NUTRITIONAL STATUS AND DIETARY INTAKE PATTERNS OF CHILDREN AGED 7-13 YEARS IN QWA-QWA

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I love you with all my heart.

ABSTRACT

Both under and over nutrition are prevalent among children in South Africa. At national level, children suffered from under nutrition. Childhood malnutrition starts early in life, the first two years being the most vulnerable period. Malnutrition is a public health problem in South Africa, especially in young children, requiring a systematic approach to improve nutrition services and promote behavior change. The objective of this cross-sectional study was to determine the nutritional status of the primary school children in Qwa-Qwa in South Africa.

The study was carried out in two phases, namely Phase 1 (Planning) and Phase 2 (data collection and analysis of socio-demographics, 24-hour recall, a food frequency questionnaire, dietary diversity and anthropometric measurements). Weight and height were measured for 70 children (100% of the sample) and analysed according to the World Health Organization documents (WHO 2007) to determine nutritional status of the respondents. The data were captured on an *Excel* spreadsheet by the researcher and analysed for descriptive statistics such as frequencies, standard deviations and confidence intervals on the Statistical Package for Social Sciences (SPSS), version 18.0 program.

A convenience sample of 70 primary school children aged 7-13 years, including girls (n=38) and boys (n=32) forming part of 105 purposively selected households were recruited for the study. The results showed that the majority of the households (80.4%) had been living in Qwa-Qwa for more than five years and lived in RDP brick houses (86.7%) with more than four rooms (56.3%). The monthly income of the households was less than R1000.00 in the majority of the households (73.9%) and 42.0% of the households spent < R100 on food per week which is calculated at R14.29 per day and R 2.86 per household member per day.

The respondents consumed a mainly carbohydrate rich diet as 10 of the 20 most consumed food items were carbohydrates (mean daily intake) such as stiff maize meal porridge(195g), soft maize meal porridge (174g) , brown and white bread(122g), potato, cooked (66g), samp, cooked (187g), potato fries (85g), breakfast cereal (300g) and rice cooked (140g). Only three vegetables and fruit formed part of the Top 20 food items mostly consumed. It is showed that very small portion sizes of mostly the vegetables and fruit as well as the protein-rich food sources were consumed. The dietary intakes of the nutrients showed deficient intakes of all except, carbohydrate, iron, Vitamin K and B12. However, these nutrients showed an adequate

intake, but there were still 38% of all respondents who did not consume 100% of the EAR for the CHO compared to 38%, 73%, 71% and 60% for Fe, vitamin A, vitamin B12 and K respectively. Vitamin C intakes were low which was consistent with only three vegetables and fruit which showed that children consumed small amounts of vegetables and fruit portions.

The mean (±SD) Food Variety Score for all the food groups consumed from all the food groups in a period of seven days was 23.96 (±16.08). These results revealed poor dietary diversity. Cereal was the food group with the highest mean food variety score in this study population.

The mean ±SD FVS of 23.96 (±16.08) revealed poor dietary diversity in the children despite the relatively high food variety (88 individual foods consumed in seven days). More boys (28.5%) were underweight (<-2SD) compared to fewer girls (17.4%). There is thus acute malnutrition in this group of the children which is consisted with the insufficient food intakes reflected by the 24-hour recall and dietary diversity measurements. Stunting was prevalent in 21.1% and 18.7% of the girls and boys respectively, with 4.3% of all the children being severely stunted (<-3SD). This indicates chronic malnutrition and or the presence of infections over a long period leading to failure of linear growth. None of the boys and girls were overweight or obese, whilst (71.8 %) of boys and (81.5%) of girls were of normal weight. It can be concluded that poverty, household food insecurity and poor dietary intakes and diversity resulted in poor nutritional status of the children in this community.

The high prevalence of inadequate nutrient intakes and poor nutritional status (under-nutrition) amongst the children in this study, demonstrates the need for effective sustainable food and nutrition interventions aimed at improving dietary intake and diversity as well as the poor nutritional status.

Keywords: nutritional status; children; dietary intake; dietary diversity.

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GLOSSARY OF TERMS

AI	Adequate Intake
AIDS	Acquired Immunodeficiency Syndrome
ALVs	African Leafy Vegetables
AOAC	Association of Official Analytical Chemists
ARV	Antiretroviral
BMI	Body Mass Index
BMIA	Body Mass Index-for-age
BMIZ	Body-mass-index-for-age Z-score
BTech	Baccalaureus Technologiae
C18	Chromatography
COH	Carbohydrates
CVD	Cardio vascular disease
DDS	Dietary Diversity Score
DHS	District Health System
DoA	Department of Agriculture
DoE	Department of Education
DoH	Department of Health
DoL	Diseases of lifestyle
DoSD	Department of Social Development

DPPH	Diphenly-1-picrylhydrazyl
Dr	Doctor
DRI	Dietary Reference Intakes
DTech	Doctor Technologiae
e.g	Example
EAR	Energy Adequacy Ratios
ed	Editions
et al	and others
FAO	Food Agriculture Organization
FBDGs	Food-Based Dietary Guidelines
Fe	Iron
FFQ	Food Frequency Questionnaire
FGDS	Food Group Diversity Score
FRAP	
FRAP	Ferric reducing/antioxidant power
FVS	Food Variety Score
FW	Fresh Weight
g	Grams
GDP	Gross Development Domestic
GTZ	Gesellschaft fur, Techische Zusammenarbeit
H2O	Hydrogen dioxide (Water)

HA	Height-for-age
HAZ	Height-for-age Z-score
Hg	Haemoglobin
HIV	Human Immunodeficiency Virus
HPLC	High Performance Liquid Chromatography
i.e.	In other words
IDA	Iron Deficiency Anemia
IDD	Iron Deficiency Disorders
IFPRI	International Food Policy Research Institute
IFSNP	Integrated Food Security and Nutrition Programme
IL	Illinois
ILSI	International Life Sciences Institute
Inc	Incorporated
INP	Integrated Nutrition Programme
INS	Integrated Nutrition Strategy
IoM	Institute of Medicine
Kg	Kilogram
kJ	Kilojoules
m	Meter
MA	Massachusetts
MAR	Mean adequacy ratio

mcg	Microgram
MDG	Millennium Development Goal
MDG1	Millennium Development Goal 1
mg	Milligrams
Min	Minute
mL	Milliliter
mm	Millimeter
mmol/L	Millimol Per Litre
Mn	Magnesium
MoU	Memorandum of Understanding
n	Number
n.d	Not dated
NAR	Nutrient Adequacy Ratios
NE	Nutrition Education
NFCS	National Food Consumption Survey
NGO	Non Government Organisation
p	Significances
PEM	Protein Energy Malnutrition
PHC	Primary Health Care
PhD	Doctoral of Philosophy
PLWHA	People living with HIV and AIDS

ppm	Parts per million
PSNP	Primary School Nutrition Programme
r	Correlation
R	South African Rand
RDAs	Recommended Dietary Allowances
RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
SA	South Africa
SADHS	South Africa Demographic and Health Survey
SAEDP	Southern African Endogenous Development
SAVACG	South Africa Vitamin A Consultation Consultative Group
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
SSA	sub-Saharan Africa
STATSSA	Statistics South Africa
TB	Tuberculosis
THUSA	Transition in Health during Urbanisation in South Africa
U5	Under age of five
UCED	University-Community Endogenous Development
µm	Micrometres
µmol	Micromol

µmol	Micromol
UN	United Nations
UNAIDS	United Nations Programme on Acquired Immune Deficiency Syndrome
UNICEF	United Nations Children's Fund
UNS-SCN	United Nations System-Standing Committee on Nutrition
US$	United States Dollar
USA	United States of America
USAID	United State Agency for International
VAD	Vitamin A Deficiency
VAT	Value added Tax
VUT	Vaal University of Technology
WA	Weight-for-age
WAZ	Weight-for-age Z score
WFP	World Food Programme
WFS	World Food Summit
WHO	World Health Organization
WHZ	Weight-for-height Z- score

LIST OF SYMBOLS

&	And
=	Equals to
>	Greater than
≥	Greater than or Equals to
<	Less than
≤	Less than or Equals to
%	Percentage
-	To

CHAPTER 1

THE PROBLEM AND ITS SETTING: MALNUTRITION IN CHILDREN

1.1 INTRODUCTION

Nutrition is a basic human right for all human beings, including children, as set out in the "Convention on the rights of the child" and other human rights agreements (United Nations Children's Education Fund [UNICEF] 2004). Furthermore, the first millennium development goal (MDG) adopted by the Millennium Declaration in 2000 was to "eradicate extreme poverty and hunger" (Maunder, Khoza, Kuzwayo & Eide 2008:9). In order to develop fully and maintain physical and mental health and wellbeing, children need to be free from hunger and malnutrition (UNICEF 2004). Nutrition is one of the most important factors contributing to health and quality of life (King & Burgess 2000), whereas malnutrition is often a silent and masked problem, the persistence of which has far-reaching and devastating consequences for future generations (UNICEF 2004).

Malnutrition can be classified as over-nutrition and under-nutrition, the latter's causes of which include lack of access to and availability of food and health services (Kruger, Hendricks & Puoane 2008:665). Under-nutrition occurs when the body does not have enough nutrients to produce energy, grow and repair the tissues and immune system, and when a person is not consuming enough of one or more nutrients (Hogan & Burstein 2007:45-47). Over-nutrition, on the other hand, causes overweight and obesity, which are the outcome of eating too much, eating too much of the wrong food and not getting enough physical activity (Kuzwayo 2008:167). Malnutrition is therefore the cellular imbalance between supply of nutrients and energy and the body's demand nutrients and energy to ensure growth, maintenance, and perform specific functions (World Health Organization [WHO] 2010a). The most adversely affected groups are women and young children, with between one quarter and one half of women of child-bearing age in Africa and South Asia being underweight. This in turn contributes to the number of low birth weight infants born annually (Blossener & de Onis 2005).

Malnutrition is globally the highest risk factor for illness and death, contributing to more than half of infant mortality worldwide. Child malnutrition was associated with 54 percent of deaths in children in developing countries in 2001, with protein-energy malnutrition (PEM), first described in the 1920s, also observed most frequently in developing countries (WHO 2004).

The South African National Food Consumption Surveys (NFCS) of 1999 and 2005 assessed children for growth, dietary intake, procurement and food consumption patterns, and hunger by interviewing the mothers and caregivers of children aged 1-9 years old. At the national level, stunting and underweight remained the most common nutritional disorders, affecting almost 20 percent and 10 percent respectively. On the other hand, 10 percent of the children were classified as being overweight and 4 percent as obese. With regard to micronutrient deficiencies, 67 percent and 45.3 percent had a poor vitamin A and zinc status respectively, with 33 percent being iron deficiency anaemic (Labadarios *et al*. 2005:256).

South Asia has one of the highest malnutrition rates in the world, with women of low status lacking knowledge on nutrition and thus providing inadequate feeding and care (International Food Policy Research Institute [IFRPI] 2010). For instance, six million primary school children in Thailand, or 30 percent of the population, are undernourished, and around one million critically malnourished. This is ironic, given that Thailand is a major producer and exporter of food (Gunde 2010).

Changes in environmental conditions and overpopulation, more commonly seen in developing countries, can reduce food production, leading to inadequate food intake or foods of poor nutritional quality. Conversely, the effects of malnutrition on individuals can create and maintain poverty, with adverse effects on economic and social development (WHO 2011a).

1.2 TYPES OF MALNUTRITION

The nutritional status of children is assessed by anthropometric measurements, four indicators commonly used being stunting, underweight, wasting and overweight, according to various indices (Kuzwayo 2008:167). Malnutrition can be classified as either under- or over-nutrition, both of which can co-exist in the same household or individual.

1.2.1 Under-nutrition

Many children on the African continent are unable to access or effectively use food and the health services they need for a healthy life. In the early 1990s about 20 percent of children and adults were malnourished in Africa (Food Agriculture Organization [FAO] 2003). Under-nutrition is the outcome of insufficient dietary intake and/or repeated infections and disease. It includes being underweight, stunted or wasted, and may be marked by micronutrient deficiencies (Kuzwayo 2008:167). Under-nutrition has serious implications for health, productivity and the social and economic development of country (Kuzwayo 2008:167), whilst malnutrition affects children's cognitive development and performance at school. Educational outcomes may not be attained owing to a reduced potential to learn caused by poor concentration in class (Wanjohi 2010).

1.2.1.1 Underweight

Underweight is defined as low weight-for-age (below-2 z-score/standard deviation (SD) (WHO 2007a) and is usually the result of acute insufficiency of food and nutrient intake (UNICEF 2007a). The prevalence of underweight in children under five years of age (U5) declined from 31 to 26 percent between 1990 and 2008, but this did not reach the MDG target to reduce by half the number of people living on less than a dollar a day suffering from hunger (UNICEF 2010). In 2003, statistics indicated that South Africa had 11.6 percent underweight in urban areas and 11.4 percent in rural areas (Republic of South Africa Department of Health [DoH] 2008a). It is one of the most common

nutritional disorders, occurring in children whose mother has no education, particularly those between the ages of 25-29 and 40-44 (Labadarios *et al*. 2008:255).

On the other hand, the prevalence of underweight is low in North Africa, and the improvement rate has met MDG 1. An improved socio-economic environment and wide coverage of health and nutrition programmes have contributed to this improvement (UNICEF 2010). South Asia and Sub-Saharan Africa (SSA) are far behind meeting the MDG target. Children in rural areas of developing countries are twice as likely to be underweight than in urban areas. The unavailability and inadequate access to food, lack of water, sanitation and health services, and suboptimal feeding practices of children can also result in under-nutrition (UNICEF 2010).

1.2.1.2 Stunting

Stunting is defined as low height-for-age below-2 z-score/SD (WHO 2007a) and is usually an indication of chronic insufficient food and nutrient intake and frequent infections (UNICEF 2007a). Several studies before 1994 showed that about 2.3 million children in South Africa were undernourished, of whom 87 percent were Black African (Labadarios, Dhansay & Hendricks 2008:133). Most living in the former Bantustan rural areas and peri-urban communities were stunted, including 25 to 53 percent of preschool and primary school children (Dhansay & Hendricks 1994). Studies between 1976 and 1996 of the nutritional status of children in South Africa found that 20 to 25 percent of preschool and 20 percent of primary school children were stunted (Vorster *et al*. 1997). Black African children living in rural areas and coloured children were more vulnerable (Labadarios, Dhansay & Hendricks 2008: 133). According to the NFCS, stunting is prevalent in 19 percent of children aged 1-9 years nationally (Steyn *et al*. 2005). In the North West Province, 19 percent of children aged 10-15 years were also stunted (Mukuddem – Petersen & Kruger 2004), compared to 31-75 percent of primary school children aged 8-11 years in KwaZulu-Natal (Jinabhai *et al*. 2003).

Stunting after the age of 24 months is irreversible and usually results in poor motor and cognitive development (UNICEF 2007a, 2010; WHO 2004). Children of rural areas in developing countries are 1.5 times more likely to be stunted than those living in urban areas. The prevalence rate of stunting in rural areas is 50 percent in developing countries (UNICEF 2010). During 2003, stunting was high in rural areas with a prevalence of 28.1 percent compared to 26.9 percent in urban of South Africa (DoH 2008b). Children of uneducated mothers were also likely to be more stunted with a prevalence rate of 38.4 percent. Black and Mixed Race children, as well as those with mothers between the ages of 45 and 59 years were also found to be more stunted (Labadarios *et al.* 2008:255). Stunted children in South Africa were also found to be at risk of being overweight (Faber & Wenhold 2007:393).

1.2.1.3 Wasting

Wasting is defined as low BMI-for-age (below-2 z-score/SD) (WHO 2007a), and is an indicator of acute malnutrition which results from recent food deprivation or illness (Khan & Azid 2011:749). A child whose is moderately wasted has a weight-for-height that is below -2SD of the reference population, whilst a severely wasted child weight-for-age is below -3SD. Wasting shows acute under-nutrition or severe disease, independent of possible chronic under-nutrition that might have compromised the height of the child. The NFCS found the prevalence of wasting to be low (Steyn *et al*. 2005). In South Africa severe wasting was less than 2 percent and moderate about 5 percent in children under 5 years in 2005 (Kruger *et al*. 2007). Five years earlier the prevalence of wasting in South Africa had been measured at 30.2 percent (Steyn & Walker 2000), with 41.8 percent children aged 3-10 in Limpopo's Ellisras rural area found to be wasting (Monyeki *et al*. 2000). Internationally it is not as common as underweight or stunting, with global prevalence around 9 percent, however the rates can change rapidly with emergency food shortages, population displacements, and disease (Faber & Wenhold 2007:349).

1.2.1.4 Micronutrient deficiencies

Micronutrients are small amounts of essential nutrients obtained from the diet and not produced by the body (Torpy, Cassio Lynm & Glass 2004:648). Micronutrient deficiencies are thus largely caused by inadequate dietary intake of vitamins, minerals and trace elements, with more than two billion people globally suffering from them (WHO, WFP & UNICEF 2007), usually more prevalent amongst resource poor, food insecure and vulnerable households in developing countries. Key contributory factors include poverty poor or limited food variety, lack of nutritional knowledge, inappropriate dietary practices and high incidence of infectious disease. The deficiency has an impact on the socio-economic development, contributing to a vicious cycle of underdevelopment to the detriment of already underprivileged groups (WHO & FAO 2006).

Micronutrient malnutrition contributes substantially to the world's burden of diseases, as micronutrients are important for the prevention and control of diseases such as human immunodeficiency virus (HIV & AIDS) and acquired immunodeficiency syndrome (AIDS), malaria, tuberculosis (TB) and diet- related chronic diseases of lifestyle (DoL). It can also cause various micronutrient disorders such as anaemia (iron, vitamin B12, folate), scurvy (vitamin C), pellagra (vitamin B3), beriberi (vitamin B1) and xerophthalmia (vitamin A), and can ultimately result in death. Vitamin A, iodine and iron are the three major micronutrient deficiency diseases occurring in developing countries, where they are amongst the 10 leading causes of death. Lack of iron is the most prevalent form of malnutrition globally, affecting millions of people (Faber & Wenhold 2007:393). Micronutrient malnutrition can be prevented by consuming a balanced diet with adequate nutrients (WHO & FAO 2006).

The following micronutrient deficiencies are commonly found:

- Iodine deficiency

Iodine is the essential to producing the hormones that regulate the thyroid gland, which controls a number of critical body functions such as heart rate, body temperature and blood pressure (UNICEF 2012). Inadequate dietary intake is related to a spectrum of diseases, collectively referred to as iodine deficiency disorders (IDDs) (Jooste, Weight & Lombard 2000).

Unlike other deficiencies, where socio-economic, health and dietary change may establish underlying secular trends, here the iodisation of salt is the most effective and sustainable long-term public measure for the prevention of conditions such as impaired mental function, goitre, hypothyroidism, cretinism and retarded physical development, as well as of child mortality (Jooste, Weight, Locatelli-Rose & Lombard 1999). Every year, around two million children are born mentally impaired because of their mother's lack of iodine consumption. Iodine deficiency is, associated with severe mental retardation, stunting, growth failure and immune deficiency in young children (WFP 2010). These conditions are irreversible and later in life the intellectual and education performance of the child may become affected (WFP 2010).

In 1995, the South African government introduced compulsory iodisation of table salt to eliminate deficiency by increasing the level of iodine from 10-20mg/kg to 40-60mg/kg at the site of production (Hendricks, Eley & Bourne 2006). The results of a national survey show that 62.4 percent of households used iodised salt (Jooste, Weight, Locatelli-Rose & Lombard 1999). A survey carried out between 1995 and 2005 in developing countries (South Central Asia including India, West Africa, South and Central America and Caribbean) using iodated salt showed that more than 75 percent of women or children had a goitre prevalence rate of 12 percent (n=17), compared to 10.5 percent in the period before 2000 (UNS-SCN 2010). Countries with a high prevalence responded more strongly to salt iodisation. Ninety-seven percent of households at the national level had salt containing a significant amount of iodine (more than 2ppm). Eight out of nine provinces in Republic of South Africa (RSA) had a remarkable high percentage of households (in excess of 95 percent) using a significant amount of iodated salt, for

instance more than 15ppm (76.9 percent) in Limpopo (45.3 percent), and Western Cape (87.7 percent) (Jooste *et al.* 2007). Goitre was reported in South Africa for the first time in 1927, mainly in rural areas (Steyn *et al*. 1995). In 1994, voluntary iodated table salt was introduced at a level of 10 to 20 mg/kg to prevent and control it. Only 30 percent of salt was iodated and did not reach most rural populations (Moeng & de Hoop 2008:298).

- Iron Deficiency

Iron is an essential nutrient found in two proteins, namely haemoglobin in the red blood cells and myoglobin in the muscles that assist with the acceptance, carrying and releasing and delivery of oxygen to the tissues (Whitney & Rolfes 2008:440). Compared with vitamin A deficiency or child underweight, for which most countries in Africa and South Asia, America and Caribbean have shown an improvement since 2005, the prevalence of iron deficiency anaemia is not showing a long-term improvement trend. For instance, the African country of Mozambique has a prevalence rate of more than 60 percent in children (Granz 2010). Iron deficiency has to be reduced in children and school supplementation may have a role. Anaemia is one of many reasons to control malaria and widespread fortification is part of solution. A school-aged child with iron deficiency has loss of appetite, higher morbidity and growth retardation (WFP 2010).

- Zinc deficiency

One of the co-morbidities of a zinc deficiency is stunting and poor cognitive development. Zinc supplementation can assist in increasing the height and food intake of children (Wenhold, Kruger & Muehlhoff 2008:453). Zinc supplementation is associated with an increase in lean body mass of undernourished children but not in fat mass (Golden & Golden 1981). The lowest prevalence zinc deficiency was 27.3 percent in Mpumalanga, Limpopo Province, whilst the Western Cape had the highest prevalence at 58.5 percent. The urban formal and rural population had the highest zinc prevalence and urban people the lowest (Labadarios, Dhansay & Hendricks 2008:146).

At national level, 45.3 percent of children between 1 and 9 years had inadequate zinc status, meaning they were at risk of zinc deficiency (Labadarios *et al.* 2005).

- Vitamin A Deficiency

Vitamin A is needed for growth and repair of body tissues (Mason, Lofti, Dalmiya, Deitchler, Geibel, Gillenwater, Gilman, Mason & Mock 2001). Developing countries have about 163 million children with vitamin A deficiency, with 30 percent prevalence. The highest prevalence is in south central Asia where two thirds of the children have deficiency. India also has a highest prevalence, as do central and west Africa with more than 40 percent. South and Central America and the Caribbean have lower prevalence, at only 10 percent (UNS-SCN 2010). The South African Vitamin A Consultation Group (SAVACG) showed that one in three children under the age of six had vitamin A deficiency. The deficiency was worse in the Limpopo, KwaZulu-Natal, Mpumalanga, North West and Eastern Cape provinces. Rural area children with low socio-economic environments were more severally affected than those living in urban areas, with better socio-economic environments (Labadarios *et al.* 2005).

One of the targets of the MDG for malnutrition is to reduce vitamin A deficiency (VAD) prevalence between 1990 and 2015 by 50 percent (UNS-SCN 2010). The rates are similar to those needed in East Asia and South and Central America, as well as in the Caribbean. In most African countries, besides northern Africa, progress is very slow. Fortification with vitamin A is one of the strategies adopted to address VAD and was also adopted in South Africa. Vitamin A deficiency causes night blindness and corneal damage as well as weakening the immune system. As well as causing child blindness in developing countries, it increases the risk of dying from diarrhoea, measles and malaria by 20-24 percent (WFP 2010). The widespread use of vitamin A supplements (UNICEF 2007b), reaching more than half the developing countries' children does not appear to be affecting the prevalence of vitamin A deficiency. Vitamin A supplementation is aimed to reduce the mortality in children rather than affecting serum retinol levels (UNICEF 2010).

1.2.1.5 Protein energy malnutrition (PEM)

PEM is a form of malnutrition caused by inadequate intake of energy and protein, resulting in body muscles wasting. There are three types of PEM in children, clarified in Table 1.

Table1.1 Types of PEM (Woodruff *et al*. 2009; Whitney & Rolfes 2008).

Type	Appearance	Cause
Acute	Underweight	Acute (recent severe) inadequate food intakes leading to rapid weight loss or failure to gain weight normally
Chronic	Stunting or shortness	Long-term food deprivation leading to failure of linear growth
Acute and chronic	Thinness	A combination measure; therefore, it could occur as a result of wasting, stunting, or both

1.2.2 Over-nutrition

There are a number of conditions associated with over-nutrition.

1.2.2.1 Overweight and obesity

- Definition

Overweight and obesity, defined as abnormal or excessive fat accumulation in the body, present a risk of disease and thus may affect health (WHO 2006). People who eat more than they need to cover their nutrient needs are likely to become overweight or obese. Overweight means that the person is too heavy for his/her height (King & Burgess 2000), which is above the range of weights of healthy people. Overweight (>2SD) and obesity (>3SD) are measured by the BMI-for-age growth standard (WHO 2007a).

- Prevalence

In South Africa, overweight and obesity are said to be comparable to those found in developing countries more than decade ago. The South African Primary Schools' Anthropometric Survey and The Health of the Nation Study have estimated an increase in overweight from 12 percent to 13 percent and in obesity from 0.2 percent to 3.3 percent over a period from 1994 to 2004 (Armstrong *et al*. 2011). Mamabolo and co-authors (2005) reported that high prevalence is related to cultural beliefs and practices, where fat infants are seen as healthy and mothers therefore indulge in overfeeding, often with energy-rich foods. A higher prevalence was found in girls than in boys in most studies on children and adolescents in South Africa (Hermanus, Rossouw, Grant & Viljoen 2012:3). The indicators of socio-economic conditions, cultural practices, health statistics, food-related behaviour, knowledge, attitudes, and practices should be considered in order to draw meaningful interpretations (Faber & Wenhold 2007:393).

Obesity is more prevalent in South African children between the ages of one and three, with 19.3 percent in rural areas and 15 percent in urban. The NFCS in 2005 reported that 4 percent of children aged 1-9 were obese and 10 percent overweight (DoH 2008a, Labadarios *et al*. 2008:255). In 2010, the overweight and obesity burden was higher than in 1990, with about 43 million children below the age of five being overweight globally, of whom 35 million were living in developing countries (De Onis, Blossener & Borghi 2010). In the past, overweight and obesity were mainly associated with high-income and developed countries, but are now on the increase in low- and middle-income countries, especially in urban settings. Close to 35 million children in developing countries are overweight, compared to 8 million in developed countries. More deaths worldwide are linked to overweight and obesity as opposed to underweight. Sixty five percent of the world's populations in all high-income and most middle-income countries are killed by overweight and obesity-related disorders (WHO 2011a).

❖ Causes

Obesity and overweight are caused by an imbalance between energy consumed and energy expended, with high-fat and sugar diets increasing the risk of becoming overweight or obese. There has been an increased intake of energy-dense foods with high content of fat and sugars, but fewer vitamins, minerals and other micronutrients, coupled with a decrease in physical activity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanisation. Dietary and physical activity patterns are often the result of environmental and societal changes associated with the development and lack of supportive policies in sectors such as health, agriculture, transport, urban planning, environment, food processing, distribution, marketing and education (WHO 2011a).

Low birth weight and under-nutrition early in life increases the risk of becoming obese and associated non-communicable diet-related diseases in the later stages of life (Kuzwayo 2008:167). Insufficient sleep, which in itself may lead to overeating, has also been reported as a contributory factor of overweight (Lamberg 2006).

❖ Consequences and strategies to prevent overweight and obesity

It was estimated that non-communicable diseases such as obesity-associated disorders could be the cause of seven out of ten deaths by 2020 (Hermanus, Rossouw, Grant & Viljoen 2012:1). Common health consequences of overweight and obesity are:

- Cardiovascular diseases, mainly heart disease and stroke, which were the leading cause of death in 2008 (WHO 2011a)
- Diabetes mellitus (WHO 2011a)
- Musculoskeletal disorders, especially osteoarthritis, a highly disabling degenerative disease of the joints (WHO 2011a)
- Some cancers, such as endometrial, breast and colon (WHO 2011a).

The prevalence of these non-communicable diseases usually accompanies an increase in BMI. Obesity in childhood is associated with a higher chance of obesity, premature death and disability in adulthood. Children who are obese experience breathing difficulties, increased risk of fractures, hypertension, and early markers of cardiovascular disease, insulin resistance and psychological effects. It is common to find under-nutrition and obesity existing side-by-side within the same country, the same community and the same household. In low- and middle-income countries children are more vulnerable to inadequate prenatal and young child nutrition as they are exposed to high-fat, high-sugar, energy-dense, micronutrient-poor foods, as they tend to be lower in price (WHO 2011a).

These types of dietary intake patterns, together with low levels of physical activity, result in sharp increases obesity in childhood when under-nutrition issues remain unsolved. Overweight and obesity, together with related non-communicable diseases, are preventable through supportive environments and communities that are fundamental in shaping people's choices, making healthier choices of food and regular physical activity the easiest choices (WHO 2011a).

The following lifestyle changes can be incorporated to prevent overweight and obesity, as well as non-communicable diseases:

- Limit energy intake from total fats
- Increase consumption of fruit and vegetables, as well as legumes, whole grains and nuts
- Limit sugar intake
- Do regular physical activity
- Achieve energy balance and a healthy weight (WHO 2011a).

Supportive individuals sustained political commitment and collaboration between many public and private stakeholders, making regular activity and healthier dietary patterns affordable and easily accessible to all, especially the poorest individuals in the society (WHO 2011a). The food industry can also play a role in pole in promoting healthy diets by reducing the fat, sugar and salt content of processed foods and ensuring that healthy nutritious choices are available and affordable to all consumers. It can use practical,

responsible marketing and ensure the availability of healthy food choices, whilst supporting regular physical activity and practices in the workplace (WHO 2011a).

The WHO highlighted a link between the prevention of obesity in children and frequency of meals and their distribution throughout the day (Maffeis *et al*. 2000:75-80). A maize-based diet that is inadequate in energy and low in nutrient density was consumed by most South African children. Mixed cropping can be introduced to promote underexploited traditional food crops and home gardens to increase nutritious food at household and community level (Faber & Wenhold 2007: 393).

The negative impacts of overweight and obesity during childhood and adolescence are mainly on physical and psychological well-being. Diabetes mellitus (mainly type 1) and a number of cardiovascular abnormalities during childhood and adolescence are caused by obesity. The risk of developing asthma or an increase in the severity of existing asthma, low grade systematic inflammation, and obstructive sleep apnoea, early onset of puberty, foot and other skeletal abnormalities, and fatty liver disease are conditions associated with overweight and obesity in childhood. The condition of a child being overweight or obese can persist into adulthood (Hermanus *et al.* 2012:2).

A concern associated with being overweight or obese may be the resulting low self-esteem from a psychological point of view. During childhood and adolescence overweight and obesity can give rise to a lack of confidence, negative self-perception and depression, which in turn may result in stereotyping, discrimination and social rejection. In urban Potchefstroom it was found that overweight and obesity can significantly influence scholastic and athletic competency, physical self-concept and social acceptance (Hermanus *et al*. 2012:2).

1.3 Diseases of lifestyle

A number of diseases are associated with lifestyle such as hypertension and diabetes mellitus.

1.3.1 Hypertension

Hypertension is a type of blood flow (vascular) disease with several causes, ranging from hormonal body imbalances to arterial narrowing and excessive pumping of the heart (cardiac output). It is defined as a “higher-than-normal blood pressure (Whitney & Rolfes 2008). When the heart output increases as a result of resistance in the small blood arteries (peripheral arterioles), the blood pressure increases. If the blood pressure (systolic or diastolic) of a child is > 140/90 mm Hg he or she may have hypertension, though the measurements must be repeated at least twice to confirm the diagnosis. Stage one hypertension ranges from 95 percentile to 5mmHg above 95 percentile, whilst stage two blood pressure level is > 5mmHg above the 95 percentile, and requires immediate treatment and consultation with experts (DoH 2005). In rural South Africa the prevalence of hypertension in children aged 6-13 years ranged from 1 percent to 5 percent in boys and 3.1 percent to 11.4 percent in girls (Monyeki, Kemper & Makgae 2006:114-120). Chronic disease hypertension may occur at any stage of childhood, from the newborn stage through adolescence.

Some of the main factors that contribute to the development of high blood pressure are obesity, inactivity, salt sensitivity and eating too much salt, advanced age (physiological), smoking, genetic predisposition (inheritance from either or both parents), and excessive alcohol consumption. Secondary causes of hypertension are found more frequently in children than in adults, and require different approaches in evaluation. It has some striking similarities to hypertension in adults, and severe untreated childhood hypertension can express similar risk factors for cardiovascular disease. Children can benefit from dietary guidelines interventions to prevent the onset of hypertension (Falker 2010).

The development of atherosclerosis is accelerated by hypertension, which develops in the first decades of life, especially in obese children, as do other chronic diseases such as atherosclerosis and high blood cholesterol. The disease can be controlled by participating in regular aerobic activity and by losing weight or managing weight as one grows taller (Whitney & Rolfes, 2008:587). A balanced diet with less added salt will contribute to good health and thus normal blood flow and pressure in the body. Salt is present in large amounts of processed foods, such as packet soups, canned foods,

processed meats (sausages, salami, polony), dried products such as biltong and dried fish, commercially prepared sauces and stock cubes. Other foods containing much salt are take-away foods such as pizza, crisps and salted nuts, seasoning salts, Bovril, Marmite and savoury biscuits. These foods should be avoided and very little table salt should be used. It is better to use herbs and spices to season foods.

1.3.2 Diabetes Mellitus

Diabetes is a disease state when blood sugar is not normally regulated, and it can be up or down depending on the physiological state of the body. Blood sugar comes from the food consumption mainly in the form of glucose and is needed by the body as a fuel for all body cells. In Type 1 diabetes the body cannot produce insulin to regulate the sugar in the blood and this causes high blood sugar. Type 1 diabetes is also known as 'juvenile diabetes' as it usually manifests itself during childhood. This type of diabetes thus needs insulin to be injected into the body. On the other hand, in type 2 diabetes, the pancreas cannot produce enough insulin fast enough to regulate blood sugar as well as insulin insensitivity of the body cells in the body. Juvenile diabetes (childhood less insulin) can be attributed to less insulin in the bloodstream, and without insulin blood sugar cannot be utilised by the body cells and will lead to lack of energy in the body cells. Type 1 diabetes is linked to genetic and immunological factors, leading to the destruction of insulin-producing cells (Wardlaw & Kessel 2002).

Type 2, also known as 'diabetes mellitus', is mainly found during adulthood (Wardlaw & Kessel 2002). Diabetes mellitus, like obesity, is mainly recognized as a disease of lifestyle in which diet and activity are the main contributing factors. Diabetes mellitus, also known as type 2 diabetes, can be defined as "a disease characterized by high blood glucose (sugar) resulting from insensitive insulin (hormone) action in the body" (Wardlaw & Kessel 2002). This chronic disease occurs mostly in children who are obese and sedentary and have a family history of diabetes. If a child becomes obese and diabetic, insulin resistance produces a cluster of symptoms, including high blood cholesterol and high blood pressure. In the long run it in turn promotes the development of atherosclerosis and early development of cardiovascular disease (CVD). The

complication of diabetes occurring at a young age can shorten life expectancy, but can be prevented and treated by managing weight. However, this may be difficult for youngsters in societies in which they are subjected to food advertising, play video games and receive pocket money for sweets (Whitney & Rolfes 2008: 586). The diabetic diet is a healthy eating plan, with meals that contain a mixture of starchy foods, protein and fat, at 4-6 hourly intervals. Three regular meals should be eaten with nutritious snacks between meals (WHO 2006).

1.4 RATIONAL AND MOTIVATION

In South Africa there is a high poverty rate, inequalities in the distribution of income between various populations' subgroups, and a high rate of unemployment. These are often rural phenomena, given that many of the rural inhabitants are linked to agricultural activities and the South African Department of Agriculture has an important role to play in addressing the problem. The Free State province is home to about 6.0 percent of South Africa's population, with non-citizens making up 1.9 percent and unspecified 0.4 percent (STATSSA 2012). The province has the lowest total current household income of all the provinces, which ranks fifth in per capita income terms (STATSSA 2003). There are five district municipalities in Free State, namely, Xhariep, Lejweleputswa, Northern Free State, Motheo and Thabo Mofutsanyane, part of which fell under the Qwa-Qwa homeland and is the largest, with 27.9 percent of the population (Punt *et al.* 2005:1-3). The majority of the Free State population are classified as African (86.9%), with Whites making up 9.9 percent, Mixed Race (3.0%) and Asians (0.1%) (Punt *et al.* 2005:3).

The average size of agricultural households in Free State ranges from 4.0 (strict) to 4.2 (broad), which is higher than the provincial average of 3.5. About 130 853 are classified as agricultural workers, loosely defined here as skilled agriculture workers and/or people working in the agricultural industry, either in an informal or formal capacity, and reporting a positive wage or salary for the year 2000. Africans are the majority of agricultural households in all region of the province. Many households of Thabo Mofutsanyane are involved in agricultural activities but these do not represent a

significant income source to the households. However, it does stand out as region with a large difference between the broad and strict shares (Punt *et al.* 2005:6). Free State province contributed approximately 5.5 percent to National Gross Development Product (GDP) in 2003, although only 6.0 percent of the South African population lives in the province (STATSSA 2003), so the per capita GDP is lower than the national average. High levels of poverty and inequality persist, as they do in the rest of the country, even though Free State is not the poorest province (Punt *et al.* 2005: 7).

Agricultural workers often reside in rural areas having moved away from employment opportunities in urban areas. The National Department of Agriculture places strong emphasis on rural poverty reduction. The rate of poverty of 57.2 percent in Free State is higher than the national average, while the ultra-poverty rate is 34.9 percent. Thabo Mofutsanyane is severely impoverished, with a 73.0 percent poverty rate that is much higher among agricultural households (79.6 percent) than non-agricultural households (52.9 percent). Poverty is greater in rural areas and amongst African and Mixed Race people, who are more involved in agricultural activities as a livelihood strategy (Punt *et al.* 2005: 8-9).

This study formed part of the larger Southern African Endogenous Development Programme (SAEDP) – University - Community Endogenous Development (UCED) collaboration and focused on primary school children aged 7-13, in the Bakoena and Batlokoa communities within Qwa-Qwa. The partnership was founded in May 2004 at the Vaal University of Technology (VUT), when VUT formed a partnership with the Batlokoa and Bakoena communities in Qwa-Qwa. Largely informed by the indigenous knowledge systems, endogenous development is “development from within”, based mainly on locally available resources such as land, water, vegetation, local knowledge and the values and preferences of local people, and it strives to optimise the dynamics of these local resources, thus contributing to economic growth, ecological stability and cultural diversity. As a result of this partnership it was agreed that a situational analysis should be conducted, including determination of the nutritional status of the caregivers and children of these communities in Qwa-Qwa. In July 2008, a team of researchers visited Makeneng and Tseseng, where reside the Bakoena and the Batlokoa tribes respectively, to meet with the chiefs and plan the way forward.

1.5 STUDY AIM AND ITS OBJECTIVES

The main objective of this study is to determine the nutritional status and dietary intake patterns of children aged 7-13 in the Bakoena and Batlokoa communities in Qwa-Qwa, in order to plan suitable intervention studies to address the identified food and nutrition insecurity problems in future (DTech study).

1.5.1 Specific objectives

The specific objectives of this study are to:

- undertake a cross-sectional baseline survey determining the socio-demographic and health profiles of the target group;
- determine the dietary intake and food consumption patterns, as well as nutritional status of the target group;
- Investigate the indigenous food knowledge system/s in the specified communities by identifying locally available foods consumed and chemically analyse these for nutrient content and contribution to the daily diet of the target group.

1.6 STRUCTURE OF THE DISSERTATION

Chapter one has presented the issue of malnutrition and its prevalence globally and in South Africa. In Chapter Two the causes and effects of malnutrition are discussed, together with strategies to address it. In Chapter Three the focus is on the methodology and methods used in this study, followed in Chapter Four by include the results of the research. A conclusion is drawn in Chapter Five, with recommendations for further study and strategies to address the problem.

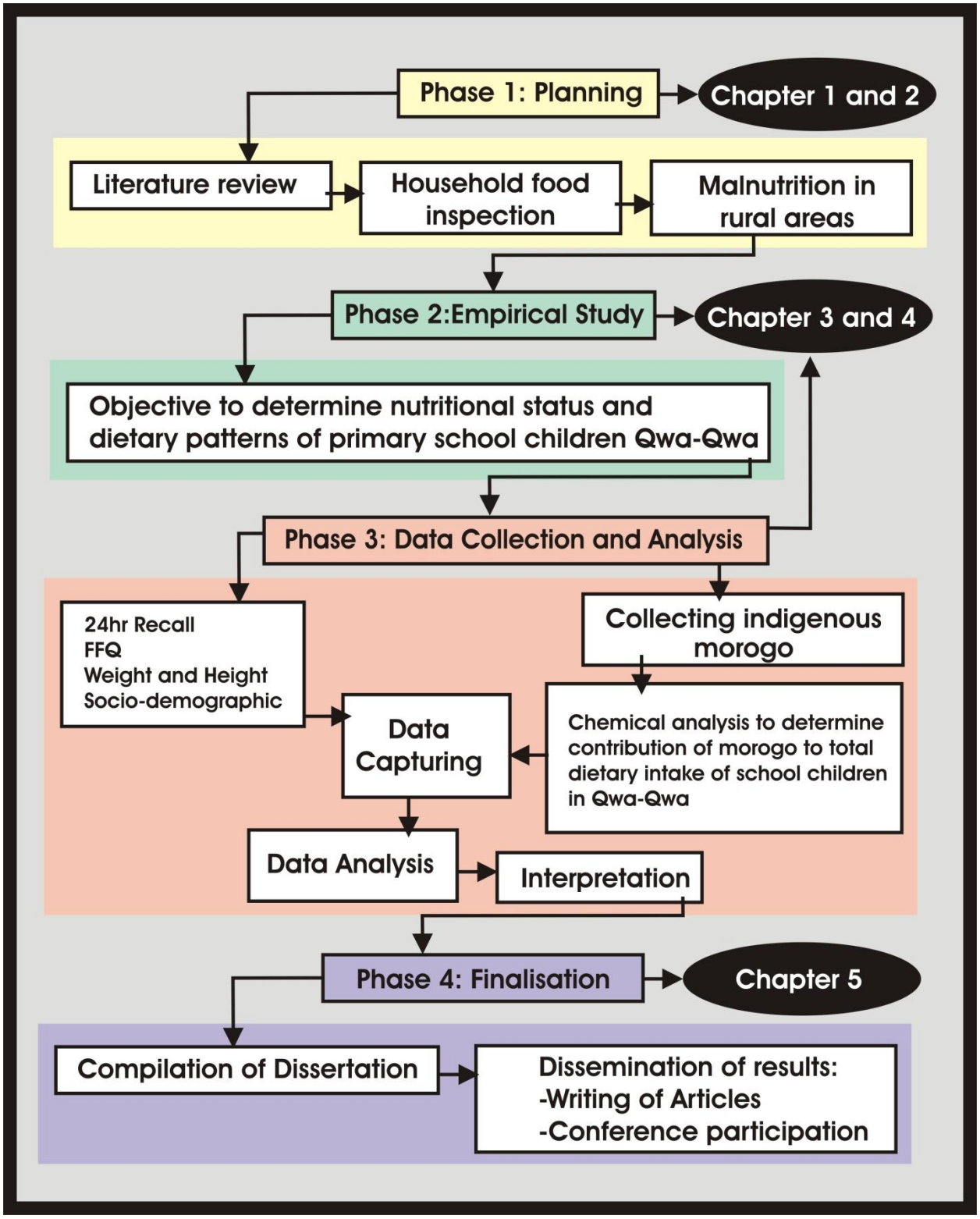

Figure 1 Conceptual framework of the study

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

In Chapter 1 the problem of malnutrition in children was discussed, with literature showing that it is a persistent problem in children globally, but specifically in the developing countries. This chapter will focus on the causes of malnutrition and the strategies adopted to address it globally and in South Africa.

2.2 CAUSES OF MALNUTRITION

In 1990, the United Nations Children's Fund (UNICEF) developed a framework for malnutrition as part of its nutrition strategy. This showed the causes of it and ultimately death to be multispectral and divisible into immediate, underlying and basic, as in Figure 2.1 (below). The framework also indicated that the factors on one level influence those on others and are thus interlinked. The framework is used as a guide to assess and analyse the causes of malnutrition and helps to identify the most appropriate interventions to address them (UNICEF 2004).

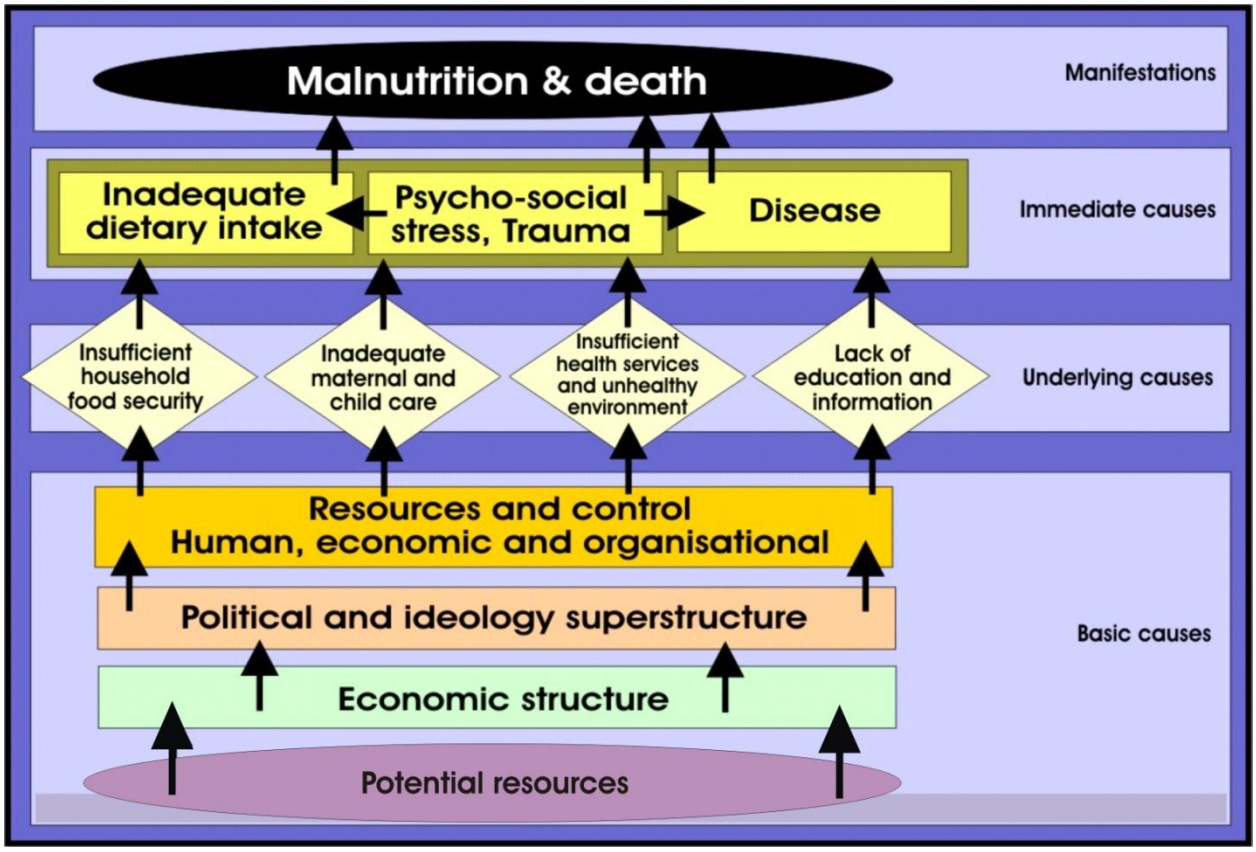

Figure 2.1 UNICEF framework of malnutrition (UNICEF 2004).

The UNICEF framework is a generic one in which specific information and causality of observed malnutrition can be entered at the immediate, underlying and basic levels, as appropriate for the specific situation being considered. It is a causality hierarchy as it allows an analysis of the causes which precede the obvious immediate ones of inadequate food and nutrition intake and possible confounding disease factors. Underlying factors are a range of situation-specific causes that can be clustered around food insecurity or inadequate access to food, inadequate care of vulnerable children and inadequate control and prevention of disease, including adverse environmental and sanitary conditions. However, there are more fundamental and cross-cutting problems at the society level. The potential available resources, which are natural, financial,

organisational or human, are not always used in the best interests of those in need (Maunder, Khoza, Kuzwayo & Edie 2008: 5-6). Their use is determined by the prevailing economic, ideological and political conditions. The reason for developing the framework was to create a revolutionary breakthrough in understanding and to address nutrition as a community and social issue.

This framework allowed the science and practice of nutrition to enter the broader debate on development, both internationally and nationally (Maunder, Khoza, Kuzwayo & Eide 2008:5-6).

The underlying cause of under-nutrition is poverty, with inadequate care, poor access to health services and poor environmental conditions being crucial components in inaccessibility to nutritious food are the underlying causes of malnutrition (Ramakrishnan & Huffman 2001). Environmental factors, including geographical location of households, can cause some of the children to be under-nourished. Rural areas are often dry, with poor water supply, and it is therefore difficult to grow any vegetables except during the rainy season. Households are therefore forced to purchase food. There are more undernourished children in rural than urban areas because of the poor infrastructure, with poor water and sanitation, lack of electricity and poor education facilities (Kruger, Hendricks & Puoane 2008:665). The immediate causes of under-nutrition are inadequate food intake and diseases which influences the nutritional status of children. Food insecurity in households and the community is the main cause of under-nutrition, leading to inadequate energy and micronutrient intake. Poor environmental sanitation and access to clean water lead to diseases such as diarrhoea and other infections that interfere with a child's appetite and food absorption. This also affects the nutritional status of children (Kruger, Hendricks & Puoane 2008:666).

2.2.1 Immediate causes

The immediate causes of under-nutrition may relate to disease, diet, psycho-social stress and trauma, to be examined in detail in this section.

2.2.1.1 Disease

The mortality rate for children aged 5-14 years differs from the under-five age group. In South Africa, mortality occurred more in boys (6.6%) than in girls (5.7%) at this age at national level (STATSSA 2012), and from one province to another. Accidents and injuries, such as fire, drowning, and murder, are the main cause of death in boys, whilst for girls it is HIV and AIDS, followed by accidents and injuries. In this age group conditions such as diarrhoea, respiratory infection, bacterial meningitis, tuberculosis and septicaemia are also causes of death (Bradshaw & Nannan 2006).

- HIV and AIDS

The Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) epidemic is one of the greatest threats to the realisation of children's rights in South Africa, and, more broadly, sub-Saharan Africa (SSA). The country currently has more people infected with HIV than any other in SSA or the world, mostly women and children (Bradshaw *et al*. 2002).

In 2009, on World AIDS Day, the South African president announced that all children below the age of one should receive treatment if they tested positive, regardless of the level of their CD4 count. Pregnant women a with CD4 count of 350 or with symptoms regardless of CD4 count received treatment from April 2010. The country had 5.2 million people living with HIV and AIDS, of whom about half a million had been newly affected in 2009. The disease has a high prevalence level, including 29 percent of pregnant women attending antenatal clinics and 17 percent of all adults. However, the prevalence rates have decreased among children and teenagers. Globally, South Africa has the highest number of people receiving treatment with antiretroviral drugs (ARVs). Around 76,000 children under the age of 15 received treatment in 2009 (UNICEF 2009a), with

the United Nations Programme on Acquired Immune Deficiency Syndrome UNAIDS & WHO 2007) reporting that it was one of the countries with the highest number of people living with HIV and AIDS (PLWHA), at approximately 5.5 million.

Both HIV and AIDS can increase vulnerability to food insecurity, as the pandemic exacerbates food insecurity by acting as a long-term stressor that affects the economy of the affected household members. The situation directly reduces their ability to seek a job, negatively affecting income and the means to purchase food for family members. Furthermore, household food gardens are often impacted upon as the disease progresses due to loss of income and capacity to work. Caregivers of HIV-infected children are affected as they have to reduce the time they spend on food production or in employment and the demands for care increase over time (UNICEF 2009a). Thus, the ability to provide adequate food and nutrition for children is compromised. The ARVs also increase the appetite of the HIV-infected individual and results in other members of the household having to consume less food, thereby worsening an already precarious situation. Food insecurity increases one's exposure to HIV and AIDS and decreases the ability to cope with them. Women and girls from food-insecure households become more vulnerable to infection as they engage in illicit sexual activities to generate money to purchase food for household members (UNICEF 2009a).

Across SSA an estimated 80 percent of young people between 15 and 24 are living with HIV, girls and women being the worst affected. Globally, over 60 percent of young people living with HIV are young women and in SSA 70 percent of young people living with HIV are young women (UNICEF 2010).

Any infectious disease will influence nutritional status by increasing the use and excretion of protein and micronutrients as the body fights the infection. The micronutrients mainly affected are the antioxidant vitamins E, C and A, as well as iron, zinc, selenium, manganese and copper. Furthermore, any nutrient deficiency will reduce the body's ability to fight infection. The relationship between malnutrition and HIV and AIDS is more complicated and results in a vicious cycle of immune dysfunction, infectious disease and malnutrition (Piwoz & Preble 2000), as shown in Figure 2.2 (below).

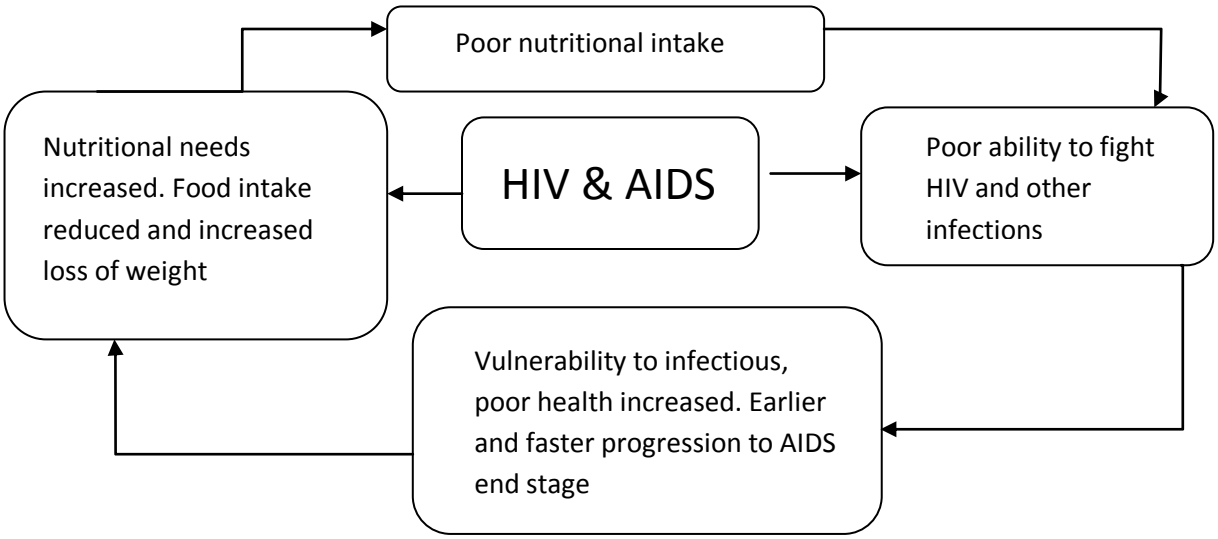

Figure 2.2 The cycle of nutrition and HIV& AIDS (WHO & FAO 2002)

HIV attacks the body's immune system, compromising its ability to fight infections and opportunistic diseases such as influenza, diarrhoea, pneumonia, tuberculosis (TB) and certain cancers. HIV eventually makes the body so weak that it cannot fight any sickness and the person dies (DoE 2003). Malnutrition and weight loss are common problems associated with the disease.

Malnutrition can result from a loss of appetite and poor dietary intake due to depression, fatigue, illness or side effects of medication. Malnutrition in children is particularly serious because they are still growing and developing, placing even higher energy demands on their bodies and immune systems and leading to growth retardation. The reason for this can be multifactorial, including poor socio-economic conditions, poor nutritional intake, mal-absorption and the disease itself (Zafonte 2002).

- ❖ Tuberculosis (TB)

Tuberculosis (TB) is primarily a pulmonary disease, but it has many manifestations, such as affecting bones, the central nervous system, and many organ systems (Naude, Labuschange & Labadarios 2008:762). In 2004, it was the most commonly identifiable disease in South Africa, with an estimated incidence of 718 per 100,000 population

(Bradshaw & Nannan 2006). Tuberculosis and HIV are the major global public health challenges (UNAIDS & WHO 2007), both of which could result in serious public health problems, impacting on the individual, community, and national level and violating the right of all citizens to health and wellness. The government provides treatment at no cost (Mclnerney *et al*. 2007).

TB can be prevented by avoiding contact with infected people and foods; the use of pasteurised milk; following an adequate and nutritious diet; comfortable living areas; and sufficient daily rest (Oldewage-Theron & Fuller 2008:659). Malnutrition has been associated with a predisposition to TB and vice versa, because some of the key signs and symptoms, such as wasting, anaemia, and loss of lean and fat mass, are also signs of malnutrition (Schwenk & Macallan 2000). Malnourished people are affected easily by TB and malnutrition has cognitive and behavioural effects that could increase the risk of being effected (Naude, Labuschagne & Labadarios 2008:768).

Children from birth to 15 years old often go undiagnosed with TB because of the lack access to health services, or the health workers who care for them are not qualified to recognise the signs and symptoms of TB in this age group (WHO 2012). The WHO reported (2012) that every year thousands of serious illness and death amongst children from TB could be prevented with better training and harmonisation of different healthcare programmes. In most countries, TB remains a hidden epidemic and most children are left behind, with many families affected by TB living in poverty and having little knowledge of the disease or (WHO 2012).

In many cases, when adults are diagnosed with TB no attempt is made to find out whether the children in the household also affected. Most children are infected by a parent or relative and it is important that those living with an adult with TB be screened by a health worker. Members of household who are not ill should be protected against the disease through preventive therapy with the drug *isoniazid* and infected ones should receive treatment (WHO 2012).

Dr Lucia Ditiu, Executive Secretary of the ‘Stop TB Partnership’ in WHO (2012) reported that an average of 200 children die every day from TB in the world, while it costs less than 3 cents a day to provide therapy that would prevent children becoming ill with TB,

and 50 cents a day for treatment that would cure the disease. Children with risk of TB should first be diagnosed, but this requires governments, civil society and the private sector to work together. Part of the problem is the TB can be hard to diagnose (WHO 2012).

Three key actions of WHO and the 'Stop TB Partnership' are needed to improve TB care and prevent TB deaths in children:

1. All children who have been exposed to TB through someone living in the same household with them should be screened.
2. People who are ill or living with HIV need to be treated for TB immediately if they have typical signs and symptoms, even if a definitive diagnosis is unavailable.
3. Children who are at risk of TB but are not ill with the disease must take drug isoniazid as preventive treatment.

Health workers who care for pregnant women, babies, and children should be trained to check patients for TB risk and signs, and if necessary refer them for TB preventive therapy or treatment (WHO 2012).

TB most commonly affects the lungs but can also affect other parts of the body. Infants and young children are at risk of having severe forms, such as TB meningitis, which can leave them blind, deaf, paralysed or mentally disabled. Each year at least half a million babies and children become ill with TB and as many as 70,000 are estimated to die of the disease. Children with severe malnutrition, a compromised immune system, and/or who are under the age of three are at greater risk of developing TB (WHO 2012).

- ❖ Acute respiratory infection

Pneumonia is a form of acute respiratory infection that affects the lungs and is the largest cause of death in children worldwide. It is estimated that, globally, 1.4 million children (18%) below the age of five die from it. It is more prevalent in South Asia and SSA but can be prevented by simple interventions, or treated with low-cost, low-tech medication and care (WHO 2011b).

The disease is caused by number of infectious agents, such as fungi, virus and bacteria that are commonly found in a child's nose or throat, and can infect the lungs if inhaled. Viruses and bacteria may spread via air-borne droplets from coughing or sneezing and through blood, especially during and shortly after birth. The child immune system may be weakened if a child is not breastfed exclusively, or is suffering from undernourishment or malnutrition. Adequate nutrition of exclusive breastfeeding for six months can prevent it. Hygienic practices should be encouraged in crowded homes and the use of a clean indoor stove also play a role in preventing pneumonia (WHO 2011b).

The symptoms of pneumonia include rapid or difficult breathing, coughing, fever, chills, loss of appetite and wheezing (WHO 2011b). In South Africa, in 1998, 19 percent of children below the age of five were identified by the South African Demographic and Health Survey (SADHS) as having low respiratory tract infection (DoH2007b). The highest prevalence was in KwaZulu-Natal, Free State, Gauteng and Mpumalanga, with children under age of 2 mainly infected, and 75 percent being taken to health facilities (Labadarios, Dhansay & Hendricks 2008:132).

- Diarrhoeal disease

Diarrhoea is common in developing countries and affects the nutritional status of children (Swart & Dhansay 2008: 419), accounting for four percent of all deaths globally and five percent of health disabilities (WHO n.d a). The most common source of diarrhoea in the developing world is contaminated water, but it can also be spread through poor personal hygiene and contaminated food (Swart & Dhansay 2008:419). Diarrheoa is the passage of three or more loose liquid stools per day, or more frequently than is normal for the individual. Disease occurs when normal electrolyte and water transport within the intestine is upset in favour of net secretion. The two disorders of diarrhoea are acute diarrhoea, which lasts less than 14 days and is most caused by infections, and chronic diarrhoea, which lasts longer than 14 days and often results in secondary infections in the presence of malnutrition or congenital digestive defects (Thapar & Sanderson 2004). Young children and those who are malnourished or have

impaired immunity are at risk of contracting diarrhoea and its resultant fluid loss, which can be life-threatening (Swart & Dhansay 2008:419).

Diarrhoea can be treated with three essential elements, namely rehydration therapy, zinc supplementation and continued feeding (Victoria *et al*. 2000; WHO 2005, n.d). The first treatment is the prevention and treatment of dehydration through rehydration with extra fluids to replace those lost through defecation and/or vomiting. Zinc supplementation reduces the duration and severity, and lowers the incidence in the following two to three months. Zinc supplementation has now been included as a new recommendation in the treatment of all children with diarrhoea (Swart & Dhansay 2008:420), and the child's usual diet should continue as feeding contributes to the repair of the intestinal mucosa and thus hastens recovery (WHO n.d(a)). Growth flattering occurs even when a child is given as much as food as possible during diarrhoea. The child should receive additional food, especially energy-dense foods after it has stopped, for a period of about two weeks, to correct under-nutrition and to achieve and sustain a normal pattern of growth. It is necessary to make regular follow-up checks of the child to ensure that weight can be monitored. Acute diarrhoea can be treated effectively at home, whilst severe diarrhoea with dehydration should be treated by the health services (Swart & Dhansay 2008: 420).

During the first two years of life, the nutritional status is compromised by the existence of diarrhoeal disease and prevalence of respiratory infections. Adequate nutrition mitigates the negative effect of diarrhoea on linear growth (Swart & Dhansay 2008:421).The impacts of diarrhoea on nutritional status of children are proportional to the duration, whilst the effect of under-nutrition on diarrhoea is proportional to the degree of under-nutrition, being greatest when under-nutrition is severe (WHO. n.d a).

The causes of nutritional decline during diarrhoea are:

- Food intake being reduced by up to 30 percent as a result of anorexia, vomiting, and withholding of food, which may be based on traditional beliefs about the treatment of diarrhoea or incorrect recommendations (resting the bowel), or by giving food with reduced nutrient value, such as gruel or soup.

- When nutrient absorption is reduced by up to 30 percent, as the result of damage to the absorptive epithelial cells. Fat and protein absorption are more affected than carbohydrate absorption.
- When nutrient requirement is increased because of metabolic demands made by fever, and the need to repair the epithelium and serum protein lost through damaged intestinal mucosa (WHO. n.d a).

The absorption of vitamin A is reduced and large amounts are used from body stores during diarrhoea. It is a particular problem when diarrhoea occurs during or shortly after measles or in children who are malnourished. High dose of vitamin A is recommended to a child with diarrhoea. Iron (Fe) (60 mg elemental Fe/day) folic acid (100 mg/day) and vitamin B,C and D in multivitamin complex, copper and magnesium are recommended to be given for two weeks following diarrhoea (WHO 2005). The appropriate water, hygiene, and sanitation interventions have been found to reduce the incidence of diarrhoea by 26 percent and mortality by 65 percent (Thapar & Sanderson 2004).

❖ Malaria

Malaria is a common and life-threatening disease that occurs mostly in tropical and subtropical countries, of whom over half the residents may be infected and an estimated million or more children on the African continent dying each year from the disease. In South Africa, malaria was originally endemic in the low-lying northern and eastern areas, but in 1930 control measures were introduced. The disease still occurs in limited areas of the country, mainly in the low altitude (below 1000 m) areas of Limpopo, Mpumalanga and North Eastern KwaZulu-Natal. In the North West and Northern Cape provinces, along the Molopo and Orange rivers, the disease is limited. It is distinctly seasonal, with the highest risk being during the wet summer months of October to May (DoH 2003).

If possible, children below the age of five, pregnant women and immune compromised patients should avoid high-risk malaria areas, with mosquito nets covering beds to

protect against bites at all times in these areas (DoH 2003). Anti-malarial drugs should be kept out of reach of children, preferably stored in childproof containers. When a child develops a febrile illness, either in a malaria-infected area or after a visit, medical help must be sought immediately (DoH 2003). Provision should be made for emergency treatment within 24 hours once the symptoms occur. Self-treatment can be an interim measure (DoH 2003).

Guidelines for Personal protection against malaria are:

- Remain indoors between dusk and dawn
- Wear long-sleeved clothing, preferably light-coloured long trousers and socks
- Apply mosquito cream to the exposed skin; repeat as recommended on the container label; avoid eyelids, lips, sunburnt or damaged skin; do not spray on face and do not exceed the recommended dose young children
- Live in well-constructed and well-maintained buildings in the best-developed part of town
- Cover windows and doors with screens, but if not available close at night
- Use aerosol insecticide for flying insects at dusk, especially the bedrooms, after closing the windows
- Treat clothes with an insecticide registered for malaria, e.g., a pyrethoid (DoH 2003).

The following measures should be applied by residents of malaria infected areas:

- Build villages and houses away from marshy areas and water bodies, as these are potential larval breeding sites
- Make provision for optimum drainage of rainwater and household water near houses
- Install gauze screens in front of outside doors and windows of household
- Apply larvicides where water existing near habitations cannot be drained
- Apply Non-toxic long-acting insecticides onto interior walls

Personal measures should be used to minimise the risk of mosquito bites (DoH 2003).

Various clinical and drug-related factors need to be taken into consideration before visiting malarial areas, whilst pregnant women and breastfeeding mothers should not visit them as they are at significantly higher risk of developing the disease

Signs and symptoms of malaria, which develop 10 to 14 days after an infective mosquito bite, include fever, which is very common but may be absent in some cases, rigors, headache, sweating, fatigue, myalgia (back and limbs), abdominal pain, loss of appetite, nausea and vomiting and coughing. Young children present with fever, lethargy, poor feeding and vomiting in young children (DoH 2003).

2.2.1.2 Inadequate dietary intake

The dietary intake patterns for South Africa, as determined by the NFCS in 1999, showed that one out of two children, aged 1-9 years, had an intake of less than half the recommended level of energy as well as of a number of important micronutrients, with the situation worse in rural areas (Labadarios *et al.* 1999). The majority of children consumed a diet deficient in energy and of insufficient nutrient density to meet their nutrient requirements. South Africans consumed less than 67 percent of the Recommended Dietary Allowances (RDAs) of the nutrients: energy, calcium, iron, zinc, selenium, vitamins A, D, D, C, E, riboflavin, niacin, folic acid and vitamin B6. It was also found that one out of two households suffered from hunger, one out of four was at risk of hunger, and only one out of four appeared to be food-secure (Labadarios *et al.* 2000). Oelofse, Van Raaij, Benade, Dhansay, Tolboom and Hautvast (2002:289-294) reported that iron and zinc intake was low during infancy, whereas Faber and Wenhold (2007:396) found that complementary foods taken by infants in rural areas were also insufficient in nutrients, iron, zinc and calcium deficient intakes being the most common.

2.2.1.3 Psycho-social stress and trauma

Despite a world-renowned Constitution and legislative overhaul that supposedly safeguards women's and children rights, South Africa still has high levels of violence against women and children (UNICEF 2009a). In 2008/2009, around 50,000 children were victims of violent crimes (South Africa Police Services) sexual assault being the most frequent. A South African Labour survey estimated that around 850,000 children were engaged in some form of child labour, often of a hazardous nature or to the detriment of the child's full development. In UNICEF (2009a) the media have reported child trafficking, forced marriage and gang violence, all of which are harder to monitor. A high numbers of orphans have resulted from high prevalence of HIV and AIDS in South Africa (UNICEF 2009a). Many cause of death are HIV-related illnesses, which have left around 3.7 million of children without one or both parents, thus living with extended families and the stress this causes (UNICEF 2009a). Following the trauma of loss, the children are forced to play adult roles too early in their lives, causing them to skip school, attend healthcare facilities and suffer from lack of good nutrition (UNICEF 2009a).

2.2.2 Underlying causes of malnutrition

There are a number of underlying causes of malnutrition, dealt with in detail in this section.

2.2.2.1 Inadequate maternal and child care

Neonatal mortality can be reduced by around 20 percent when breastfeeding is provided, but only 39 percent of newborns in the developing world are put to the breast within one hour of birth (UNICEF 2009b). The three recommended breastfeeding practices are early initiation of breastfeeding, exclusive breastfeeding until six months of age, and continued breastfeeding up to one year age (WHO 2010a). In South Africa, in 2004, only 12 percent of infants less than four months were exclusively breastfed and 20 percent not at all (DoH, 2004). In Soweto, 57 percent of mothers breastfed their

children up the age of 24 months but only 38 percent of Johannesburg mothers, from a higher socio-economic bracket, did so. Higher breastfeeding rates were found in rural than in urban areas according to SADHS 1998, with the exception of the North West Province whereby the median duration of breastfeeding was 15-17 months (DoH 2001).

Breastfeeding is important for babies, contributing nutrition and health through a number of mechanisms:

- It provides all the nutrients required by an infant during the first six months of life, half during the second six months, and one-third in the second year
- It provides immunity and other factors to protect the child from illness
- It serves as a sustained source of nutrition during illness as breast milk is not reduced, whereas intake of complementary foods declines considerably during illness
- Exclusive breastfeeding reduces the risk of illness due to contamination of food or utensils
- By lengthening post-partum amenorrhea it prolongs a birth interval which is strongly related to infant and child survival.
- It improves cognitive development, as observed in preterm infants.
- It reduces the risk of obesity amongst schoolchildren (Swart & Dhansay 2008:413).

Maternal and child survival are closely connected, with healthy mothers required for the good health and growth of the child. Babies are dying or becoming orphans due to a high maternal mortality rate, last recorded in South Africa at 400 per 100,000 in 2005 and 625 per 100,000 in 2007 (UNICEF 2009a). The latest statistics from the United Nations (UN) estimated that one out of 250 women die during pregnancy or child birth, with 23 percent of all maternal deaths being from AIDS-related diseases and complications during pregnancy, particularly hypertension. Despite a high coverage of antenatal care, with 95 percent of births in hospitals and other medical facilities, deaths

still occur in pregnancy. South Africa provides primary healthcare for pregnant women and children under the age of six years for free (UNICEF 2009a).

Most maternal child birth complications can be prevented or treated if delivery is performed by skilled health personnel who are regularly supervised, have appropriate equipment and supplies, and can refer women in a timely manner for emergency obstetric care services when complications are diagnosed. Coverage of skilled attendance at delivery in all regions has increased since 1990. In SSA and South Asia, only half of the births are attended by skilled health personnel. Women from poor households are substantially less likely than those from richer ones to deliver with the assistance of a doctor, nurse or midwife (UNICEF 2010).

In the human life cycle, the childhood phase from birth to nine years is considered the most important (UNICEF 2006). Children must be ensured healthy nutrition and early learning in their child hood. A nurturing and secure family ensures development, protection, survival and participation in the family, along with social life, safe water, basic sanitation and protection from violence, abuse, exploitation and discrimination for environment conditions. Development services for early childhood need to be holistic and should attend to the child's health nutrition development, psycho-social and other needs (UNICEF 2006).

In South Africa, and internationally, research has shown that the early years are critical for development, passing on values that are important for building a peaceful, prosperous and democratic society (UNICEF 2006). However, despite the South African government being responsible for provisions for young children many parents cannot afford to raise children (UNICEF 2006). They need skills and confidence to provide psychological and emotional support, as well as financial assistance to ensure children's physical wellbeing, particularly of those affected by HIV and AIDS. Policies that do not discriminate against children affected or infected by HIV and AIDS are use in early childhood centres by educators and caregivers (UNICEF 2006). Toilet facilities that are safe for children must be available in early childhood centres, with meals provided at least once a day either by parents or the centre. When a child is ill care

must be taken, with action plans in place to deal with emergencies by all staff, families and the surrounding community (UNICEF 2006).

If a child is bleeding immediate attention is needed by applying pressure to the wound to avoid direct contact with blood. Thousands of children swallow dangerous things each year so precautions should be taken to keep medicine away from other products. Young children need to be taken to the clinic when they are ill as they cannot say exactly where the pain is or how they are feeling. A full course of immunisation according to a timetable should be considered. The immunisation and vitamin A doses must be received (UNICEF 2006).

2.2.2.2. Insufficient health services and unhealthy environment

In 2009, the DOH introduced three new vaccines to prevent the most common forms of pneumonia as an outbreak of measles affected more than 2,650 people. It raised a question with the District Heath Information System as to why 84.2 percent of children of less than one year in age had completed their primary course of immunisation in 2007 or 2008 (UNICEF 2008). Immunisation made a contribution to reducing child deaths, though disparities in coverage continue to be evident. It has been estimated that 2.5 million of children under the age of 5 are saved every year through immunisation for vaccine-preventable diseases. Measles deaths, estimated at 733,000 in 2000 and 164,000 in 2008 showed a reduction. The African continent saw a 92 percent reduction in measles death, but children in rural areas and those from poor households are less likely to be immunised (UNICEF 2010). The basic needs for children to live and grow are clean water and sanitation. The water must be of high quality to avoid water-borne disease and if sanitation is not good then disease spreads, resulting in diarrhoea, which kills more than does AIDS, malaria and measles combined. Hand washing and basic toilet facilities will help combat diarrhoea (UNICEF 2009b). For people to remain healthy, the food should be not only nutritious but also clean and safe for consumption (King & Burgess 2000; Whitehead & Orriss 1997). In addition, water for drinking or preparing food should be safe (FAO 2004; King & Burgess 2000).

Food-borne diseases are defined as those which are either infectious or intoxicating (i.e., caused by toxins), or caused by agents and germs entering the body with food or water. All people can be at risk of food-borne diseases (Whitney & Rolfes 2008; WHO 2007c). However, not all micro-organisms are harmful to the body. For example, those used for making sour porridge, cheese and yoghurt are good bacteria, the harmful bacteria being those in the gut of people with diarrhoea; in the gut of animals, mainly rodents, dogs, chickens and sometimes cows; or those that are harmless in small numbers, but which may increase when food is not handled properly, and which can then be harmful to the body (King & Burgess 2000).

Figure 2.3 (below) illustrates the spread of food-borne diseases. Poor hand-hygiene practices and viruses (not only bacteria) are seen as the most important risk factors for food-borne disease. In food contamination, bacteria growing on the food before it is eaten create toxins that may cause illness (Payne-Palacio & Theis 2004).

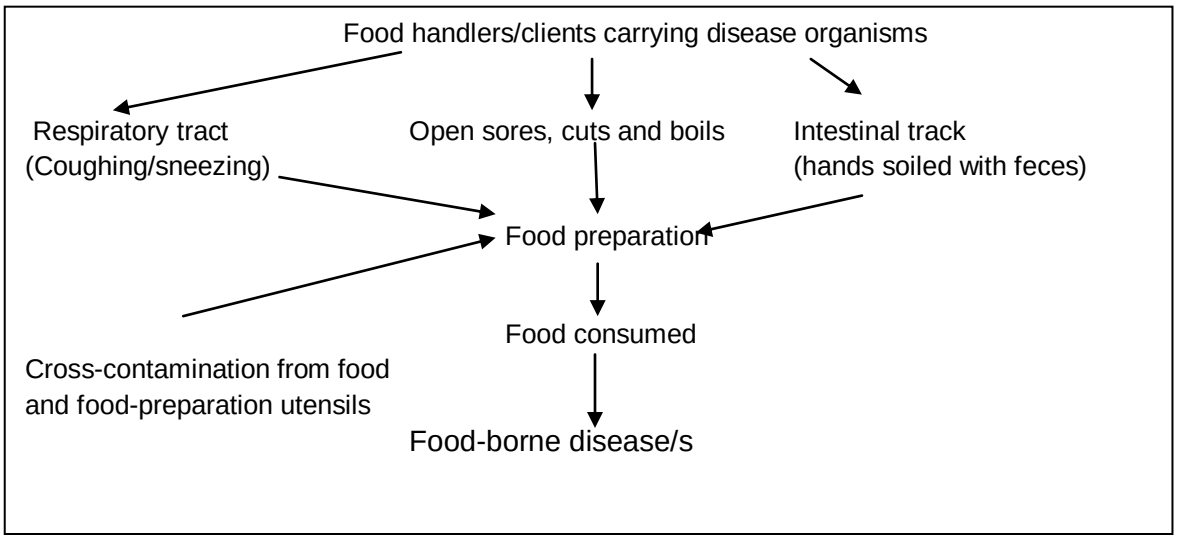

Figure 2.3 The spread of food-borne disease

To prevent the many food-borne illnesses that can be the result of contaminated foods, food safety and hygiene are very important at home and at school, as well as in shops, supermarkets and restaurants or street stalls where food is bought and sold.

Climate change is believed by some to be the most urgent and alarming threat to the environment, threatening disruption to the very context in which children live and develop. Environmental degradation, loss of important natural resources and the conditions that undermine food and water security are threatening 56 countries with climate-exacerbated strife (UNICEF 2011). Change of climate is thought by some to be of increased frequency and severity, with an impact not only on the health and nutrition of children but also their education and development. For instance, households that lose their livelihood during a drought may fail to send their children back to the school or pay for healthcare (UNICEF 2011).

Climate change needs collective actions that bring together sustainable development, energy security, and actions to safeguard children‘s health and wellbeing. Children are mostly affected by the deteriorated environment and become effective agents of change for the long-term protection and stewardship of planet earth, if they are provided with knowledge and opportunity (UNICEF 2011). At times of natural disaster children are most vulnerable as they will suffer from disease, food shortages, poor water and sanitation, interrupted education and family separation or displacement. Children should be an integral part of all international frameworks and national programmes implemented to counter climate change (UNICEF 2011). Global climate change allegedly destroys the ability to grow a variety of foods required for providing the children with balanced and nutritious meals. Global warming puts mental development and physical ability at risk. It also affects cultural, social and financial costs and affects children’s rights to the standard of living adequate for their physical, mental, spiritual, moral and social development (UNICEF 2011).

2.2.2.3 Lack of education and information

The South African government has prioritised girl’s education, resulting in more enrolling in primary schools than boys, and early childhood development (UNICEF 2009a). In 2008/2009, the government spent more resources on the education, at around 5.4 percent of gross domestic product (GDP) (UNICEF 2009a). The ability and desire of children to learn is however undermined by the poor quality of the education,

irregular attendance, absent teachers, pregnancy of teenagers and abuse around schools. The high poverty level has denied thousands of children access to quality education. Close to 27 percent of public schools do not have running water, 78 percent are without libraries and computers and only 16.9 percent of children aged five have access to day care, crèches, preschools and early childhood development centres.

In 2008, UNICEF estimated that over 100 million primary school aged children were out of school, including 33 million in South Asia, 25 million in West and Central Africa, and 19 million in Eastern and Southern Africa. SSA has the lowest rate, with only 60 percent (UNICEF 2010). On the other hand, more than 60 developing countries have at least 90 percent of primary school aged children in school.

Twenty percent of children from the poorest households have less chance of attending primary school than the 20 percent from the richest household, according to data from 43 developing countries. 80 percent of children in urban areas are at school, compared to only 72 percent in rural areas, according to data from 43 countries (UNICEF 2010). Globally, 84 percent of primary-school aged children are in school (UNICEF: 2010). Girls are still at a disadvantage in SSA, with poor households in rural areas having lager gender disparities in primary school than urban areas (UNICEF 2010).

2.2.2.4 Insufficient household food security

In South Africa, food insecurity still affects a large proportion of the population though it shows that national food supply may be sufficient in a country. The national or sub-national level supplies sufficient food, but does not necessarily guarantee adequate access of food at household level. According to Statistics South Africa, a ‘household’ may be a single person living alone or a group of people living together and providing themselves jointly with food and/or other essentials for living (STATSSA 2003). Malnutrition and food security are highest in rural populations of provinces such as KwaZulu-Natal, Northern Cape, Eastern Cape and Free State (DoA 2002). The primary concern for food security is access to food which is nutritionally safe by the household, and is a prerequisite for adequate dietary intake. The adequate income and assets, including land and productive resources, enable households to produce, purchase or

obtain through transfers enough nutritionally adequate food to meet the nutritional needs of all members (Kuzwayo 2008:164). Poor nutrition status results from food insecurity. A multi-pronged approach should be considered in order to improve the nutritional status and food security of South Africans (DoA 2002).

At the World Food Summit (WFS) held in Rome in 1996, 186 nations committed themselves to reducing by half the number of undernourished people by 2015 (FAO 1996). Global food supplies are more than adequate to meet the world population's energy or calorie needs if distributed equally (IFPRI & FAO 2008). Worldwide, about 862 million people were undernourished according to FAO data in 2003. In developed countries the figure was 9 million, with 25 million in transition and 820 million in developing countries (FAO 2006). The undernourished rate proceeded slowly to meet the 1996 WFS goals in halving the number of undernourished people from 1990 to 2015, but progress of the MDG target to cut proportion of people living with hunger to half of the 1990 level by the same year was uneven (FAO 2006). An overall reduction in both the numbers and proportion of undernourished people since the 1990s at the regional level, Asia, the Pacific, Latin America and Caribbean has been reported, unfortunately it has fallen short of achieving the MDGs. South Asian outside India, Eastern Africa and the near East have large numbers of undernourished people, while overall the number increased from 200 to 209 million in SSA (Kuzwayo 2008:177).

2.2.3 Basic causes

Political, legal and cultural factors may defeat the best efforts of households to maintain good dietary practices (UNICEF 1998), including laws dealing with the protection of women and children, the political and economic system and the ideologies and policies that govern the social sectors. School feeding and food subsidisation was introduced in 1938, with free milk in school given to White and some "Coloured" primary schools (DoH 1994). In the 1940s, the Nutrition Council recommended that certain foodstuffs be subsidised, including bread in 1991. The nine basic foodstuffs were exempt from value-added tax (VAT) introduced in 1992. Nineteen foods have been exempted from VAT since 1994, namely brown bread, maize meal, samp, rice, dried mealies (maize), dried

beans, dried lentils, tinned pilchards/ sardines, edible legumes and pulses, ,ilk, milk powder, diary powder blend, cultured milk, vegetables and fruit, eggs, and brown wheat flour (DoH 1994).

Parliament rejected the proposal of the Nutrition Council for fortification of maize meal in 1948, but milling companies began voluntarily enriching maize meal with niacin and riboflavin in 1975. This practice was largely unknown because the companies were not subjected to control (DoH 1994). The Department of Nutrition was established under the Ministry of Health to embark on a variety of schemes to improve food production and quality of diets. Policies favoured Whites and disadvantaged Blacks through food aid. In 1960, the Department of Nutrition was disbanded because of poor planning schemes and lack of coordination with other departments (Behr 2008:35). The situation partly reflected the diminished significance of malnutrition and the rapid economic advancement of Whites (DoH 2005).

Following a change in political regime, in 1994 the new government undertook to address malnutrition as one of the key priority issues. President Nelson Mandela announced the implementation of a “Nutritional feeding scheme in every primary school where a need is established” (24 May 1994, State of the Nation Address) (Behr 2008:39). The new government implemented the Primary School Nutrition Programme (PSNP) as one of the 100-day Presidential Lead Projects of the Reconstruction and Development Programme (RDP), the first policy document of the new government and one that provided a strategic framework in action to achieve food security and equality for previously marginalised sectors of the population (Behr 2008: 39).

PSNP was designed to contribute to improving the health and education of primary school learners by alleviating hunger, enhancing active learning capacity, improving school attendance and punctuality, addressing micronutrient deficiencies, improving knowledge and the practice and control of parasitic infections (Behr 2008:39). In was meant to enhance broader development initiatives by involving community and parent groups as well as small, medium, and micro-enterprises as food and service suppliers (Behr 2008 39). INP is based on the recommendations of the Nutrition Committee appointed by the Minister of Health in August 1994 to develop a nutrition strategy for the

country (DoH 1997). The committee recommended an Integrated Nutrition Strategy (INS) with three components, namely: health facility-based services, community-based nutrition programmes and nutrition promotion, in considering the multi-sectoral and complex cause of malnutrition. INP's vision was optimal nutrition for all and improving nutritional status through implementing integrated nutrition activities. It combined direct and indirect nutrition interventions to address the causes of malnutrition.

2.2.3.1 Human rights

One of the obligations of the DOH is to ensure that nutrition security is respected, protected, and fulfilled as a basic human right, with food security, health security, and care security being incorporated into nutrition security (Behr 2008:40). Primary Health Care is based on practical, scientifically sound and acceptable methods made universally accessible to individuals and families in the community through their full participation and at a cost that is affordable (Behr 2008:41).

The INP implemented the integral part of the PHC approach within the District Health System (DHS) whilst RDP provided a strategic framework for action to achieve nutritional security. The integrated approach of the RDP to improve the quality of life for all South Africans, particularly the poor and those who had been marginalised, provided a context within which programmes for improving nutrition could be implemented and coordinated (Behr 2008:41).

2.2.3.2 Political and ideology superstructure: Nutrition policy

The new government identified malnutrition as the first key priority issue that needed to be addressed. The UNICEF framework (Figure 2.1) was adopted with the development of the INP to tackle malnutrition. In 1994, President Mandela announced to implementation of "A nutritional feeding programme in every primary where such need has been established and the democratic government implemented the Primary School Nutrition programme (Behr 2008: 39).

The population of South Africa children is close to 19 million, many of whom are vulnerable, living in households with unemployed parents or a single parent, or chronically sick or elderly parents. Other children are caregivers and two-thirds of those children leave in poverty. Poverty is greater because the country has a high rate of AIDS and unemployment and poor service delivery, creating hardship for many households. Over the past 15 years much effort has been given to improving the welfare of children and their families. Successive governments have attempted to address poverty through a social grants system, which supposedly increased every year (Labadarios, Dhansay & Hendricks 2008:113), from 2.5 million in 1998 to 13 million in 2009. Significantly for this study, the grants also reached nine million children below the age of 15. However, children's survival, development and protection are still subject to wide inequalities in society. The Western Cape was the highest in terms of economic growth rate of all provinces between 1996 and 2006, with an average of 3.7 percent, while the Northern and Free State had the lowest rate at 1.9 percent (Labadarios, Dhansay & Hendricks 2008:113).

The high levels of unemployment and vulnerable employment were exacerbated by the global financial crisis, as in 2008 and 2009 almost 4 percent of the world's workers were at risk of falling into poverty. Children from poorer households who spend most of their income on essential items such as basic foodstuffs, lack access to social safety nets or adequate savings to lessen economic shock. In 2008 and 2009 high food prices and real household income reduced consumer purchasing power and consumers from poorer households had less money to spend on food. The poor households in rural areas found themselves with fewer economic opportunities and less access to core services. Economic hardship among poor households could have lifelong consequences for children who miss out on essential healthcare and education, and could hinder overall economic growth in the long term (UNICEF 2010).

Despite the growing population in developing countries, poverty levels remain high. The number of people living on less than US$1.25 a day declined from 42 percent of the population in 1990 to 25 percent in 2005 in developing countries around the world. Developing countries is estimated to reach a target of 21 percent of people living on less than US$ 1.25 a day by 2015 (MDG 2011). However, economic performance has

not brought a significant reduction in poverty among the African population, even though it has contributed significantly to the global economic growth. Due to an increase in food, fuel and financial crises between 2006 and 2008, it is still difficult to reduce poverty and achieve the MDGs (MDG 2011).

2.3 GLOBAL STRATEGIES TO ADDRESS MALNUTRITION IN CHILDREN

There are several strategies in place to combat child malnutrition, dealt with in this section.

2.3.1 Food fortification

Food fortification is a sustainable and cost-effective medium- to long-term strategy in developing countries to improve micronutrient status at-risk populations. In order for food fortification to be effective the foodstuff needs to be consumed in constant and significant quantities by most members of the target group. It also needs to retain appropriate levels of the fortification during the processing, cooking, and storage, and there should be no changes in the organoleptic properties of colour, taste and appearance. Collaboration is needed between government and the food industry to develop an affordable strategy for the target sample (Kruger, Hendricks & Puoane 2008:683). A quality assurance system that regularly monitors micronutrient levels to ensure that the fortified product contains the specified micronutrient concentration at the time of consumption needs to be included in the programme (FAO & International Life Science Institute ILSI, 1997).

Guatemala and other Central American countries, such as El Salvador and Honduras, have had extensive experience and success in fortifying sugar with vitamin A, with significant reductions achieved in the proportion of preschool children suffering from deficiency (FAO & ILSI), 1997). Fortified sugar was found to be two to four times more cost-effective in reaching beneficiaries in adequate amounts compared to vitamin A supplementation in Guatemala (Phillips *et al*. 1996). In the Philippines, fortification of

margarine and wheat flour has also been found to improve the vitamin A status (Ramakrishnan & Huffman, 2001).

In South Africa, after the NFCS, the Department of Health was provided with information on the most commonly consumed foods and the average portion size at national level. The five most commonly consumed foods were maize, sugar, tea, whole milk and brown bread. Maize meal porridge is fortified with iron and other micronutrients to improve the iron status and motor development of infants aged 6-12 months (Faber *et al* 2005). In 1995 and 2003 regulations for mandatory iodization of salt and fortification of maize meal became effective. According to percentage of the RDA, fortified maize meal and the wheat meal flour is to provide a child of ten years and above with the following: 200g raw maize meal or wheat with vitamin A 31 percent, thiamine 25 percent, niacin 25 percent, pyridoxine 25 percent, folate 50 percent, riboflavin 17 percent (from maize meal 20 percent from wheat flour), iron (25 percent from unsifted maize meal and 50 percent wheat flour) and zinc 20 percent (Labadarios 2007).

Food fortification is one of the programmes implemented by the DOH to address malnutrition in South Africa, and provides nutrients to a large population without requiring radical changes in consumption patterns. Food fortification can reduced micronutrient malnutrition when existing food supplies have limited access and fail to provide adequate levels of certain nutrients in the diet (Labadarios 2007). Food fortification plays a role in reducing vitamin A and iron deficiencies (WHO & FAO 2006), and is an effective way of decreasing deficiency diseases and increasing nutrient intake. Programmes of fortification are used to increase the intake of nutrients around the world (WHO & FAO 2006). Fortification of food with vitamins and minerals is the most effective method of improving health and preventing nutritional deficiencies such as pellagra, beriberi, rickets and goitre (John 2005:1). Developing countries use a fortification strategy to reduce malnutrition diseases, with industries able to expand markets and profits while playing a key role in improving the health and nutritional status of the population. The public and private sectors should work closely to understand and recognise each other's interests and concerns for the programmes to be effective and sustainable (Reddy *et al*. 2007:91).

A disadvantage of food fortification programmes, however, is that they require a suitable food vehicle, since some populations are hard to reach with commercial fortification, especially those living in remote geographic and not used to purchasing foods (Horton 2006:1068-9). Fortified foods are targeted at vulnerable and low-income groups (Delange *et al*. 2001: 437), Fortification may include toxicity, and cause nutrient imbalance because of the plethora of the products available. The risk of exceeding the tolerable intake level of some minerals and vitamins increases (WHO & FAO 2006).

The shelf life of milled cereals such as ground sorghum, wheat flour and maize meal may be reduced. During baking cereal, most vitamins are destroyed though nutrients that are more stable might exhibit smaller reductions. The process of fortification only works well if there are widespread deficiencies such as iron and/or if the cost of the fortification is not too high (Horton 2006: 1068-9).

2.3.2 Supplementation

Supplementation is the provision of relatively large doses of micronutrients in the form of pills, capsules or syrups. It is capable of supplying an optimal amount of a specific nutrient or nutrients in a highly absorbable form and is fastest way to control deficiencies in individuals or populations groups that have been identified as deficient. Supplementation is used more to provide iron and folic acid to pregnant women, vitamin A to infants and children under the age of 5, and postpartum women in developing countries (WHO & FAO, 2006).

Supplementation is an interim strategy to reduce micronutrient deficiencies in sample populations until more medium- to long-term measures such as dietary diversification and food fortification are established (Kruger, Hendricks & Puoane 2008:685). It may be targeted at populations that may adequately be covered by food diversification and food fortification programmes, once the latter are in place. Supplementation is provide to the target group of populations with xerophthalmia, severe under-nurtition and diseases such as measles, malaria, diarrhoea, and acute respiratory infection (Kruger, Hendricks & Puoane 2008: -685).

Supplementation is very specific treatment and can improve the educational abilities of children with learning difficulties, whilst preparation time of food becomes less and supplementation is sustainable (Karim *et al*. 2005:2). Disadvantages of food supplements include a necessity to choose with care what the nutrient needs are and ensure the risk of toxicity is minimal. Supplements are more costly than other measures and not all can be in the form of a tablet, thus leading to overdosing with dangerous adverse effects. Other vitamins, such as vitamin C need to be distributed frequently because they are not adequately stored in the body

Vitamin A deficiency is one of the most common micronutrient deficiencies in the world, including South Africa. The purpose of the administration of supplementation in the form of a high-dose vitamin A capsule to infants 0–11 months, children 12-60 months, pregnant women and all post-partum women, is to reduce child mortality and improve maternal health (Moeng & de Hoop 2008).

2.4 STRATEGIES TO ADDRESS MALNUTRITION IN CHILDREN IN SA

Community-based food and nutrition programmes focus on nutrition-related objectives, such as reducing the prevalence of malnutrition in broad terms or, more specifically, programmes relating to specific nutrients or nutrition activities (Ismail *et al.* 2003).

2.4.1 Integrated food security and nutrition programme

In 2002, the Department of Agriculture (DoA) launched an Integrated Food Security and Nutrition Programme (IFSNP) in response to food security being part of Section 27 of the Constitutional Bill of Rights, which states that, together with other rights, “every citizen has the right to have access to sufficient food and water”, and that it is the state’s responsibility “by legislation and other measures, within its available resources, to achieve the progressive realization of these rights”. The vision of the IFSNP was to achieve widespread physical, social and economic access to sufficient, safe and nutritious food for all South Africans, to meet their daily dietary needs and food choices for an active and healthy life (DoA 2002).

The goal of the IFSNP was to eradicate hunger, malnutrition and food insecurity by 2015, some of the strategic objectives being to increase household food production and trading, improve income generation and job creation opportunities, improve nutrition and food safety and increase safety nets and food emergency management systems.

The following government departments are stakeholders of the IFSNP:

- Social Department for Food Security – DoA
- Community Development Programme – Department of Public Works
- Integrated Nutrition and Food Safety Programme – DoH
- Comprehensive Social Security Programme – Department of Social Development (DoSD)
- Information and Communication Programme – Statistics South Africa
- Food Security Capacity-building Programme – all government departments
- Food Security Stakeholder Dialogue Programme – all government departments (DoA 2002).

The IFSNP has a number of programmes in place, including food parcels, food production, improving maternal, infant and child nutrition, school feeding, and micronutrient malnutrition control.

2 4.1.1 Food parcels

Distribution of food parcels were introduced in 2002 by the cabinet for vulnerable sections of the population. This was a short-term measure, managed by the DoSD's National Food Emergency Scheme, to assist poor people who were able to spend less than R300 per month on food. The specific beneficiaries of this scheme were children and child-headed households, orphaned children, people with disabilities, female-headed households and HIV and AIDS-affected households (Moeng & de Hoop 2008: 290).

2.4.1.2 Food production

A food production programme aims to alleviate hunger and poverty, and to provide families with a variety of foods in order to address micronutrient deficiencies (Moeng & de Hoop 2008: 291). It includes the National School Nutrition Programme (NSNP – Refer to Part 7 of the Nutrition Education Guidelines Manual B: NSNP workers), the Integrated Nutrition Programme (Refer to Section 3.6.3) and the Food Emergency Relief Programme (Moeng & de Hoop 2008: 292).

2.4.1.3 Improving maternal, infant and child nutrition

The aim is to reduce malnutrition in children under five, as well as in pregnant and lactating women, through education of the target groups on practices promoting health in communities and by support initiatives aimed at increased food production. The focus of this education is on:

- Household food supply
- Diet diversification - changing the dietary patterns to include more variety in the diet (Refer to Part 5 on Healthy eating habits of children), more frequent feeding of young children, use of iodized salt and enriched/fortified cereals.

- Health - birth spacing, immunisation, de-worming, promotion of exclusive breastfeeding for the first six months and for two years at least, growth-promotion, hygiene.
- Household care - literacy and numeracy, reducing women's workload, community production of supplementary foods (Moeng & de Hoop 2008).

2.4.2 Micronutrient malnutrition control

Control of micronutrient malnutrition may be helped by salt iodisation (adding iodine to salt), legislated for in the Act on Foodstuffs, Cosmetics and Disinfectants (Act 54 of 1972) (RSA 2007) to alleviate iodine deficiency. Fortification is the addition of one or more nutrients to foods, with the main aim of increasing the level of consumption of the added nutrients in order to improve the nutritional status of a specific population. Legislation on the fortification of wheat flour (white and brown bread) and maize meal, under the regulations of the Act on Foodstuffs, Cosmetics and Disinfectants (Act 54 of 1972) (RSA 2007), came into effect in October 2003, and these products must now carry the fortification logo on the packaging.

The contribution that fortification of maize and bread may make to the total nutrient intakes, measured as the Recommended Dietary Allowances (RDA) of persons 10 years and older, is indicated in Table 2:4 (below) (Moeng & de Hoop 2008).

Table 2.1: Contribution of fortified products to RDA for persons 10 years or older (Moeng & de Hoop 2008).

Micronutrient	% RDA per 200g raw maize meal	% RDA per 200g raw wheat flour
Vitamin A	25%	25%
Vitamin B6	25%	25%
Vitamin B1 (Thiamine)	25%	25%
Vitamin B2 (Riboflavin)	17%	20%
Vitamin B2 (Riboflavin)	17%	20%
Vitamin B3 (Niacin)	25%	25%
Folic acid / Folate	50%	50%
Iron	25%	25%
Zinc	20%	20%

Vitamin A deficiency is one of the most common micronutrient deficiencies in the world, including South Africa. The purpose of the administration of supplementation in the form of a high-dose vitamin A capsule to infants 0 to 11 months, children 12 to 60 months, pregnant women and all post-partum women, is to reduce child mortality and improve maternal health (Moeng & de Hoop 2008).

Iron supplementation is often needed during pregnancy and late infancy to prevent iron deficiency anaemia. In South Africa, all women should receive daily oral supplementation with iron and folic acid during pregnancy and for two months after the birth of a baby (Moeng & de Hoop 2008).

2.4.3 Integrated Nutrition Programme (INP)

The Minister of Health appointed in 1994 was tasked with developing a nutrition strategy for South Africa, and four years later the Department of Health developed the existing nutrition programme into the Integrated Nutrition Programme (INP) (Labadarios, Dhansay & Hendricks 2008). The INP is managed by the DoH and aims to prevent and manage malnutrition and to ensure optimum nutrition for all citizens by implementing programmes that are integrated, sustainable, driven by the people and the community and are targeted at the most vulnerable groups of the population. The INP has eight focus areas and three support systems, targeting:

- ❖ children at risk, especially <2 years of age;
- ❖ pregnant and lactating women at risk;
- ❖ persons suffering from diseases of lifestyle and chronic diseases; and
- ❖ elderly and disabled persons at risk.

The focus areas include the following:

- Disease-specific nutrition support, treatment and counselling, where the focus is on chronic diseases like overweight, obesity and severe malnutrition.
- Maternal nutrition, including nutrition for pregnant women as well as nutrition to prevent congenital abnormalities.
- Feeding for infants and young children, focusing on early childhood nutrition and growth monitoring and promotion.
- Youth and adolescent nutrition, which includes nutrition in schools, eating disorders and obesity.
- Activities to prevent, reduce or control dietary deficiencies and to control micronutrient malnutrition.
- Food service management, where the focus is on the activities of planning, development, control, implementation and evaluation of suitable food service

systems to provide balanced and nutritious meals to groups and ill people in the communities.

- Nutrition education, promotion and advocacy.
- Community-based interventions (refer to Figure 2.4, below).

The INP support systems include nutrition information systems, human resource plans and financial and administrative system (DoH 2008b).

Figure 2.4 indicates the goals, objectives, vision and mission of the INP

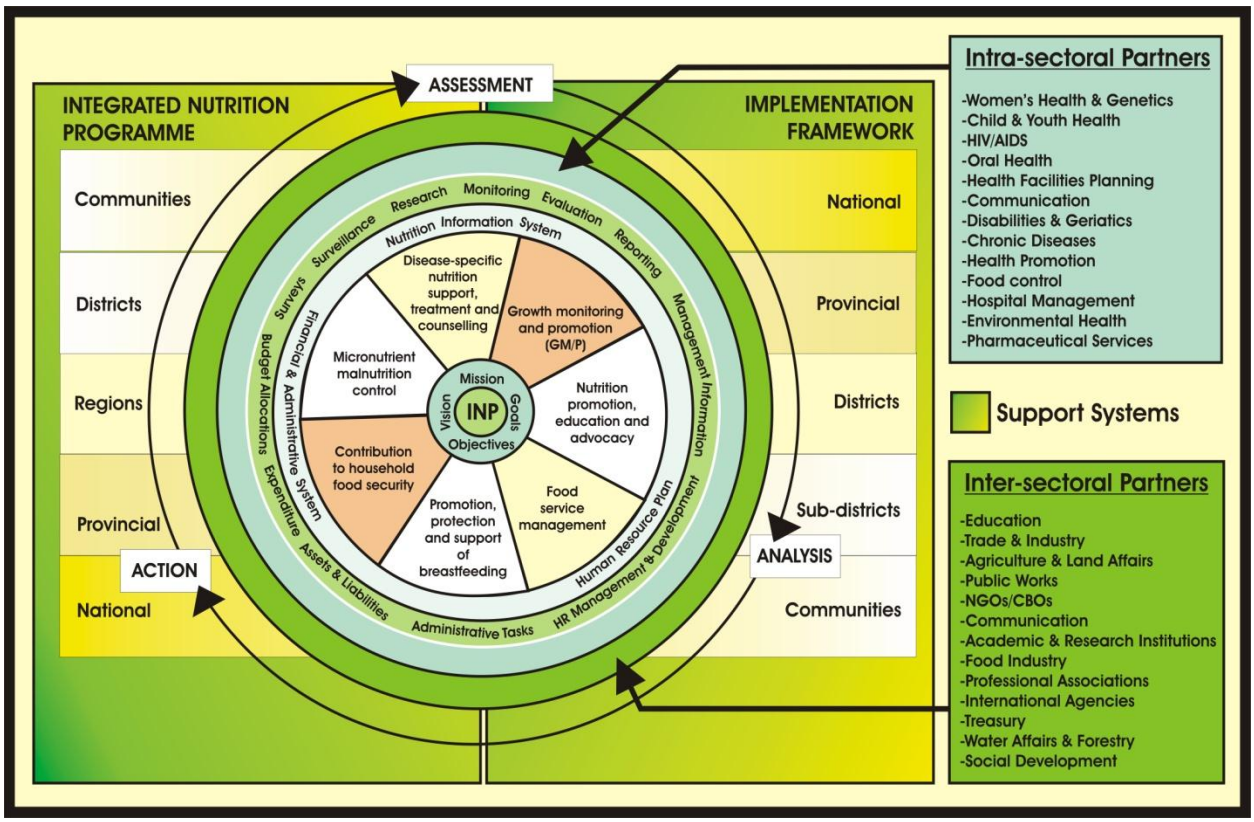

Figure 2.4 DoH 2008b strategy

All nutrition policies, strategies and interventions in South Africa should follow the application of the fundamental nutrition programming process of assessment, analysis and action. The emphasis is on building the long-term capacity of communities to be self-sufficient in terms of their food and nutritional needs while simultaneously improving and protecting the health of women and young children. To contribute to the success of

a programme, inter-sectoral collaboration and cooperation with other departments, such as health and the private sectors, as well as NGOs, is necessary. Building knowledge and skills within communities and within government structures is an important contributor to the success of intervention programmes (DoH 2004).

2.4.4 School feeding programmes

School feeding was introduced in South Africa in the early 1940s, providing free milk to White and Coloured schools. In the late 1960s and early 1970s, this benefit was withdrawn from all, except for those children who were very needy (Tomlinson 2007). School feeding programmes are powerful tools for relieving hunger pains, and serving breakfast to children at school may improve their scholastic performance (Grantham-Mcgregor, Chang & Walker 1998). Breakfast is an important meal, making a large contribution to children's total daily nutrient intake, whereas those who have missed breakfast may not be able to make up the shortfall of nutrients during the rest of the day (The World Bank 2006). Breakfast usually provides children with approximately one-third of their daily energy and other nutrient needs. Without breakfast at home they may suffer from hunger at school (Richter, Rose & Griesel 1997), therefore, it is important to serve them a school meal early in the day to reduce short-term hunger (Roche 2000).

In 1994, South Africa introduced school feeding on a national scale for primary schools, to eliminate malnutrition. The DoH implemented the programme, though it was recently taken up by the DoE. The main aims were to alleviate acute hunger by improving 25 percent of the energy requirement of the child per day and micronutrient requirements, though the deficiencies persist in some schools. School-aged children are often a neglected group in terms of micronutrient interventions, unlike preschool children and pregnant women (Behr 2008:39).

Meals should be provided to all primary school learners in Quintiles 1, 2 and 3 and secondary school learners in Quintile 1. All Quintile 2 and 3 public secondary schools will be included in 2010 and 2011 respectively (DoE 2009). The DoE, together with the DoH, provides a variety of menu options, with tasty and adequate meals that must meet at least 20-30 percent of the daily nutritional needs of learners for energy, protein,

calcium, iron, zinc and vitamin A per meal. All the identified learners should be provided with a balanced daily school meal before 10H00, providing the following:

- Protein, either vegetable (soy, dried beans, peas, lentils, nuts) or animal (milk, meat, eggs, fish);
- Starch, such as maize meal, samp, maize rice, rice, bread or potatoes;
- Vegetables – at least one green and one red/yellow/orange vegetable included in each meal (DoE 2009).

The DoE also recommends that:

- fats and oils and iodised salt and seasonings be used in moderation;
- menus be socially acceptable;
- indigenous foods be incorporated in menus;
- peanut butter may be used only if approved by the DoH for quality;
- all maize meal, bread or flour and flour products be fortified and carry the fortification logo;
- Learners be encouraged to drink at least eight glasses of water per day (DoE 2009).

The school meals should be prepared, cooked and served by volunteer food handlers, of whom there should be one for every 200 learners. These are also responsible for the cleaning of the cooking area, cooking equipment and utensils. Schools are allocated funding for the purchase of all equipment and utensils needed to prepare the school meals.

2.5 FOOD DIVERSIFICATION

Food diversification includes activities such as agricultural projects and nutrition education.

2.5.1 Home gardening

Home gardening is an integrated system in a small area such as the family house, rooftop garden, living area, and kitchen or mixed gardens. Home gardens produce a variety of foods, such as vegetables, fruits, herbs, staple crops and living stock to generate income or households consumption (FAO 1999). Home gardens are a long-term strategy to complement supplementation, food fortification programmes and nutrition education for mothers to take informed decisions regarding food choices (Faber 2007). Home gardening produces crops for household consumption, with the surplus harvested and sold to generate income and supply more nutrients that are within physiological levels and have minimal risk of toxicity (Faber 2007). Vegetable gardens are sustainable and affordable, and supply vegetables continually, thus empowering households to take responsibility for the nutritional quality of their diets through growing their own nutrient-rich food and making informed consumption choices (Faber 2007).

Vegetable gardening is the most sustainable way of providing a dietary source of vitamins, trace elements and other bioactive compounds (Chadha & Olouch 2003). Vegetables are the immediate accessible key sources of micronutrients and can be cultivated throughout the year, by staggering the planting mixture of early, average and late-maturing varieties. A vegetable garden helps to overcome seasonality of available nutrients and should be cultivated in relation to interventions such as nutrition education and promotion, other development initiatives and basic hygiene (Sikhakhane 2007). Vegetables are healthy important dietary components, not only a side dish to add flavour. They release and make available bound micronutrients in other staple crops for effective absorption from food (Chadha & Olounch 2003).

The following are initiatives of the DoH:

- Home gardens with the intention of nutritional benefits and some income generation for the intended beneficiaries.

- Communal or clinic gardens for onsite-feeding, integral aspects of rehabilitation or nutrition support, PEM Scheme, NE, take-home rations and form of supplementary income.
- School gardens are mainly driven through health promotion to encourage consumption of vegetables and linked to school feeding programmes (Sikhakhane 2007).

There is a perception that gardens are for the poor or those infected with TB, HIV and AIDS (Faber 2007). Most of the vegetables gardens have limited crop diversity, as only the common ones such as spinach, cabbage, carrots and beetroot are cultivated. It is necessary to identify or develop the market for extra produce within the intervention (Faber 2007). Community mobilisation is essential to allow gardening projects to grow, thus alleviating hunger and malnutrition which affects about 2.5 million of South Africans (Labadarios & Steyn 2001).

The combination of nutrition education and home gardens has been highly effective in improving nutrition in poor households (FAO 2000).

2.5.2 School gardening

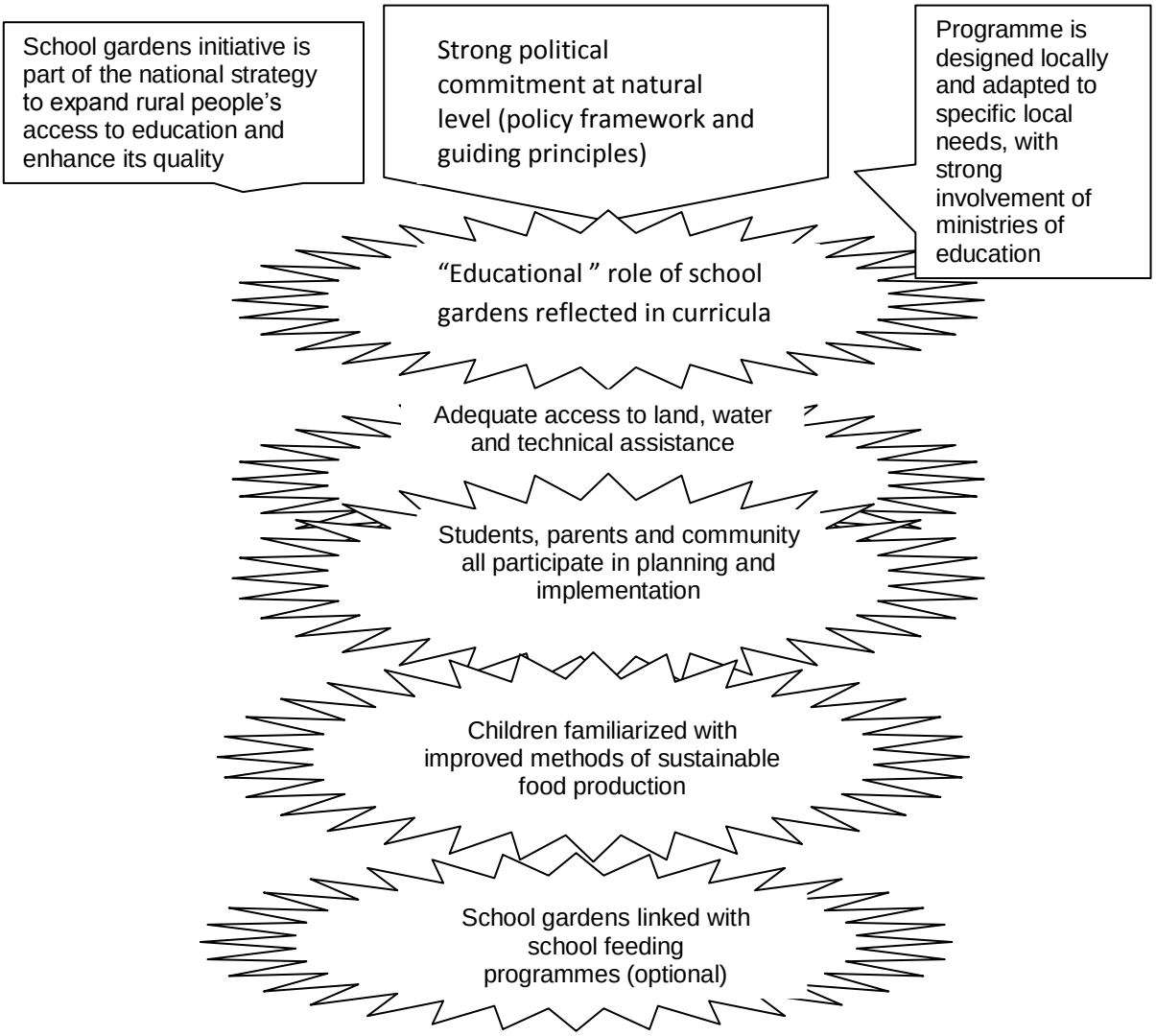

Figure 2.5: Strategic elements for school garden programmes (FAO n.d)

The possibility of establishing school gardening programmes depends on political commitment and consequent national policies. Sustainability of school gardening programmes implies independence from long-term external inputs and participation of stakeholders such as teachers, pupils, parents, school administrations, funding agencies, NGOs and ministries of agriculture, education and health (FAO n.d). The programmes should be developed as part of a national effort to improve education quality and expand access to it for children in general, particularly in rural areas. Government should decide on how school gardens initiatives can fit into the country's

overall education goals. They can contribute to increasing the relevance and quality of education, improving the children's and household members' knowledge of food production techniques and nutrition. Such achievements would lead to an improvement in the nutritional status of the children and household members, thereby contributing to improvement in food security and the national economy (FAO n.d).

Programmes offer a great opportunity to improve the quality of education and learning basic skills and can serve as a laboratory for the teaching of modern farming skills and nutrition. The activities include nutrition education, food preservation techniques, integrated pest management, integrated soil fertility management, and sustainable natural resource management. School gardens can complement school feeding programmes and enhance their long-term impact on terms of children's health or nutritional status and learning achievements, if planned and implemented with the support of parents and the community (FAO n.d).

The promotion of micronutrient vegetables, including indigenous vegetables, fruits and other foods in school, home and community gardens will diversify the local food base, generate income and add nutritional value to children's school meals, so contributing to their nutritional status. It is not possible for school gardening to generate much of the staple food required for a school feeding programme. History has shown that school gardening and nutrition education have a greater impact and can be sustained longer if they are part of programme involving the school and linked to activities which engage parents and community. Another advantage of linking school gardening is the active role that children can play in the provision of food for themselves, and in involving their parents in the learning process, as opposed to being passive food recipients (FAO n.d).

Children become proud and happy when the produce of their efforts in the garden is utilised for their lunches. In the past, misuse of the school gardens and exploitation of pupils has unfortunately been a phenomenon in rural areas, with teachers using them as an additional source of income for themselves. The situation can only be avoided if parents and community become involve in the process (FAO n.d).

2.5.3 Nutrition education programmes

Nutrition Education is an essential tool used to improve the nutritional status and well being of people. In the past years health or community worker and individual persons had face-to-face conversations on nutrition education. People were not encouraged to pay attention to nutrition or health but rather were instructed on what to do instead and not what they might be able to do. Currently, disciplinary teams use more effective nutrition education approaches, with well-defined strategies in communication behavioural psychology. Nutritional advices were not practical or appropriate for the people as the message was decided by the nutritionists or health expects of government offices rather than collaborate with the local community (Deutsche Gesellschaft fur, Technische Zusammenarbeit, (GTZ) GmbH n.d).

Advantages of nutrition education:

- It is interdisciplinary, combining the sectors of education, communication, nutrition, health and agriculture
- It helps to make a link between physical assets, such as knowledge, and attitudes and practices, for a better use of these
- It enables sustainable and long-term behavioural changes in the field of food consumption and other related subjects
- It facilitates the relationship between the project staff, the local leader and the target population through communication (GTZ n.d).

Limitations of nutrition education are:

- It has no influence on long-term behavioural change, if the causes of malnutrition are not known and if the enabling factors for these changes are not ensured. For

example, food consumption can only be changed if important food items are available.

- It requires specific skills and more resources for appropriate conceptualisation and implementation in the field.
- It is not an ad-hoc programme with short term effects, but requires a long-term and integrative approach.
- It has to respond adequately to the causes of the identified nutritional problems, to the cultural attitudes and psychological constraints, otherwise it remains ineffective (GTZ n.d).

Nutrition education cannot stand or work effectively on its own, but education interventions should be part of an integrated programme aimed at linking nutritional messages with other programmes and services. Community participation is important in the attempt to resolve nutrition problems, and is the key approach to design interventions by development planners and nutritionists. Systematic community participation can be achieved by involving the following:

- Community representatives, such as men and women from village community-based organisations
- Chiefs of village or local leaders
- Religious leaders
- Community workers.

The representatives are important facilitators for the modification of social-cultural beliefs to change nutritional behaviour. It is important also to integrate teachers, agriculturists or health workers in transmitting nutritional message. This can be crucial for long-term behavioural change and assure collaboration between sectors (GTZ n.d).

2.5.4 School nutrition education

Nutrition education works through schools because they are the natural development zone for nutrition education (FAO 2005). Primary schools are best for nutrition education because children are young and their habits are still being formed. The lessons become simple, interesting, colourful and easily learned by demonstrating, illustrating, and providing examples of practical actions (FAO 2005). School-aged children develop behaviour through interaction with other children, teachers, parents, siblings and peer groups. The homes, communities, the mass media and the school have more influence on children, making school part of a network of influences that shape eating patterns and attitudes (FAO 2005). The following are ideal settings for promoting healthy eating:

- Schools reach most children for many years on a regular basis.
- Nutrition education is responsible at schools in guiding children towards growth.
- Educators are qualified to educate and guide children.
- Educators at schools reach children at a critical age when eating habits and attitudes are being established.
- Schools allow opportunities to practice healthy eating behaviour and food safety through school feeding programmes and the sale of food on school premises.
- Schools establish schools policies and practices, for example, sanitation facilities and rules about hand washing in order to improve health and nutrition.
- Nutrition education becomes effective by including families and their children's education.
- Community members can be involved through school garden projects, school canteens, or local inter-sectoral committees.
- Cost-effective nutrition interventions can be provided at school (FAO 2005).

Nutritional education can assist dietary diversity and finally lead to the increase of food consumption. Malnutrition can be increased by a lack of nutrition information and knowledge (DoH 2004:4), whereas nutrition education can stimulate the demand for other type of foods. It is necessary that individuals have the means and opportunity to act on knowledge received during the process. For instance, the caregivers of all children in the Ndunakazi project in South Africa were exposed to nutrition education, regardless of whether they were involved in a home gardening project or not. The results showed that the nutritional status of children with a home garden was better as their vitamin A status was better than those without gardens (Faber *et al.* 2002). Education must emphasise methods of food preparation, preservation and cooking (FAO 2008).

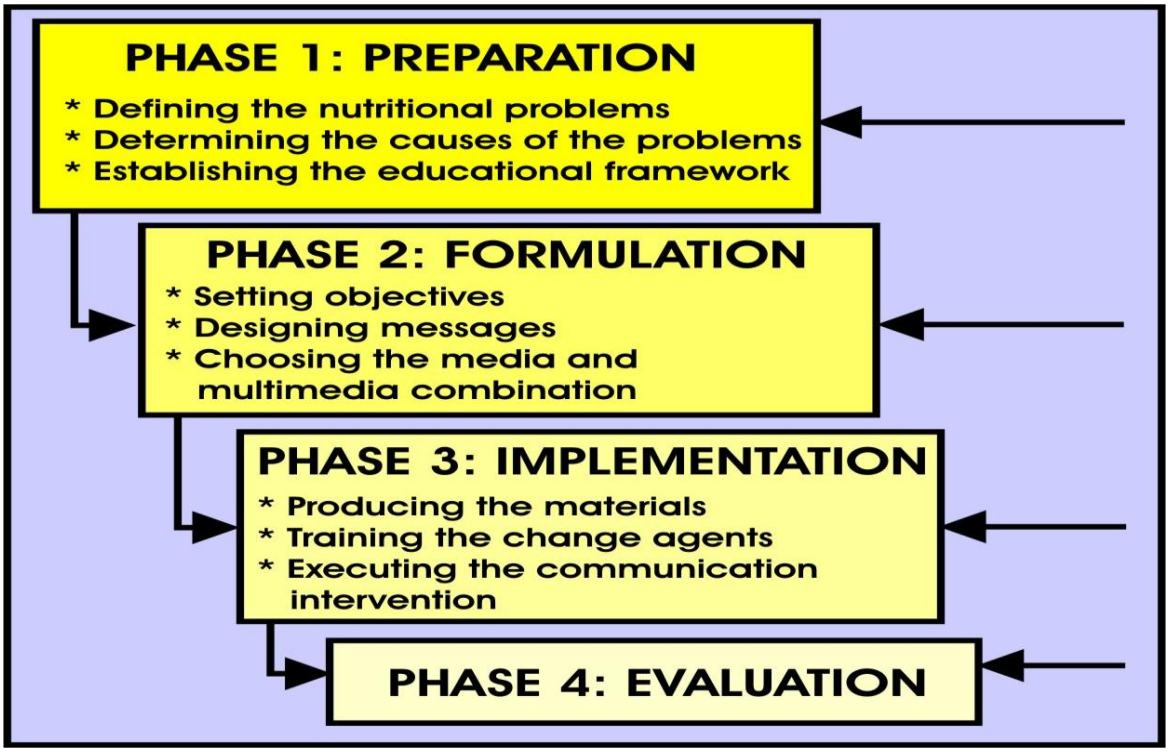

Figure 2.6 Framework for nutrition education (FAO 1997).

2.5.5 Food-based dietary guidelines

Dietary diversity refers to a number of different food groups consumed over a given period (Ruel 2003: 391), long recognised by nutritionists as a key element of high quality diet. Increased varieties of food across and within food groups are recommended in most dietary guidelines, internationally, to ensure sufficient intake of essential nutrients and promote good health (Ruel 2003:391). It can be measured by use of questionnaires, and by counting the number of food groups other than only the quantity of food consumed. Dietary diversity is mostly considered as a measure of access to food and at individual level it reflects dietary quality, mostly micronutrients adequate in the diet. The given period can be a previous day or week. A dietary diversity score is the number of food groups consumed at household level or by an individual (Arimond & Ruel 2004).

South African's households with low income have low variety intake (Labadarios *et al.* 2000) and the food-Based dietary guidelines (FBDGs) were developed for children aged 7 or above, to be able to consume adequate diets (Smuts & Meltar 2008:1).The dietary guidelines are based on locally food that is available and consumed by households and applicable to people of different ethnic backgrounds in both rural and urban areas (Vorster, Love & Browne 2001: S3). The South African dietary guidelines which improve the diets of children are as follow:

- Enjoy a variety of foods
- Be active
- Make starchy food the basis of most meals
- Eat plenty of vegetables and fruit everyday
- Eat dry beans, peas, lentils and soya often
- Meat, fish, chicken, milk and eggs can be eaten every day
- Eat fat sparingly
- Use salt sparingly

- Drink lots of clean safe water
- Use food and drinks containing sugar sparingly and not between meals
- If drinking alcohol, drink sensibly (Vorster, Love & Browne 2001:S3).

2.6 INDIGENOUS FOODS

South African researchers has realised the importance of indigenous and traditional crops as living strategies of people live in rural areas. The uses of African leafy vegetables (ALVs) are used to address food insecurity during winter (Almekinders & de Boef 2000:22-26). South African indigenous foods are mainly harvested in the wild, as crops that can be cultivated in the home gardens to increase food supply. A wider variety of food containing a mix of protein and carbohydrates, as well as vitamins and minerals, contributes to healthy eating and improves the quality, quantity and diversity of a diet all year around. The preparation, processing, and marketing of indigenous leafy vegetables are an important way of having nutritious food available throughout a year (Voster, Venter & van Rensburg: 2007). The knowledge of indigenous food depends on that of the people in the community and is passed on from one generation to another (Kaya & Masoga: 2005). ALVs are edible and biologically indigenous to an area (Maunder & Meaker 2007:403); growing very well in many places of South Africa, even though there is low or unreliable rainfall (Laker 2004). They require little effort and few resources for production, as they survives in poor soil and are available at times where exotic vegetables such as cabbage and spinach are not available. They grow well without chemical fertiliser and pesticides, because they are adapted to local growing conditions (Van Vuuren 2006: 22-25). Domestic indigenous leaf vegetables grow very quickly in small plots and can be harvested in a short time (Maunder & Meaker 2007:403).

A South Africa local leafy vegetable, morogo, has become daily food in place like Limpopo (Vorster, Venter & van Rensburg 2007), but generally the knowledge of indigenous food has been lost in many South African communities (Lwoga *et al*.

2010:13), owing to factors such as politics, changes in lifestyle, and stigma associated with the use of indigenous food (Musinguzi *et al*. 2006: 1-14). Indigenous foods are associated with food for the poorest, and many youth refuse to consume them because they do not want to be stigmatised. (Vorster *et al*. 2007). Elderly people still collect and cook non-cultivated indigenous plants and appreciate indigenous leafy vegetables for their perceived health value and taste, and out of a sense of local identity (Nebel *et al*. 2006:341).Indigenous foods are treated as weeds by many farmers, and considered as useless food occupied space.

2.6.1 African leafy vegetables in South Africa

The use of green leafy vegetables continues to spread in South Africa, although Westernisation has decreased its overall use. The leafy vegetables which are used as vegetables are young, succulent stems, flowers and very young fruit. Vegetable dishes may be prepared from single plants or a combination. In Sesotho and isiPedi they are called leafy vegetables, such as morogo, or imifino in isiZulu and isiXhosa. This may be harvested from the wild or cultivated, and is variable in terms of origin (van Rensburg, Averbeke, Slabbert, Faber, van Jaarsveld, van Heerden, Wenhold & Oelofse 2007:317). The sun-drying of fresh leaves and blanched or cooked leaves methods were preservation methods to increase shelf lives (Vorster *et al*. 2005). The dry vegetables are rehydrated by cooking in water. The blanching and freezing of leaves were new methods of preservation in rural areas after electricity were installed (Tshikalange & Van Averbeke 2006). The food consumption patterns of leafy vegetables of the households is highly variable and depends on factors such as poverty status, degree of urbanisation, distance to fresh produce markets and time.

Poor household use leafy vegetables because of lack of finance to purchase vegetables and ability to produce their own (Vorster *et al*. 2003).

In urban areas the use of wild leafy vegetables is less than in rural households. Many leaves vegetables are obtained by collecting, not by cultivation (Vorster *et al*. 2003). Amaranth and spider flower are most popular vegetables that are obtained by collection rather than cultivation and pioneer plants which emerge naturally when soils are disturbed. Most of them grow during summer. The availability, ease of preparation,

taste, and consistency are factors that increase the use of leafy vegetables (Van Rensburg, Van Averbeke, Slabbert, Faber, Van Jaarsveld, Van Heerden, Wenhold & Oelofse 2007: 319).

Traditional leafy vegetables are regarded as rich sources of micronutrients and high nutritional content of vitamin A. They complement the nutritional value of basic staple foods and add taste and palatability (Maunder & Meaker 2007:403). Micronutrient intake can be increased by consuming more indigenous vegetables (Maunder & Meaker 2007:405). Amaranth is known as *thepe* in Sesotho and belongs to the Amaranthaceae family. It is so extremely variable, erect to spreading herb. The young leaves, growth points and whole seedlings are harvested and cooked as vegetables. It rarely cultivated because, as with many other African leafy vegetables, people believe the plants will grow naturally. They are treated as crops and allowed to grow without being disturbed, and are parts of the group of leafy vegetables that have the potential to be developed as crops (Van Rensburg *et al*. 2007:319).

2.7 CONCLUSION

Malnutrition remains a persistent public health problem in children of developing countries, despite various strategies that have been employed to address the situation. This is due to the multi-factoral nature of malnutrition, as summarised in the UNICEF framework for malnutrition and death.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This study aims to determine the nutritional status and dietary intake patterns of primary school children aged 7-13 years in QwaQwa, Free State. This chapter presents the methodology used in this study, carried out in two phases, namely Phase 1 (Planning),and Phase 2 (Data collection and analysis), as graphically presented in figure 3.1

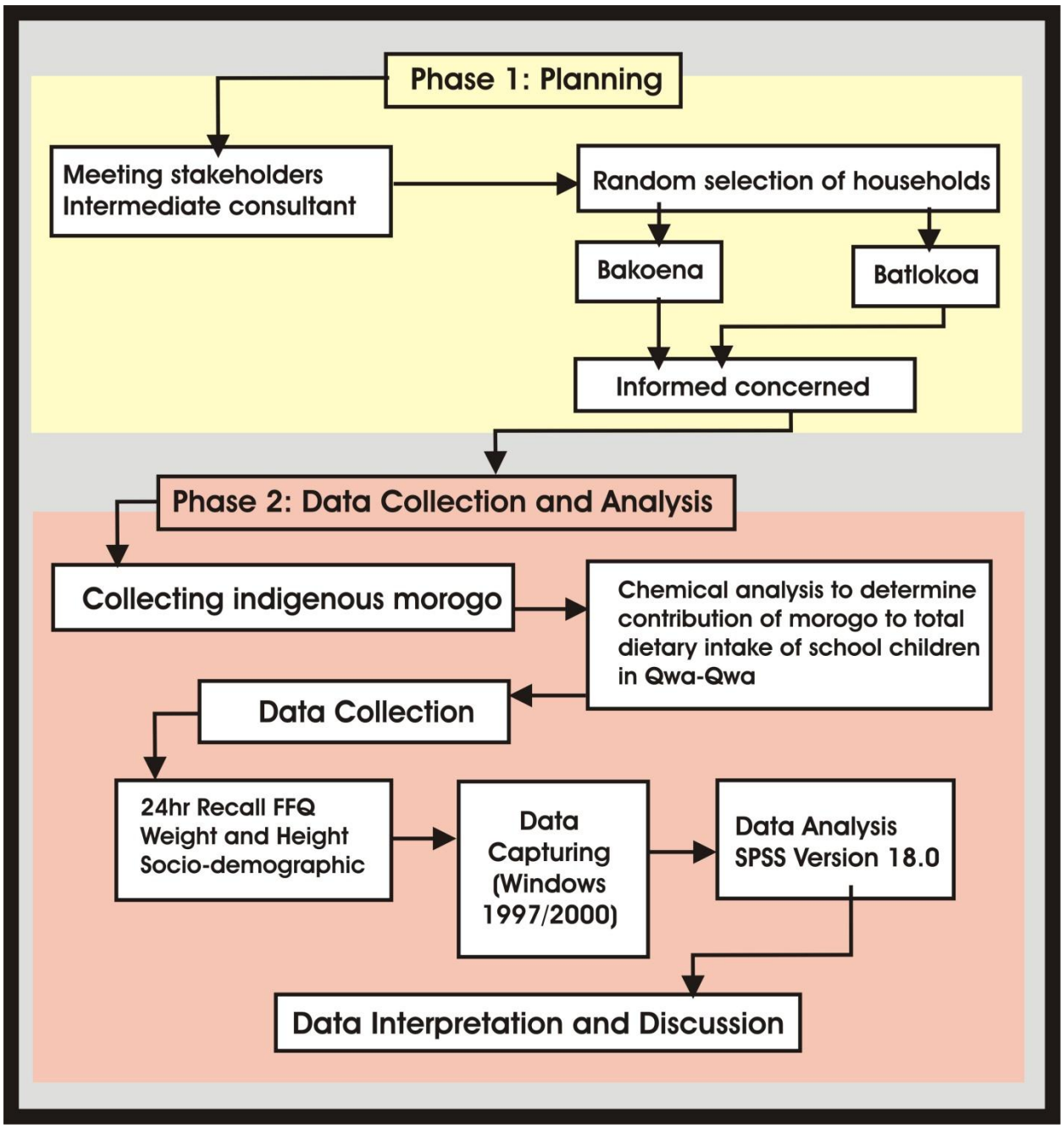

Figure 3.1 conceptual framework of the empirical study

3.2 PHASE 1: PLANNING AND ADMINISTRATION

The first phase involved planning and administration.

3.2.1 Obtaining permission and ethics

This project formed part of the SAEDP agreement between the VUT and the community leaders of Qwa-Qwa. The chiefs of both Bakoena and Batlokoa tribes gave permission to undertake this part of the study after the objectives and methods of the project had been discussed with them. A public meeting was held in the community halls of the village with the poorest of the poor households (n=200) (identified by the local community leaders) as poorest among each community in Batlokoa and Bakoena to explain the objectives and methodology of the project to the child caregivers and the children. At this meeting, the caregivers and children ≥ 7 years signed the informed consent forms (Annexure B), and 105 households gave consent to be participants in the study. They were informed that they could withdraw from the study at any time and were guaranteed confidentiality by allocating a coded subject number to each of the respondents. Only the researcher had a list of the children's names and study numbers. The fieldworkers only had the study numbers available to them during data collection. The consent of parents was obtained for the children's participation. All consent was obtained from the chiefs and a memorandum of understanding (MoU) was signed.

Ethical approval was obtained in September 2008 from the Witwatersrand University of Medical Ethics Committee for Research on Human Beings (M080931) (Annexure A). The researcher followed the South African Medical Research Council ethical guidelines for research on human beings as well those of the Helsinki Agreement, throughout the study.

3.2.2 Planning

A visit was made to the University of Free State Qwa-Qwa branch to recruit and train fieldworkers from undergraduate and postgraduate students of the University of the Free State. Other fieldworkers were recruited from postgraduate students and staff members from the Vaal University of Technology (VUT). The former were Southern Sotho-speaking women whilst the latter included Sotho and Afrikaans speakers. All were trained for two days for them to understand and know the procedures for completing all the questionnaires to be used.

The fieldworkers were trained in how to complete questionnaires, with the caregivers or mothers of the children, and on how to assist in answering the questions without interviewers bias (Babbie & Mouton 2001:249) for the respondents with a low level of education. The fieldworkers were also trained on ethical codes of conduct and the importance of the project objectives and collection of valid and reliable data. A demonstration was given on the use of food models to demonstrate estimating the correct portion sizes and to assist the respondents in identifying unfamiliar food items. A variety of participatory facilitating methods was used in the training. These included demonstrations, role-play and communication skills, allowing the fieldworkers to capture the correct data and to familiarise them with the data collection methods.

3.3 STUDY POPULATION

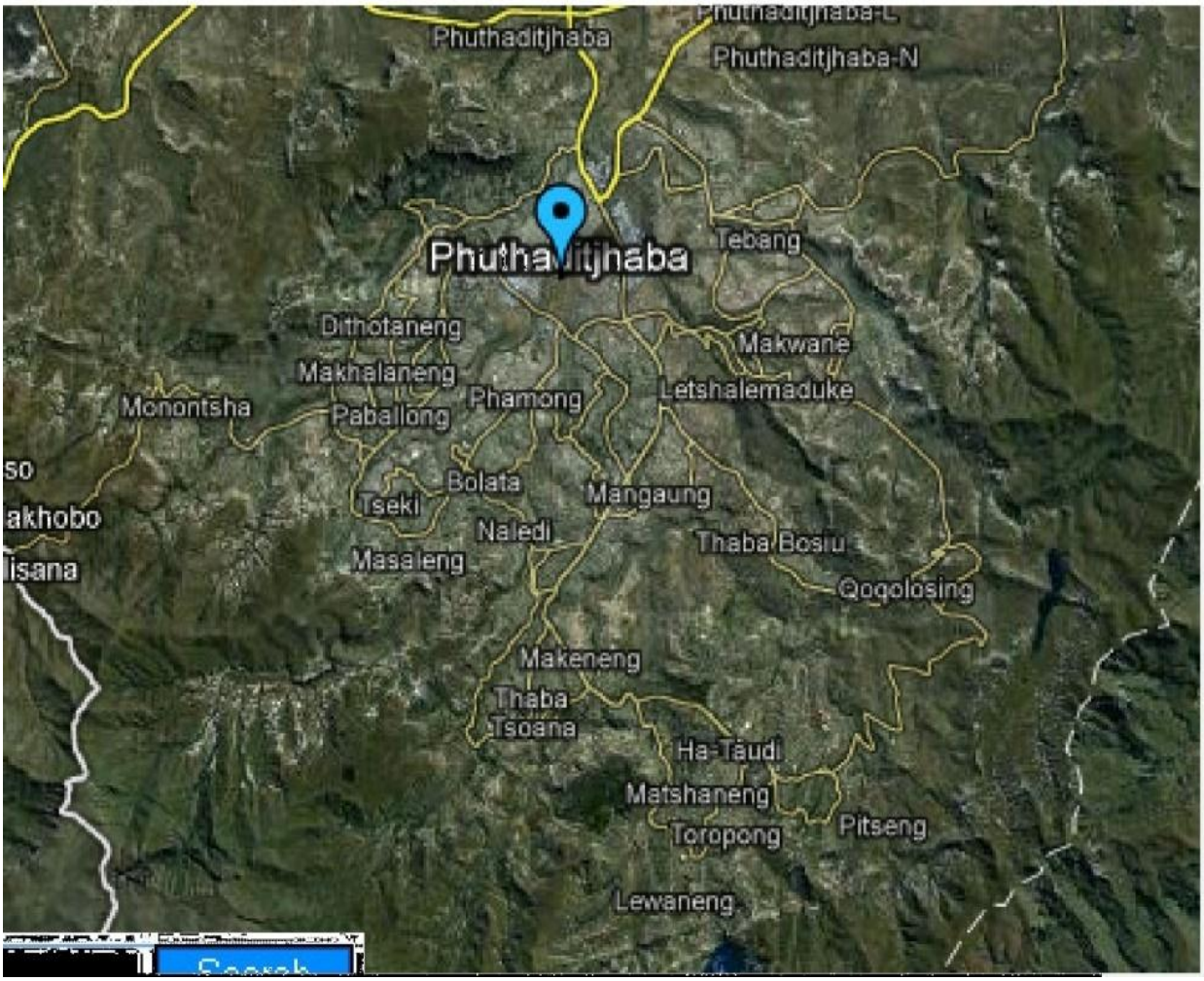

Figure 3.2: Map of study area (Qwa-Qwa)

Qwa-Qwa is a rural area fall under Maluti-a-Phofung local municipality on Thabo-Mufutsanyana district, situated in the Free State province. It is the traditional home of the South Sotho people. Phuthaditjhaba is the urban centre, with surrounding rural villages, such as Makeneng in ward 15 and Tseseng in ward 21, in which the research took place. These are established tribal lands, administered by Land affairs. The city thrives as a friendly agricultural town and holiday area set in spectacular high altitude surroundings. It is 48 km from Harrismith, passing the N3 road that links the Gauteng

and KwaZulu-Natal provinces, and Kestel 28 situated along the N5 road that links Harrismith and Bethlehem.

A sample size calculator (The Survey System n.d.) was used to determine the sample size for representative statistical data as follows:

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

Where:

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

p = percentage picking a choice, expressed as decimal (0.1) used for sample size needed

c = confidence interval, expressed as decimal (5.83 used for this study)

The calculation was based on the total number of households in the Batlokoa and Bakoena communities (n=6000) in Qwa-Qwa, as obtained from the community leaders. A statistically representative sample size of 100 households was needed for this study.

A total of 105 households gave consent to be included in the study. A purposively selected sample of 70 children (n=70), including girls and boys, aged 7-13 years, forming part of the 105 households were recruited for the study. To test for statistical representativeness, the sample size calculation was repeated as follows:

Sampling Size:

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

$$ss = \frac{(1.96X1.96) \ X \ (0.5 \ X0.5)}{(0.095 \ X \ 0.095)} = 43$$

Where:

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

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

c = confidence interval, expressed as decimal (in this study 9.5)

A sample of 43 children was required for statistical significance and the 70 children recruited would thus satisfy the sample size requirements.

3.4 STUDY DESIGN

The study design used for this study was a cross-sectional, analytical survey design whereby a variety of variables were measured. For the collection and analysis of the *morogo*, an experimental study design was used.

For the baseline cross-sectional study, different activity stations were set up to streamline the data collection process.

3.5 MEASURING INSTRUMENTS

A number of measuring instruments were used during data collection.

3.5.1 Questionnaires

Different questionnaires were compiled and used in the study.

3.5.1.1 Socio-demographic questionnaire

A validated socio-demographic questionnaire (Annexure C) was adapted for this study (Oldewage-Theron *et al.* 2005), to cover certain aspects of life. It included questions to measure the household size, housing conditions, household income and expenditure, as well as education level of the caregivers. Other information included assets in the household and services. The questions were completed by the parents of the children, who assisted in a one-on-one interview by the trained fieldworkers from the University of the Free State. The questionnaire included multiple choice options to make it easier for the respondents and to save time in completing. The researcher sorted and checked all

data completed on the socio-demographics for completeness and accuracy. Only 53 were usable and were reported for the socio-demographic data.

The data were captured on an *Excel* spreadsheet by the researcher and analysed for descriptive statistics such as frequencies, standard deviations and confidence intervals on the *Statistical Package for Social Sciences* (SPSS), version 18.0 programme. Tables were drawn up including percentages (%) of the different variables included in the questionnaire. Data was presented in terms of frequencies and percentages for various categories.

3.5.1.2 Dietary intake assessment

Dietary assessment is the evaluation of food consumption and nutrient intake. In this study a 24-hour recall (Annexure D) and food frequency questionnaire (Annexure E) was used.

- 24-hour recall

24-hour recall is one of the most frequently used methods for collecting food consumption data. This method is quick, easy and inexpensive, with fewer respondent burdens and no long-term memory required. No alteration of diet is needed in the respondent; whilst a good reliability exists for trained interviewers and no literacy on the part of the respondents is needed (Walsh & Joubert 2007: 294). 24-hour recall was carried out by VUT postgraduates and staff members. Three 24-hour recalls were completed for each of the respondents and an average of the three 24-hour recalls calculated for each of the respondents.

A validated 24-hour recall method described by Gibson (2005) was followed for data collection, with the interviewer assisting the respondent in estimating portion sizes of foods consumed and recalling food and drinks consumed. Food models were used to help with the portion size by the fieldworkers and to determine dietary intake of large sample (>50 people). The information is mostly used to determine trends in eating

patterns (Joubert & Ehrlich 2007:296). A validated four-stage, multiple-pass interviewing procedure was used for the completion of the 24-hour recall questionnaires, as follows:

1. The first step consisted of obtaining a complete list of all the foods and beverages consumed during the 24-hour period under review.
2. In the second step, each of these foods and beverages are described in detail with brand names and cooking methods.
3. The third stage consists of estimating the amount of each food and beverage item consumed. This is usually done in household measures and entered on the questionnaire. Food models and household measurement tools were used for this.
4. The fourth step is a review to ensure that all items, including the use of vitamin and mineral supplements, have been recorded correctly (Gibson 2005).

Full sets (three days) of 24-hour recalls were completed for 55 respondents. The average intakes for the three days were calculated for all the nutrients and divided by three to determine the mean daily intake. To ensure reliability and validity, only one person, namely a registered dietician, did the coding of dietary intake data, having also captured and analysed the data using the MRC *Food Finder* version 3.0 software, based in the South African Food Composition Tables of South Africa (Langenhoven, Kruger, Gouws & Faber 1991). The programme was developed to analyse the nutrient content of food items consumed. The nutrient intakes were compared to 100 percent of the DRIs (IoM, 2003) for children aged 7-13 years. Furthermore, the percentage of respondents with <100 percent of DRI was also calculated. The top 20 most commonly consumed food items daily were also determined from the three 24-hour recalls and were tabulated.

- ❖ Food frequency questionnaire

The Food Frequency Questionnaire (FFQ, Annexure E) has been validated previously in the Boipatong and Eatonside community (Oldewage-Theron & Kruger 2008b) and used without any adaptation as foods similar to those in QwaQwa are consumed. Another study of South African children found that dietary diversity, specifically Food

Variety Score (FVS) and Food Group Diversity Score (FGDS), are good indicators of dietary adequacy in children and can therefore be used as reference measurement for dietary intake assessments (Steyn, Nel, Nantel, Kennedy & Labadarios 2006:644-650). The food frequency questionnaire was used to calculate the dietary variety and is not time-consuming, thus resulting in a reduced burden for the respondent. It is inexpensive, reasonably accurate, valid and quick to administer (Joubert & Ehrlich 2007:295). The FFQ consisted of a list of foods categorised according to the FAO nine nutritious food groups. The BTech postgraduate students from VUT helped with food frequency questionnaires with the correct use of the food models. The FFQ was completed in one-on-one interviews with the assistance of trained field workers and food models were used to identify food items.

The data were captured on an *Excel* spreadsheet by the researcher and analysed on the SPSS, version 18.0 programme for frequencies, means and SDs. The different dietary diversity measures were calculated as follows: 1) the overall variety score (simple count of food items); 2) a variety score across all nine food groups; and 3) a variety score within every food group (Hatloy, Torheim & Oshaug 1998). These scores were calculated for a reference period (Ruel 2003) of seven days. The dietary diversity score (DDS) consisted of a simple count of single foods and food groups, similar to scores used in previous studies in developing countries (Clausen, Charlton & Gobotswang *et al*. 2005). The nine nutritious food groups recommended by the United Nations Food and Agricultural Organization (FAO) were used to classify food intakes categorically. Fewer than 30 foods consumed in the period of seven days indicated low food variety, 30 to 60 foods indicated medium variety, and more than 60 foods, high variety (Matla 2008). All the dietary diversity scores (FVS, FGDS and DDS) were calculated from the seven-day FFQ.

To calculate the nutrient adequacy of the dietary intervention and to validate the DDS, the nutrient adequacy ratio (NAR) was calculated for energy, protein, carbohydrate and 21 micronutrients. The NAR for a given nutrient is the ratio of the respondent's actual intake of a nutrient to the current dietary reference intakes (DRI) for the respondent's sex and age category (Guthrie & Scheer 1981:240-245). The estimated average requirement (EAR) values are the standard for estimating inadequate nutrient intakes

within a group (IoM 2003). These were used to assess nutrient adequacy and recommended dietary allowances (RDA), with adequate intake (AI) levels used for those nutrients without an EAR. The mean adequacy ratio (MAR percentage) of the diet was calculated by the sum of NAR (truncated at 100 percent) for nutrients (excluding macronutrients and energy) divided by the number of nutrients (n=21). A value of 100 percent for both NAR and MAR indicates that intake equals the requirement (Steyn *et al.* 2006).

3.5.2 Anthropometric measurements

A registered dietician (from South Africa) and–public health nutritionist (from the USA) were responsible for the anthropometric measurements, using standardised techniques as recommended by Lee and Niemann (2003, 165,167,225). Height and weight measurements are mostly used since they are easy to use, quick and inexpensive to obtain.

Anthropometry is a sensitive measure of nutritional status because growth and body size are influenced by dietary intake, energy expenditure, and general health, and because slowing of growth is an early response to nutritional inadequacy (Annexure F). An anthropometric measurement is a globally used method for determining nutritional status, especially in children. Many anthropometric measures reflect more than the nutritional environment alone. The assessment of growth and body size must be made relative to some norm of adequate growth and appropriate body size presumed to be associated with optimal health and nutritional status (Gage & Zansky 1995). Anthropometry can be used as a proxy for nutritional status, or measure of exposure to nutritional stress. Poor growth is not only the outcome of nutritional stress but also of combined stresses, some of which are in synergy with it. The problem of the use of anthropometry in nutritional assessment is that the measured outcome is due to interactive processes, such as those between under-nutrition and infection, which are still poorly understood (Joubert & Ehrlich 2007:295).

Body weight was obtained using a digital Phillips scale (Lee & Nieman 2003:167), placed on a hard floor with the sliding weight placed at zero and the balance bar aligned

to balance. Subjects were asked to remove heavy outer garments, take off shoes and empty their pockets, such as trousers. They were asked to stand still in the centre of the platform to distribute the weight equally on both feet, without touching anything during the process of measurements. The weight was recorded on the questionnaire, as an average of two measurements taken.

3.5.2.1. Height and weight measurements

Height for children was measured by means of a stadiometer, with vertical scale of metres and a sliding headpiece, to the nearest 0.1 cm. The children had to remove their shoes, heavy clothes and were positioned to face straight towards the fieldworker and relax with their back to the height ruler. They then put their legs and knees straight together with arms aside, and were requested to stand still with feet and heels touching together. The measuring rod was lowered to press the hair flat and the height was recorded in centimetres on the questionnaire. Two measurements were taken that had to correspond.

The weight and height was captured on an *Excel* spreadsheet and analysed according to the WHO growth standards for nutritional status (2006/2007) on *AnthroPlus*, version 1.0.2 to determine height-for-age Z-scores (HAZ), weight-for-age Z-scores(WAZ), weight-for-height scores (WHZ) and body-mass-index-for-age Z scores (BMIZ). The cut-off points were expressed as z-scores (<-3SD severely underweight, severely thin and severely stunting, ≥-3SD<-2SD underweight, stunting and thinness (WHO 2007a).

3.6 RELIABILITY AND VALIDITY

Validity is the degree to which an empirical measure adequately reflects the real meaning of the concept under consideration, whilst content validity is the extent to which an assessment measure covers the entire range of meaning included in the concept (Babbie & Mouton, 2001:22,123). In this study all the questionnaires were validated previously in other studies in the Vaal area and were used for this study.

3.7 EXPERIMENTAL WORK

Morogo is an African green leafy vegetable consumed Basotho in Qwa- Qwa, one kilogram of which was collected for chemical analysis from Basotho Cultural village by one of the local community leaders, Chief N Thabane. A 100g of raw morogo was washed before being chemically analysed by Dr G Medoua (PhD Food & Nutrition Science) in the VUT Centre of Sustainable Livelihoods laboratory. The edible portions were washed and processed according to their consumption state. Morogo, usually eaten when cooked, was prepared by boiling in a stainless steel cooking pot for 25 minutes with a little water covering it. The cooked morogo was then divided into smaller portions, mixed thoroughly, vacuum packed in a sealed plastic bag and stored at -20ºC until analysed within one month.

3.7.1. Materials and methods

The analyses were performed with a Series 200 Liquid Chromatography (PerkinElmer, Inc, Waltham, MA) equipped with a Series 200 LC Quaternary Pump, Series 200 Austosampler, Series 200 Diode Array DectorII and Series 200 Peltier Colum Oven. Chromatographic data was stored and processed with Tota Chrom Workstation version 6.3.1 (PerkinElmer, Inc.) and IRIS HPLC Spectral Processing Software VI.2.0 (PerkinElmer, Inc.).

Table 3.1 Methods for chemical analyses of products to determine nutrient content (Oldewage-Theron & Amuna 2002).

Nutrient	Method	Basic Principle
Protein	Total Kjedahl digestion method Modified Berthelot reaction	Acid is used to release nitrogen from the sample, which is then measured and used to derive protein value by using the conversion factor
Fat	Acid-hydrolysis	Hydrocloric acid is used to digest the sample of fat and or is added to dissolve the fat
Ash	Direct	Organic matter is removed by heating the sample to 55ºC in a furnace.
Moisture	Drying	Water is evaporated by drying the sample in an oven at 150°C
Carbohydrate	Derived	100 %=(% protein +% fat+ % ash +% moisture).
Energy		(Protein x 16.8 kJ)+(Carbohydrate x 16.8 kJ)+(Fat x 237.8 kJ)

3.7.1.1 Moisture content

The moisture content was determined by air- drying 100g of sample in an oven at 105ºC to a constant weight according to the Association of Official Analytical Chemists Method (AOAC 1997).

3.7.1.2 Carotenoids sample extraction

The procedure described by Lako *et al*. (2007) was used for the extraction of the. carotenoids. One gram of heavy magnesium carbonate, 20g sodium sulphate and 30 Ml acetone were added to 100g of morogo sample, and extracted for five minutes using a high-speed homogeniser. The mixture was filtered through Whatman Nº4 filter paper (Maidstone, England) under vacuum. The residue, including the filter paper, was re-extracted with acetone until the residue was observed in the filter cake. The filters were

combined and made up to a volume in either a 100 or 200mL volumetric flask with acetone, depending on the intensity of the colour in the sample. An aliquot of the extract was filtered through a 0.5µm nylon filter disk before HPLC analysis. All extractions were conducted in a dark room to protect the vitamin A content (Medoua & Oldewage-Theron 2011).

3.7.1.3 Carotenoids assay.

Twenty microliters of carotenoid extracts were injected in a reverse phase C18 (150X4.60 mm, 5-µm) HPLC column. The mobile phase consisted of 75 percent acertonitrile, 20 percent 0.05 percent triethylamine and 0.1 percent BHT with a flow rate of 2.0mL/min. The carotenoids were detected at 450mm. Retention times for standard lycopene and β-carotene were recorded and peak areas used for calculations (Medoua & Oldewage-Theron . 2011).

3.7.1.4 Vitamin C assay.

The method described by Association of Official Analytic Chemist Method (AOAC 1997) was used for vitamin C (ascorbic acid) analyses. A hundred grams of morogo sample was homogenised in a blender with 100mL of 1 percent m-phosphoric acid. The slurry was adjusted to 25 mL with 1 m-phosphoric acid and filtered through Whatman filter-paper. One millilitre of this filtrate was added to 1 mL of 5 percent dinitrothreitol, and the volume made up to 10 mL with 1 percent m-phosphoric acid. The solution was filtered and 20µL injected on a reverse phase C18 (150X4.60mm), 5µm) HPLC column. The mobile phase consisted of acetonitrile: 0.05 M KH_2PO_4 (pH 5.9) in the ration of 75:25 with a flow rate of 1.5mL/min. The vitamin C was recorded and peak area used for calculations (Medoua & Oldewage-Theron 2011).

3.7.2 Quality control

To produce data, fully validated analytical methods were used and pure reference standards used for calibration and to verify consistent performance of the methods and the instruments (Medoua & Oldewage-Theron 2011).

3.8 STATISTICAL ANALYSIS

All samples were analysed in triplicate and the mean of three determinations reported. Statistical analyses of data were performed using SPSS software (SPSS Inc., Chicago, IL), version 18.0. Comparisons between dependent variables were determined, using analysis of variance, Duncan's multiple range tests and correlation analysis.

3.9 CONCLUSION

This chapter has presented an overview of the methods used for this study to determine the nutritional status and dietary–intake patterns of children aged 7-13 years in the Bakoena and Batlokoa communities in Qwa-Qwa. This will be used to plan suitable intervention studies to address the identified food and nutrition insecurity problems in future. The results of this study and discussion will be reported in Chapter four.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

The purpose of this study was to determine the nutritional status and dietary intake patterns of children aged 7-13 years in the Bakoena and Batlokoa communities in Qwa-Qwa. This chapter will focus on the results obtained in this study, based on social-demographic and health questionnaires, dietary intake and diversity, as well as frequency questionnaire, 24-hour recall and anthropometric results. The analyses of the indigenous morogo eaten and the contribution to total dietary intakes will also be presented and discussed. The conclusions and recommendations will follow in Chapter 5.

4.2 SOCIO-DEMOGRAPHIC RESULTS

A complete set of socio-demographic questionnaires existed for 105 households and were used in the data analyses. These 105 questionnaires included parents as caregivers of the study population of 70 children. The results in Table 4.1 showed that the children in the sample ranged from 7-13 years, with a large percentage (37.2%) between 10 and 11 years old. The mean age and standard deviations of the children were 10.23±10.85 respectively. The gender representation for the 7 to 13 year old children was 45.7% (n=32) for boys and 54.2% (n=38) for girls. The average household size was five people (66.7%) per household including children.

Table 4.1 General information on the household

Age	Number (n) = 105	Percentage (%)
Age distribution of children in household (years)		
7	11	15.7
8	7	10.0
9	8	11.4
10	13	18.6
11	13	18.6
12	9	12.9
13	9	12.9
Total	70	100.0
Gender of children		
Female	38	54.2
Male	32	45.7
Total	70	100
Number of people per household		
1-5	70	66.7
6-10	30	28.6
>10	5	4.7
Total	105	100

The results in Table 4.2.showed that the majority of the households (71.3%) were permanent residents of area and had been living in Qwa-Qwa for more than five years and lived in brick houses (86.7%) with more than four rooms (56.3%). These were mainly the Reconstruction and Development Programme (RDP) houses provided by the government

Table 4.2 Accommodation results

Description/Variable	Number (n) = 105	Percentage (%)
How long have you been permanently staying in this house?		
<1 year	6	5.2
1-2 years	14	12.2
>5 years	82	71.3
Other	3	11.3
Total	105	100.0
What type is your house?		
Brick	91	86.7
Clay	6	5.7
Zinc/shack	1	1.0
Other	7	6.7
Total	105	100.0
Number of rooms		
>2 rooms	18	17.5
3-4 rooms	25	24.3
>4 rooms	58	56.3
Other	4	1.9
Total	105	100

Table 4.3 Food procurement results

Description/Variable	Number (n) = 105	Percentage (%)
How often do you buy food?		
Every day	8	7.8
Once a week	4	3.9
Once a month	89	87.3
Other	4	1.0
Total	105	100.0
Where do you buy your food?		
Spaza shop	21	20
Street vender	3	2.8
Supermarket	78	74.3
Other	3	2.8
Total	105	100.0
How much do you spend on food per week?		
R 1 – 100	42	40.8
R 101 – 200	25	24.3
R 201 – 300	9	14.6
>R300	10	9.7
I don't know	19	16.5
Total	105	100.0

The results in Table 4.3 showed that the majority (87.3%) of households bought their food once a month and 74.28 percent from supermarkets. A large percentage (42%) of families spent <R100 on food per week, which means they spent R14.29 per day in the household, averaging R2.86 per person per day. This is the equivalent of less than a loaf of bread and ½kg of maize per day. In Table 4.4 it is shown that most households used pots made of stainless steel (74.8%), followed by aluminum (22.3%) and cast iron (2.9%).

Table 4.4 Food preparation results

Description/Variable	Number (n) = 105	Percentage (%)
What type of fuel do you usually use for preparing food?		
Wooden fire	14	13.6
Paraffin	4	3.9
Electricity	63	61.2
Gas	3	2.9
Coal	19	18.4
Other	2	2.0
Total	105	100.0
What types of pots do you use to cook your food?		
Cast iron	3	2.9
Aluminum	23	22.3
Stainless steel	77	74.8
Total	105	100.0

Table 4.5 Services results

Description/Variables	Number (n) = 105	Percentage (%)
Water supply		
Tap in the house	12	11.4
Tap outside of the house	66	62.9
Fetch water from	27	25.7
Total	105	100.0
Toilet facilities		
Pit latrine	100	95.2
Flush/sewage	2	1.9
Bucket system	3	2.9
Total	105	100.0
Waste removal		
Yes	5	4.8
No	100	95.2
Total	105	100
Electricity available		
Yes	63	61.8
No	42	38.2
Total	105	100

The facilities available were mainly electricity (61.8%), although 18.4% and 13.6% used coal and wood for energy respectively.

The majority of the households had a tap outside the house (62.9%), and 95.2 percent used a pit latrine toilet. Waste removal was almost non-existent as 95.2 percent disposed of their waste in pit holes and 4.8 percent removed it from their yard by dumping in the waste area. This was because no municipal service removed waste (Table 4.5).

Table 4.6 Education levels of the caregivers

Description/Variables	Number (n) = 104	Percentage (%)
Highest education		
None	9	8.7
Primary School	26	25.0
Secondary School	65	62.5
College	3	2.9
Other Post School	1	1.0
Total	104	100

The education level of the parents shows that the majority of the caregivers attended school, with 25.0 percent and 62.5 percent having completed, primary and secondary school education respectively. Only 8.7 percent of the caregivers did not attend school (Table 4.6).

Table 4.7 Household income

Description/Variables	Number (n) = 92	Percentage (%)
Income of Household		
< R500	35	38.0
R501-1000	33	35.9
R1001-R1500	11	12.0
R1501-R2000	4	4.3
R2001-R2500	1	1.1
>R2500	8	8.7
Total	92	100

The results in Table 4.7 show that the monthly income of the households was less than R1000.00 in the majority (73.9%).

Table 4.8 Employment status of the caregivers

Description/Variables	Number (n=105)	Percentage (%)
Employment status		
Employed caregiver	18	17.1
Employed partner	24	22.9
Total	42	40.0
Period of unemployment		
<6 Months	6	9.0
6-12 Months	5	7.5
1-3 Years	7	10.4
>3 Years	49	73.1
Total	67	100

The results in Table 4.8 showed that the majority of the child caregivers were unemployed (82.9%), of whom 73.1 percent had been unemployed for more than three years. Furthermore, only 22.9 percent of the spouses/partners were employed.

4.3 DIETARY INTAKE RESULTS

The results from dietary intake data collection methods were as follows

4.3.1 24-hour recall results

A full set of 55 24-hour recall questionnaires were completed and used for the dietary intake results.

The results in Table 4.9 show that the respondents consumed a mainly carbohydrate rich diet with 10 of the 20 most commonly consumed food items being carbohydrates such as stiff maize meal porridge (195g), soft maize meal porridge (174g portion), bread, brown and white (122g), potato, cooked (66g), samp, cooked (187g), potato fries (85g), breakfast cereal (300g) and rice cooked (140g). Only three items of vegetable and fruit formed part of the 20 food items mostly consumed. The only five protein-rich food sources that appeared in Top 20 items were fresh full cream milk (138g), chicken stew (126g), sausage (87g), beef, stewed (112g) and egg fried (66g).

The actual food consumption portion sizes looked sufficient for children, however, when the per capita food consumption patterns are determined it is evident that very small portion sizes of mostly the vegetables and fruit, as well as the protein-rich food sources, were consumed. Only the maize meal porridge showed good portion sizes.

Table 4.9 Top 20 food items consumed by the children as measured by 24 - hour recall (n=55)

Food item	Total daily intake (n=55)	Mean daily intake (gram per person)	Per capita mean intake (mean gram per person)	Respondents with daily consumption
Maize meal, stiff	10725	195	195	55
Tea, brewed	9758	287	177	34
Maize meal, soft	5046	174	92	29
Milk, fresh full cream	2898	138	57	21
Bread, brown and white	2684	122	49	22
Spinach, cooked	1887	111	34	17
Stew, chicken	1890	126	34	15
Sugar, white	1242	27	23	46
Cabbage, cooked	1044	108	2	12
Sausage	896	87	19	12
Stew, beef	896	112	16	8
Tomato and onion	448	56	8	8
Potato, cooked	792	66	14	12
Apple, Average raw	600	300	11	2
Samp, cooked	374	187	7	2
Cold drink	340	340	6	1
Potato fries	330	85	6	4
Egg, fried	300	66	5	5
Breakfast cereal	300	300	5	1
Rice cooked	280	140	5	2

Table 4.10 Dietary intake as measured by 24-hour recall (n=54)

Nutrient and unit of measure	Adequate intake Mean(±SD)	(EAR) Boys	(EAR)Girls	Prevalence of inadequate intakes
Energy (kJ)	3666(±1730)	8698	9572	100%
Total protein (g)	28(±15)	34	34	61%
Plant protein(g)	13(±7)	-	-	
Animal protein (g)	14.8(±11.9)	-		
Total fat (g)	24(±19.5)	-	-	
Carbohydrate(g)	124(±60.8)	100	100	38%
Total dietary fibre(g)	8.8(± 5)	31	26	100%
Ca (mg)	178(± 129)	1300	1300	100%
Fe (mg)	7 (±5.4)	5.9	5.7	38%
Mg (mg)	140(± 66)	200	200	82%
P (mg)	415(± 204)	1055	1055	100
Zn (mg)	4.5 (± 2.8)	7.0	7.0	89%
Cu (mg)	0.42 (± 0.49)	-	-	80%
Cr (mg)	15 (± 16)	25	21	89%
Se (mg)	13 (± 13.7)	35	35	
Mn (mg)	1399(± 1048)	-	-	86%
I (mcg)	11 (± 11.9)	73	73	96%
Vitamin A (RE) (mcg)	527 (± 1135)	445	420	73%

Table 4.10 Dietary intake as measured by 24-hour recall (n=54) continued

Nutrient and unit of measure	Adequate intake Mean(±SD)	(EAR) Boys	(EAR)Girls	Prevalence of inadequate intakes
Thiamin (mg)	0.63 (± 0.58)	0.7	0.7	78%
Riboflavin (mg)	0.79 (± 1.43)	0.8	0.8	84%
Niacin (mg)	8.78 (± 7.9)	9.0	9.0	71%
Vitamin B6 (mg)	0.77 (± 0.77)	0.8	0.8	
Folate (mcg)	212 (± 121)	250	250	69%
Vitamin B12 (mcg)	2 (± 11.8)	1.5	1.5	71%
Pantothenate (mg)	2 (± 2.1)	4.0	4.0	85%
Biotin (mcg)	14.8 (± 12)	20	20	78%
Vitamin C (mg)	21 (± 25.9)	39	39	87%
Vitamin D (mcg)	1(±21)	5.0	5.0	95%
Vitamin E (mg)	4 (± 5.4)	9.0	9.0	83%
Vitamin K (mcg)	289 (± 449)	60	60	60%

EAR for boys and girls 9-13 years old (IoM, 2003).

Adequate intake values were used where EAR not available

The dietary intakes (Table 4.10) showed deficient intakes for all the nutrients except, COH, Fe, Vitamin K and B12, when compared to the EAR (10M, 2003) for children aged 9-13 years old. Although these nutrients showed an adequate mean intake, there were still 38 percent of respondents who did not consume 100 percent of the EAR for carbohydrate, compared to 38 percent, 73 percent, 71 percent and 60 percent for iron,

vitamin A, vitamin B12 and vitamin K respectively. The nutrients for which none of the children met the DRI included total energy, dietary fibre, calcium and phosphorus. More than 90 percent of the children did not meet the DRI for iodine and vitamin D.

These results were consistent with the results of the 20 most commonly consumed food items as carbohydrates showed sufficient nutrient intakes compared to a mainly carbohydrate-based diet shown in Table 4.9. Furthermore, vitamin C intakes were low, which is consistent with the only three vegetable and fruit food items included in Table 4.9, which showed that not all the children consumed vegetables and fruit and those who did consumed very small portions. The same trend was observed for calcium intakes.

4.3.2 Dietary diversity results

A total of 55 FFQ were completed for the children in the sample. The dietary diversity results are presented in the tables below.

The results in Table 4.11 show that the mean Food Variety Score (±SD) for all the food groups consumed by all the groups in a period of seven days was 23.96 (±16.08). These results reveal poor dietary diversity. The food group with the highest mean food variety score was the cereal group with a mean Food Variety Score of (±SD) of 5.78 (±2.56), followed by the flesh foods, other vegetables, fruit and other juices and vitamin A-rich fruit and vegetables with 4.11 (±2.57), 3.57 (±2.25), 2.83 (±2.8) and 2.70 (±1.79), respectively.

These results were consistent with the findings of the 20 most commonly consumed food items as measured by 24-hour recall reflected in Table 4.8.

Table 4.11 Summary of variety within the food groups (as measured by FFQ) (n=55)

Food Group	Mean	SD	Ranges of Scores
Cereals, roots and tubers	5.78	2.56	0-14
Other vegetables	3.57	2.25	0-12
Vitamin A-rich fruit and vegetables	2.70	1.79	0-7
Flesh foods (meat, poultry, fish)	4.11	2.57	0-10
Fats and oils	1.50	1.27	0-7
Dairy products	2.09	1.98	0-7
Fruit and other juices	2.8	2.43	0-12
Legumes and nuts	1.35	1.23	0-4
Eggs	1	0.	0-1
Total items	23.96	16.08	0-68

The Food Variety Score consisted of a food count within the nine nutritional food groups as specified by the FAO (Ruel 2003). In total, 88 different individual food items were consumed in seven days by all the respondents, indicating a large variety (> 60 food items) for the group (Matla 2008). However, the majority of the respondents (n=34, 62.9%) consumed between 21 and 35 individual food items, indicating poor food variety (30 food items defined by Matla 2008).

The total range of individual food items consumed by an individual during the seven day period of data collection was 0-68, with one person who did not consume any food items during the seven-day reporting period and only one person showing good food variety (>60 food items defined by Matla 2008).

Table 4.12 Household food access as measured by the food variety within the food groups consumed over a period of one week (n=55).

Cereal Group (n=16)	Flesh Products Group (n=13)	Legumes Group (n=14)	Egg Group (n=1)	Dairy Group (n=8)	Vitamin A Rich Fruit and Vegetable Group (n=7)	Vegetable Group (n=17)	Fruit and Juices 100% Group (n=7)	Fats and Oil Group (n=5)	Total individual Food items Eaten from all groups (n=88)
0=1	0=2	0=18	0=28	0=12	0= 10	0=13	0=7	0=13	0=1
1=0	1=7	1=12	1=26	1=14	1=3	1=1	1=12	1=14	1-45=3
2=3	2=7	2=11		2=13	2=9	2=10	2=7	2=18	6-10 =1
3=4	3=6	3=10		3=3	3=13	3=7	3=12	3=8	11-15 =10
4=8	4=7	4=2		4=2	4=14	4=6	4=5	4=0	16-20=7
5=9	5=13			5=6	5=2	5=2	5=7	5=0	21-25=5
6=12	6=3			6=2	6=1	6=3	6=1	6=0	26-30=20
7=6	7=3			7=2	7=2	7=6	7=0	7=1	31-35=7
8=4	8=1					8=0	8=1		36-40=2
9=1	9=1					9=0	9=0		41-45=2
10=2	10=3					10=1	10=1		46-50=4
11=1						11=0	11=0		51-55=1
12=1						12=3	12=1		56-65=0
13=0									166-70=1
14=1									

The results in Table 4.12 show that not one of the food groups was consumed by all the respondents. The food items reported were mainly consumed from the groups of vegetable, cereal, legume and flesh products with (n =17, 16, 14 and 13) four items each respectively. This was followed by dairy products, vitamin A-rich fruit and vegetables, fruit and juices 100 percent and egg groups with (n=8, 7, 7, 5 and 1).

Table 4.13 Summary of food group diversity (n=54)

Number of food group consumed	Frequency	Percentage
0	1	1.8
2	3	5.6
5	4	7.4
6	7	13.0
7	8	14.8
8	17	31.5
9	14	25.
Total	54	100

The mean FGDS was 6.4 ±1.5 SD is indicating a high dietary diversity (6-9 groups) (defined by Matla 2008). The majority of the respondents (73.2%) showed high food group diversity score (6-9 food groups consumed in a period of seven days). This was followed by 20.4% with a medium food group diversity score (4-5 food groups) and 5.6 percent with a low food group diversity score (1-3 food groups) (defined by Matla 2008).

Although the dietary diversity results showed good food group diversity scores, the 24-hour recall results and the food variety score indicated contradictory poor dietary diversity (Table 4.12)

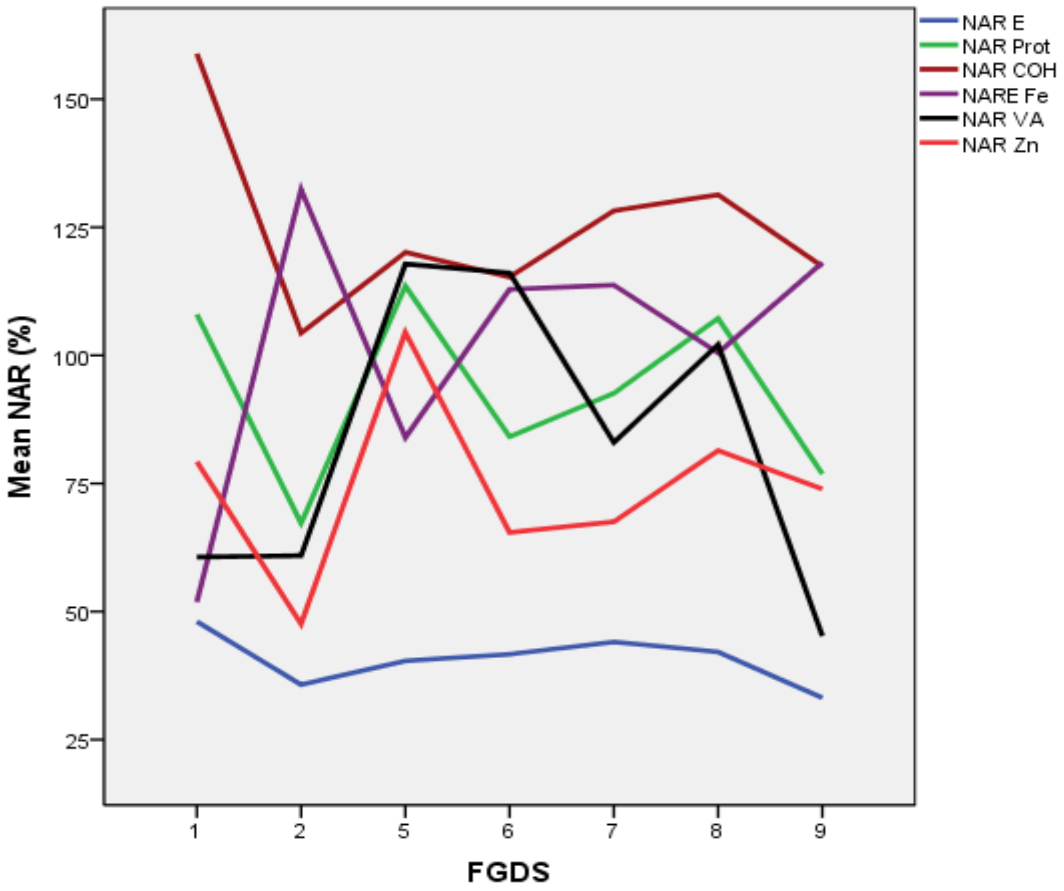

Figure 4.1 Correlation between FGDS and mean NAR percent of selected nutrients

The relationship between the food group diversity score and nutrient adequacy ratios (NAR) of protein, carbohydrates and selected micronutrients showed an increase in NAR for all the macronutrients as FGDS increases from two to five groups and again from six to eight groups, after which the NAR surprisingly showed lower intakes with the consumption of nine food groups. However, very few people consumed 1-4 food groups and therefore the results indicated for FGDS 1-5 are not representative of the total sample. Energy intakes showed an increase in NAR as the FGDS increased with a peak of almost 50 percent of NAR with a FGDS of 7. The NAR for energy never reached 100 percent maybe due to the poor socio-economic situation and the small portion sizes of the various food items consumed. All the nutrients reached maximum NAR at FGDS of 8 except for iron reaching a maximum NAR at a FGDS of 7 (Figure 4.1).

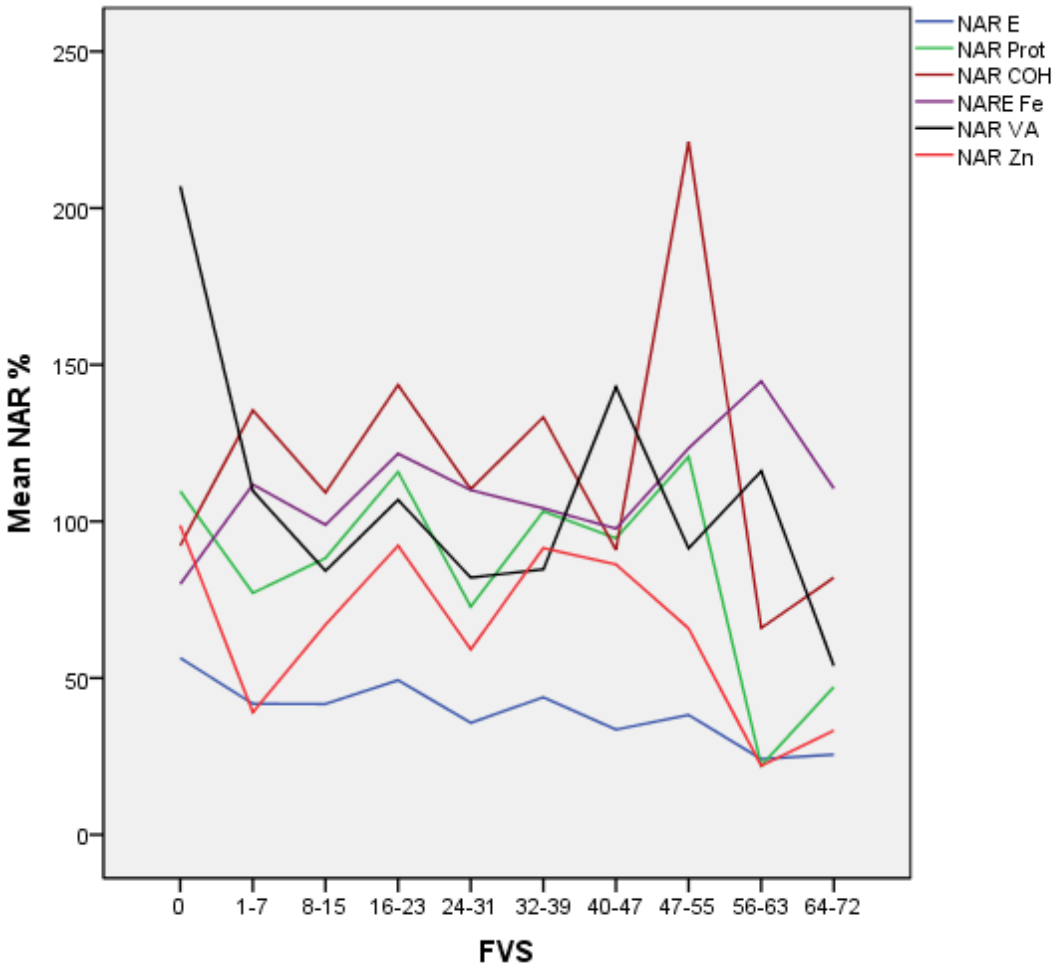

Figure 4.2 Correlation between FVS and mean NAR percent of selected nutrients

The relationship between the FVS and NAR of protein, carbohydrates and selected micronutrients did not show the same relationship as when the FGDS and NAR were correlated. It seems as if the NAR for energy intakes decreased as the FVS increased. The NAR for energy never reached 100 percent, maybe due to the poor socio-economic situation and the small portion sizes of the various food items consumed (Figure 4.2).

4.3.3 Anthropometric results

Weight and height were measured for 70 children (100 percent of the sample) and analysed according to the World Health Organization (WHO) standards (2007b) to determine nutritional status of the respondents.

The results of the anthropometric measurements are reflected in the tables below.

Table 4.14 Weight-for-age: girls (n=38) and boys (n=32)

Parameter	Percentage Girls	Percentage Boys	Total (n=70) (%)
Severely underweight <-3SD	0	7.1	2.7
Underweight ≥-3SD<-2SD	17.4	21.4	18.9

The results in Table 4.14 indicate that boys (28.5%) were underweight (<-2SD) compared to girls (17.4%). However, 7.1 percent of the boys were severely underweight compared to not one of the girls. This indicates that there is acute malnutrition in this group of children, which is consistent with the insufficient food intakes reflected by the 24-hour recall and dietary diversity measurements.

Table 4.15 Height-for-age: girls (n=38) and boys (n=32)

Parameter	Percentage Girls	Percentage Boys	Total (n=70) %
Severely stunting <-3SD	5.3	3.1	4.3
Stunting ≥-3SD<-2SD	15.8	15.6	15.7

The results in Table 4.15 indicate that 21.1 percent of the girls and 18.7 percent of the boys were stunted (<-2 SD), with 4.3 percent of all the children being severely stunted (<-3 SD). This indicates chronic malnutrition and/or the presence of over a long period leading to failure of linear growth (WHO 2007b).

Table 4.16 BMI–for-age: girls (n=38) and boys (n=32)

Parameter	Percentage Girls	Percentage Boys	Total (n=70) %
Severely thin <-3SD	5.3	6.3	5.7
Thinness ≥-3SD <-2SD	13.2	21.9	17.1
Normal weight ≥-2SD<+SD	81.5	71.8	8.6
Overweight ≥+1SD<+2SD	0	0	0
Obesity ≥+2SD	0	0	0

The results in Table 4.16 indicate that 28.2 percent and 18.5 percent of the boys and girls were thin respectively. None of the boys and girls were overweight or obese whilst 71.8 percent of boys and 81.5 percent girls were of normal weight.

From these results it can be concluded that both acute and chronic malnutrition are prevalent in this group of children, however, the boys were more accurately malnourished (wasting) compared to more girls who were chronically malnourished (stunting).

4.4 SIGNIFICANT RELATIONSHIPS BETWEEN VARIABLES

Correlations were drawn between the anthropometric indices of the children and the education, employment status as well as the household income of the caregivers. Furthermore, correlations were also drawn between selected nutrient intake levels, dietary diversity scores and nutritional status parameters (HAZ, WAZ, and BMI). Only the significant relationships are reported in Table 4.16.

Table 4.17 Correlations between anthropometry, dietary intake and socio-demographic status

Variables	Correction *R*	Significance *p* <0.05
BMI-for-age & energy intake	0.262	0.045
Height-for-age & household income	-0.270	0.046
Height–for-age & mother's education	-0.258	0.038
Money spent of food weekly	-0.262	0.035
Employment of both care-givers and house hold vegetable garden	0.416	0.049

From Table 4.17 it is indicated that only BMI-for-age is positively correlated to energy intakes (*p*=0.045). With regards to correlation between children's anthropometric measurements and household socio-demographic status, only height–for-age correlated with the household income, mother's education level and money spent on food purchase, *p*=0.046, *p*=0.038 and *p*=0.035, respectively. However, stunting and household socio-demographics have negative correlations. It is known that stunting cannot be reversed after the age of two, which could explain the negative growth relation between the two parameters.

No significant relationships existed between the nutritional status (underweight) of the children and the age and employment status of the caregivers. There is, however a

positive significant relationship (r=0.416, p=0.049) between the employment of both the caregiver with the presence of a household garden.

4.5. EXPERIMENTAL RESULTS

The nutritional analyses of the indigenous morogo grown in Qwa-Qwa and consumed by the respondents are indicated in Table 4.17.

Table 4.18 Proximate composition (fresh weight basis) of morogo (Amaranthus spp) leafy vegetable.

Component	Minimum	Maximum	Mean(±SD)
Moisture (g/100g)	89.32	90.05	89.75(±0.36)
Ash (g/100g)	1.91	2.03	1.96(±0.06)
Dietary fibre (g/100g)	1.74	1.93	1.81(±0.09)
Carbohydrate (g/100g)	0.87	0.88	0.87(±0.02)
Fat(g/100g)	0.63	0.67	0.66(±0.02)
Protein (g/100g)	3.48	3.68	3.58(±0.09)
Energy (kJ/100g)	99.4	167.4	132.4(±2.4)

It is shown that the mean energy content was 132 kJ, consisting of 34 percent carbohydrates and fibre (2.7g, 45.4 kJ), 46 percent protein (3.6g, 60.5 kJ) and 20 percent fat (0.7g, 26.5 kJ) per 100g raw portion. Morogo contains a significant amount of protein (3.5±0.1g/100g fresh weight [FW]) and minerals of which the level exceeded 1 percent of FW. The total antioxidant capacities (µmol TE/100g FW) determined by DPPH and FRAP assays were 118.3± 15.3 and 128.4± 11.9 respectively. Total polyphenols (109.4± 7.5mg GAE/100g FW),vitamin C (36.6 ± 1.0 mg/ 100g FW) and carotenoids (Vitamin A) represented by _ carotene (25.3 ± 1.3 mg/ 100g FW) and xanthophylls (7.48± 0.31mg/100g FW) formed a significant part of bioactive compounds content of morogo leaves. Since the boiling can cause significant losses of compounds into the water, it can be recommended that where a boiling step is included, the water should not be discarded (Table 4.18).

Table 4.19 Contribution of morogo consumption to total daily macronutrient intakes

Component	Contribution of morogo	Total dietary intake	Percentage of contribution
Carbohydrates and fibre (g/310g)	49.6	7063.1	0.7
Protein (g/310g)	66.2	1505.4	4.4
Fat (g/310g)	12.2	8215.0	
Total energy intake	2449.4kJ	194722.6	1.3

The results in Table 4.19 showed the contribution of the total amount of morogo (310g) consumed by the group of children and the contribution made to the total macronutrient intake of the sample (n=55). It is clear that the largest contribution is in terms of protein, at 4.4 percent of the total protein intake for the sample.

Table 4.20 Contribution of morogo intake to total intake of the individual children who consume the morogo

Nutrients	Content per 111g morogo	Percentage of total intake
Energy	147kJ	4.0%
Protein	3.97g	0.30%
Carbohydrate	0.97g	0.08%
Fat	0.73g	0.03% or 3.0%

The results in Table 4.20 show that a mean portion of 111g of morogo was consumed by only three children in the sample. The main contribution of the morogo was made in terms of energy at 4 percent of total intake, followed by protein at 0.3 percent of the total intake of these children. Morogo thus does not significantly contribute to the dietary intakes of the group of children in this sample. This may have been due to seasonal availability.

4.6 DISCUSSION

The main aim of this study was to determine the nutritional status and dietary intake patterns of children aged 7-13 years in the Bakoena and Batlokoa communities in Qwa-Qwa. Firstly, the results obtained regarding the socio-demographic profile, as well as the household information, as provided by the child caregivers will be discussed, followed by the nutritional status (anthropometric results) and adequacy and frequency of dietary intake of the child respondents. Throughout the discussion the results obtained in this study will be compared to the NFCS and other South African studies for the interpretation of the results. Limitations of the study, conclusions and recommendations will be discussed in Chapter 5.

4.6.1 Demographic profile of the respondents

Food security is a problem around the world, though poverty and hunger alleviation is the first Millennium Development Goal (MDG). The South African Constitution stipulates that every child has the right to have food, however, the country still has high poverty and unemployment rates (Labadarios *et al*. 2011: 891), which were also found in this community.

The results further showed that household food insecurity was a major challenge experienced by these households in Qwa-Qwa as a large percentage (42%) of them spent less than R100 on food per week, which was thus calculated as less than R14.29 per day (R 100/7 days). This amounted to an average of R2.86 per person per day

(R14.29/5 people), which is much less than the US$1 or US$1.25 regarded as people living in poverty. R 2.86 can buy less than half a loaf of bread a third of a litre of milk, or half a kilogram of maize. This was also evident from the type of foods consumed. The list of 20 most consumed foods indicated that the majority were carbohydrate-based, with a low frequency of small portions of protein-rich sources and vegetables and fruit, not meeting the recommended intake of 400g per day (Love & Sayed 2001:S29). This is in agreement with the THUSA (Transition in Health during Urbanisation in South Africa) study conducted in North-West Province, in which regular vegetable and fruit consumption was found only in upper class urban households (Macintyre, Kruger, Venter & Vorster 2002:250). Other results similar to the study were found.

In a study conducted in a peri-urban area of the Vaal Region (Oldewage-Theron *et al.* 2006), the average household size of five spent R2.90 per person per day on food. Bonti-Ankomah (2001) recommended a minimum of ±R9.55 (US$1.22) should be available daily for every household member, depending on the inflation rates. A family of five thus requires around R38.20 to 47.75 per day to survive (US$4.85 (Bonti-Ankomah 2001). Labadarios and co-authors (2011:895) and Selepe (2010: 46) found similar results, indicating that the majority of South African households still struggle to sustain a decent income, earning less than R1000 (US$127) every month, as also found in this study. The Free State, where this study was conducted, is not the poorest province, though the high levels of inequality in the country persist (Punt *et al*. 2005:7).

The living conditions in a household and the environment in which people live can further negatively contribute to or influence the health status of its members (Statistics SA, 2003). Although this study was mainly undertaken in a rural area, the majority of the households were situated in built-up areas with brick houses of four or more rooms. Most of these houses were built as part of the South African government's Reconstruction and Development Programme (RDP). However, the environment still showed a lack of services as the majority of the households did not have a tap inside the house, but had access to piped water outside the house, and 95.2 percent of the households still used an outside pit toilet. This was consistent with the NFCS findings (Labadarios *et al*. 1999).

Access to safe drinking and food preparation water usually promotes good health through reducing the possibility of food- and water-borne diseases (STASSA 2003). The majority of the households used electricity; however, a large percentage still relied on coal and wood for energy. Waste removal was almost non-existent as the majority used pit holes to throw their wastage and others removed the waste from their yard by dumping it in the waste areas. No municipal waste removal facility was available. Thus, the RDP has brought some improvement in the lives of these household members, but it was not sufficient to meet an acceptable standard of living (Meth & Dias 2004). This was also found in another study conducted in Mangaung, the capital city of the Free State (Pienaar 2005).

4.6.2 Dietary intake patterns

A nutritionally adequate diet should meet both macronutrient and micronutrient requirements. In this study this was not achieved. The results showed adequate mean intakes for carbohydrates, iron, Vitamins K and B12 only, whilst the rest of the other entire nutrients showed deficient intakes for the children when compared to EAR. Similar results were found in the NFCS, where the majority of the children consumed a diet deficient in energy with most micronutrient needs not met (Labadarios *et al.* 1999; Labadarios *et a*l. 2005). Furthermore, similar results of poor nutrient intake were observed in primary school children from a school in Qwa-Qwa (Oldewage-Theron & Egal 2010:153), excluding the children in this study.

The five food items most commonly consumed by the children in this study were stiff and soft maize meal porridge, tea, milk and bread. With the exception of sugar, this pattern was also observed in the NFCS amongst all provinces (Labadarios *et al*. 1999). The results of this study further showed that the respondents consumed a mainly carbohydrate-rich diet, as six of the 20 most commonly consumed food items were stiff and soft maize meal porridge, brown and white bread, sugar, potato and samp. Only four vegetables and fruit items, as well as protein-rich food sources, were on the list of the 20 food items mostly consumed. The actual food consumption portion sizes looked

sufficient for children, however, when the per capita food consumption patterns were determined, it showed very small portion sizes of mostly the vegetables and fruit as well as the protein-rich food sources consumed. Only the maize meal porridge showed good portion sizes. These findings were consistent with a study conducted by the Vaal region amongst primary school children (Oosthuizen 2010:146).

Studies have shown that poor dietary quality and diversity, evidenced by suboptimal food and nutrient intakes, is a feature of many developing countries, including South Africa. In the absence of a National Nutrition Surveillance Programme in South Africa, limited recent data is available on diet quality and dietary diversity in children, especially in Black and impoverished population groups. However, low dietary variety is usually associated with low-income Black South Africans.

The dietary diversity results of this study were consistent with the 24-hour recall results in terms of the most commonly consumed food items. The mean ±SD FVS of 23.96 ±16.08 revealed poor dietary diversity in the children, despite the relatively high food variety (88 individual foods consumed in seven days) reflected in the total number of individual food items consumed in seven days. Although 88 different food items were mentioned by all the children in the group, this was not a mean intake value, but meant that different combinations of the individual food items were consumed by the children. This indicates that although most food groups were consumed by the children, only a few foods from each group were included. Consuming one or two foods from each of the nine groups does not, therefore, constitute a varied intake. Another South African study had reported the opposite, where a low food variety score was restricted to a relatively narrow range of food items (Bourne, Lambert & Steyn 2002). The food group with the highest mean food variety score was the cereal group, followed by the flesh food group, other vegetables group and fruit and other juices group, and vitamin A-rich fruit and vegetables group. However, the majority of the respondents consumed between six and nine food groups, indicating high food group diversity.

Household food gardens were available in 86.2 percent of the households, but it is clear that they did not contribute greatly to the dietary diversity or nutrient intakes of the

children in this study. Furthermore, nor did the consumption of indigenous foods such as morogo contribute significantly to the nutrient intakes of the children.

4.6.3 Nutritional status

Anthropometric data is most commonly used as an indication of dietary practices, despite it being seen as an indicator of various factors such as neglect and disease (Walsh *et al.* 2003), Underweight or a weight-for-age of below -2SD is usually the result of an acute food shortage. In this study more boys (28.5%) than girls (17.4%) were underweight. The prevalence of underweight was much higher than the national prevalence rate of 10 percent (Labadarios *et al.* 2005:265). Underweight is difficult to interpret as it cannot always discriminate between acute and chronic food shortage (Zere & Mcintyre 2003). Therefore, stunting and wasting were also determined.

As found in another study in Mangaung (Pienaar 2005), the results of this study indicated that the number of well-nourished children was relatively small. Stunting or height-for-age of below -2SD usually occurs after a period of chronic malnutrition (Lee & Nieman 2003:184) and is a major problem in South Africa (Labadarios *et al*. 2005). In this study, 21.1 percent of the girls and 18.7 percent of boys were stunted, indicating chronic malnutrition leading to failure of linear growth. These findings reported slightly lower stunting rates than the national prevalence rates of 20 percent (Labadarios *et al*. 2005:265). Stunting is a serious condition as it often has irreversible consequences, with stunted children usually growing up as stunted adults (United State Agency for International [USAID 2013]),and at an increased risk of becoming obese and developing chronic diseases of lifestyle.

Wasting (thinness) or BMI-for-age of below -2SD is an indicator of recent and severe malnutrition (Lee & Nieman 2003:184). A greater percentage of the boys (28.2%) than girls (18.5%) was wasted. These results were disturbing, as children who are wasted usually have a significantly increased risk of death (UNICEF 2009). Wasting typically reflects the inadequacy of the diet and these findings thus reflect the poor nutriental intakes of the children in this study. None of the children were overweight or obese,

which conflicted with the national prevalence rate of 10 percent and 4 percent respectively for children aged 1-9 (Labadarios *et al.* 2005:265).

Both acute and chronic malnutrition are thus prevalent in this group of children. These results were confirmed the studies indicating that more rural children were more malnourished than those in urban areas (Labadarios *et al.* 2008*;* Oldewage-Theron & Egal 2010).

Although micronutrient deficiencies of South African children have been improved (Steyn et al. 2006:9:644-650), the poor dietary diversity and poor micronutrient intakes are still predominantly the cause of stunting still in many children (Kuzwayo 2008: 167).

4.6.4 Discussion of associations

Two main associations were found in the study.

4.6.4.1 Associations between household income and caregiver education and stunting, wasting and underweight of children

In this study, BMI-for-age of the children positively correlated with the energy intake (p=0.045), while the height-for-age (stunting) correlated with the household income, education level of mother and the money spend on the food of the household *(p=0*.046, *p=0*.038 and *p=0.035)* respectively. However, all height-for-age and socio-demographic parameters have had significantly negative correlations. Literature has shown that stunting does not improve beyond the age of two and thus could partially explain the negative development as this growth index remains unchanged, while others improve with children growth trajectory. There was indeed a correlation that could have been positive if those parameters had been favorable for child during those crucial growth stage under two years of age (Bonti-Ankomah 2001:2). Furthermore, stunting is associated with challenges in child development which result in poor cognitive development, weak education performance, increased morbidity and impaired immune

functions (Bonti-Ankomah 2001:2; Mendez & Adair 1999: 1555; Martorell, Rivera & Kaplovitz 1992:143; Monyeki, Kemper, Koppes & Twisk 2005: 877).

Bonti-Ankomah (2001) also found that rural households spend less on food than do urban ones. The lower food expenditure contributes more to malnutrition of the children in households that are poor. The lower the household income the higher the prevalence of food insecurity, which causes malnutrition and affects the dietary intake patterns of the children. The majority of the mothers had secondary education, which did not have any positive impact on the nutritional status of the children.

4.6.4.2 Associations between household gardening and stunting, wasting and underweight in children

The researcher found a positive significant correlation between the employment of the both caregivers with vegetable garden in their (*r=0*.416, *p=0*.049) concomitantly, there was no significant relationships between the nutritional status (underweight) of the children and the age and employment of the caregivers. This elucidates the importance of supplemental household food gardening to the nutritional status of the respondent children that is independent to a certain degree from household income.

4.6.5 Discussion of the indigenous food consumption

The nutritional value the total antioxidant capacity and selected bioactive compounds present in morogo leaves were determined in laboratory analysis. In the results of this study it was found that there was a significant amount of protein (3.5±0.1g/100g fresh weight) and minerals, of which level exceeded 1 percent of FW. Similar results for protein were found in morogo (3.6±0.1g/100g FW) (Medoua & Oldewage-Theron 2011). Another African Leafy Vegetable (ALV) had higher protein content than exotic (Uusiku, Oelofse, Duodu, Beester & Faber 2010). It can be recommended that cooking methods avoid using boiling of water, as found by Medoua and Oldewage-Theron (2011). The mean portion of morogo was consumed by only three children in the sample, in terms of

energy at 4 percent of total intake, followed by protein at 0.3 percent of the total intake of the children. Morogo does not contribute to the dietary intakes of the children; however morogo or ALVs are not a very good source of protein if compared to legumes (Uusiku, Oelofse, Duodu, Beester & Faber 2010). Communities must be exposed to the value of the indigenous foods in their areas and encourage to employ the best cooking methods to preserve nutrients for optimum use for human nutrition and wellbeing.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In the previous chapter the results of the study were presented and discussed and aligned with the literature in Chapters 1 and 2. The purpose of this study was to determine the nutritional status and dietary intake patterns of children aged 7 to 13 years in the Batlokwa and Bakoena communities in Qwa-Qwa. This study put more emphasis on the nutritional status of children in the age group between 7 and 13 years, as this is known as the growth spurt period (UNICEF 2011). This was a worthwhile study as little information existed on the nutritional status of rural people in South Africa and none as far as Qwa-Qwa was concerned. The findings assisted in formulating practical recommendations for further research and to address the nutritional status challenges of the children in Qwa-Qwa.

5.2 LIMITATIONS OF THE STUDY

There were a number of possible limitations to the study.

5.2.1 Study population

The local community leaders granted permission to undertake the study and also purposively selected the households meeting the inclusion criteria. This may have introduced a selection bias as the sample thus only represents a certain part of the community and the results cannot thus be generalised to all communities in Qwa-Qwa.

Due to time available by the respondents during the collection of data, it was collected on different days and some were therefore not collected as not all the caregivers or children attended all the data collection days. For this reason, a complete data set of the dietary intake and diversity data is not available.

5.2.2 Data collection limitations

The Hawthorne effect refers to the influence the data collection process itself could have on the answers provided during an interview (French, 1953:10). It is possible that respondents could have given untrue answers in order to try and impress the interviewer or by hiding the poor situation. To limit this effect, the respondents were informed that the questionnaires were not a test and no right or wrong answers existed. It was also explained that the data collected would eventually be of benefit to the children and the community and that honesty was thus essential. Furthermore, valid and reliable questionnaires and procedures were used to limit this effect.

5.2.3 Dietary intake limitations

No single dietary assessment method has been described as the “ideal” method to date (Gibson 2005) and all dietary assessment methods have limitations and challenges. A limitation of the 24-hour recall and FFQ used in this study had to rely on the memories of both the respondents and their caregivers (Walsh & Joubert, 2007). Furthermore, over- and under-estimation of foods consumed by respondents may occur with most dietary assessment methods (Dwyer 1994). Trained fieldworkers who could speak Sotho were thus used for the dietary intake data collection. Food models were also used to assist with the identification of food items and estimation of portion sizes. The 24-hour recall was completed with the validated four-step method as described by Gibson (2005:41-42). Three 24-hour recall questionnaires were completed as described by the literature for more valid and reliable data (Gibson 2005).

5.3 MAIN FINDINGS OF THE STUDY

The main findings of the study are as follows:

- Children are mostly affected by malnutrition globally and in 2010 the mortality rate of the children was very high, also in South Africa. From the literature study it is clear that malnutrition is a persistent problem amongst children, especially in developing countries. However, both under- and over-nutrition are prevalent in the developing countries. Furthermore, given the multiplicity of environments, the nature of societal changes, involvement in globalisation, and the genetic and evolutionary experience across regions, generalisation about nutritional status of vulnerable children is very complex, and many studies have indicated that poor nutritional status and dietary intake patterns of the children occur mostly in rural areas. Malnutrition is associated with reduced cognitive development, impacting on child education around the world.

- One of the underlying causes of malnutrition is household food security, which is exacerbated by recent rises in prices of staple foods such as maize meal, cooking oil and milk, as well as fuel prices that in turn affect the food prices. This has a direct effect on the dietary intake of the household, since the income is not sufficient to buy nutritious foods.

- A drought in South Africa has affected the home gardening and the agricultural status of the country. Qwa-Qwa is an agricultural area though government has identified it as one of the places where poverty exists, even after 17 years of the new political dispensation.

- From the socio-demographic data collected, it was clear that poverty and the resultant food insecurity were the major challenges observed in this Qwa-Qwa community.

- Although household food gardens existed in some of the households, it did not significantly contribute to the dietary diversity of this community as poor dietary diversity was observed in this community. This was confirmed by the actual foods consumed, as measured by the 24-hour recall showing a mainly carbohydrate-rich diet with limited

vegetables, fruit, dairy and other protein-rich food sources. This resulted in poor nutrient intakes for almost all of the macro- and micro-nutrients.

- Malnutrition is still a problem in Qwa-Qwa, as the results indicated that stunting, wasting and underweight occurred in the children forming part of this study. This was mainly caused by poor dietary intake patterns of the children.
- This study found that household food gardening plays role in child growth and restraint nutritional status of Qwa-Qwa children.

5.4 CONCLUSIONS

It can be concluded that poverty, household food insecurity and poor dietary intakes and diversity resulted in poor nutritional status of the children in this community. Most of the children were undernourished, with both chronic and acute malnutrition being prevalent. Although indigenous foods were available and consumed by the children, they did not contribute significantly to the dietary intake of the children.

5.5 RECOMMENDATIONS

Children are the future of any nation and should be properly cared for. The high prevalence of inadequate nutrient intakes and poor nutritional status (under-nutrition) amongst the children in this study demonstrates the need for effective and efficient sustainable food and nutrition interventions aimed at improving dietary intake and diversity as well as countering poor nutritional status.

5.5.1 Recommendations for the community

Household diversification is important for the achievement of a balanced meal intake through food production strategies (e.g., household gardening) to improve the availability of food insecure households such as those in this study (Kimokoti & Hamer 2008). Household vegetable gardens should thus be implemented with nutrition education to empower the child caregivers to provide balanced meals for the children. Nutrition education should include handling and storage of food as well as preparation methods, such as healthy cooking methods for the preservation of essential nutrients.

Furthermore, caregivers should consider the available indigenous foods as part of the dietary intakes of the households as these often grow wild and do not cost anything, but can contribute to the nutrient intakes of both the caregivers and the children. The produce from indigenous and home vegetable and fruit gardens are less expensive than buying these items from the market.

School vegetable and fruit gardens can also be implemented and the produce included in the National School Nutrition Programme menus to complement their dietary patterns, vis-à-vis possible nutritional deficiencies. It is however very important to monitor and correct any nutritional deficiencies at this age as such affect cognition and therefore compromise academic achievement.

5.5.2 Recommendations for policymakers

Nutrition education should be considered to improve the nutrition knowledge and change dietary intake behavior of children from an early age. Poor knowledge of nutrition is a key factor involved in the development of malnutrition and (Walsh *et al*. 2003:89) it is known that dietary habits in childhood impact on growth, development and the prevalence of disease throughout life. It is thus important that healthy eating habits be established during the primary school years, when it is being developed (Anderson *et al.* 2005:650; Vijayapushpam et al. 2008:108) and healthy eating behaviours should continue throughout life (Sharma et al. 2008:362). Most children spend much of their time in school, therefore school-based nutrition education can be used to engage them

in healthy eating and physical activity programmes, designed to introduce nutrition knowledge and reinforce healthful eating patterns (Gross & Cinelli, 2004:793; Wechsler et *al*. 2000:S121).

5.5.3 Recommendations for further research

The results of this study indicate that further research is needed as follows:

- A representative baseline survey including all the rural, peri-urban and urban areas of Qwa-Qwa for a complete situation analysis.
- The associations between socio-economic status, food intake patterns and nutritional status of the child caregivers and the children with suitable interventions to improve the overall dietary intake patterns and diversity.
- The impact of the use of all available indigenous foods, not only morogo, in this Qwa-Qwa community.
- Impact of nutrition education on nutritional knowledge and dietary intake behaviour of child caregivers and children in Qwa-Qwa

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ANNEXURE A

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Egal

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M080931**
PROJECT	Qwa-Qwa Integrated Nutrition Project
INVESTIGATORS	Dr AA Egal
DEPARTMENT	Ins. of Sustainable Livelihoods
DATE CONSIDERED	08.09.26
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 08.11.05 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof WO Theron

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Vaal University of Technology
Your world to a better future

ANNEXURE B

INFORMED CONSENT FOR PARENTS/ LEGAL GUARDIANS

(On behalf of minors under 18 years old)

I, the undersign ……(full name in print) have listened to the oral explanation of the project, and declare that I understand it. I have had the opportunity to ask clarifying questions and discuss relevant aspects with Prof Wilna Oldewage-Theron and/ or Dr Abdulkadir Egal. It has been explained to me that I will be free to withdraw myself and/ or my child from the study at any time, without any disadvantage to future care. I hereby declare that I understand everything that has been explained to me and give consent that my child/children and I may voluntarily participate the project and that blood samples may be taken from us.

I hereby indemnify the Vaal University of Technology (VUT), or any employee of the VUT, against any liability that may originate during my participation in this research project. I further undertake that I will not lay any claim against the VUT or any VUT employee for damage or personal disadvantages that my child may suffer as a result of this research**.**

MOTHER:

_____

_____

Printed name signature/ Mark or Thumbprint Date and time

GRANDMOTHER:

Printed name signature/ Mark or Thumbprint Date and time

CHILD: *(Seven (7) years old and above)

Printed name signature/ Mark or Thumbprint Date and time

CHILD: *(Seven (7) years old and above)

Printed name signature/ Mark or Thumbprint Date and time

(* Minors competent to understand must participate as fully as possible in the entire procedure)

STUDY DOCTOR:

Printed name signature Date and time

TRANSLATOR / OTHER PERSON EXPLAINING INFORMED CONSENT:……(DESIGNATION):

Printed name	signature	Date and time

Address of volunteer household:

……
……
……
……
……
……

Contact telephone number:

……
……..

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ANNEXURE C

QWA-QWA INTERGRETED NUTRITION PROJECT:
SOCIO-DEMOGRAPHIC QUESTIONNAIR

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 information will not be identifiable from any reports or publications.

1. GENERAL INFRMATION

Date:……

Fieldworker:……

Subject Number:……

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

Example: In what town do you live?

Johannesburg	Bloemfontain	Cape Town	Vanderbijlpark	Durban

2. PERSONAL INFORMATION

2.1 Your role in the family

Mother	Grandmother	Father	Grandfather	Other, specify……

2.2 When were you born? Year:_____

2.3 Gender:

Male	Female

2.4 Are you?

Single	Married	Widowed	Divorced	Other, specify……

3 ACCOMODATION AND FAMILY COMPOSITION

3.1 Do other people live in your house?

Yes
No

3.2 How many people live in your house?

1	2	3	4	5	6	7	8	9	10+

3.3 Indicate your family composition by completing the following table. Indicate in the appropriate box.

Household Relationship	Gender	Age
Mother	F	
Father	M	
Grandmother	F	
Grandfather	M	
Child 1		
Child 2		
Child 3		
Child 4		
Child 5		
Other, specify		
Other, specify		

3.4 Are all members permanent residents in this house?

Male	Female

3.5 How long have you been staying permanent in this house?

< 1 year	1-5years	>5 years

3.6 Do you have another home outside QwaQwa?

Yes	No

3.7 In what type of house are you staying?

Brick	Clay	Grass	Zinc/Shack	Other, specify……..

3.8 How many rooms are in your house?

< 2 rooms	3-4rooms	>4 rooms

3.9 How would you describe the place where you are currently living?

Rented house	
Own house	
Other, specify	

3.10 Do you have the following facilities at home?

3.10.1 Water:

Tap in the house	
Tap outside the house (in yard)	
Borehole	
Spring / River / Dam water	
Fetch water from elsewhere	

3.10.2 Toilet facilities:

None	
Pit latrine	
Flush / Sewage	
Bucket system	
Other, specify	

3.10.3 Waste removal

Yes	No

3.10.4 Tarred road in front of house

Yes	No

Gravel road in front of house

Yes	No

3.10.5 Vegetable garden

Yes	No

3.10.6 What do you do with your vegetables?

Household consumption	Selling	Preserving for the future	Give away to family, etc.	Other, specify……..

3.11 Do you have problems with the following?

Mice / Rat	Cockroaches	Ants	Other, specify……..

4 INCOME

4.1 Are you employed at the moment?

Yes, full time, permanent	
Yes, part time, permanent (<25 hours p.w.)	
Yes, temporary	
No, unemployed	
No, retired	
No, other, specify	

4.2 If unemployed, for how long?

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

4.3 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	

4.4 What is the total income in the household per month?

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

4.5 How long does it happen that you do not have money to buy food or clothes for you or your family?

Always	Often	Sometimes	Seldom	never

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

0	1	2	3	4	5	6	7	8	9

4.7 How often do you buy food?

Everyday	Once a week	Once a month	Other, specify……..

4.8 Where do you buy food?

Spaza shop	Street vendor	Supermarket	Other, specify……..

4.9 How much money is spend on food PER WEEK? (Tick only one box)

R0-R50	R51-R100	R101-R150	R151-R200	R201-R250	R251-R300	>R300	I do not know

5 EDUCATION AND LANGUAGE

5.1 What is the highest education qualification do you have?

None	Primary School	Secondary School	College	Other, specify……

5.2 What language is mostly spoken in the house?

Sotho	Xhoza	Zulu	Pedi	Other, specify……

6 ASSETS

Tick one box for each question	Father	Mother	Child	Grandmother	Grandfather
6.1 Who is mainly responsible for food preparation in the house?					
6.2 Who decides on what type of					

food are to be 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 on how much is to be 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	Café	Other, specify……

6.8 Does your home have the following and how many?

	Yes	No	Number of item(s)
Electric 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			
Electric kettle			

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

Food fire	Paraffin	Electricity	Gas	Coal	Other, specify……

6.10 What type(s) of pots do you use to cook your food? (Tick all relevant options)

Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

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

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ANNEXURE D

24- Hour recall

Subject ID number: _____ Gender: Male/Female

Interviewer: _____

Date: ____ /____/2008

Tick what day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

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

Yes	No

If not, why?

I bought some food	My visitor brought some food	Other reasons (pls. specify)

I want to find out about every thing that you ate or drank yesterday, including food you bought. 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	Description of food	Amount	Amount in g(office use only)	Code (office only)
From waking up to going to work, or starting day's activities					

During the morning (after breakfast)					

Time (approximately)	Place	Description of food	Amount	Amount in g(office use only	Code (office only)
Middle of the day (Lunch time)					
During the afternoon					
At night (dinner time)					

Time (approximately)	Place	Description of food	Amount	Amount in g(office use only)	Code (office use only
After dinner, before night to sleep					
*Do you take any vitamins (tablets or syrup)			Yes		No
Give the brand name and dose of the vitamins/ tonic :					

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ANNEXURE E

QWA-QWA INTEGRATED NUTRITION PROJECT
FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

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

GROUP 1 : Flesh foods (meat, poultry, fish) diversity	**MOTHER/ GRANDMOTHER**	**CHILD**
Chicken		
Beef		
Pork		
Tinned fish (pilchards, tuna)		
Fish (fresh/ whole)		
Minced meat		
Mutton		
Chicken runners and heads		
Chicken livers		
Goat meat		
Tripe		
Dried meat (biltong)		
Vienna's / polony / Russians		
Sausage 9wors)		
Steak		
Other, specify		
GROUP 2: Eggs diversity		
Eggs		
GROUP 3: Dairy products diversity		
Milk, unpasteurized (cow, goat)		
Evaporated milk (Ideal milk)		
Maas (inkomasi)		
Powdered milk		
Skim or low-fat milk (pasteurized)		
Full cream milk (pasteurized)		
Cheese		
Custard / Ultramel		
Ice cream		
Yoghurt / Yogisip		
Other, specify		

Group 4 : Cereals, roots and tubers diversity		
Rice		
Pap (Maize)		
Macaroni/ pasta/ spaghetti		
Maize rice (mielierys)		
Samp (stampmielies)		
Bread (white or brown)		
Dumpling / ‘‘Vetkoek’’		
Scones		
Biscuits		
Buns / bread rolls		
Mabela (soft porridge)		
Corn flakes / Rice krispies / Wheat Bix		
Oats		
Mageu		
Potatoes		
Sweet potatoes		
Traditional beer		
Other, specify		
Group 5: Legumes and nuts		
Dried beans		
Dried peas		
Peanut butter		
Peanut or any other nuts		
Soya		
Group 6: vitamin A rich fruits and vegetables diversity		
Pumpkin		
Carrots		
Wild leafy vegetables (morogo) Fresh and dried		
Spinach		
Butternut		
Ap4ricots (Appelkoos)		
Peach (yellow cling)		
Mango		
Group 7: Other fruits (and juices) diversity		
Delicious fruits		
Apple		
Peaches		
Pear		
Grapes (black/ green)		
Plum		

Sub- tropical fruit		

Lemon		
Orange		
Naartjie		
Banana		
Pineapple		
Avocado		
Blueberry		
Cherry		
Kiwi fruit		
Raspberry		
Watermelon		
Wild watermelon (tsamma)		
Guava		
Juices		
Juice (100% pure juice e.g. Ceres/ Liquifruit)		
Group 8: Other vegetables diversity		
Onions		
Cabbage		
Beetroot		
Rhubarb		
Turnips (raap)		
Gem- sguash (lemoenpampoen)		
Tomatoes		
Green beans (fresh)		
Peas (fresh – green)		
Cauliflower		
Chili (red/ green)		
Lettuce		
Mushroom		
Baby marrow		
Green pepper		
Sweet-corn (baby)		
Corn-on-the-cob(white)		
Garlic		
Group 9: Oil and fat diversity		
Butter		
Sunflower oil		
Margarine		
Lard		
Salad oil		

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

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ANNEXURE F

QWAQWA INTERGRATED NUTRITION PROJECT (SINP)
ANTHROPOMETRIC, HEALTH, MEDICAL AND BEHAVIOURAL QUESTIONNAIRE

Section A:

1.

Subject	
Age	Years
Gender	
Weight	Kg
height	m

Section B:

HEALTH QUESTIONNAIRE:

2. IS THERE A HISTORY OF THE FOLLOWING IN YOUR FAMILY?

	YES	NO
1. Any skin disease?		
2. Any affection of the skeleton and/or joints?		
3. Any affection of the eyes, nose or teeth?		
4. Any affection of the heart or circulation system?		
5. Any affection of the chest or respiratory system?		
6. Any affection of the digestive system?		
7. Any affection of the urinary system and/or genital organs?		
8. Any nervous affection or mental abnormality?		
9. Any headaches?		
10. Any other illness?		

3. Has any of the household members reported the following?

	MOTHER	GRANDMOTHER	CHILD
eight loss during the past month?			
ecent change in appetite?			
edness			
oblems with the following:			
• Chewing?			
• Swallowing?			
• Nausea?			
• Diarrhoea?			
• Vomiting?			
• Constipation?			
Follow a specific diet?			
If yes, specify……			
Allergic to any food?			
If yes, specify……			

4. Is anyone in the household physically disabled?

	Yes	No
GIVE THE TYPE OF THE DISABILITY …… …… …… …… ……..		

5. Does any of the household members smoke at the moment?

	MOTHER	GRANDMOTHER	CHILD
1 Yes			
2 No (Never smoked)			
3 No (Stopped)			

6. Does your spouse or partner smoke at this moment?

1. Yes	2. No	3. Not Applicable

7. Does anyone in the household make use of snuff at this moment?

	MOTHER	GRANDMOTHER	CHILD
1 Yes			
2 No (Never used)			
3 No (Stopped)			

8. Does anyone in the household use alcohol on a regular basis?

	MOTHER	GRANDMOTHER	CHILD
1 Yes			
2 No (Never smoked)			
3 No (Stopped)			

9. Does anyone in the household use drugs other than medication on a regular basis?

	MOTHER	GRANDMOTHER	CHILD
1 Yes			
2 No			
3 No Applicable			

10. Has anyone in the household undergone any operations during the past five years?

	MOTHER	GRANDMOTHER	CHILD
GIVE THE TYPE OF THE OPERATION ……			

…… …… …… …… …… ……..			

Section C:

MEDICATION AND HEALTH FACILITY QUESTIONNAIR:

1. **Does anyone in the household use chronic medication?**

	YES	NO
IF YES, WHO/ WHAT FOR / WHY? …… …… …… …… …… …… ……..		

2. **Do you keep any supplements?**

Yes	no

3. **If yes in previous question, specify the type.**

tamins, specify…… ……...	nerals, specify…… ……	ultivitami ns	her, specify…… ……..

4. **Which health facility is commonly used by the household?**

	Tick the appropriate block
1. Private Doctor	
2. Clinic	
3. Hospital	

4. Traditional Healer	
5. Other (please state)	

5. How do you travel to the health facility?

	Tick the appropriate block
1. On foot	
2. Taxi	
3. Bus	
4. Own transport	
5. Other (please state)	

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

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ANEXURE G

ACKNOWLEDGMENT OF LANGUAGE EDITING

Date: Tuesday, 11 December 2012

This is to certify that Language Editing has been carried out on the following

master's dissertation:

Nutritional status and dietary intake patterns of children aged 7-13 years in QwaQwa

by: Mosela Julia Mofokeng

Language Editing was carried out to appropriate academic standards, including syntax, grammar and style.

Andrew Graham (BA, MA dist., PhD, University of Keele, UK)*

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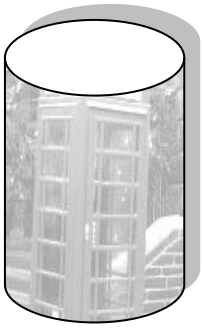

*Former Tutor in Postgraduate Writing Centre and Managing Editor of ISI Accredited Journal