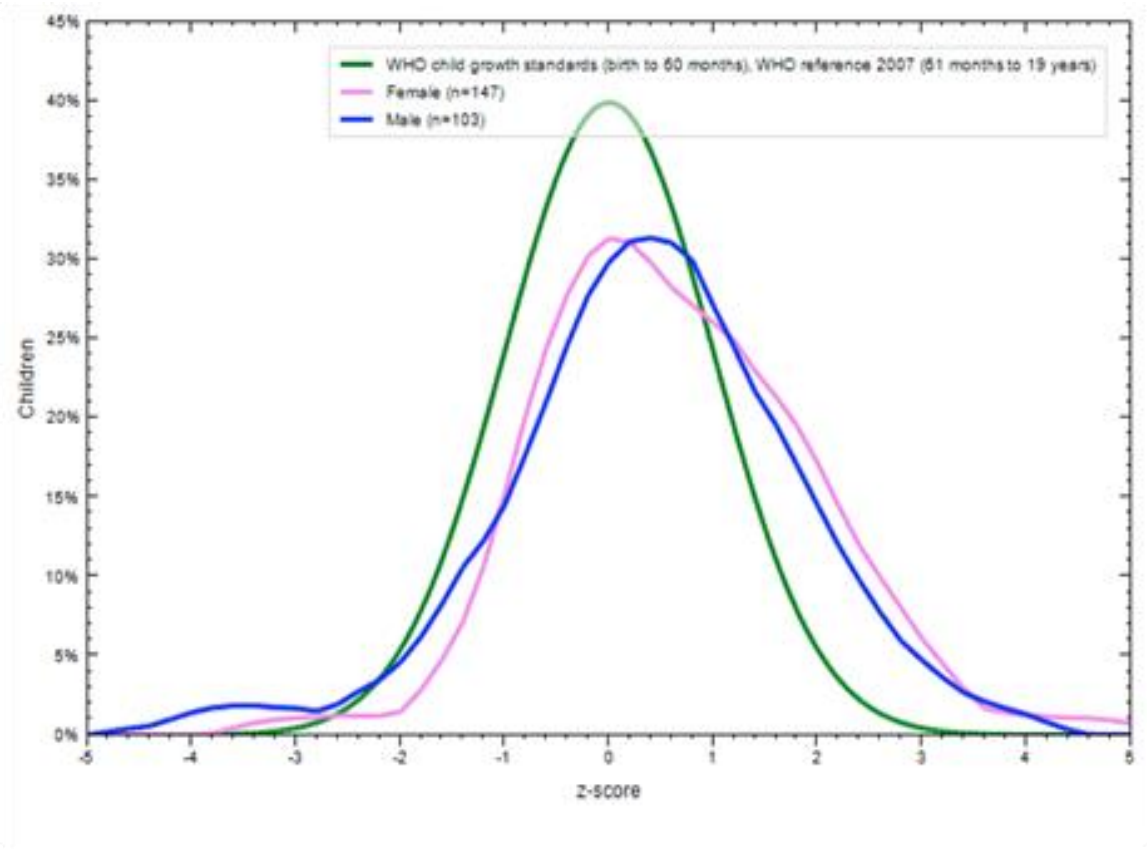
green line, are at risk of underweight SD1.31±0.92 for girls and SD1.28±0.75 for boys. The pink line that represents the girls is furthest from the WHO graph, which indicates that girls are more at risk of underweight. Stunting measured with height-for-age z scores <-2SD to >-3SD was prevalent among 16.5% boys and 17% girls.



Height-for-age		
	Girls (n=147)	Boys (n=103)
Mean	-0,920	-0,750
SD	1.310	1.280

Figure 4.7: Height-for-age

The leaning of the pink and blue lines to the right (figure 4.8) indicates the mean and ±SD 1.26±0.630 for girls and 0.39±1.34 for boys that were overweight 10.7% (n=27) boys and 13.6% (n=34) girls.



BMI-for-age		
	Girls (n=147)	Boys (n=103)
Mean	0.630	0.390
SD	1.260	1.340

Figure 4.8: BMI-for-age

4.2.4 Food group diversity and food variety

The food variety scores consisted of a single count of food within the nine nutritional food groups. In total, all the respondents consumed 57 different individual food items over a seven-day period. It is important to note that the FFQ was for seven days of food intake and the 24-hour food recall was for two days only. Data here is presented in a Food Variety Score (FVS) and a Food Group Diversity Score (FGDS).

However, the total range of individual food items consumed by an individual during the seven days' data collection period was between five and nine foods (refer to table 4.10). Some of the respondents consumed five (22.4%; n=56), six (26.4%; n=66) and seven (26.8%; n=67) food types of the cereal group in seven days. Maize meal was commonly consumed in two forms as maize porridge and maize crumbly porridge. Most of the respondents (40.8%; n=102) consumed three varieties of dairy products. A considerable number of respondents consumed between four and five varieties of the meat group (30.8%; n=77 and 34%; n=85) respectively. Eggs were consumed by 71.2% individuals (n=178).

According to table 4.10, between two (15.6%; n=39), three (44.4%; n=111) and four (24.4%; n=61) different varieties of vitamin A rich fruit and vegetables were consumed by some of the respondents. The other fruit and vegetable groups were poorly consumed by the majority 88.8% (n=209) for the fruit group and a considerable number 42.4% (n=100) for the vegetable group, between seven to nine varieties were consumed in both the fruit and vegetable groups. In the fruit group table 4.14 indicates that two (n=80; 32%), three (27%; n=68) and four (21%; n=52) different varieties of fruit were consumed by the respondents. In the vegetable group three (15%; n=37), four (24%; n=61), five (30%; n=76) and six (21%; n=53) varieties of vegetables were consumed by the respondents. This is confirmed by the top twenty foods consumed by the respondents in table 4.11 and 4.12 which indicated that fruit was consumed by 98 respondents and only a few varieties appeared, being apples for fruit and beans and cabbage for vegetables.

Between two (13.6%; n=34) and three (40%; n=100) types of fats were consumed. Sixty percent (n=151) of the respondents had a low FGDS (0-30 food groups or <30 individual foods) and 40% (n=99) consumed between four and five food groups or < 30-60 individual foods, indicating a medium FGDS.

Table 4.10: Food Group Diversity Score consumed over a period of seven days (n=235).

Meat group (n=8)	Egg group (n=1)	Dairy group (n=6)	Cereal, roots and tubers group (n=9)	Legume and nuts group (n=4)	Vitamin A rich fruit and vegetable group (n=7)	Fruit group (n=7)	Vegetable group (n=9)	Fat group (n=6)	Total food items (n=57)
0 = 9	0= 72	0 = 20	0 = 0	0 =20	0 = 4	0 = 5	0=0	0 =1	0-11=2
1 = 7	1 = 178	1 = 23	1 = 0	1 = 108	1 = 18	1 = 17	1 = 1	1 = 5	12-15=20
2 = 8		2 = 70	2 = 0	2 = 101	2 = 39	2 = 80	2=7	2 = 34	16-20=53
3 = 23		3 = 102	3 = 7	3 = 15	3 = 111	3 = 68	3=37	3 = 100	21-25=149
4 = 77		4 = 33	4 = 21	4 = 6	4 = 61	4 = 52	4=61	4 = 93	26-29=26
5 = 85		5 = 1	5 = 56		5 = 16	5 = 21	5=76	5 = 16	
6 = 26		6 = 1	6 = 66			6 = 6	6=53	6 = 1	
7 = 14			7 = 67		7 = 1	7 = 1	7=4		
8 = 1			8 = 26				8=6		
			9 =7				9=5		

Low= 0-3 food groups or < 30 individual foods. Medium = 4-5 food groups or 30-60 individual foods. High = 6-9 food groups or>60 individual foods

The results in table 4.11 showed the largest food variety was in the cereal, roots and tubers group (6.8±1.322) followed by the vegetable group (4.76±1.383). The participants consumed a low variety of fruit (301±1.204) and Vitamin A rich fruit and vegetables with seven food varieties (3.09±1.010).

Table 4.11: Mean standard deviation and the range of scores for the 9 food groups (FVS) n=235

Food Group	Mean	±SD	Range of scores
Meat group	4.51	±1.269	0-8
Egg group	1.00	±0.000	0-1
Dairy group	2.66	±0.890	0-6
Cereal, roots and tubers group	6.08	±1.322	0-9
Legume and nuts group	1.65	±0.719	0-4
Vitamin A rich fruit and vegetables group	3.09	±1.010	0-7
Fruit group	3.01	±1.204	0-7
Vegetable group	4.76	±1.383	0-9
Fat group	3.34	±0.879	0-6
Total food items	30.09	±8.676	0-9

According to table 4.12 most of the respondents (96.4%; n=227) consumed between seven and nine food groups. These respondents can be said to have a high FGDS, followed by 2.8% (n= 7) with a medium score of six food groups and 0.8%; (n=2) with the lowest score of zero to five food groups. A variety of 57 different food items were generally consumed, which was proven by the number of respondents (96%; n=240) who consumed food from seven to nine food groups.

Table 4.12: Summary of food group diversity (n=235)

Number of food groups consumed (n=9)	Frequency	Percentage %
5	2	0.8
6	7	2.8
7	21	8.4
8	60	24.0
9	160	64.0
TOTAL	250	100

4.3 Correlations

The following section illustrates the relationship between the Food Group Diversity Score (FDGS) and the Nutrient Adequacy Ratio (NAR) values for energy, protein, calcium, iron and zinc

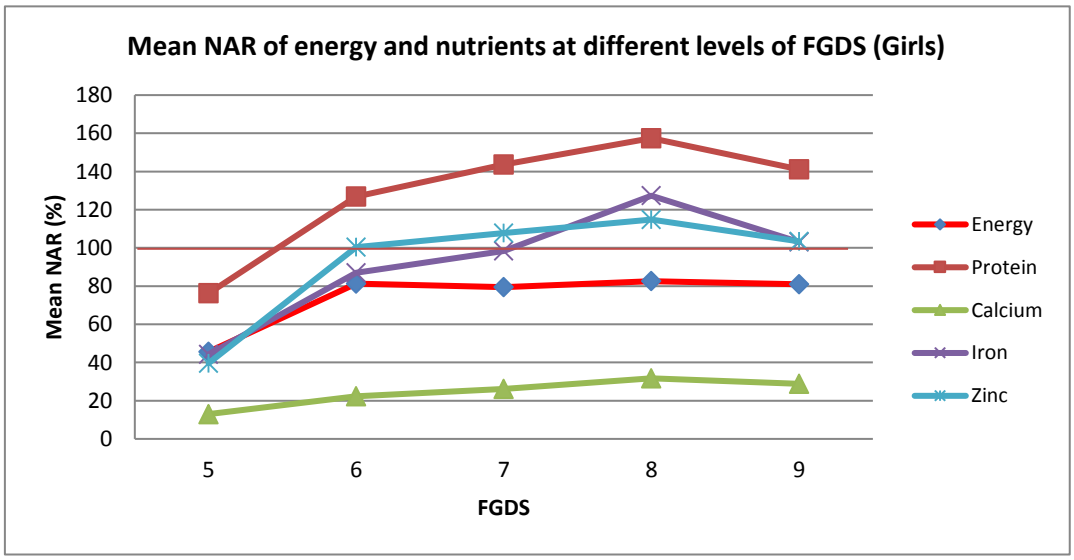


Figure 4.9 Mean NAR% of energy and nutrients versus different FGDS (girls). Mean NAR of vitamins at different levels of FDGS (girls)

As the FGDS increases from five to nine there is an increase in protein, calcium, iron and zinc intake in the girls, placing the respondents within the average mean NAR% intake. The correlation analysis revealed no statistical significance between daily energy and FGDS.

Figure 4.10 indicates the mean NAR% intake of the girls at different levels of FGDS. There is an increase in all the vitamins as the FGDS increases, especially for riboflavin and vitamin B6 followed by vitamin A, placing the respondents within the average mean NAR%.

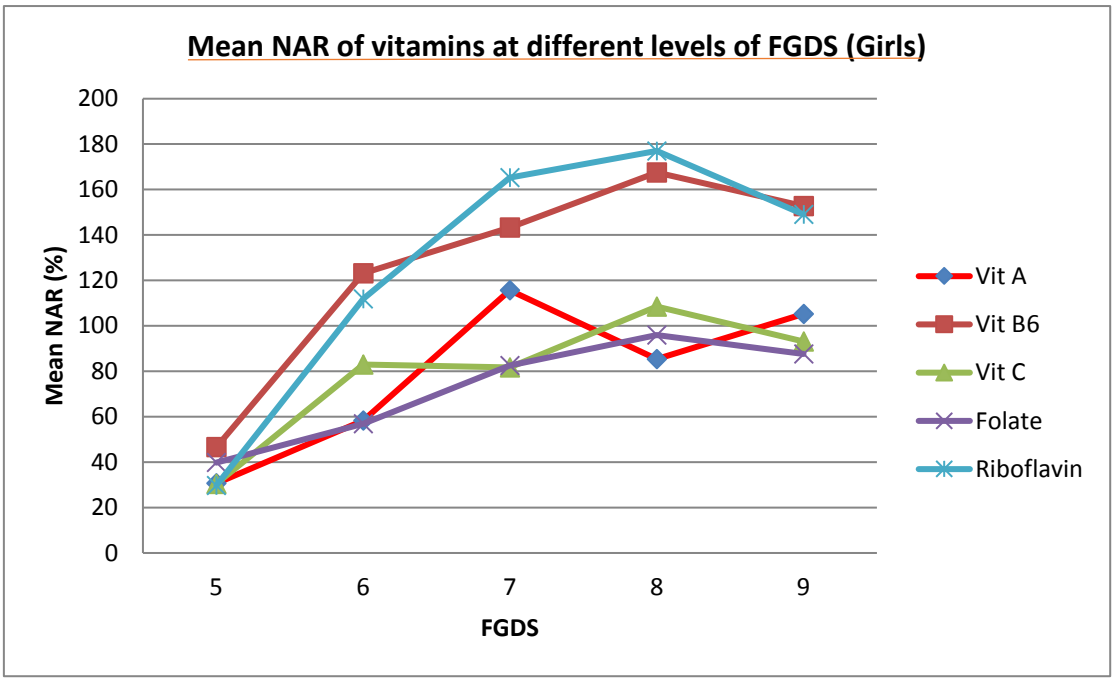


Figure 4.10: Mean NAR% vitamins versus different levels FGDS (girls). Mean NAR of energy and nutrients at different levels of FGDS (girls)

A relationship exists between the mean NAR% and FGDS (figure 4.11). As the FGDS increase from six to nine there is no clear increase in mean NAR%.

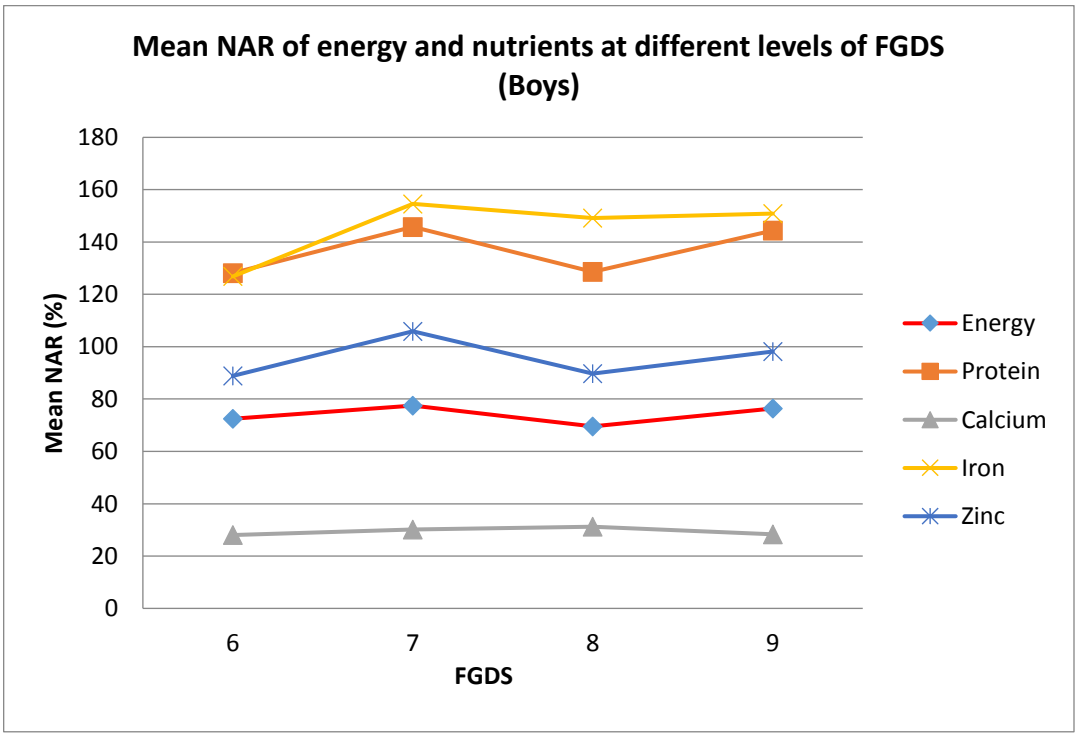


Figure 4.11: Mean NAR% energy and nutrients versus different FGDS (boys). Mean NAR of vitamins at different levels of FGDS (boys)

Figure 4.12 indicates the relationship between mean NAR% and FGDS. As the FGDS increase from six to nine there is an increase in mean NAR% of vitamins especially in vitamin B6.

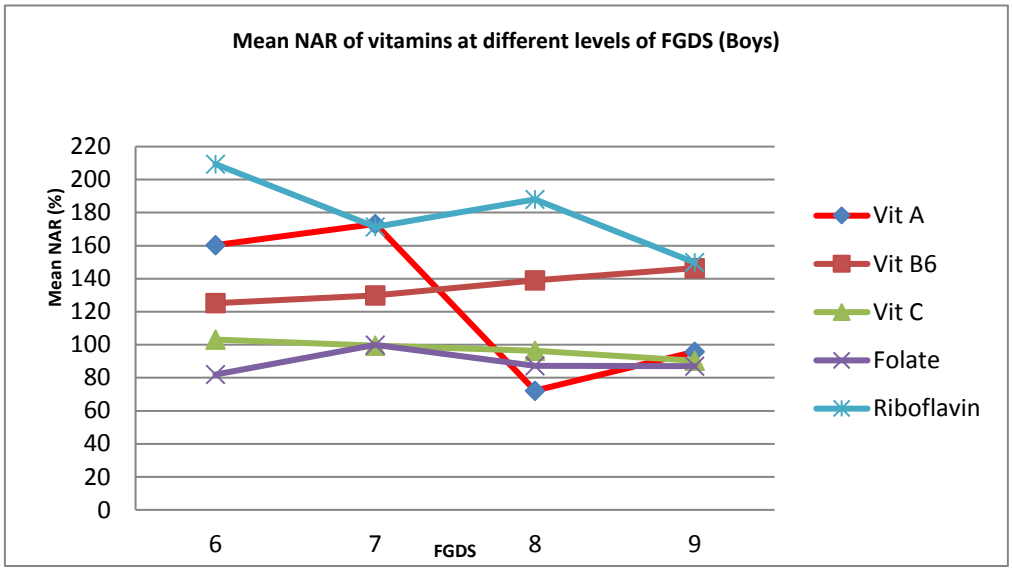


Figure 4.12: Mean NAR% vitamins versus different levels FGDS (boys)

Correlations were drawn between variables using the Pearson's statistical test. Pearson's correlation r=0 shows no relationship while negative correlations are shown by r= -1 and positive correlations are shown by r= 1. The *p* value is the likelihood of obtaining a test statistic at least as extreme as the one that was observed, if the null hypothesis is true. The dismissing of the null hypothesis happens when the *p* value is less than 0.005 or 0.001. When the null hypothesis is dismissed the results are said to be statistically significant.

Table 4.13 shows the correlations drawn between the number of people in the household and money spent on food, the number of people in the household currently employed and household income, meals per day and the number of people in the household unable to purchase food, the number of people in the household unable to purchase food and household income, the number of people in the household unable to purchase food and the education level of the parents, the number of people in the household unable to purchase food and the money spent on food, BMI-for-age and average energy intake and BMI-for-age and average carbohydrate.

Various variables were analyzed to determine a statistical significance (refer to chapter 3, table 3.1) but the results were statistically not significant. There was a statistical significance (p=0.000) between the number of people in the household and money spent on food, the number of people in the household currently employed and household income, meals per day and the number of people in the household unable to purchase food, the number of people in the household unable to purchase food and money spent on food, and a statistical significance of p=0.003 between BMI and average CHO. The relationships between these variables are further explored in the discussion section of this chapter.

Table 4.13: Relationship between variables with statistical significance (p<0.05)

Variables	**Relationship (r value)**	**Significance 2-tailed (*p* value)**
Total population		
Number of people in the household and money spent on food	0.244	0.000
Number of people in the household currently employed and household income	-0.527	0.000
Meals per day and the number of people in the household unable to purchase food	0.270	0.000
Number of people in the household unable to purchase food and household income	0.588	0.000
Number of people in the household unable to purchase food and education level of parents	0.266	0.000
Number of people in the household unable to purchase food and money spent on food	0.248	0.000
BAZ and Energy (kJ)	0.154	0.018
BAZ and Average carbohydrate	0.195	0.003

4.3 Discussion

The study was conducted to determine the nutrition status of school-going children and was focused on children between the ages of 4 and 13 years because this is the critical age for children to develop healthy eating habits and receive education about healthy food choices.

Socio-economic status played an important role in the quality of food choices made by the parents/ caregivers of these learners. The socio-demographic questionnaire provided important data about different variables that affected the community and gave a clear picture of the life of the community. The results analysed in this chapter clearly indicated that poverty existed in the community where the study was conducted and the level of food insecurity and the poor nutrition status compromised the quality of life of the children living in this community. The analysis of the results indicated a lack of post matric education, inappropriate eating patterns, income inadequacy and a high unemployment rate. It has generally been considered that female-headed households are more at risk of food insecurity - the'triple burden'' that has a greater outcome of vulnerability for female-headed households since males earn more than females in the same job. Most of the children in the current study were from female-headed households (83%) and included grandmothers who were breadwinners, which placed them at risk as indicated by (Nandoo, 2012). Poverty, unemployment, lack of skills, high food prices and the global financial dilemma can affect malnutrition (Kazadi, 2011).

Households most vulnerable to food insecurity include those which have insufficient productive assets and depend on an irregular income from daily labour. In this community, basic household assets were present, for example, electric stove, microwave oven, television set, radio, electric iron, electric kettle and cooking pots. Basic municipal services such as waste removal, running water, electricity, toilet facilities and tarred roads were available. This is contrary to Drimmie, Faber, Vearey and Nunez' (2013) statement that Sub-Saharan Africa still does not have proper infrastructure and has limited access to electricity.

In many households, girls, women, the elderly and disabled members are mostly the victims of discrimination and are thus more vulnerable. The results of this community indicated living in poverty with a substantial number of respondents (36.4%) indicating that they were living on one person's income, 35.2% reporting that they did not have enough money to spend on food, and 15% of the household reporting that they always didn't have enough money to buy food, and 20.8% of households having on average eight people living under one roof. Another observation from this study was that the majority of the respondents lived in shared accommodation (93%) and a number of households (20.8%) had up to eight people living in a house that only had between two and four rooms and 33 .6% had shacks outside the house. Crowding can be measured by the number of people living in the household. When more than one individual occupies a room, it is considered to be crowding (Schwartz, 2014). There was a positive correlation in this study between the number of people in the household and money spent on food with a significance 2 tailed value of p=0.000. The more people there are in a household the more money should be spent on food; however, in this community the majority of the households had only one person contributing to the household income. Most of the respondents (75.2%) purchased food once a month while 12.4% of the respondents reported that they purchased their food once a week and 10.8% of the respondents made their purchases of food every day. Food was purchased from a supermarket by the majority of the respondents (88%). Food insecurity comes from high unemployment, limited income-generating opportunities and household poverty (Crush and Frayne, 2014). The amount of money spent on food by 45.2% of the respondents was R500 per month. Shortage of food due to limited income was frequently reported by some of the households. These results indicated that food shortage could be linked to a low total income received by most of the respondents and the high unemployment rate. The majority (94%) of the respondents travelled to work by bus and the majority (94%) of the learners walked to school. There was high unemployment in this community with 61% unemployed and 39% employed. This is supported by the findings by Oldewage-Theron, Kruger and Egal (2014) on the high unemployment rate of 78% in the Vaal region in South Africa, where 14.7% of the people were pensioners and 7.3% were unemployed. The national unemployment rate in 2016 was 26.4% and this is the highest since 2005 Statistics South Africa (SSA), 2015.

In this study, there was a noticeable expenditure of 22% of income spent on food, 15.2% on housing and electricity and 11.4 % on income tax. According to Caswell and Yaktine (2013), full-time working mothers spend less time on meal preparation, preparing fewer family meals and consuming fewer fruits and vegetables. When work-life stress is higher, the outcome is a less healthful food environment overall, exemplified by even fewer family meals and more frequent consumption of fast foods and sugar-sweetened beverages (Caswell and Yaktine, 2013).

Purchasing and preparing a healthy diet can be a time-intensive process for households that do not use commercially prepared foods. Producing healthy meals requires several activities, skills and resources that include planning, transportation to and from a grocery store or other food outlet, shopping, preparation, and cleaning up (Caswell and Yaktine, 2013).

The Multisectoral Poverty Index (MPI) from 1993 to 2010 in South Africa dropped by 29% points from 37% to 8%. During this period, the level of severe MPI poverty also dropped substantially from 17% of the population in 1993 to just above 1% in 2010. Not only did the intensity and incidence of multisectoral poverty fall significantly, but the average distance from the multisectoral poverty line across all dimensions also decreased over the period (Finn, Leibbrandt and Woolard, 2013). The community of Chesterville reported to have an average monthly household income of R1000 which when divided by 8 (the average number of household members) and then divided by 30 days equals an average amount of R4.00 available per person for food per day in each household.

The South African National Health and Nutrition Examination Survey (SANHANES-1) findings stated that over 40% of South African people did not have enough money to spend on food (Hoosain *et al.*, 2013). A considerable number of respondents earned between R501 and R1000 (34.6%) and R1001-R1500 (20.8%) during 2010. In this study, there was a positive correlation between currently employed respondents and household income with a significance 2 tailed value of p=0.000.

Although some of the households had people employed, the amount of money earned was not enough to cater for all the needs of the household let alone food. According to Ozor, Umunnakwe and Acheampong (2013) a large proportion of the income of the poor (an estimated 50-75%) is spent on food. In addition, the level of education in this community was very low with only 20% having obtained a matric and 4% a college qualification. This finding was supported by the positive correlation in this study between the education level of parents and inability to purchase food with a significance 2 tailed value of p=0.000. Drimmie and McLachlan (2013) concur with the positive correlation between education and food security although they argue that education and food security can help in improving food security. Labadarios *et al*., (2011) states that many South Africans don't have enough income to spend on their household needs. The bulk of the income of a household is used to pay for water, gas, electricity and other fuels. There was a positive correlation between the inability to purchase food and household income (with a significance 2 tailed value of p= 0.000) which supports the findings by (Labadarios *et al*., 2011).

According to Ngure, Reid, Humphrey, Mbuya, Pelto and Stoltzfus (2014) living standards, including sanitation and running water, and the mother's level of education are factors that contribute to either good or poor nutrition and this is reflected in this study. UNICEF (2009) stated that socio-economic conditions influence diet and poor populations tend to have poor intake of essential nutrients. The study provides evidence that some of the school children in this community were malnourished. Poor nutrition status in childhood is an important indicator of health status. The results in this study indicated the scarcity of dietary diversity, which contributes to nutrient deficiency.

The FGDS indicated that 64% of the participants consumed food from all nine food groups. A high FGDS was observed as most of the respondents (99%) consumed 6–9 different food groups. Food insecure communities find it difficult to diversify their diets due to income constraints. The FGDS indicated that the cereal group (6.08±1.322) had the highest score followed by the vegetable group (4.76±1.383) and the meat group (4.51±1.269).

This is in line with the Sharpeville study where the cereal group (2.01±0.81) was the most consumed followed by the dairy group (0.62±0.53) and the meat group (0.40±0.53) (Olgewage-Theron and Kruger, 2008). The total fat intake was within the level of the goal recommended by the WHO in the 24-hour food recall for both girls (24.0%) and boys (25.0%). The FGDS showed that the fat group score was 3.34±0.879. The respondents need to cut down on fast food as it has little nutritional value.

Sixty-one percent of South Africans are overweight and this is the result of a decrease in or a lack of exercise together with unhealthy eating habits (Hoosain *et al*., 2013; Baleta and Mitchell 2014). These findings are similar to the findings in this study from the top 20 foods consumed which indicated the consumption of fast food contributing to weight gain because of the high fat and sugar content. In this study squash (diluted juice) ranked sixth in the top 20 foods consumed by girls and had a per capita intake of 18.79g per day; squash ranked seventh in the boys' top 20 foods consumed with a per capita intake of 17.26g per day.

Potato chips (crisps) followed at number seven for the girls and at number 11 for the boys with a mean intake per frequency of 18.73g for the girls and a mean intake per frequency of 16.81g for the boys. Ice blocks were ranked at number eight in the 20 top 20 foods consumed by girls with a per capita intake of 18.79g per day and for the boys' ice blocks were ranked at number eight with a per capita intake of 17.26g per day. The respondents also consumed diluted juice and ice blocks which add no nutritional value to the diet. According to Drimie and McLachlan (2013) a diet of staple food (maize meal, sugar and potatoes) is the main cause of overweight and obesity. The main source of food intake was CHO sugars and fats in this study. The intake of fruit and vegetables intake was lower than the >400g goal as recommended by the WHO. Table 4.10 indicates that the maximum FGDS for fruit was (n=7). The FGDS indicated that 2% of the respondents did not consume any fruit, 7% consumed one fruit, 32% consumed two fruit varieties, 27% consumed three fruit varieties, but only 2% consumed six fruit varieties and one person consumed all seven varieties of fruit. The fruit group had a per capita intake of 19.90g for girls and 22.93g for boys and had a mean FVS of 3.01±1.204.

Keino, Plasqui, Ettyang and van den Borne, (2014), Tathiah, Moodley, Mubaiwa, Denny and Taylor (2013) states that there has been a rapid increase in the number of children affected by excess body fat in both developing countries and in countries with a developed economy. The report by Keino *et al.* (2014), further states that some groups of children may be at risk because of their ethnic, economic and social status).

The increase in overweight and obesity affects both adults and children as an estimated 42 million children under the age of five were found to be obese or overweight in 2014 (WHO 2015a; WHO 2015b). In this study, the risk of overweight for boys was 31.1% (n=78) and 37.4% for girls (n=94) >1+SD. The number of boys that were overweight was 10.7% (n=27) and 13.6% (n=34) of the girls >+2SD were overweight. Correlations between BAZ and energy *(p*=0.000) and BAZ and average CHO (*p*=0.000) were drawn and there was statistical significance between the two. Obesity was 2.9% (n=7) for boys and 2.7% (n=7) for girls >=3SD in this study. The FGDS showed that the CHO group had the highest score 6.08±1.322. The mean CHO intake was higher than the DRIs for all girls and boys >100%. The CHOs mostly consumed from the top 20 foods consumed are maize meal (n=146), brown bread (n=146), white sugar (n=146), cooked white rice (n=126). The FGDS indicated that the respondents consumed between three and nine different varieties of carbohydrates; 22% consumed five varieties, 26% consumed six varieties, 27% consumed seven varieties, with only11% consuming eight varieties and 3% consuming nine varieties. A study conducted by Oldewage-Theron and Kruger (2008) indicated similar results with a high CHO intake in the top five foods including tea, maize meal, stiff porridge, bread rolls and milk. The contribution of protein to the total daily intake was within the recommended 10%–15% of the WHO goal. The FVS for the meat group had a score of 4.51±1.269. Most of the respondents consumed five different types of meat per week (34%). Meat is an important commodity in the South African diet but it has become unaffordable. Meat is an integral part of meals in developing countries and it can be eaten daily and an average South African consumes 18kg of meat annually (Ronquest-Ross *et al.,* 2015). Twenty nine percent of the respondents indicated that they did not consume eggs.

Socioeconomic factors such as unemployment, insufficient money to spend on food and low monthly income steered households towards food insecurity and the results can be seen in this study of the Chesterville community. The per capita intake of vegetables mostly consumed was beans (17.58g by the boys and 18.16g by the girls) and beetroot with 0.74g consumed by the boys and 11.95g by the girls. The FGDS for vegetables was (n=9). Table 4.10 indicates that most of the respondents (40%) consumed three different varieties of vegetables, 37% consumed four vegetables and 6% consumed five vegetables. Table 4.11 indicates that the vegetable group had a FVS of 4.76±1.383. Fruit was ranked at number 14 for girls and vegetables was ranked number 15 and 20 in the girls' top 20 foods and in the boys' top 20 foods fruit was number 12 and vegetables ranked at number 13 and 16. The respondents need to increase the variety and portion sizes of both fruit and vegetables. The majority of the girls (75%) consumed >100% of the DRIs for biotin, 62.7% of the girls consumed a diet low in vitamin C, vitamin D, vitamin E (78%), vitamin K (75.2% >100% of the DRIs). Poor nutrient intake is to be expected since all vegetables were consumed in small quantities and appear in the last five of the top 20 foods; no vegetables were eaten on their own, vegetables were eaten as a salad or as part of a meal. The decreased consumption of fruit and vegetables is not a local problem as the findings are seen on an international level as well.

The respondents' consumption of fibre was very low: 90.1% of the girls and 90% of the boys consumed <100% of the fibre requirements. According to a study conducted by Hassan, Hashad and Hassad (2016) in Tripoli City, Libya among school children, the fibre intake of the two age groups 6 to 8 years and 9 to 12 years old was lower than their needs. The mean intake of dietary fibre for boys was 17.5g and for girls it was 17.6g with over 90% of boys and girls not reaching WHO nutrient intake goals (>25g). The respondents' calcium intake was considered good but it was consumed in inadequate quantities; the portion sizes of calcium rich foods need to increase.

Table 4.11 indicates the FVS of dairy products to be 2.66±0.890. The FGDS for milk was six percent, the FGDS of the respondents (n=20) 8% indicated that they do not consume any dairy products, 9% consumed one variety of dairy products, 28% consumed two varieties of dairy products, 41% of the respondents consumed three varieties of dairy products, 13% consumed four varieties of dairy products, one respondent consumed 5 varieties of dairy products and one respondent consumed six varieties of dairy products. Fifty-four-point six percent of the girls in this survey consumed 100% of the DRIs for iron and 19.1% of the boys consumed 100% of the DRIs for iron. The results of this study correlate with the results of a study conducted in Dakar in urban West Africa where there was a prevalence of anemia, iron deficiency and iron deficiency anemia was14.4%, 39.1% and 10.6% respectively. Three points zero had vitamin A deficiency 25.9% had zinc deficiency and 35.9% had a marginal vitamin A deficiency status (Fiorentino *et al.*, 2013).

According to UNICEF (2009) there are three immediate interlinked causes of a child becoming stunted: either they are not getting enough food, or they have a low birth weight or there was an incidence of mismanagement of childhood disease. These diseases can cause reduced food consumption and reduced food intake can cause disease. Each of these predicted causes of stunting were rooted at the household level. Low household income will automatically lead to low food intake. Large family sizes and short birth spacing can lead to low birth weight, as can poor feeding habits during pregnancy. Providing balanced protein energy and multiple micronutrient supplements to pregnant woman will reduce intrauterine growth restrictions and low birth weight. Exclusive breast feeding protects the infant and its mother and has shown decreased morbidity and mortality in infancy (Imdad and Bhutta, 2013).

The findings of Imdad and Bhutta (2013) are similar to the findings in this study. Most of the households have one person contributing to the household income (37.6%) and 20.8% have no one contributing to the household income. Over and above the low household income there was a minimum of eight people living in each household and 15.2% of the respondents reported that they always do not have enough money to spend on food, 12.8% indicated that they often do not have enough money to spend on food and 35.2% indicated that they sometimes do not have enough money to spend on food.

One of the observations from the study regarding the socio-economic status of this community was that there was poverty although it was not severe. The findings in this study indicated that the prevalence of severe stunting (>-3SD) was 4.9% for boys and 5.4% for girls, and 16.5% of the boys and 17% of the girls were stunted (<-2SD). The survey indicated that 2.9% (<-3SD) of the boys were wasted and 3.9% of the girls were wasted and 1.4% of the girls were severely wasted (<-2SD). This may be because of a chronic inadequate dietary intake and repeated infection. According to Von Grebmer, Fritshel, Nestorova, Olofinbiyi, Pandya-Lorch, Yohannes (2008), the researchers found that the faltering of growth, especially stunting and underweight, happens from birth to age two.

Overweight and obesity are high among South African children even in rural settings (Toriola, Moselakgomo, Phil and Goon, 2012). This study supports the notion of the double burden of disease in developing countries.

4.4 Conclusion

The poor nutrition status of children has serious implications in terms of physical and cognitive development. The results of this study indicated that the majority of the respondents belonged to households of low to moderate socioeconomic status. The study revealed a trend of improvement in accessing basic services. Income plays a vital role in South Africans' access to food and low income and unemployment causes people to consume inappropriate diets. Several factors, excluding economic limitations, can contribute to unhealthy eating habits such as taste, physical access and convenience (Crush and Caesar 2014; Meacham, 2014)

The respondents were found to be micronutrient deficient and food insecure. The data provides evidence that the average school child at H.P. Ngwenya Primary School was malnourished. Healthy, low calorie foods are costly, and the focus should be on advocating quality foods that are affordable and diverse (O'Kane, 2012).

In this study, it was found that there was insufficient money to purchase food and food choices were made by the females. The variety of food consumed was not good and this indicated that inadequate food was purchased and prepared. Inadequate food can be associated with the data recorded on the income and education levels of parents in this study. In conclusion, interventions to address malnutrition and overnutrition are of public health importance among the children of Chesterville.

Chapter 5 – CONCLUSION AND RECOMMENDATIONS

This chapter presents a summary of the study, purpose, limitations, conclusion and recommendations for future research.

5 Purpose of the study

The main purpose of the study was to investigate the nutrition status of primary school children at H.P. Ngwenya Primary School in Chesterville, Durban. This was done by measuring the current socio-demographic profile, anthropometric status, 24-hour food recall and dietary intake of the respondents.

5.1 Limitations of the study

The data presented in this study represents one primary school from the area and cannot be extrapolated to include all primary schools in the Chesterville community. Some respondents were not prepared to disclose specific information, for example, how much they earned, the parents/ caregivers age and this could have influenced the outcome of the overall impression of the socio-demographic data. The reliability of the data was dependent on the respondents' honest disclosure.

5.2 Summary of the study

The first years of life are a critical period for child development. There is a strong agreement that improvement in the nutrition status of young children and infants not only has a direct short-term impact on their health but also affects their physical and mental development later in life. Past studies show that acute malnutrition is a vital factor in explaining deficit in cognitive development in early childhood and there is an equally universal acceptance that health inequalities begin very early in childhood, and growth retardation occurs in the first two to three years of life after which the physical and cognitive deficits are difficult to reverse.

The anthropometric indices showed that 10.3% of the children were severely stunted and 33.5% were stunted, 2.9% severely wasted, 5.3% wasted. Despite the marked improvement worldwide in the prevalence of stunting and under-nutrition among under-five children, recent South African studies show that child malnutrition rates have increased thereby compromising child health. Malnutrition (measured as poor anthropometric status) is a vital public health challenge and is one of the major killers of children in developing countries. Malnutrition continues to be a public health problem in low-income countries especially in South Asia and Sub-Saharan Africa. The study revealed that 68.5% of the respondents had possible risk of overweight, 24.3% overweight and 5.3% obese. Correlations between BAZ and energy were drawn and there was a statistical significance between the two. The prevalence of obesity in children increased worldwide by 47.1% between 1980 and 2013. Overweight and obesity, which were previously considered problems affecting mainly the affluent, are now markedly on the rise in low and middle-income countries, particularly in urban areas.

5.3 Socio-demographic profile

The study indicated that the children of the Chesterville community come from low socioeconomic households with limited resources. An association has been established by several studies between malnutrition and socioeconomic status. The study has also indicated overcrowding in the majority of the households with more than eight people living under one roof. The study also indicated a high unemployment rate, which can be linked to not having enough money to spend on food. In some households, children were raised by grandparents and the family was living on the grandparents' social grants. Often food could not be bought simply because there was no available money to spend on food. The majority of the households were headed by females and were dependent on one person's income. The level of education was low, with a significant number of caregivers not having a post matric qualification, which could be a contributory factor to the high unemployment rate.

Many of the employed parents worked on a temporary basis and some are permanently employed but not in professional positions, which correlates with several research studies that indicated a high rate of food insecurity in households with a high unemployment rate. The majority of the children in this community walked to school, which obviates the need to erode the low income to pay for transport. Most households have all the basic assets.

5.4 Dietary intake

The study indicated that many of the respondents from the Chesterville community consumed a diet high in CHO. The respondents had a low vegetable variety in the diet and the portion sizes were small. Prominent protein foods were milk, beans, beef, chicken and sour milk. The consumption of sour milk and beans may be influenced by affordability as compared to red meat and the intake of these foods is linked to income. The calcium consumption was fairly good but in inadequate quantities.

The total contribution to energy by fat was above the level of the goal recommended by the WHO as measured by the 24-hour food recall for both girls and boys. The possibility of respondents of low socioeconomic status over-reporting to avoid shame or under-reporting if they perceived that they were going to gain something cannot be overlooked. In this study, the children's intake of fat and added sugars exceeded the guidelines. The apparent result of overweight and obesity may be the result of the overconsumption of fatty and sugary foods and a CHO-rich diet, for example, vetkoek, sweets, ice blocks, savoury snacks (potato crisps and maize snacks) and cold drinks. The mean intake of the dietary fibre was lower than the WHO recommended amount of 31g to 26g for both boys and girls respectively.

The diet of the respondents was high in vitamin A, folate, pantothenate and low in riboflavin, niacin and vitamin B6. The results of the FFQ indicated that 57 different individual food items were consumed in seven days by all the respondents.

The total range of individual food items consumed by an individual during the seven days' data collection was between five and nine foods. Some of the respondents consumed three varieties of dairy products.

The FFQ also indicated that four different varieties of vitamin A-rich vegetables were consumed by the respondents. The quantity and quality of the diet of the respondents is likely to be compromised because of the level of education of the caregivers and the amount of money spent on food by the families. This is supported by the positive correlation between the inability to purchase food and the education level of the caregivers in chapter 4 (table 4.13). Families suffer from malnutrition because of the type of employment of the caregivers and their reliance upon social grants and the high cost of food.

5.5 Nutrition status

In this study, we found to be a prevalence of stunting, overweight and obesity in the sampled boys and girls at a primary school in Chesterville. The ratio of stunting, overweight and obesity is 1:1 across all three classifications. Education about food is necessary at an early age so that children can be taught to make healthy food choices early in life. To deal with issues of obesity and overweight, portion control and physical activity should be emphasized at school level

5.6 Conclusion

The available literature and the present study revealed that there is an incidence of both undernutrition and overnutrition and dietary inadequacy in school-going children with respect to micronutrient consumption. The findings of the study strongly suggest that malnutrition is linked to economic and social factors.

Research showed that children and woman are more vulnerable to malnutrition. Intervention strategies are needed to prevent the increasing prevalence of overweight, obesity and underweight among children.

Parents and caregivers should be educated on the importance of monitoring the eating habits of their children.

5.7 Recommendations

5.7.1 Recommendations for government departments

- Addressing malnutrition requires a combination of equity-oriented development of policies and the implementation of cost-effective interventions. These must be coupled with effective support systems such as capacity building, operations research, supervision and monitoring and control. Programme implementation requires that nutrition must have a prominent position on the policy agenda of government.
- Incorporate growth monitoring and the promotion of nutrition related behavioural change and micronutrient supplementation into health services.
- Give appropriate nutrition counselling in emergency areas with high prevalence of HIV and AIDS and malaria.

- Have community based nutrition projects aimed at young children, pregnant woman and adolescent girls, combined where possible with early childhood education.
- Fortify commonly consumed, centrally processed food such as bread and cereals.
- Support community health nutrition programmes that focus on key nutrition interventions such as exclusive breast feeding, complimentary feeding, micronutrient supplementation and identification and referral of children with severe malnutrition.

5.7.2 Recommendations for the community

Sound nutrition intervention programmes need to consider economic, health, social and demographic factors and future studies are needed to address the expanding needs of this community.

A possible lack of nutrition knowledge in conjunction with the low socio-economic status of the community could have contributed to the study findings. Nutrition education and the importance of getting the best from eating patterns and sound food choices within the limited food budget is of importance. Communities should start programmes of their own on poverty alleviation and not wait for government to do so. People need to act and take responsibility to improve their lifestyle. Community upliftment can only succeed if all relevant stakeholders are involved. Educating the community about home-grown foods will be of great benefit to this community.

5.7.3 Recommendations for future research

Improving nutrition status among school-going children and adolescents is a powerful investment in the future generation and for preventing the development of obesity and other nutrition related diseases later in life.

Schools provide opportunities to promote healthy physical activities and dietary patterns for children and are also a good access point to engage community members and parents in preventing malnutrition among their own adolescents and school children in all its forms, for example, obesity, undernutrition, micronutrient deficiency and nutrition related chronic diseases.

Stronger policies are necessary to provide healthier meals to learners at school and to limit their, access to low-nutrient, energy dense foods during the day and increase the frequency, duration and intensity of physical education activity at school (Story, Nanney and Schwartz, 2009).

- Nutrition plays an integral role from early foetal life into adulthood. It is essential for survival, good health, growth, mental and physical development, performance and productivity. Malnutrition compromises children`s right to survival and development and continues the cycle of intergenerational poverty. Concentrating on adequate nutrition for mothers and children will contribute towards achieving the Sustainable Development Goals (SDGs). Child health is strongly associated with educational achievement. Better health and nutrition are associated with gains in schooling in many aspects; that is, enrolment at a younger age, less absenteeism, less grade repetition, better performance on test scores and more grades completed.

- Nutrition programmes are in place in most South African schools; the challenge is the effectiveness and the quality of services being rendered by the service providers. There needs to be improvement in the educational knowledge of the service providers about food production and preparation.
- Storage facilities need to be improved to avoid food contamination.
- Food distribution needs to be improved so that there is consistency in food delivery so that children receive their meals regularly.
- Monitoring, control and evaluation is required to ascertain whether the food programmes are a success.

- Sustainable nutrition education and promotion programmes should be put in place to sensitize people about the importance of good nutrition in children.
- Further research is required to establish how best to deliver the message about the importance of micronutrient consumption and a healthy diet.

References

Aberman, N.L., Meerman, J. and Benson, T. eds., 2015. *Mapping the linkages between agriculture, food security and nutrition in Malawi*. Intl Food Policy Res Inst.

Acham, H., Egal, A.A. and Oldewage-Theron, W.H. 2012. Household Asset Index and Total Iron Intake, But Not Education, Best Predict Iron Status in A Black Population Sample in Gauteng, South Africa. *Scientific Research and Essays*, 7 (9): 1035-1050.

Acham, H., Kikafunda, J.K., Malde, M.K., Oldewage-Theron, W.H. and Egal, A.A. 2012. Breakfast, Midday Meals and Academic Achievement in Rural Primary Schools in Uganda: Implications for Education and School Health Policy. *Food & Nutrition Research*, 56.

Acheampong, H. 2014. *Church-Based HIV/AIDS Prevention for Adults*. Available at: http://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=1083&context=dissertations (Accessed 9 February 2015).

Acosta, A.M. and Fanzo, J. 2012. Fighting maternal and child malnutrition: analysing the political and institutional determinants of delivering a national multisectoral response in six countries. *A synthesis paper*: Brighton, UK, Institute of Development Studies.

Aertsens, J., Mondelaers, K., Verbeke, W., Buysse, J. and Van Huylenbroeck, G. 2011. The influence of subjective and objective knowledge on attitude, motivations and consumption of organic food. *British Food Journal*, 113 (11): 1353-1378.

Ahmed, T., Hossain, M. and Sanin, K. I. 2013. Global burden of maternal and child undernutrition and micronutrient deficiencies. *Annals of Nutrition and Metabolism*, 61 (Suppl. 1): 8-17.

Ahsan, T., Rahman, M., Ramatullah, M., Ahsan, M., Khan, M.N.I. and Islam, S.N. 2013. Multiple micronutrient (zinc, magnesium) therapy to severe malnourished children: effect on growth catch-up and clinical recovery. *European Scientific Journal*, 9 (30).

Akhtar, N., Yasmin, S. and Saleem, R., 2016. Household Food Security Issues and Rural Women. *Imperial Journal of Interdisciplinary Research*, *2*(9).

Alderman, H. and H. Bleakley 2013. Child health and educational outcomes.

Alemu, F., 2013. Assessment of the impact of malnutrition on children at Dilla referral hospital and unity pediatric clinic, Ethiopia. *International Journal of Nutrition and Metabolism*, *5*(6), pp.105-113.

Algarín, C., Nelson, C. A., Peirano, P., Westerlund, A., Reyes, S. and Lozoff, B. 2013. Iron-Deficiency Anemia in Infancy and Poorer Cognitive Inhibitory Control at Age 10 years. *Developmental Medicine & Child Neurology*, 55 (5): 453-458.

Allen, L.H., De Benoist, B., Dary, O., Hurrell, R. and World Health Organization, 2006. Guidelines on food fortification with micronutrients.

Allender, S., Wickramasinghe, K., Goldacre, M., Matthews, D. and Katulanda, P. 2011. Quantifying Urbanization as a Risk Factor for Non-Communicable Disease. *Journal of Urban Health*, 88 (5): 906-918.

Altman, M., Hart, T. and Jacobs, P., 2009. Household food security status in South Africa. *Agrekon*, *48*(4), pp.345-361.

American Thyroid Association, 2012: Iodine Deficiency*: Dedicated to Scientific enquiry, Clinical excellence, Public service, Education and Collaboration:* June 2012.

Ani, C. 2014. The Role of Nutrition in Intellectual Development. *Environmental Effects on Cognitive Abilities*: 119.

Apondi, M. K. 2014. The Relationship Between Nutrition and Performance of Pre-school Children in Rabour Zone Kisumu Country, Kenya

Armstrong, M.E., Lambert, M.I. and Lambert, E.V., 2011. Secular trends in the prevalence of stunting, overweight and obesity among South African children (1994–2004). *European journal of clinical nutrition*, *65*(7), pp.835-840.

Asghari, G., Yuzbashian, E., Mirmiran, P., Mahmoodi, B. and Azizi, F. 2015. Fast food intake increases the incidence of metabolic syndrome in children and adolescents: Tehran Lipid and Glucose Study. *PloS one*, 10 (10): e0139641.

Atkinson, E.C., Thiara, D., Tamura, D., Di Giovanna, J.J., Kraemer, K.H. and Hadigan, C. 2014. Growth and Nutrition in Children with Trichothiodystrophy. *Journal of Pediatric Gastroenterology and Nutrition*, 59 (4): 458-464.

Balarajan, Y., Ramakrishnan, U., Özaltin, E., Shankar, A. H. and Subramanian, S. V. 2012. Anaemia in Low-Income and Middle-Income Countries. *The Lancet*, 378(9809): 2123-2135. Available at: https://www.ncbi.nlm.nih.gov/pubmed/21813172 (Accessed 27 March 2013).

Baleta, A. and Mitchell, F. 2014. Country in Focus: Diabetes and Obesity in South Africa. *The Lancet Diabetes & Endocrinology* 2(9): 687-688. Available: http://www.thelancet.com/journals/landia/article/PIIS2213-8587(14)70091-9/fulltext?rss=yes (Accessed 28 April 2016).

Basch, C.E. 2011. Breakfast and the achievement gap among urban minority youth. *Journal of School Health*, 81 (10): 635-640.

Basch, C.H., Samuel, L. and Ethan, D. 2013. Obesity, diabetes and heart disease: effects of globalization on population health, preventive efforts, and the importance of social change. *International Journal of Health Promotion and Education*, 51 (4): 185-197.

Behrman, J.R. 2010. Investment in Education Inputs and Incentives. *Handbook of Development Economics*, 5: 4883-4975.

Bhandari, S. and Banjara, M.R., 2015. Micronutrients deficiency, a hidden hunger in Nepal: prevalence, causes, consequences, and solutions. *International Scholarly Research Notices*, *2015*.

Bhatia, V., Das, M.K., Kumar, P. and Arora, N.K., 2010. Infantile hookworm disease. *Indian pediatrics*, *47*(2), pp.190-192.

Biesalski, H.K., 2013. Hidden hunger. In *Hidden Hunger* (pp. 25-50). Springer Berlin Heidelberg.

Biesalski, H.K. and Black, R.E. eds., 2016. *Hidden Hunger: Malnutrition and the First 1,000 Days of Life: Causes, Consequences and Solutions* (Vol. 115). Karger Medical and Scientific Publishers.

Black, R.E., Allen, L.H., Bhutta, Z.A., Caulfield, L.E., De Onis, M., Ezzati, M., Mathers, C., Rivera, J. and Maternal and Child Undernutrition Study Group. 2008. Maternal and Child Under-nutrition: Global and Regional Exposures and Health Consequences. *The Lancet*, 371(9608): 243-260.

Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., De Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J. and Martorell, R. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382 (9890): 427-451.

Blundell, J.E., Dulloo, A.G., Salvador, J. and Frühbeck, G. 2014. Beyond BMI-Phenotyping the Obesities. *Obesity Facts*, 7(5): 322-328.

Bougma, K., Aboud, F.E., Harding, K.B. and Marquis, G. S. 2013. Iodine and Mental Development of Children 5 Years Old and Under: A Systematic Review and Meta-Analysis. *Nutrients*, 5(4): 1384-1416.

Bouis, H.E. and Welch, R.M. 2010. Biofortification – A Sustainable Agricultural Strategy for Reducing Micronutrient Malnutrition in the Global South. *Crop Science*, 50(Suppl.): S-20-S-32.

Bowles, D. C. 2016. Climate Change-Associated Conflict and Infectious Disease. *Examining the Role of Environmental Change on Emerging Infectious Diseases and Pandemics*: 68.

Bowley, A. 2008. Alliances against hunger. *Editorial. Nutriview*, 4 (2).

Briggs, M., Fleischhacker, S. and Mueller, C.G. 2010. Position of the American Dietetic Association, School Nutrition Association, and Society for Nutrition Education: Comprehensive School Nutrition Services. *Journal of nutrition education and behavior*, 42 (6): 360-371.

Brinkman, H.J., de Pee, S., Sanogo, I., Subran, L. and Bloem, M.W. 2010. High Food Prices and the Global Financial Crisis Have Reduced Access to Nutritious Food and Worsened Nutritional Status and Health. *The Journal of Nutrition*, 140 (1): 153S-161S.

Brummer, Y., Duss, R., Wolever, T.M. and Tosh, S.M. 2012. Glycemic Response to Extruded Oat Bran Cereals Processed to Vary in Molecular Weight. *Cereal Chemistry*, 89 (5): 255-261.

Budlender, D., Woolard, I. and Pension, O.A. 2012. Income Inequality and Social Grants: Ensuring Social Assistance for Children Most in Need. *South African Child Gauge*: 48-51.

Buhl, A., 2010. Meeting Nutritional Needs Through School Feeding: A Snapshot of Four African Nations. *Global Child Nutrition Foundation.*

Bundy, D.A., 2009. *Rethinking school feeding: social safety nets, child development, and the education sector*. World Bank Publications.

Burchi, F., Fanzo, J. and Frison, E. 2011. The Role of Food and Nutrition System Approaches in Tackling Hidden Hunger. *International Journal of Environmental Research and Public Health*, 8 (2): 358-373.

Cameron, M.E. and Van Staveren, W.A., 1988. Manual on methodology for food consumption studies.

Can, Y., 2011 World Hunger and Poverty Facts and Statistics.

Casale, D., Desmond, C. and Richter, L., 2014. The association between stunting and psychosocial development among preschool children: a study using the South African Birth to Twenty cohort data. *Child: care, health and development*, *40*(6), pp.900-910.

Caswell, J.A., Yaktine, A.L. and Council, N.R. 2013. Individual, Household, and Environmental Factors Affecting Food Choices and Access.

Centers for Disease Control and Prevention. 2015. *International Micronutrient Malnutrition Prevention and Control (IMMPact).* Available at: https://www.cdc.gov/immpact/ (Accessed 3 August 2016).

Chambers, R. 2014. Rural development*: Putting the last first*. Routledge.

Chemaly, C.T., MacIntyre, U.E. and Abrahamse, H., 2004. Calcium intake and knowledge among white adolescent girls in Gauteng, South Africa. *South African Journal of Clinical Nutrition*, *17*(3), pp.102-108.

Chernoff, R., 2013. *Geriatric nutrition*. Jones & Bartlett publishers.

Chesire, E.J., Orago, A.S., Oteba, L.P. and Echoka, E. 2008. Determinants of Undernutrition among School Age Children in a Nairobi Peri-Urban Slum. *East African medical journal*, 85(10): 471-479.

Christian, P. 2010. Impact of the Economic Crisis and Increase in Food Prices on Child Mortality: Exploring Nutritional Pathways. *The Journal of Nutrition*, 140 (1): 177S-181S.

Cloete, F., 2015. Measuring progress towards sustainable development in Africa. *African Journal of Public Affairs*, *8*(3), pp.51-74.

Cloete, J. 2015. Management of severe acute malnutrition. *SAMJ: South African Medical Journal*, 105 (7): 605-605.

Conor Dougherty. 2011: The Wall street Journal: Children of divorce more likely to live in poverty: Census Report: available at: http://www.huffingtonpost.com/2011/08/25/divorce-poverty-children-census_n_936896.html (Assessed 12 July 2014)

Cohen, M. J., Tirado, C., Aberman, N.-L. and Thompson, B. 2008. Impact of climate change and bioenergy on nutrition. *Rome: Food and Agricultural Organisations of the United Nations (FAO) and International Food Policy Research Institute (IFPRI)*.

Cole T.J. 2005. *Sampling study size and power calculation. In Design concepts in Nutrition Epidemiology*. 2nd ed. Edited by: Margets, B.M., and Nelson, M (eds): design concepts of nutritionally epidemiology. New York: Oxford University Press; 1997: 64-86.

Comley, V., Nkwanyana, N. and Coutsoudis, A. 2015. Immunisation and Vitamin A Capsule Coverage in a Semi-Urban Area of KwaZulu-Natal Province, South Africa. *South African Journal of Child Health*, 9 (4): 108-111.

Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'neill, R.V., Paruelo, J. and Raskin, R.G., 2016. The Value of the World's Ecosystem Services and Natural Capital (1997). *The Globalization and Environment Reader*, p.117.Naeem,O`.

Coughlan, M.P. 2014. *Molybdenum and Molybdenum-Containing Enzymes*. Elsevier.

Coutinho, T., Goel, K., de Sá, D.C., Carter, R.E., Hodge, D.O., Kragelund, C., Kanaya, A.M., Zeller, M., Park, J.S. and Kober, L. 2013. Combining Body Mass Index with Measures of Central Obesity in the Assessment of Mortality in Subjects with Coronary Disease: Role of "Normal Weight Central Obesity". *Journal of the American College of Cardiology*, 61 (5): 553-560.

Crush, J. and Caesar, M. 2014. City without choice: Urban Food Insecurity in Msunduzi, South Africa. *Urban Forum* 25(2): 165-175. Available at: http://link.springer.com/article/10.1007%2Fs12132-014-9218-4 (Accessed 10 November 2015).

Da Silva, J. 2013. *World Food Day 2013: Towards Sustainable Food Systems*.

De Boer, M.D., Lima, A.A., Oría, R.B., Scharf, R.J., Moore, S.R., Luna, M.A. and Guerrant, R.L. 2012. Early Childhood Growth Failure and the Developmental Origins of Adult Disease: Do Enteric Infections and Malnutrition Increase Risk for The Metabolic Syndrome? *Nutrition reviews*, 70 (11): 642-653.

De Onis, M., Blössner, M. and Borghi, E., 2012. Prevalence and trends of stunting among pre-school children, 1990–2020. *Public health nutrition*, *15*(1), pp.142-148.

De Pee, S., Grais, R., Fenn, B., Brown, R., Briend, A., Frize, J., Shoham, J. and Kiess, L. 2015. Prevention of acute malnutrition: distribution of special nutritious foods and cash, and addressing underlying causes—what to recommend when, where, for whom, and how. *Food and nutrition bulletin*, 36 (suppl): S24-S29.

De Sousa, E.F., Da Costa, T.H., Nogueira, J.A. and Vivaldi, L.J. 2008. Assessment of Nutrient and Water Intake among Adolescents from Sports Federations in The Federal District, Brazil. *British Journal of Nutrition*, 99(06): 1275-1283.

De Onis, M. and Blössner, M., 2000. Prevalence and trends of overweight among preschool children in developing countries. *The American journal of clinical nutrition*, *72*(4), pp.1032-1039.

Department of Basic Education, 2013/14. National School Nutrition Programme: 2013/14 Annual Report

Department of Basic Education. 2011. National School Nutrition Program. *Annual Report 2010/2011*. Available at: http://www.education.gov.za/Portals/0/Documents/Reports/NSNP%202010%2011%20Annual%20report.pdf?ver=2012-01-27-115329-953 (Accessed 15 February 2012).

Department of Health South Africa. 2013. Road Map for Nutrition in South Africa 2013-2017.

Department of Social Development, 2012. *The South African Child Support Grant Impact Assessment: Evidence from a survey of children, adolescents and their households*: South Africa. Department of Social Development.

Development Bank Southern Africa. 2008. Combating Malnutrition in South Africa Available at: http://www.dbsa.org/EN/About-Us/Publications/Documents/South%20Africa%20Nutrition_%20input%20paper_roadmap.pdf (Accessed 20 February 2013).

Dewey, K.G. and Begum, K. 2011. Long- term consequences of stunting in early life. *Maternal & child nutrition*, 7(3): 5-18. Available: DOI: 10.1080/01639360802060140.soursce.pubMed (Accessed 14 May 2015).

Dhansay, M.A., Labadarios, D., Shisana, O. and Parker, W., 2013. Stunting, overweight and obesity in the very young: two sides of the coin.

Dietician of Canada. 2014. *Food Sources of Vitamin B12.* Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Vitamin-B12.aspx (Accessed 18 July 2014)

Dietician of Canada. 2014. *Food Sources of Vitamin B6 (Pyridoxine)*. Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Vitamin-B6-(Pyridoxine).aspx (Accessed 17 September 2016)

Dietician of Canada. 2016. *Food Sources of Thiamine (Vitamin B1)*. Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Thiamin-(Vitamin-B1).aspx (Accessed 2 December 2016).

Dietician of Canada. 2016. *Food Sources of Folate*. Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Folate.aspx (Accessed 20 November 2016)

Dietician of Canada. 2016. *Food Sources of Vitamin D*. Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Vitamins/Food-Sources-of-Vitamin-D.aspx (Accessed 2 December 2016)

Dieticians of Canada. 2016. *Food Sources of Selenium*. Available at: http://www.dietitians.ca/Your-Health/Nutrition-A-Z/Minerals/Food-Sources-of-Selenium.aspx (Available 02 November 2016).

Drake, V. 2011. Micronutrients and cognitive function. *Research Newsletter-Spring/Summer*. Available: http://lpi.oregonstate.edu/mic/health-disease/cognitive-function (Accessed 6 February 2012).

Drimie, S. and McLachlan, M. 2013. Food Security in South Africa—First Steps Toward a Transdisciplinary Approach. *Food Security* 5(2): 217-226. Available at: http://scholar.sun.ac.za/handle/10019.1/80704 (Accessed 12 December 2015).

Drimie, S., Faber, M., Vearey, J. and Nunez, L. 2013. Dietary Diversity of Formal and Informal Residents in Johannesburg, South Africa. *BMC Public Health* 13(1): 911-911. Available at: http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-13-911 (Accessed 15 December 2015).

du Plessis, L.M., Labuschagne, I.L. and Naude, C., 2008. Nutrition during pregnancy and lactation.

Duong, M.C., Mora-Plazas, M., Marín, C. and Villamor, E. 2015. Vitamin B-12 Deficiency in Children is Associated with Grade Repetition and School Absenteeism, Independent of Folate, Iron, Zinc, or Vitamin a Status Biomarkers. *The Journal of nutrition*, 145 (7): 1541-1548.

Dyer, J.S. and Rosenfeld, C.R. 2011. Metabolic Imprinting by Prenatal, Perinatal, and Postnatal Overnutrition: a review in *Seminars in reproductive medicine*, 29(03): 266-276.

Egger, G., Binns, A. and Rossner, S. 2011. Lifestyle medicine: managing diseases of lifestyle in the 21st century.

Ehrlich, S.D. and NMD, S.A., 2011. A private practice specializing in complementary and alternative medicine, Phoenix, AZ. *Review provided by VeriMed Healthcare Network*.

Entin, E. 2012. Eating Out is Out of Control. *The Doctor Will See You Now* (blog). Available at: http://www.thedoctorwillseeyounow.com/content/kids/art3870.html (Accessed 3 March 2013).

eThekwini Municipality. 2010. *Household income per annum*. Available at: http://www.durban.gov.za/Online Tools/Pages/Community Profiles.aspx (assessed 20 September 2016).

European Food Safety Authority. 2013. Scientific Opinion on Dietary Reference Values for Fluoride. *EFSA: European Food Safety Authority Journal*, 11(8):3332. Available at: doi:10.2903/j.efsa.2013.3332 (Accessed 16 November 2016).

Eufic, 2012. Parental influence on children`s food preferences and energy intake: available at: http://www.eufic.org/en/healthy-living/article/parental-influence-on-childrens-food-preferences-and-energy-intake (Assessed 13August 2016)

Faber, M., Van Jaarsveld, P., Wenhold, F. and Van Rensburg, J. 2010. African Leafy Vegetables Consumed by Households in the Limpopo and Kwazulu-Natal Provinces in South Africa. *South African Journal of Clinical Nutrition*, 23 (1).

Fagan, P.F. 2014. THE RELATIONSHIP OF FAMILY LIFE TO POVERTY/INCOME AND TO CRIME/ABUSE. Available at: http://www.um.edu.uy/docs/fagan_discurso.pdf (Accessed 15 March 2015).

Fanzo, J., 2012. *The nutrition challenge in sub-Saharan Africa* (No. 2012-012). United Nations Development Programme, Regional Bureau for Africa.

Food and Agriculture Organisation, 2010. Human Resource Development in Agriculture: Developing Country Issues. Available at: http://www.fao.org/docrep/v4200e/v4200e11.htm (accessed 20 March 2014).

Food and Agriculture Organisation, 2014. United Nations: The State of Food Insecurity in the World (SOFI) 2014.

FAO and WFP. 2015. The State of Food Insecurity in the World 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress. *Food and Agriculture Organization Publications, Rome*.

Finn, A., Leibbrandt, M. and Woolard, I. 2013. *What happened to multidimensional poverty in South Africa between 1993 and 2010?*

Fiorentino, M., Bastard, G., Sembène, M., Fortin, S., Traissac, P., Landais, E., Icard-Vernière, C., Wieringa, F.T. and Berger, J. 2013. Anthropometric and Micronutrient Status of School Children in an Urban West Africa Setting: A Cross-Sectional Study in Dakar (Senegal). *PloS one*, 8 (12): e84328.

Florencio, C.A. 2001. Developments and Variations in school based feeding programs around the world. *Nutri Today*, 36(1):29-36.

Folaranmi, T., 2012. Food Insecurity and Malnutrition in Africa: Current trends, causes and consequences. *Consultancy Africa Intelligence (CAI), http:// www. consultancyafric a. com/ index. php*.

Food and Drug Administration, 2015. Dietary Supplements.

Food finder 3. 2002. *Dietary Analysis Software Program, Version 1.0.7.* Cape Town: South African Medical Research Council.

Food Stuff South Africa. 2013. Tuckshops Truths Study Reveals Poor Nutritional Offering. Available at: https://foodstuffsa.co.za/news-stuff/latest-sa-news/3125-tuck-shop-truths-study-reveals-poor-nutritional-offerings (Accessed 13 May 2014).

Forrester, T.E., Badaloo, A.V., Boyne, M.S., Osmond, C., Thompson, D., Green, C., Taylor-Bryan, C., Barnett, A., Soares-Wynter, S. and Hanson, M.A. 2012. Prenatal Factors Contribute to the Emergence of Kwashiorkor or Marasmus in Severe Undernutrition: Evidence for the Predictive Adaptation Model. *PloS one,* 7 (4): e35907.

Freeland-Graves, J.H. and Nitzke, S. 2013. Position of the academy of nutrition and dietetics: total diet approach to healthy eating. *Journal of the Academy of Nutrition and Dietetics,* 113 (2): 307-317.

Funari, M. 2013. Detecting Symptoms, Early Intervention, and Preventative Education Eating Disorders & the School-Age Child. *NASN School Nurse*.

Galhena, D.H., Freed, R. and Maredia, K.M. 2013. Home Gardens: A Promising Approach to Enhance Household Food Security and Wellbeing. *Agriculture & Food Security*, 2 (1): 1.

Garcia, K.S., Power, T.G., Fisher, J.O., O'Connor, T.M. and Hughes, S.O., 2016. Latina mothers' influences on child appetite regulation. *Appetite*, *103*, pp.200-207.

Garg, M., Rajesh, V. and Kumar, P. 2015. Effect of Breakfast Skipping on Nutritional Status and School Performance of 10-16-Year-Old Children of Udupi District. *Health and Population-Perspectives and Issues*, 37 (3 & 4): 98-117.

Garnett, T. and Wilkes, A., 2014. Appetite for Change. *Social, Economic and Environmental Transformations in China's Food System*.

Ghate, P. and Kotwal, D, 2014. Prevence of Malnutrition amoung the children residing in India and Ethiopia. The International Journal of Science and Journal of science and technology, vol 2 issue 1.

Gibson, R.S (ed.). 2005. *Principles of nutritional assessment*. 2nded. Oxford: Oxford University Press, USA.

Gigaba, M. and Maharaj, B., 1996. Land invasions during political transition: the Wiggins saga in Cato Manor. *Development Southern Africa*, *13*(2), pp.217-235.

Gillespie, S., Haddad, L., Mannar, V., Menon, P., Nisbett, N., Maternal and Group, C. N.S. 2013. The Politics of Reducing Malnutrition: Building Commitment and Accelerating Progress. *The Lancet*, 382 (9891): 552-569.

Glewwe, P. and Miguel, E. A. 2007. The impact of child health and nutrition on education in less developed countries. *Handbook of development economics*, 4: 3561-3606.

Goran, M.I., Ball, G.D. and Cruz, M.L., 2003. Obesity and risk of type 2 diabetes and cardiovascular disease in children and adolescents. *The Journal of Clinical Endocrinology & Metabolism*, *88*(4), pp.1417-1427.

Goran, M.I., Ball, G.D. and Cruz, M.L., 2003. Obesity and risk of type 2 diabetes and cardiovascular disease in children and adolescents. *The Journal of Clinical Endocrinology & Metabolism*, *88*(4), pp.1417-1427.

Gravani, R.B., 2009. The role of good agricultural practices in produce safety. *Microbial safety of fresh produce*, *101*.

Graven, M.H., 2014. Poverty, inequality and mathematics performance: the case of South Africa's post-apartheid context. *ZDM*, *46*(7), pp.1039-1049.

Gupta, N., Goel, K., Shah, P. and Misra, A. 2012. Childhood Obesity in Developing Countries: Epidemiology, Determinants and Prevention. *Endocrine Reviews*, 33 (1): 48-70.

Habashi, J., Wright, L. and Hathcoat, J.D. 2012. Patterns of Human Development Indicators across Constitutional Analysis of Children's Rights to Protection, Provision, and Participation. *Social Indicators Research*, 105 (1): 63-73.

Hammond, K. 2008. Dietary assessment: in Mahan, K. L., Escott-Stump, S., and Krause"s (eds). Food, nutrition and diet therapy. 12th edition. Philadephia: WB Saunders Company.

Harris, R.J. and Sanborn, F.W., 2013. *A cognitive psychology of mass communication*. Routledge.

Haselow, N., Obadiah, M. and Akame J. 2004. The Intergration of Vitamin A Supplematation into Community-Directed-Treatment with Ivermectin: A practical guide for Africa: Nancy Haslow, HKI: Guide for the Intergration of VAS into CDTI, September 2004

Hassan, E.M., Hashad, L.A.K. and Hassan, M.I. 2016. Nutritional Status of School Children in Tripoli City, Libya 2012. *Journal of Food and Nutrition Research*, *4*(4): 223-229.

Hassan, L., Umar, K., Dangoggo, S. and Maigandi, A. 2011. Anti-Nutrient Composition and Bioavailability Prediction as Exemplified by Calcium, Iron and Zinc in Melocia Corchorifolia Leaves. *Pakistan Journal of Nutrition*, 10 (1): 23-28.

Health 24, 2013. South Africa`s Hidden Hunger. As food prices increase, South Africa finds it exceedingly difficult to afford healthy nutrients-rich foods April 2013

Health Systems Trust, 2016. Malnutrition causes economic loss, half of child deaths.

Hegerl, G., Luterbacher, J., González-Rouco, F., Tett, S.F., Crowley, T. and Xoplaki, E. 2011. Influence of human and natural forcing on European seasonal temperatures. *Nature Geoscience*, 4 (2): 99-103.

Hendricks Michael, 2009/2010. An interigated approach to Malnutrition in childhood (school of child and Adoliscent Health, University of Capetown) and Lesley Bourne (Environment and Health Research unit, *Medical Research Counsil*) South African Child gauge 2009/2010.

Hendricks, M. and Bourne, L. 2009. An integrated approach to malnutrition in childhood. *Child Gauge*.

Hendricks, M.K., Kruger, H.S. and Puoane, T., 2016. Nutritional Management of Multiple Nutrient Deficiencies. *Community Nutrition for Developing Countries*, p.155.

Hendriks, S., 2013. South Africa's National Development Plan and New Growth Path: reflections on policy contradictions and implications for food security. *Agrekon*, *52*(3), pp.1-17.

Herrador, Z., Sordo, L., Gadisa, E., Buño, A., Gómez-Rioja, R., Iturzaeta, J.M., de Armas, L.F., Benito, A., Aseffa, A. and Moreno, J. 2014. Micronutrient Deficiencies and Related Factors in School-Aged Children in Ethiopia: A Cross-Sectional Study in Libo Kemkem and Fogera Districts, Amhara Regional State. *PloS one*, 9 (12): e112858.

Hester, H., Anne Marie and Barrie M. Margettes. 2011. The Nutrition Transition in Africa: Can it be steered to a more positive direction. 3(4):429-441

Hidrobo, M., Peterman, A. and Heise, L., 2016. The Effect of Cash, Vouchers, and Food Transfers on Intimate Partner Violence: Evidence from a Randomized Experiment in Northern Ecuador. *American Economic Journal: Applied Economics*, *8*(3), pp.284-303.

Hoosain, E., Dwane, N. and Reddy, P. 2013. South African National Health and Nutrition Examination Survey. *Human Sciences Research Council, Pretoria, South Africa*. Available at: http://www.hsrc.ac.za/uploads/pageNews/72/SANHANES-launch%20edition%20(online%20version).pdf (Accessed 10 December 2015).

Household income per (per annum): eThekwini Municipality 2016: Available at http://www.durban.gov.za/Online Tools/Pages/Community Profiles.aspx (Accessed 20 September 2016).

Huffman, S.L., Harika, R.K., Eilander, A. and Osendarp, S.J., 2011. Essential fats: how do they affect growth and development of infants and young children in developing countries? A literature review. *Maternal & child nutrition*, *7*(s3), pp.44-65.

Igumbor, E.U., Sanders, D., Puoane, T.R., Tsolekile, L., Schwarz, C., Purdy, C., Swart, R., Durão, S. and Hawkes, C., 2012. "Big food," the consumer food environment, health, and the policy response in South Africa. *PLoS Med*, *9*(7), p.e1001253.

Imdad, A. and Bhutta, Z.A. 2013. Nutritional Management of the Low Birth Weight/ Preterm Infant in Community Settings: A Perspective from the Developing World. *The Journal of pediatrics*, 162 (3): S107-S114.

Institute of Meicine. 2001. Dietary Reference Intake: the essential guide to nutrient requirements. Available at http://www.nap.edu/catalog/11537.html (Assessed 25 July 2017)

Jahn, A., Floyd, S., Crampin, A.C., Mvula, H., Mwinuka, V., Mwaiyeghele, E., McGrath, N., Zaba, B., Fine, P.E.M. and Glynn, J.R., 2010. Declining child mortality in northern Malawi despite high rates of infection with HIV. *Bulletin of the World Health Organization*, *88*(10), pp.746-753.

Janjua, N.Z., Mahmood, B., Islam, M.A. and Goldenberg, R.L. 2012. Maternal and early childhood risk factors for overweight and obesity among low-income predominantly black children at age five years: a prospective cohort study. *Journal of obesity*, 2012.

Jensen, L., 2010. *The Millennium Development Goals: Report 2010*. United nations (UN). Department of economic and social affairs (DESA).

Jensen, L.A., Arnett, J.J. and McKenzie, J. 2011. Globalization and cultural identity. In: *Handbook of identity theory and research*. Springer, 285-301.

Jinabhai, C.C., Reddy, P., Taylor, M., Monyeki, D., Kamabaran, N., Omardien, R. and Sullivan, K.R., 2007. Sex differences in under and over nutrition among school-going Black teenagers in South Africa: an uneven nutrition trajectory. *Tropical Medicine & International Health, 12*(8), pp.944-952.

Joubert, G., Ehrlich, R. 2008. *Edidemiology, A research Manual for South Africa 2nd edition*: Oxford University Press South Africa

Kant, A.K. and Graubard, B.I. 2010. Contributors of water intake in US children and adolescents: associations with dietary and meal characteristics: National Health and Nutrition Examination Survey 2005–2006. AJCN. *The American Journal of Clinical Nutrition*: 29708.

Karakochuk, C., Van den Briel, T., Stephens, D. and Zlotkin, S. 2012. Treatment of Moderate Acute Malnutrition with Ready-To-Use Supplementary Food Results in Higher Overall Recovery Rates Compared with a Corn-Soya Blend in Children in Southern Ethiopia: An Operations Research Trial. *The American Journal of Clinical Nutrition*, 96(4): 911-916.

Katzmarzyk, P.T., Shen, W., Baxter- Jones, A., Bell, J.D., Butte, N.F., Demerath, E.W., Gilsanz, V., Goran, M.I., Hirschler, V., Hu, H.H. and Maffeis, C., 2012. Adiposity in children and adolescents: correlates and clinical consequences of fat stored in specific body depots. *Pediatric obesity*, *7*(5), pp.e42-e61.

Kazadi, M.L., 2011. *Public perceptions of the impact of the global financial crisis on the South African economy* (Doctoral dissertation, Cape Peninsula University of Technology).

Keino, S., Plasqui, G., Ettyang, G. and Van den Borne, B. 2014. Determinants of stunting and overweight among young children and adolescents in sub-Saharan Africa. *Food and nutrition bulletin*, 35 (2): 167-178.

Kerac, M., Postels, D.G., Mallewa, M., Jalloh, A.A., Voskujil, W.P., Groce, N., Gladstone, M. and Molyneux, E. 2014. The interaction of malnutrition and neurologic disability in Africa. In: Proceedings of Seminars in pediatric neurology. *Elsevier*, 42-49.

Khandelwal, S., Paul, T., Haddad, L., Bhalla, S., Gillespie, S. and Laxminarayan, R. 2014. Postgraduate Education in Nutrition in South Asia: A Huge Mismatch between Investments and Needs. *BMC: Biomed Central medical education*, 14(1): 1.

Khor, G.L. and Misra, S., 2012. Micronutrient interventions on cognitive performance of children aged 5-15 years in developing countries. *Asia Pacific journal of clinical nutrition*, *21*(4), pp.476-486.

Khuzwayo, P., 2008. Food and Nutrition Security: In Steyn, N. P.and Temple, N. Community Nutrition textbook for South Africa, A right-based approach. Cape Town: South African Medical Research Council. 162-197.

Kim, K., Hong, S.A., Yun, S.H., Ryou, H.J., Lee, S.S. and Kim, M.K. 2012. The Effects of a Healthy School Tuck Shop Program on the Access of Students to Healthy Foods. *Nutrition research and practice*, 6 (2): 138-145.

Kimani-Murage, E. W., Kahn, K., Pettiror, S. M., Tollman, S. M. Dunger, D. B., Gomez-Oliver, X. F., Norris, S. A. 2010. The perelance of stunting, overweight and obesity and metabolic disease Risk in Rural South African Children: Biomed Central Public Health. 10(150):1-13

Kimani-Murage, E.W., 2013. Exploring the Paradox: Double Burden of Malnutrition in Rural South Africa. *Glob Health Action*, 6(0).

Kimani-Murage, E.W., Kahn, K., Pettifor, J.M., Tollman, S.M., Dunger, D.B., Gómez-Olivé, X.F. and Norris, S.A. 2010. The Prevalence of Stunting, Overweight and Obesity, and Metabolic Disease Risk in Rural South African Children. *BMC public health*, 10 (1): 158.

Kimutai, D., Maleche-Obimbo, E., Kamenwa, R. and Murila, F. 2009. Hypo-Phosphataemia in Children under five years with Kwashiorkor and Marasmic Kwashiorkor. *East African medical journal*, 86 (7).

Kitsao-Wekulo, P., Holding, P., Taylor, H.G., Abubakar, A., Kvalsvig, J. and Connolly, K. 2013. Nutrition as an Important Mediator of the Impact of Background Variables on Outcome in Middle Childhood.

Kraak, V.I. and Story, M., 2015. Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs. *obesity reviews*, *16*(2), pp.107-126.

Kral, T.V. and Rauh, E.M. 2010. Eating Behaviors of Children in the Context of their Family Environment. *Physiology & Behavior*, 100 (5): 567-573.

Kramer, K.Z., Myhra, L.L., Zuiker, V.S. and Bauer, J.W., 2016. Comparison of Poverty and Income Disparity of Single Mothers and Fathers Across Three Decades: 1990–2010. *Gender Issues*, *33*(1), pp.22-41.

Kroone, D. and Alant, B., 2012. Competing with The Tuck Shop: How Can I Influence Teenage Food Choices in This South Africa High School. *Educational Research for Social Change (ERSC)*, *1*(1), pp.69-84.

Kruger, R., Kruger, H.S. and Macintyre, U.E., 2006. The determinants of overweight and obesity among 10-to 15-year-old schoolchildren in the North West Province, South Africa–the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study. *Public health nutrition*, *9*(3), pp.351-358.

Kruger H. Salome, M. H., Thandi Puoane 2008. *Nutritional Management of Multiple Nutrient Deficiencies: In Steyn, N.P and Temple, N(eds). Community Nutrition textbook for South Africa. A right based Approach.*

Kruger, H.S., Steyn, N.P., Swart, E.C., Maunder, E.M., Nel, J.H., Moeng, L. and Labadarios, D. 2012. Overweight among Children Decreased, but Obesity Prevalence Remained High among Women in South Africa, 1999–2005. *Public health nutrition*, 15 (04): 594-599.

Kulkarni, A. and Metgud, D. 2014. Assessment of gross motor development in infants of age 6 to 18 months with protein energy malnutrition using Alberta infant motor scale: A cross-sectional study. *International Journal of Physiotherapy Res*, *2*(4): 616-20.

Kumssa, D.B., Joy, E.J., Ander, E.L., Watts, M.J., Young, S.D., Walker, S. and Broadley, M.R. 2015. Dietary calcium and zinc deficiency risks are decreasing but remain prevalent. *Scientific reports*, 5.

Kweagwu, E.E., A.E. Agwu and E. Madukwe. The role of Micronutrients in Child health: A review of the literature. *African Journal of Biotechnology* [Online], Vol.7 (21):3804-3810.Available at: http://www.acedemicjounals.org/AJB. [Accessed 5 November 2008]

Labadarios, D., Steyn, N.P., Maunder, E., MacIntryre, U., Gericke, G., Swart, R., Huskisson, J., Dannhauser, A., Vorster, H.H., Nesmvuni, A.E. and Nel, J.H., 2005. The national food consumption survey (NFCS): South Africa, 1999. *Public health nutrition*, *8*(5), pp.533-543.

Labadarios, D., Mchiza, Z. J-R., Steyn, N.P., Gericke, G., Maunder, E.M.W., Davids, Y.D. and Parker, W. 2011. Food security in South Africa: a review of national surveys. *Bulletin of the World Health Organization*, 89 (12): 891-899.

Kruger, S.H., Labadarios, D., Swart, R., Maunder, E.M.W., Gericke, G.J., Kuzwayo, P.M.N., Ntsie, P.R., Steyn, N.P., Schloss, I., Dhansay, M.A. and Jooste, P.L., 2008. National food consumption survey-fortification baselin (NFCS-FB-I).

Labree, L., Van De Mheen, H., Rutten, F. and Foets, M. 2011. Differences in overweight and obesity among children from migrant and native origin: a systematic review of the European literature. O*besity reviews*, 12 (5): e535-e547.

Lapillonne, A. and Griffin, I.J. 2013. Feeding preterm infants today for later metabolic and cardiovascular outcomes. *The Journal of Pediatrics*, 162 (3): S7-S16.

Lask, B. and Bryant-Waugh, R. 2013. *Eating disorders in childhood and adolescence*. Routledge.

Le Grange, D. and Lock, J. 2011. *Eating disorders in children and adolescents: a clinical handbook*. Guilford Press.

Lean, G., 2011. *Rich World, Poor World: Routledge Library Editions: Development*. Routledge.

Lee, R.D. and Nieman, D.C., 2003. Nutritional assessment. 3rd ed. *Mc GrawHill*.

Lehman, S. 2016. *Vitamin C Requirement and Dietary Sources*. Available at: https://www.verywell.com/vitamin-c-requirements-and-dietary-sources-2507041 (Accessed 14 August 2016).

Leibbrandt, M., Finn, A. and Woolard, I. 2012. Describing and Decomposing Post-Apartheid Income Inequality in South Africa. *Development Southern Africa*, *29*(1): 19-34.

Levine, M.P. and Murnen, S.K. 2009. "Everybody Knows that Mass Media are/are not [Pick One] a Cause of Eating Disorders": A Critical Review of Evidence for a Causal Link between Media, Negative Body Image, and Disordered Eating in Females. *Journal of Social and Clinical Psychology*, 28 (1): 9-42.

Lewis, N. 2010. Malnutrition/Starvation. *NEWSLETTER*, 5 (1).

Lipman Frank, *Symptoms & Diseases Associated with Vitamin D Deficiency*, September 15 2014.

Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., Abraham, J., Adair, T., Aggarwal, R., Ahn, S.Y. and Almazroa, M.A. 2013. Global and Regional Mortality from 235 Causes of Death for 20 Age Groups in 1990 and 2010: A Systematic Analysis for the Global Burden of Disease Study 2010. *The Lancet*, 380(9859): 2095-2128.

Lozoff, B. 2011. Early iron deficiency has brain and behavior effects consistent with dopaminergic dysfunction. *The Journal of nutrition*, 141 (4): 740S-746S.

Luchuo Engelbert Bain., P. K. A., Ngia Geraldin, Njem Peter Kindong, Ylena Sigal., Nsah Bernard., Ajime Tom Tanjeko. 2013. Malnutrition in Sub-Saharan Africa: Burden, Causes and Prospects. *Pan African Medical Journal*,

MacIntyre, U.E., Venter, C.S., Kruger, A. and Serfontein, M. 2012. Measuring Micronutrient Intakes at Different Levels of Sugar Consumption in 'A Population in Transition: The Transition and Health During Urbanisation in South Africa (THUSA) study. *South African Journal of Clinical Nutrition*, 25 (3): 122-130.

Maile, S., 2008. 10 Education and poverty: Development policy options in. *Edited by Simeon Maile*, p.157.

Manios, Y., Moschonis, G., Dekkers, R., Mavrogianni, C., Grammatikaki, E. and Van den Heuvel, E. 2015. Vitamin B2, Vitamin B12 and Total Homocysteine Status in Children and their Associations with Dietary Intake of B-Vitamins from Different Food Groups: The Healthy Growth Study. *European journal of nutrition*: 1-11.

Mansourian, M., Marateb, H.R., Kelishadi, R., Motlagh, M.E., Aminaee, T., Taslimi, M., Majdzadeh, R., Heshmat, R., Ardalan, G. and Poursafa, P. 2012. First Growth Curves Based on the World Health Organization Reference in a Nationally-Representative Sample of Pediatric Population in the Middle East and North Africa (MENA): the CASPIAN-III study. *BMC Pediatrics*, 12 (1): 1.

Marra, M.V. and Boyar, A.P. 2009. Position of the American Dietetic Association: Nutrient Supplementation. *Journal of the American Dietetic Association, 109*(12): 2073-2085.

Masemola, M.E., Van Aardt, C.J. and Coetzee, M.C. 2012. Household Income and Expenditure Patterns in South Africa, 2011. Available at: http://www.unisa.ac.za/contents/faculties/ems/docs/press429.pdf (Accessed 14 July 2013).

Masemola, M.E., Van Aardt, C.J. and Coetzee, M.C., 2011. Income and Expenditure of Households in South Africa. *Pretoria: Unisa, Bureau of Market Research (Research report 417.).*

Maylam, P. 1983. The "Black Belt": African Squatters in Durban 1935–1950. *Canadian Journal of African Studies/La Revue Canadienne Des Études Africaines*, *17*(3): 413-428.

Mayo Clinic, 2014. *Drug and Supplements,Thiamine* (Vitamin B1) 2014.

Mayo-Wilson, E., Imdad, A., Herzer, K., Yakoob, M.Y. and Bhutta, Z.A. 2011. Vitamin A Supplements for Preventing Mortality, Illness and Blindness in Children aged under 5: Systematic Review and Meta-Analysis. *BMj*, 343: d5094.

Mbenyane, X. Makuse, S., Ntuli, S., Mbhatsani, H. and Sayed, N. 2008: In Steyn N. P. Temple N(eds) Community Nutrition Textbook for South Africa. A right based approach, Capetown: South African Medical Research Council 200-2009

McDowell, M.A., Fryar, C.D., Ogden, C.L. and Flegal, K.M., 2008. Anthropometric reference data for children and adults: United States, 2003–2006. *National health statistics reports*, *10*(1-45), p.5.

Mchiza, Z.J., Parker, W.A., Makoae, M., Sewpaul, R., Kupamupindi, T. and Labadarios, D., 2015. Body image and weight control in South Africans 15 years or older: SANHANES-1. *BMC public health*, *15*(1), p.992.

Mchiza, Z.J., Parker, W.A., Makoae, M., Sewpaul, R., Kupamupindi, T. and Labadarios, D., 2015. Body image and weight control in South Africans 15 years or older: SANHANES-1. *BMC public health*, *15*(1), p.992.

Mciza, Z., Goedecke, J.H., Steyn, N.P., Charlton, K., Puoane, T., Meltzer, S., Levitt, N.S. and Lambert, E.V., 2005. Development and validation of instruments measuring body image and body weight dissatisfaction in South African mothers and their daughters. *Public health nutrition*, *8*(05), pp.509-519.

Meacham, A.T. 2014. Urban Food Insecurity. Doctor of Philosophy in Public Health, University of Utah. Available at: http://gradworks.umi.com/36/80/3680383.html (Accessed 6 November 2016).

Meinshausen, M., Meinshausen, N., Hare, W., Raper, S.C., Frieler, K., Knutti, R., Frame, D.J. and Allen, M.R. 2009. Greenhouse-Gas Emission Targets for Limiting Global Warming to 2°C. *Nature*, 458 (7242): 1158-1162.

Mengistu, K., Alemu, K. and Destaw, B., 2013. Prevalence of malnutrition and associated factors among children aged 6-59 months at Hidabu Abote District, North Shewa, Oromia Regional State. *Journal of Nutritional Disorders & Therapy*, 2013.

Milka, N. 2014. Myths and Cultural Beliefs Regarding Martenal and Child Nutrition: *A Cause for Worry*? Available at: http://aphrc.org/archives/2982 Accessed (13 April 2015).

Minujin, A., 2012. *Global child poverty and well-being: Measurement, concepts, policy and action*. Policy Press.

Moeng, T. L., and de Hoop, M. 2008. Government community nutrition programmes and strategies. In: Steyn, N. P. and Temple, N. eds. Community Nutrition textbook for South Africa: A rights-based approach. Cape Town: South African Medical Research Council, 287-314.

Mondal, D., Minak, J., Alam, M., Liu, Y., Dai, J., Korpe, P., Liu, L., Haque, R. and Petri, W. A. 2012. Contribution of enteric infection, altered intestinal barrier function, and maternal malnutrition to infant malnutrition in Bangladesh. *Clinical Infectious Diseases*, 54 (2): 185-192.

Montgomery, A. 2012. *Evaluating the South African National School Nutrition Programme* (Doctoral dissertation, University of Cape Town).

Monyeki, M.A., Awotidebe, A., Strydom, G.L., De Ridder, J.H., Mamabolo, R.L. and Kemper, H. C. 2015. The Challenges of Underweight and Overweight in South African Children: Are We Winning or Losing the Battle? A Systematic Review. *International journal of environmental research and public health*, 12 (2): 1156-1173.

Moran, V.H., Skinner, A.L., Medina, M.W., Patel, S., Dykes, F., Souverein, O.W., Dullemeijer, C. and Lowe, N.M. 2012. The Relationship between Zinc Intake and Serum/Plasma Zinc Concentration in Pregnant and Lactating Women: A Systematic Review with Dose-Response Meta-Analyses. *Journal of Trace Elements in Medicine and Biology*, 26(2): 74-79.

Mukherjee, D., 2017. Improved Agronomic Practices and Input Use Efficiency for Potato Production under Changing Climate: Improved Practices for Potato Production. In *Sustainable Potato Production and the Impact of Climate Change* (pp. 105-132). IGI Global.

Musosti, A. A., Sgot, A. J. and Moa Onyango. 2008. The role of home gardening in household food security in Butere Division of Western Kenya. *African Journal of Food Agriculture, Nutrition and Development,* 8(4): 375-390.

Muzigaba, M., Puoane, T. and Sanders, D., 2016. The paradox of undernutrition and obesity in South Africa: A contextual overview of food quality, access and availability in the new democracy. In *Food Poverty and Insecurity: International Food Inequalities* (pp. 31-41). Springer International Publishing.

Nambia, S., Truby, H., Abbott, R. A., Davies, P. S. W. 2008. Validating the waight-height ratio and developing centile for use among children and adolescents. The Aurthor(s)/Journal Compilation, Acta Paediatrica. 98.148-152.

Nandoo, K., 2012. Livelihood strategies: analysis of female-headed households in Vrygrond, South Africa.

National Institute of Mental Health. 2016. *Eating Disorders*. Available at: https://www.nimh.nih.gov/health/topics/eating-disorders/index.shtml (Accessed 15 March 2016).

National Kidney Foundation. 2017. *Phosphorus and Your CKD Diet*. Available at: https://www.kidney.org/atoz/content/phosphorus (Accessed 14 January 2017).

Ngure, F.M., Reid, B.M., Humphrey, J.H., Mbuya, M.N., Pelto, G. and Stoltzfus, R.J., 2014. Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: making the links. *Annals of the New York Academy of Sciences*, *1308*(1), pp.118-128.

Nestle, M., 2013. *Food politics: How the food industry influences nutrition and health* (Vol. 3). Univ of California Press.

NICUS (Nutrition Information Centre University of Stellenbosch). 2003. Available: http://www.sun.ac/nicus (Accessed 25 April 2014).

Njeri, M. 2014. Myths and Cultural Beliefs Regarding Martenal and Child Nutrition: A cause for worry. 19 May 2014.

Nkhoma, O.W., Duffy, M.E., Cory-Slechta, D.A., Davidson, P.W., McSorley, E.M., Strain, J. and O'Brien, G.M. 2013. Early-stage primary school children attending a school in the Malawian School Feeding Program (SFP) have better reversal learning and lean muscle mass growth than those attending a non-SFP school. *The Journal of nutrition*, 143 (8): 1324-1330.

Nutrition News, 2013: Tuck shop truths study reveals poor nutritional offerings. Available at: www.bizcommunity.com/Article/196/329/98197.html (Assessed 15 January 2017)

Nyapokoto, R. 2014. The road between Sandton and Alexandra Township: A Fanonian Approach to the Study of Poverty and Privilege in South Africa.

Ogden, C.L. and Flegal, K.M. 2010. Changes in terminology for childhood overweight and obesity.

Ogden, C.L., Carroll, M.D., Curtin, L.R., Lamb, M.M. and Flegal, K.M., 2010. Prevalence of high body mass index in US children and adolescents, 2007-2008. *Jama*, *303*(3), pp.242-249.

O'Kane, G., 2012. What is the real cost of our food? Implications for the environment, society and public health nutrition. *Public Health Nutrition*, *15*(02), pp.268-276.

Oldewage-Theron, W.H. and Kruger, R. 2008. Food Variety and Dietary Diversity as Indicators of the Dietary Adequacy and Health Status of an Elderly Population in Sharpeville, South Africa. *Journal of Nutrition for the Elderly* 27(1): 101-133. Available at: http://www.tandfonline.com/doi/abs/10.1080/01639360802060140 (Accessed 18 February 2016).

Oldewage-Theron, W.H., Dicks, E.G., Napier, C.E. and Rutengwe, R. 2005b. Situation Analysis of an Informal Settlement in the Vaal Triangle, *Development Southern Africa* 22(1): 13–26.

Oldewage-Theron, W.H., Kruger, R. and Egal, A.A. 2014. Socio-Economic Variables and Nutrient Adequacy of Women in the Vaal Region of South Africa. *Ecology of Food and Nutrition*, 53 (5): 514-527.

Omoleke, S.A., Saidu, Y., Foma, M.A., Bashorun, A. and Jafali, J., 2015. Clinical Characteristics, Predictors of Complications and Therapeutic Options of Diabetes Mellitus among Diabetic Patients Attending a Lone Tertiary Health Facility in The Gambia.

Onis, M.D., Onyango, A.W., Borghi, E., Siyam, A., Nishida, C. and Siekmann, J., 2007. Development of a WHO growth reference for school-aged children and adolescents. *Bulletin of the World health Organization*, *85*(9), pp.660-667.

O'Reilly, J.R. and Reynolds, R.M. 2013. The risk of maternal obesity to the long-term health of the offspring. *Clinical endocrinology*, 78 (1): 9-16.

Osorio, S.N. 2011. Reconsidering Kwashiorkor. *Topics in Clinical Nutrition*, 26 (1): 10-13.

Owolabi and Olutunji. 2010. HIV AIDS the Future of the Infected and Affected.

Ozor, N., Umunnakwe, P.C. and Acheampong, E. 2013. Challenges of Food Security in Africa and the Way Forward. *Development* 56(3): 404-411. Available: http://search.proquest.com/docview/1535604293?pq-origsite=summon (Accessed 11 July 2015).

Pachón, H., Spohrer, R., Mei, Z. and Serdula, M.K., 2015. Evidence of the effectiveness of flour fortification programs on iron status and anemia: a systematic review. *Nutrition reviews*, p. nuv037.

Palaniappan, L P., Wong, E.C., Shin, J.J., Fortmann, S.P. and Lauderdale, D.S. 2011. Asian Americans Have Greater Prevalence of Metabolic Syndrome Despite Lower Body Mass Index. *International Journal of Obesity*, 35 (3): 393-400.

Paoane, T., Sanders, D and Mason, J. 2008. Success Factors and Examples of Successful Community-Based Nutrition Programmes. *In Community Nutrition Textbook for South Africa, a Right Based Approach*. Capetown: South African Medical Research Council.

Pasricha, S.R., Drakesmith, H., Black, J., Hipgrave, D. and Biggs, B.A. 2013. Control of iron deficiency anemia in low-and middle-income countries. *Blood*, 121 (14): 2607-2617.

Perea, C., Suárez-García, M.J., Del Río, J., Torres-Lagares, D., Montero, J. and Castillo-Oyagüe, R., 2013. Oral health-related quality of life in complete denture wearers depending on their socio-demographic background, prosthetic-related factors and clinical condition. *Medicina oral, patologia oral y cirugia bucal*, *18*(3), p.e371.

Pienaar, A. E. (2015). Prevalence of overweight and obesity among primary school children in a developing country: NW-CHILD longitudinal data of 6–9-yr-old children in South Africa. *BMC Obesity*, *2*, 2. http://doi.org/10.1186/s40608-014-0030-4

Popkin, B.M., Adair, L.S. and Wang, S.W. 2012. Global Nutrition Transition and the Pandemic of Obesity in Developing Countries. *Nutrition Reviews*, 70 (1): 3-21.

Prado, E.L. and Dewey, K.G. 2014. Nutrition and brain development in early life. *Nutrition reviews*, 72 (4): 267-284.

Pryke, R. and Lopez, B. 2013. Managing Malnutrition in the Community: We will all Gain from Finding and Feeding the Frail. Br J Gen Pract, 63 (610): 233-234.

Puentes, E., Wang, F., Behrman, J.R., Cunha, F., Hoddinott, J., Maluccio, J.A., Adair, L.S., Borja, J.B., Martorell, R. and Stein, A.D., 2016. Early life height and weight production functions with endogenous energy and protein inputs. Economics & Human Biology, 22, pp.65-81.

Pyne, V. and Macdonald, I.A., 2016. Update on carbohydrates and health: the relevance of the Scientific Advisory Committee on Nutrition report for children. Archives of disease in childhood, 101(10), pp.876-880.

Raine, L., Cohen, N., Kramer, A., Hillman, C. and Khan, N., 2016. Carbohydrates differentially influence children's efficiency during cognitive control tasks. *The FASEB Journal*, *30*(1 Supplement), pp.679-2.

Rankin, D., Hanekom, S.M., Wright, H.H. and MacIntyre, U. 2010. Dietary Assessment Methodology for Adolescents: A Review of Reproducibility and Validation Studies. *South African journal of clinical nutrition*, 23 (2).

Rayman, M.P. 2012. Selenium and Human Health. *The Lancet*, 379 (9822): 1256-1268.

Reddy, S.P., Resnicow, K., James, S., Kambaran, N., Omardien, R. and Mbewu, A.D., 2009. Underweight, overweight and obesity among South African adolescents: results of the 2002 National Youth Risk Behaviour Survey. *Public health nutrition*, *12*(2), pp.203-207.

Reddy P.S, R., K.S, Kambaran, N. Omurdien, R, Mbewe, AD. 2008. *Underweight, Overweight and Obesity Among South African Adolescents:* Results of 2002 National Youth Risk Behaviour Survey Public Health Nutrition. (12(2)): 203-220.

Reksuppaphol, Lukkana and Sanguansak. 2013. *International Journal of Collaborative Research on International Medicine & Public Health* 5.1 (Jan 2013): 19-29.

Rerksuppaphol, L. and Rerksuppaphol, S., 2013. Waist circumference and waist-to-height ratio percentiles of Thai school-aged children. *International Journal of Collaborative Research on Internal Medicine & Public Health*, *5*, pp.19-29.

Rerksuppaphol, S. and Rerksuppaphol, L., 2014. Waist circumference, waist-to-height ratio and body mass index of Thai Children: Secular changes and updated reference standards. *Journal of clinical and diagnostic research: JCDR*, *8*(11), p.PC05.

Rivlin, R. 2012. *Riboflavin*. Springer Science & Business Media.

Roccisano, D., Kumaratilake, J., Saniotis, A. and Henneberg, M., 2016. Dietary Fats and Oils: Some Evolutionary and Historical Perspectives Concerning Edible Lipids for Human Consumption. *Food and Nutrition*, *7*, pp.689-702.

Ronquest-Ross, L.C. Vink, N. and Sigge, G.O. 2015. Food Consumption Changes in South Africa Since 1994. *South African Journal of Science*, 111(1): 9-10. Available at: http://sajs.co.za/food-consumption-changes-south-africa-1994/lisa-claire-ronquest-ross-nick-vink-gunnar-o-sigge (Accessed 6 November 2016).

Rosen, D.S. 2010. Identification and management of eating disorders in children and adolescents. *Pediatrics,* 126 (6): 1240-1253.

Rothausen, B.W., Tetens, I., Matthiessen, J., Frost Andersen, L. and Brockhoff, P.B. 2012. *Aspects of Energy Intake Assessment, Dietary Intake Patterns and Sleep Duration in Children* (Doctoral dissertation, University of Oslo University).

Rudolph, M., Kroll, F., Beery, M., Marinda, E., Sobiecki, J.F., Douglas, G. and Orr, G. 2013. A Pilot Study Assessing the Impact of a Fortified Supplementary Food on the Health and Well-Being of Crèche Children and Adult TB Patients in South Africa. *PloS one*, 8 (1): e55544.

Ruel, M.T., Alderman, H., Maternal and Group, C.N.S. 2013. Nutrition-Sensitive Interventions and Programmes: How can they help to Accelerate Progress in Improving Maternal and Child Nutrition? *The Lancet*, 382 (9891): 536-551.

Saam, K. 2010. The Impact of Culture on Child Nutrition: Vitamin Angels.

Sage, C., 2013. The interconnected challenges for food security from a food regimes perspective: Energy, climate and malconsumption. *Journal of Rural Studies*, *29*, pp.71-80.

Sartorius, K., Sartorius, B., Tollman, S., Schatz, E., Kirsten, J. and Collinson, M. 2013. Rural Poverty Dynamics and Refugee Communities in South Africa: A Spatial–Temporal Model. *Population, Space and Place*, 19 (1): 103-123.

Satterthwaite, D., McGranahan, G. and Tacoli, C. 2010. Urbanization and its Implications for Food and Farming. *Philosophical Transactions of the Royal Society of London: Biological Sciences*, 365 (1554): 2809-2820.

Sauvageot, N., Alkerwi, A., Albert, A. and Guillaume, M. 2013. Use of Food Frequency Questionnaire to Assess Relationships between Dietary Habits and Cardiovascular Risk Factors in NESCAV Study: Validation with Biomarkers. *Nutrition journal*, 12 (1): 1-11.

Savage, J. S., Fisher, J. O., and Birch, L. L. 2007. Parental Influence on Eating Behavior: Conception to Adolescence. *The Journal of Law, Medicine & Ethics: A Journal of the American Society of Law, Medicine & Ethics*, *35*(1): 22–34. http://doi.org/10.1111/j.1748-720X.2007.00111.x

Schatz, Enid, Sangeetha Madhavan, and Jill Williams. 2011. Female-Headed Households Contending with Aids-Related Hardship in Rural South Africa. *Health & place*, 17(2): 598-605.

Schonfeldt, H.C. and Hall, N., 2013. "Fish, chicken, lean meat and eggs can be eaten daily": a food-based dietary guideline for South Africa. *South African Journal of Clinical Nutrition*, *26*(3), pp.S66-S76.

Schor, J.B., 2014. *Born to Buy: The Commercialized Child and the New Consumer Cult*. Simon and Schuster.

Schwartz, A. F. 2014. *Housing Policy in the United States.* New York: Routledge.

Shin, H.S., Valente, T.W., Riggs, N.R., Huh, J., Spruijt- Metz, D., Chou, C.P. and Ann Pentz, M., 2014. The interaction of social networks and child obesity prevention program effects: the pathways trial. *Obesity*, *22*(6), pp.1520-1526.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P. and Hongoro, C., 2013. SANHANES-1 Team. *South African National Health and Nutrition Examination Survey (SANHANES-1)*.

Singh, J., Kariwal, P., Gupta, S., Singh, A. and Imtiaz, D. 2014. Nutritional Status and Morbidity Among School-Going Children: A Scenario from A Rural India. *Sch J App med sci: Scholars Journal of Applied Medical Sciences*, 2 (1D): 379-383.

Sleddens, S.F., Gerards, S.M., Thijs, C., De Vries, N.K. and Kremers, S.P. 2011. General Parenting, Childhood Overweight and Obesity-Inducing Behaviors: A Review. *International Journal of Pediatric Obesity*, 6 (supp3): e12-27.

Smith, L. and Haddad, L., 2014. Reducing Child Undernutrition: Past Drivers and Priorities for the Post- MDG Era. *IDS Working Papers*, *2014*(441), pp.1-47.

Smith, L.C. and Haddad, L. 2015. Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. *World Development*, 68:180-204.

Solomon, M.R., Russell-Bennett, R. and Previte, J. 2013. *Consumer Behaviour: Buying, Having, Being*. Pearson Australia.

South Africa Department of Social Development, 2012. *The South African Child Support Grant Impact Assessment: Evidence from a survey of children, adolescents and their households*. Department of Social Development

South Africa, 2013-2017. Road Map for Nutrition in South Africa. *Department of Health Republic of South Africa*. Department of Health 2013 ISBN :- 978-1-920031-75-6. www.doh.gov.za.

Sowers, J.R. 2012. Role of TRIB3 in Diabetic and Overnutrition-Induced Atherosclerosis. *Diabetes*, 61 (2): 265-266.

Staff, K. 2013. Africa Widening – Obesity Rising Fast. Online Nigeria, 22 November. Available at: http://news2.onlinenigeria.com/africa/323145-africa-widening-obesity-rising-fast.html (Accessed 13 March 2016).

Statistics South Africa. 2013. Millennium Development Goals. *Country Report 2013*. Available at: http://beta2.statssa.gov.za/wp-content/uploads/2013/10/MDG_October-2013.pdf (Accessed 14 March 2016).

Statistics South Africa. 2015. *South African Statistics, 2015*. Available at: http://www.statssa.gov.za/publications/SAStatistics2015.pdf (Assessed 15 October 2016).

Stevens, B., Buettner, P., Watt, K., Clough, A., Brimblecombe, J. and Judd, J. 2015. The Effect of Balanced Protein Energy Supplementation in Undernourished Pregnant Women and Child Physical Growth in Low- and Middle- Income Countries: A Systematic Review and Meta- Analysis. *Maternal & Child Nutrition*, 11 (4): 415-432.

Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., Peña-Rosas, J.P., Bhutta, Z.A., Ezzati, M. and Nutrition Impact Model Study Group, 2013. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. *The Lancet Global Health*, *1*(1), pp.e16-e25.

Steyn, N.P., Nel, J. and Labadarios, D., 2008. Will fortification of staple foods make a difference to the dietary intake of South African children?. *South African journal of clinical nutrition*, *21*(1), pp.22-26.

Stoltzfus, R.J. 2011. Iron Interventions for Women and Children in Low-Income Countries. *The Journal of nutrition*, 141 (4): 756S-762S.

Story, M., Kaphingst, K.M., Robinson-O'Brien, R. and Glanz, K., 2008. Creating healthy food and eating environments: policy and environmental approaches. *Annu. Rev. Public Health*, *29*, pp.253-272.

Story, M., Nanney, M.S. and Schwartz, M.B. 2009. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. *Milbank Quarterly*, 87 (1): 71-100.

Strategy, P.R., 2013. Poverty Reduction Strategy Paper PRS III (2013-2015).

Steytler, N. P. and Powell, D. 2010. The Impact of Global Financial Crisis on Decentralised Goerenment Working Paper Phiadephia

Sumberg, J. and Sabates-Wheeler, R., 2011. Linking agricultural development to school feeding in sub-Saharan Africa: Theoretical perspectives. *Food Policy*, *36*(3), pp.341-349.

Surender, R., Noble, M., Wright, G. and Ntshongwana, P., 2010. Social assistance and dependency in South Africa: An analysis of attitudes to paid work and social grants. *Journal of Social Policy*, *39*(02), pp.203-221.

Swart, R., Sanders, D. and McLachlan, M. 2008. Nutrition: A Primary Health Care Perspective. *South African Health Review*, 129-147. Available at: http://www.hst.org.za/uploads/files/chap9_08.pdf (Accessed 12 March 2011).

Sweeting, H.N., 2007. Measurement and definitions of obesity in childhood and adolescence: a field guide for the uninitiated. *Nutrition journal*, *6*(1), p.32.

Table, E. and Table, V., 2001. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc.

Tacoli, C., McGranahan, G. and Satterthwaite, D., 2015. *Urbanisation, rural-urban migration and urban poverty*. Human Settlements Group, International Institute for Environment and Development.

Tathiah, N., Moodley, I., Mubaiwa, V., Denny, L. and Taylor, M. 2013. South Africa's Nutritional Transition: Overweight, Obesity, Underweight and Stunting in Female Primary School Learners in Rural Kwazulu-Natal, South Africa. *SAMJ: South African Medical Journal*, 103 (10): 718-723.

The British Psychological Sociaty . *Promoting Excellence in Psychology* : How peer pressure influences food choices 30/10/2013.

The Heritage Foundation. 2017. Marriage and Poverty. Family Facts Organisation.

Tine, R.C., Ndiaye, M., Hansson, H.H., Ndour, C.T., Faye, B., Alifrangis, M., Sylla, K., Ndiaye, J.L., Magnussen, P. and Bygbjerg, I.C. 2012. The Association between Malaria Parasitaemia, Erythrocyte Polymorphisms, Malnutrition and Anaemia in Children less than 10 Years old in Senegal: A Case Control Study. *BMC Research Notes*, 5 (1): 1-10.

Tomlinson, M., 2007. School feeding in east and southern Africa: Improving food sovereignty or photo opportunity. *Health Systems Research Unit, Medical Research Council. Equinet Discussion Paper*, (46).

Tomlinson, I., 2013. Doubling food production to feed the 9 billion: a critical perspective on a key discourse of food security in the UK. *Journal of Rural Studies*, *29*, pp.81-90.

Toriola, A.L., Moselakgomo, V., Shaw, B. and Goon, D.T. 2012. Overweight, Obesity and Underweight in Rural Black South African Children. *South African Journal of Clinical Nutrition*, 25 (2): 57-61.

Tremblay, M.S., LeBlanc, A.G., Kho, M.E., Saunders, T.J., Larouche, R., Colley, R.C., Goldfield, G. and Gorber, S.C. 2011. Systematic Review of Sedentary Behaviour and Health Indicators in School-Aged Children and Youth. *Int J Behav Nutr Phys Act*, 8 (98): 1-22.

Troesch, B., Biesalski, H.K., Bos, R., Buskens, E., Calder, P.C., Saris, W.H., Spieldenner, J., Verkade, H.J., Weber, P. and Eggersdorfer, M., 2015. Increased intake of foods with high nutrient density can help to break the intergenerational cycle of malnutrition and obesity. *Nutrients*, *7*(7), pp.6016-6037.

UNDP, 2010. The Millenium Development Goals Country Report. Republic of South Africa.

UNICEF, WHO and World Bank Group. 2015. Levels and Trends in Child Malnutritiioin. Available at: http://www.who.int/nutgrowthdb/jme_brochure2015.pdf (Accessed 5 March 2016).

UNICEF, WHO, The World Bank. 2014 "Summary of key facts about the 2013 joint malnutrition estimates."

UNICEF. 2010. Progress for Children. *A report card and water sanitation.* Available at: http://www.unicef.org/publications/files/Progress_for_Children_No._5_-_English.pdf (Accessed 6 February 2016).

UNICEF. 2015. Improving Child Nutrition. *The achievable imperative for global progress*. Available at: http://www.unicef.org/gambia/Improving_Child_Nutrition_the_achievable_imperative_for_global_progress.pdf (Accessed 14 April 2016).

UNICEF. Division of Communication, 2009. *Tracking Progress on Child and Maternal Nutrition: A Survival and Development Priority*. UNICEF.

Union, A., 2014. *Analysis of the Common African Position on the post-2015 Development Agenda:* United Nations Economic Commission for Africa, African Unioon, African Development Bank Group and UNDP 2014.

Union, A., 2015. *Lessons Learned in Implimenting MDGs, MDG Report 2015*: United Nations Economic Commission for Africa, African Unioon, African Development Bank Group and UNDP.

United Nations. 2015c. *The Millennium Development Goals Report*. Available at: http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%rev%20(July%201).pdf (accessed 16 August 2016).

United Nations Economic Commission for Africa, Africa Union, African Development Bank Group and UNDP, 2013: Assessing Progress in Africa towards the Millennium Development ;Goals MDG Report 2013

United States Agency for International Development (USAID). 2014. *Mobile Money Food Assistance Reaches Zimbabwe.* Available at: https://www.usaid.gov/results-data/success-stories/first-time-mobile-money-food-assistance-program-reaching-zimbabweans (Accessed 18 July 2016).

University of Maryland Medical Centre Vitamin C (Ascorbic Acid) June 2013.

Uzogara, S.G., 2016. Underweight, the Less Discussed Type of Unhealthy Weight and Its Implications: A Review. *American Journal of Food Science and Nutrition Research*, *3*(5), pp.126-142.

van der Kam, S., Salse-Ubach, N., Roll, S., Swarthout, T., Gayton-Toyoshima, S., Jiya, N.M., Matsumoto, A. and Shanks, L., 2016. Effect of short-term supplementation with ready-to-use therapeutic food or micronutrients for children after Illness for prevention of malnutrition: a randomised controlled trial in Nigeria. *PLoS Med*, *13*(2), p.e1001952.

Van Ginneken, N., Lewin, S. and Berridge, V. 2010. The Emergence of Community Health Worker Programmes in the Late Apartheid Era in South Africa: An Historical Analysis. *Social Science & Medicine*, 71 (6): 1110-1118.

Van Jaarsveld, P.J., Faber, M. and Van Stuijvenberg, M.E. 2015. Vitamin A, Iron, and Zinc Content of Fortified Maize Meal and Bread at the Household Level in 4 Areas of South Africa. *Food and nutrition bulletin*, 36 (3): 315-326.

van Stuijvenberg, M.E., Nel, J., Schoeman, S.E., Lombard, C.J., du Plessis, L.M. and Dhansay, M.A., 2015. Low intake of calcium and vitamin D, but not zinc, iron or vitamin A, is associated with stunting in 2-to 5-year-old children. *Nutrition*, *31*(6), pp.841-846.

Vaughn, A.E., Hales, D. and Ward, D.S. 2013. Measuring the Physical Activity Practices Used by Parents of Preschool Children. *Medicine and Science in Sports and Exercise*, 45 (12): 2369-2377.

Vaughn, A.E., Ward, D.S., Fisher, J.O., Faith, M.S., Hughes, S.O., Kremers, S.P., Musher-Eizenman, D.R., O'Connor, T.M., Patrick, H. and Power, T.G., 2016. Fundamental constructs in food parenting practices: A content map to guide future research. *Nutrition reviews*, *74*(2), pp.98-117.

Vin Tangpricha, M.D,Ph.D, Chief Editor Romash Khardon,M.D,Ph.D. FACP. *Vitamin D Deficiency and Related Disorders*, July 7 2014.

Von Braun, J. 2009. Food and Financial Crisis – Implications for Agriculture and the Poor Food Policy Report. Available: www.ifpri.org/pubs/fpr/pr20p.d.f (Accessed 12 June 2013).

Von Grebener, K., Fritshel, H., Nestorova, B., Olofinbiyi, T., Pandya-Lorch, R,. Yohhanes, Y. 2008. *Global Hunger Index. International Food Policy Research Institute;* Concern Worldwide and Welhungerhilfe.

Von Grebmer, K., Bernstein, J., De Waal, A., Prasai, N., Yin, S. and Yohannes, Y., 2015. *2015 Global hunger index: Armed conflict and the challenge of hunger*. Intl Food Policy Res Inst.

Von Grebmer, K., Torero, M., Olofinbiyi, T., Fritschel, H., Wiesmann, D. and Yohannes, Y. 2010. *2010 Global Hunger Index: The Challenge of Hunger: Focus on the Crisis of Child Undernutrition*. Intl Food Policy Res Inst.

Von Mutius, E., Schwartz, J., Neas, L.M., Dockery, D. and Weiss, S.T., 2001. Relation of body mass index to asthma and atopy in children: the National Health and Nutrition Examination Study III. *Thorax*, *56*(11), pp.835-838.

Vorster, H.H., 2001, 'The emergence of cardiovascular disease during urbanisation of Africans', *Public Health Nutrition* 5(1), 239–243.

Vorster, H.H., Kruger, A. and Margetts, B.M. 2011. The Nutrition Transition in Africa: Can it be steered into a more positive direction? *Nutrients*, 3 (4): 429-441.

Vorster, H.H., Venter, C.S., Wissing, M.P. and Margetts, B.M., 2005. The nutrition and health transition in the North-West Province of South Africa: a review of the THUSA (Transition and Health during Urbanisation of South Africans) study. *Public health nutrition*, *8*(05), pp.480-490.

Wahlqvist, M.L., 2008. International trends in nutritionally-related health and their implication for health policy. *Asia Pacific journal of clinical nutrition*, *17*(3), pp.360-369.

Wang, Y. and Lim, H., 2012. The global childhood obesity epidemic and the association between socio-economic status and childhood obesity.

Wardlaw Gordon, W. and Smith Anne, M. 2011. Contemporary Nutrition: Eighth Edition

Wardlaw, G. M. and Smith, A. M. 2007. *Contemporary nutrition*. McGraw-Hill College.

Wardlaw, T., Salama, P., Brocklehurst, C., Chopra, M. and Mason, E., 2010. Diarrhoea: Why Children Are Still Dying and What Can Be Done. *The Lancet*, 375(9718): 870-872.

Weil, A. and Becker, B. 2014. *Vitamins, Suppliments and Herbs. Calcium*, 29 September 2014. Available at: http://www.drweil.co/vitamins-suppliments-herbs/vitamins/calcium/ (Accessed 22 October 2016)

Welch, R.M., Bouis, H.E. 2009. Biofortification – a Sustainable Agricultural Strategy for Reducing Micronutrient Malnutrition in the Global South. Available: http://www.scienceforum2009.n//portals/11/2welchbouisbiofotification (Accessed 10 August 2011).

Wenhold, F., Kruger, S and Muehlhoff, E. 2008. *Nutrition for School-Aged children and Adolescents: In Styn, N.P and Temple, N(eds). Community Nutrition Textbook for South Africa Medical Research Council*.

Wolmarans, P., Kunneke, E. and Laubscher, R. 2009. Use of the South African Food Composition Database System (SAFOODS) and its Products in Assessing Dietary Intake Data: Part II. *South African Journal of Clinical Nutrition, 22*(2): 59-67.

World Bank Group and Health Systems Trust. 2017. Malnutrition causes economic loss, half of child deaths.

World Health Organization and Unicef. 2013. *Ending Preventable Child Death from Pneumonia and Diarrhoea by 2025*. Available at: http://www.unicef.org/immunization/files/GAPPD.pdf (Accessed 15 May 2016).

World Health Organization, W. H. 2007. Preventing and controlling micronutrient deficiencies in populations affected by an emergency. *Joint Statement by the World Health Organization, the World Food Programme and the United Nations Children's Fund.*: Available at:

http://www.who.int/nutrition/publications/nut_emergencies/en/index.html (accessed September 15, 2016),

World Health Organization, W. H. 2016. *Obesity and overweight Fact sheet January 2015*.

World Health Organization. 2008. Training course on child growth assessment. WHO Child Growth Standards (B&C).

World Health Organization and UNICEF., 2013. *Progress on sanitation and drinking-water*. World Health Organization.

World Health Organization /UNICEF. 2014b. Global Immunization Data. Available at: http://www.who.int/immunization/monitoring_surveillance/global_immunization_data.pdf (Accessed 12 March 2016).

World Health Organization. 2014a. Global Status Report. *On non-communicable diseases*. Available at: http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf (Accessed 16 June 2016).

World Health Organization. 2014.c Global Nutrition Targets 2025: Childhood overweight. Available at: http://www.who.int/nutrition/publications/globaltargets2025_policybrief_overweight/en/ (Assessed 24 July 2017)

World Health Organization. 2015 Global Strategy Physical Activity and Health: Available at: http://www.who.int/dietphysicalactivity/childhood/en/ (Accessed 28 October 2016).

World Health Organization. 2017. Children: reducing mortality: Available at: www.who.int/mediacentre/factsheets/fs178/en/

World Health Organisation. 2003. Population_nutrient/en/index10.html (Accessed 15 August 2016).

World Health Organisation. 2015a. *Obesity and overweight.* Available at: http://www.who.int/mediacentre/factsheets/fs311/en/ (Assessed 7 August 2016).

World Health Organisation. 2015b. *Global database on child growth and malnutrition.* Available at: http://www.who.int/nutgrowthdb/estimates/en/ (Assessed 4July 2016)

World Health Organisation. 2013. Obesity and overweight fact sheet N311.2013. Available at: http://www.who.int/mediacentre/factsheets/fs311/en (Accessed 18 April 2016)

World Health Organization, 2003. Population nutrient intake goals for preventing diet-related chronic diseases. *Geneva, Switzerland*.

World Health Organization, 2010. Maternal mortality in 2005. Estimates developed by WHO, UNICEF, UNFPA, and the World Bank.

World Health Organization, 2012. *Guideline: potassium intake for adults and children*. World Health Organization.

Zarif, T., Haider, K., Ahmed, A. and Bano, F. 2014. Probing Reasons of High Student Dropout Rate in Grade 5-6 at Public Schools of District Thatta, Sindh-Pakistan. *Asian Journal of Social Sciences & Humanities*, 3 (1): 158-169.

Zempleni, J. and Kuroishi, T. 2012. Biotin. *Advances in Nutrition: An International Review Journal*, 3 (2): 213-214.

Zhang, Y. X., Liya, Lin., Zhao, Jin-Shaun., Chuzun, Hau., Zhou, Jing Yang. 2012. Distribution of Waist- to- Heightratio for children and adoliscents in Shandong, China. Springer-Verlag Berlin Heidelberg.

Annexure A – Permission letter from the school

H.P. NGWENYA PUBLIC PRIMARY SCHOOL

PHONE : 031 264 1576
FAX : 031 264 1224

P.O.BOX 36094
MAYVILLE
4058

TO WHOM IT MAY CONCERN

Be informed that **Ms P.L.N. Luthuli** has been given a permission by the School Governing Body and the, undersigned to conduct a research on FOOD NUTRITION and CONSUMER SCIENCE STUDIES at our school.

It will be appreciated if we can be prior furnished with research dates for our school, to avoid inconveniency.

[redacted]

Signature (Principal)

DEPARTMENT OF EDUCATION & CULTURE
H.P. NGWENYA P.P. SCHOOL
P.O. BOX 30094
MAYVILLE 4058
TEL.: 031 264 1576 FAX.: 031 264 1609
07/11/08

Signature (SGB Chairperson)

Annexure B – Consent Form

I the parent of …….. who attends school at H.P. Ngwenya Primary School give permission for my son/daughter to take part in the nutrition study being conducted at the school.

Signature _____

Witness 1_____

Witness 2_____

Date / /20

……
…

Isivumelwano

Mina mzali ka…….. ofunda e H.P. Ngwenya Primary School nginika igunya ukuba umntwana athathe iqhaza kucwaningo lwendlela esidla ngayo nesiphila ngayo

Sayina_____

Ufakazi 1_____

Ufakazi 2_____

Usuku / /20

Annexure C – Letter inviting parents for a meeting

Dear Parents

You are invited to attend the meeting at H.P. Ngwenya Primary School on the 17th of October 2009 at 11:00 am. The meeting is about the Nutrition study that is going to be conducted with your children at the above-mentioned school.

Thanking you in advance
Researcher
Portia L.N. Mfeka

……
……

Mzali

Uyamenywa ukuba ubekhona emhlanganweni ozoba esikoleni H.P. Ngwenya Primary School la umntwana wakho efunda khona usuku umhlaka 17 ku Octhoba 2009 isikhathi u 11:00 ezimpondweni. Umhlangano umayelana nendlela enidla ngayo wena nontwana wakho ofunda e H.P. Ngwenya Primary school.

Ngiyabonga
Researcher
Portia L.N. Mfeka

Annexure D – Field Worker Manual

FIELD WORKER MANUAL

Why am I here?

The Department of Food and Nutrition Consumer Sciences has started a variety of research projects in communities around Durban.

The main projects are as follows:

- L.Makhaza: Wellness programmes in Organisations in Durban.
- H. Grobbelaar: The effect of nutrition education on the food intake of immune compromised children in Durban Children's homes.
- P.Dlungela: Nutritional status and dietary intake patterns of adolescent girls living in a rural high school hostel.
- B. Silangwe: Nutritional status and dietary intake patterns of adolescent girls in an Urban high school.
- K. Phetsula: Evaluation of the lunch box content of adolescent girls in a high school in Lindelani.
- L.Gila: Nutritional knowledge and nutritional status of students attending a Hotel School in Durban.
- A. Reddy: The effect of a nutrition education programme on the nutritional knowledge and food intake of University students.
- I. Shabane: Nutritional status of FET college students in Durban.
- Frayne: Nutritional status and dietary intake of primary school school children in a urban community in Uganda.
- T. Govender: Nutritional status and dietary intake patterns of the elderly resident in a frail care facility.
- X. Mkhize: Nutritional status and dietary intake patterns of the elderly visiting an elderly community centre.

What is a Field Worker?

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

How should I behave?

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

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

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

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

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

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

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

8. Neat Appearance: the field worker must always look neat and well groomed, but never overdressed. The following guidelines for dress should be followed:
   - wear neat, simple and comfortable clothes
   - do not wear badges or emblems of organisations, churches, etc. as these may influence the way subjects answer.
   - dress so that the subject will concentrate on the interview and not on the way you are dressed.

How do I interview the subject?

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

1. How do I begin?

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

2. How do I conduct the interview?

- During the interview direct the questions to the subject, but if it is a child and he or she cannot answer, ask the parent/caregiver for the information needed.
- Ask the questions exactly as they are written on the questionnaire. Try even to keep your tone of voice the same for each subject so as not to lead the subject or to give him an idea of how you want him to answer. You may have to explain a question or use different wording if the subject cannot understand it.
- Ask the questions in the order that they appear on the questionnaire. If the subject refuses to answer the question, record the lack of response and go on to the next question.

- Follow the instructions on the questionnaire. Sometimes it may seem that a subject has already answered a question when he answered a previous one, but the interviewer must still answer the question. For example, the questions about polony and atchaar. Start the question: "We have already mentioned this, but...".
- Do not lead the respondents. Do not try to influence the way the subject answers. Keep your facial expression friendly, but neutral. Never show surprise or shock or approval to the subject's answers. Try to avoid unconscious reactions such as nodding the head, frowning, raising the eyebrows. Never give your own opinions.
- Keep the tone of the interview conversational. Be friendly and courteous. Do not make the subject feel as if he or she is taking an examination or is on trial be familiar with the questionnaire so that you can ask questions conversationally rather than reading them stiffly. The questionnaire is designed to keep the amount of writing to a minimum. However, if a subject gives a long response to an 'other' question, say, 'excuse me while I write that down'. Don't make the subject feel as though you have forgotten he is there.
- Keep control of the interview. Do not let the subject go off into irrelevant conversation. If he or she does, bring him or her gently back to the interview.
- Allow the subject time to think; do not hurry him to answer. However, if he is silent for too long, repeat the question, or 'prompt' him. For example, say 'you have told me how you cook cabbage; now please tell me how you cook pumpkin.
- Follow the instructions on the questionnaire for recording the responses. Record all responses, including negative responses or refusals to answer.
- **Make sure that you have written in the subject's number.**

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

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

Interview for the Quantitative Food Frequency Questionnaire.

Quantitative = amounts of food
Frequency = number of times food is eaten

1. **Part I**

   Part I of the QFFQ is aimed at finding out the eating pattern of the subject, that is, how many times a day he eats, at about what times he eats, where he eats and does he consume snacks or drinks between his main meals (and also what does he think of as a snack). We need this information to be able to compare the eating habits of people in different areas and to be able to give people relevant advice.

   We start by asking the number of meals the subject ate 'yesterday' because it is easy to remember what you ate yesterday. ('What is a meal?). Put a circle around the day, which was 'yesterday'. Then ask at about the times at which he ate each meal. The number of questions to ask next will depend on the subject's answer to question 1. So, if the subject answered that he ate 2 meals yesterday ask questions 2.1.1-2.2.2.

   We then ask if this is the number of meals he usually eats (2.5). If the answer is YES do not ask questions 2.5.1. We also ask if he eats at these times usually. If the answer is YES do not ask questions 2.6.1-2.6.7.

2. **Part 2**

We now come to the main part of the QFFQ. It is very important that this information be filled in as accurately as possible. All that the subject tells us will be put onto a computer and analysed to tell use how much energy, protein, fat, vitamins and minerals the subject is eating and whether it is too little or too much to be healthy or whether it is the correct amount.

The subject must answer about what he has eaten or drunk in the last few months. Anything, which he has not eaten in this time, must be marked with an X under 'Seldom/Never'.

Filling in the amounts and frequencies.

For the direct questions, e.g. "Do you eat maize-meal?" circle the number next to the subject's answer.

To fill in the amount: estimate the portion size of the food using the food samples or crockery and utensils available, i.e. cups, spoons, bowls, etc. Write this amount in the column under 'AMOUNT'. If the subject describes the amount as spoons or teaspoons, ask him which size of spoon and whether it is level or heaped. Use L for level and H for heaped. For example: If a subject takes one small, heaped teaspoon of sugar in a cup of tea write *1 x small heaped tsp* under 'AMOUNT' or if he takes 2 level 5 ml teaspoons of sugar per cup of tea write *2 x level tsp* under 'AMOUNT'. Use the sizes of the cups and glasses in the sample pack for amounts of drinks, or the sizes of cans or bottles.

Remember that amount of most foods should be the cooked amount and not the raw amount.

To fill in the frequency: ask the subject how many times he has the food per day; how many times he has it per week or how many times per month. Write the number under the column 'Per day' 'per week' or 'Per month' For example, a subject has 500g stiff porridge in the morning and evening every day. It will be filled in as follows:

Example 1: The subject eats a medium size dish of maize-meal porridge once every day, except on Sundays.

FOOD	DESCRIPTION	Amount	TIMES EATEN Per day	Per week	Per month	Seldom Never	CODE	AMOUNT/DAY
Maize-meal porridge	Stiff	*2 cups*	2	7				

Interviewer: How do you like your maize-meal porridge?
Subject: I eat it stiff
Interviewer:(*Circle 'Stiff'*) How much do you eat at a time? (*Show the cup and let the subject tell you how many at a time)*)
Subject: About 1 of those cups.
Interviewer: How many times a day do you eat this amount of stiff porridge?
Subject: I eat it once every day.
Interviewer: (*Write 1 under the column Per Day).*

Field Worker Training Manual, p4

Do you eat stiff porridge every day?
Subject: No, I do not eat it on Sunday.
Interviewer: So you eat stiff maize-meal porridge six times a week (*Write 6 under the column Per Week*)

FOOD	DESCRIPTION	Amount	TIMES EATEN Per day	Per week	Per month	Seldom Never	CODE	AMOUNT/DAY
Maize-meal porridge	Stiff	*1 cup*	1	6				

Example 2.The subject eats a large dish of ting twice a month

I: Do you eat ting?
S: Yes
I: How much do you eat (*Show the cup and let the subject tell you how much would fit in the cup*)
S: About 2 of those cups.
I: How many times a day do you eat ting?
S: I don't eat ting every day.
I: How many times a week do you eat ting?
S: I eat it less than once a week
I: How many times a month do you eat it?
S: I eat it twice a month.
I: (*Write 2 under the 'per month' column*)

FOOD	DESCRIPTION	Amount	TIMES EATEN Per day	Per week	Per month	Seldom Never	CODE	AMOUNT/DAY
Ting		*2 cups*	1		2			

Brand names.

In some sections, the subject is asked what brand he uses. This is so that we can be sure to use the correct item for nutrient analyses. For example, some maize-meals have vitamins added, others do not. The subject may not know whether the maize-meal he uses has added vitamins or not, but he should know the brand name. We can then check if that brand has added vitamins or not. The same applies to margarines, milk powders, fruit juices, and breakfast cereals.

Preparation methods (meat and vegetables).

Do not read out the list of all the possible preparation methods to the subject. Ask 'How do you prepare your beef?' Then circle the option closest to the subject's answer. If the answer does not fit one of the options, circle 'other' and write in the description.

Also, check if the subject cooks the food in more than one way.

Field Worker Training Manual, p5

If the subject does not know the preparation method (men or if eaten away from home), help him by reading the list. If he still does not know, circle 'Don't know' and fill in the amounts and frequency next to 'Don't know'.

Example: The subject sometimes cooks cabbage with potato and onions and sometimes fries it.

I: How do you cook cabbage?
S: I cook it with potato and onion.
I: *(Circle boiled with potato, onion and fat).*
Do you cook it any other way?
S: Sometimes I fry it.
I: (*circle Fried, nothing added)*
What is the amount you eat if it is cooked with potato and onion? (*Show the samples, cutlery or crockery available*)
S: This one (*Subject points to ladle*)
I: *(Write 1 ladle under 'Amount' next to boiled, potato, onions and fat).*
How often do you eat it?
S: About three times a week.
I: (*Write 3 under 'per week'*)
What is the amount you eat when you fry cabbage?
(*Show the samples, cutlery or crockery available*)
S: This one (*Subject points to ladle*)
I: *(Write 1 ladle under 'Amount' next to fried, nothing added).*
How often do you eat it?
S: I only fry it if I haven't got any potatoes?
I: How many times per month is that?
S: Usually at month end, when the potatoes are finished.
I: So, how may times a month?
S: Say twice a month.
I: (*Write 2 under 'per month')* Can I check that I have got this right? You eat cabbage with potato and onion three times a week and fried cabbage with nothing added twice a month.
S: That is right.

FOOD	DESCRIPTION	Amount	TIMES EATEN Per day	Per week	Per month	Seldom Never	CODE	AMOUNT/DAY
Cabbage	**How do you cook cabbage?**							
	Boiled nothing added							
	Boiled with potato, onion and fat	30	1	3				
	Fried nothing added	30	1		2			
	Boiled then fried with potato onion							

Field Worker Training Manual, p6

	Other describe Don't know							

Other foods.

Vegetables and fruit: Ask the subject which vegetables and fruits he eats and mark them on the questionnaire, then go back to each answer and ask about the preparation, amount and frequency. Do not read the list to the subject.

Tomato and onion gravy: Use the ladle to help the subject judge the amount of gravy used with the porridge.

Canned fruit with custard: Custard is included under fruit as it is usually eaten with canned fruit. This is also a control question, as canned fruit and custard is also included under puddings. The answers to both questions must be the same. If not, make sure the subject has understood the question.

Bread and spreads: Ask the subject if he spreads anything on his bread. If he answers **YES** ask him what he spreads and mark them on the questionnaire, then go back to each answer and ask about the amount and frequency. Do not read the list to the subject. (Remember not to ask how much is put on per slice of bread, but how much is used every day or every week or every month).

Atchar: Atchar is included here as a spread on bread, it is also asked about later under 'condiments' for when it is used as sesebo.

Polony: Polony is asked about here again (it was included with cold meat) as something put on bread, whereas previously it was asked about as cold meat. Make sure with the subject whether he uses polony only on bread (e.g. with atchar) or if he also eats it on its own.

Margarine: There is a difference between the type of fat in soft (tub) margarines and hard (brick) margarines. When you ask about the brand also ask whether it is the hard or soft type and write the answer with the brand e.g. *'Rama - soft'* or *'Rama - hard'*.

Fats, drinks and snacks: As for vegetables, fruit and spreads. Ask the subject what he uses and mark them on the questionnaire, then go back to each answer and ask about the preparation, amount and frequency. Do not read the list to the subject.

Fats: Most people will add fat to vegetables or other food while it is being cooked. So to try to find out how much fat one person is getting, we need to ask how much fat is used for the whole amount of food and then how many people will eat the food. These are also checking questions for the cooking methods of vegetables.

Alcoholic drinks: Some questions are asked in the first general questionnaire about the use of alcohol. The subject may want to know why he is being asked again. The first questionnaire is to assess the general state of health of the subject and alcohol is a part of this. In our questionnaire we want to find out the amounts used as alcoholic drinks are 'food' and contribute energy and some nutrients to the diet.

Repetition: Some questions are repeated e.g. custard, atchar, polony. This has been done as a double check to make sure that everything is included. For example, atchar may be spread on

bread or eaten as 'sesebo'. The subject may only think of it as sesebo, if it was not also included under spreads.

Storing food: Keeping food can affect its nutritional value and other properties of the food. If food is regularly stored, it could have an important effect on the quality of the diet.

Salt: Separate questions are asked about the use of salt, as it is very difficult to estimate the amount of salt used.

Interview for the 24-Hour Recall Questionnaire.

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

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

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

Time (approximately)	Place (Home, school, etc)	Description of food and preparation method.	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to work, or starting day's activities					
6 am	Home	Tea	1x		
		With milk	little milk		
		And sugar	2 heaped tsp		
		Soft mealie meal porridge	2 cups		
		With sugar	2 heaped tsp		
		And margarine	1 tsp		

Field Worker Training Manual, p8

Portion sizes

FOOD	Smaller than smallest	Between small and medium	Between medium and large	Between large and very large	Larger than large/very large
Stiff porridge	125 g	275 g	425 g	600 g	800 g
Soft porridge	125 g	275 g	425 g		575 g
Samp and beans	100 g	200 g	375 g	600 g	800 g
Rice	70 g	105 g	190 g		310 g
French fries	30 g	90 g	185 g		340 g
Fried beef	15 g	45 g	80 g		120 g
Beef with bone	45 g	75 g	120 g		180 g
Meat stew	55 g	165 g	275 g		385 g
Sausage/ Wors	20 g	50 g	90 g		135 g
Offal	20 g	60 g	100 g		140 g
Pilchards	15 g	45 g	90 g		150 g
Mashed pilchards	15 g	45 g	90 g		240 g
Fried fish	50 g	70 g	105 g		155 g
Cabbage, potato and onion	15 g	45 g	75 g		105 g
Spinach, potato	15 g	45 g	75 g		105 g
Tomato and onion gravy	10 g	30 g	60 g		100 g
Pumpkin	15 g	35 g	60 g		80 g
Carrots, potato	45 g	65 g	80 g		95 g

Field Worker Training Manual, p9.

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

Other questionnaires

We may also use any of the following questionnaires:
Socio-demographic questionnaire
Health questionnaire
Smaller questionnaires drawn up by each individual researcher e.g. lunch box content of school children.

Field Worker Training Manual, p10

Annexure E – Anthropometric Form

DURBAN UNIVERSITY of TECHNOLOGY

FOOD AND NUTRITION CONSUMER SCIENCES

Anthropometric measurements

Section A:

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

2. Community:.....

3. Date of birth	Year	Month	Day

4. Gender	Male	Female

Section B:

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

Annexure F – 24 Hour Food Recall

24 – HOURS RECALL

Subject number: _____ Interviewer: _____

Name: _____ Date: _____ / _____ / 20___

Address: _____

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

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

Yes	1	No	2

If not, why? _____

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

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

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

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 – Socio-demographic Questionnaire

SOCIO-DEMOGRAPHIC QUESTIONNAIRE:

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 ID number:.....

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

Where do you live?

.....

2. PERSONAL INFORMATION

2.1 Your role in the family

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

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

2.3 How old are you? _____ years

2.4 Gender:

Male	Female

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Do you live in?

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

3.2 Do other people live in your house?

Yes
No

3.3 How many people are living in your house?

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

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

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

3.5 Are all members' permanent residents in this house?

Yes	No

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

< 1 year	1-5 years	>5 years

3.7 In what type of house are you staying?

Brick	Clay	Grass	Wood	Zinc/shack

3.8 How many rooms does your house have?

< 2 rooms	3-4 rooms	> 4 rooms

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

Yes	No

3.10 How are you currently living?

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

3.11 Do you have the following facilities at home?

3.11.1 Water

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

3.11.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	
Other, specify.....	

3.11.3	Waste removal	Yes	No

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

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

.....
.....

4. WORK STATUS AND INCOME

4.1. Are you currently employed?

Yes	No

If YES, go to Question 4.5.

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

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

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

Yes	No

4.4. How long have you been unemployed?

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

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

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

4.6. Is your job?

Full time	< 25 hours per week

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

If YES, go to Question 4.10.

4.8 If NO, is your spouse (partner) in paid employment at present?

Yes, full time, permanent	
Yes, part-time, permanent (< 25 hours p w)	
Yes, temporary	
No, unemployed	
No, retired	
No, other, specify.....	

4.10. If YES, what is your spouse (partner)'s occupation or job?

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

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

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

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

Always	Often	Sometimes	Seldom	Never

4.14 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

4.15 How often do you buy food?

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

4.16 Where do you buy food?

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

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

Taxi	
Bus	
Train	
Own vehicle	
Other Specify	

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

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

5 EDUCATION AND LANGUAGE

5.1. What is the highest education you have?

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

5.2 What language is spoken mostly in the house?

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

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

None	1	2	3	4	5	6	7	8	All

5.4 How many children have completed their immunisation schedule?

None	1	2	3	4	5	6	7	8	All

5.5 Number of children attending school

None	1	2	3	4	5	6	7	8	All

5.6 How do the children get to school?

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

5.7 If you have children, how much money do you give to each child to take to school for buying food / Snacks PER WEEK?

0	50c	R 1 – 2	R 2- 3	R 3 - 4	R 4 - 5	> R 5

6 ASSETS

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

6.6 How many meals do you eat per day?

0	1	2	3	> 3

6.7 Where do you eat most of your meals?

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

6.8 Where do your children eat most of their meals?

Home	Friends	School	Other, specify.....

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

	Yes	No	Quantity
Electrical stove			
Gas stove			
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?

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

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

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

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

Annexure H – Food Frequency Questionnaire

DIETARY INTAKE INTERVIEW SCHEDULE

SUBJECT ID NUMBER: ..... INTERVIEWER: .....
Address.....

INTRODUCTION:

Greeting

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

Please think carefully about the food and drink you have consumed during the past few months. I will now go through a list of foods and drinks with you and I would like you to tell me

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

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

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

THERE ARE NO RIGHT OR WRONG ANSERS.

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

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

PART I

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

SUBJECT ID NO: .....

EXAMPLE:

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

Please answer the following questions:

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

PART II

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

SUBJECT ID NO: .....

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

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

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

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

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

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

FOR OFFICE USE

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

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

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

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Pork	Fried – with bone							
	Fried – without bone							
	Stewed – with bone							
	Stewed – without bone							
	Grilled – with bone							
	Grilled – without bone							
Beef Offal	Intestines: boiled, nothing added						161	
	Stewed with vegetables							
	Tripe						1546	
	Heart						1565	
	Lungs							
	Liver						1515	
	Kidneys						1518	
	Other specify:							
What vegetables are usually put into meat stews?								
Wors sausage	Fried Grilled						1526	
Bacon							1501	
Cold meats	Polony						1514	
	Ham						1564	
	Viennas						1531	
	Other specify:							
Canned meat	Bully beef						1535	
	Other specify:							
Meat pie	Home made Bought						1548	
Hamburger	Home made Bought							
Dried beans, peas, lentils (10)	How do you prepare them?							
Soya products e.g. Toppers	Brands at home now Don't know…….. Show examples						3527	
Pilchards in tomato chilli brine	Whole						2557	
	Mashed with fried onion							
Fried fish	With batter/ crumbs						2523	
	Without batter/crumbs						2509	
Other canned fish	Tuna							
	Pickled fish Other:						2562	
Fish cakes	Home made (describe) Frozen Bought						2531	

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

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

FRUIT:

Do you like fruit? YES NO How many times per week do you eat fruit in winter? ...../ in summer? .....

Where do you get your fruit from?

Own fruit trees	1
Farm – employer	2
Farm – own	3
Supermarket/greengrocer	4
Hawker	5
Veld	6
Gifts	7
Other	8

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

FOOD	DESCRIPTION	Amount	TIMES EATEN				CODE	AMOUNT/ DAY
			Per day	Per week	Per month	Seldom Never		
Peanut butter							6509	
Jam/syrup/ honey							9008	
Marmite/Fray Bentos etc.							9501	
Fish/meat paste							1512	
Cheese	Type:						0010	
Atchar							3004	
Polony							1514	
Other spreads: specify								
Dumpling							4001	
Vetkoek							4057	
Provita, crackers etc.								
FATS: What fats do you use and where do you use them?								
Margarine	Where used: on bread							
	with vegetables** Number of spoons ..... /number in family							
Butter	on bread with vegetables** Number of spoons ..... /number in family							
Holsum / vegetable fat	Where used: Number of spoons ..... /number in family						6508	
Oil	Where used: Number of spoons ..... /number in family						6510	
Dripping	Where used: Number of spoons ..... /number in family							
Mixed fat (makhuru)	Where used: Number of spoons ..... /number in family							

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

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

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

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

SALT USE:

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

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

Always 1	Sometimes 2	Never 3	Don't know 4

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

Always 1	Sometimes 2	Never 3	Don't know 4

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

Very much 1	Like 2	Not at all 3

KEEPING FOOD:

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

Always 1	Sometimes 2	Never 3	Don't know 4

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

FOOD	Reheated	Eaten cold

Do you use any of the following?

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

THANK YOU FOR YOUR COOPERATION AND PATIENCE

GOOD-BYE!

Annexure I – Meeting with School Principal and Head of Department

The Prinncipal Mr Mayishe and HOD

My name is Portia Mfeka studying at Durban University of Technology doing Masters in Food and Nutrition and Consumer Studies and I am also a teacher at Chesterville Extension your school feeds to our High School. I would like to set up a meeting for the 7th of October to discuss my intentions to work with the school in doing research work for my theses using the learners from your school and how it will benefit the learners and the community.

My theses is on Nutritional status of primary school children aged 4 to 8 years and 9 to 13 years. Your assistance will be highly appreciated.

Thanking you in advance
Researcher
Portia L.N. Mfeka
Date
01/10/2008

Annexure J – Certificate of Language Editing

07 February 2017

To whom it may concern Re: Masters Dissertation by Ms Lungi Mfeka

This letter serves to confirm that as requested I have edited and proofread the Dissertation provisionally entitled:

The relationship between the socio-demographic indicators, nutritional status and dietary intake of primary school children living in Chesterville, KwaZulu- Natal.

I have edited the work twice and to the best of my knowledge it is now free of spelling and grammatical errors and reads well. However, the author is responsible for implementing final corrections in chapter 2. Where necessary I also made comments to enable the author to clarify, improve and develop her work.

I am an experienced publisher, editor and proof reader.

Michael Vermeer (B.A., U.E.D., Dip. Translation)

082 093 4347

mike.vermeer3@gmail.com