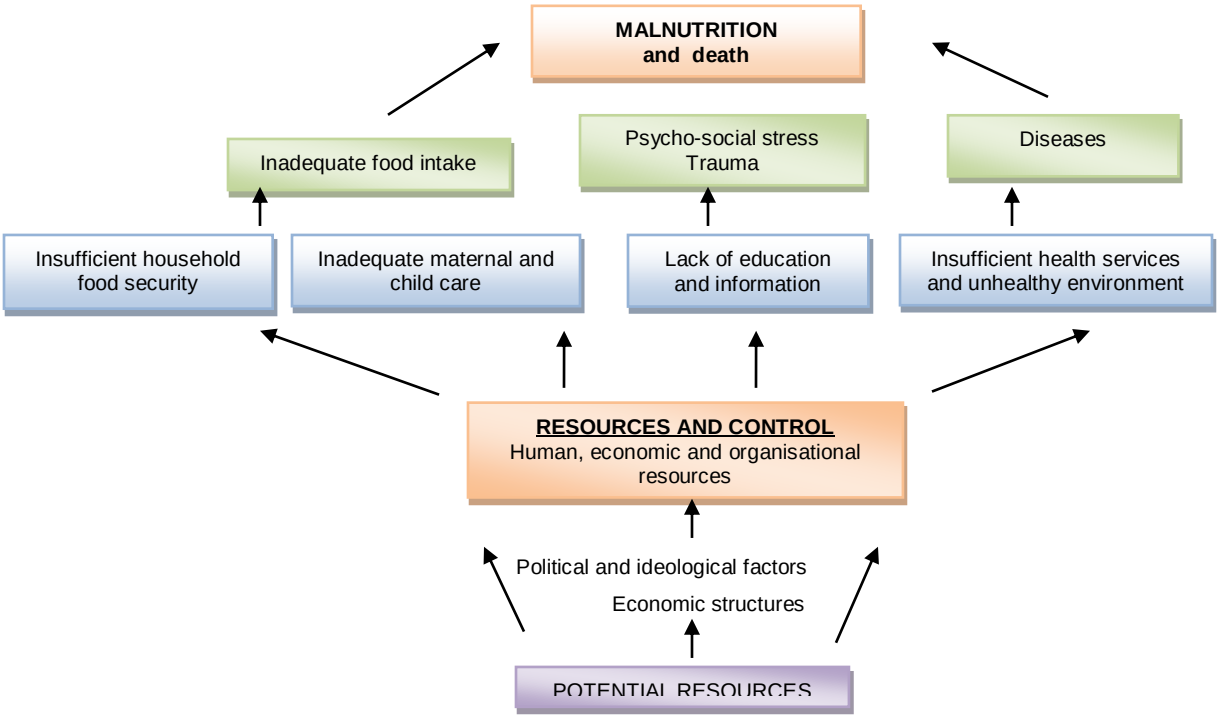
CHAPTER 1: MALNUTRITION IN CHILDREN

1.1 Introduction and background

This chapter reports on the background and justification of this study and introduces the research problem and the concepts that will be used throughout this study.

Malnutrition can be defined as a lack of proper nutrition. The nutritional status of a child, as with any individual, is assessed through dietary, anthropometric, biochemical and physical observation for signs of malnutrition. These methods of measurement are usually done in combination for more accurate results. When there is a deficiency in the amount and nutritional value of the food consumed, the growth pattern of a child becomes disrupted owing to nutrient deficiencies (Faber & Wenhold 2007:393; Labadarios 2005:119).

The global dilemma of malnutrition can be understood and addressed with the aid of the framework, shown in Figure 1.1, developed by the United Nations Children's Fund (UNICEF) (2004). The framework categorizes the causes of malnutrition as basic, referring to poor economic and political structures; immediate, referring to poor dietary intake, psycho-social stress and trauma and diseases such as diarrhoeal and acute respiratory conditions, which further complicate malnutrition; and underlying causes, referring to household food insecurity, lack of knowledge and education, caring practices and health services, as well as an unhealthy environment. Hunger and under-nutrition arise from poor food consumption, poor care and unhealthy facilities, and, indirectly, through agricultural barriers, lack of employment opportunities and women's status in society (Klugman 2002:1; Kurz & Johnson-Welch 2001:443-453; World Health Organization (WHO) 2001a).



1 – Manifestation; 2 – Immediate causes; 3 – Underlying causes; 4 – Basic causes

Figure 1.1: Immediate, underlying and basic causes of malnutrition (UNICEF 2004).

Malnutrition in children is the consequence of much food insecurity, which stems from poor food quality and quantity, severe repeated infections or combinations of all three. These conditions are linked to the standard of living and whether basic needs can be met (UNICEF 2007a; WHO 2001a). A lack of knowledge on the nutritional needs of children and the benefits of breastfeeding contributes to childhood malnutrition (UNICEF 2007a). The extent of hunger has also been associated with low energy intake, low micronutrient intake and poor income levels. This affects growth patterns negatively (Labadarios 2005:119). Malnutrition can cause physical, cognitive and psychological impairment, which over time causes permanent learning disabilities (Pelletier, Frangillo, Schroeder, Habicht 1995:443-448).

The global number of child deaths under the age of five, recorded in 2006 by UNICEF, WHO, United Nations Population Division (UNPD) and United Nations

Statistics Division (UNSD) (UNICEF 2007a:9), was just below 10 million, which is a 60 percent decrease since the 1960s. During 2007, UNICEF recorded 9.2 million child deaths under the age of five, globally. Child mortality and poverty are linked with one third of child deaths caused by malnutrition (UNICEF 2009). Globally, per region, 4.8 million child deaths were recorded in Sub-Saharan Africa; 900 000 in East Asia and the Pacific; 3.1 million in South Asia; 400 000 thousand in the Middle East and North Africa; and 300 000 in Latin America and the Caribbean. According to the United Nations Children's Fund (UNICEF) (2007b:9), 26 000 children die daily from preventable causes.

In South Africa (SA), estimates of under-five mortality during 2005 ranged between 69 and 76 per thousand, approximately 60 000 per annum (Labadarios, Swart, Maunder, Kruger, Gericke, Kuzwayo, Ntsie, Steyn, Schloss, Dhansay, Jooste, Dannhauser, Nel, Molefe, Kotze 2008:254-266). Results from the National Food Consumption Survey (NFCS) and NFCS-Fortification Baseline (NFCS-FB) concluded that children aged between one and three years are most vulnerable to poor nutritional status (Labadarios *et al*. 2008:254-266). Malnutrition and lack of access to clean water increase the risk of mortality. During 2000, child deaths caused by malnutrition accounted for 12 percent of child deaths and unsafe water usage and practices accounted for 9.3 percent (Nannan, Norman, Hendriks, Dhansay, Bradshaw 2007:4-6).

Education of children may assist in reducing poverty (UNICEF 2009). Globally, 101 million children of primary school age are not attending school. Children are deprived of education because of illness, being forced to care for siblings, or because they have been orphaned and placed with caregivers who are unemployed and income is minimal (UNICEF 2005:10-71). Over 140 million children globally, between the ages of seven and 18, have never attended school. The percentages of children in various regions under the age of 18 deprived of education and nutrition support structures are listed in Table 1.1 (UNICEF 2005:21).

Table 1.1 Number of children deprived of education and nutrition support structures globally (UNICEF 2005:21)

REGION	EDUCATION (%)	NUTRITION SUPPORT STRUCTURE (%)
Sub-Saharan Africa	29	18
South Asia	19	24
Middle East and North Africa	21	14
Latin America and Caribbean	3	5
Central and West Asia	7	6
East Asia and Pacific	3	12

% Percentage

Lack of proper education and illiteracy amongst caregivers, parents and children contribute to the growing malnutrition epidemic. Children are not equipped to make suitable food choices and are dependent on caregivers and parents to make choices. The choices are, unfortunately, reflective of the poor income status. Although studies have been done to assist in assessing nutritional status, very little has been done on nutrition education (NE) as a strategy to improve the quality of life and address malnutrition. The main purpose of this study was to assess the nutritional status of primary school children within a community and promote NE with the aim of improving nutrition knowledge and food choices, to encourage a better quality of life into adulthood.

1.2 Classification of malnutrition

Malnutrition can be classified as over- and under-nutrition. When food required for growth and development is lacking, the consequence is under-nutrition, which refers to a condition resulting from either micronutrient or macronutrient deficiencies, or from both (De Haen & Thompson 2003:375). Macronutrient deficiency is classified as Protein Energy Malnutrition (PEM). Under-nutrition is further categorized as micronutrient deficiencies, wasting, stunting and being underweight (Klugman 2002:1; Kurz & Johnson-Welch 2001:443-453; WHO 2001b).

1.2.1 Under-nutrition

Under-nutrition is a condition caused by a lack of food of good nutritional value combined with interaction from infections. Micronutrient deficiency is caused by poverty, food insecurity, lack of knowledge, and lack of distribution of adequate resources (Nagati, Mansour, Alouane 2003:282).

Body mass index (BMI) for age, is used to classify the nutritional status of a child. BMI is calculated by dividing the weight, in kilograms (kg), by the height squared (^{2}), in metres (m) (WHO 1998), per age. The WHO (2007) developed standards to assess the growth of a child. Table 1.2 reflects the median for measuring the child's nutritional status with the Standard Deviation (SD) value. Under-nutrition is associated with deficit in behaviour and development of the brain's anatomy, neurochemistry, and metabolism (Black, Hess, Papas 2005).

Table 1.2 WHO (2007) standards for growth assessment

AGE CLASSIFICATION	*BMI-for-age (underweight) "kg/m²	#SD BMI for age	Height-for-age (stunting) '(cm)	SD height-for-age	Weight-for-age (wasting) 6 – 10 years	SD weight-for-age °(kg) 6 – 10 years
Boys; 6 – 13 years	15.3 – 18.7	0.08 – 0.12	116.4 – 162.2	4.59 – 7.67	20.7 – 31.2	2.5 – 4.5
Girls; 6-13 years	15.3 – 19.1	1.3 – 2.4	110.5 – 159.8	5.1 – 6.94	20.3 – 31.9	2.7 – 4.9

*BMI – body mass index; #standard deviation; "kilogram per square metre; 'centimetre; °kilograms

1.2.1.1 Micronutrient deficiencies

The three most prevalent micronutrient deficiencies include Iodine Deficiency Disease (IDD), Iron (Fe) Deficiency Anaemia (IDA) and Vitamin (Vit.) A Deficiency (VAD) (Nagati *et al.* 2003:282; Faber & Wenhold 2007:393-394). According to the WHO, World Food Programme (WFP) and UNICEF (2007), an

estimated two billion people across the globe are deficient in key minerals and vitamins.

*** Iodine Deficiency Disease**

Iodine is a natural salt found in seaweed and certain animal proteins, such as eggs, meat and milk. It is a nutrient that assists in synthesizing the thyroid hormone, and regulates the metabolism of the body. Clinical detection of Iodine deficiency occurs with the presence of goitre, which is a swelling of the thyroid. Sub-clinically, IDD is tested through urinary iodine (Kennedy, Nantel, Shetty 2002:6). In severe form, IDD can cause stillbirth and miscarriages (UNICEF 2009).

Currently, approximately 741 million people globally are affected by goitre (WHO 2001a) in comparison with 1997, when 1500 million people globally were reported to have IDD (Food and Agriculture Organization (FAO) United Nations (UN) & International Life Science Institute (ILSI) 1997). In developing countries, 37 million children remain unprotected from the lifelong consequence of brain damage associated with IDD (UNICEF 2009). The 2005 NFCS in South Africa indicated that four out of ten women and five out of ten children had urinary iodine (UI) levels higher than standard. Six out of nine provinces reflected values above normal rate, with the Northern Cape (NC) having a higher prevalence of 95 percent of children and 83.3 percent of women (Labadarios *et al.* 2008:260).

Irreversible mental retardation can develop during the first and second semester of pregnancy if the mother has IDD (UNICEF & East Asia and Pacific Regional Office (EAPRO) 2009). The WHO recorded in 2002 that 50 million people worldwide were mentally handicapped owing to iodine deficiency (WHO 2002). Iodine deficiency is the most preventable cause of brain damage, and requires only the addition of a small quantity of salt to the diet (Kennedy *et al.* 2002:3). In

1994 UNICEF and the WHO recommended universal iodization of salt as a safe and cost-effective strategy to address IDD (UNICEF 2009).

*** Iron Deficiency Anaemia**

When a deficiency in oxygen-carrying red blood cells occurs, it is defined as IDA. It is the most common cause of anaemia and related to vit. B12 or folate deficiency. IDA also occurs during periods of higher Fe requirements, such as pregnancy and menstrual loss, and severe losses occur during illnesses such as malaria and parasite infections, also referred to as hookworms (Kennedy *et al.* 2002:2).

IDA is more prevalent in women, young children and the elderly. Children of pre-school age, adolescents and women of childbearing age account for 2000 million victims of IDA (FAO 1997). Approximately two billion people globally are affected by IDA (Kennedy *et al.* 2002:2). In SA, during the NFCS of 2005, one third of women and children were anaemic. Nationally, poor iron status occurs amongst one out of five women and one out of seven children. Prevalence is higher than in previous recordings in 1999 (Labadarios *et al.* 2008:262).

During infancy and in children of pre-school age, IDA causes impaired psychomotor and physical development, as well as poor immune structure. In adults, IDA diminishes stamina and work capacity by as much as 15-20 percent (Faber & Wenhold 2007:396).

*** Vitamin A Deficiency**

Vit. A is needed for growth of all body tissues and repair. The immune and visual system is dependent on vit. A for normal functioning. VAD is most recognized clinically through Bitot's spots and complete blindness, and can be prevented in

children (Mason, Lotfi, Dalmiya, Sethuraman, Deitchler, Geibel, Gillenwater, Gilman, Mason, Mock 2001).

PEM and VAD are associated and account for 250 million people globally, with 2.8 to three million people clinically deficient (FAO 1997). Improving the vit. A status of children may decrease mortality rates by 25 percent, measles death rates by 50 percent and death caused by diarrhoea by 40 percent (UNICEF 2007b). Between 100 and 140 million children globally, under the age of five, may have low vit. A stores. Four million children globally show signs of severe deficiency (UNICEF 2009). During the NFCS in South Africa in 2005, nationally 20.5 percent of children aged one to four had high doses of vit. A supplementation. Vitamin A deficiency is prevalent amongst two thirds of children and one quarter of women. Highest levels are in Kwa-Zulu Natal (KZN), where six out of ten women have a deficiency. The deficiency also reflects amongst the children. Prevalence was higher than previously recorded in 1999 (Labadarios *et al.* 2008:261).

VAD can cause complete blindness and a decline in the functioning of the body's immune system and its resistance to disease (World Hunger Education Service (WHES) 2008; Unnevehr, Pray, Paarlberg 2007:124-134; Rodriguez-Amaya 2000:30). VAD can cause ailments such as measles, diarrhoea or malaria before causing complete blindness. UNICEF suggests fortification and dietary diversification as a solution to address VAD (UNICEF 2009).

1.2.1.2 Underweight

Children are classified as moderately underweight when the weight-for-age is below the median by -2SD. When the proportions are below the median by -3SD, this is regarded as severe underweight (UNICEF 2009; WHO 2007).

Classifications of childhood malnutrition are categorized, according to the WHO (2007), as weight-for-age, referred to as underweight; height-for-age, referred to as stunting; and BMI-for age, referred to as underweight. Underweight defines acute malnutrition whilst stunting defines chronic malnutrition. Wasting defines severe malnutrition and also implies acute malnutrition in a chronically stunted child (Faber & Wenhold 2007:394). Globally (Table 1.3), 23 percent are moderately underweight, according to the WHO Standards. In SA (Department of Health (DoH) 2008a) by 2003, statistics indicated 11.6 percent underweight in urban areas, with 11.4 percent in rural areas. The highest level was the NC with 25.8 percent. Underweight occurs in 17 percent of children where the mother has no education, and a higher prevalence occurs where the mothers are between the ages of 25 to 29 and 40 to 44 years. During the NFCS-FB-1 in South Africa, reported in 2005, one out of ten children was underweight nationally. Underweight is one of the most common nutritional disorders in South Africa (Labadarios *et al.* 2008:255).

1.2.1.3 Stunting

Low height-for-age is referred to as stunting and occurs when the Z-score is below the median by more than -2SD (WHO 2007). Stunting is seen as a failure to reach linear growth and is prevalent in children with long-term insufficient nutrient intake and frequent infections. If a child is stunted before the age of two, then irreversible effects of poor motor and cognitive development occur. The prevalence of stunting occurs amongst one-third of the world's children (UNICEF 2007a; WHO 2004). Table 1.4 reflects that 33 percent of the world's children are moderately stunted and 17 percent severely stunted (UNICEF 2009).

Table 1.3 Underweight prevalence (2000-2007) (UNICEF 2009)

Region	Moderate and severe *WHO Standards
Sub-Saharan Africa	24
Eastern and Southern Africa	23
West and Central Africa	24
Middle East and North Africa	11
South Asia	41
East Asia and Pacific	11
Latin America and Caribbean	5
CEE/CIS	–
Industrialized countries	–
Developing countries	24
Least developed countries	30
World	23

*World Health Organization

Table 1.4 Stunting prevalence (2000-2007) (UNICEF 2009)

Region	Stunting	
	Moderate and severe (%)	Severe (%)
Sub-Saharan Africa	38	18
Eastern and Southern Africa	41	18
West and Central Africa	36	18
Middle East and North Africa	25	12
South Asia	46	22
East Asia and Pacific	16	-
Latin America and Caribbean	16	-
CEE/CIS	12	3
Developing countries	32	18
Least developed countries	42	19
World	31	17

In SA, during 2003 (DoH 2008b), stunting was found to be higher in rural areas, with a prevalence of 28.1 percent, in comparison with 26.9 percent in urban areas. The NC reported the highest count of 37 percent. Stunting was prevalent in 38.4 percent of children where the mother had no education. Stunting is also more prevalent amongst children where the mothers are between the ages of 45

and 59, and of Black and Coloured race. The NFCS of 2005, compared to the survey of 1999, found that stunting decreased to 23.4 percent amongst children aged one to three years, 66.4 percent amongst children aged four to six years and 12 percent amongst children aged seven to nine years. Stunting has been regarded as a leader in nutritional disorders in South Africa, with one in five children affected nationally (Labadarios *et al.* 2008: 255).

1.2.1.4 Wasting

Low weight-for-height, known as wasting, is reflected by a low body mass relative to age and is classified when the Z-score is below the median by -2SD. Low weight-for-height by a percentile lower than -3SD is regarded as severe wasting (WHO 2007; WHO 2004). This is as a result of acute starvation and disease, which results in severe malnutrition, with implications of acute malnutrition in a chronically stunted child. The child then becomes underweight because of poor food quality and quantity (UNICEF 2007a; WHO 2004). Globally (Table 1.5), 11 percent of all children are moderately wasted with only three percent suffering from severe wasting (UNICEF 2009).

Statistics from 2003 (DoH 2008a) reflected the prevalence of wasting to be 5.6 percent amongst urban children and 4.5 percent amongst rural children in South Africa. The NC recorded the highest levels at 16.8 percent. The level of education of parents and caregivers had no effect on the prevalence of wasting, as levels were also high amongst parents with higher education.

Table 1.5 Wasting prevalence (2000-2007) (UNICEF 2009).

Region	Wasting	
	Moderate and severe (%)	Severe (%)
Sub-Saharan Africa	9	2
Eastern and Southern Africa	7	1
West and Central Africa	10	2
Middle East and North Africa	8	2
South Asia	18	5
East Asia and Pacific	-	-
Latin America and Caribbean	2	-
CEE/CIS	2	-
Developing countries	11	4
Least developed countries	10	2
World	11	3

1.2.1.5 Low birth weight

Low birth weight occurs when the baby is born with a weight below 2,500 grams (g). This places the baby at higher risk for health-related problems. Low birth weight is due to premature birth or foetal growth restriction, where the baby is born small (American College of Obstetricians and Gynaecologists (ACOG) 2000). Low birth weight occurs when the expecting mother is of poor health and nutritional status. The risks of pre-term birth are higher if premature labour has previously occurred, in the carrying of twins or triplets, or in the presence of uterus or cervix abnormalities, placenta problems, excessive smoking, drug use or alcohol abuse (Berghella 2007:904-912; UNICEF 2007b). Six out of ten newborns are not weighed at birth. Low birth weight can be diminished through proper interventions for pregnant women, micronutrient supplementation, education and better health-care facilities (UNICEF 2007b).

Table 1.6 Percentage of infants not weighed at birth (UNICEF 2009).

Region	Percentage
South Asia	68
Sub-Saharan Africa	66
Middle East and North Africa	46
East Asia and Pacific (Excluding China)	22
Developing Countries	57

1.2.1.6 Protein energy malnutrition

Protein energy malnutrition (PEM) is now regarded as a lethal form of malnutrition basically caused by a lack of energy and protein. Kwashiorkor is a form of malnutrition caused by inadequate protein intake, while marasmus is caused by a lack of energy and protein within the diet (WHES 2008).

Estimated globally, 854 million people are undernourished, with 820 million of these living in developing countries. Poverty is associated with malnutrition and the level of PEM is also affected by political, economic, seasonal and climatic conditions, education and sanitation levels, food production and prevalence of disease (FAO 2004; WHO 2002).

PEM is associated with poor weight gain, slow linear growth and behavioural changes such as irritability, anxiety and attention deficit (Grigsby 2003).

1.2.2 Over-nutrition and obesity

Obesity and overweight are rapidly becoming a health risk within the poor economic strata of industrialized countries. Obesity and under-nutrition coexist within families (UNICEF 2006:26). The consequence of inappropriate diets leads to mortality amongst children and adults. The most prominent issues related to over-nutrition include obesity, allergies, and chronic disease such as cardiovascular disease, diabetes and cancer. The nutrition transition is regarded

as causing a double burden of obesity and inactivity (UNICEF 2007a; UNICEF 2006:26).

Overweight is classified as BMI>+1 Standard Deviation (SD), which is equivalent to BMI 25 kg/m² at 19 years; obesity is >+2SD, which is equivalent to BMI 30 kg/m² at 19 years; thinness is <-2SD and severe thinness is <-3SD (WHO 2007).

The highest prevalence of obesity in South Africa amongst children occurs between the ages of one and three years, at 19.3 percent in rural areas and 15 percent in urban areas. A comparison between the NFCS of 1995 and that of 2005 shows that there was a decrease in the prevalence of overweight based on weight-for-height. Amongst children, four percent are obese and 10 percent are regarded as overweight (DoH 2008a; Labadarios *et al.* 2008:255).

The prevention of obesity amongst children has been highlighted by the WHO, and links such as the frequency of meals, distribution throughout the day (Maffeis, Provera, Filippi, Sidoti, Schena, Pinelli, Tatò 2000:75-80), meals of adults and parents provided to the children (Lifshitz & Tarim 1996:10315-415) and quantity consumed, have an impact on obesity (Smiciklas-Wright, Mitchell, Mickle, Goldman, Cook 2003:41-7).

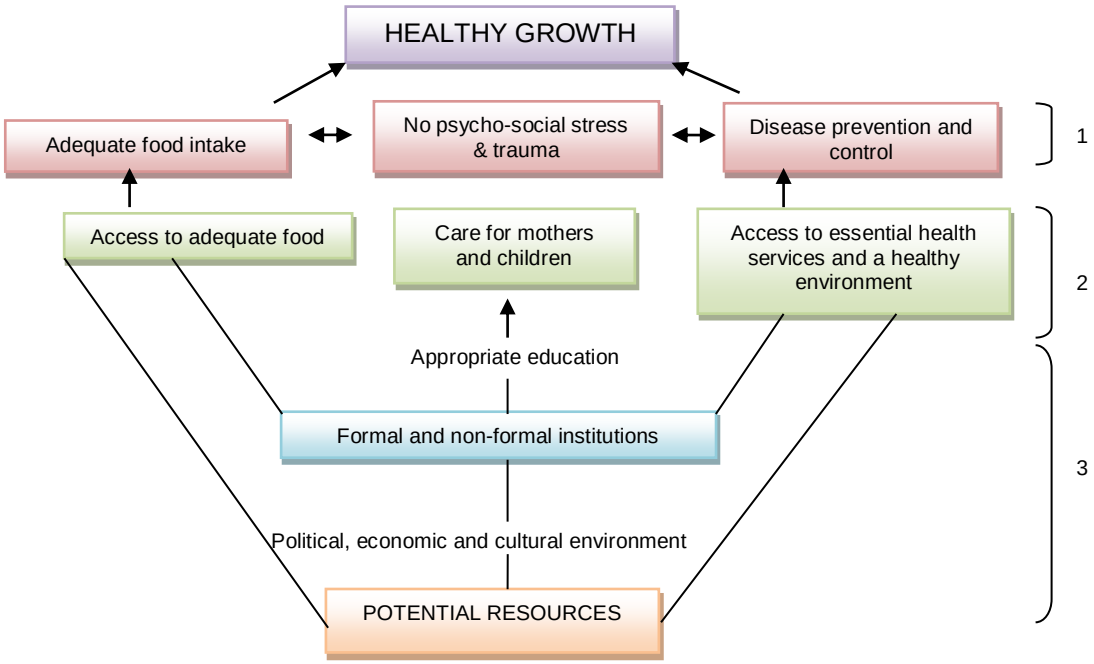
1.3 Factors affecting the nutritional status of children

The level of food insecurity within the household determines the nutritional status of children, and is the immediate cause of malnutrition. The caregivers and parents make most food choices for meals consumed at home. These choices are based on culture, beliefs, cost, time restraints and availability (Kelly & Patterson 2006:345-351; Kruger & Gericke 2003:217-223; Pelletier *et al.* 1995:443-448).

The nutritional needs of low-income consumers are different and not always met through the private market. The very poor suffer from a shortage of energy, proteins and/or micronutrients (Unnevehr *et al.* 2007:14). The nutritional status is also affected by the access that the community, household or individual has to food and the utilization of the food available. The age of the individual also dictates the nutritional requirements and the diet of a child should not be based on that of the adult (De Haen & Thompson 2003:376; Lifshitz & Tarim 1996:1031S-1041S).

In the framework of malnutrition developed by UNICEF (2004), the immediate and underlying causes of malnutrition are also factors which affect the nutritional status of children. Figure 1.2, which has been adapted from the UNICEF framework (2004), reflects the factors contributing to healthy growth. The factors which cause malnutrition can also be changed to make positive contributions to healthy growth. These aspects include the level of disease and inappropriate health facilities and unhealthy environments for children, as well as the illiteracy levels within the households. Poor literacy and lack of knowledge result in poor food choices and combinations. Consequently, self-growth and development stagnate, reducing the possibility of increasing income levels and of variety in food purchases. The lack of knowledge as to which nutrients are required for growth also contributes to the poor nutritional status of a child (De Haen & Thompson 2003:376).

Studies within KZN, SA, have shown a definite link between the caring capacity of the caregivers and the nutritional status of the children (Medical Research Council (MRC) 2006). Children do not have sufficient knowledge of correct food choices and mothers and caregivers are illiterate (MRC 2006). School children have a tendency to consume more snacks and items from vending machines. During meals at home, staple foods are consumed. Unfortunately, nutritional value is lacking as staple food items provide the only major source of energy (Steyn & Badenhorst 1993:5-9; Food Aid Organization (FAO*) UN 2005).



1 – Immediate contributors; 2 – Intermediate contributors; 3 – Fundamental contributors

Figure 1.2 Contributing factors to a healthy growth (WFP & UNICEF 2006:14)

1.4 Addressing malnutrition

Reducing child hunger and malnutrition has been successful in various countries with the combined use of dietary diversification, complementary feeding, fortification, supplementation and supplementary food aid (WFP & UNICEF 2006:18-32). Table 1.7 lists the various successful approaches in addressing malnutrition.

Table 1.7 Successful approaches to reducing child hunger and malnutrition (WFP & UNICEF 2006:18-32)

COUNTRY	SUCCESSFUL APPROACH
Chile	Redesign of national health structure – emphasis on health and nutrition interventions. Key interventions included free milk for young children; immunisations; nutrition and education and breastfeeding promotion. Collaboration between academic institutions, government and local organisations.
Thailand	Successful programmes included food supplementation; basic health care; investment in water and sanitation, primary and secondary education. Use of large-scale community mobilisation of volunteers and national consensus.
India	Integrated Child Development Services (ICDS) – Largest child nutrition programme in the world. Improvement of health, education and nutrition components.
Brazil	Civil society movement, which encouraged a family health programme.
Tanzania	Use of community growth-monitoring programme with emphasis on child feeding practices. Nationwide Child Survival and Development programme.
Global	Exclusive breastfeeding; appropriate complementary feeding; micronutrient supplementation; water and sanitation interventions (Black, Morris, Bryce 2003)

Malnutrition can be addressed through:

- Supplementary food aid: offering assistance to neighbouring countries and global organisations.
- Supplementation: minerals and vitamins supplied in the form of tablets.
- Food fortification: food is fortified with nutrients which are lacking, and enriched by enhancing current nutrients.
- Dietary diversification: food-based strategies which incorporate home gardens, Nutrition Education (NE) and food diversification (Faber & Wenhold 2007:19-37).

Table 1.8 lists the WFP and UNICEF (2006:20-24) interventions and combinations of interventions considered to be most effective in reducing child hunger and under-nutrition, thereby reducing under-five mortality.

Table 1.8 Most effective interventions to reduce under-five mortality (WFP & UNICEF 2006:20-24)

INTERVENTION	ACTION (PROGRAMME) AND RESULT
HEALTH, NUTRITION & HYGIENE EDUCATION PROMOTION	**Hygiene education and promotion programme**: - Substantial reduction in diarrhoeal morbidity, under-nutrition and mortality. - Promoting good hygiene practices increases community awareness and reduces helminth-related diseases. **Maternal nutrition education programmes:** - Child's survival is dependent on promoting maternal health. Nutritional requirements of the mother during and after pregnancy including infant can reduce malnutrition rates. - Provision of prenatal vitamins and Fe supplements, prevents birth defects. **Promotion of exclusive breastfeeding:** - Important component of NE to encourage up to six months after birth. - Assists in preventing childhood diseases (diarrhoea, pneumonia and neonatal sepsis). - Breastfeeding is economical. **Promotion of complementary feeding practices:** - World Health Organization suggests introduction of complementary feeding at six months. - Will improve child's weight and reverse growth retardation. **Growth monitoring promotion programmes:** - Programmes intended to support families to monitor and address nutrition and health-related problems.
HOUSEHOLD FOOD SECURITY INTERVENTIONS (SITUATION-SPECIFIC)	**Household livelihoods and food production:** - Increasing availability of household food through diversified homestead food production; food processing and preservation; and preparation of enriched foods for small children. **Safety nets and transfers:** - Refers to child grants, cash transfers, food supplements, public works programmes, and emergency responses. **Supplementary feeding:** - The provision of food to certain groups with particular nutritional requirements. Supplementation has been proven to assist in reducing nutrition-related deficiencies. **Therapeutic Feeding:** - Addressing severe child malnutrition in institutions or community settings. A community-based programme implemented as an emergency situation in cases of severe malnutrition.
MICRONUTRIENT SUPPLEMENTATION	**Vitamin A supplementation:** - Vitamin A supplementation has reduced VAD considerably. - Reduce VAD, which causes night blindness and increases risk of infectious diseases.

Table 1.8 Continued. Most effective interventions to reduce under-five mortality (WFP & UNICEF 2006:20-24)

INTERVENTION	ACTION (PROGRAMME) AND RESULT
	Iron supplementation: - Can reduce the most global of all micronutrient deficiencies. - Iron-fortified foods can reduce the prevalence of anaemia in pre-school children from 40 to 10 percent. - Global warning against supplements where malaria is prevalent amongst children. **Zinc supplementation:** - Can reduce malaria morbidity amongst young children, including pneumonia. Zinc supplementation may be best delivered through the management of child diarrhoea. **Salt iodization programmes:** - Salt iodization protects 82 million newborns annually against IDD-caused learning disabilities.
HOUSEHOLD WATER TREATMENT	- Water treatment can reduce bacteria and most viruses with residential protection against contamination; ease of use; low cost.
HAND-WASHING WITH SOAP	- Regular hand washing and promotion of this through awareness can reduce diarrhoea morbidity. A study showed that after two years of a four-month intervention of hand washing, the mothers were still buying soap.
PARASITE CONTROL INTERVENTIONS	- Long-term benefits if children are regularly de-wormed for improved nutritional status. - De-worming has shown a 70 percent reduction in helminth infections globally. - WHO recommends two to three times per year. Delivery treatment can be done at school.

In South Africa, the most recent recommendations to prevent and manage malnutrition are made by the DoH (2008c:1-3) through the Integrated Nutrition Programme (INP). The aim of the INP is to ensure optimum nutrition for all. Table 1.9 reflects the approaches through disease control, nutrition for pregnant and lactating women, NE and community-based interventions.

Table 1.9 South African approaches to managing malnutrition (DoH 2008c:1-3)

INTERVENTION	ACTION (PROGRAMME)
DISEASE CONTROL	- Offering specific Nutrition Support, treatment and counselling for HIV/AIDS, severely malnourished individuals and clinical nutrition.
MATERNAL NUTRITION	- Assisting pregnant and lactating women with supplementation, education on breastfeeding and emotional support.
INFANT AND YOUNG CHILD FEEDING	- Encouraging breastfeeding only for six months. - Ensuring optimum nutrition for infants and young children. - Encouraging the implementation of growth charts and community monitoring for infants and children to identify malnutrition during the early stages.
YOUTH AND ADOLESCENT NUTRITION	- Offering Nutrition Education within all curriculums. - Reducing the risk of obesity and encouraging physical activity. - Identifying any eating disorders amongst adolescents.
MICRONUTRIENT MALNUTRITION CONTROL	- Offering governmental support through supplementation and legislation on food fortification.
FOOD SERVICE MANAGEMENT	- Ensuring facilities and catering institutions offer well-balanced foods to children.
NUTRITION EDUCATION, PROMOTION AND ADVOCACY	- Aiming to improve the nutritional status, assist with sound food choices, and ultimate improvement of quality of life and emphasising outcome-based approaches.
COMMUNITY-BASED INTERVENTIONS	- Promotion of vegetable gardens, community projects and community-based growth monitoring.

The DoH (2008c:1-3) considers youth and adolescent nutrition and nutrition education and promotion as a vital approach to addressing malnutrition. The focus of this study is to combine nutrition education within primary schools with the ultimate goal of improving nutrition knowledge and food choices. This study encompasses the two important approaches of the DoH, namely youth and adolescent nutrition and NE promotion and advocacy. A second project within the same community focuses on NE for parents. Matvienko (2007:284) has suggested in a study that children six and seven years of age are able to make food choices. When given the opportunity they make healthier food choices, especially after a nutrition education intervention.

1.5 Value of the study

Poor nutrition practices are usually associated with inadequate food intake and unhygienic dietary practices. Household food security is compromised by deficiencies in knowledge about nutrition, budgeting, food purchasing and preparation methods (Walsh, Dannhauser, Joubert 2003:89). Education is an important element in improving the income levels of individuals, which ultimately promotes healthier and better food choices (Unnevehr *et al.* 2007:5). NE can stimulate the individual to make better quality food choices only if the resources and opportunity exist (Faber, Jogessar, Benadé 2001:401-411). According to the FAO (2005), people in many countries are not eating correctly because of poverty and poor NE. In order for malnutrition to be addressed, people need an understanding of the requirements of a good diet, and both willingness and knowledge to make the best food choices. NE (FAO 2009a:1-2) is required to reduce poverty, improve agricultural infrastructures and, ultimately, improve living conditions. Adult illiteracy and limited access to education amongst children is higher within rural areas.

The impact of this study is to assist children, by providing sound knowledge of nutrition, in the ultimate improvement of their lives into adulthood. The INP (DoH 2008c:1-3) proposes nutrition promotion, education and advocacy as an immediate goal, aim, objective and vision to address and manage malnutrition. The INP (DoH 2008b:266) also recommends the use of the South African Food-Based Dietary Guidelines (SA FBDG) during NE as a tool to improve food choices and ultimately, improve quality of life into adulthood. The objective of the INP is also to use NE to encourage healthful food choices, through trained health workers, to reduce micronutrient deficiencies (MND). Furthermore, the Nutrition Education Tools (NET), developed by Doctor (Dr.) Carin Napier and Professor (Prof) Wilna Oldewage-Theron, Director of the Centre for Sustainable Livelihoods (CSL) of the Vaal University of Technology (VUT), was based on the SA FBDG and could be used by the DoH in national studies, thus providing the necessary

reliable and valid resources for similar studies, as well as to disseminate the SA FBDG to the general public. Many studies have been conducted to assess the nutritional status of various sample populations in SA, but very little has been done on NE as a means to improve the nutritional status of South Africans.

The value of this study is critical to the DoH's approaches to addressing malnutrition, as it will be the first study where NET have been developed for primary school children, with the emphasis on the SAFBDG. This study was implemented in Boipatong, and its impact tested to determine the amount of nutrition knowledge the children have retained and the possible behavioural change in food choices.

1.6 Purpose of the study

A situational analysis completed by Oldewage-Theron and co-authors (2005:13-26) within a rural community in the Vaal Triangle, SA, clearly indicated that the state of malnutrition within the community was caused by household food insecurity, illiteracy and limited access to health services. The poor living conditions and low income levels within the community and households further exacerbated the latter. As a result, children are restricted in food choices. Poor food choices and food intake resulted in children consuming less than 30 percent of their daily requirements and the increasing prevalence of wasting (Napier 2003).

Based on the background information, it is clear that a large number of South African children are still malnourished as a result of poor food intakes. The main purpose of this study will thus be to address malnutrition in children through the implementation and evaluation of a NEP. Using the SA FBDG, the study would determine the impact of NE on the behavioural and food choices of children. The aim of the NEP is to promote healthy wellbeing by improving the nutrition knowledge of primary school children (six to thirteen years old) in Boipatong, in

order to enable them to make informed food choices and change food intake behaviour. SA is seen as a developing country with limited resources and much poverty. One of the strategies of the Department of Health (DoH) is to promote nutrition through education in the hope of reducing malnutrition.

A study completed by Faber, Venter and Benadé (2002) found higher intakes of vit. A, riboflavin, vit. B6 and vit. C amongst children when home gardens, NE and growth monitoring were combined to improve nutrient intake.

The above literature suggests that nutritional guidance and advice on good health practices may contribute to better quality of life and food choices. Although income levels are low, alternative items can be chosen which will have an impact on children's health into adulthood.

The specific objectives of this research are thus to:

1) implement and evaluate NEP based on the needs assessed for the target group, with the aim of addressing household food insecurity, growth failure, and vitamin A, Fe and zinc (Zn) deficiencies with the aid of the SA FBDG; and
2) analyse and share the findings of the intervention study in order to recommend relevant actions and strategies to teachers, community nurses, nutrition advisors and the scientific community.

This research project is empirical in nature and was conducted within the quantitative paradigm following a positivistic orientation to address the problem of malnutrition, an approach explicated by other researchers such as Babbie and Mouton (2001:22-28;47-53). It is applied action research in which the researcher and respondents were equally involved in the process of addressing the nutrition problem, namely to improve the nutrition knowledge and dietary intake patterns as influenced by a lack of access to and availability of good food choices, as well as poor nutrition knowledge.

The research took place in three phases where the triple A cycle of assessment, analysis and action was applied. Though the research was based on the triple A cycle process, the phases of the study tended to overlap in line with its stated procedure. Phase one was the assessment and analysis of the situation in Boipatong to provide the baseline information. Phase two, representing the action, focused on the development and implementation of the NEP, which involved training primary school children in basic nutrition of the food-based dietary guidelines (FBDG). The final phase, phase three, involved the assessment by means of measuring the impact of the NEP on nutrition knowledge and dietary intake patterns. A flow diagram was developed for this study (Table 1.10) and each of the phases is thus treated as a separate entity in the thesis.

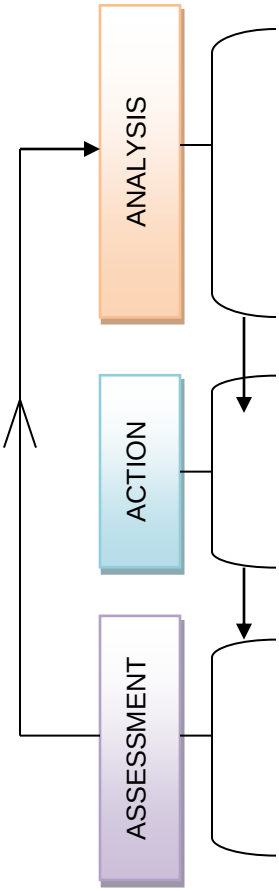


Table 1.10 Flow diagram of the study

PHASE 1	**PLANNING**
Chapter 1 & 2	-Defining problem of malnutrition and causes thereof.
	-Identifying a strategy to reduce malnutrition.
	-Submission of Proposal.
PHASE 1	**CONCEPTUALISATION**
Chapter 3	-Baseline study to assess nutrition knowledge, level of malnutrition and causes of malnutrition.
PHASE 2	**IMPLEMENTATION**
Chapter 4 & 5	-Training of fieldworkers in objectives of the NEP
	-Testing of tools for validity
	-Implementation over three months
	-24-hour recall questionnaires
PHASE 3	**EVALUATION**
Chapter 4 & 5	- Testing of impact of NEP tools by means of
	questionnaires (NK and 24-hour (hr) recall)
	-Interpretation of results
	-Thesis
	-Articles

1.7 Outline of the thesis

In chapter 1, the problem of malnutrition was stated and the causes examined. A brief description of methods of addressing malnutrition was included, which leads to chapter 2, the NE approach to addressing malnutrition. Nutrition Education Programmes (NEP) are discussed in detail. The baseline survey is covered in chapter 3, which is followed by the intervention programme and results in chapter 4. The long-term evaluation results are found in chapter 5, and the thesis is concluded with chapter 6, which comprises the discussion and recommendations based on this project. The conceptual framework of the methods of the study is depicted in Figure 1.3.

1.8 Conceptual framework of the study

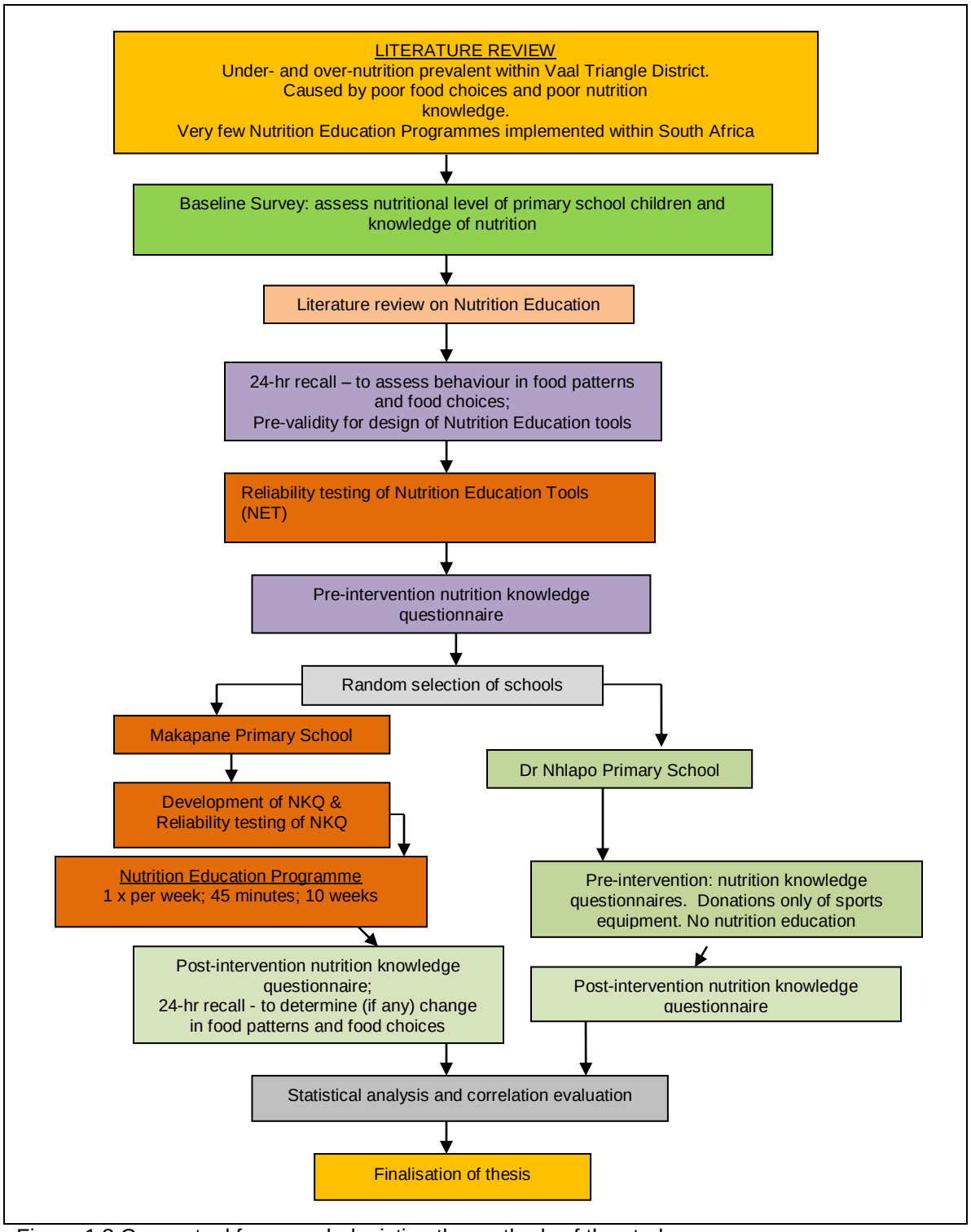


Figure 1.3 Conceptual framework depicting the methods of the study

CHAPTER 2: NUTRITION EDUCATION

2.1 Introduction

Global and national strategies have been developed to manage the dilemma of malnutrition. From the 1960s to 2006, the number of child deaths under the age of five amounted to almost 10 million, globally (UNICEF 2007a:9). In SA, the number is approximately 60 000 per annum (Labadarios *et al.* 2008:254-266). One of the strategies considered in helping to manage malnutrition and encourage change in behaviour is Nutrition Education (NE). The DoH (2008c:1-3) in SA, through the INP, encourages NE as a main focus area. Therefore this chapter will focus on NE and NEP as a strategy for managing malnutrition in children.

2.2 Definition of nutrition education

NE is classified as a food-based strategy, which allows for community empowerment through information. It is a change process whereby beliefs, attitudes and influences are changed to encourage improved nutritional practices consistent with individual needs and available resources. NEPs allow for the communication of information which can ultimately improve the quality of life (DoH 2003:11-20). NE is a means of promoting lifelong healthier eating habits by educating people in making the right food choices and in carefully preparing and preserving foods which have a good nutritional value (FAO 2008).

NE is vital as it ensures a better and more diversified food supply. Decision-making is encouraged at all levels when the intervention covers various levels of the population, i.e. parents, children and the elderly, and must address the needs of the school, scholars and teachers (FAO 2008). It takes into account current knowledge and how to improve that knowledge and involves promoting healthier eating habits within cultural boundaries. Attitudes, knowledge and skills of

youngsters can be changed so that they understand the link between food and nutrition. The people who will benefit from NE can act as change agents by spreading the message to a larger segment of the population (Vijayapushpam, Rao, Antony, Rao 2008:108). NE communicates information which must be understood, and the best approach is through schools: children attend schools, which are nested within neighbourhoods and are the existing connection between families and communities (Blom-Hoffman, Kelleher, Power and Leff 2004:45-60; Friel, Kelleher, Campbell, Nolan 1999:549-555). The aim of NE is to encourage movement from a knowledge orientation to a behavioural orientation (Contento, Randel, Basch 2002:2-25). NE involves not only imparting information or submitting messages, but also getting people to do something different to improve nutrition (Contento *et al.* 2002:2-25).

2.3 Effectiveness of nutrition education

The aim of NE is to encourage change through a learning process with the outcome of voluntary action towards changing eating patterns (Contento *et al.* 2002:2-25; Berg 1993:278-282). NE becomes effective when participation occurs through the school especially if there is a bridge between theory and practical learning. Improvement is further encouraged through family and community involvement. Focus must be placed on behaviour and active learning (Sherman and Muehlhoff 2007:336).

Another possible approach is the involvement of the family and/or community in NE. Generally, mothers and caregivers undertake to make the primary diagnosis of a child's illness. Treatment is based on income available, home remedies and available health-care facilities within the vicinity, and knowledge of possible causes and cures. Therefore, it is important to consider improving the knowledge of nutrition and health practices of parents and children, and incorporating community members within these strategies (UNICEF 2007b:45-50). Findings in Bangladesh, India, recorded a large number of women in rural

areas with a very low literacy level and poor knowledge of good health practices. The authors suggest that providing nutrition education and guiding participants with correct food practices may assist in reducing the critical situation of malnutrition, which is further worsened by cultural norms, including early marriages and discrimination against girls in food allocation (Roy, Bilkes, Islam, Ara, Tanner, Wosk, Rahman, Chakraborty, Jolly, Khatun 2008:68). A further suggestion was made in a study by Ritchie, Whaley, Spector, Gomez and Crawford (2010:S2-S10) to consider a co-ordinated approach within nutrition education, as this could enable significant changes resulting in healthier food choices.

Participation is the ultimate goal for achieving positive changes of attitude towards health care, hygiene practices, nutrition, water and sanitation, and is a rights-based approach to human progress (UNICEF 2007b:45-50). Participation throughout the household ensures effectiveness of the programme amongst younger children. Gaining support from parents and community members encourages change (Pérez-Rodrigo & Aranceta 2001:131-133). Community participation can be seen as a mechanism which can alleviate the causes of malnutrition by bridging the gap between knowledge, policy and action.

The effectiveness of a NEP (FAO 2008) is determined by the following:

- the length and intensity of the intervention;
- the involvement of children, teachers and families to ensure continuous dissemination and understanding of information;
- full commitment to ensuring that the programme is carried out correctly and to its full potential (DoH 2003:11-20);
- family involvement, which enhances effectiveness and encourages variety within a diet;
- offering feedback and self-assessment of the children to assist in obtaining effectiveness within a NEP;

- creating supportive nutrition-friendly environments; and
- strengthening community knowledge and emphasizing the importance of locally produced foods and eating behaviours (FAO 2008).

To be effective, a NEP must also be creative, engaging, inexpensive and widely disseminated (Pérez-Rodrigo & Aranceta 2003:582; Pérez-Rodrigo & Aranceta 2001:131-133). The DoH suggests that a NEP can also be made more effective through:

- Proper training for workers and helpers.
- Emphasis on the benefits of breastfeeding and immunisation.
- The involvement of people within the community, who must understand and relate to the information given.
- Placing emphasis on women, as they, like children, are at higher risk of malnutrition (DoH 2003:11-20).

Effectiveness is also achieved through appropriate NE messages, which are reinforced through school, community and home-based food and nutrition interventions. This enables a desirable behavioural change (Sherman and Muehlhoff 2007:340).

Further recommendations, made by Sherman and Muehlhoff (2007:341), were to ensure that classroom interventions were successful as children were used to learning within a classroom environment and group participation occurred; and that food security and sanitary infrastructure had to co-exist with interventions.

The term “community” refers to “a group of people residing in a specific geographical area with common interests, heritage and culture”. “Community participation” means “a measure or approach which actively engages the community members, along with children and other dependants”. Community-based approaches increase the potential of the population to access health

services and interventions. They are perceived as having the potential to change behaviour and care practices positively and as empowering households to demand quality (UNICEF 2007b:45-50).

According to UNICEF (2007b:45-50), in order for a community-based approach to be effective and successful, the following criteria are of importance:

- Communities are based on members with similar norms and values. The programme needs to consider and respect the heritage and culture within the community. There should be a cohesive, inclusive communicative organisation and participation.
- Health workers are the main agents for communicating the information and offering training to the community members. There should be support and incentives for community health workers.
- The programme must be supportive and motivating with effective referral systems and feedback.
- Secure funding is required to ensure the effectiveness and completeness of any programme.
- The current programme must be integrated with other community programmes and national programmes and coincide with government policies.

A recent study by Zoellner, Bounds, Connell, Yadrick and Crook (2010:41-48) suggested that in order for community involvement to take place, the nutrition education messages must be encouraging, and provide knowledge. The channels and messages used must be culturally relevant and delivered according to the cultural context of the community (Institute of Medicine (IOM) 2004).

2.4 Criteria and development of a nutrition education programme

A NEP must focus on specific groups and be simplified to fall in line with the levels of illiteracy within rural communities. The intention of the NEP must consider the limited resources within the community (FAO 2005). Messages designed in a NEP for children must consider the eating habits of children and focus on encouraging change in these habits, such as the eating of snacks (Cross, Babicz, Cushman 1994:1398-1603). School-based (SB) NE must take into consideration the requirements and interests of the scholars, teachers and school. SBNE must focus on information which is relevant and vital to improve the nutritional status of the children. The aim is to promote skills and behaviour development related to the areas of food preparation, food preservation, storage and all cultural obligations towards food and eating (Pérez-Rodrigo & Aranceta 2003:582).

Nutrition Education Programmes (NEP) should include the following in attempting to reduce malnutrition and ensure a successful programme (DoH 2003:11-20; Yambi & Belbase 2003:112):

- Good hygiene practices. Bacteria and germs can cause illness, which, together with disease, are contributing factors to malnutrition.
- Understanding of the basic food groups and the daily requirements and sources thereof to assist in making the correct choices. Poor quality and quantity of food are underlying factors which contribute to malnutrition.
- Immunisation assists during childhood development against illness and disease, which can be detrimental to a child's health. Insufficient health services are an underlying factor contributing to malnutrition.
- Adequate eating habits. By encouraging good eating habits, a healthier body is developed and the child can grow optimally. Inadequate food intake is seen as an immediate cause of malnutrition.

The FAO (1997) has developed a framework (Figure 2.1) which assists in developing a NEP most suited to the community. The framework indicates food supply as the centre of nutrition promotion and education. It is the access to and availability of food which determines the nutritional state of the family and community members. Four interactive components occur within this framework. The framework is generic, which allows for the implementation of different theories and approaches to be considered within any stage.

2.4.1 Identification of nutrition issues

Food supply is based on cultural and traditional practices. Therefore, the NEP is based on access to food and factors determining choice. The role of the Nutrition Educator is to increase the capacity of the household and its use of existing resources. Education in ways to produce, store, process and prepare food must also be incorporated. Issues such as race, gender, age, disability, physical infrastructure and people's perceptions can be a barrier to adequate nourishment (FAO 1997).

In this study, a baseline survey was conducted to determine the eating habits, food consumption patterns and the nutritional status of the children within the Boipatong community. This is described in Chapter 3. The information indicates the nutritional issues of the Boipatong community and, based on this, the intervention focuses on addressing nutrition knowledge and basic hygiene practices.

2.4.2 Selection of target group and suitable environment

This component is divided between health enhancement and risk factor reduction. Selection of the primary target group should be based on the life cycle approach. The first stage should start at pre-birth and birth, continuing to

maternity and infancy. Stage two includes childhood and adolescence, while the final stage places the focus on adulthood and family (FAO 1997).

Primary school children were the specific focus of this study, which would coincide with other NEPs focusing on pre-school children, mothers and caregivers and the elderly. Malnutrition and poverty exist within the Vaal Triangle (Oldewage-Theron *et al.* 2005:13-26), (refer to Section 1.6) and the children were shown to consume about 30 percent of the daily requirements, with a high prevalence of wasting (Napier 2003).

As regards the approach to nutrition for people with special needs, which implies risk factor reduction, what must be taken into consideration are the type of disability and disadvantaged men and women with risk factors. This secondary target group comprises people who can be used to reach the primary target group through the use of effective training by health workers, teachers and food producers. The third target group involves people who can support NE activities, such as politicians, religious leaders and people of high status within communities. It is important to choose an appropriate environment where information is distributed to a large audience (FAO 1997). This study focused on NE within a school setting as it encompassed a larger audience at a given point. Findings by Subba Rao, Raghunatha, Venkaiah, Dube and Rameshwar (2006:991-995) showed an improvement in results during classroom-based intervention and that retentions were more successful.

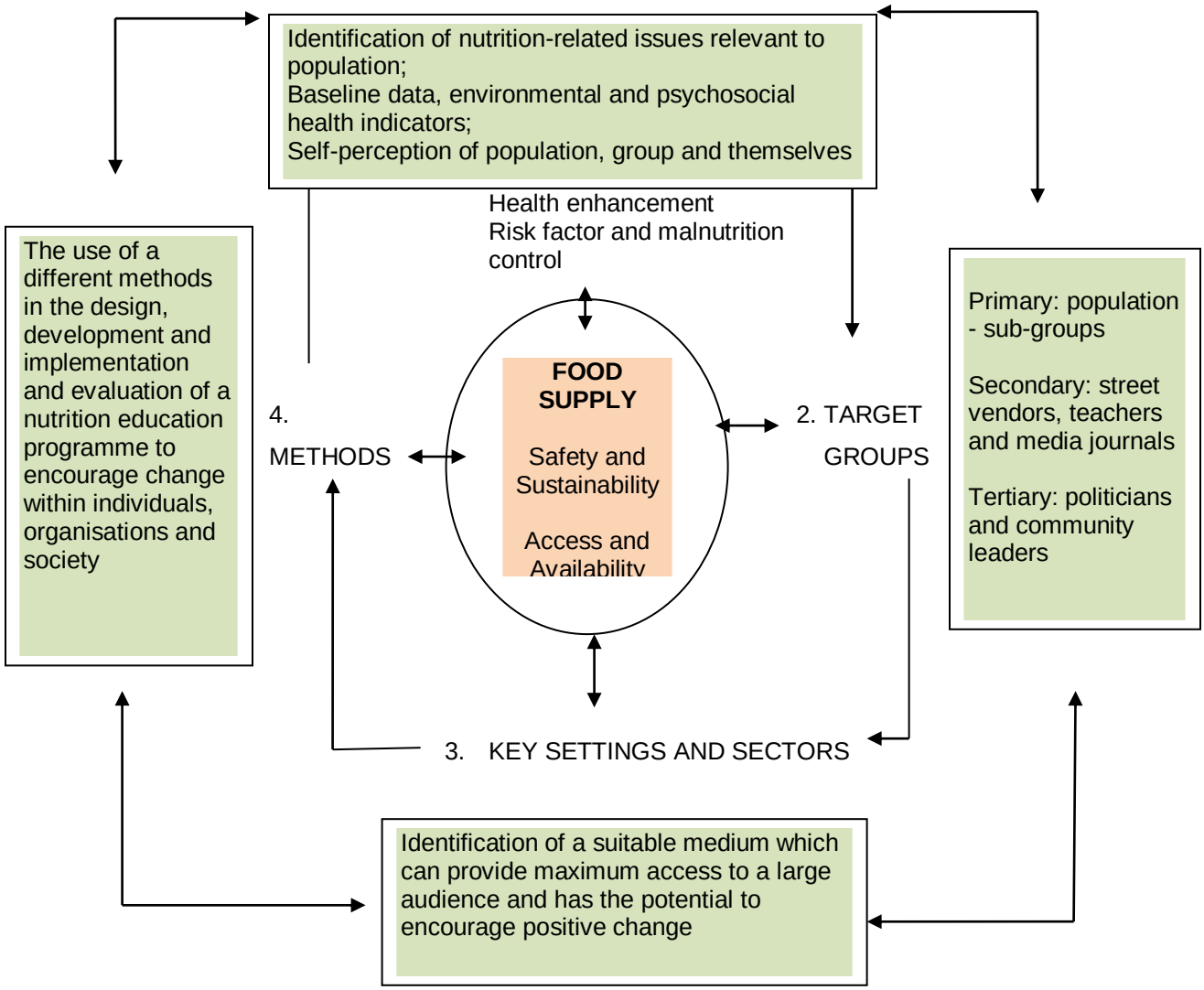


Figure 2.1: Adapted framework for planning nutrition promotion and education programmes for the public (FAO 1997)

2.4.3 Selection of means of encompassing nutrition issues

The means by which the nutrition information is communicated is a very important component, which will ultimately affect the success of the programme. Food guides, including the FBDGs, can be used to assist. The latter are dependent on the level of the food supply and the effectiveness of food practices. Implementing good food habits and practices from an early age can influence a child permanently (FAO 1997).

This study focuses on the use of the SA FBDGs, as they are relevant to the country, foods available and cultural practices. The guidelines were incorporated into various teaching materials, and used within the NEP.

2.4.4 Implementation

The final component includes the implementation. This is based on a continuous evaluation and research process. This component requires precise planning and pre-intervention data, implying selection of groups, finding the correct settings, method of communication and establishing cost. NE can be promoted through dramatisation, healthy lunch options in cafeterias, the use of audiovisual aids and school gardens (FAO 1997). This study implemented the NEP, (refer to Chapter 4), and nutrition knowledge was measured before and after the intervention.

2.5 Benefits of a nutrition education programme

The benefits of a NEP can be divided into those for the individual and those for the community. When considering the community member as an individual, the advantages are (Ladzani, Steyn, Nel 2000:811-816; Friedrich 1997:26-27):

- Better use of resources, as a NEP can encourage the community member to use the ingredients available within the household and also utilize ground for agricultural development.
- Improved quality of life, as each caregiver or parent will obtain the skills and knowledge to improve the quality of food provided for the family, ultimately improving the quality of food consumed.
- Reduction in malnutrition in children, as the provision of healthier meals can lead to a reduction in malnutrition since fewer micronutrient deficiencies occur and food insecurity can be diminished.
- By providing adequate food intake, the child's immune system becomes stronger and this may result in decreased hospitalisation and medical costs.

On a community level, a NEP can provide the following advantages (Sherman & Muehlhoff 2007:339; Ladzani *et al.* 2000:811-816):

- When nutrition education is provided on a community level through schools and clinics, the information is distributed to a larger audience, reducing the levels of malnutrition amongst pregnant women and children.
- When provided food of sufficient quality and quantity, the body begins to function and become more productive. More energy is available and individuals become more alert and responsive, resulting in a more productive workforce.
- Providing a NEP through clinics and schools provides employment opportunities for fieldworkers and health practitioners and allows community members to develop businesses and opportunities for growth.

During a study in Zambia (Sherman and Muehlhoff 2007:339), parents and teachers reported an improvement in children's reading, food intake, hygiene practices such as washing hands, and physical activity. The NEP was encouraged through the school, parents' involvement with homework, reminder messages communicated on a daily basis and community participation as a whole.

2.6 Challenges facing nutrition education

Community participation may change during education presentations. Existing groups may feel threatened owing to the participation of community members in making decisions about activities and resources. It is important to keep communities interested and to request their involvement in resource allocation to prevent loss of interest and participation. Important aspects in achieving participation are motivation and good staff management. Motivation is assisted by a system of regular advice to staff and communities and through recognition of achievements. A participatory monitoring system will itself provide some

advice to the community, but for effective progress and effort, community participation must form part of a larger process (FAO 2005).

Factors (FAO 2008) which may also hinder or create barriers to a NE intervention include:

- A lack of interest from governments and donors owing to lack of research, or current supplementation and fortification programmes which may be effective and efficient, but are not money-generating.
- The language used within NE may be very technical and not understood by all. The use of many languages in a country would require NET to be translated to accommodate all language groups.
- Insufficient research on the effectiveness of NE.
- Lack of awareness of NE may hinder interventions on a national level.
- Absence from the school curriculum and lack of proper information materials may also hinder the NE intervention approach.

Unfortunately, problems may arise within communities. The effort to reduce malnutrition may be hindered because of:

- Hunger, poverty and population growth. Participation will not occur if the community involved has high levels of hunger and poverty, with poor income levels. Poverty increases with more mouths to feed within one household.
- High use of fats and oils. Fats and oils are cheaper but of low nutritional value. A person feels fuller much longer when food is fried and contains high levels of saturated fats.
- Pollution. Water, land and air pollution contribute to illness and disease. Pollution is created by industries and poor sewerage and refuse-removal infrastructure.

- Loss of food-producing land, development of more housing and cities. More people and businesses are investing in land to create more housing and business infrastructure.
- Loss of ozone layer and extinction of fauna and flora. Global warming is having detrimental effects, which are exacerbated by pollution and poor infrastructure (Kloka 2003).

2.7 Nutrition education globally

Larger global projects will be discussed individually whilst small NEPs will be discussed in Table 2.1. The evolution of a NEP will be discussed chronologically in the following section.

2.7.1 1986

The World Health Organization (WHO) (1986) sponsored The Ottawa Charter for Health Promotion (TOCHP) in developing countries (38) during 1986. The TOCHP identified five domains of action for combating malnutrition:

- Building a public health policy which is acceptable to the nations and allows for opportunities for all.
- Creating a supportive environment through grants, NEPs, community-based programmes and governmental support structures.
- Strengthening of community action by allowing members to become responsible and offering communities opportunities to assist one another.
- Development of personal skills through training facilities for adults and community members and NE within schools.
- Consistent and reliable health services, implying sufficient water supply, basic electricity and refuse removal.

2.7.2 1996

The FAO and WHO (1996) initiated a global framework for the design and implementation of FBDGs with the objective of reducing the prevalence of malnutrition, micronutrient malnutrition and other diet-related communicable and non-communicable diseases (NCD). These recommendations were considered when the SA FBDGs were developed (Vorster, Love, Browne 2001:S3-S5). The recommendations by the FAO and WHO include the method of developing FBDGs, consideration of cultural differences, encouragement of the use of affordable, available and widely consumed foods, and the encouragement of friendly agriculture.

2.7.3 1998

In 1998, the Food and Drug Administration (FDA) and Centre for Food Safety and Applied Nutrition (CFSAN) prioritised research in population trends in food safety knowledge, attitudes and practices. The aim was to determine to what extent primary and secondary school children were aware of safe food handling and practices. Research by Daniels, Daniels, Gilmet and Noonan (2001) reported that 40 percent of all food safety errors occur as a result of lack of education and 20 percent from lack of motivation. Barclay, Greathouse, North, Swisher and Cale (2001:72-75) revealed that, in a study conducted in a secondary school, food-borne illnesses occurred because of a lack of knowledge of food safety, and thus education was a necessity. Only 50 percent of the schoolchildren, mostly girls, reported washing their hands after using the bathroom, sneezing, blowing their noses and petting dogs or cats. Barclay *et al.* 2000 suggested the importance of providing sound knowledge of food practices and handling from an early age so that these may become imprinted throughout adulthood. The FDA (2004) advises that education material needs to emphasize safe food handling practices, as food-borne illness will continue to be a problem in the future.

2.7.4 2000

During September 2000, 189 countries of the UN signed the United Nations Millennium Declaration (UNMD), aiming to eradicate poverty completely by 2015. The Millennium Development Goals (MDG) included eight goals, 21 targets and 60 indicators for measuring the progress between 1990 and 2015. Table 2.1 lists the MDG targets, which include reducing poverty, allowing enrolment for primary school children, reducing under-five mortality, increasing literacy amongst people from 15 to 24 years old, men and women, and increasing access to safe drinking water and sanitation globally (UNICEF 2008).

Table 2.1 Adapted Millennium Development Goals (MDGs) (UNICEF 2008)

Goals
Goal 1: Eradicate extreme poverty and hunger
Goal2: Achieve universal primary education
Goal 3: Promote gender equality and empower women
Gaol 4: Reduce child mortality
Goal 5: Improve maternal health
Goal 6: Combat HIV/AIDS, malaria and other diseases
Goal 7: Ensure environmental sustainability
Goal 8: Develop a global partnership for development

In September 2000, the WHO (2001b) endorsed the First Action Plan for Food and Nutrition Policy for the WHO European Region, 2000-2005. The purpose was to call for the development of food and nutrition polices in Member States. To date, one third of the Member States in the WHO European Region have developed polices on food and nutrition (WHO 2008).

2.7.5 2002

During 2002, the Sustainable Development Department (SDD) and FAO (UN) developed the Dakar Framework for Action with the focus on rural communities. Based on the National Education for All Assessment, several conclusions were

made: 113 million primary school children globally, mostly girls, are out of school. Illiteracy amongst adults accounts for 880 million, mostly women. The SD and FAO highlighted the poor quality of education globally; a lack of education increases the forum for poverty, child labour, violence, conflict and HIV/AIDS. The framework allows for achievable goals:

- Expansion and improvement of comprehensive early childhood care and education by 2015; free access to free and compulsory primary education of good quality; governmental role in educating all especially in remote and rural areas.
- Learning needs are met for the young and adults, with equitable access to appropriate learning and life skills programmes by 2015. A 50 percent increase in adult literacy, especially among women, and equitable access to basic and continuing education for all adults.
- Other goals include the elimination of gender disparities in primary and secondary education by 2015 and achievement of gender equality by 2015 and improvement of all aspects of quality education.

2.7.6 2003

The FAO UN (2003) encouraged nutrition through education by the development of generic booklets, classified as Education for Rural People (ERP). The purpose was to educate children and teachers within classrooms. The booklets provide a clear bridge for environmental and agricultural practices amongst farmers and communities. More than 40 percent of the earth's surface is agriculturally cultivated. The purpose of the FAO booklets is to encourage understanding of the environment and protection and improvement of the productivity of the land. The booklets incorporate the topics of biodiversity, the link between food and nutrition and how children can assist in reducing malnutrition through participation in school gardening, and the importance and understanding of forestry and trees as a means of understanding issues relating

to food security, nutrition and community-based natural resources. The animated booklets also define water as a necessity and highlight how water must be saved, protected and managed, and emphasise the importance of water to food security.

2.7.7 2004

In 2004, the WHO addressed the increasing burden of NCD with a Global Strategy on Diet, Physical Activity and Health (DPAS) (Coitinho, Nishida, Keller, Tukuitonga, Taylor 2005:107-108). The main objective was to tackle NCD through the obvious risk factors – unhealthy diets and physical inactivity. This would be achieved through a multi-sectoral approach. The policy aims at environmental changes and at empowering consumers to exercise individual responsibility. This incorporated the *Codex Alimentarius*, developed in 1979, which led to the Codex Guidelines on Claims, to discourage labelling that misleads consumers.

2.7.8 2005

The FA0 (2005) also developed a classroom curriculum, labelled Promoting Lifelong Healthy Eating Habits, which highlights the purpose of incorporating nutrition education in primary schools within developing countries The curriculum covers grade one through to ten and covers topics such as food and emotional development; eating habits and cultural and social influences; food, nutrition and personal health; food supply, production, processing and distribution; consumer aspects of food; food preservation and storage; and food preparation, as well as hygiene and sanitation. The curriculum is generic, allowing nutrition education to be developed using the curriculum as a guideline.

A global strengthening tool is the development of information and communication materials (FAO 2005): The Family Nutrition Guide encourages governments and

non-governmental organisations to promote and encourage education; Nutrition Education in Primary Schools – A Planning Guide for Curriculum Development assists teachers and promoters to establish a nutrition education programme in schools; and Teaching Aids at Low Cost (TALC), based in the United Kingdom (UK), and India-based Transformation Net, which works to transfer knowledge for the empowerment of farmers and the agricultural sector

2.7.9 2006

The Global Framework for Action (WFP and UNICEF 2006:6-62) is an Ending Child Hunger and Under-nutrition Initiative, which is a partnership taking the MDG into account. The purpose is to reduce child hunger by promoting information and strengthening regional and national strategies. The National Programming Framework (NPF) is a tool to assist in planning interventions at the national level. The programme encourages food security, good care practices and a healthier environment for a child's healthy development.

There are six major components of the NPF:

- Immediate response is required if national interventions are inadequate.
- A broad network of partnership is required to ensure effectiveness.
- Emphasis is placed on education and child development.
- Food security and ensuring clean, safe water and sanitation is essential.
- Although interventions may be present, a safety net needs to be in place. This includes access to services and community support over a long period.
- Information, implying continuous feedback and evaluation, is required at all levels to determine the degree of child hunger and the problems causing under-nutrition (WFP & UNICEF 2006:6-62).

The four intended outcomes of the Ending Child Hunger and Under-nutrition Initiative are (WFP & UNICEF 2006:8):

- Understanding and creating awareness of hunger and under-nutrition and possible solutions.
- Strengthening national policies and interventions to have more positive results.
- Allowing more participation and responsibility on the part of community members in acting on child hunger and under-nutrition.
- Creating continuous feedback sessions of global strategies aimed at alleviating child hunger and under-nutrition.

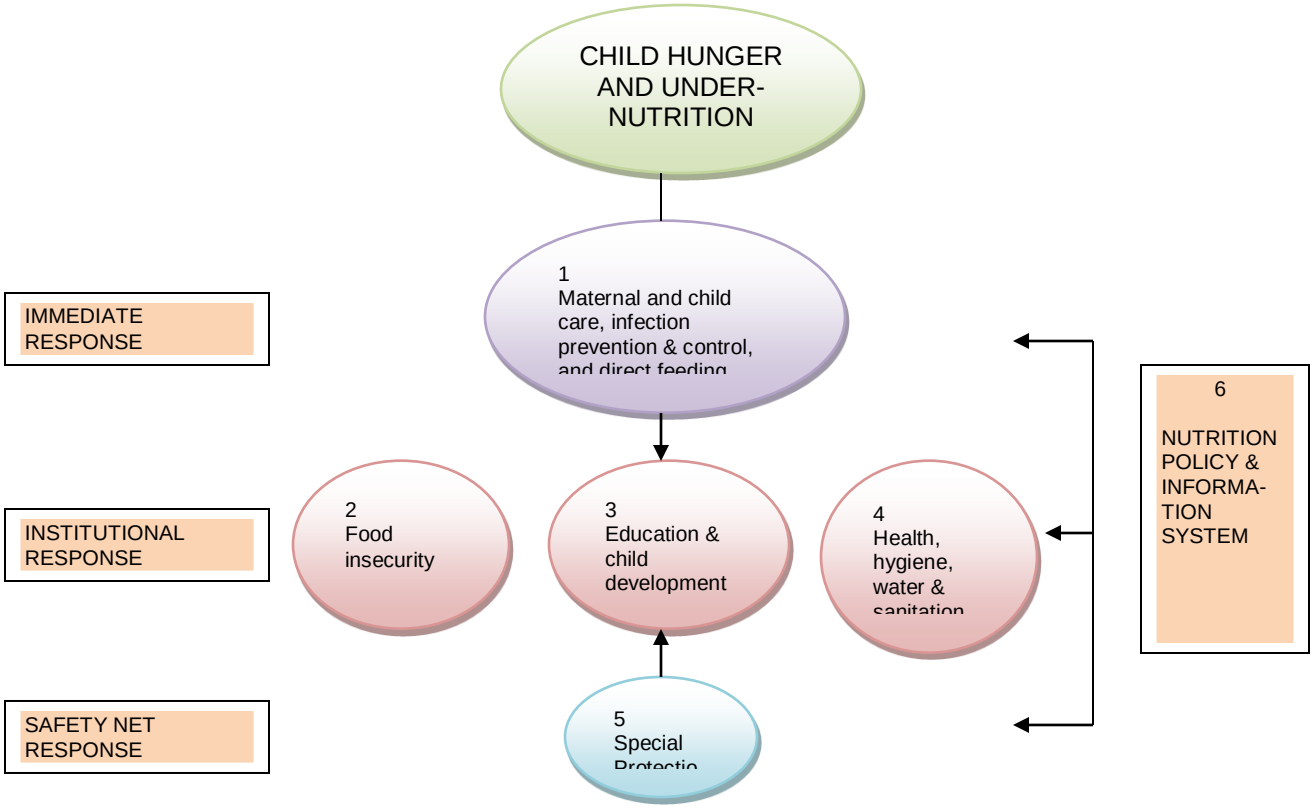


Figure 2.2 Adapted National Programming Framework (WFP & UNICEF 2006:40)

2.7.10 2007

Since the First European Action Plan for Food and Nutrition Policy in 2000, various action plans have been agreed upon and implemented (WHO 2008:1-3), such as the Protocol on Water and Health, the WHO Global Strategy for Food Safety, the Global Strategy for Infant and Young Child Feeding, the Global Strategy on Diet, Physical Activity and Health, the European Strategy for Child and Adolescent Health and Development, the European Strategy for the Prevention and Control of NCD, and the European Charter on Counteracting Obesity. As a result of these developments, The First European Action Plan was altered and a second action plan, the WHO European Action Plan for Food and Nutrition Policy 2007-2012, was created to address the major barrier to public health, namely food security and safety. The goals of The Second Action Plan (WHO 2008:4) are to reduce the prevalence of nutrition-related NCD, slow the rapidly developing crisis of obesity amongst children and adolescents, diminish the prevalence of micronutrient deficiencies and try to eliminate the incidence of food-borne illnesses.

2.7.11 2009

The Nutrition-Friendly Schools Initiative (NFSA) (WHO 2009) provides a generic framework for designing a programme which can combine strategies to combat the double burden of nutrition-related problems and inactivity into a school-based approach, which inter-links with the on-going work of various agencies, including UNICEF, WHO, and FAO, and incorporates the Baby-Friendly Hospital Initiative (BFHI).

Other NEPs which have been implemented are presented in table 2.2. The table outlines the methods of the programme, the results and the author(s). A summary of 15 other projects completed in the United States of America (USA) and the UK (Knai, Pomerleau, Lock, McKee 2006:85) between the 1990s and

early 2000, showed the combination of two measurement methods, Food Frequency Questionnaire (FFQ) and 24-hour (hr) recall, to be most effective during observation. Particular attention was paid to higher vegetable and fruit intake, which improved after the various interventions. This was promoted through the school canteens, posters, hand-out leaflets and training with the aid of fictional cartoon characters. Through NE within the curriculum, schools encouraged the approach of making healthier food choices.

Recommendations made include more in-depth follow-up periods, and more accurate consideration of the effectiveness and efficiency of interventions promoting vegetable and fruit consumption. Developing countries must consider the promotion of more robust vegetable and fruit. Any project must be part of a larger project plan in order for meaningful changes to occur. Any barriers to effectiveness must be assessed and taken into account to ensure maximum success of future projects.

Table 2.2 List of smaller NE interventions in various countries and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
1990-1995	NE for pre-school and primary school children using picture formats.	Use of 24-hr recall and three-day FFQ. NE emphasised reduction of fat intake, improvement of fibre, label knowledge, serving size and portion control. Nutrition knowledge questionnaires were multiple choice.	Improvement in knowledge and dietary practices	Contento, Randel, Basch (2002:2-25)
1995-2000	Various programmes implemented: Nutrition Education at Primary School (NEAPS) programme (Ireland) Grades 3-5	Classroom, family and physical activity intervention for three months. Five-day food diary.	Small significant increase of four or more vegetables and fruits daily	Summarised in Pérez-Rodrigo & Aranceta (2003)
	Heart Health (Crete) Grade 1	Classroom, family and physical activity intervention for three years		
	Minnesota Heart Health Grade 6	Classroom, family and physical activity intervention for seven years		Summarised in Pérez-Rodrigo & Aranceta (2003)
	GIMME 5 Georgia Grades 4 & 5	Classroom, workshops, school meals and cafeteria, family and video for four years. Seven-day food record	Slight decrease in intervention & control group in servings per day. No difference at Follow-up	
	GIMME 5 Louisiana Grades 9 – 12	Classroom, workshops, school meals and cafeteria, family and videos for three years	Intervention group had higher consump-tion of fruit & vegetables	
	High 5 Grades 4 & 5	Classroom, family and physical activity intervention for two years	Higher mean intake of vegetables and fruits daily	
	5-a-day Power Plus (Minnesota) Grade 4 & 5	Classroom, family and physical activity for two years	No difference at follow-up	
	CATCH – Child and adolescent trial for cardiovascular disease	24-hr recall; 30-minute interviews; modifications of school service, physical education, parents and curriculum.		
	Eat Well & Keep Moving Grades 4 & 5	Classroom, school meals, family, teacher and staff wellness for two years	Significant improvement in fruit & vegetable consump-tion.	
	Planet Health Grades 6 – 8	Classroom, family and physical activity and social services intervention for two years	Higher increase in intervention group	

Table 2.2 contd. List of smaller NE interventions in various countries and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
	Eat Well & Keep Moving Grades 4 & 5 Planet Health Grades 6 – 8 Low-income urban area in Spain	Classroom, school meals, family, teacher and staff wellness for two years Classroom, family and physical activity and social services intervention for two years Classroom, workshops school meals, family and health education intervention for three years education; and nutrition taught in schools.	Significant improvement in fruit & vegetable consump-tion. Higher increase in intervention group Improvement in knowledge and skills; Positive change in Personal hygiene; More willing to try new vegetables and fruits	
2003-2007	Improvement of health and nutritional status of school children in Zambia aged seven – 13 years.	Development of a Teacher's Book. In collaboration with the FAO. <u>Challenges (FAO 2009b):</u> High levels of malnutrition amongst children under five; Chronic household food insecurity; Poor access to adequate health, water and sanitary facilities; Inadequate knowledge and delivery of nutrition services; Lack of public nutrition	Improvement of knowledge influenced many food behaviours for better nutrition and health. Creation of booklets, Grade 2-4 Nutrition Education materials, base-line survey, radio programme, 46 community nutrition promoters and 200 peer educators.	Sherman & Muehlhoff (2007:336-348)
2004	Promotion of healthier food amongst Urban African-American Kindergarten and Grade 1 children	Education through school.	Children improved knowledge and increased consumption of vegetables during lunch.	Blom-Hoffman, Kelleher, Power, Leff (2004:48)
2004	Development of a book as part of the Rural Youth Development Programme of the Namibian Ministry of Higher Education.	Aids leaders and educators to educate villages on the understanding and importance of nutrition and food selection. Use of posters, nutrition dictionary, growth charts, games and activities.	Aim to improve nutritional status of children in Namibia.	Namibian Minister of Higher Education, Training and Employment Creation, Namibia and the FAO of the UN (2004)
2005	Implementation of the Fluids Used Effectively in Living (FUEL) programme in promoting healthier beverage choices	Six classroom sessions of four classes of grade nine students. Methods included visual, group interaction, tactile and auditory teaching. Project led by a dietician.	Students made healthier beverage choices after intervention and school provided healthier choices.	Lo 2005.
2005	NEP to increase the consumption of vegetables and fruits amongst primary school children (Scotland).	Provided more vegetable and fruits at school. Offered tasting sessions, posters and quizzes,	Increased vegetable and fruit consumption. Improved knowledge	Anderson, Porteous, Foster, Higgins, Stead,

Table 2.2 contd. List of smaller NE interventions in various countries and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
		newsletter to parents and teacher information session.	about vegetable and fruits	Hetherington, Ha, Adamson (2005:650-656)
2005	MyPyramid United States of America (USA)	MyPyramid United States of America (USA)	Aim is to encourage a healthier eating plan.	Peregin (2006:656-657)
2006	Framing of nutrition message for kindergarten children.	Video – 60 seconds was shown.	Children made a healthier choice. An active programme has results four months after intervention. Taste preferences are the strongest predictor of food intake in childhood.	Bannon & Schwartz (2006:124-129)
2006	Nutrition knowledge programme amongst primary school children in Nigeria	35 – 45 children per class. NEP divided into six topics.	Improvement in knowledge and dietary behaviour.	Eboh & Boye (2006:308-311)
2006	Feeding Minds Fighting Hunger (FMFH). SBNE in schools in Hyderabad, India. Classroom setting for NE	SBNE in schools in Hyderabad, India. Classroom setting for NE	Improvement through classroom setting of nutrition knowledge.	Subba Rao *et al.* (2006:991-995)
2007	Attitude and behavioural change through nutrition education and teaching agricultural practices to high school girls in Guaimaca, Honduras	Supplemental education programme working with young women and their families to address organic farming and garden.	Increased both crop and dietary diversification. Nutrition reinforced through classes on nutrition, cooking, agronomy and environmental science. Project a success and expanded from a school project to household and community agriculture projects.	Potenza (2007)
2007	Promoting a healthy lifestyle for children.	Puppet show implemented for 30 minutes promoting diet and physical activity.	Good response. Improvement of knowledge. Inexpensive approach and implementable.	Wright, Lukoschek, Wylie-Rosett,Moadel (2007:290-294)
2007	Four-week programme to improve participants' nutrition knowledge, food choices, fitness and motor skills. Kindergarten children and first grade students of schools within the Iowa district.	Programme included a 15-minute walk before school, 90-minute after-school session, 20-minute classroom session and a snack.	Improved knowledge. Made healthier food choices and chose healthier snack options.	Matvienko (2007)
2008	NEP for students (India) to enhance their skill and enhance change agents within the community.	Classroom lectures to students with the aid of posters, charts, folders on nutrition education. Control group 2 received NE through television version of folk-art form.	Improvement of knowledge gained by both groups.	Vijayapushpam *et al.* 2008:108-111

Table 2.2 contd. List of smaller NE interventions in various countries and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
2008	Determining the impact of a Michigan Model (MM) Nutrition Curriculum on nutrition knowledge and eating behaviours.	An MM instructor taught the teachers, who then taught the children.	Nutrition knowledge increased after post. Improved behaviour - more vegetable and fruits intake.	Fahlman, Dake, McCaughtry, Martin 2008:216-222.
2008	Research needs to determine the impact of a NEP on dietary behaviours and health outcomes	Internet database search, literature review and studying the Journal of Nutrition Education and Behaviour (JNEB).	Peer nutrition education has an effect on diabetes as well as general nutrition knowledge and dietary intake behaviours	Pérez-Escamilla, Hromi-Fiedler, Vega-López, Bermúdez-Millán, Segura-Pérez 2008:208-225.
2008	The efficacy of Game On in improving nutrition knowledge	Education sessions were implemented during which the Game On! Curriculum was taught.	Nutrition knowledge improved with the Game On! Curriculum although with no significance.	Seher 2008
2008	Nutrition Education Intervention Improves Nutrition Knowledge, Attitude and Practices of Primary School Children: A Pilot Study	Intervention group - nutrition education taught by trained school teachers; control group – Standard Health and Physical Education curriculum	Intervention group – knowledge, attitude and dietary practices improved compared to control group	Shariff, Bukhari, Othman, Hashim, Ismail, Jamil, Kasim, Paim, Samah, Hussein 2008:119-132
2009	United States Department of Agriculture (USDA), Food and Nutrition Service (FNS) have created various programmes aimed at improving diets and lives within the country.	Center for Nutrition Policy and Promotion: offers Dietary Guidelines, Healthy Eating Index, and Interactive Food Supply. Team Nutrition: provides training and technical assistance for the food service industry, nutrition educators and children. Eat Smart. Play Hard. Aim is to improve the health of American children. Practical guide to motivating children and care-givers to eat healthy and be active. Core Nutrition Messages: 16 nutrition education messages, support content and implementation guidance for use in nutrition assistance programmes. Program Nutrition Education: focuses on programmes, namely: Supplemental Nutrition Assistance Programme (SNAP), Breastfeeding Promotion and Support, and Fathers Supporting Breastfeeding. State Nutrition Action Plan Supports the State SNAP committees.	The objective is to provide adults and children with the education materials needed to improve diets and life.	USDA, FNS (2009)

Table 2.2 contd. List of smaller NE interventions in various countries and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
2009	Guidelines for Schools to Promote Lifelong Healthy Eating	Guidelines to help schools implement effective nutrition policies and educational programmes. Guidelines include seven recommendations for ensuring a quality school programme to promote lifelong healthy eating.	Improve quality of life and encourage healthier eating patterns.	National Center for Chronic Disease Prevention and Health Promotion (CDC) (2008)
2009	NEP implemented on adolescent girls	Using of nursing staff to design and implement a NEP to improve mother's And girls nutrition –related self care operations	Girls' and mothers' nutrition knowledge improved and dietary changes were made	Moore, Pawloski, Rodriguez, Lumbi, Ailinger 2009:144-152.
2009	Implementation of a school garden to examine the affects on vegetable and fruit consumption and knowledge.	Scholars divided into three groups: 1) NE and gardening; 2) NE only; and 3) control group	Improved taste ratings and knowledge. More children made a choice of vegetables during lunch.	Parmer, Salisbury-Glennon, Shannon, Struempler 2009:212-217.
2009	Class-based nutrition intervention to change consumption in beverages	80 college students enrolled in basic nutrition class with interactive activities.	Successful in decreasing soft drink consumption with higher milk, and fat-free milk increased.	Ha, Caine-Bish, Holloman, Lowry-Gordon 2009:50
2010	Food Safety Education in a Supplementation Nutrition Program for Women, Infants and Children (WIC) Program	Using of Interactive Multimedia Kiosk (computer) to improve food handling	Food safety education was accepted using this form of communication.	Trepka, Newman, Huffman, Dixon 2010:202-207.
2010	Special Supplementation Program for WIC	Family coordinated education	Participants recognised nutrition messages, intended to consume and use vegetable and fruits, eat more whole-grain and drink lower-fat milk.	Ritchie, Whaley, Spector, Gomez, Crawford 2010:S2-S10
2010	Finding the Teacher Within (FTW) Program	Comparison agency for participants of WIC 4 to 6 months after participation..	Messages were retained and integrated family practice occurred.	Gerstein, Martin, Crocker, Reed, Elfant, Crawford 2010:
2010	Snack Smart Workshops	Snack Smart workshops based on Social Cognitive Theory, conducted in eight branch libraries (children aged between 9 and 14)	Intake of milk, vegetables, and water improved. Low-intensity program after three months showed decline in consumption.	Freedman & Nickell 2010:192-196
2010	The Healthy Food Slide Rule (HFSR)	Education tool designed for children in grades 4-6. Focuses included the five food groups and portion sizes.	Portion sizes were more adhered to. Children became more inquisitive, asking about the eating plan.	Long, Reischl, Abo 2010:64

2.8 Nutrition education in South Africa

National strategies will be discussed as developed per year and smaller community projects will be presented in Table 2.3.

2.8.1 2001

The SAFBDG were developed in order to motivate a positive, practical, affordable and sustainable approach to food choices by South Africans over the age of seven years (Vorster *et al*. 2001:S3-S5). The guidelines were based on the National Food Consumption Survey (NFCS) with the aim of addressing over- and under-nutrition and providing nutrition education for all populations of South African society (Maunder & Meaker 2007:402). The FBDG is based on the concept that nutrition education should be focused on foods rather than nutrients (Maunder & Meaker 2007:401-402). The guidelines are now used as the basis for nutrition education in SA. The guidelines are short, clear and simple (Vorster *et al.* 2001:S3):

- Enjoy a variety of foods.
- Be active.
- Drink lots of clean, safe water.
- Make starch the basis of most meals.
- Eat vegetables and fruit every day.
- Eat dry beans, peas, lentils and soya regularly.
- Chicken, fish, meat, milk or eggs can be eaten daily.
- Use fats sparingly.
- Use salt sparingly.
- Use sugar sparingly.
- Drink alcohol sensibly.
- Hygiene is important.

Barriers to the application of the FBDG are cited as affordability, availability, household taste preferences, time constraints, traditional purchasing and preparation methods and persistent attitudes (Love, Maunder, Green 2008:21-22). The economic situation of most rural South Africans has not improved and the poverty level is still very high. This is seen as the greatest barrier to the

application of the FBDG for people mostly within rural and urban informal settlements (Steyn, Abercrombie, Labadarios 2001:98-102). The SAFBDGs may improve not only household food insecurity, but also the best use of resources, including food (Love *et al.* 2008:23).

2.8.2 2002

The Indaba Declaration on Food, Nutrition, Health and Sustainable Development (Stakeholders Forum for Our Common Future 2003:9) was approved in August 2002. This policy aims to:

- Create food systems which are sustainable by all, and designed to strengthen and improve human nutritional status;
- Provide education and information, including product labelling, to ensure improvement of knowledge to promote healthy lifestyles; and
- Create successful and acceptable public policies.

The Indaba Declaration on Food, Nutrition, Health and Sustainable Development encourages:

- Good health, which is an important objective for sustainable development.
- Addressing underlying and basic causes, which will promote good health.
- Addressing the modifiable causes of health and diseases.
- Caring for the environment, as human health and welfare are dependent on nature and a quality food system.

2.8.3 2003

The DoH (2003:11-20) developed the Integrated Nutrition Programme (INP) (refer to Table 1.9 and Figure 2.3), focusing on three areas to reduce malnutrition, namely nutrition education, promoting and support of breastfeeding

and care during pregnancy. By improving the nutritional knowledge of mothers and children, the nutritional status of children will improve, as will proper birth outcomes. The national Integrated Nutrition Programme is a nutrition strategy focusing on children below six years old, at-risk pregnant and lactating women, and those affected by communicable diseases and NCD (Bourne, Hendricks, Marais, Eley 2007b:230-238).

In South Africa, a nutritional labelling education programme should be implemented to promote the correct choice of foods so as to eliminate nutrition-related disease (Anderson & Coertze 2003). Studies conducted by Anderson and Coertze (2003) indicated that consumers required more nutritional information on products in order to assist with:

- Understanding the format of labelling used to present nutritional information;
- Understanding of terms used on food labels, and those used to describe the purpose and origin of the nutrients within;
- Understanding the relationship between diet and disease;
- Providing information relating to the benefits of reducing body weight, fat, salt and improvement of dietary fibre; and
- Teaching the consumer how certain food groups such as red meat are related to health issues.

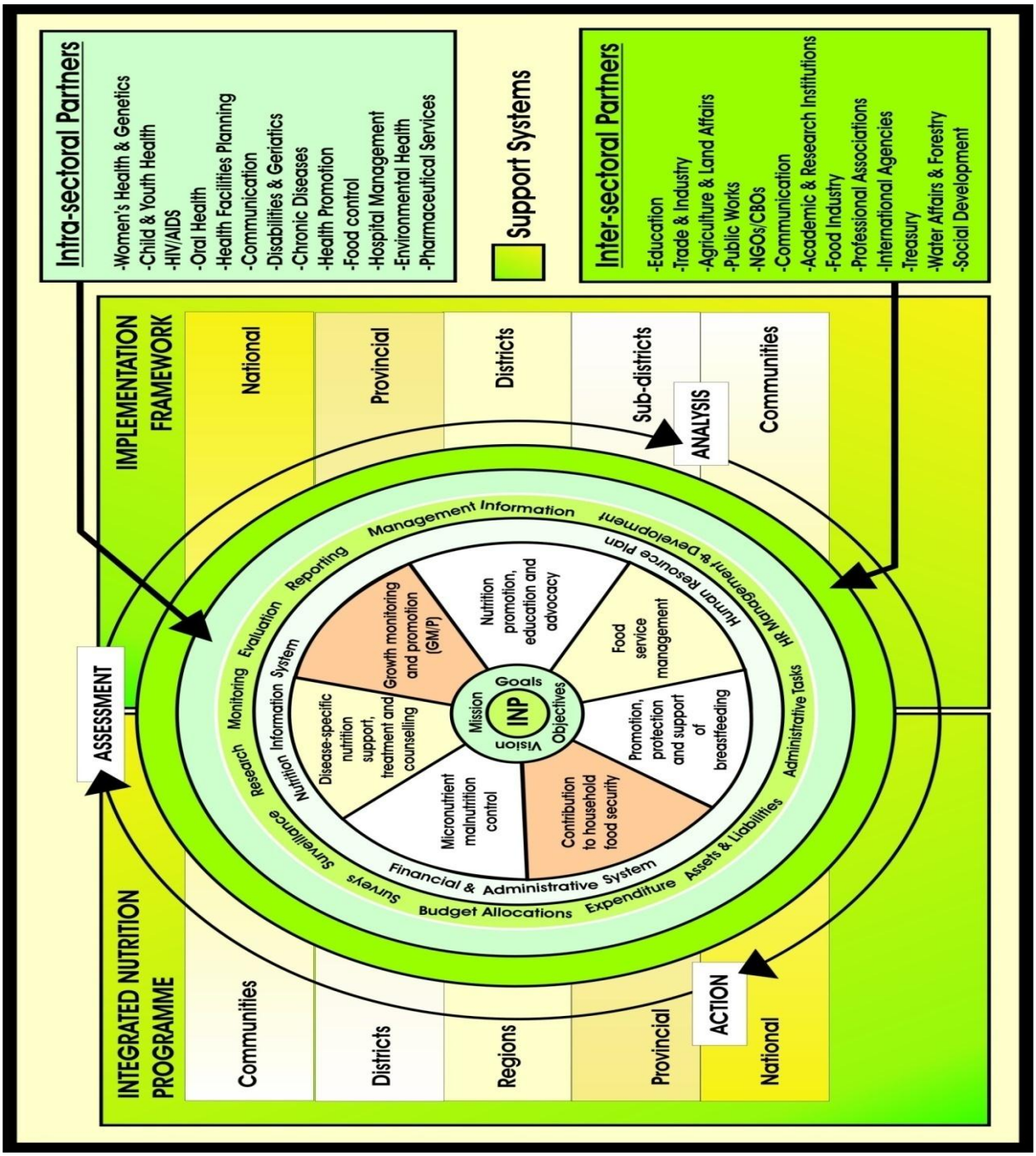


Figure 2.3 Adapted Integrated Nutrition Programme DoH (2008c:1-3)

2.8.4 2007

The Paediatric Food-Based Dietary Guidelines (PFBDGs) were developed in 2007 to complement the guidelines for children, adolescents and adults, which were made available to the public through the DoH in 2003 (Bourne *et al.* 2007b:230-8). Children from the ages of zero to six months, seven months to a year and one to seven years have different nutritional requirements for optimal growth. Challenges of traditional food, lack of facilities and services to have children checked on a regular basis and food intolerances and allergies add a further burden. The limitation of FBDGs includes the evolutionary adaptation to available foods (Briend 2007:224; Bowley, Pentz-Kluyts, Bourne, Marino 2007:288-289). The PFBDGs were developed on the same principles of the SAFBDGs, which were also developed using the WHO/FAO criteria for developing FBDGs. The commencement of the SAFBDGs was changed from five years of age to seven. This was encouraged as seven years of age covers most SA pre-school children for whom school becomes compulsory (Bourne, Marais and Love 2007c:244). The suggested PFBDGs are indicated below and change per age group (Bourne 2007a:155-156; Bourne *et al.* 2007b:230-8; Bourne *et al.* 2007c:244):

Preliminary PFBDGs: Younger than six months:

1. Enjoy time with your baby.
2. Breastfeeding is best for your baby for the first six months.
3. Clean your baby's mouth regularly.
4. Take your baby to the clinic every month.

Preliminary PFBDGs: six – twelve months:

1. Enjoy time with your baby.
2. From six months start giving your baby small amounts of solid foods.

3. Increase your baby's meals to five times a day.
4. Keep on breastfeeding your baby.
5. Offer your baby clean safe water regularly.
6. Teach your baby to drink from a cup.
7. Take your baby to the clinic every month.

Preliminary PFBDGs: One – seven years

1. Encourage children to eat a variety of foods.
2. Feed children five small meals a day.
3. Make starchy foods the basis of a child's main meals.
4. Children need plenty of vegetables and fruit every day .
5. Children need to drink milk every day.
6. Children can eat chicken, fish, meat, eggs, beans, soya or peanut butter every day.
7. If children have sweet treats or drinks, offer small amounts with meals.
8. Offer children clean, safe water regularly.
9. Take children to the clinic every three months.
10. Encourage children to play and be active every day.

Studies relating to the PFBDGs will reflect in Table 2.3, as they have been implemented only in a small province.

Table 2.3. List of smaller NE interventions in various provinces, and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
1995	MRC in KZN – Pre-school children provided with NE.	Monitoring and guidance of pre-school children.	Early detection and diagnosis of malnutrition with correct referral to health clinics.	MRC (2006)
1998 - 2000	Nutrition Intervention Programme (NIP) in an informal settlement, Mangaung, Free State (FS).	NE – improving of weaning practices, food selection, food availability and nutritional status of pre-school children. Anthropometric status and dietary intake measured pre- and post intervention.	Children became better nourished after the intervention. Stunting and under-weight still prevailed.	Dannhauser, Kruger, Slabber, Du Toit, Badenhorst. Bester (2002:S13)
2001	Nutrition Education Intervention Programmes (NEIP) – Northern Province	NE to the rural areas.	Improvement of breast-feeding, frequency of meals and overall improved quality of life.	Ladzani *et al.* 2000:811-816
2001	Nutrition Intervention Research Unit (NIRU) of the MRC, Langebaan.	Community based project – health monitoring and identifying health problems in pre-school children.	Status of pre-school children has improved over a period of time.	MRC (2001)
2001	Computer Aided Learning (CAL) used in disadvantaged communities in Southern Cape and Karoo.	Use of computer to provide NE. Use of only two keys on the keyboard. Personalised interaction with each participant.	Improvement of knowledge, attitude and behaviour in immediate post-test. Proved NE can be delivered via computer to low-income and low-literacy communities.	Venter, Marais, de Muynk, Shedden (2001:106-109)
2002	Community-based NE programme implemented in Free State and Northern Cape Provinces.	NEP in combination with food aid. Use of trained advisors and anthropometric nutritional status.	Improved nutritional measurements amongst children.	Walsh, Dannhauser, Joubert (2002:3-9)
2002	Nutrition information and medium used, in Cape Town and Pretoria, amongst black women.	Questionnaires determine level of knowledge, and obtaining of nutrition information.	Radio, major source of nutrition knowledge, followed by family and friends. Misconception of certain nutritional aspects. Health professionals perceived as most trusted form of receiving information	Charlton, Brewitt, Bourne (2002:S12)
2005	Food Aid Programme (FAP) implemented over FS and Northern Cape Province.	Nutrition Education Programme.	Improvement of weight status in children but no catch-up growth was achieved	Walsh, Dannhauser, Joubert (2002:3-9)

Table 2.3. Contd. List of smaller NE interventions in various provinces, and results obtained

Year	NEP Implemented	Methods	Results	Author(s)
2005	Development of a NEP based on the SA FBDG, aimed at primary school children	Use of MRC questionnaires amongst primary school children (n=60), aged 6-13 years. Pre- and post-intervention tests were used. Education sessions included pictures and 11 guidelines. Each guideline was discussed and presented individually.	Knowledge increased, mean 11.8%.	Napier, Oldewage-Theron (2005:1-12)
2007	PFBDG implemented in the Western Cape.	Testing the PFBDG for appropriateness and prevention of overlapping. Phase 1: Screening of mothers and caregivers (n=31) of children in target age, in low socioeconomic area. Use of diverse groups with children under 6 yrs, and six to ten mothers per session. Phase 2: 21 dieticians check content for validity and suggestions for alterations.	Breastfeed and complementary feeding suggestions differ from WHO guidelines. 0 – 6 months: general understanding and implementable. 6 – 12 months: Not understood fully on own – required assistance and explanation. 1 – 7 years: Understood but did not understand the purpose and reason for development of the PFBDG.	Scott, Marais, Bourne (2009:979-985); Bourne *et al.* 2007b:230-8; Bourne *et al.* 2007c:239-249

2.9 Conclusion

NE has been employed globally and in SA to address malnutrition in children. The objective is not only to improve knowledge on food and nutrition, but also to encourage behavioural change. Children are capable of making healthier food choices from an early age. Children also have the ability to encourage change within families and communities. NE has been emphasised to assist in reducing malnutrition. Studies show that education institutions can be an effective medium for implementing nutrition education as they reach a large segment of a community. Schools are an established setting within communities and children represent a large population that is present.

The hypothesis developed for this study, namely that nutrition education will improve the nutrition knowledge of the children and this will improve the food choices and nutritional status of the primary school children, is concluded on

results showing the possibility to influence children in their formative years. The ability to influence children in their formative years can be seen as a potential mechanism to influence change (Steyn, Lambert, Parker, Mchiza, De Villiers 2009:146). Results have proved that early learning about nutrition-related topics, affecting attitudes and behaviours, is important (Wong, Sun, Lee, Stewart, Cheng, Ho 2009:209-214; Subba Rao *et al.* 2006:991-995). Therefore, NE should start at an early age in order to influence behaviour and improvement of the quality of life into adulthood. For individuals to remain well nourished, they require access to food of good quality and quantity, coupled with an understanding of the need for food to remain nourished and the skills to make accurate choices (FAO 2008).

Figure 2.4 illustrates the possible relationship between nutrition education, food choices and nutritional status.

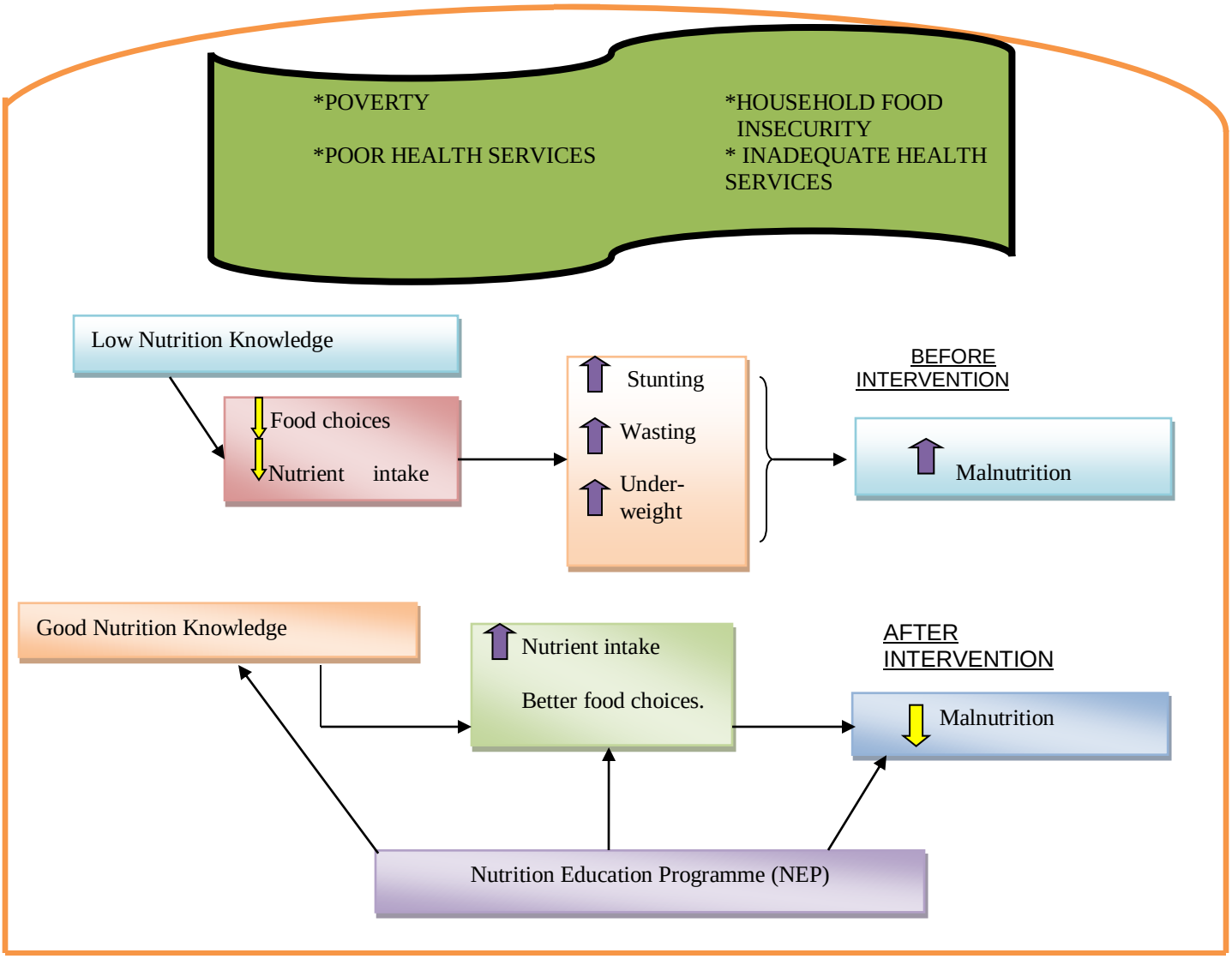


Figure 2.4 Framework representing the relationship between nutrition education, food choices and nutritional status in a low-income community

CHAPTER 3: BASELINE SURVEY

3.1 Introduction

A situational analysis was completed to obtain relevant information regarding the eating patterns, nutritional status, knowledge of nutrition and health practices, as well as surrounding environment, amongst the community members and children. The gathering of this information is referred to as a baseline survey, which states the problems and allows possible solutions based on desired outcomes to be generated. The baseline survey is regarded as a study of the needs assessment of the children.

The main study was divided into three phases: planning, baseline survey (conceptualization), and intervention study (implementation and evaluation). This part of the study formed part of the analysis phase and the objectives were to determine, by means of a baseline survey, the prevalent underlying causes of malnutrition, (for example, inadequate food consumption) and the level of nutrition knowledge amongst the children and to assess the demographic environment surrounding the children in the households. Creating awareness of good health, hygiene practices and nutrition may impact on food choices, which may ultimately lead to a better quality of life.

3.2 Planning and administration

Boipatong is a neighbouring community to Eatonside. In view of the food insecurity and malnutrition occurring within the Vaal region, the management of a Care Centre in Boipatong invited the researcher to assess the needs of the Boipatong community and its children in order to find a possible link between the level of malnutrition and nutrition knowledge and food practices. Children (n=400) visit the Care Centre voluntarily on Wednesdays, when lunch is served. A meeting was held with the Boipatong Care Centre management to invite the

parents of the children participating in the programme to an information session where the objectives of the study were explained and voluntary permission to participate in this study was obtained. Therefore, this study focused on the children in Boipatong.

Figures 3.1 – 3.5 below are photographs obtained during a visit to the Boipatong Care Centre, where children are given food once a week. The food is donated by various organisations and prepared in a small area, referred to as a garage. The providers try to teach the children basic hygiene practices: washing of hands is essential before eating. Children are required to stand in a row and may sometimes be turned away if the food is finished. This results from the limited number of portions available, due to the food being donated by various stakeholders and only provided once a week. No other form of food aid is provided.

Figures 3.1 - 3.5 Children receiving food at the Boipatong Care Centre

3.3 Ethics

Ethics approval was obtained from the Medical Ethics Committee for Research on Human Beings at the Witwatersrand University (M080365; R14/49) (Annexure A). Planning committees were advised and before intervention could commence, community participation was negotiated. All field work was conducted in accordance with the South African Medical Research Council's (SA MRC) ethics guidelines for research in humans, which includes written informed consent forms, signed by each participant. A signed consent form is essential with research on individuals and communities. Four elements describe the basis of this consent form, as set out by Singh, Kagee and Swartz (2007:35):

- Research participants were competent and skilled to participate in the research. The VUT and National Research Foundation (NRF) offer grants to qualified post-graduate students to assist in research in their chosen field and allow for further qualification.
- All information as well as the purpose of the study was explained to the participants (ANNEXURE B). During the baseline survey all the parents

and children were given detailed information regarding the purpose of this project and the outcomes expected.

- The purpose of the research was understood by the participants. In order for the baseline survey to continue, the parents, children and Care Centre management confirmed that they understood the purpose and reason for the research.
- Participation was voluntary. Caregivers and parents, (n=52) signed consent forms (ANNEXURE C) as representatives of the children, as the ages of the children varied between six and thirteen years. However, according to the Helsinki agreement, all children aged ≥seven years should also sign the consent form and 45 children agreed to participate in the baseline survey. Confidentiality was applied in that all the children and adults participating were allocated study numbers, and no names appeared in the data.

3.4 Sampling

During the planning meeting, 45 parents, representing the 400 children who attend the Care Centre, gave voluntary consent. All 45 parents (13.0 percent of the total number of children) and children (>7 years of age) gave consent, and thus a purposive/convenience sample of 45 children was used for the baseline survey. This is a non-probability sample technique (Leedy & Ormrod 2005; Leedy 1993:200). Convenience sampling confines a sample to an accessible section of the population (Kumar 1999:161) and was used in this study for the purpose of choosing the respondents. The respondents were easily identified, as recommended by Babbie and Mouton (2001:66), and all the caregivers and primary school children from the identified Care Centre could have been included. The study population was, therefore, composed of the caregivers and the primary school children attending the Care Centre and who gave consent to participate in the study, and this became the baseline sample group. The

intervention study would, therefore, include two primary schools, and they were selected based on the children who attended the Care Centre on a weekly basis.

3.5 Fieldworkers

Fieldworkers were required to assist in obtaining the information. Students from the Hospitality and Tourism Department were recruited and trained in the purpose of the study, the importance of accurate information to ensure correct and achievable objectives, and in how to complete all the baseline survey questionnaires with the caregivers/mothers and children, as well as how to assist the caregivers/mothers and children in the answering of the questions without the interviewer's bias being prevalent. Explanations were provided in the relevant languages to assist in obtaining accurate information. This approach is endorsed in the literature (Babbie & Mouton 2001:249), especially for respondents with a low level of literacy. Care was taken, however, to prevent respondents from influencing each other. Although this method of data analysis is time-consuming, the fieldworkers and researcher had the opportunity to probe for answers when necessary. The fieldworkers were given a sheet (ANNEXURE D) detailing the procedures of the baseline survey. The fieldworkers and researcher assisted the caregivers and children in completing the questionnaires. The questionnaires were not self-administered. This was to ensure more accurate answering, easier understanding of questions and a more speedy completion process.

3.6 Methodology

3.6.1 Measuring Instruments

In this study, the measuring instruments were questionnaires: socio-demographic (Annexure E), food consumption (Annexure F), 24-hour recall (Annexure G), nutrition knowledge (Annexure H) and health questionnaires as well as anthropometric measures (Annexure I), signs of malnutrition (Annexure J) and

biochemical measures. A description is given below and discussed in detail thereafter:

- Questionnaires:
  - Socio-demographic (Section 3.6.1.1)
  - Study of the dietary intake and food consumption patterns through: 24-hour (hr) recall questionnaire (Section 3.6.1.2)
  - Food frequency questionnaire (FFQ) (Section 3.6.1.3)
- Food and nutrition knowledge questionnaire (Section 3.6.1.4)
- Anthropometric measurements: (Section3.6.2)
  - Weight
  - Height
  - Signs of malnutrition
- Biochemical measures: Blood sampling (Section 3.6.3)

3.6.1.1 Socio-demographic questionnaire

A validated socio-demographic questionnaire included questions to define the population group by measures of size, age, level of literacy, income sources and basic living conditions, such as water and sewerage facilities and the structure of the dwelling. A validated socio-demographic questionnaire was used (Oldewage-Theron *et al.* 2005:13-26). The researcher and fieldworkers met with parents and children at the Care Centre in Boipatong, where the questionnaires were completed, through an interview process, by the researcher and fieldworkers. The socio-demographic questionnaire contained questions relating to type of dwelling, family responsibilities within the household, number of children in the house, economic status, services available, water and sewage facilities, and method and frequency of food purchases.

3.6.1.2 Dietary intake and food consumption patterns: 24-hour recall

The 24-hour recall questionnaire is regarded as a quick and easy method of gathering information. This allows the individual to recall the foods consumed during the preceding 24 hours, providing details as to the type of eating pattern followed. This type of questionnaire can assist in the gathering of relatively accurate information as the participants rely on memory recall. Fieldworkers, however, need to be well trained (Walsh & Joubert 2007:294-296).

With the assistance of the caregivers and mothers, 15 children provided details for the previously validated 24-hr recall questionnaire (Oldewage-Theron *et al*. 2005:13-26). The fieldworkers and researcher used food models to explain the types of foods and portion sizes to the children. Caregivers and mothers assisted the children in providing accurate information if food item names were not known. The questionnaires were filled in by the field workers and researcher as the children were either standing in a row waiting for food, or sitting down on the floor eating. The information was then captured and analysed to determine the nutritional intake of the children.

3.6.1.3 Food variety patterns: Food Frequency Questionnaire

The FFQ used was a pre-printed list of foods that correlated with the dietary patterns of the population of the Vaal region. Only food items were listed, with no quantities specified, and the questionnaire was one which had been standardized in previous studies (Oldewage-Theron & Kruger 2008:115-121). Whilst the children were either standing in a row, awaiting food, or sitting down on the floor eating, the researcher and fieldworkers assisted the children, through the interview process, to complete the questionnaire. The information given reflected the items consumed over the previous seven days.

3.6.1.4 Nutrition knowledge questionnaires

The nutrition knowledge questionnaire (Annexure G) was based on the validated questionnaire designed by the MRC (Whati, Senekal, Steyn, Lombard, Nel, Norris 2004). A few changes were made concerning certain questions and the children's perception of nutrition knowledge, source of information and how the information should be presented. Whilst the children were either standing in a row, awaiting food, or sitting down on the floor eating, the fieldworkers, through an interview process, assisted the children (n=45) with completing the questionnaires.

3.6.2 Anthropometric measures and signs of malnutrition

For this study, the weight, age and height were measured by Prof. Wilna Oldewage-Theron and Dr Abdulkadir Egal of the CSL at VUT. The physical appearance of the children was noted by the nursing sisters, using a tick list for signs of malnutrition (Annexure J). These recorded, for example, signs of tooth caries and decay, missing teeth, mottled teeth and spongy gums. Malnutrition was also detected through the physical appearance of the hair and the scaling of facial skin.

3.6.3 Biochemical measures

Blood was drawn by qualified nursing sisters from the *vena cephalica* of seated subjects after an 8-12 hour fast, using a Vacutainer. The blood was separated within two hours of blood collection. Two medical technologists continuously audited the separating procedure. Serum and plasma were stored at -60° C until analysed at the laboratories of the Vaal University of Technology.

All blood parameters were analysed according to protocol and the following analyses were performed: haematocrit (Hct) (numeric integration, Coulter counter

ABX MICROS$_{CT}$); haemoglobin (Hb) (cyanomethaemoglobin colorimetric method, Coulter counter ABX MICROS$_{CT}$); red and white blood cell count (RBC; WBC) (Coulter counter ABX MICROS$_{CT}$); serum glucose (colorimetric, Konelab^{TM}, GOD-POD); serum albumin (colorimetric, Konelab^{TM},BCG); total protein (colorimetric, Konelab^{TM},); serum folate (immunoturbidity, TOSHO, AIA-PACK B12); vit. B12 (immunoturbidity, TOSHO, AIA-PACK B12); Fe (colorimetric, Roche Unimate 5 Iron); ferritin (immunoturbidity method, Roche Unimate 3 FERR); Zn (non-diluted serum flame atomic absorption spectrophotometry); Zn and selenium (Se) (Atomic Absorbance Spectroscopy (AAS)); vit. B, A, C and folate (High Performance Liquid Chromatography (HPLC)); and total cholesterol and triglycerides (homogenous enzymatic colorimetric, Konelab^{TM}).

3.7 Data capturing and analysis

The socio-demographic and nutrition knowledge questionnaires were captured by the researcher, assisted by a research assistant, on Microsoft Excel spreadsheets and analysed for descriptive statistics (means, standard deviations and frequencies) with the Statistical Package for Social Sciences (SPSS) program, version 17.

The dietary intake and food consumption patterns (24-hr recall) were analysed by means of the FoodFinder Program, by a registered Dietician. The FoodFinder Program is a food and dietary analysis program developed by the MRC and is based on the SA Food Composition Tables (Langenhoven, Kruger, Gouws, Faber 1991). Nutrient intake was analysed and compared with Dietary Reference Intakes (DRI) as reflected in the Nutrition Information Centre (NICUS). Furthermore, the top 20 most frequently consumed foods were calculated as means, and SDs and ranked in order of consumption. The FFQ was analysed for frequencies with SPSS, version 17. The FFQ were also analysed for Food Variety Scores (FVS) and Food Group Diversity Scores (FGDS).

Anthropometric measurements were analysed according to the WHO Standards (2007) cut-offs for wasting (weight-for-height), stunting (height-for-age) and underweight (weight-for-age) (BMI-for-age). Table representation will be given for this comparison. Biochemical results were captured and then analysed for means and SDs and compared with reference ranges for the specific age groups.

3.8 Results

3.8.1 Socio-demographic

The socio-demographic questionnaires were completed by 52 mothers/caregivers (Table 3.1). It is clear that government support has been provided to more than half of the volunteers were 69.2 percent are residing in brick structures (referred to as Reconstruction and Development Programme (RDP) housing). Just over 50 percent of the residents had four rooms, and 74 percent had access to basic water and electricity; however, only 53.9 percent had water facilities inside the house. Only seven percent of the caregivers/mothers were forced to fetch water on a regular basis. Flush sewerage has been made available to above 82.7 percent of the community members. Children present in the household varied from two to five in number and 19.2 percent of the caregivers/mothers had more than five children in a home, which places a larger burden of food procurement and distribution on the mothers/caregivers. The economic situation of each household indicates high levels of poverty, as an average household accommodates between four and seven people, with a maximum income of R1000 (at Rand to Dollar exchange of 1:8, equivalent to United States Dollars (US$) 125) in 40 percent of the households. Shopping was usually done on a monthly basis (69.2 percent) and at supermarkets (76.9 percent). Food preparation was done by the mother (64.7 percent) on a daily basis, with 95.9 percent of meals eaten at home. Unemployment levels were high (60.9 percent), owing to levels of education ranging between primary (33.3 percent) and secondary school (54.9 percent).

Table 3.1: Socio-demographic results of Boipatong (n= 52)

Description	No. of participants	% of participants
Occupancy and gender		
Residing in Boipatong	48	92.3
Residing in Sharpeville	4	7.7
Role in the family: Caregiver	35	67.3
Grandmother	9	17.3
Guardian	3	5.8
Other	5	9.6
Gender of participant completing the forms (Female)	52	100
Participants in the dwelling		
Number of people in the dwelling:		
2 - 3	6	11.5
4 - 8	42	80.7
> 8	4	7.7
Resident more than 5 years in the dwelling	45	88.2
Resident between 1 and 5 years	6	11.8
No. of children eating at home	47	95.9
No. of children in the dwelling: 1	6	11.5
2	12	23.1
3	11	21.2
4	13	25.0
≥ 5	10	19.2
Type of dwelling		
Type of house: Brick	36	69.2
Zinc / Shack	16	30.8
Number of rooms in the dwelling: < 2	12	23.1
3 - 4	12	23.1
Number of rooms in the dwelling: > 4	28	53.8
Facilities in the dwelling		
Electricity within the dwelling	40	78.4
Paraffin	6	11.8
Other	5	9.9
Tap inside the dwelling	12	23.1
Tap outside the dwelling	20	38.5
Tap inside and outside the dwelling	16	30.8
Fetching of water	4	7.7
Flush toilets	9	82.7
Pit latrine	5	9.6
Facilities in the dwelling		
Number of rooms in the dwelling: ≥ 4	40	78.4
Facilities in the dwelling		
Electricity within the dwelling	6	11.8
Paraffin	5	9.9
Other	12	23.1
Tap inside the dwelling	20	38.5
Tap outside the dwelling	16	30.8
Tap inside and outside the dwelling	4	7.7
Fetching of water	9	82.7
Flush toilets	5	9.6
Pit latrine/Bucket	3	5.8
Pit and flush	1	1.9

Table 3.1 Contd. Socio-demographic results of Boipatong (n= 52)

Description	No. of participants	% of participants
Other form of toilet facilities		
Community services		
Tarred roads (n=12)	11	91.7
Gravel roads	40	76.9
Waste removal services	39	75
Problems		
Mice and rat infestation	16	31.4
Mice, rat and cockroach infestation	5	9.8
Cockroaches and other	31	58.8
Socioeconomic status		
Unemployed	28	60.9
Retired	9	19.6
Housewife and other	9	19.6
Looking for employment	10	57.7
A partner with part-time or full-time job	11	52.4
Monetary status and expenditure		
Number of people contributing to income: 1	7	13.7
2	30	58.8
3	8	15.7
>4	6	11.9
Income level:		
<R500 (US$62.5)	14	35.0
R501 – R1000 (US$62.6 – US$125)	16	40.0
R1001 – R1500 (US$125.12 – US$187.50)	5	12.5
Above R1501 (US$187.70)	5	12.5
Frequency of money shortage:		
Always and often	16	32.0
Sometimes	24	48.0
Seldom and never	10	20.0
Frequency of shopping: Once a month	36	70.6
Every day and weekly	15	29.4
Food is bought at: Spaza	9	17.3
Supermarket	40	76.9
Other	3	5.8
Value spent on food:		
R0 – R50 (US$0 – US$6.25)	10	19.6
R51 – R100 (US$6.37 – US$12.50)	12	23.5
R101 – R150 (US$12.62 – US$18.75)	6	11.8
R151 – R 200 (US$18.87 – US$25)	7	13.7
R201 – R 300 (US$25.12 – US$37.50)	7	13.7
> R300 (US$37.50)	2	3.9

Table 3.1 Contd. Socio-demographic results of Boipatong (n= 52)

Description	No. of participants	% of participants
Education levels of participants(Caregivers)		
Primary school education	17	33.3
Secondary school education	28	54.9
College	4	7.8
None	2	3.9
Most common language spoken: Sotho	30	57.7
Zulu	7	13.5
Xhosa	5	9.6
Other	10	19.2
Responsible for food preparation:		
Father	2	3.9
Mother	33	64.7
Child	5	9.8
Grandpa	7	13.7
Other	1	2.0
Mother and child	3	5.9
Food decisions		
Father	1	2.0
Mother	37	72.5
Child	3	5.9
Grandpa	10	19.6
Responsibility of feeding		
Father	1	2.0
Mother	34	66.7
Other	16	31.3

% - percentage

3.8.2 Dietary Intake and food consumption patterns: 24-hour Recall

The baseline survey was commenced in the morning with the parents while the children were at school. The validated socio-demographic questionnaires were completed during the morning with the parents. The 24-hr recall questionnaires were completed when the children arrived at the Care Centre, at approximately 13h45, 10 minutes after the school closed for the day. By 15h00 there was only a small number of children left at the Care Centre because the children had to walk home, and some stayed on the other side of Boipatong. The children left immediately after eating, as homework needed to be completed for the following day. A total of 15 children completed the 24-hr recall questionnaire; the FFQ as well as the nutrition knowledge questionnaires were completed while the children were standing in line to receive food. Because of the small number of children completing the 24-hr recall questionnaire, a pre-intervention questionnaire was

completed prior to the commencement of the NEP. This allowed for more accurate results as the numbers of children were higher. The level of poverty within the community is reflected in the food consumption patterns of the children (Table 3.2).

The list of the top 20 food items most commonly consumed indicated that a mainly carbohydrate (CHO)-based diet was followed, since four of the top five items consumed, namely stiff maize meal porridge (466g), bread (132g), fruit juice (250ml) and cold drinks (318g), are high in carbohydrates. Rice was number seven on the list with a mean portion of 156g and potatoes at number 15 and 20 on the list with a combined mean portion size of 115g. The protein food items included eggs (10^{th}) with a mean portion of 169g, chicken (11^{th}) with a mean portion of 77g, sausages (13^{th}) with a mean portion of 90g and stewed beef was number 14 on the list, with a mean portion of 150g. Vegetables and fruits occurred from number 17, with oranges at a mean portion of 180g; cooked cabbage was number 18, with a mean portion of 80g and a raw apple, number 19 on the list, with a mean portion of 150g.

Maize meal and bread were consumed by all the children (n=15). Although chicken, beef and eggs were consumed in good mean portion sizes for children, at 77g, 150g and 169g respectively, they were consumed only by a minority of the children (seven, two and four respectively). Fruits and vegetables also reflected good portion sizes but, once again, only a mean sample size of two consumed these items. Water consumption remained low with a mean sample size of 450ml per day, consumed by only five children. Less than half the children ($n \leq 7$) consumed a diet where all the food groups, including protein, CHO, fruit, vegetables and dairy products, occurred within the daily diet.

Table 3.2: Top 20 food list and means consumed (n=15)

FOOD ITEM DESCRIPTION (uom*)	MEAN (by weight)	SD	No of children who consumed
1. Stiff Maize Meal (g)	466 g	147	15
2. Water (ml)	450 ml	326	5
3. Bread, brown and white (g)	132 g	27	15
4. Fruit juice (ml)	250 ml	0	6
5. Cold drink, squash (ml)	318 ml	45	4
6. Tea, brewed, (ml)	250 ml	0	5
7. Rice, cooked (g)	156 g	99	5
8. Milk, fresh full cream (ml)	151 ml	103	5
9. Soup (ml)	250 ml	0	3
10. Egg, fried (g)	169 g	491	4
11. Chicken, cooked (g)	77 g	8	7
12. Tomato and onion gravy (ml)	105 ml	108	5
13. Sausage (g)	90 g	0	5
14. Stew, beef (g)	150 g	141	2
15. Potato, boiled and mashed (g)	49 g	31	6
16. Maas (ml)	250 ml	-	1
17. Orange (g)	180 g	-	2
18. Cabbage, cooked (g)	80 g	0	2
19. Apple, average raw (g)	150 g	-	1
20. Potato, chips fried (g)	75 g	35	2

Uom - Unit of measurement

The 24-hr recall questionnaires, completed during the baseline survey were analysed to determine the nutritional intake of the children on a daily basis (Table 3.3). The mean nutrient intakes were compared with the Estimated Average Requirements (EAR) for children aged six to thirteen years (NICUS 2010) (Table 3.3). The nutrient intakes of less than 100 percent of EAR included energy, total dietary fibre, Ca, vit. K and vit. D. The nutrient intakes in which none of the children reached the EAR were Ca and dietary fibre. Although the mean for energy intake was deficient, the mean protein, Ca and fat intakes exceeded the EAR. Furthermore, the majority of children (86.7 percent) consumed less than the EAR for energy compared with 13.3 percent, 26.7 percent and 13.3 percent, who did not meet 100 percent of DRI in protein, fat and CHO respectively. The micronutrients, vit. D, vit. K and Ca, were based on Adequate Intake (AI) references. Macronutrients were also compared with the AI and include carbohydrates (CHO), total dietary fibre, total fat, protein and energy. With

regard to the energy supply of protein, fat and carbohydrates (CHO), the children were consuming a balanced diet as energy supplied is 13 percent from protein, 29 percent from fat and 54 percent from carbohydrates (CHO).

3.8.3 Food variety patterns: food frequency questionnaire

The FFQ was completed by 44 children with the assistance of the fieldworkers and most indicated that a variety of foods had been consumed within the previous seven days. The mean ±SD food variety score (FVS) was 40.39 ±SD with a minimum of 15 and a maximum of 81 food items consumed within seven days, within the nine groups (Table 3.4). Food variety was measured by means of a scale where zero to 30 indicated a low FVS, 31 to 60 indicated a medium variety and >61 is reflective of a high variety of foods (Matla 2008). The children of Boipatong thus consumed a medium variety of food items. The range of nutritious food items fitting into the nine groups consumed by any individual in this research study was 15 to 81 (Table 3.5).

The food groups with the most variety were the fruit and vegetable groups with 16 food items (Table 3.4). This was followed by the cereal, flesh and vit. A-rich groups, with 13, 11 and 7 food items respectively. The dairy and legume groups followed with 7, while the least varied food groups were the fat group with four items and the egg group with one. However, the three least popular food groups were eggs, legumes and fat with a mean ±SD of 1.0, 2.5 and 2.7 respectively. The cereal group showed the highest mean ±SD FVS of 8.4±, followed by the fruit (6.2±SD) and flesh foods (6.0 ±SD) groups (Table 3.4).

Table 3.3 Comparison of nutritional value from 24-hr recall with EAR for children aged 9-13 years (n=15)

Nutrient	Female EAR*/ AI#	Male EAR/AI	Mean of 24-hr recall	Variance between EAR and Mean (%)	% of children <100 % of EAR
[1]Energy (kJ) #	8628 [2]	9569 [2]	6855.7	-27.5	86.7
[1]Total Protein (g) #	34	34	54	58.7	13.3
[1]Total Fat (g) #	25-35	25-35	52	72.7	26.7
[1]Total CHO (g) #	130	130	222	70.4	13.3
Vitamin E (mg)	9.0	9.0	6.0	-33.4	80.0
[1]Total Dietary Fibre (g) #	26	31	15.0	-47.3	100.0
Zn (mg)	7.0	7.0	9.3	32.4	20.0
Se (mg)	35.0	35.0	39.2	12.0	60.0
Ca (mg) #	1300.0	1300.0	284.2	-78.14	100.0
Fe (mg)	5.9	5.7	12.9	123	0.0
Mg (mg)	200.0	200.0	234.5	17.2	20.0
Vit. A (μg)	445.0	420.0	535.7	24.0	26.7
Thiamin (mg)	0.7	0.7	1.2	70.0	20.0
Riboflavin (mg)	0.8	0.8	1.0	21.2	53.3
Vit. B6 (mg)	0.8	0.8	1.3	67.5	0.0
Vit. K (μg) #	60.0	60.0	32.0	-46.7	93.3
Vit. B12 (μg)	1.5	1.5	1.8	18.7	66.7
Vit. C (mg)	39.0	39.0	83.8	115.0	40.0
Vit. D# (μg)	5.0	5.0	4.0	-20.4	86.7

*Estimated Average Requirements for age group 9 to 13 years (NICUS 2010)
[#]Adequate Intakes for age group 9 to 13 years (NICUS 2010)
mg milligrams
g grams
kJ kilojoules
μg micrograms
[1]NAP 2002
[2]Estimated energy requirements (EES) for females and males based on physical activity level (PAL) active

Table 3.4 Classification of food groups with mean values

Description of food groups consumed	Range	Mean±SD
Flesh Foods	1 – 11	6.0
Eggs	1 – 1	1.0
Dairy (n=43)	1 – 7	4.7
Cereals	1 – 13	8.4
Legumes	1 – 5	2.5
Vit. A-rich foods	1 – 8	4.3
Fruit	1 – 16	6.2
Vegetable	1 – 16	5.8
Fat	1 – 4	2.7

The first group, (Table 3.5), flesh foods, was categorized into 11 sub-groups, namely chicken, beef, pork, tinned fish, fresh fish, lamb, giblets, goat, tripe, biltong and processed meats. Items reflecting as most often consumed included pork (item 3) at 13.6 percent (n=6), fresh fish (item 5) at 13.6 percent (n=6), lamb (item 6) at 22.7 percent (n=10) and chicken giblets (item 7) at 18.2 percent (n=8).

Although a variety exists within the food group, the number of children consuming the flesh foods remained small. The other flesh food items were consumed by between one and four children (i.e. two percent and nine percent respectively).

For the food group labelled egg, eight children (18.2 percent) indicated no consumption of eggs, while the remaining 36 (81.8 percent) had consumed eggs during the preceding seven days.

The third group, dairy, was categorized into seven sub-groups. Custard (item 5), ice-cream (item 6) and yoghurt (item 7) were the items most consumed by the children (n=9, n=11 and n=7 respectively). Milk (item 1) and powdered milk (item 2) were consumed by 4.7 and 11.6 percent respectively. Cheese was consumed by only 14 percent (n=6) of the children.

Cereals included all starch-related food items, i.e. biscuits, maize meal, box cereals and fatcakes. Biscuits (item 9) were consumed by nine (20.5 percent) children, with mielie rice, mabela porridge and bread consumed equally by five (11.4 percent) children. Maize meal was consumed by all the children (n=43).

For legumes, 41 children reflected the consumption of foods from the legumes group. Items of higher consumption included potatoes (item 1) at 26.8 percent (n=11), sweet potatoes (item 2) at 24.4 percent (n=10) and traditional beer (item 3), 29.3 percent (n=12). Peas and beans (items four and five) were consumed by 14.6 (n=6) and 4.9 percent (n=2) respectively.

The question on vit. A-rich food was completed by 42 children. Soya (item 4) was consumed most, by 21.4 percent (n=9), followed by pumpkin (item 2) and peanuts (item 3) consumed by 16.7 percent (n=7) of children. Carrots (item 5) and spinach (item 6) were consumed equally by 14.3 percent (n=6) of children in the preceding seven days.

Fruits most commonly consumed amongst the children included pears (item 5), consumed by 18.6 percent (n=8), followed by plums (item 7) by 14.0 percent (n=6), and apples (item 4) and mangos (item 3), both consumed by 11.6 percent (n=5).

Vegetables consumed included rhubarb (item 4), mentioned by 16.7 percent (n=7), turnips (item 5) by 16.7 percent (n=7), gem squash (item 6) by 11.9 percent (n=5) and tomatoes (item 7) by 14.3 percent (n=6).

Group 9, fat, was divided into butter (item 1), sunflower oil (item 2), margarine (item 3) and salad oil (item 4). The items most consumed included sunflower oil, by 24.4 percent (n=10), margarine, 51.2 percent (n=21) and salad oil 14.6 percent (n=6). Butter had been consumed by only 9.8 percent (n=4) of the children over the preceding seven days.

The mean dietary diversity score (DDS) was 8.55 ±0.67, indicating a high variety, and the total range of food groups consumed during the seven-day period was seven to nine (Table 3.6). The majority of the children (n=29, 65.9 percent) consumed all nine nutritious food groups. There was a total of 20 children who did not consume items from all nine food groups.

Table 3.6 FGDS for the children of Boipatong

Group	Frequency	Valid Percent
7	5	11.4
8	10	22.7
9	29	65.9
DDS: 8.55 ±0.67		

3.8.4 Nutrition knowledge questionnaire

The questionnaire was divided into two sections. Section one was made up of 48 questions relating to foods, food practices and hygiene. The food-related questions incorporated the SA FBDG. The questions included, for example,

identification of low-fat snack items, portion sizes, quantity of water intake on a daily basis, frequency of hand washing, and different types of food groups. Section two was made up of six questions relating to where nutrition education had been obtained, tools most preferred, reliable sources and types of nutrition education, and whether animated sketches or photographic pictures were preferred. The nutrition knowledge questionnaire was completed by 45 children, 27 female, 17 male and one with no gender specification on the questionnaire. The mean age was between 12 and 13 years, 25.6 percent and 18.6 percent respectively. The remainder ranged between six and 11 years of age, with one child at 14 years of age.

Table 3.7 is a summary of the true and false questions. The results showed the children to have some form of nutrition knowledge and understanding, with a mean 66.7 percent (n=32) of the children answering all the questions correctly.

The two questions with the lowest score included Question 20, the importance of physical activity and healthy eating for weight management, which was answered correctly by only 50.0 percent (n=22) of the children, and Question 27, the addition of salt into the diet and the nutritional value of sugar, answered correctly by only 36.4 percent (n=16) and 43.2 percent (n=19) respectively. The question which was answered correctly by 84.4 percent of the children (n=38) was Question 46, which related to the importance of cleanliness of oneself and of food and water to minimize the number of germs taken in.

Table 3.7 Nutrition knowledge questionnaire: summary of correct true/false answers

Description per question	Answer	% of children who answered correctly	No. of children answering correctly	No. of children not answering correctly and no answering of the question
1 - You should eat a lot of sugar to have enough energy	False	56.8	25	20
4 - Salt must be added to all cooked food before eating	False	64.4	29	16
8 – Overweight people should not be physically active	False	65.9	29	15
9 – You do not need to wash vegetables before eating them	False	68.9	31	14
17 – Fried foods, fats and oils can be eaten as often as wanted	False	66.7	30	15
18 – Drinking boiled water is a good way to lose weight	False	62.2	28	20
19 – Salt must be added to all foods except fruit	False	36.4	16	29
20 – Dieting is necessary for losing weight and no form of exercise is needed	False	50.0	22	23
21 – All water is safe to drink	False	73.3	33	12
22 – A little sugar can be eaten when one is trying to lose weight	True	54.5	24	21
24 – Your body only needs a small amount of salt to be healthy	True	64.3	27	18
26 – Sugar and foods containing sugar should be eaten in small portions	True	82.2	37	8
27 – Sugar contains a lot of minerals and vitamins	False	43.2	19	26
28 – It is impossible to get nutrients from foods alone; supplementation is needed	False	53.7	22	23
32 – Starchy foods should not be eaten when trying to lose weight	False	58.1	25	20
34 – Eating bread always causes weight gain	False	71.4	30	15
36 – Always eat a variety of foods to protect yourself against illness	True	58.5	24	21
37 – It is healthy to snack on sugar foods	False	66.7	28	17
38 – Dry beans, lentils and peas should be eaten often	True	65.0	26	19
39 – Soya mince is as healthy as meat	True	61.9	26	19
40 – You can eat as much meat as you want to every day	False	55.8	24	21
42 – Dry beans, peas and lentils are a very healthy choice to eat in place of meat	True	73.7	28	17
45 – Vitamin C is needed for building the immune system and is found in most green and yellow vegetables	True	82.5	33	12
46 – Keeping yourself, and the food and water you drink clean, will reduce the number of germs taken in	True	84.4	38	7
47 – You must only eat once a day, at night	False	65.0	26	19
48 – Washing of hands is done only during bath or shower time	False	70.7	29	16
MEAN VALUE		66.7		

%percentage

The remaining questions will be discussed individually, as the children had to choose the correct answer from a few answers. The appropriate amount of

starch and reason for consuming starch (Table 3.8) on a daily basis with every meal was not fully understood by the children (n=17), as answers included the lack of importance of starch (29.3 percent), weight gain can be caused by consuming starch (17.1 percent) and starch can cause disease (19.5 percent). Only 34.1 percent of the respondents agreed that these answers were incorrect.

Table 3.8 Reason why starches should not be consumed with all meals – Question 2

Q2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not important to health	12	26.7	29.3	29.3
	Eating small amounts can cause weight gain	7	15.6	17.1	46.3
	Causes disease	8	17.8	19.5	65.9
	None	14	31.1	34.1	100.0
	Total	41	91.1	100.0	
Missing	0	4	8.9		
Total		45	100.0		

The children (n=45) considered that the amount of water intake a day, (Table 3.9) should vary from one to three glasses (36.4 percent), four to six glasses (29.5 percent) and seven to nine glasses (29.5 percent). Only two (4.5 percent) children did not drink water every day and one child did not answer question.

Table 3.9 Amount of water intake per day – Question 3

Q3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not drink water every day	2	4.4	4.5	4.5
	1 - 3 glasses	16	35.6	36.4	40.9
	4 - 6 glasses	13	28.9	29.5	70.5
	7 - 9 glasses	13	28.9	29.5	100.0
	Total	44	97.8	100.0	
Missing	0	1	2.2		
Total		45	100.0		

The children answered the question about the correct portion size of cooked vegetables (Table 3.10) as one tablespoon (33.3 percent), half a cup (33.3

percent), one cup (21.4 percent) and two cups (11.9 percent). The correct answer was half a cup, answered correctly by 14 children

Table 3.10 Portion size of cooked vegetables – Question 5

Q5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Tablespoon	14	31.1	33.3	33.3
	Half a cup	14	31.1	33.3	66.7
	1 Cup	9	20.0	21.4	88.1
	2 Cups	5	11.1	11.9	100.0
	Total	42	93.3	100.0	
Missing	0	3	6.7		
Total		45	100.0		

The children had a variety of responses as to which items are regarded as a low-fat snack (Table 3.11). “Simba” and “Niknaks” chips were regarded by 27.9 and 23.3 percent of the children as low-fat snack items. Fried chips were seen as a low-fat snack by 11.6 percent, and the correct answer, popcorn, was chosen by 37.2 percent of the children.

Table 3.11 Definition of a low-fat snack item – Question 6

Q6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	"Simba" chips	12	26.7	27.9	27.9
	Popcorn	16	35.6	37.2	65.1
	Fried chips	5	11.1	11.6	76.7
	"Niknaks"	10	22.2	23.3	100.0
	Total	43	95.6	100.0	
Missing	0	2	4.4		
Total		45	100.0		

Of the food groups which need to be consumed every day (Table 3.12) the children (n=45) ranked fruit, cereal and dairy as priorities. The values included 40.0, 33.3 and 17.8 percent of the responses respectively. Protein and the combination of fruits and cereals were chosen by four (8.8 percent) children.

Table 3.12 Food groups from which food must be consumed every day – Question 7

Q7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cereal	15	33.3	33.3	33.3
	Fruit	18	40.0	40.0	73.3
	Dairy	8	17.8	17.8	91.1
	Flesh	2	4.4	4.4	95.6
	Cereal & Fruit	2	4.4	4.4	100.0
	Total	45	100.0	100.0	

The key factors for healthy eating (Table 3.13) chosen by the children (n=44) were: consuming a variety of foods (29.5 percent), eating specific foods more than others (22.7 percent), eating certain foods in small quantities (31.8 percent) and all of the above answers (15.9 percent).

Table 3.13 Key factors for healthy eating – Question 10

Q10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Many different kinds of foods	13	28.9	29.5	29.5
	Some foods more than other foods	10	22.2	22.7	52.3
	Certain kinds of foods in small amounts	14	31.1	31.8	84.1
	All of the above	7	15.6	15.9	100.0
	Total	44	97.8	100.0	
Missing	0	1	2.2		
Total		45	100.0		

A good source of Ca (Table 3.14) was known by the majority (n=26) of the children (n=43), who gave the answer of milk and yoghurt. Chicken and eggs were chosen by 20.9 percent of children but few (n=4) identified pilchards as a good source of Ca. Only four (9.3 percent) regarded the combination of milk, yoghurt and pilchards as a good source of Ca.

Table 3.14 Calcium is found in which foods? – Question 11

Q11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Chicken and eggs	9	20.0	20.9	20.9
	Milk, yogurt	26	57.8	60.5	81.4
	Pilchards	4	8.9	9.3	90.7
	Milk, yogurt & pilchards	4	8.9	9.3	100.0
	Total	43	95.6	100.0	
Missing	0	2	4.4		
Total		45	100.0		

The majority of the children (n=15) classified milk, meats, vegetables and fruits as the food groups (Table 3.15). Only 14.6 percent (n=6) classified foods into the correct categories of cereals, vegetables and fruits and fats, milk and meats. The other food groups chosen by the children (n=7 and n=13 respectively) as the correct classification of foods were fats, milk and meats (17.1 percent) and cereals, vegetables and fruits (31.7 percent).

Table 3.15 Classify foods into groups – Question 12

Q12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cereals, fruits and vegetables	13	28.9	31.7	31.7
	Fats, milk and meats	7	15.6	17.1	48.8
	Milk, meats, fruit and vegetables	15	33.3	36.6	85.4
	Cereals, fruit and vegetables & fats, milk and meats	6	13.3	14.6	100.0
	Total	41	91.1	100.0	
Missing	0	4	8.9		
Total		45	100.0		

More than half the children (53.5 percent) agreed that apples and carrots were a source of fibre (Table 3.16). Eating chicken and fresh fish was seen by 18.6 percent of the children (n=8) as a means of increasing fibre. Unfortunately, cakes and biscuits, and chips and pies were regarded by 20.9 and 7.0 percent respectively as a source of increasing fibre within the diet.

Table 3.16 Increasing fibre can be done by consuming which foods? – Question 13

Q13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cakes and biscuits	9	20.0	20.9	20.9
	Apples and carrots	23	51.1	53.5	74.4
	Chips and pies	3	6.7	7.0	81.4
	Chicken and fresh fish	8	17.8	18.6	100.0
	Total	43	95.6	100.0	
Missing	0	2	4.4		
Total		45	100.0		

Only three (7.1 percent) of the children (n=42) agreed that walking a lot was a form of physical activity (Table 3.17). Going to gym and playing sports were selected by 63.1 percent of the children and twelve (28.6 percent) children agreed that all the above choices were a form of physical activity.

Table 3.17 Meaning of being physically active – Question 14

Q14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Going to the gym	11	24.4	26.2	26.2
	Walking a lot	3	6.7	7.1	33.3
	Playing sports	16	35.6	38.1	71.4
	All of the above	12	26.7	28.6	100.0
	Total	42	93.3	100.0	
Missing	0	3	6.7		
Total		45	100.0		

A majority of the children (n=26) agreed that oats, apples and beans were food items containing plenty of fibre (Table 3.18). Butter and margarine were chosen by four (9.1 percent) of the children (n=44) and the remainder, 18.2 and 13.6 percent respectively, chose beef, chicken and mutton, and milk, yoghurt and cheese as food items containing plenty of fibre.

Table 3.18 Foods containing plenty of fibre – Question 15

Q15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Oats, apples, beans	26	57.8	59.1	59.1
	Milk, yogurt, cheese	6	13.3	13.6	72.7
	Beef, chicken, mutton	8	17.8	18.2	90.9
	Butter, margarine	4	8.9	9.1	100.0
	Total	44	97.8	100.0	
Missing	0	1	2.2		
Total		45	100.0		

The question on portion consumption of fruits and vegetables (Table 3.19) was answered correctly by 24.4 percent (n=11) of the children. The remaining 24 (53.3 percent) and 10 (22.2 percent) children indicated that one and three to four portions a day were correct.

Table 3.19 Portions per day of fruits and vegetables – Question 16

Q16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 fruit and veg a day	10	22.2	22.2	22.2
	3-4 fruits and veg a day	24	53.3	53.3	75.6
	5 or more fruits and veg every day	11	24.4	24.4	100.0
	Total	45	100.0	100.0	

The majority of the children (n=28), regarded one cup of milk and/or maas to be sufficient for daily consumption (Table 3.20). Only 17.8 percent of the children regarded two cups as sufficient on a daily basis. Portion sizes of half a cup and none were indicated by three and six children respectively.

Table 3.20 Quantity of milk and/or maas to be consumed daily – Question 23

Q23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	3	6.7	6.7	6.7
	Half a cup	6	13.3	13.3	20.0
	1 cup	28	62.2	62.2	82.2
	2 cups	8	17.8	17.8	100.0
	Total	45	100.0	100.0	

Table 3.21 reflects the answers pertaining to the meaning of a well-balanced diet. Only 29.3 percent (n=12) of the children agreed with the correct answer of consuming mostly starches, fruits and vegetables, with smaller quantities of meat and dairy. There were two children who did not agree with any of the answers, and 39.0 and 29.3 percent of the children (n=16 and n=12 respectively) chose the two remaining incorrect options.

Table 3.21 Meaning of a well-balanced diet – Question 25

Q25

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mostly of meat, smaller amounts of starch, fruits, vegs and dairy products	16	35.6	39.0	39.0
	Mostly of veg and smaller amounts of meat and dairy products	11	24.4	26.8	65.9
	Mostly of starches, veg and fruits with smaller amounts of meat and dairy	12	26.7	29.3	95.1
	None of the above	2	4.4	4.9	100.0
	Total	41	91.1	100.0	
Missing	0	4	8.9		
Total		45	100.0		

A majority of the children (n=22) answered Question 29 correctly, (Table 3.22) indicating that fruits and vegetables are a good source of fibre and vit. A. Ten children (24.4 percent) indicated fruits and vegetables to be a good source of fats, Fe and Ca. Starches, fat and vit. D was the answer chosen by 17.1 percent of the children (n=41) and two children indicated that none of the above applied.

Table 3.22 Which group of nutrients is found in large amounts in fruits and vegetables? – Question 29

Q29

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fibre, Vit A	22	48.9	53.7	53.7
	Starches, fat, Vit D	7	15.6	17.1	70.7
	Fats, Iron, Calcium	10	22.2	24.4	95.1
	None of the above	2	4.4	4.9	100.0
	Total	41	91.1	100.0	
Missing	0	4	8.9		
Total		45	100.0		

The correct low-fat breakfast menu (Table 3.23) of Weet-bix with low-fat milk was chosen by 21 (51.4 percent) children. The combination of Weet-bix, low-fat milk, and whole-wheat toast with thinly spread margarine was selected by 14.6 percent (n=6) of the children. Only nine (22.0 percent) children chose bacon and eggs as a low-fat breakfast menu.

Table 3.23 Low-fat breakfast menu – Question 30

Q30

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Whole-wheat toast with thinly spread margarine	5	11.1	12.2	12.2
	Weet-Bix with 2% fat milk	21	46.7	51.2	63.4
	Bacon and eggs	9	20.0	22.0	85.4
	Whole-wheat toast with thinly spread margarine Weet-Bix with 2% fat milk	6	13.3	14.6	100.0
	Total	41	91.1	100.0	
Missing	0	4	8.9		
Total		45	100.0		

The fibre content in brown and whole-wheat bread (Table 3.24) was correctly indicated as higher by the majority (65.1 and 16.3 percent) of the children. White bread and rolls were indicated, incorrectly, by eight (18.6 percent) children (n=43).

Table 3.24 Fibre content is higher in which food item? – Question 31

Q31

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White rolls	4	8.9	9.3	9.3
	Brown bread	28	62.2	65.1	74.4
	White bread	3	6.7	7.0	81.4
	Whole-wheat bread	7	15.6	16.3	97.7
	White rolls & white bread	1	2.2	2.3	100.0
	Total	43	95.6	100.0	
Missing	0	2	4.4		
Total		45	100.0		

The children (n=42) were asked to define the meaning of “eating to stay healthy” (Table 3.25). Seventeen (40.5 percent) children answered the question correctly. The remainder indicated that eating to stay healthy meant consuming fruits and vegetables daily (35.7 percent) breads, cereals, fruits and vegetables (14.3 percent), and low-fat dairy products and lean meat only (9.5 percent).

Table 3.25 What must be eaten to stay healthy? – Question 33

Q33

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lean meat, fruit and veg, Low-fat dairy and bread and cereal	17	37.8	40.5	40.5
	Fruit and veg daily	15	33.3	35.7	76.2
	Bread, cereals, fruit and veg only	6	13.3	14.3	90.5
	Low-fat dairy and lean meat only	4	8.9	9.5	100.0
	Total	42	93.3	100.0	
Missing	0	3	6.7		
Total		45	100.0		

Cornflakes and full cream milk (Table 3.26) were regarded as low-fat foods by 21 (50.0 percent) children (n=42). The correct answer, grilled lean steak and boiled carrots, was chosen by 21.4 percent (n=9) of the children. The two items containing high quantities of fat, pizza and milkshake, and fried lamb chops and creamed spinach were chosen by 19.0 and 9.5 percent respectively.

Table 3.26 Low-fat foods include which food items? – Question 35

Q35

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Corn flakes and full cream milk	21	46.7	50.0	50.0
	Grilled lean steak and boiled carrots	9	20.0	21.4	71.4
	Pizza and milkshake	8	17.8	19.0	90.5
	Fried lamb chops and creamed spinach	4	8.9	9.5	100.0
	Total	42	93.3	100.0	
Missing	0	3	6.7		
Total		45	100.0		

The question relating to a good source of vit. A was answered correctly by 26.3 percent of the children. The majority (combined 73.6 percent) answered incorrectly.

Table 3.27 Good source of Vitamin A – Question 41

Q41

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Oats, whole-wheat bread, rice	17	37.8	44.7	44.7
	Carrots, spinach, sweet potatoes	10	22.2	26.3	71.1
	Pies, cakes, pudding	7	15.6	18.4	89.5
	None of the above	4	8.9	10.5	100.0
	Total	38	84.4	100.0	
Missing	0	7	15.6		
Total		45	100.0		

The majority of the responses (33.3 percent) indicated that protein could be stored in a fridge for two days before spoiling (Table 3.28). Eight children (20.5 percent) indicated that protein could be stored in a cupboard for a few days. The correct answer, storing protein in a fridge for two days and in a freezer for three to four months, was chosen by 23.1 percent (n=9) of the children (n=39). Nine children (23.1 percent) agreed that protein can be stored in the freezer for three to four months before spoiling.

Table 3.28 How long can protein items be stored before spoiling? – Question 43

Q43

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	In the cupboard for a few days	8	17.8	20.5	20.5
	In the fridge for 2 days only	13	28.9	33.3	53.8
	In the freezer for 3-4 months	9	20.0	23.1	76.9
	In the fridge for 2 days & In the freezer for 3-4 months	9	20.0	23.1	100.0
	Total	39	86.7	100.0	
Missing	0	6	13.3		
Total		45	100.0		

The purpose of legumes in the diet (Table 3.29) was answered correctly by 31.6 percent (n=12) of the children. The benefits of legumes are not fully understood by the children (n=38) as 18.4 percent indicated the low fat content as the benefit. The fibre content was indicated by 23.7 percent as the benefit of consuming legumes, and the final option of protection against disease was chosen by 26.3 percent (n=10) of the children.

Table 3.29 Why are beans, peas and lentils good for you? – Question 44

Q44

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Contain a small amount of fat	7	15.6	18.4	18.4
	Contain a lot of fibre	9	20.0	23.7	42.1
	Protect you from diseases	10	22.2	26.3	68.4
	All of the above	12	26.7	31.6	100.0
	Total	38	84.4	100.0	
Missing	0	7	15.6		
Total		45	100.0		

With reference to section two, most of the children learnt about nutrition through school, parents and radio/television (87.9, 73.1 and 85.2 percent respectively) and most (86.2, 85.2 and 51.1 percent respectively) regard this as a reliable source (Table 3.30). Nutrition education tools preferred are bright colours (61.5 percent), colouring books (50.0 percent) and card games (22.5 percent). Only 34.2 percent of the children wanted animated pictures, 63.2 percent preferred

actual pictures, and 2.6 percent wanted both animated and photographic pictures.

Table 3.30 Purpose and form of nutrition knowledge (n=45)

Description	Frequency	Valid Percent
Obtaining nutrition information:		
- School	29	87.9
- Friends	8	35.4
- Parents	19	73.1
- Radio/Television	23	85.2
Reliability of source: (reliable and very reliable)		
- School	25	86.2
- Friends	12	48.0
- Parents	23	85.2
- Radio/Television	23	51.1
Colour preference of nutrition education:		
- Black and white	11	28.2
- Bright colours	24	61.5
- Pastel colours	3	7.7
- Bright and pastel colours	1	2.6
Type of pictures:		
- Animated	13	34.2
- Photos	24	63.2
- Both	1	2.6
Types of nutrition education tools preferred:		
- Card games	9	22.5
- Board games	1	2.5
- Puzzles	6	15.0
- Colouring books	20	50.0
- All four options	3	7.5
- Puzzles and colouring books	1	2.5

3.8.5 Anthropometric measures and signs of malnutrition

Clinical signs of malnutrition were reported amongst the children by trained nursing staff. Some of the children showed signs of tooth caries (n=17), missing teeth (n=9) and mottled teeth (n=6), which could be a result of the high consumption of sugar and sugar-rich items. Other signs of malnutrition included pale eyes (n=6), dry eyes (n=4) and red eyes (n=8). Five children had signs of spongy gums. Malnutrition was also detected through the physical appearance of the hair: dull hair was observed in 14 children while six showed signs of

plucked hair. The scaling of facial skin was observed in eight children, and white rings and lumps in six and three children respectively. Confusion was detected in four children and sensory loss in one child.

Anthropometric measures were taken by a registered Dietician (Prof. WH Oldewage-Theron) of 45 children from six to thirteen years of age. Table 3.31 reflects the frequencies and percentages of the growth charts. The risk of the children becoming underweight, (weight-for-age) was prevalent amongst 16.7 percent of the girls. Girls had a higher percentage of normal weight, at 66.7 percent than boys, at 44.4 percent. Overweight was more prevalent amongst boys (22.2 percent) than girls (16.7 percent).

Measurements of height-for-age or stunting, which reflect a chronic shortage of food, showed that the girls had a higher prevalence (15.5 percent) of stunting than boys had (11.1 percent). Also, the risk of becoming stunted was higher in girls (13.3 percent) than in boys (11.1 percent). Girls also accounted for a higher risk of becoming overweight, and being overweight (BMI-for-age) (8.9 and 2.2 percent respectively). When considering height-for-age, normal weight was more prevalent among girls (17.8 percent) than among boys (8.9 percent).

Table 3.31 Anthropometric measurements of children (n=45)

CLASSIFICATION	***GROWTH INDICATOR**	**NUMBER OF CHILDREN**	**PERCENTAGE**
***UNDERWEIGHT:** **Weight-for-age: Boys**			
Severely underweight	≤-3SD	1	2.2
Underweight	≥-2SD≤-3SD	0	0.0
Normal	≤2SD≥-1SD	4	8.9
Overweight	>2SD≤3SD	2	4.4
Obese	≥3SD	2	4.4
Weight-for-age: Girls			
Underweight	≥-2SD≤-3SD	4	8.9
Normal	≤2SD≥-1SD	1	2.2
Overweight	≥3SD	1	2.2
STUNTING: **Height-for-age: Boys**			
Severely stunted	≤-3SD	5	11.1
Stunted	>-3SD≤ -2SD	5	11.1
Normal	>-2SD≤2SD	4	8.9
Overweight	>2SD<3SD	1	2.2
Obese	≥3SD	2	4.4
Height-for-age: Girls			
Severely stunted	≤-3SD	7	15.5
Stunted	>-3SD≤ -2SD	6	13.3
Normal	>-2SD≤2SD	8	17.8
Overweight	>2SD<3SD	1	2.2
Obese	≥3SD	1	2.2
THINNESS: **BMI-for-age: Boys**			
Severe thinness	≤-3SD	4	8.9
Thin	≤-2SD≥-3SD	2	4.4
Normal	≥-2SD≤1SD	9	20.0
Overweight	≥1SD≤2SD	2	4.4
BMI-for-age: Girls			
Thin	≤-2SD≥-3SD	1	2.2
Normal	≥-2SD≤1SD	17	37.8
Overweight	≥1SD≤2SD	4	8.9
Obese	≥3SD	1	2.2

*WHO 2007

Wasting, which reflects an acute and severe shortage of food, had a higher prevalence among boys at 4.4 percent, compared with girls who had a prevalence of 2.2 percent of becoming wasted. Boys also had a higher

prevalence of becoming wasted and overweight (8.9 and 4.4 percent respectively). Girls showed a more normal BMI-for-age (37.8 percent) than boys (20.0 percent).

Significance (Table 3.32) was present between the BMI and the key way of staying healthy (*p*=0.01), the purpose of drinking warm water to lose weight (*p*=0.04) and personal and water hygiene to reduce germs (*p*=0.03). Legumes and a possible replacement for meat had significance to weight (*p*=0.02) and height (*p*=0.00).

Table 3.32 Significance linked between nutrition knowledge and anthropometric measurements

QUESTION NO.	DESCRIPTION OF QUESTION	WEIGHT (*p* value)	HEIGHT (*p* value)	BMI (*p* value)
8	People who are overweight should not be physically active	-	0.05	-
10	The key to a healthy way of eating	0.05	-	0.01
18	Drinking boiled water is a good way to lose weight	-	-	0.04
39	Soya mince is as healthy as meat	-	0.01	-
40	You can eat as much meat as you want every day	-	-	-
42	Dry beans, peas, lentils are a healthy choice to eat in place of meat	0.02	0.00	-
43	Meat/fish/chicken will not spoil if you store them	0.04	-	-
46	Keeping yourself and the food and water you drink clean, will reduce the number of germs you take in	-	-	-

3.8.6 Biochemical measures

The biochemical results are reflected in Table 3.33 and most of the parameters showed normal levels for the group of children when means were compared with normal ranges, except for high levels of transferrin, Vitamin B12, white cell count (WCC) and total protein. The glucose count was done for only one child and levels were within normal range. The percentage of respondents with nutrient blood values lower than normal ranges were between 2.0 percent and 25.5 percent. HDL-Cholesterol did not exceed the reference range for all the children (n=47). The WCC was detected in four children (8.5 percent) as being higher

than the reference range specified. This is indicative of an illness. There were no children who had values below the minimum of 3.9 x 10^9/litre (L). The nutrients which were slightly deficient in some of the children included albumin (BCG) at 6.4 percent (n=3), cholesterol at 25.5 percent (n=12), Fe at 23.4 percent (n=11), ferritin at 6.4 percent (n=3), mean cell volume (MCV) at 2.1 percent (n=1), red cell count (RCC) at 4.2 percent (n=2) and haemoglobin (Hb) at 10.6 percent (n=5). Transferrin was found to be higher than normal ranges in all the children (n=47). Iron in the body is distributed in four forms, of which one is transferrin. High levels of transferrin can be an indication of illness and/or that the child is growing. There were no clinical signs of illness, except in 8.5 percent (n=4) of the children, who had high levels of white cells in the blood. The high levels of transferrin with normal WCC indicate that the children are growing and that the risk of infection is not present. Total protein and vit. B12 were two blood nutrients which were found to be higher than normal ranges amongst all the children (n=47). These nutrients are present in protein sources such as eggs, meat, green leafy vegetables, legumes and nuts, and confirm the high intakes of these food items as found in the FVS and DDS.

Table 3.33 Blood test results: average and standard deviations (n=47)

BLOOD NUTRIENT	Mean	SD	REFERENCE RANGE *	%# of respondents with values below minimum / above# reference range
Albumin (BCG)	47.1	13.7	35.0 – 48.0 g/L	6.4
Cholesterol	4.7	1.7	3.6 – 5.0 mmol/L	25.5#
HDL-Cholesterol	1.2	0.5	> 2.2 mmol/L	0
Triglycerides	1.1	0.5	0.4 – 1.8 mmol/L	0
Iron (Fe)	12.8	7.3	9.0 – 21.0 µmol/L	23.4
Transferrin	9.4	37.0	2.0 – 3.6 g/lt	0
Vit B12	556.2	312.1	100 – 500 pmol/L	0
Ferritin	38.6	36.2	12 – 150 ng/Ml	6.4
White Cell Count (WCC)	7.3	2.0	>10 $x10^9$/L	8.5#
Mean Cell Volume (MCV)	84.5	3.9	76 – 101 Fl	2.1
Red Cell Count (RCC)	4.6	0.4	3.8 – 5.5 $x10^{12}$/L	4.2
Total Protein	99.0	17.2	60 – 84 g	0
Glucose (n=1)	4.3	0	3.8-3.9 – 6.1 mmol/L	0
Haemoglobin (Hb)	13.0	1.0	12 – 17 g/dl	10.6
Haematocrit (Hct)	38.7	3.1	30 – 50 %	0

*CARLSON 2004:436-453

#percentage

3.9 Conclusions

Boipatong is a community faced with the burden of malnutrition, as food insecurity exists in every household. There are between two and five children per household with a mean of approximately 3,5. The monthly expenditure on food is on average between R0 and R200 ($25) (combined 68.6 percent). This allows for only R50 ($6.25) to be spent on food per person with four in a household, and R28.57 ($3.57) per person with seven in a household. On a daily basis, this amounts to R1.67 ($0.21) (30-day month, four per household) and R0.95 ($0.12) (30-day month, seven per household) per day for food. A loaf of bread varies between R5 ($0.62) and R7.50 ($1.06). Household food insecurity is thus a problem in this community, as 32.0 percent of the caregivers indicated money shortages.

This becomes noticeable in the 24-hr recall, which reflects high consumption of biscuits, ice-cream and margarine, which are less expensive food items. The price of a loaf of bread varies between R5 (US$0.62) and R7.50 (US$0.93). Unemployment within the community was high as 60.9 percent of the community members were unemployed. The education levels amongst the community members ranged between primary (33.3 percent) and secondary school (54.9 percent), with only 7.8 percent (n=4) having a higher qualification.

Results from the 24-hr recall indicated a top 20 food list which reflected the first five items as carbohydrate-based, namely stiff maize meal (mean=466g), brown and white bread (mean=132g), fruit juice (mean=250ml) and cold drink (mean=318ml). Protein sources such as eggs (mean=169g), chicken (mean=77g), and beef and sausages (combined mean=240g) occurred between number 10 and 14 on the list. Unfortunately, the number of children consuming these protein sources totalled only four, seven and five respectively. Biochemical measures showed protein intake to be higher when compared with DRI (99.0g / 84g), as no deficiency for total protein and vit. B12 occurred in the blood results. Protein sources which contain high levels of Fe and albumin, egg white, milk, chicken livers and green leafy vegetables, were not consumed by all, as blood results indicated albumin (n=3), Fe (n=11), ferritin (n=3) and haemoglobin (n=5) as deficient. This was evident as the least popular food groups consumed by the children were eggs, with a mean ±SD of 1.0, and legumes, with a mean ±SD of 2.5. Although the 24-hr recall for the children indicated a diet low in vit. K (93.3 percent), vit. D (86.7 percent), and dietary fibre (100 percent), over a seven-day period the most consumed food groups included fruit, vegetables and cereals, with a mean ±SD of 6.2, 5.8 and 8.4 respectively. The FVS showed consumption of the seven to nine food groups over a seven-day period for five, 10 and 29 children respectively. The 24-hr recall indicated a diet poor in variety, but when viewed over a seven-day period, only 15 children (n=44) did not consume foods from all nine food groups. The diets of the children were not consistent and varied on a daily basis, but, reflected over a

seven-day period, the food items consumed have a mean of 40.39 out of 81 food items, with seven to nine food groups being consumed.

The 24-hr recall questionnaire may be more reflective of the true diets of the children: a diet based on carbohydrates and fat, with a small variety of fruits and vegetables, and only a few having the option of a protein source. The FFQ shows a medium variety (mean=40.39/81) of food items consumed over a seven-day period. These results are influenced by a large retail store, which dumps expired food on a weekly basis. The community members of Boipatong feed off this dump site. The action, or lack thereof, of the retail store may influence the nutritional status of the children. The variety within the diets may come directly from this action, as the diets are not consistent. The 24-hr recall reflected poor variety but over a seven-day period a completely different diet was reflected.

Nutrition knowledge amongst the primary school children (n=45) was evident, as a mean 66.7 percent of the children answered the true and false questions correctly. Only two questions were incorrectly answered by more than 50 percent of the children, namely physical activity as a means of weight management, and the nutritional value of sugar and salt in the diet. The remaining true and false questions were completed correctly by more than 53.7 percent of the children.

The physical signs of malnutrition reflected a prevalence of malnutrition amongst the children (n=45), as signs of tooth caries (n=17), missing teeth (n=9), mottled teeth (n=6), swollen gums (n=5), dull hair (n=14) and red eyes (n=8) occurred. Confusion occurred in four children and sensory loss in one child.

Biochemical results showed transferrin, vit. B12 and total protein to be above normal ranges for all the children (n=47). The WCC was high for 8.5 percent of the children and high transferrin is an indication of illness, although not physically discernable. The nutrient intake from the foods consumed indicated that over a

seven-day period, only a small number of children (2.1 – 25.5 percent) have deficiencies of Fe and iron-related elements.

The main anthropometric findings reflect girls to be more prevalent to being underweight (8.9 percent) and stunted (13.3 percent), whereas boys accounted for a higher risk of being overweight (BMI-for-age) (4.4 percent).

3.10 Recommendations

Malnutrition persists within the community, the country and the world. Strategies for managing and overcoming this dilemma include food fortification, food supplementation, food aid, and dietary diversification, which includes home gardens, NE and food diversification. The focus of this project is to address malnutrition through the implementation of a NEP with the aim of improving knowledge and encouraging healthier food procurement choices. Both the DoH in South Africa and global organisations encourage NE as a means of managing malnutrition. The DoH in South Africa created FBDGs to assist individuals in making healthier food choices. Unfortunately, the FBDGs are listed but not effectively communicated.

Teachers (n=29) at the Setlabotsja Primary School in Eatonside, which is a neighbouring community to Boipatong, were initially recruited to determine whether a need for NE existed within the schools, as well as to decide on the best tools to be created in order to promote NE within the curriculum. The SA FBDGs were suggested for use in the NEP, as they already existed although they had not yet been presented in a way which promoted understanding. The NEP implemented in this study will be based on NETs developed by Dr. Carin Napier and Prof. Wilna Oldewage-Theron of the CSL, and forms part of the SANPAD-funded projects. The NETs that were developed to incorporate the SA

FBDGs in the form of pictures and illustrations. Chapter 4 will focus on the implementation of the NEP.

CHAPTER 4:
INTERVENTION STUDY AND POST EVALUATION FINDINGS

4.1 Introduction

Nutrition education is seen as a strategy which can be used to assist in and manage the problem of malnutrition. Providing sound nutrition knowledge can contribute to healthier food choices, when resources permit. The baseline survey indicated that nutrition knowledge was present amongst the primary school children, but confusion still existed regarding certain nutrients and their functions. This part of the study will focus on the implementation of a NEP to improve nutrition knowledge through the use of the SA FBDG and the specifically developed NETs to promote a healthier approach to food choices in future. This formed part of the 'action' phase in the triple A cycle.

4.2 Objectives

The objectives of this phase were to determine the impact a nutrition education programme would have on the nutrition knowledge and dietary intake patterns of primary school children participating in this intervention. The ultimate goal was to improve the nutrition knowledge of the children, which may lead to more informed food procurement choices, thereby contributing to healthier development into adulthood.

4.3 Study design

This was an experimental intervention study with a matched "placebo"-controlled parallel group. The study design is reflected in Figure 4.1.

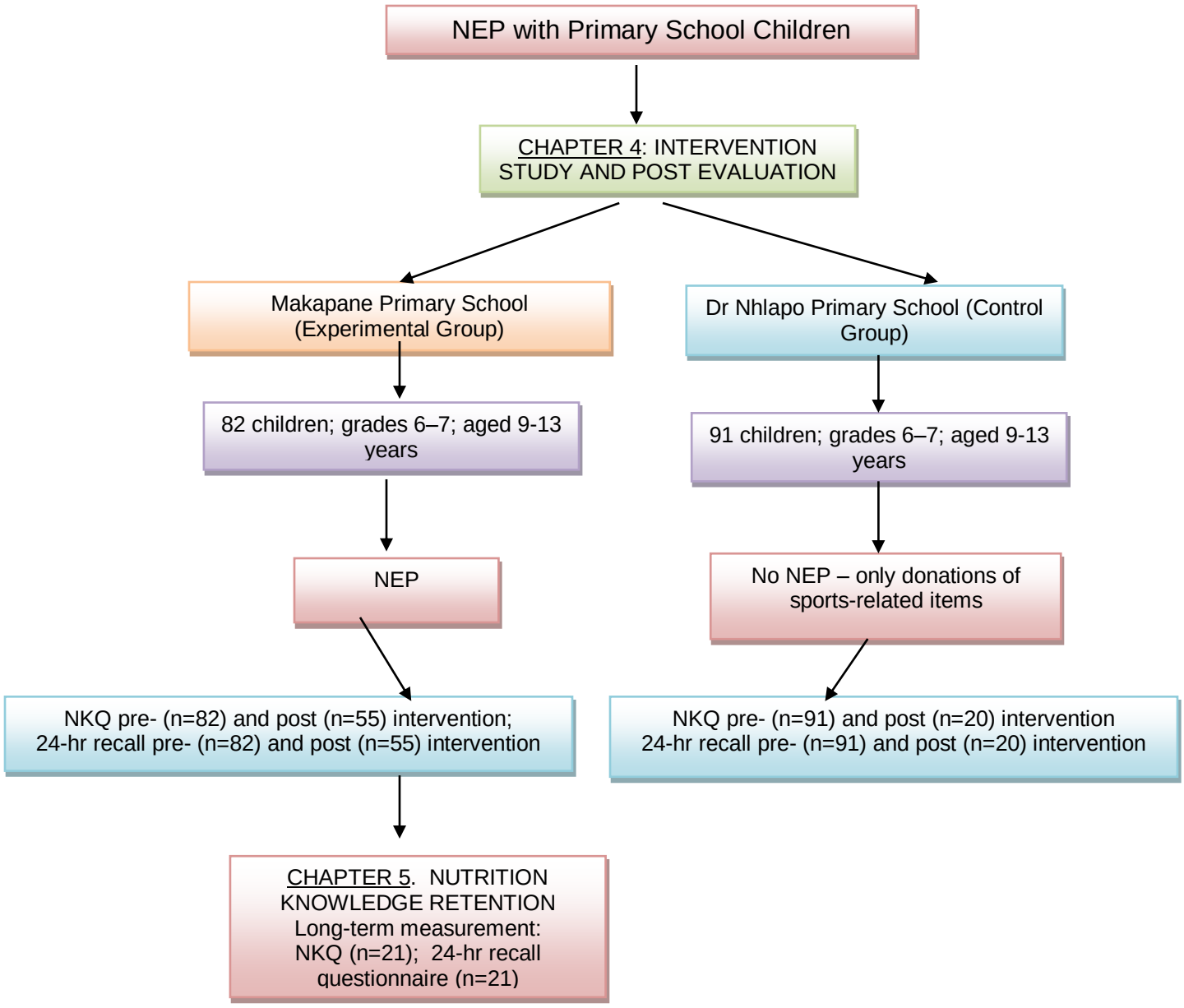


Figure 4.1 Study design

4.4 Study setting

Management of the Boipatong Care Centre provided a list of schools to be considered for the NEP. The first two names included Makapane Primary School and Dr Nhlapo Primary School, as these children ate at the Care Centre on a weekly basis.

A request was made to the Director of the CSL, Prof. Wilna Oldewage-Theron, for an assistant in the implementation of the intervention study and the capturing of data from the NKQ and 24-hr recall questionnaires. This request was granted and the assistant assisted the researcher during the intervention with any language barriers and data capturing.

4.5 Planning of the project

4.5.1 Consent

During a feedback session with the parents regarding the blood results of the baseline survey, the researcher requested permission to proceed with the NEP in the primary schools.

The headmasters of the two schools, Mr Maloka of the Makapane Primary School and Mr Kubheka of the Dr Nhlapo Primary School, were asked for permission to implement the NEP.

Permission was then requested from the Department of Education (DoE) in Vanderbijlpark to commence with the NEP in Boipatong. There were no objections to the request.

4.6 Sampling

It was decided to use the older children in the primary schools. Therefore, children in grade six and seven were used in this study. There was no gender specification. A random sample was drawn, based on a power calculation (Margetts & Nelson 2000:79-80) for representative data and statistical significance.

The following power calculation was used to determine the sample size of the intervention programme (Margetts & Nelson 2000:79-80).

$$n = 2 \frac{(Z_{1-x/2} + Z_{1-B})^2}{(d^*/\sigma)^2}$$

$$n = 2 \frac{7.8}{(1/2)^2}$$

$$n = 63$$

The sample size required was calculated for two groups, where: a) d*= the difference between the two groups, b) σ the standard deviation of the variable, with c) 1-B = 80 percent power and d) x = 95 percent significance. The required sample size for each group was therefore 63 children.

This study focused on primary school children and was, therefore, developed and implemented within a primary school setting. This enabled all the children, required for the NEP to be present on a regular basis as the school was able to assist the researcher in ensuring regular attendance by the children.

The children were divided into an experimental group (EG), Makapane Primary School (n=82), where the NEP was implemented, and a control group (CG), Dr Nhlapo Primary School (n=91), where the children received no nutrition education. Although the power calculation indicated that only 63 students were required for the study in each group, 30 to 40 percent more children were chosen to allow for drop-outs and absenteeism. Two schools were chosen to assess whether any interaction occurred amongst the primary school children and whether nutrition information would be spread across the schools (refer to Figure 4.1). The two schools were chosen based on the responses of the teachers whom indicated that the children of the two schools do not mingle very much.

4.7 Fieldworker training

The assistant and two fieldworkers (the same ones used for the baseline survey) were asked to assist the researcher in the implementation of the NEP. A

meeting was set up in the CSL boardroom, where the assistant and fieldworkers were given the schedule of the NEP by the researcher. The information, which was to be taught to the children by the researcher on a weekly basis, was discussed with the assistant and fieldworkers. The assistant and fieldworkers had to deal with any language barriers during the sessions and assist the researcher in ensuring that all activities were completed before the children could go home.

The objectives of this study were also highlighted. The 24-hr recall and nutrition knowledge questionnaire were discussed to ensure understanding of the information required and the purpose thereof, and to ensure correct completion for accurate results. The assistant and fieldworkers were shown how to complete the questionnaires and had a practice session with one another to ensure accurate recordings. The assistant and filed workers supervised the children completing the NKQ and assisted the children with the 24-hr recall questionnaires.

4.8 Data collection pre- and post-intervention and long-term measurement

The first data collection started on the 22 July 2008 (Makapane Primary) and 23 July 2008 (Dr Nhlapo Primary) with the NKQ and 24-hr recall being completed by the children at Makapane Primary (EG) and Dr Nhlapo Primary (CG), one week prior to the implementation of the NEP, with the assistance of the researcher, assistant and fieldworkers.

The second data collection took place on 11 November 2008 (Makapane Primary) and 2 December 2008 (Dr Nhlapo Primary) after the NEP. The NKQ and 24-hr recall questionnaire was completed with the assistance of the researcher, assistant and fieldworkers.

The third and final data collection took place on 28 July 2009, nine months after the NEP with the EG, to determine the long-term retention of nutrition knowledge and whether any dietary changes had occurred. The process and results are discussed in detail in Chapter 5.

4.9 Measuring instruments

A new nutrition knowledge questionnaire was developed and used to measure the level of nutrition knowledge and to determine whether nutrition knowledge had improved after the intervention.

Validated 24-hr recall questionnaires were used to assess intake patterns before and after intervention. The intervention day was on a Tuesday, and the 24-hr recall therefore reflected the intake of the Monday, a week day.

4.9.1 Socio-demographic

Age was the only socio-demographic variable collected for this study and it was completed by the assistant and fieldworkers as part of the NKQ. The children were aged between 11 and 13 years, with no gender exclusion, and included children from grade seven.

4.9.2 Knowledge questionnaire

4.9.2.1 Development

During the baseline survey, the children had difficulties in completing the NKQ (refer to Chapter 3, section 3.6.1.4). This was partly due to the length and the difficulty in understanding all the questions, as no illustrations were present. It was therefore decided to create a new NKQ for the purpose of the NEP, to determine the level of nutrition knowledge before and after the intervention (ANNEXURE K). The new questionnaire included 24 questions, which

incorporated the topics in the SA FBDG, and picture illustrations were provided where possible. The new questionnaire covered the SA FBDG and consisted of 24 questions. The questionnaire was made up of 18 questions, with written questions accompanied by illustrations, and related to identifying forms of physical activity, amount of water required daily, purpose and source of certain nutrients, colour associations with certain fruits and vegetables, and portion sizes. The remaining six questions were written questions only and included aspects of the various types of food groups, portion sizes, the meaning of being healthy, and the role of fried foods, salt and oil in the diet and the importance of breakfast.

4.9.1.2 Methods employed to combat error

The research was conducted in a setting familiar to the participants, in the school environment, with full permission from the principal, teacher and participants. The quality of the study was controlled through the elimination of potential errors in the following way:

***Reliability testing**

Reliability testing was done as prescribed by Babbie and Mouton (2001:119), where the technique applied would indicate if the same results were obtained after repeated application. The internal reliability of this questionnaire was therefore tested amongst the same 10 children, meeting the selection criteria specified, over a period of four consecutive weeks. The children would form part of the intervention group from Makapane Primary School.

Data were captured on Microsoft Excel and statistically analysed on SPSS version 15 using descriptive statistics, frequencies and Alpha (Cronbach), with the assistance of a statistician of the Vaal University of Technology. This was used weekly to measure the internal consistency of all the questions. If the

correlation amongst the items was high, then the Alpha was greater. The higher the Alpha, the more reliable the test. The acceptable level is usually 0.7 (zero point seven) and above.

4.9.1.3 Administration

The nutrition knowledge questionnaires were completed in the classroom, where each pupil sat at his or her own desk and completed the questionnaires. No interaction was allowed amongst the pupils while completing the questionnaires. The questionnaires were completed by the children in both experimental and control groups before and after the intervention study to assess the level of improvement (or lack thereof) in nutrition knowledge, whether there was an overlap in the nutrition information of each school, and the impact on food choices of the children. The tests and comparisons will be discussed individually.

The short-term measurement of nutrition knowledge was completed immediately after the NEP was implemented. The EG and CG completed the nutrition knowledge questionnaires individually, but under supervision of the researcher and fieldworkers. The results from the EG would indicate if nutrition knowledge had improved and the results from the CG would indicate if any interaction had occurred amongst the children regarding the NEP.

4.9.1.4 Data analysis

The NKQ were captured on Microsoft Excel, transferred to SPSS Version 17 and analysed for descriptive statistics (frequencies). Paired t-tests were conducted to compare for significant differences pre- and post-intervention, and a multivariate analysis was done to examine relationships between variables in the long-term measurement.

4.9.2 24-hour recall questionnaire

4.9.2.1 Description

A validated 24-hr recall questionnaire (the same used in the baseline study) was used (Section 3.8.2).

4.9.2.2 Administration

The 24-hr recall questionnaires were completed in the classrooms with the assistance of trained fieldworkers and an assistant. Food models were used to assist in the estimation of portion sizes and identification of food items. Foods and portion sizes consumed within the previous 24 hours were recorded.

Children sat in a row and awaited a fieldworker to call them to complete the 24-hr recall questionnaire in an interview with the field worker. The questionnaire was completed before the NEP so that the children could not be influenced by the knowledge gained in the NEP. The questionnaire was also completed at the end of the programme to determine if dietary changes occurred.

4.9.2.3 Data analyses

The 24-hr recall questionnaires were captured and analysed by means of the FoodFinder Program, by a registered Dietician. Means and SDs were calculated, as well as the Top 20 most commonly consumed food items. The means of the nutrients were compared with the EAR/AI, as reflected in the Nutrition Information Centre (NICUS) for children aged nine to thirteen years. Paired t-tests were done to compare for significant differences before and after intervention.

4.10 Nutrition Education Intervention

4.10.1 Duration of the nutrition education programme

The NEP started on 29 July 2008 and continued for nine weeks until 23 September 2008. A schedule was developed to correspond to one school term of nine weeks, (refer to Table 4.1). Each session was between 30 and 45 minutes, with an additional 15 minutes for the handing out of bags and snack items. The total time spent at the school was one hour per week. An additional two-hour session was added before and after the NEP to complete the relevant questionnaires. The NEP was implemented on a weekly basis, every Tuesday immediately after school ended at 13H50, so as not to interfere with the school curriculum. The total number of hours spent on the implementation of the NEP was nine hours with an additional four hours (two each) for the pre- and post-intervention questionnaire sessions. Seven hours were spent on teaching the children the information in the activity book and included the completion of the relevant activities, and two hours were spent on the games. Tables and chairs were set up in a large classroom to accommodate all the children in one area for the NEP.

4.10.2 Content of the nutrition education programme

The Nutrition Education Tools (NETs) used were developed by Oldewage-Theron and Napier (2009) for primary school children within the Vaal Region, (refer to Figure 4.2). The SA FBDGs were used as the basis for these tools. The NETs developed included a text and activity book with theoretical information about and visual illustrations of food groups, the SA FBDG, and hygiene and physical activity. The activities in the books included colouring in, word searches and crossword puzzles. The text and activity book was further supplemented by a card and a board game. The card game consisted of 24 different playing cards with each card having a message on one side and a colour picture on the other side.

Table 4.1 Nutrition education schedule for Makapane Primary School – programme only

DATE	**ACTIVITY**	**WEEK**	**PAGES NO.**
29 July 2008	Attendance register; Name on each book; Introduction to the SAFBDG; Definition of vitamins and minerals	1	1 – 3, 16
5 August 2008	Food groups: starch, vegetables and fruits	2	4 – 6, 24
12 August 2008	Food groups: proteins and dairy; Healthy activities	3	7 – 10, 23
19 August 2008	Food groups: fats and sugar; hygiene and be active	4	11 – 13, 25
26 August 2008	Nutrients	5	14 – 15
2 September 2008	Activities	6	16 – 19
9 September 2008	Activities	7	20 – 25
16 September 2008	Activities	8	Card Games / Slides and Ladders (board game)
23 September 2008	Activities	9	Card Games / Slides and Ladders (board game)

The board game, called slides and ladders, consisted of 42 colourful blocks all linked to each other in the form of a zigzag across the board.

Figure 4.2 The nutrition education tools

The ‘start’ was indicated in the left corner and the finish was indicated as ‘winner’ in the top left corner. Messages, ‘Good for you’ and ‘Not so good for you’, were placed on every second or third block, and messages which were good had a ladder, allowing the child to move more quickly. The bad messages had a slide, indicating that steps had to be retraced. The board game came with dice and four round plastic sliders of different colours.

4.10.3 Implementation of the nutrition education programme

The assistant and fieldworkers assisted in the handing out of bags, completing the attendance register, and the handing out of snacks after each session. Bags containing all the NETs were labelled with stickers showing each pupil’s name and handed out at each session. Each pupil returned the bag after each session. When the programme was completed, the pupils were given the bags with the NETs to take home and share with the family.

Before the commencement of each session the attendance register was marked, based on the bags that had been handed out. The material was divided into sections to be presented by the researcher, and taught over a nine-week period; before each session, an overview of the previous week’s work was completed. This information was then communicated to the children, where constant interaction occurred through questions and repetition. The assistant and fieldworkers were present and when explanations given in English were not understood by the children, the fieldworkers explained in Sotho. This assisted in overcoming any language barrier which may have existed. There was continual interaction amongst the children. The blackboard was also used by the researcher to make a note of keywords to assist the children in remembering. The school principal, Mr. Maloka, attended some of the sessions to view the children’s interaction and participation. The teachers assisted the researcher in ensuring the children attended the NEP and in keeping the children quiet during our sessions, especially during activities such as colouring-in. The children were

asked to call either the researcher and/or fieldworkers to their tables to check that all the necessary activities had been completed. Only upon full completion were the children allowed to leave. After each session, the children were given an energy/snack bar made from oats, sesame seeds, yoghurt and dried fruit (40g), a packet of Simba chips (32g) and pure fruit juice (200ml). Although the Simba chips were not seen as a very healthy snack choice, the portion size was very small and only presented once a week for nine weeks.

Figures 4.3 to 4.7 show photographs taken during the intervention programme, where the children were seated in a large classroom. When group activities were required, the tables were turned around to face each other and groups of six to eight children were formed.

Figures 4.3 – 4.7 Children participating in classroom activities

The second group (CG) received energy/snack bar made from oats, sesame seeds, yoghurt and dried fruit (40g), a packet of Simba chips (32g) and pure fruit juice (200ml) at the end of the first and second NKQ and 24-hr recall questionnaire sessions. Sports equipment was donated to the school in the form of tennis balls, skipping ropes, and netball and soccer balls. This was done to promote activity amongst children and to coincide with the new programme of physical activity implemented by the DoE within the school curriculum, and in appreciation of their willing participation in this programme.

4.11 Results

The pre-intervention group included 82 children in the EG and 91 children in the CG, with only 55 completing the post-intervention questionnaires for the EG and 20 children for the CG. Children voluntarily stopped participating in the NEP and the complete database included only the 55 and 20 children from each group and these were used for the interpretation of the results.

4.11.1 Drop-outs

There was a total of 27 children in the EG who did not complete the post-nutrition programme questionnaires and who were therefore eliminated from the results. Only a complete database with pre- and post-intervention data was thus used. The NKQs completed by these children were then captured on Microsoft Excel spreadsheets and analysed on SPSS Version 17 for frequencies and significance against the results of the pre-NKQ of the remainder of the children. No significant differences were observed in knowledge between the drop-outs and the rest of the group in 32 out of 38 questions and it was therefore assumed that the drop-outs would not have made a significant contribution to the results of the EG should they have completed the study. Only six answers out of 38 had significance to the results of the pre-intervention NKQ. These related to water consumption on a daily basis, the source and purpose of Ca, one serving size of starch, daily serving requirements for fat and dairy products and the classification of protein-rich foods. Similarly, the drop-outs (n=70) in the CG had a significant effect on the results of the pre-intervention test only for questions 8.2 (p=0.02), 9d (p=0.05), and 19 (p=0.01). These questions related to the linking of spinach with the colour green, the importance of starch in the daily diet, and the consequence of not eating breakfast. It was therefore assumed that the drop-outs would not have made a significant contribution to the results.

Statistical significance was measured for the total number of drop-outs and the total number of children who participated in the intervention, in both EG and CG. Only four out of the 24 questions showed significance, where $p \leq 0.05$. Therefore the drop-outs had some significant impact on the pre-intervention results for the questions relating to water consumption on a daily basis (p=0.01), the linking of vit. A to carrots (p=0.02), the correct serving size of starch (p=0.00) and the number of eggs to be consumed weekly (p=0.03). Similarly, paired correlations was calculated to determine if the drop-outs may have had any impact on the dietary intake results of the pre-intervention. A total of six micronutrients were reported with significance and included calcium (p=0.05), niacin (p=0.00), vitamin B6 (p=0.04), vitamin B12 (p=0.03), vitamin D (p=0.01) and vitamin E (p=0.00). Therefore the drop-outs had influenced the above mentioned nutrients within the pre-intervention results.

4.11.2 Socio-demographic results

The age of the school children in the EG, Makapane Primary School, and the CG, Dr Nhlapo Primary School, ranged between 11 and 15 years, (refer to Table 4.3). The EG (Makapane Primary School) had a higher number of children aged between 11 and 13 years (94.7 percent combined) in comparison with the CG, Dr Nhlapo Primary, with a combined mean of 90 percent. The mean age for both Makapane Primary (EG) and Dr Nhlapo Primary was 13 years of age. One child aged 15 was still present in the primary school and may have been as a result of failing on more than one occasion.

Table.4.2 Age summary of children participating in this project

AGE OF CHILDREN	MAKAPANE FREQUENCY	MAKAPANE PERCENT (%)	DR NHLAPO FREQUENCY	DR NHLAPO PERCENT (%)
11	29	30.5	16	17.8
12	40	42.1	37	41.1
13	21	22.1	28	31.1
14	4	4.2	8	8.9
15	1	1.1	1	1.1
MEAN: 13				
SD: 1.6				

% percentage

4.11.3 Nutrition knowledge results

4.11.3.1 Reliability testing of nutrition knowledge questionnaires

The majority, or 20 out of 24, (83.3 percent) of the questions (refer to Table 4.4) showed an internal reliability for Alpha greater than 0.7, with 0.6 accepted, and the questionnaire was thus not revised before implementation.

The results from the EG (refer to Table 4.4) showed an improvement of a mean 13.4 percent of correct answers between the pre-intervention (45.4 percent) and post-intervention (58.8 percent) tests. Significance was seen in 14 out of 38 questions (36.8 percent) between the pre- and post-intervention tests. Only five questions reflected a negative score of between 1.0 and 9.1 percent. The questions are categorized and discussed as per specified topic.

Table 4.3 Scale statistics per question

Question no:	Mean	Variance	SD	No of Items	Cronbach's Alpha[a]	Cronbach's Alpha based on Standardized items[a]
1	8.8	1.0	1.0	3	-1.0	-0.2
2	14.3	5.6	2.4	4	**0.7**	0.5
3	-	-	-	-	-	-
4	11.7	2.2	1.5	4	**0.6**	0.5
5	8.0	14	3.7	4	**0.9**	1.0
6	7.7	3.6	1.9	4	**0.8**	0.8
7	8.9	2.1	1.5	4	**0.9**	0.9
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10.1	7.0	0.7	0.8	0.8	-0.4	-0.4
10.2	8.2	6.2	2.5	2.5	0.3	0.4
10.3	7.2	10.2	3.2	3.2	**0.8**	0.8
11	10.7	20.9	4.6	4.6	**0.9**	0.9
12	5.8	2.7	1.6	1.6	**0.6**	0.5
13	10.0	2.5	1.6	1.6	0.5	0.6
14.1	12.3	22.3	4.7	4	**1.0**	1.0
14.2	10.3	30.3	5.5	4	**0.9**	0.9
14.3	6.0	4.0	2.0	3	**0.7**	0.9
14.4	7.3	8.3	2.9	3	**1.0**	1.0
15	11.3	2.7	1.6	4	**1.0**	1.0
16	7.3	3.1	1.7	4	**0.7**	0.8
17	8.8	17.0	4.1	4	**1.0**	1.0
18	6.3	3.5	1.9	4	**0.8**	0.8
19	5.5	0.7	0.8	3	0.4	0.4
20	10.3	12.0	3.5	4	**0.8**	0.4

Table 4.3 cntd. Scale statistics per question

Question no:	Mean	Variance	SD	No of Items	Cronbach's Alpha[a]	Cronbach's Alpha based on Standardized items[a]
21	12.1	5.1	2.3	4	**0.6**	0.6
22	9.9	3.5	1.9	4	0.3	0.4
23	6.0	17.0	4.2	4	**1.0**	1.0
24	13.1	11.1	3.3	4	**0.8**	0.8
MEAN						**0.7**

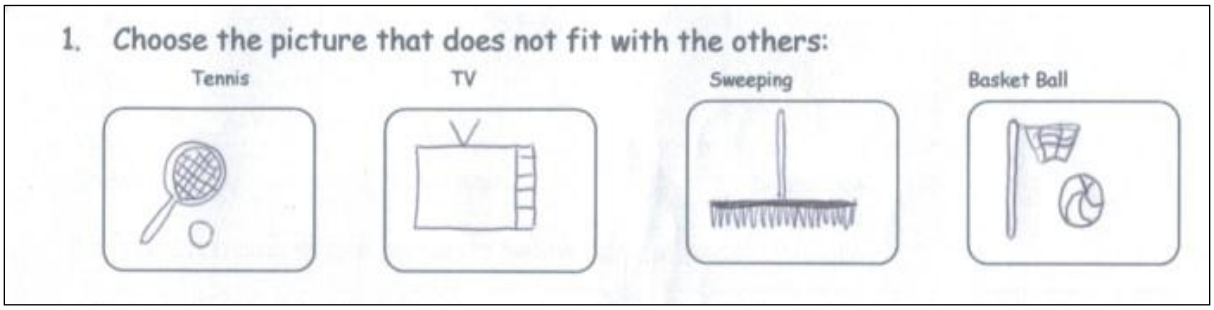
4.11.3.2 Pre- and post-nutrition knowledge programme results

The CG (refer to Table 4.4) had no interaction with the researcher during the nine weeks of the nutrition intervention. The mean percentage of correct answers varied by only 1.3 percent between pre- (49.2 percent) and post-intervention (50.5 percent) tests and one question (2.6 percent) out of 38 showed a significant difference between pre- and post-intervention results in the CG and related to the topics of fruit and vegetable consumption on a daily basis, where 90.9 percent agreed after the intervention period. However, 72.7 percent knew the correct answer in the pre-intervention test.

***Importance of health and physical activity**

Question 1 consisted of a multiple-choice question, (refer to Figure 4.8) where the children were asked to find the incorrect picture reflecting activity from among those depicting television, tennis, sweeping and basketball. The correct answer, television (TV), was chosen by 68.5 percent in the post-intervention test compared with 20.0 percent in the pre-intervention test. There was a significant improvement (p=0.00) of 48.5 percent of the respondents answering this question correctly after the intervention.

In the CG, there was a 12.9 percent improvement between pre and post tests, with no statistical significance. The majority (52.4 percent) still answered incorrectly.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 5.5	0.0	**20.0***	**68.5***	72.7	31.5	1.8	0.0
(CG) 5.0	0.00	**30.0**	**42.9**	60.0	52.4	5.0	4.8

* indicating significance at $p \leq 0.05$

Figure 4.8 Question 1 of the NKQ

Question 18, (refer to Figure 4.9) related to how one can stay healthy and the children were given three options. There was no picture illustration. There was an improvement of 17.1 percent from pre-intervention (55.6 percent) to post-intervention (72.7 percent) with no significance. However, the majority (55.6 percent) of the children knew the answer before the intervention.

In the CG, 54.5 percent answered correctly in the post test, a decline from 68.2 percent in the pre test.

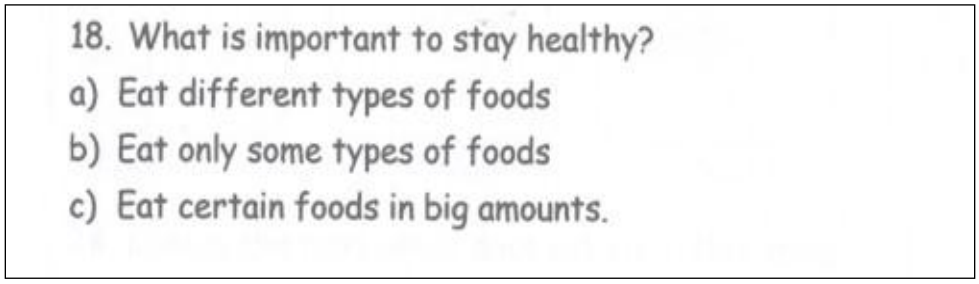
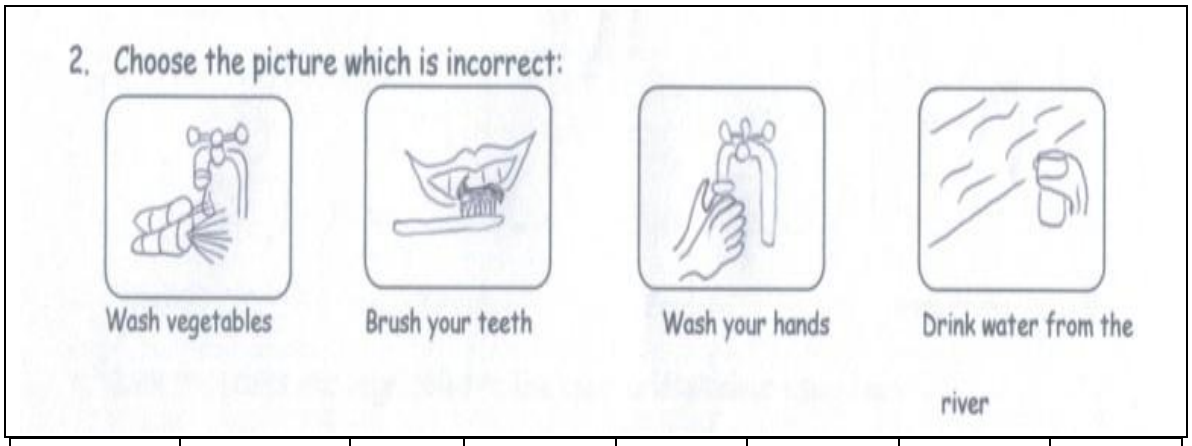


Figure 4.9 Question 18 of the NKQ

***Importance of hygiene**

Questions 2 and 15 related to hygiene and only Question 15 showed a significant improvement (p=0.00) after the intervention. Question 2, (refer to Figure 4.4) had pictures representing the washing of vegetables, brushing of teeth, washing of hands, and drinking of river or dam water. The children were asked to choose the picture which was incorrect. The mean percentage for this question improved from 74.5 percent before to 78.2 percent after the intervention. Before the intervention a majority (74.5 percent) of the children knew the correct answer of not drinking the water from a river.

The CG showed a decline of 15.4 percent between pre and post tests, with no statistical significance.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 3.6	5.5	12.7	12.7	9.1	3.6	**74.5***	**78.2***
(CG) 4.5	14.3	13.6	23.8	4.5	0.0	**77.3**	**61.9**

* indicating significance at $p \leq 0.05$

Figure 4.10 Question 2 of the NKQ

Question 15, (refer to Figure 4.11) related to the brushing of teeth and the required number of times it should be done on a daily basis. A 21.7 percent significant (p=0.00) improvement was seen in Question 15 between the tests before (70.9 percent) and after (92.7 percent) intervention. However, the majority (70.9 percent) already knew the answer before the intervention.

In Question 15, the CG showed a 13.6 percent improvement between pre-intervention (77.3 percent) and post-intervention results (90.9 percent), with no statistical significance.

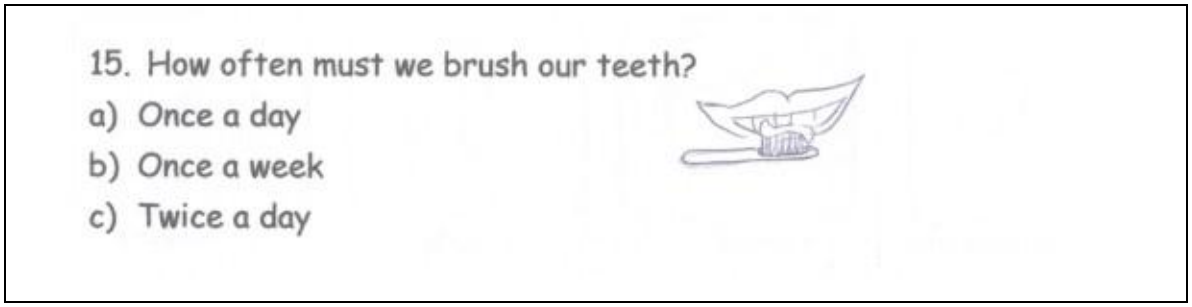
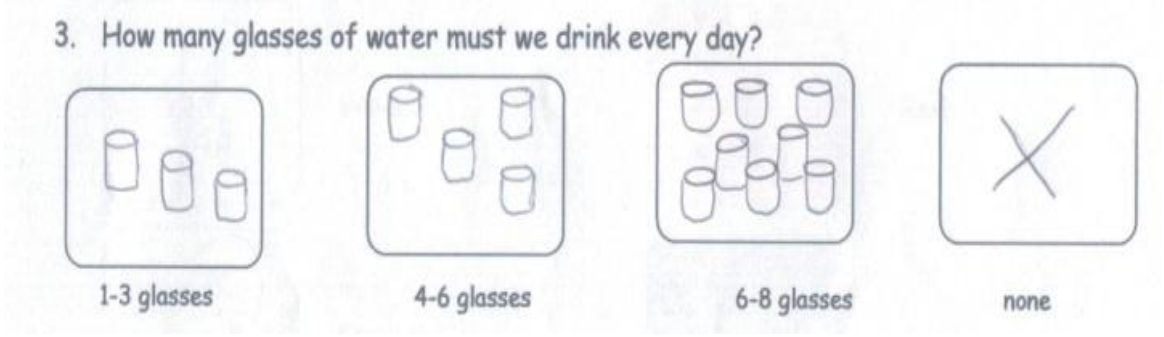


Figure 4.11 Question 15 of the NKQ

***Daily water consumption**

Question 3, (refer to Figure 4.12) related to daily water consumption and the pictures provided included three, four to six, six to eight, and no glasses of water required daily. There was a significant (p=0.00) improvement of 34.1 percent between pre- (52.7 percent) and post-intervention test results (86.8 percent). A majority of the children knew the answer before the intervention.

The CG had a decline of 7.4 percent between pre (45.5 percent) and post tests (38.1 percent). No statistical significance was present.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 27.3	5.7	9.1	1.9	**52.7***	**86.8***	10.9	5.7
(CG) 31.8	42.9	22.7	19.0	**45.5**	**38.1**	0.0	0.0

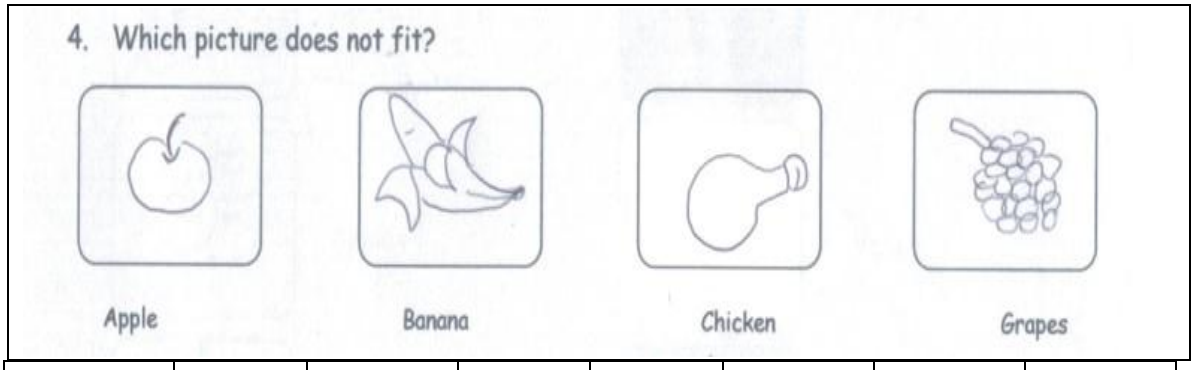
* indicating significance at $p \leq 0.05$
Figure 4.12 Question 3 of the NKQ

***Classification of food groups**

Each question related to the classification of food groups was asked with pictures and will be summarized with the mean average percentage improvement and significance indicated. In Question 4, (refer to Figure 4.13), children had to identify the food item not belonging to the fruit group. Between the pre- (78.2 percent) and post-intervention (89.1 percent) test there was an improvement of

10.9 percent with no significance. The majority (78.2 percent) already knew the answer before the intervention.

The CG showed no statistical significance although improvement of 13.6 percent occurred in the number of correct answers before (77.3 percent) and after the intervention (90.9 percent).

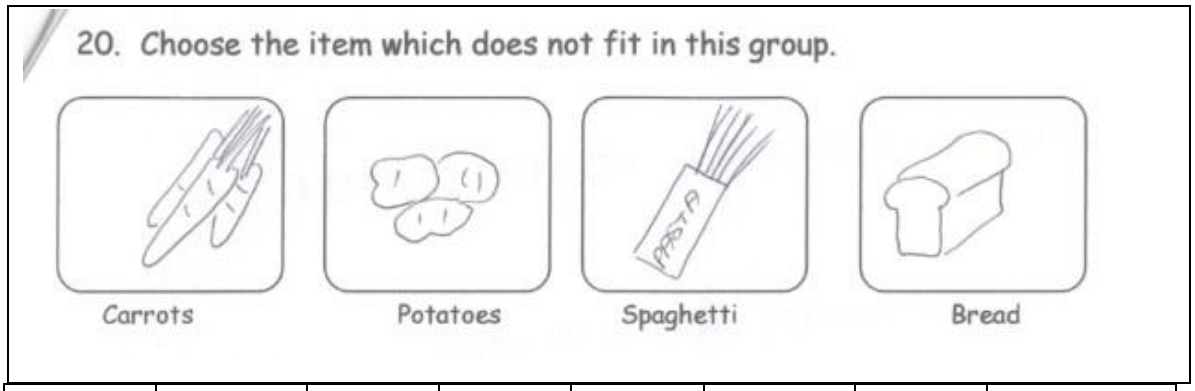


PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 3.2	3.8	9.5	5.1	**78.2**	**89.9**	6.3	1.3
(CG) 0.0	0.0	13.6	0.0	**77.3**	**90.9**	9.1	9.1

Figure 4.13 Question 4 of the NKQ

Question 20 (refer to Figure 4.14) referred to starchy food items and included a selection between carrots, potatoes, spaghetti and bread. The children were expected to choose the incorrect item in the group. There was a significant (p=0.03) improvement between the pre- (13.0 percent) and the post-intervention (25.5 percent) test results. Although there was a 12.5 percent improvement, the majority of the children (87.0 percent) did not know the answer before the intervention and 74.5 percent of the children still answered incorrectly in the post-intervention test.

An improvement of 8.4 percent was observed in the CG between pre (14.3 percent) and post (22.7 percent) test results.

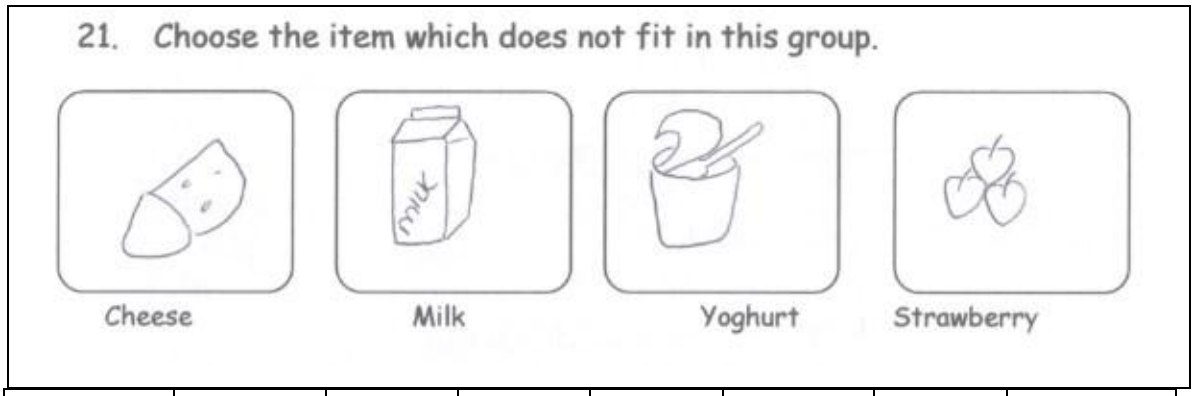


PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) **13.0***	**25.5***	9.3	3.6	63.0	34.5	14.8	36.4
(CG) **14.3**	**22.7**	4.8	0.0	71.4	63.6	9.5	13.6

* indicating significance at $p \leq 0.05$
Figure 4.14 Question 20 of the NKQ

For Question 21, (refer to Figure 4.15), relating to dairy products, the children were asked to choose the incorrect picture from amongst cheese, milk, yoghurt and strawberries. Almost half (46.3 percent) of the children answered correctly in the pre-intervention test. There was an improvement of 15.5 percent with no significance after the intervention, where a majority (61.8 percent) of the children answered correctly.

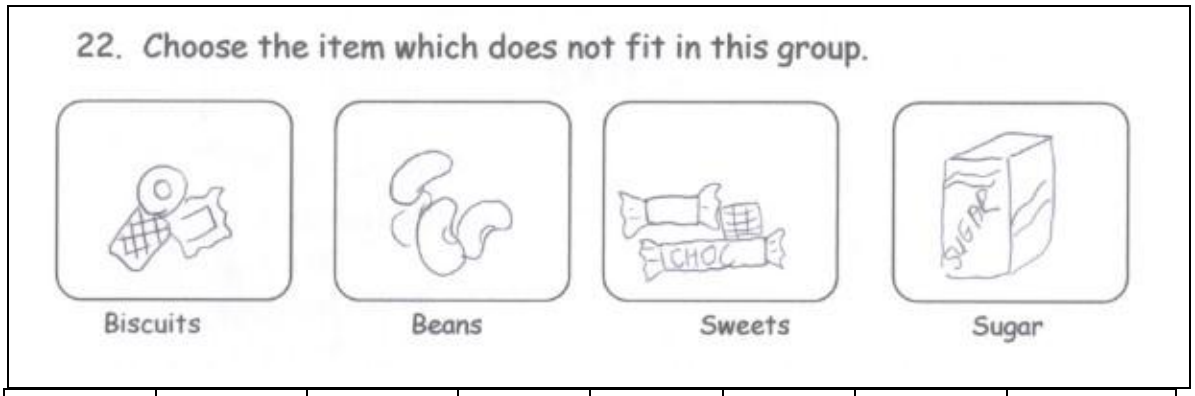
No statistical significance was found for Question 21 amongst the children in the CG, with an improvement of only 4.6 percent, and a majority (54.5 percent) still answering incorrectly in the post test.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 11.1	20.0	3.7	5.5	38.9	12.7	**46.3**	**61.8**
(CG) 22.7	18.2	4.5	4.5	31.8	31.8	**40.9**	**45.5**

Figure 4.15 Question 21 of the NKQ

Question 22, (refer to Figure 4.16) related to sugary food products and the children were asked to choose the picture which did not fit in. The question provided pictures of biscuits, beans, sweets and sugar. There was a significant (p=0.00) improvement of 32.0 percent between the pre- (38.9 percent) and the post-(70.9 percent) intervention tests. The CG showed a minimal improvement of 2.1 percent with no statistical significance in the difference between pre (45.5 percent) and post (47.6 percent) results.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 5.6	3.6	**38.9***	**70.9***	37.0	18.2	18.3	7.3
(CG) 9.1	0.0	**45.5**	**47.6**	31.8	38.1	13.6	14.3

* indicating significance at $p \leq 0.05$
Figure 4.16 Question 22 of the NKQ

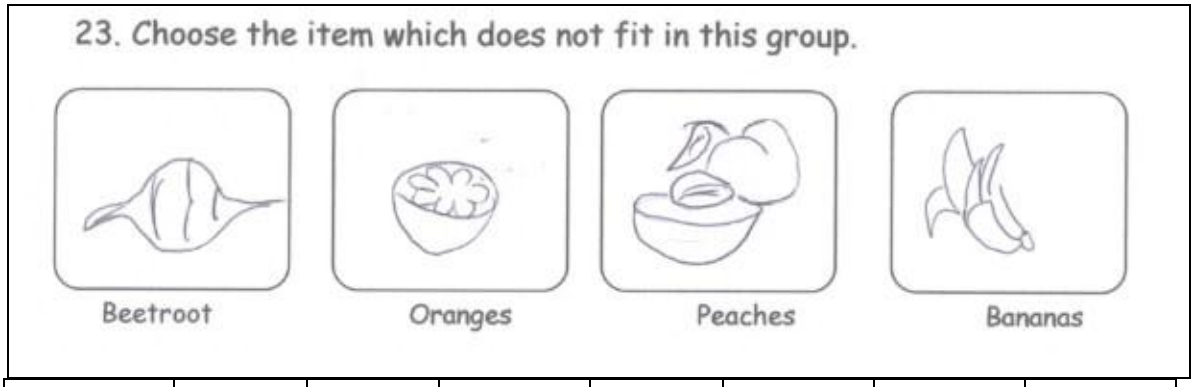
In Question 23, (refer to Figure 4.17) the children were asked to choose the incorrect picture from amongst beetroot, oranges, peaches and bananas. Although the majority (66.0 percent) knew the correct answer before the intervention, there was a significant (p=0.00) improvement of 26.6 percent in the post-intervention (92.6 percent) test.

The CG had an improvement of 4.6 percent, with no significance. However, a majority (63.6 percent) knew the correct answer in the test before intervention.

In Question 24, (refer to Figure 4.18), the children were asked to identify the item which did not relate to the protein-rich foods. In the pre-intervention test only 16.7 percent of the children chose the correct answer. After the intervention, a majority (56.4 percent) of the children chose the correct answer with a significant (p=0.00) improvement (39.7 percent) from the pre-intervention test of 16.7 percent.

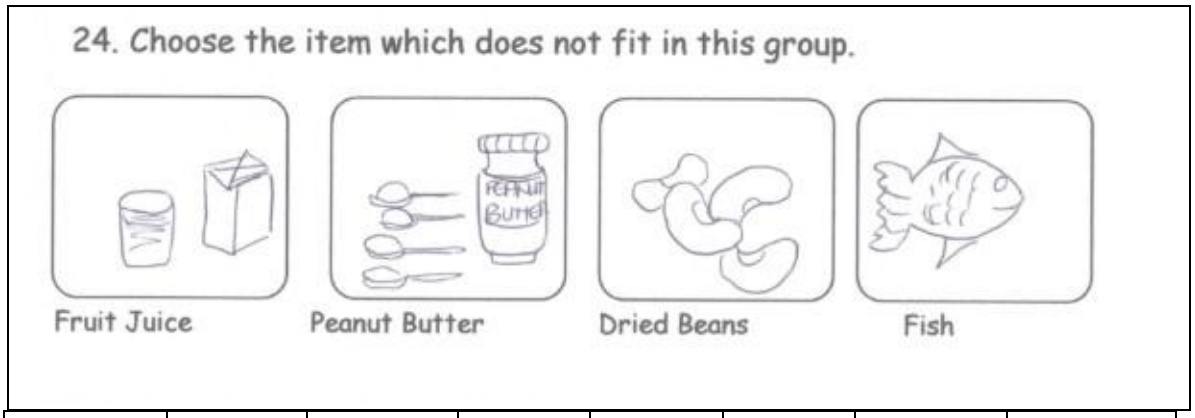
A decline was seen in the results of the CG between tests before (31.8 percent) and after (22.7 percent) intervention. No statistical significance occurred;

however, the majority (68.2 percent) did not know the answer before the intervention.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) **66.0***	**92.6***	1.9	1.9	24.5	3.7	7.5	1.9
(CG) **63.6**	**68.2**	4.5	4.5	31.8	22.7	0.0	4.5

* indicating significance at $p \leq 0.05$
Figure 4.17 Question 23 of the NKQ



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) **16.7***	**56.4***	20.4	10.9	20.4	16.4	42.6	16.4
(CG) **31.8**	**22.7**	22.7	31.8	18.2	18.2	27.3	27.3

* indicating significance at $p \leq 0.05$
Figure 4.18 Question 24 of the NKQ

All except Question 20 showed a significant improvement after the intervention for the EG.

***Importance of specific nutrients**

Question five, (refer to Figure 4.19) related to the importance of a specific nutrient, vit. A, in the diet. The children were asked to choose the correct answer as to which nutrient improved eyesight. An improvement of 14.8 percent occurred between the pre- (33.3 percent) and post-intervention (48.1 percent) results. However, 51.9 percent of the children still did not know the answer after the intervention.

No statistical significance was noted amongst the CG, with a 9.1 percent improvement between results before (50.0 percent) and after (59.1 percent) the intervention.

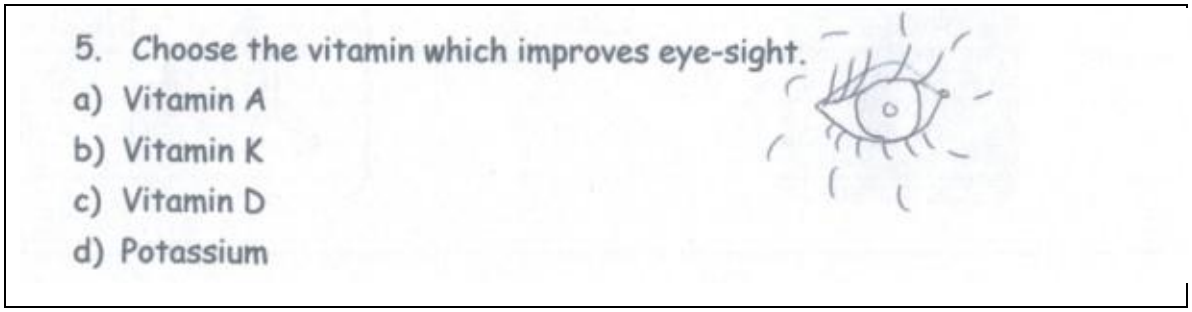
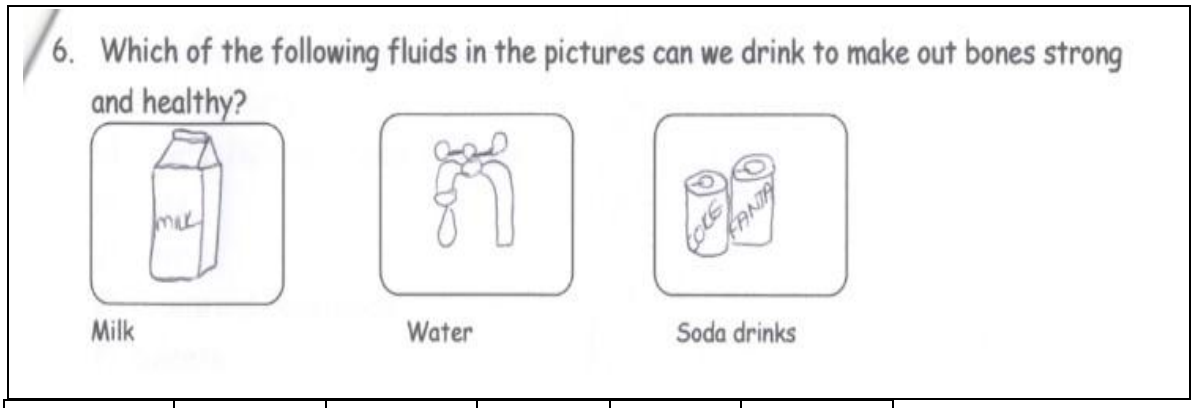


Figure 4.19 Question 5 of the NKQ

***Nutrient content and function of food**

The children were asked in Question 6, (refer to (Figure 4.20), which drink was important for the development of strong and healthy bones. The pictures reflected milk, water and soda drinks. The mean percentage of correct answers (70.9 percent) for Question 6, in the post-intervention test showed an improvement of 12.7 percent with no significance noted. However the majority (58.2 percent) of the children already knew the answer before the intervention.

No change was seen for Question 6 amongst the CG.



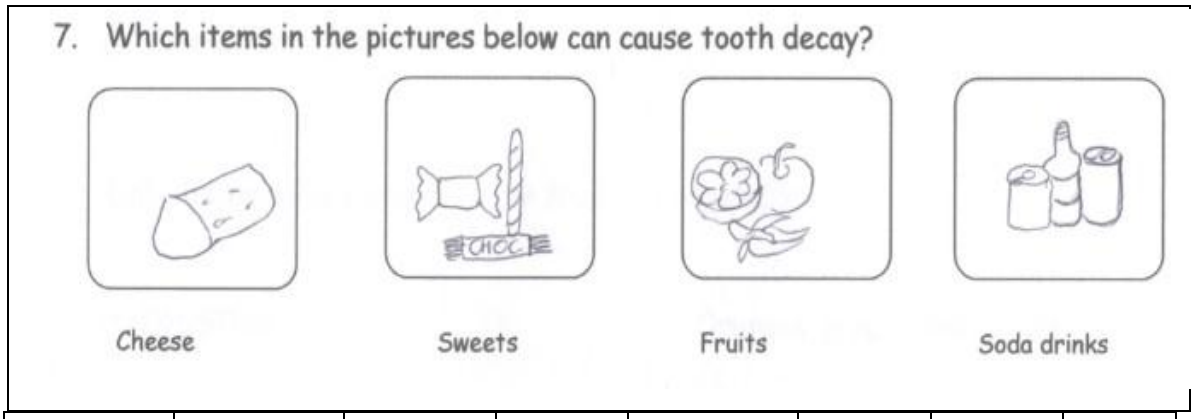
PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) **58.2**	**70.9**	34.5	27.3	7.3	1.8
(CG) **72.7**	**72.7**	18.2	18.2	9.1	9.1

Figure 4.20 Question 6 of the NKQ

***The link between sugar and tooth decay**

In Question 7, (refer to Figure 4.21) the children were asked to indicate which food item caused tooth decay. Almost all the children (94.5 percent) answered this question correctly in the post-intervention test, with a marginal improvement from the pre-intervention test (92.7 percent). No significance was present; however, the majority of the children (92.7 percent) knew the answer before the intervention.

The results amongst the CG changed in that the children indicated in the post test that cheese (4.5 percent) and fruits (9.1 percent) could cause tooth decay. No statistical significance was present.



PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
(EG) 1.8	1.8	**92.7**	**94.5**	3.6	1.8	1.8	1.8
(CG) 0.0	4.5	**86.4**	**86.4**	13.6	9.1	0.0	0.0

Figure 4.21 Question 7 of the NKQ

***Fruit and vegetable colours and nutrients**

In Question 8, (refer to Figure 4.16) the children had to identify the correct colour group to which the fruit or vegetable belonged, namely grapes – purple; spinach – green; apples – red and bananas – yellow. The questions were correctly answered by a mean 99.1 percent and 98.2 percent of the children in both the pre- and post-intervention tests.

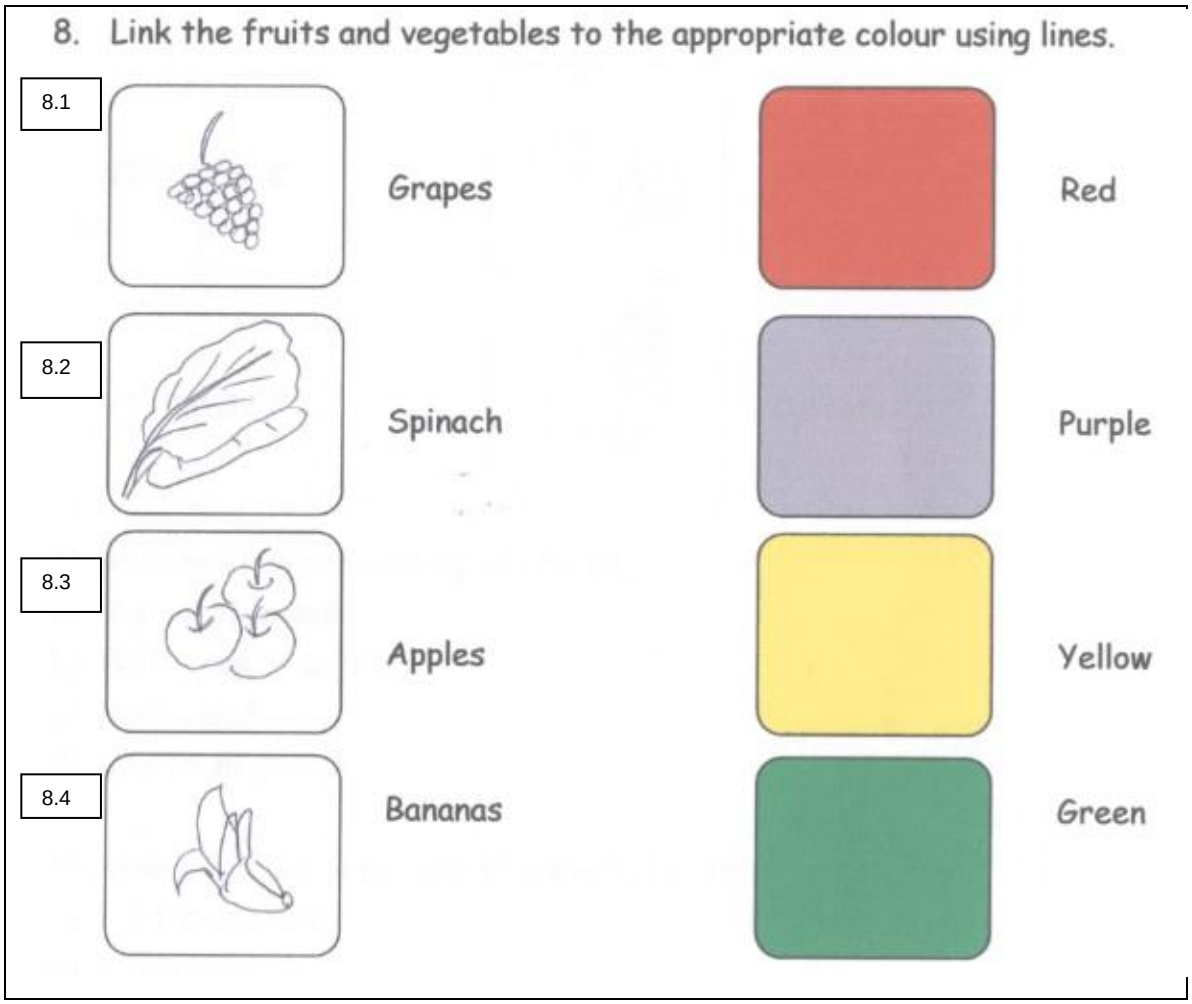


Figure 4.22 Question 8 of the NKQ

No significance was shown in any part of Question 8, but for Question 10, (refer to Figure 4.23), the children were asked to identify the dominant micronutrient present in the food item. The options were potassium, vit. C and vit. A, which had to be linked with fruit (oranges, grapes and raisins), broccoli and carrots. There was an improvement from the pre-intervention (74.0 percent) test of 0,5 percent for Question 10.1, the linking of potassium with broccoli. Question 10.2, the linking of vit. C with oranges, grapes and raisins, had a significant (p=0.00) improvement of 34.8 percent in the post-intervention (56.4 percent) test. The linking of vit. A with carrots, Question 10.3, had a significant (p=0.00) improvement of 30.4 percent from the pre- (7.8 percent) to the post- (38.2 percent) intervention test. However, the majority of the children (74.0 percent)

knew the answer for Question 10.1 in the pre-intervention test, but for Questions 10.2 and 10.3, the majority (78.4 and 92.2 percent) did not know the answer before the intervention.

The CG had no statistical significance for Questions 8 or 10. However, for Question 10, a majority (45.5 and 23.8 percent) did not answer correctly for the link of vit. C and vit. A after intervention, with similar results before intervention (47.6 and 33.3 percent respectively).

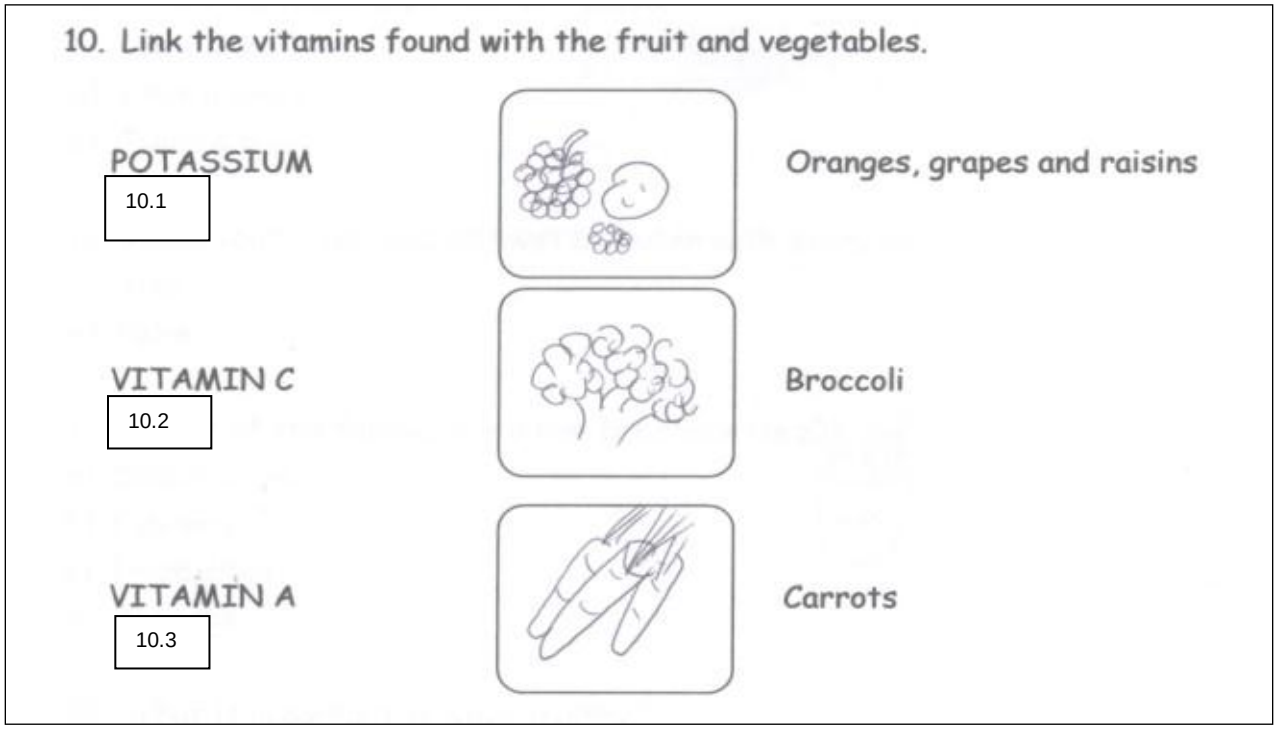


Figure 4.23 Question 10 of the NKQ

***Importance of variety in the diet**

The children were asked in Question 9, (refer to Figure 4.24) to indicate which food group items needed to be consumed daily. In the pre-intervention test, only 23.6 percent of the children thought that milk products (9a) needed to be consumed on a daily basis. Similar results were also found for food items from

the protein group, the fat group, and the starch group, with 18.2 percent, 3.6 percent, and 1.8 percent respectively. However, 87.3 percent of the children agreed that vegetables and fruits should be eaten on a daily basis. There was, however, a significant (p=0.00) improvement for the food group starch, between the pre- (1.8 percent) and post- (27.3 percent) intervention results, but the majority (72.7 percent) still did not agree on the need for starch group food items in the daily diet.

Similarly, 72.7 percent and 90.9 percent of the children in the CG, in pre and post tests respectively, agreed that vegetables and fruits should be eaten daily. Statistical significance (p=0.04) was observed for this correct answer.

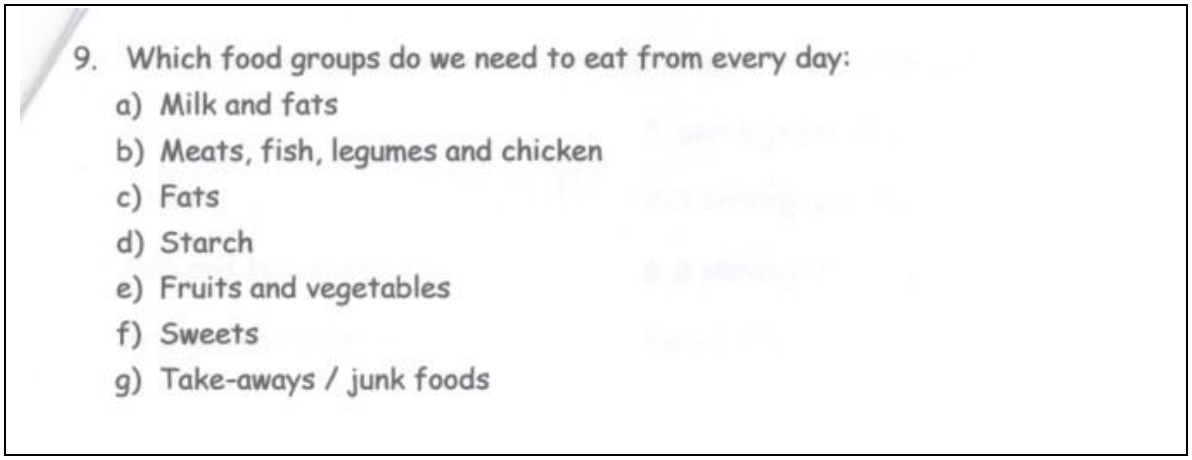

9. Which food groups do we need to eat from every day:
   a) Milk and fats
   b) Meats, fish, legumes and chicken
   c) Fats
   d) Starch
   e) Fruits and vegetables
   f) Sweets
   g) Take-aways / junk foods

Figure 4.24 Question 9 of the NKQ

***Serving size and servings per day**

Each question related to the serving size of certain food items and the servings required daily.

In Question 11, the children had to choose the correct portion size for starch, (refer to Figure 4.25) and the options included a) one slice of bread, b) half a cup of porridge, c) half a loaf, and d) one small potato. In the pre-intervention test, the majority of the children (78.2 percent) chose correctly amongst the three

correct answers (a) one slice of bread, b) half a cup of porridge and d) one small potato, with only 21.8 percent choosing the incorrect answer, c) half a loaf. There was a 9.1 percent decline after the intervention as the number of children not knowing the answer was 12.7 percent compared with the pre-intervention result of 21.8 percent.

Similar results came from the children in the CG, where 13.6 percent answered incorrectly in the pre-intervention test compared with 19.0 percent in the post-intervention test. However, the majority (86.4 and 81.0 percent respectively) chose the correct answers.

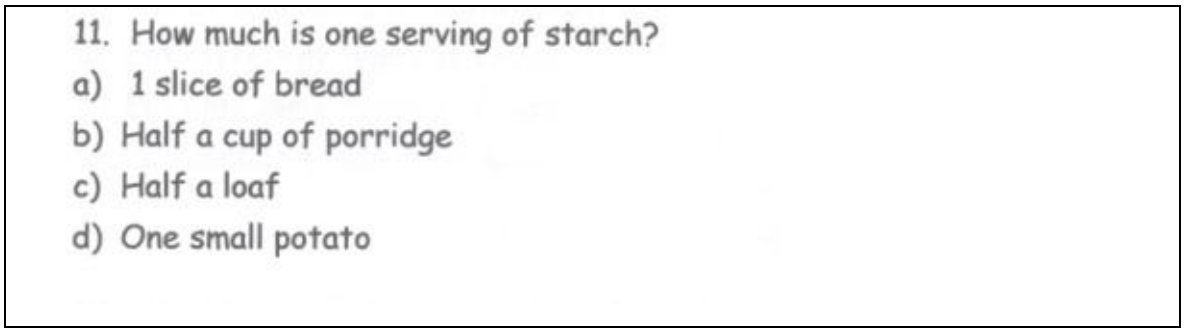


Figure 4.25 Question 11 of the NKQ

In Question 12, (refer to Figure 4.26) the children had to indicate the serving size of peanut butter, a protein-rich food. The correct answer, four tablespoons, was answered correctly by 18.5 percent of the children in the pre-intervention test. There was a 14.2 percent improvement in the post-intervention test; however, the majority (67.3 percent) of the children did not know the correct answer after the intervention.

Amongst the children of the CG, the majority (95.2 and 90.9 percent) answered incorrectly in both the pre- and post-intervention tests, with no statistical significance occurring.

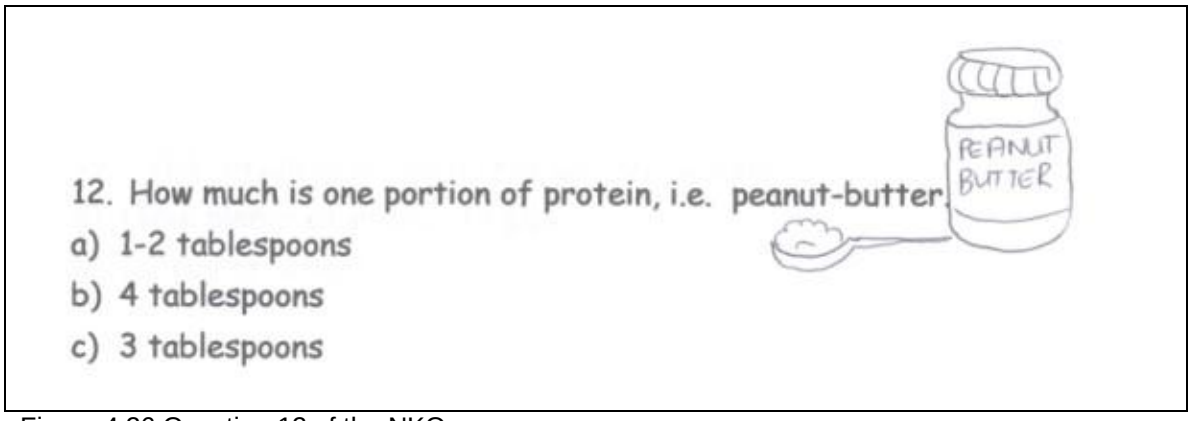


Figure 4.26 Question 12 of the NKQ

The number of eggs that could be eaten weekly was dealt with in Question 13, (refer to Figure 4.27), and although there was a significant (p=0.01) improvement (24.4 percent) in the post-intervention (71.7 percent) test, a majority (52.7 percent) of the children did not know the answer before the intervention, as only 47.3 percent answered correctly.

The majority (63.6 percent) of the children in the CG answered incorrectly in the pre (36.4 percent) test with an improvement of 6.5 percent in the post (42.9 percent) results. No significance was present.

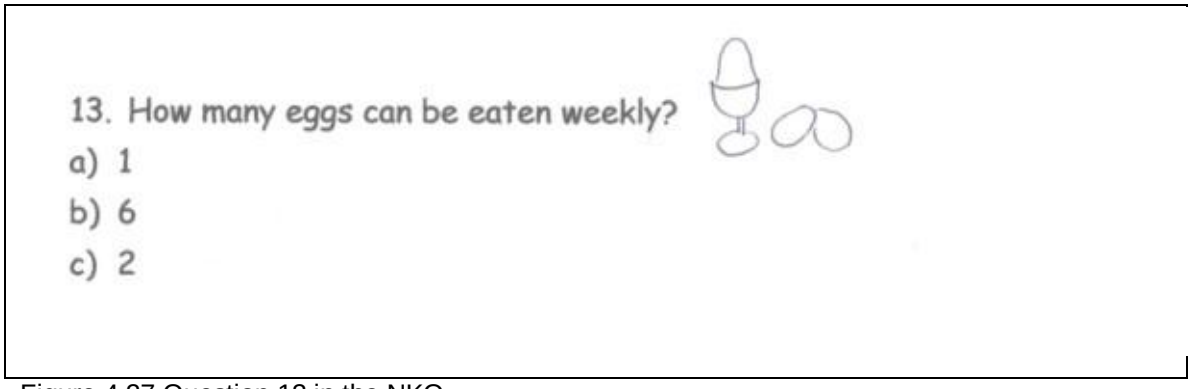
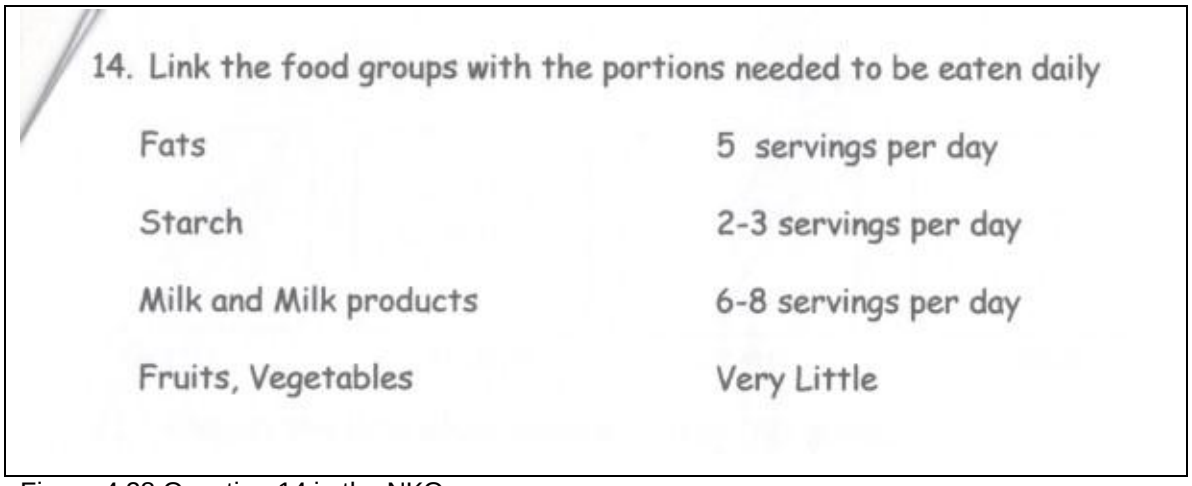


Figure 4.27 Question 13 in the NKQ

Question 14, (refer to Figure 4.28) was divided into the food groups with the number of servings that should be consumed daily scrambled on the opposite side of the page. The children were to link the correct number of servings per

day with the relevant food group. The results showed only no significant improvement. However, the majority (73.0 percent) of the children knew the answer before the intervention for the correct serving size of fat. For starch there was a 7.1 percent improvement after the intervention, with 7.9 percent for dairy products and 10.0 percent improvement for fruits and vegetables. Only 18.9 percent, 36.1 percent and 13.5 percent of the children knew the correct answers for starch, dairy products and fruits and vegetables respectively before the intervention. Although the knowledge improved after the intervention, only 26.0 percent, 44.0 percent and 23.5 percent answered correctly for the number of servings for starch, dairy products, and fruits and vegetables respectively, thus still indicating a lack of knowledge amongst the children.

For the CG, majority (71.4 percent) knew the correct servings for fats, with a small decline of 4.7 percent in the post (66.7 percent) test. Although most of the children did not know the correct servings for the other food groups, there was a 42.9 percent improvement in the post (66.7 percent) test. This may be due to the intake of fruit in the school as part of a feeding scheme.


14. Link the food groups with the portions needed to be eaten daily

Fats	5 servings per day
Starch	2-3 servings per day
Milk and Milk products	6-8 servings per day
Fruits, Vegetables	Very Little

Figure 4.28 Question 14 in the NKQ

***Fat intake and classification**

In Question 16 the children were asked to indicate whether fried foods, salt and oil are to be consumed daily. The choice of answer was either true or false. Question 16 was answered correctly by 88.9 percent of the children in the post-intervention test, compared with 64.8 percent in the pre-intervention test. A significant (p=0.00) improvement of 24.1 percent was observed after the intervention, although the majority (64.8 percent) knew the correct answer before the intervention.

No statistical significance or change was seen amongst the children in the CG as the majority (70 percent) answered correctly in both pre- and post-intervention tests.

The identification of low-fat snack items (Question 17, refer to Figure 4.29), reflected poor knowledge as the majority (83.0 percent) of the children did not know the correct answer before the intervention. There was only 1.7.1 percent improvement between the pre- (17.0 percent) and post- (24.1 percent) intervention results, thus indicating that the majority (75.9 percent) of the children still did not know the correct answer after the intervention.

A majority (63.6 percent and 76.2 percent) of the children in the CG did not answer correctly in either of the two tests.

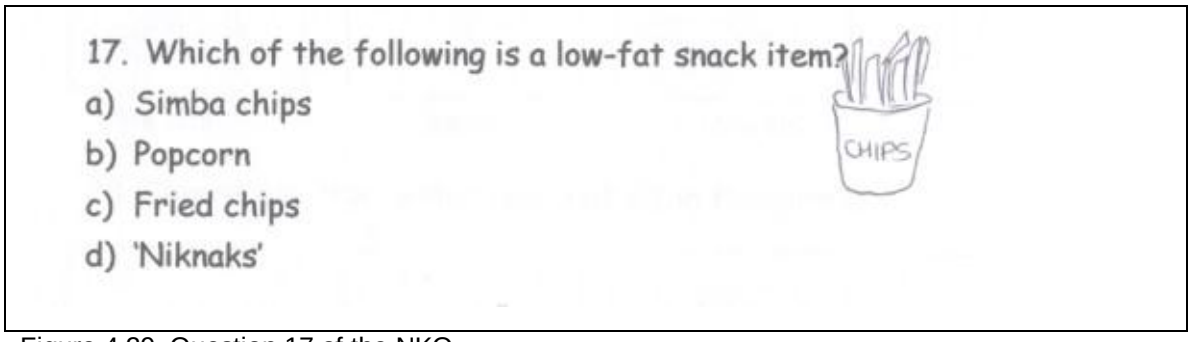


Figure 4.29 Question 17 of the NKQ

***Lack of breakfast**

The children were asked in Question 19 to indicate what happens when breakfast is not consumed. The choices were either 'have plenty of energy to play' or 'being sleepy at school'. 'Being sleepy at school' was chosen correctly by 88.2 percent of the children in the post test compared with 64.2 percent in the pre test. There was a significant (p=0.00) 24.0 percent improvement. Before the intervention the majority (64.2 percent) of the children knew the consequence of not eating breakfast.

Similarly, the majority (95.5 percent) of the children in the CG knew the answer in the first test, with a slight decline of 9.1 percent in the second (86.4 percent). Independent t-tests were done for both pre- and post-intervention tests between the EG and CG to determine any statistically significant differences between the two groups. For the pre-intervention tests there was statistical significance in seven (18.4 percent) questions out of 38. These questions included number 8.1, 9d, 10.2, 10.3, 11, 12 and 18, and related to the linking of grapes with the colour purple, the importance of starch consumption on a daily basis, the linking of vit. C and vit. A with sources of food, the serving size of starch and protein-rich foods and the importance of health and physical activity. The tests after intervention reflected significance in ten (26.3 percent) questions, namely Question 1, 3, 11, 12, 13, 14.2, 14.3, 22, 23, and 24. These questions related to the importance of health and physical activity, the importance of hygiene, serving sizes of protein-rich foods, number of eggs per week, daily servings of starch and dairy products, fat intake and classification, as well as the classification of sugary products and protein-rich foods.

Paired sample tests were conducted to determine if the drop-outs had any statistically significant effect on the pre-intervention results. All the drop-outs were grouped together and all pre-intervention results of both CG and EG were combined. The results reflected significance in four (16.6 percent) out of the 24

questions. These questions related to the daily consumption of water (Q3: p=0.01), classification of food groups, namely dairy (Q21: p=0.02), sugary products (Q22: p=0.00) and protein-rich foods (Q24: p=0.03).

4.12 Dietary intake results: 24-hr recall

The pre-intervention group included 82 children in the EG and 91 in the CG, with only 55 and 21 completing the post-intervention questionnaire. The complete database included only the 55 and 21 from the EG and CG.

4.12.1 Experimental Group

The Top 20 list (refer to Table 4.5), reflects the diets of the children before the intervention and shows tea as the item most consumed, with a mean portion of 263ml, consumed by 43 (78.2 percent) of the children.

Protein sources are included in the diet and occur at number eight in the form of cooked beef (n=23) with a mean portion of 97g consumed by 41.8 percent of the children. Cooked chicken (n=14) occurred twelfth with a mean portion of 94g, consumed by 25.5 percent of the children. Other protein sources included sausage (13th), with a mean portion of 95g consumed by only 21.8 percent of the children, polony (15th) with a mean portion of 38g, and cooked fish (18th) with a mean portion of 118g, but consumed by only 50.9 and 12.7 percent respectively. Although five protein sources are found within the Top 20 most frequently consumed food items, these were consumed by only a small percentage of children.

Table 4.5 Top 20 food list and means consumed (Pre-intervention with experimental group) (n =55)

FOOD ITEM DESCRIPTION (uom*)	MEAN (by weight)	SD	No. of children consuming – percentage in brackets
1. Tea, brewed (ml)	263 ml	103	43 (78.2)
2. Bread, brown and white (g)	146 g	65	52 (94.5)
3. Cold drink, squash (ml)	316 ml	209	18 (32.7)
4. Milk, fresh full cream (ml)	124 ml	115	31 (56.4)
5. Fruit juice (ml)	208 ml	100	18 (32.7)
6. Maize meal, stiff (g)	125 g	82	26 (47.3)
7. Rice, cooked (g)	102 g	38	24 (43.6)
8. Beef, cooked (g)	97 g	27	23 (41.8)
9. Water (ml)	400 ml	224	5 (9.1)
10. Maize meal, soft (g)	157 g	67	12 (21.8)
11. Apple (g)	140 g	64	12 (21.8)
12. Chicken, cooked (g)	94 g	18	14 (25.5)
13. Sausage (g)	95 g	35	12 (21.8)
14. Potato crisps, snack (g)	38 g	16	30 (54.5)
15. Polony (g)	38 g	16	28 (50.9)
16. Sweets (g)	41 g	27	23 (41.8)
17. Sugar, brown and white (g)	18 g	7	48 (87.3)
18. Fish, cooked (g)	118 g	58	7 (12.7)
19. Tomato and onion gravy (ml)	27 ml	16	28 (50.9)
20. Cookies (g)	59 g	21	12 (21.8)

The only fruit consumed was raw apple (11th), by only 21.8 percent (n=12) of the children, with a mean portion of 140g, and the only vegetable was recorded in the form of tomato and onion gravy (19th), with a mean portion of 27ml consumed by 50.9 (n=12) percent of the children

Carbohydrates were consumed in large amounts over a 24-hour period, with bread second at a mean portion of 146g, consumed by 94.5 percent of the children. Stiff maize meal appeared sixth with a mean portion of 125g, consumed by 47.3 percent (n=26), followed by cooked rice (6th; n=24) with a mean portion of 102g, but consumed by only 43.6 percent of the children. Soft maize meal was tenth with a mean portion of 157g, consumed by only 21.8 percent of the children. Potato crisps were consumed by more than half the children (54.5 percent), with a mean portion of 38g, equivalent to one packet.

Sweets (16th; n=23), sugar (18th; n=48) and cookies (20th; n=12) were also found, with the highest consumption occurring for sugar, consumed by 87.3 percent of the children with a mean portion of 18g, equivalent to just over three teaspoons each.

Dairy was found in the form of milk, at fourth place, with a mean portion of 124ml consumed by a majority (56.4 percent) of the children. Although mean portion sizes seemed large for certain items, including water (400ml), cold drink (316ml) and fruit juice (208ml), only a small number of children (9.1 percent, 32.7 percent and 32.7 percent respectively) consumed these items. Bread and tea were the items most consumed by 43 (78.2 percent) and 52 (94.5 percent) children respectively. Unfortunately, very little variety existed within the Top 20 items, with no form of legumes or vegetables being present.

Table 4.6 reflects the Top 20 list recorded in the 24-hr recall after the intervention with the EG. The first four items are still carbohydrate-based, with bread at a mean portion of 358g consumed by 100.0 percent of the children, maize meal (stiff), at a mean portion of 132g consumed by 87.3 percent of the children, and tea (240ml) and fruit juice (262ml) consumed by 69.1 (n=38) and 32.7 percent (n=18) respectively. Protein occurs at number five in the form of cooked chicken (89g) and consumed by 76.4 percent (n=42) of the children. Protein is also found at number seven as polony, which is processed meat, with a mean portion of 41g consumed by more than half the children (n=35; 63.6 percent). Eggs are consumed at a mean portion of 72g but by only ten (18.2 percent) of the children. Starch is also found at number nine, with soft maize meal, consumed by 10.9 (n=6) percent, and at number 17, as boiled potato consumed by 23.6 (n=13) percent of the children, with a mean portion of 56g.

Carbohydrate-based foods containing high levels of fat are still present in the form of snacks and chips (11th; n=35) with a mean portion of 34g, cold drink, carbonated (10th; n=5) with a mean portion of 250ml, French fries with a mean

portion of 66g (15th; n=13), sugar, at number 16 with a mean portion of 17g, equivalent to three tablespoons, consumed by the majority (85.5 percent) of the children, and vetkoek, at number 20, with a mean portion of 72g consumed by only seven (12.7 percent) children.

Fruit is present in the form of an orange (12th; n=9) with a mean portion of 116g and, an apple, (19th) with a mean portion of 67g, consumed by only 14.5 percent of the children. Vegetables are present in the form of tomato and onion gravy (13th), with a mean portion 57g consumed by 18 (32.7 percent) of the children, and atchar (18th) with a mean portion of 42g consumed by 25.5 percent (n=14) of the children.

Table 4.6 Top 20 food list and means consumed (Post-intervention with experimental group) (n=55)

FOOD ITEM DESCRIPTION (uom*)	MEAN (by weight)	SD	No. of children consuming – percentage in brackets
1. Bread, white and brown (g)	358 g	350	55 (100.0)
2. Tea brewed (ml)	240 ml	82	38 (69.1)
3. Maize meal, stiff (g)	132 g	96	48 (87.3)
4. Fruit juice (ml)	262 ml	200	18 32.7)
5. Chicken cooked (g)	89 g	41	42 (76.4)
6. Milk, fresh (ml)	77 ml	93	26 (47.3)
7. Polony (g)	41 g	16	35 (63.6)
8. Coffee (ml)	225 ml	69	6 (10.9)
9. Maize meal, soft (g)	210 g	69	6 (10.9)
10. Cold drink, carbonated (ml)	250 ml	0	5 (9.0)
11. Snacks, chips (g)	34 g	13	35 (63.6)
12. Orange (g)	116 g	77	9 (16.4)
13. Tomato gravy (ml)	57 ml	22	18 (32.7)
14. Eggs (g)	72 g	64	10 (18.2)
15. French fries (g)	66 g	101	13 (23.6)
16. Sugar (g)	17 g	22	47 (85.5)
17. Potato, boiled (g)	56 g	25	13 (23.6)
18. Atchar (g)	42 g	14	14 (25.5)
19. Apple (g)	67 g	41	8 (14.5)
20. Vetkoek (g)	72 g	39	7(12.7)

Comparison of the pre- and post-intervention results of the 24-hr recall showed that after the intervention the consumption of tea declined slightly to 240ml but

still remained within the top five items, moving from first to second place. The consumption of bread moved from second to first with the mean portion doubling to 358g per child, and consumed by 100.0 percent of the children, compared with 94.5 percent before the intervention. Stiff maize meal was consumed by 87.3 percent of the children after the intervention compared with 47.3 percent before, and shifted from sixth to third position.

The inclusion of protein within the top five, in the form of cooked chicken, moved from twelfth place pre-intervention to fifth after the intervention, with a mean portion of 89g compared with 94g, and the number of children consuming this increasing from 25.5 percent to 76.4 percent. The other protein sources found within the Top 20 list before the intervention no longer appeared on the list after the intervention, and included cooked beef, sausage and cooked fish. Processed meats (polony) moved from fifteenth to seventh, with more children (63.6 percent) consuming the item. Eggs, a protein source, were introduced into the diet, but by only 18.2 percent of the children, at a mean portion of 72g.

Starch in the form of boiled potato was included in the diet at number 17 with a mean portion of 56g, consumed by only 23.6 percent. However, this item did not appear within the Top 20 list before the intervention and was incorporated into the diet after the intervention, although by only 23.6 percent of the children. Other starch items which were included after the intervention included French fries (15^{th}; n=13) and vetkoek (20^{th}; n=7), consumed by 23.6 and 12.7 percent only. Soft maize meal appeared at number nine as against tenth place before the intervention, with mean portions of 210g and 157g respectively. Although the mean portion of soft maize meal increased, the number of children consuming this item declined from 21.8 percent to 10.9 percent.

Fruits and vegetables were present in the Top 20 list after the intervention, but consumed by very few children. Oranges were consumed by 16.4 percent of the children, apples (19^{th}) by 14.5 percent, tomato gravy by 32.7 percent and atchar

was introduced at number 18, with 25.5 percent of the children consuming this item.

High-fat snack items were present before the intervention in the form of potato crisps (14th), sweets (16th) sugar (17th) and cookies (20th). There was a change after the intervention, where the potato crisps moved to number 10 with a mean portion of 34g compared to 38g. Sweets were no longer present and sugar moved from number 17 to number 16 with a mean portion of 17g. French fries (15th; n=13) and vetkoek (20th; n=7) were introduced, but were consumed by only 23.6 and 12.7 percent of the children.

Table 4.7 reflects the nutritional comparison between the pre- and post-intervention results of the 24-hr recall. The energy intake (6543.6kJ) was below the EAR before the intervention. However, total protein and carbohydrates were higher than the recommended EAR before the intervention, with mean intakes of 52.2g and 196.3g respectively. Similar results occurred for the mean intake of total fat, which was 57.0g before the intervention.

Micronutrients, which still reflected a mean intake below the EAR (pre and post values in brackets) after the intervention, included total dietary fibre (12.7g and 18.0g), Ca (393.0mg and 340.0mg), vit. K (50.0mcg and 24.7 mcg) and vit. D (2.6mcg and 2.1mg). Micronutrients, which showed an improvement in mean intake with values higher than EAR (post-intervention values in brackets), included selenium (Se) (88.8mg), magnesium (Mg) (236.5mg) and thiamin (1.1mg). Micronutrients which were above EAR before the intervention and declined after the intervention but still remained above EAR included (pre- and post-intervention values in brackets) Zn (9.0mg and 7.8mg), Fe (10.6mg and 8.8mg), riboflavin (2.2mg and 0.9mg), vit. B12 (3.1mcg and 1.6mcg) and vit. C (65.5mg and 58.1mg). The two micronutrients which had values above EAR before intervention but after the intervention declined to below the EAR included vit. E (9.1mg and 5.1mg) and vit. A (682.0mcg and 212.6mcg).

Table 4.7 Comparison of pre- and post-intervention nutritional values from 24-hr recall with EAR/AI for children aged 9-13 years (experimental group)

NUTRIENT	FEMALE *EAR/AI#	MALE *EAR/AI #	Mean of 24-hr recall pre-intervention	Mean of 24-hr recall – post-intervention	Variance of 24-hr recall – pre-intervention (%)	Variance of 24-hr recall – post intervention (%)	% of children 100% *EAR/AI# pre-intervention	% of children 100% *EAR/AI# post-intervention	Significant (*p*) change after the intervention
[1]Energy (kJ) #	8628 [2]	9569 [2]	6543.6	8016.6	-30.6	-15.2	89.1	80.0	**0.00**
[1]Total Protein (g) #	34	34	52.2	66.2	53.5	94.7	14.5	7.3	**0.00**
[1]Total Fat (g) #	25-35	25-35	57.0	54.2	128.0	116.8	9.1	7.3	0.72
[1]Total CHO (g) #	130	130	196.3	269.2	51.0	107.1	10.9	18.2	**0.00**
Vitamin E (mg)	9.0	9.0	9.1	5.1	1.1	-43.3	49.1	85.4	**0.00**
[1]Total Dietary Fibre (g) #	26	31	12.7	18.0	-51.2	-30.8	96.4	81.8	**0.01**
Zn (mg)	7.0	7.0	9.0	7.8	28.6	11.4	36.4	47.3	**0.00**
Se (mg)	35.0	35.0	38.0	88.8	8.6	153.7	54.4	30.9	**0.00**
Ca (mg) #	1300.0	1300.0	393.0	340.0	-69.8	-73.8	100.0	100.0	0.28
Fe (mg)	5.9	5.7	10.6	8.8	79.7	49.2	94.5	21.8	**0.02**
Mg (mg)	200.0	200.0	185.1	236.5	-7.5	18.3	58.2	50.9	**0.03**
Vit. A (*μ*g)	445.0	420.0	682.0	212.6	53.3	-52.2	63.6	94.5	**0.00**
Thiamin (mg)	0.7	0.7	0.9	1.1	28.6	57.1	23.6	20.0	**0.04**
Riboflavin (mg)	0.8	0.8	2.2	0.9	175.0	12.5	25.4	56.4	**0.00**
Vit. B6 (mg)	0.8	.8	1.3	1.3	62.5	62.5	14.5	23.6	0.71
Vit. K (*μ*g) #	60.0	60.0	50.0	24.7	-16.7	-58.8	85.4	89.1	0.23
Vit. B12 (*μ*g)	1.5	1.5	3.1	1.6	106.7	6.7	30.9	56.4	**0.00**
Vit. C (mg)	39.0	39.0	65.5	58.1	67.9	49.0	60.0	61.8	0.61
Vit. D (*μ*g) #	5.0	5.0	2.6	2.1	-48.0	-58.0	87.3	94.5	0.36

*Estimated Average Requirements for age group 9 to 13 years (NICUS 2010)
#Adequate Intakes (NICUS 2010)
mg milligrams
g grams
kJ kilojoules
*μ*g micrograms
[1]NAP 2002
[2]Estimated energy requirements (EES) for females and males based on physical activity level (PAL) active

Therefore, the micronutrients where a decline was observed after the intervention included vit. E, Zn, Ca, Fe, vit. A, riboflavin, vit. K, vit. B12, vit. C and vit. D. Comparison of the macronutrient intakes (energy, protein, carbohydrates and fat) before and after intervention reveals that energy intake improved by 1473.0kJ to 8016.6kJ after the intervention. The mean intake for protein, at 66.2g after the intervention, was higher by 14.0g but still higher than the EAR by 94.7 percent. Similar results occurred for carbohydrates, where the mean intake increased to

269.2g from 196.3g, 107.1 percent higher than EAR. The total mean intake of fat diminished to 54.2g, although it was still 116.8 percent higher than the minimum 25g for EAR. This meant that the children obtained a higher amount of energy from other macronutrients and less from fat before the intervention. The Top 20 results reflected a carbohydrate-based diet, which was also reflected in the increase in the mean intake of carbohydrates.

Except for total dietary fibre, Se, Mg and thiamin, all the nutrients were lower after the intervention. However, the mean values for Zn (7.8g), Fe (8.8mg), riboflavin (0.9mcg), vit. B12 (1.6mcg) and vit. C (58.1mg) were still higher when compared to EAR for children aged within the age group of nine to thirteen years.

None of the nutrients, except for total fat, calcium, vit. B6, vit.K, vit. C and Vit D, reflected significant changes. The remaining micronutrients and macronutrients reflected significant changes in mean intakes, and in the number of children not meeting the daily requirements. The significances were as follows: energy (p=0.00), total protein (p=0.00), total carbohydrates (p=0.00), vit. E (p=0.00), total dietary fibre (p=0.01), zinc (p=0.00), Se (p=0.00), Fe (p=0.02), Mg (p=0.03), vit. A (p=0.00), thiamin (p=0.04), riboflavin (p=0.00), and vit. B112 (p=0.00).

A reduction occurred in the percentage of children with deficiencies in the following nutrients: energy, from 89.1 to 80.0 percent, total protein, from 14.5 to 7.3 percent, total fat, from 9.1 to 7.3 percent, total dietary fibre, from 96.4 to 81.8 percent, Se, from 54.4 to 30.9 percent, Fe, from 94.5 to 21.8 percent, Mg, from 58.2 to 50.9, and thiamin, from 23.6 to 20.0 percent. This means that a greater number of children were consuming the recommended daily requirements. However, nutrients where the number of children reflected deficiency within the diet were carbohydrates (18.2 percent), vit. E (85.4 percent), Zn (47.3 percent). Vit. A (94.5 percent), riboflavin (56.4 percent), vit. B6 (23.6 percent), vit. K (89.1 percent), vit. B12 (56.4 percent), vit. C (61.8 percent), and vit. D (94.5 percent). This means that, although for some micronutrients the mean intake was above

EAR, the number of children not meeting these requirements was greater after the intervention. Only a small percentage of children were consuming a variety within the diet. The micronutrients, Zn, riboflavin, vit. B12, and vit. C, declined after the intervention but were above EAR.

The energy supplied by the diet was distributed amongst the macronutrients as follows: protein and fibre combined (16.7 percent, 18.0 percent), carbohydrates (50.4 percent, 56.4 percent) and fat (32.9 percent, 25.6 percent).

4.12.2 Control Group

The Top 20 list (refer to Table 4.8) reflects the dietary patterns of the children represented in the CG before the intervention conducted with the EG. The top five items reflect a diet based on carbohydrates, with the inclusion of fruit juice, bread and maize meal consumed by more than half of the children.

Table 4.8 shows fruit juice as the most-consumed item, with a mean portion of 286ml consumed by 70.0 percent (n=14) of the children.

Protein is present in the form of cooked chicken, consumed by half the children with a mean portion of 124g. Other sources included polony (10th), with a mean portion of 55g, sausages (12th) with a mean portion of 106g and dried beans (14th) with a mean portion of 320g, consumed by 60.0 percent, 25.0 percent and 5.0 percent respectively.

Table 4.8 Top 20 food list and means consumed (Pre-intervention with control group) (n=20)

FOOD ITEM DESCRIPTION (uom*)	MEAN (by weight)	SD	No. of children consuming – percentage in brackets
1. Fruit juice (ml)	286 ml	149	14 (70.0)
2. Bread, brown and white (g)	153 g	89	20 (100.0)
3. Maize meal, soft (g)	255 g	57	11 (55.0)
4. Milk fresh, full cream (ml)	222 ml	67	10 (50.0)
5. Maize meal, stiff (g)	234 g	53	8 (40.0)
6. Tea, brewed (ml)	290 ml	119	5 (25.0)
7. Chicken, cooked (g)	124 g	48	11 (55.0)
8. Cold drink, squash (ml)	310 ml	52	3 (15.0)
9. Apple (g)	132 g	40	5 (25.0)
10. Polony (g)	55 g	30	12 (60.0)
11. Rice, cooked (g)	157 g	62	4 (20.0)
12. Sausage (g)	106 g	19	5 (25.0)
13. Coffee (ml)	250 ml	0	2 (10.0)
14. Dried beans (g)	320 g	0	1 (5.0)
15. Breakfast cereal (g)	52 g	26	6 (30.0)
16. Potato crisps, snacks (g)	40 g	14	7 (35.0)
17. Tomato onion gravy (ml)	38 ml	12	7 (35.0)
18. Mabela (g)	250 g	0	1 (5.0)
19. Milo (ml)	200 ml	0	1 (5.0)
20. Oats, cooked (g)	200 g	0	1 (5.0)

Vegetables and fruits are present in the form of an apple (9th) with a mean portion of 132 g and tomato and onion gravy (17th) with a mean portion of 38g, consumed by 22.7 and 31.8 percent of the children respectively. Dairy is found at number four as full cream milk, consumed by 50.0 percent of the children, with a mean portion of 222ml.

Foods from the starch food group are dominant within the Top 20 list with eight items relating to this group and the remaining four being carbohydrate-based (number, mean portion and percentage consuming the item in brackets): fruit juice (1st, 286ml, 63.6 percent), bread, brown and white (2nd, 153g, 100.0 percent), maize meal, soft (3rd, 255g, 55.0 percent), maize meal, stiff (5th, 234g, 40.0 percent), tea, brewed (6th, 290ml, 25.0 percent), cold drink, squash (8th, 310ml, 15.0 percent), rice, cooked (11th, 157g, 20.0 percent), breakfast cereal (15th, 52g, 30.0 percent), potato crisps (16th, 40g, 35.0 percent), mabela (18th,

250g, 5.0 percent), Milo (19th, 200ml, 5.0 percent), and cooked oats (20th, 200g, 5.0 percent).

The diet of the children in the CG (refer Table 4.9) was recorded after the intervention with the EG. The Top 20 list is still based on carbohydrates, although fruits have been included.

Table 4.9 Top 20 food list and means consumed (Post-intervention with control group) (n=20)

FOOD ITEM DESCRIPTION (uom*)	MEAN (by weight)	SD	No. of children consuming – percentage in brackets
1. Maize meal, stiff (g)	154 g	73	20 (100.0)
2. Bread, brown and white (g)	119 g	58	20 (100.0)
3. Tea (ml)	258 ml	19	19 (95.0)
4. Cold drink (ml)	323 ml	147	15 (75.0)
5. Water (ml)	700 ml	481	5 (25.0)
6. Fruit juice (ml)	272 ml	126	11 (55.0)
7. Chicken (g)	110 g	35	20 (100.0)
8. Apple (g)	126 g	57	9 (45.0)
9. Peach (g)	450 g	212	2 (10.0)
10. Snacks, chips (g)	34 g	20	20 (100.0)
11. Polony (g)	38 g	21	20 (100.0)
12. Rice, cooked (g)	117 g	44	7 (35.0)
13. Beef cooked (g)	88 g	38	9 (45.0)
14. Banana (g)	82 g	8	6 (30.0)
15. Pear (g)	117 g	42	4 (20.0)
16. French fries (g)	38 g	12	12 (60.0)
17. Sugar (g)	14 g	7	20 (100.0)
18. Atchar (ml)	18 ml	9	20 (100.0)
19. Cheese, slices (g)	31 g	2	12 (60.0)
20. Gravy (ml)	36 ml	14	9 (45.0)

The inclusion of fruit (mean portion in brackets) appears with banana (82g), peach (450g) and pear (117g) in the post evaluation and can be attributed to the provision of fruit on a daily basis at the school as part of a feeding scheme. High-fat snack items in the form of French fries (38g, n=16) were recorded, consumed by 60 percent of the children. Breakfast cereal (mabela and oats) was omitted and the only vegetable present in the Top 20 list was atchar (18th), with a mean portion of 18g and consumed by all the children. However, vegetables

were recorded in the 24-hr recall but not reflected within the Top 20 list, and included dried beans (67g, n=3), beetroot (30g, n=1) and cabbage (40g, n=2).

In a comparison of the pre- and post-intervention 24-hr recall, cooked chicken was present in both the pre and post evaluations with portion sizes changing from 124g to 110g. Sausages were omitted but cooked beef was included, consumed by only 45.0 percent of the children. The mean portion of polony changed from 55g to 38g and dropped to eleventh on the list. However, other forms of protein-rich food sources were also recorded in the 24-hr recall but not reflected in the Top 20 list, namely peanut butter (17g) consumed by only 6.0 percent, pilchards (70g) consumed by 2.0 percent and pork (85g) consumed by 2.0 percent of the children.

Foods from the dairy food group were still present on the Top 20 list but changed from fresh milk to cheese slices, (19^{th}) and were consumed by the majority (60.0 percent) of the children. The only starch food present was stiff maize meal which moved from fifth to first and the intake was diminished from a mean 234g to 154g. Bread remained unchanged in position but the mean intake changed from 153g to 119g. Similar results occurred for cooked rice, where the mean intake diminished from 157g to 117g, and French fries were included in the Top 20 list and consumed by the majority (60.0 percent) of the children.

The nutritional analysis (refer to Table 4.10) of the 24-hr recall shows a decline in the nutritional value of the diet even though the post-intervention 24-hr recall shows a diet where fruits have been included and the intake of high-fat snack items is lower. Although the macronutrients (carbohydrates, total protein and total fat) and micronutrients (Zn, Se, Fe, thiamin, riboflavin and vit. B6) were above the EAR for children aged nine to thirteen years before the intervention, there was nevertheless still a decline in mean intake, especially for Zn and Se, which dropped below the recommended EAR. Energy, total dietary fibre, Mg, vit. A, vit. K, vit. B12, Vit. C and vit. D were below the recommended EAR before the

intervention with the EG. The number of children consuming less than the daily EAR requirements increased for all the nutrients except total fat, total dietary fibre, Ca and Mg, which remained unchanged at 13.6

Table 4.10 Comparison of pre- and post-intervention nutritional values from 24-hr recall with EAR/AI for children aged 9-13 years (control group)

NUTRIENT	FEMALE *EAR/AI#	MALE *EAR/AI #	Mean of 24-hr recall pre-intervention	Mean of 24-hr recall – post-intervention	Variance of 24-hr recall – pre-intervention (%)	Variance of 24-hr recall – post intervention (%)	% of children < 100% of *EAR/AI# pre-intervention	% of children < 100% of *EAR/AI# post-intervention	Significant (p) change after the intervention
[1]Energy (kJ) #	8628 [2]	9569 [2]	6324.6	5110.9	-33.1	-46.0	95.4	100.0	**0.02**
[1]Total Protein (g) #	34	34	54.7	47.0	60.9	38.2	13.6	22.7	0.21
[1]Total Fat (g) #	25-35	25-35	48.6	40.9	94.4	63.6	13.6	13.6	0.22
[1]Total CHO (g) #	130	130	201.2	151.8	54.8	16.8	4.5	45.4	**0.01**
Vitamin E (mg)	9.0	9.0	4.5	2.9	-50.0	-67.8	86.4	100.0	0.06
[1]Total Dietary Fibre (g) #	26	31	12.4	12.8	-52.3	-50.8	90.9	90.9	0.84
Zn (mg)	7.0	7.0	7.4	5.5	5.7	-21.4	50.0	72.7	**0.00**
Se (mg)	35.0	35.0	51.8	27.5	48.0	-21.4	40.9	54.4	**0.02**
Ca (mg) #	1300.0	1300.0	356.5	269.5	-72.6	-79.3	100.0	100.0	**0.04**
Fe (mg)	5.9	5.7	11.8	5.9	100.0	0.0	0.0	54.5	**0.00**
Mg (mg)	200.0	200.0	197.1	175.1	-1.5	-12.5	68.2	68.2	0.28
Vit. A (µg)	445.0	420.0	335.5	132.2	-24.6	-70.3	63.6	100.0	**0.00**
Thiamin (mg)	0.7	0.7	1.1	0.7	57.1	0.0	4.5	50.0	**0.00**
Riboflavin (mg)	0.8	0.8	2.1	0.6	162.5	-25.0	9.1	72.7	**0.00**
Vit. B6 (µg)	0.8	0.8	1.5	1.0	87.5	25.0	9.1	36.4	**0.03**
Vit. K (µg) #	60.0	60.0	24.1	20.1	-59.8	-66.5	90.9	86.3	0.78
Vit. B12 (µg)	1.5	1.5	2.0	1.8	33.3	20.0	40.9	54.5	0.74
Vit. C (mg)	39.0	39.0	133.7	68.2	242.8	74.9	36.4	77.3	0.13
Vit. D# (µg)	5.0	5.0	1.4	1.5	-72.0	-70.0	95.4	90.0	0.75

*Estimated Average Requirements for age group 9 to 13 years (NICUS 2010)
#Adequate Intakes for age group 9 to 13 years (NICUS 2010)
mg milligrams
g grams
kJ kilojoules
µg micrograms
[1]NAP 2002
[2]Estimated energy requirements (EES) for females and males based on physical activity level (PAL) active

percent, 90.9 percent, 100.0 percent and 68.2 percent respectively. Nutrients where improvement was seen were vit K, from 90.9 percent to 86.3 percent, and

vit. D, from 95.4 percent to 90.0 percent, which meant an improvement in the daily intake of those nutrients.

Significant changes were seen for energy (p=0.02), where mean intakes decreased and all the children were consuming below daily requirements. Similarly, significance was seen for total carbohydrates (p=0.01), Zn (p=0.00), Se (p=0.02), Ca (p=0.04), Fe (p=0.00), Vit. A (p=0.00), thiamin (p=0.00), riboflavin (p=0.00) and vit. B6 (p=0.03), and all the results indicated an increase in the number of children not consuming the daily requirements for all the nutrients which had significance.

The energy supplied from the diet, as recorded in pre- and post-intervention evaluation, changed for protein and fibre combined (17.5 percent to 19.8 percent), carbohydrates (53.5 percent to 50.0 percent) and fat (29.0 percent to 30.2 percent).

Comparison of the dietary patterns of the EG and CG shows that the Top 20 lists of both groups in the pre-intervention results are very similar, in that the first five items are comprised of maize meal, bread, tea, and cold drink. The CG has the inclusion of water, while the EG indicates fresh milk. The consumption of vegetables and fruits is minimal in both groups, with the EG reflecting only two sources, whereas the CG reflects only one source of fruit. Legumes were present in the diet in the CG but not amongst the children of the EG. Both groups reflected high-fat snack items. In the post-intervention test the changes were again similar. The EG reflected changes such as the inclusion of protein, with mean portions improving, and the addition of eggs and another fruit. Similarly, the CG indicated the inclusion of more fruit in the diet, which was contributed by the provision of fruit at the school. They, too, incorporated high-fat snack items in the form of polony, sugar and French fries. The nutritional analysis of both groups showed significant changes for various macronutrients and micronutrients. Although energy intake improved amongst the EG, the CG

showed a decline in mean intakes, with an increase in the number of children not meeting the daily requirements. Similarly, total protein intake, although improving amongst the EG, declined for the CG. The EG reflected mean intake improvement for total dietary fibre, Se, Mg and thiamin, while the CG had improvement only in total dietary fibre and vit. D.

4.13 Discussion

Nutrition education interventions amongst children have been implemented globally with successful results in improving their knowledge and in increasing the fruit and vegetable consumption within schools and communities (Parmer *et al*. 2009:212-217; Matvienko 2007:281-29=85; Anderson *et al*. 2005:650-656, Blom-Hoffman *et al*. 2004:48; Pérez-Rodrigo & Aranceta 2003) but only a few such programmes have been implemented in South Africa, with emphasis on adults and children aged two to five years (Peltzer 2004:24; Walsh *et al*. 2003:85-89; Charlton *et al*. 2002:S12; Walsh *et al*. 2002:3-9).

Nutrition education was implemented in this informal community with the aim of improving knowledge and encouraging behavioural change amongst the children, objectives similar to those set by Napier and Oldewage-Theron (2005) in a neighbouring community. The pre-intervention nutrition knowledge results, of the two communities were similar in that the percentage of correct answers for physical activity and health was 26.0 percent in Boipatong compared with 27.4 percent in the neighbouring community. Similar results were found in questions relating to the importance and amount of water consumption daily, (59.0 percent compared with 41.0 percent), and the importance of variety in the diet, (27.0 percent compared with 24.0 percent). Misconceptions regarding sources of nutrients, as found in this study amongst 38.6 percent of the children, were similar to those found in a study amongst adults in South Africa, where 35.0 percent of adults partially understood nutrition (Peltzer 2004:24).

A mean improvement of 13.4 percent was obtained in this study amongst the EG, in comparison with 12.3 percent in a neighbouring community (Napier & Oldewage-Theron 2005:8), 41.1 percent amongst primary school children in the USA (Seher 2008), and a mean change of 2.17 amongst children in Malaysia (Shariff *et al*. 2008:123). A school setting was used in this study to implement the NEP. Significant impact was made on improving the nutrition knowledge of the children participating in this programme. Similar results were found amongst children where a classroom setting was used and the results reflected greater awareness of portion sizes and more questions were asked by the children regarding physical activity and portioning (Long *et al.* 2010:64). The majority of the studies over the past few years (refer to Chapter 2, Table 2.2) have been implemented within a school environment and results have indicated that school-based delivery is the most cost-effective approach. Delivering interventions through education systems may improve educational outcomes (Worsley 2005 S135-S143).

The questions in which significant ($p \leq 0.05$) improvements occurred even though the majority of the children still answered incorrectly after the intervention were related to the inclusion of starch on a daily basis and the variety of foods from each food group to be consumed on a daily basis, as well as portion sizes, nutrient content and function of specific fruits and vegetables, and classification of food groups. Questions in which significant improvements occurred and which the majority of the children answered correctly were those dealing with the relationship between health and physical activity, water consumption on a daily basis, source of vit. C, hygiene, fat intake, the consequence of not eating breakfast and classification of the food groups fruit, protein and sugary products.

Answers where majority of the children answered incorrectly, with no significant difference after the intervention, included the nutrient required for good eyesight, the variety required within the diet from the different food groups, serving sizes of the different food groups and the classification of a low-fat snack item. This

study reflected results in the pre- and post-intervention tests similar to those of a study amongst teens of low socioeconomic status, which found that little knowledge was present on topics relating to identification of the correct number of servings to be consumed daily, the correct identification of food groups, and the connection between dietary behaviour and chronic diseases (Fahlman, McCaughtry, Martin, Shen 2010:10-16).

When comparing the knowledge of the EG and CG, the EG and CG both had only 13 (34.2 percent) questions which the majority (>50 percent) answered correctly. In both groups, the questions which the majority answered correctly were the same and reflected on topics of (mean correct answers in brackets for both EG and CG) health and physical activity (Q2) (74.5 and 77.3 percent), classification of the food group, fruit (Q4 and Q23)(78.2 and 77.3 percent, 66.0 and 63.6 percent), nutrient content and source of calcium (Q6) (58.2 and 72.7 percent), the link between sugar and tooth decay (Q7) (92.7 and 86.4 percent), and the linking of food with specific colours (Q8) (mean 99.1 and 99.5 percent). Other questions included the consumption of vegetables and fruits on a daily basis (Q9) (87.3 and 72.7 percent), the linking of potassium with broccoli (Q10) (74.0 and 76.2 percent), serving size and serving per day of fat (Q14) (73.0 and 71.4 percent), the importance of hygiene (Q15) (70.9 and 77.3 percent), fat intake and classification (Q16 and Q19) (64.8 and 70.0 percent, 64.2 and 95.5 percent), and how one must stay healthy (Q18) (55.6 and 68.2 percent). However, in the evaluation after the intervention, the identical questions were answered correctly by a majority (50 percent) of the children in the CG with the inclusion of Question 14.4 (66.7 percent), concerning the serving size and servings per day for the fruit food group. The improvement of knowledge may be attributed to the inclusion of fruit as part of a feeding scheme which was introduced during the intervention period. Similar results occurred amongst the children of the EG, but the questions where the majority already knew the answer improved, along with the further improvement in certain topics where results indicated that the majority of the children did not know the answer before the

intervention. These additional improvements occurred in the topics relating to the linking of vit. C to certain fruits and vegetables (56.4 percent), the weekly allowances for the protein-rich food, eggs (71.7 percent), and the classification of the food groups, sugary food products (70.9 percent) and dairy products (61.8 percent). Both EG and CG showed some form of nutrition knowledge before the intervention. This is similar to findings during the baseline survey (Chapter 3), where 87.9 percent confirmed that nutrition information was obtained at school, and 23 percent recorded that they obtained nutrition information from radio or television. Some form of nutrition knowledge existed but clarity was needed on specific topics. The findings of this study, where very little difference occurred in the results between the pre- and post-intervention tests amongst the CG, can be compared to the pilot study competed by Shariff *et al.* (2008) where similarly, no significant difference was found between the pre and post results of the CG. Similarly, the NK existed prior to the intervention, with an improvement after the intervention. A study completed by Watson and co-authors found that 17 out of 45 students had prior knowledge of and exposure to nutrition-related courses. The pre test showed mean scores of 7.4 with improvement to 8.6 after the intervention. A report by Oldewage-Theron and Egal (2009), indicated that children between the ages of six and seven had some form of NK before the intervention, with mean scores ranging between 3.1 and 45.8 percent for multiple-choice questions, 20.6 to 42.3 percent for identification questions and 44.0 to 76.1 percent in true/false questions.

The dietary changes in the 24-hr recall for the EG after the intervention reflected the Top 20 list with no cookies, although vetkoek was present after the intervention with a mean portion of 72g. The EG had a change in macronutrient intake with energy, total protein and carbohydrates increasing, and a decline in fat intake. This also occurred amongst children in Nigeria after the intervention (Eboh & Boye 2006:309). The protein sources, cooked beef and sausages, were omitted from the diet; however, eggs were introduced in the Top 20. The addition of an orange to the Top 20 list occurred, and there was an inclusion of

another vegetable source, atchar. This is similar to findings by Hanson and Chen (2007:263-285), where teens of low socioeconomic status have inadequate consumption of fruits and vegetables and greater consumption of fats and refined sugars.

A change in behaviour amongst a few children in the experimental group was found in studies by Parmer *et al*. (2009:212-217) and Fahlman *et al*. (2008:216-222), where the NE resulted in an increase in fruit and vegetable intake in the lunchroom, and the children were less likely to eat junk food. However, this was not evident in this study. Fruit and vegetable intake increased, with the inclusion of only one fruit and one vegetable, and high-fat snack items were still present in the 24-hr recall. These changes were very small in comparison with studies in USA, where significant increases in fruit and vegetable consumption occurred after an intervention in 26 primary schools (WHO 2005). These studies were, however, not conducted within poor rural communities, where poverty exists and very little money is available for food. Vegetables found on the 24-hr recall list of the experimental group, but not listed on the Top 20 list, included beetroot, cabbage, carrot, mixed vegetables, peas and spinach, with a total mean intake of only 33.9g. If any child in this study were to consume 33.9g of each portion of the vegetables listed above, the total portion would be 203.4g, which would not be within the daily requirement of five portions a day, equivalent to 400g per portion (Steyn *et al.* 2009). Unfortunately, the majority of the children do not consume vegetables and this is probably why micronutrient intakes were low amongst the children in this study. The additional vegetables listed above, which were not present in the Top 20 list, were consumed by only one to two children (1.8 percent and 3.6 percent).

In comparison with the NFCS-FB-1 (Labadarios *et al*. 2008:254-267) the consumption of bread remains high. Bread was listed at number one on the Top 20 list for children in the experimental and control groups, with a mean portion of 358g and 119g respectively, consumed by 100.0 percent of the children,

compared with eight out of ten households procuring bread for consumption. Brown bread was procured in seven out of ten households (Labadarios *et al*. 2008:258). The children in both experimental and control groups consumed a mean portion of 132g and 154g of maize meal after the intervention, which supports the findings of Labadarios *et al*. (2008:258), where nine out ten households have maize meal.

In a comparison of the dietary patterns of children with the SA FBDG, a few behavioural patterns reflect within the 24-hr recall completed by the children after the intervention. One recommendation is to make starchy foods the basis of every meal. The results of this study indicated a carbohydrate-based diet, which was provided primarily through bread and maize meal. Mandatory fortification of maize meal and wheat flour was introduced in 2003. The bread and maize meal consumed by the children in this study was thus fortified with micronutrients. Although the intake of fruits and vegetables was very low, the children obtained some micronutrients, although not sufficient for the daily requirements, from the fortified maize meal and bread. A study by Steyn and co-authors (2007:307-313) found micronutrient levels to be lower in rural areas but the high consumption of fortified maize-meal and wheat flour (bread) contributed to the raised levels of micronutrients, although mean intakes remained below the EAR.

Another recommendation of the SA FBDG is to eat fat sparingly. Although the daily fat intake is higher than required, it fell to 25.6 percent of total energy supply after the intervention. The dietary patterns of the children reflected a decline in energy supplied from high-fat snack items, with the elimination of sweets. This was similar to findings by Fahlman *et al*. (2008), where after the intervention the children consumed less junk food. However, vetkoek and French fries were introduced into the diet but were consumed only by 12.7 and 23.6 percent of the children respectively.

Unfortunately, certain recommendations were not adhered to. Protein and legumes were not consumed by all the children on a daily basis, and legumes do not appear within the Top 20 list. The eating of vegetables and fruits, as advised in the SA FBDG, are not reflected within the 24-hr recall, and very few children were consuming a diet filled with variety, with only 16.4 percent and 14.5 percent consuming an orange and an apple, and 25.5 percent consuming atchar.

Unfortunately the number of fruit and vegetable servings and the number of children consuming these items was very low in the 24-hr recalls of both the EG and CG. This is, however, completely different from other studies where significant changes were seen amongst EGs, and more fruits and vegetables were consumed (Gerstein *et al.* 2010). This was evident amongst some children in the CG where fruit intake increased due to the provision of fruit by the school. The dietary intake for the CG showed few changes, with the inclusion of fruit occurring amongst 10.0 percent, 30.0 percent and 20.0 percent. More breakfast cereal items were omitted and the inclusion of French fries, sliced cheese, polony and atchar was found, which was contributed by the lunch made available for purchase at the tuck shop. Energy distribution changed slightly, and the 3,5 percent drop in energy supplied by carbohydrates was seen to increase fat and protein energy supply.

When comparing the pre-intervention results, both groups were consuming a carbohydrate-based diet, with the first three items made up of tea, bread, and cold drink for the EG, and juice, bread and maize meal for the CG. Bread was consumed by both groups with a mean portion of 146g (94.5 percent) for the EG and 153g (100.0 percent) for the CG. The mean portion of 234g of maize meal for the CG was double that of the EG at 125g. High-fat snack items were more prevalent amongst the EG in the form of potato crisps, polony, sweets, sugar and cookies, whereas the CG reflected only polony and potato crisps. Fruit and vegetable items were minimal for both groups, which had only one portion of each item. The intake of the CG seemed to differ from that of the EG in the

inclusion of legumes, and some cereal items, whereas the EG had more protein sources included. After the intervention, although the first three items still reflected carbohydrate-based items, the portion sizes changed. For the experimental group, the mean intake of bread doubled from 146g to 358g, while for the CG the mean intake declined to 119g. Both groups had an improvement in variety, in that the EG group introduced another vegetable, boiled potato and eggs. In the CG, on the other hand, although fruit intake increased, the cereal items were no longer in evidence, while French fries and processed cheese were included. However, it is evident in these results that the dietary patterns of the two schools were very similar. The type of food made available by the school was reflected within the Top 20 list, as in the CG where the meals consisted of either fruit or a bread dish made up of polony, processed cheese, French fries and atchar. The EG had more snacks available. The food items listed in the Top 20 lists were foods which were eaten at school and sold by vendors along the road. Only a few children were able to consume a variety of foods in the form of proteins, fruits and dairy.

4.14 Conclusion

The results of the NEP indicated a statistically significant immediate improvement in nutrition knowledge amongst the primary school children participating in the NEP with no significant changes with dietary practices, although nutrient analysis revealed significant changes. The mean correctly answered questions improved by 0.13 units from the pre-intervention (0.45) to the post-intervention (0.58) results. This meant an improvement of 13.4 percent amongst the children after the intervention. In the power calculation exercise, the author hypothesized a 30 percent significant change with a SD 1.0 in knowledge, but the results indicated an increase of only 13.4 percent. Thus the results cannot be generalized to other communities. The CG had an improvement of only 1.3 percent, from 49.2 percent to 50.5 percent. There was no form of NE and this was evident as the questions which were answered correctly by the majority of the children in the

first test were the same as in the second test. The nutrition information did not overlap as no significant changes were made except for the daily servings of fruit. However, paired tests indicated that the results of all the drop-outs combined had statistical significance in four out of the 24 questions in the pre-intervention.

The community and children are still faced with the burden of food insecurity, as the dietary pattern, reflected in the 24-hr recall, still shows a diet based on carbohydrates, with very little variety. There were only a few dietary changes made by a small number of children, which shifted the energy distribution but the overall impact is not observed as no or very few legumes, fruits and vegetables occur in the diet. The nutrient value of the diets still remains below the daily requirements, with significant changes occurring within the EG and CG. However, the 24-hr recall questionnaire is not always reliable as it reflects the intake for only one day. Multiple 24-hr recalls can be done with a single individual over a period of time in order to provide a more reasonable estimate of the child's usual intake (Walsh & Joubert 2007:296). Certain factors may affect the intake, as described by Walsh and Joubert (2007), and Margetts and Nelson (2000). These reflect as limitations of using the 24-hr recall questionnaire and include the difficulty in determining accurate portion sizes when food models are not available. The children and participants may be unable to recall the kinds and amounts accurately. Other factors which affect the relative validity of the 24-hr recall completed by the participants include depression, body image, history of dieting, social desirability, time of the month, age and sex (Gibson 2005). Furthermore, socioeconomic status and ethnicity may also affect the outcomes (Kristal, Feng, Coates, Oberman, George 1997:856-669).

An evaluation was conducted to determine the long-term implications of the NEP on nutrition knowledge and whether behavioural change in food choices occurs over a longer period in the EG. This was done and is described in Chapter 5.

CHAPTER 5: LONG-TERM RETENTION OF NUTRITION KNOWLEDGE AND DIETARY PATTERNS

5.1 Introduction

The aim of NE was to improve nutrition knowledge and encourage better dietary choices in food-pattern behaviours. Healthy eating behaviours should be formed from an early age in order to continue into adulthood (Sharma, Gernand, Day 2008:361). Consequently, the main focus of this study was to improve the nutrition knowledge of children in the primary school with the aim of encouraging the children to make healthier food choices in the future. The objective of this chapter was to determine how much nutrition information the children had retained over a longer period of time (nine months), and to determine whether dietary patterns had changed. This formed part of the 'assessment' phase of the triple A cycle. The results will allow future researchers implementing this type of programme to plan for continuity within programmes to allow children to retain what they have learnt and focus on areas of difficulty.

5.2 Sampling

The same children from Makapane Primary School, referred to in chapter four as the EG, were used for this long-term measurement. There were 55 children who completed the immediate post-intervention test, but in the long-term measurement only 21 were available to complete the test. The remaining 34 children had gone to other secondary schools outside the region, as they were in grade 7, the final year of primary school, during the NEP

5.3 Fieldworkers

The same administrator and fieldworker used in the NEP were requested to assist the researcher with the long-term measurements. An additional fieldworker was trained to assist in completing the 24-hr recall questionnaires.

The administrator and fieldworkers were provided with a revision session where the objectives of this study were highlighted, as well as the requirements for the completion of the 24-hr recall and the NKQ.

5.4 Data collection

5.4.1 Nutrition knowledge questionnaire

The same NKQ used in the intervention (refer to Section 4.6.1.1 Knowledge questionnaire) was used for testing the long-term retention of the nutrition knowledge of the children.

5.4.1.1 Administration

After nine months, 21 children were available to complete the questionnaires. The only criterion required for completion of the long-term measurement was the completion of the NEP and immediate post-intervention test, and this resulted in only 21 questionnaires being used. This was controlled with the aid of the attendance register which reflected the names of the children who had completed the post-intervention test. The children were seated in the same classroom used during the NEP. An attendance register was signed based on the names provided on the NKQ. There was no interaction amongst the children while completing the questionnaire. The researcher and fieldworkers ensured

all the questions were completed before allowing the children to proceed to the next measurement, the 24-hr recall.

5.4.1.3 Data analysis

The NKQs were captured on Microsoft Excel and analyzed using SPSS version 17 for descriptive statistics (frequencies, means and SD). Paired t-tests were completed to determine any statistically significant differences between the post-intervention and long-term measurements.

5.4.2 24-hr recall

5.4.2.1 Description

A validated 24-hr recall questionnaire (the same as used pre- and post-intervention) was used (Section 4.6.1.2).

5.4.2.2 Administration

After nine months, 21 children were available to complete the 24-hr recall. The 24-hr recall questionnaires were completed in the classrooms with the assistance of a trained administrator and fieldworkers. Food models were used to assist in the estimation of portion sizes and identification of food items. Foods and portion sizes consumed within the preceding 24-hrs were recorded. Each child received a container of fruit juice and fruit upon completion of both questionnaires.

5.4.2.3 Data analysis

The 24-hr recall questionnaires were captured and analyzed by means of the FoodFinder Program, by a registered Dietician. Means and SDs were calculated, as well as the Top 20 most commonly consumed food items. The means of the nutrients were compared with the EAR/AI of children aged nine to thirteen years. Paired t-tests were completed to determine any statistical significance between the post-intervention and long-term evaluation.

5.5 Results

5.5.1 Nutrition knowledge

The result of the long-term evaluation, (refer to Table 5.1) indicated that retention of nutrition knowledge was still present, as 20 out of 38 questions reflecting a further improvement from the post intervention results, while 15 questions declined, and two remained unchanged. The improvement in results indicated good retention of knowledge. Only one question showed significance (p=0.03) from the post test of 38.1 percent compared with 14.3 percent in the long-term assessment. This question related to the importance of consuming starchy foods on a daily basis.

The questions where nutrition knowledge was retained and the results remained unchanged between the post-intervention and long-term evaluations related to the classification of protein-rich foods with post-intervention and long-term results of 50 percent. The other question which remained unchanged related to the daily consumption of fat, and in both tests the children indicated that fat was not necessary on a daily basis.

The questions which reflected a decline, although the majority still answered correctly, related to topics on the importance of hygiene (post-intervention and long-term results in brackets) (80.0 and 76.2 percent), the daily serving size of fat (76.5 and 61.1 percent), personal hygiene (90.0 and 85.7 percent), classification of low-fat snack items (85.0 and 76.2 percent), and how to stay healthy (60.0 percent and 57.1 percent).

The questions which the majority (>50 percent) of the children answered incorrectly in both post-intervention and long-term evaluation related to the questions (post-intervention and long-term results in brackets) on the inclusion of milk and fat on a daily basis (23.8 and 19.0 percent), the source of vit. A (40.0 and 25.0 percent), daily serving sizes of starch (29.4 and 22.2 percent), dairy products (41.2 and 38.9 percent) and fruit and vegetables (23.5 and 11.1 percent), and the classification of low-fat snack items (26.3 and 9.5 percent). Although the children knew the source of vit. C in the post-intervention test (60.0 percent), retention of knowledge was poor as the results of the long-term test indicated a decline of 25 percent.

Questions (n=21) (post and long-term results in brackets) in which nutrition knowledge was retained and improvements occurred related to water consumption on a daily basis (84.2 and 95.2 percent), classification of fruit (85.0 and 95.2 percent;), source of vit. A (50.0 and 61.9 percent), source of Ca for strong bones and teeth (90.0 and 100.0 percent), linking of colours to vegetables and fruits (mean 96.4 and 100.0 percent), importance of fruit and vegetable consumption on a daily basis (85.7 and 90.5 percent), source of potassium (75.0 and 80.0 percent), number of eggs to be consumed weekly (63.2 and 85.7 percent), the consequence of no breakfast (83.3 and 85.7 percent) and the classification of the food group, sugary products (65.0 and 71.4) and dairy products (55.0 and 76.2 percent).

The questions in which improvements occurred but the majority did not answer correctly (post and long-term results in brackets) related to the correct serving size of starch (5.0 and 15.0 percent), the serving size of protein-rich foods (25.0 and 28.6 percent) and classification of the starch group (15.0 and 23.8 percent).

Table 5.1 Comparison of correct answers and significance (n=21) between post-intervention and long-term tests

DESCRIPTION OF QUESTION	**CORRECT ANSWERS (%) POST-INTERVENTION n=21**	**CORRECT ANSWERS (%) LONG-TERM n=21**	**VARIANCE BETWEEN POST AND LONG-TERM**	**STATISTICAL SIGNIFICANCE ($p \leq 0.05$)**
Importance of health and physical activity	63.2	66.7	3.5	0.72
Importance of health and physical activity	60.0	57.1	-2.9	0.66
Importance of hygiene	80.0	76.2	-3.8	1.00
Importance of hygiene	90.0	85.7	-4.3	1.00
Daily water consumption	84.2	95.2	11.0	0.08
Classification of the food group: fruit	85.0	95.2	10.2	0.16
Classification of the food group: fruit	85.2	95.2	10.2	0.33
Classification of the food group: starchy foods	15.0	23.8	8.8	0.58
Classification of the food group: dairy	55.0	76.2	21.2	0.16
Classification of the food group: sugary products	65.0	71.4	6.4	0.30
Classification of the food group: protein-rich foods	50.0	50.0	0.0	0.75
Importance of specific nutrients: vitamin A	50.0	61.9	11.9	0.49
Nutrient content and function of dairy products	75.0	95.2	20.2	0.26
The link between sugar and tooth decay	90.0	100.0	10.0	0.33
Linking of fruit and vegetables with colours: purple - grapes	100.0	100.0	0.0	-
Linking of fruit and vegetables with colours: green - spinach	95.2	100.0	4.8	-
Linking of fruit and vegetables with colours: red - apple	95.2	100.0	4.8	-
Linking of fruit and vegetables with colours: yellow - banana	95.2	100.0	4.8	-
Linking of fruit and vegetables with nutrients: potassium - broccoli	75.0	80.0	5.0	0.67

Table 5.1 cntd. Comparison of correct answers and significance (n=21) between post-intervention and long-term tests

DESCRIPTION OF QUESTION	CORRECT ANSWERS (%) POST-INTERVENTION n=21	CORRECT ANSWERS (%) LONG-TERM n=21	VARIANCE BETWEEN POST AND LONG-TERM	STATISTICAL SIGNIFICANCE ($p \leq 0.05$)
Linking of fruit and vegetables with nutrients: vitamin C - oranges, grapes and raisins	60.0	35.0	-25.0	0.06
Linking of fruit and vegetables with nutrients: vitamin A - carrots	40.0	25.0	-15.0	0.16
Importance of variety in the diet: milk and fats	23.8	19.0	-4.8	0.72
Importance of variety in the diet: meat, fish and legumes	23.8	42.9	19.1	0.19
Importance of variety in the diet: fats	0.0	0.0	0.0	-
Importance of variety in the diet: starch	**38.1**	**14.3**	**-23.8**	**0.03**
Importance of variety in the diet: fruit and vegetables	85.7	90.5	4.8	-
Importance of variety in the diet: sweets	4.8	0.0	-4.8	-
Importance of variety in the diet: take-away / junk food	4.8	0.0	-4.8	-
Serving size of starch	5.0	15.0	10.0	0.33
Serving size of protein-rich foods	25.0	28.6	3.6	1.00
Servings size and servings per day: fats	76.5	61.1	-15.4	0.33
Servings size and servings per day: starch	29.4	22.2	-7.2	0.33
Servings size and servings per day: dairy products	41.2	38.9	-2.3	1.00
Servings size and servings per day: fruit and vegetables	23.5	11.1	-12.4	0.33
Number of eggs to be consumed weekly	63.2	85.7	22.5	0.06
Consumption of high-fat foods on a daily basis	85.0	76.2	-8.8	0.43
Classification of low-fat snacks	26.3	9.5	-16.8	0.27
Lack of breakfast	83.3	85.7	2.4	0.21
MEAN	**56.5**	**57.6**	**1.1**	**0.54**

In a comparison of the results of the post-intervention and long-term tests with those of the pre-intervention test, it is evident that although improvement occurred after the intervention, certain questions reflected poorly in the pre test, with improvements after the intervention, but the majority still answered

incorrectly and results declined in the long-term evaluation, indicating poor retention. These questions related to the importance of variety in the diet, which reflected poor results as the majority of the children answered incorrectly. However the majority (87.3, 85.7 and 90.5 percent) of the children agreed that fruit and vegetables need to be consumed daily. Retention of knowledge on the sources of vit. C and vit. A improved significantly (p=0.00) after the intervention but results from the long-term tests showed a decline to 35.0 and 25.0 percent of the children answering correctly. Knowledge of the daily serving sizes for starch, dairy and fruit and vegetables improved after the intervention but the majority did not answer correctly, and the retention of this knowledge was poor as results indicated 22.2, 38.9 and 11.1 percent answering incorrectly in the long-term tests compared with post-intervention results of 29.4, 41.2 and 23.5 percent respectively. The question relating to the identification of a low-fat snack item was not answered correctly in the pre-intervention test by 83.0 percent of the children. Although improvement occurred, with only 75.9 percent of the children answering incorrectly, the long-term results showed poor retention and knowledge as the number of children answering incorrectly increased to 90.5 percent.

5.5.2 Dietary intake: 24-hr recall questionnaire

The Top 20 list (refer to Table 5.2) is reflective of the diets of the children (n=21), who participated in the intervention after nine months. The first five items are carbohydrate-based, with all the children consuming maize meal and bread.

Starchy food items are found on the list in the form of soft maize meal (n=9) with a mean portion of 158g consumed by 19.0 percent of the children, cooked rice (n=11) with a mean portion of 90g consumed by 19.0 percent of the children, and oats (n=15) with a mean portion of 250g but consumed by only 4.7 percent

(n=1). Protein food sources are found on the Top 20 list at number seven in the form of cooked chicken, with a mean portion of 72g and consumed by 57.1 percent of the children, boerewors (n=12) and cooked beef mince (n=16) with mean portions of 76g and 115g respectively, but consumed by only 19.0 and 9.5 percent respectively. Other protein sources included polony (processed meats) at number eight with a mean portion of 57g and consumed by 66.7 percent of the children, and cooked chicken feet at number 18 and consumed by only 9.5 percent of the children with a mean portion of 100g.

Table 5.2 Top 20 food list and mean consumed (Long-term with experimental group) (n=21)

FOOD ITEM DESCRIPTION (uom*)	**MEAN (by weight)**	**SD**	**No. of children consuming – percentage in brackets**
1. Maize meal, stiff (g)	130 g	88	21 (100.0)
2. Bread, brown and white (g)	121 g	44	21 (100.0)
3. Tea, brewed (ml)	283 ml	25	9 (42.8)
4. Fruit juice (ml)	253 ml	135	7 (33.3)
5. Cold drink, carbonated (ml)	285 ml	110	4 (19.0)
6. Milk, fresh (ml)	152 ml	136	7 (33.3)
7. Chicken, cooked (g)	72 g	28	12 (57.1)
8. Polony (g)	57 g	33	14 (66.7)
9. Maize meal, soft (g)	158 g	81	4 (19.0)
10. Tomato gravy (g)	57 g	30	7 (33.3)
11. Rice, cooked (g)	90 g	11.5	4 (19.0)
12. Boerewors (g)	76 g	26	4 (19.0)
13. Apple (g)	90 g	0	3 (14.3)
14. Vetkoek (g)	90 g	17	3 (14.3)
15. Oats, cooked (g)	250 g	0	1 (4.7)
16. Beef, cooked (g)	115 g	7	2 (9.5)
17. French fries (g)	45 g	27	5 (23.8)
18. Chicken feet, cooked (g)	100 g	28	2 (9.5)
19. Cheese, slice (g)	38 g	18	5 (23.8)
20. Pear (g)	90 g	0	2 (9.5)

Dairy is included in the diet as milk (n=6) and cheese (n=19), with mean portions of 152ml and 38g. However, the number of children consuming these items remains low at 33.3 and 23.8 percent only.

One vegetable is found in the form of tomato gravy (n=10) with a mean portion of 57g, and fruit is present in the form of apple (n=13), and pear (n=20) with portion sizes of 90g respectively. Although not present on the Top 20 list, other sources of fruit and vegetables are found (mean portion and number of children consuming in brackets), namely plum (30g, n=1), cabbage (42g, n=4), and cucumber (30g, n=1). High-fat snack items are present in the form of vetkoek (90g, n=3) and French fries (45g, n=5).

When compared with the post-intervention list, tea, maize meal and bread still reflected as the first three items, with maize meal moving from third to first, bread from first to second and tea now at number three. The portion size of maize meal remained similar (132 and 130g), while tea increased from a mean portion of 240ml to 283ml and bread declined from a mean portion of 358g to 130g. Milk, from the dairy group remained at number six but the portion doubled from 77ml to 152ml. Sliced cheese has been included in the Top 20 list with a mean portion of 38g but consumed by only 9.5 percent.

The inclusion of protein has improved with the addition of cooked beef (115g), chicken feet (100g), and boerewors (76g) but consumed by only 9.5 and 19 percent of the children. This is very similar to the results of the 24-hr recall before the intervention, where five sources of protein were found within the Top 20 items, although consumed by only a few children. Post-intervention results reflected only three sources of protein, but in the long-term measurement, five sources of protein are again found, although the consumption of each source is very low.

Fruit was still present in the form of apple, now at number 13 on the list compared with number 19, with the mean portion size increasing from 67g to 90g. Orange (n=12) has been replaced with pear (n=20) but consumed by only

19.0 percent of the children. There was an improvement from the pre-intervention list of only one source of fruit within the Top 20. After the intervention, two fruit sources were present but consumed by only a few children. Unfortunately, there were still only two fruit sources found on the list in the long-term evaluation.

High-fat food items still appeared on the Top 20 list in the form of vetkoek, with the mean portion increasing from 72g to 90g, and French fries, with mean portion sizes increasing from 66g to 90g. The pre-intervention list included (mean portion in brackets) potato crisps (30g), sweets (41g), sugar (18g) and cookies (59g). The post-intervention evaluation reflected a change towards different forms of high-fat snacks in the form of vetkoek (72g) and French fries (66g), with no sugar or potato crisps appearing on the Top 20 list for post-intervention and long-term evaluation.

Vegetable intake before the intervention reflected only tomato and onion gravy (27ml), with the inclusion of atchar (42g) after the intervention. Unfortunately, the long-term evaluation reflected only tomato and onion gravy (57ml) as a source of vegetable.

The long-term evaluation, (refer to Table 5.3) reflected a diet where the nutritional value still did not meet the daily requirements for children aged nine to thirteen years (variance between mean intake and EAR in brackets) for energy (43.6 percent), vit. E (61.1 percent), total dietary fibre (58.1 percent) and Ca (79.8 percent). Similar results occurred for other micronutrients, vit. A, vit. K and vit. D, with values below EAR by 72.8 percent, 57.5 percent and 70.0 percent respectively. The macronutrients - protein, carbohydrates and fat - reflected mean intake values above the daily requirements. Micronutrients which reflected values above EAR include only Se, with a mean intake of 36.8mg, Fe, 5.7mg, thiamin, 0.7mcg and vit. B12, with a mean intake of 2.1mg. This is due to the intake of protein sources present in the 24-hr recall. Improvements were noted

only for carbohydrates, where the number of children not consuming the daily requirements dropped from 18.2 percent to 4.7. For the remaining nutrients, the number of children not meeting the daily requirements increased, except for Ca, which remained unchanged at 100.0 percent, and vit. C, with a 0.1 change to 61.9 percent. The lack of variety within the diet was evident as total dietary fibre intake was below requirements for all the children. Very few fruits, vegetables and legumes reflected in the mean intakes, with Zn, Mg, vit. A, thiamin, riboflavin, vit. K and vit. D being deficient.

Table 5.3 Comparison of post-intervention and long-term nutritional value of 24-hr recall with EAR/AI for children aged 9-13 years (Experimental Group)

NUTRIENT	FEMALE *EAR/AI#	MALE *EAR/AI #	Mean of 24-hr recall – post-intervention	Mean of 24-hr recall – long-term	Variance of 24-hr recall – post-intervention (%)	Variance of 24-hr recall – long-term (%)	% of children < 100% *EAR/AI# post	% of children < 100% *EAR/AI# long-term	Significant (*p*) change in the after long-term evaluation
[1]Energy (kJ) #	8628[2]	9569[2]	8016.6	5332.5	-15.2	-43.6	80.0	100.0	**0.00**
[1]Total Protein (g) #	34	34	66.2	48.7	94.7	43.2	7.3	28.6	**0.00**
[1]Total Fat (g) #	25-35	25-35	54.2	47.4	116.8	89.6	7.3	19.0	0.09
[1]Total CHO (g) #	130	130	269.2	150.9	107.1	16.1	18.2	4.7	**0.00**
Vitamin E (mg)	9.0	9.0	5.1	3.5	-43.3	-61.1	85.4	90.5	**0.04**
[1]Total Dietary Fibre (g) #	26	31	18.0	10.9	-30.8	-58.1	81.8	100.0	**0.03**
Zn (mg)	7.0	7.0	7.8	5.8	11.4	-17.1	47.3	33.3	**0.01**
Se (mg)	35.0	35.0	88.8	36.8	153.7	5.1	30.9	47.6	**0.00**
Ca (mg) #	1300.0	1300.0	340.0	269.9	-73.8	-79.2	100.0	100.0	0.12
Fe (mg)	5.9	5.7	8.8	5.7	49.2	-3.4	21.8	47.6	**0.00**
Mg (mg)	200.0	200.0	236.5	164.0	18.3	-18.0	50.9	61.9	**0.05**
Vit. A (*µ*g)	445.0	420.0	212.6	121.0	-52.2	-72.8	94.5	95.2	0.12
Thiamin (mg)	0.7	0.7	1.1	0.7	57.1	0.0	20.0	52.4	**0.00**
Riboflavin (mg)	0.8	0.8	0.9	0.6	12.5	-25.0	56.4	71.4	**0.00**
Vit. B6 (mg)	0.8	0.8	1.3	0.8	62.5	0.0	23.6	38.1	**0.00**
Vit. K (*µ*g) #	60.0	60.0	24.7	25.5	-58.8	-57.5	89.1	90.5	0.72
Vit. B12 *µ*g)	1.5	1.5	1.6	2.1	6.7	40.0	56.4	42.8	0.77
Vit. C (mg)	39.0	39.0	58.1	68.7	49.0	76.2	61.8	61.9	0.63
Vit. D# (*µ*g)	5.0	5.0	2.1	1.5	-58.0	-70.0	80.0	90.5	0.37

*Estimated Average Requirements for age group 9 to 13 years (NICUS 2010)
#Adequate Intakes for age group 9 to 13 years (NICUS 2010)
mg milligrams
g grams
kJ kilojoules
*µ*g micrograms
[1]NAP 2002
[2]Estimated energy requirements (EES) for females and males based on physical activity level (PAL) active

Significance was found for the nutrient, energy (*p*=0.00), in which none of the children met daily requirements. Similarly, an increase in the number of children not meeting daily requirements was seen in the long-term evaluation and reflected in total protein (p.0=00), vit. E (*p*=0.04), total dietary fibre (*p*=0.03), Se (*p*=0.00), Fe (*p*=0.00), Mg (*p*=0.05), thiamin (*p*=0.00), riboflavin (*p*=0.00) and vit. B6 (*p*=0.00). For Zn, there was significant (*p*=0.01) change, in that the mean

intake decreased, with a decrease in the number of children meeting the daily requirements. For the micronutrient zinc, the mean intake declined, while for vit. B12, the mean intake improved. The macronutrient carbohydrate had similar results, where the mean intake decreased but the number of children meeting the daily requirements improved. However, both micronutrients, vit. B12 and Zn reflected an improvement in the number of children meeting the daily requirements, whereas the remaining nutrients reflected a decline in the number of children meeting the daily requirements.

Table 5.3 reflects the comparison of the nutritional value of the post-intervention and the long-term 24-hr recall measurements. The macronutrient (protein, carbohydrates and fat) intake decreased from post-intervention to long-term measurement, although still remaining above EAR for children aged nine to thirteen years of age. Energy intake decreased by 2684.1 kJ with similar results for protein (17.5g), fat (6.8g) and carbohydrates (118.3g). The mean energy intake was 43.6 percent lower in the long-term evaluation when compared with the EAR for children aged nine to thirteen years.

The Top 20 list from the long-term measurement shows a decline in the high-fat items like potato crisps and sugar, and this is seen in the nutritional value, where the total fat intake declined by 5.3g. The micronutrient vit. B12 increased by 0.5µg, possibly as a result of the increase in protein sources within the diet. Except for Vit. K, vit. B12 and vit. C, the remaining micronutrients declined in the long-term measurement when compared with the post evaluation. Micronutrients which reflected below EAR (percentage in brackets) for the post-intervention and long-term measurements were vit. E (43.3 and 61.1 percent), total dietary fibre (30.8 and 58.1 percent), Ca (73.8 and 79.2 percent), vit. A (52.2 and 72.8 percent), vit. K (58.8 and 57.5 percent) and vit. D (58.0 and 70.0 percent). Micronutrients which were higher than EAR (long-term percentage in brackets)

in post evaluation but lower in the long-term measurement included Fe, zinc, thiamin and Mg. Micronutrients where values remained above EAR for both post and long-term measurements included vit. B12, vit. C, thiamin and vit. B6. The macronutrients, carbohydrates, fat and protein, remained above EAR immediately after intervention and in the long-term measurement. This is reflected in the Top 20 list with the inclusion of more protein, although intake levels declined from 54.5g to 46.5g, and the inclusion of another fruit.

Energy distribution between post-intervention and long-term measurements (percentages in brackets) is allocated to protein (13.7 and 15.6 percent), carbohydrates and fibre combined (60.4 and 49.9 percent) and fat (25.8 and 34.4 percent). The Top 20 list reflects the inclusion of boerewors (76g), cooked beef (115g), chicken feet (100g) and vetkoek (90g), which may contribute to the increase in energy supplied from fat and protein. The decline in energy supplied from carbohydrates and fibre could be due to the decline in portion size of bread, from 358g to 130g.

5.6 Multivariate Analysis

A multivariate analysis was completed to determine if there was any significant correlation between certain nutrient intakes and answers provided in the long-term measurement.

The energy intake amongst the children was compared against the general knowledge, where all the questions of the NKQ were considered. Only through the intercept model was significance concluded for the questions relating to the importance of hygiene (Q2; p=0.00), the number of eggs to be consumed weekly (Q13; p=0.00), the importance of hygiene (Q15; p=0.00), and the classification of the food groups, dairy (Q21; p=0.01) and fruit (Q23; p=0.00).

The protein intake was compared to four questions which related to protein and protein-rich foods. Protein intake was reflected as a covariant and statistical significance (p=0.00) was seen, through the intercept model, for Question 13, which related to the number of eggs to be consumed on a weekly basis.

The vit. C intake of the children was compared to six questions in the NKQ which related to fruit and vegetables. Significance was seen using the intercept and corrected model for questions 10.2 (p=0.05) and 23 (p=0.00) and these questions related to the linking of vit. C with oranges, grapes and raisins, and the classification of the food group, fruit, where significance (p=0.00) was observed.

The implications of these results, when compared to studies as far back as 1985 (Perron &Endress 1985), where knowledge, attitude and dietary practices were correlated amongst adolescent female athletes, shows that when resources permit, children will try and make the correct choices. Although the study by Perron & Endress (1985) found a link between nutrition knowledge and attitude, and no significance was seen towards dietary practices, within this study significances were seen. Similarly, studies conducted globally (refer Table 2.2) reflect how providing nutrition education and appropriate resources, encourages improved dietary intake. Implications for future studies therefore include implementing a co-ordinated NEP with a gardening and/or food-aid program.

5.7 Discussion

The purpose of conducting the long-term test was to determine how much nutrition knowledge had been retained by the children after nine months and whether any change in dietary behaviour and food intake patterns had occurred. The comparison of results of the pre-, and post-intervention evaluation indicated

that nutrition knowledge had improved by 13.4 percent amongst the primary school children, slightly higher than that found by Venter *et al*. (2001:108) where the improvement between the two tests was 9.2 percent.

In the long-term evaluation of this study, the mean of correct answers was 57.6 percent, compared with 56.5 percent in the test immediately after the intervention (refer to Table 5.1). However, the immediate post-intervention test (Chapter 4) indicated the mean correct answers at 58.8 percent. The mean of correct answers was recalculated based on the children available for the long-term evaluation. This was slightly lower than findings by Lamb, Joshi, Carter, Cowburn, Matthews (2006), where the children's knowledge increased after the intervention but after three months, only three out of the five questions (60 percent) showed retention of knowledge. However, in this study, there was an improvement from 56.5 percent correct answers in the post evaluation, and 21 out of 38 questions showed retention of knowledge. The retention of knowledge may be attributed to the types of NETs used and the method of teaching, as found by Raman, McLaughlin, Violato, Rostom, Allard, Coderre 2010:250-255; Lamb *et al.* 2006:161-165), where consistent small amounts of information dispersed over a period of time, and immediately completing activities relating to the topics discussed, can encourage retention of knowledge.

However, within this study there were questions in the pre-intervention test that indicated poor nutrition knowledge and although a slight improvement occurred after the intervention, most of those improvements declined over the long term. Findings by Salgado, Mardones, Ivanovic (2005:57-79) found that a positive and significant impact was made with the NEP but tests completed after three months and five years showed that the nutrition knowledge retained had decreased significantly.

The questions reflecting poor knowledge in all three tests included the source of the nutrients vit. C and vit. A (Q10) and daily servings of the food groups, starch, dairy and fruit and vegetables (Q14). The classification of low-fat snack items (Q17) was not understood and remembered, as all three evaluations showed poor knowledge. Similar results occurred amongst middle school children, where nutrition knowledge was low and the questions where children needed more education related to the functions and different sources of nutrients (Pirouznia 2001:66).

The questions where the children retained the nutrition knowledge concerned personal hygiene (Q2 and Q15), the daily requirements of water consumption (Q3), the classification of the food group, fruit (Q4, Q23), the link of tooth decay with sugar (Q7), the importance of fruit in the diet (Q9e), and the number of eggs to be eaten weekly (Q13). A similar finding was made by Walsh *et al*. (2003:94), where, during the long-term evaluation, the children still knew that the daily consumption of fruit and vegetables was necessary, and findings amongst school children by Subba Rao *et al.* (2006:991-995) found nutrition retention after two months.

The Top 20 most commonly consumed food items base on the 24-hr recall reflected a slight change in dietary patterns, where protein and fat sources increased with the inclusion of boerewors, cooked beef and chicken feet. This may have been the contributing factor in the change in energy distribution towards more energy being obtained from protein and fat. However, the total energy obtained from the diet declined and the number of children not meeting the daily requirements increased. The decline in fruit and lack of vegetables within the Top 20 list is also reflected in the nutritional analysis, where a deficiency in certain micronutrients exists, as values have declined when compared to the EAR of children aged nine to thirteen years.

The baseline survey reflected the mother's influence on food choices and purchases and this became evident amongst the children. The CG had fruit included in the diets but this was introduced by the school. The children's dietary patterns can be compared to those reported in studies by Venture and co-authors (2010), who found a link amongst different cultures between feeding practices, cultural obligations and the role of parent-focused decision-making. In this study the primary decision-maker for food practices was the parent. In another long-term study completed by Ritchie *et al.* (2010:S2-S10) and Gerstein *et al.* (2010) it was found that that coordinated nutrition education assists in increased recognition and use of a variety of food items after a four-to-six-month comparison. Unfortunately, such changes were not observed, since very few children changed their dietary habits. A study by Sharma *et al.* (2008:361-368) examined the association between nutrition knowledge and dietary practices. Although some nutrition knowledge was evident regarding water consumption and daily serving requirements, less than half the population was eating the recommended servings of food. Although nutrition knowledge was shown to be a strong predictor of dietary behaviour, no significance was seen for the link between fruit and vegetable intake and nutrition knowledge. This is similar to the study in this community, where nutrition knowledge exists amongst the children, and although the majority agreed with the importance of consumption of vegetables and fruits daily, the actual practice did not occur, even after the intervention and in the long-term measurement. A finding by Ritchie *et al.* (2010:S2-S10) suggested that a coordinated long-term approach, in which both parents and children are involved in a NEP, may significantly influence the consumption towards healthier food choices. Furthermore, the coordinated approach must be implemented from an early age in the child's life, as poor dietary behaviours established during middle school may put children at risk for future health problems. Dietary habits usually develop during early life (Hanson & Chen 2007:263-285; Powers, Struempler, Guarino, Palmer 2005:129-133).

A multivariate analysis revealed a link between certain nutrients and the nutrition knowledge of the children, namely the energy intake of the children and their general knowledge, the protein intake compared with the answers provided in the protein-related questions and the linking of vit. C with the question relating to fruit and vegetables. Significance ($p \leq 0.00$) was seen through the intercept model for all three variables. Energy intake declined significantly ($p=0.00$) and there was a shift in energy distribution amongst the macronutrients, but not necessarily linked to the knowledge as two out of five questions showed a marginal decline of between 3.8 and 4.3 percent. The remaining three questions saw a further improvement in the long-term evaluation. The knowledge amongst the children for Question 13, relating to the number of eggs to be consumed weekly, improved in the long-term test but did not reflect on the Top 20 list. However, significance ($p=0.00$) was seen in this correlation. Lastly, vit. C intake improved in the long-term test and significance ($p=0.05$ and 0.00) was seen in the link between intake and knowledge. However, for the questions where significance was noted, Question 10.2 declined in the long-term test but significance was also seen in Question 23, which saw a further improvement in the long-term test.

5.8 Conclusion

Although nutrition knowledge had improved after the NEP, the results from the long-term measurement indicated that the children did not retain all the information. The children were able to relate and understand the information of the SA FBDG. However, emphasis needs to be placed on the importance of variety within the diet, the functions and sources of certain nutrients, classification of food groups and the serving size of each food group and the daily requirements, as the information pertaining to these topics was found to be deficient in the nutrition knowledge of the children, even after the intervention. A

method needs to be identified to encourage continual revision of the work completed in the NEP in order to ensure retention of the information. The information obtained through a NEP needs to be revised on a regular basis with the children. This may assist in ensuring retention of knowledge. This coincides with findings by Pirouznia (2001:66), showing that nutrition education programmes need to be started in elementary schools in order to shape choices into adulthood and that the cooperation of education authorities is required to integrate this course within a school curriculum with regular revision.

In the long-term evaluation, it was evident that micronutrient deficiencies were still occurring, as the number of children consuming below the EAR increased after nine months. Although more protein was introduced in the diet, the number of children consuming these items was low. It is evident in the 24-hr recall that the diets lack variety. The percentage of children consuming dairy products was 33.3 and 9.5 percent, those consuming fruit, 14.3 and 9.5 percent, while vegetables did not appear on the Top 20 list with the food items derived from the protein, starch and fat food groups. The multivariate analysis revealed that two questions in the NKQ had significant impact on both knowledge and intake, namely the consumption of eggs on a weekly basis, and the classification of the food group, fruit.

Studies have shown that although nutrition awareness and knowledge may be improved, in view of the lack of food availability and accessibility experienced by children within rural communities, complete change to a healthy and varied diet may be very challenging (Sherman & Muehlhoff 2007:35-342; Townsend 2006:34-37).

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Malnutrition persists amongst children within rural and peri-urban communities and although strategies are designed to alleviate this problem, the number of child deaths remains alarming. Strategies to alleviate malnutrition include food fortification, food supplementation, supplementary food aid programmes and dietary diversification. Food diversification includes food-based strategies which incorporate home gardens, NE and food diversification.

6.2 Objectives

The objective of this study was to improve nutrition knowledge amongst primary school children within an informal settlement, with the aim of changing the dietary behaviour and food patterns of the children. The school environment was chosen to ensure attendance and to create a suitable learning environment with which the children were familiar.

6.3 Limitations

6.3.1 Voluntary drop-outs

Unfortunately, a small number (n=27) could not complete the immediate post-intervention test owing to voluntary drop-out. Similarly, 34 children were not present to complete the long-term evaluation as a result of moving outside the region to attend secondary school. The sample size was thus too small to generalize the results.

6.3.2 Measuring instrument

Measuring during the intervention was done only with 24-hr recall, which reflects the diets of the children over a 24-hour period. This may not be a true reflection of their diets, as a large retail store dumps its expired produce twice a week and the community members feed off this site.

6.3.3 Food procurement and choices

Children had little control over the nutritional environment as mothers were primarily responsible for food procurement, preparation and feeding. Exposure to nutrition information may have improved nutrition knowledge but the decision as to which foods were eaten daily remained the responsibility of the mother. With unemployment levels being so high, introducing variety into the diet may just be too costly.

6.3.4 History and culture

Another limitation may be not only the poverty levels, but also the cultural obligations of the children, families and caregivers. Although the SA FBDG were developed to encourage better dietary practices, not all the recommendations are being adhered to. There are only a few who are consuming a variety of foods. The high consumption of maize meal and bread exists not only because of low cost values, but because these foods have been present in the diets of rural communities for many years and the high levels of poverty has restricted them from purchasing any other food items. A study by Ventura *et al.* (2010) has linked the indulgent feeding styles in the cultures of various ethnic groups to the feeding practices of children aged two to six years. Therefore, nutrition education programmes need to be tailored to meet the needs of diverse audiences or target groups.

6.3.5 Individual impact

Another limitation of this study was that all the NETs were used together in the NEP and the effect of each individual tool was not tested. However, this could also have been a strength of the study, as not only one NET was relied upon for the effective transfer of nutrition information.

6.4 Findings

6.4.1 Literature

The literature highlighted the importance of NE and how starting at an early age can influence behaviour and improve quality of life into adulthood (FAO 2008; Matvienko 2007:284). The ultimate goal is participation by individuals, family members and communities (Pérez-Rodrigo & Aranceta 2001:131-133). Therefore, a coordinated approach, using tools which take into account the literacy levels of the participants, as well as their circumstances and requirements, will ensure that a NEP will achieve its full impact (Sherman & Meuhlhoff 2007:336).

6.4.2 Baseline study

Boipatong is a community faced with poverty, as food insecurity exists in the households, which have between two and five children living in each, with R1.67 available for food per day per child. Unemployment levels are high, with education levels amongst the parents and caregivers ranging between primary and secondary school. Anthropometric and biochemical measurements reflected micronutrient deficiencies. This was also evident in the diets of the children, reflective of a carbohydrate-based diet, with only a few consuming protein, fruit and vegetables.

6.4.3 Intervention

When considering the literature relating to NE (Chapter 2), it is evident that in this study certain characteristics of the NEP that was implemented complied with certain criteria. Firstly, regarding the definition and aims of NE, the results of this study complied with the definition in that nutrition knowledge was improved amongst the children, which is the primary definition and aim of NE (FAO 2008, Contento *et al*. 2002) Unfortunately, the change in behaviour did not occur, as is evident in most studies globally (refer to Table 2.2, page 48), as this community was faced with poverty, unemployment and food insecurity.

Secondly, the messages and programme presented to the children took into consideration the needs of the children. The children were asked to participate in the development of the tools for the programme during the baseline survey, as reported in Chapter 3, Table 3.30. Studies have proved that effective imparting of information and retention thereof requires the consideration of the target audience, culture, literacy levels and preferred method of learning (Gans, Risica, Strolla, Fournier, Kirtania, Upegui, Zhao, George, Acharyya 2009:25).

The school-based approach used in this study coincides with other studies, where positive results have been obtained owing to the nature of the environment and the time spent by children at school (Shariff *et al.* 2008:122).

Finally, the way in which the NEP was structured also contributed to the improvement of knowledge and its retention (Raman *et al.* 2010:250-255). The lessons were delivered in short sessions of 30 to 45 minutes over a period of nine weeks, with each lesson ending with an activity related to the topics discussed.

6.4.4 Knowledge after intervention and retention thereof

The intervention made a significant impact on the NK of programme participants as the immediate improvement of nutrition knowledge was 0.13 units from the pre- (0.45) to the post- (0.58) intervention results. The questions where significant improvements occurred although the majority of the children still answered incorrectly after the intervention were related to the servings of foods to be consumed on a daily basis from each food group as well as serving sizes, nutrient content and function of specific vegetables and fruits, and classification of food groups. Retention of knowledge was found for most topics except for the importance of variety in the diet, the serving size of each food group, and the source of vit. A and C.

Emphasis needs to be placed on the importance of variety within the diet, the functions and sources of certain nutrients, classification of food groups and the serving size of each food group and the daily requirements, as the information pertaining to these topics was found to be deficient in the nutrition knowledge of the children, even after the intervention. A method needs to be identified to encourage continual revision of the work completed in the NEP to ensure retention of the information.

6.4.5 Dietary intake after intervention and in the long term

Changes made to the diets of the children were evident in the omission of certain high-fat snack items and proteins. After the intervention there were more carbohydrate-based food items on the Top 20 list, with an additional inclusion of fruit. In the long-term evaluation the change made was very similar to the pre-intervention diet where five protein sources were found, two fruits and only one source of vegetables. Very few children had indicated dairy products within the diet and no form of legume was present. The changes were made by only a small number of children, which shifted the energy distribution. The nutrient value of the diets still remained significantly below the daily requirements for Ca, vit. E, vit. A and vit.K.

6.5 Conclusion

This study was effective in providing significant change in nutrition knowledge, as the children showed an improvement immediately after the intervention and in the long term, with regard to certain nutrition-related topics. However, the full impact of this study was not reflected in the dietary patterns as very little variety existed before the intervention, with minimal changes after the intervention. The level of poverty, cultural obligations and the lack of influence the children have on food choices and preparation, may also have contributed to the lack of significant changes in dietary practices, even though knowledge concerning daily requirements was improved.

It is important that knowledge gained, should change dietary intake behaviour in the long-term. However, this is huge challenge as behaviour is affected by many factors such as biological influences, cultural and social preferences, family and psychological factors, a sense of empowerment, material resources and environmental content (Contento 2007:1-7) Nutrition education should thus address all the afore factors that may influence food choices and dietary intake

behaviour. It is thus a long-term process (Contento 2007:43). A number of theories exist for behaviour change such as the social cognitive theory and the constructs theory (Contento 2007:114-121). A multi-disciplinary team approach is thus recommended, but did not fall in the scope of this study.

6.6 Recommendations

6.6.1 School children and their caregivers

This NEP was implemented in the second semester, which occurs in the second half of a year. The first recommendation is to commence a NEP at the beginning of the year. This will allow for the same students to be used if the long-term evaluation is to take place within nine months. The age groups and grades should also be taken into consideration to ensure that respondents are still in school when the long-term measurements are done.

A second recommendation is to design an education programme that takes into account the schedule of the school's extra-mural activities to ensure complete attendance. A day where no sporting activities occur must be considered.

Although the activity booklets were taken home, the retention of knowledge was poor for certain topics, which meant the children did not review the booklets after the NEP. Children need to be encouraged to re-read the information, which should also be provided within the school curriculum.

6.6.2 Policy makers and health workers

The SA FBDG were developed to encourage change in behaviour. The impact is not being seen as NE is provided in Life Skills, as a small section of the curriculum. A recommendation is firstly for the DoE to consider NE as a separate subject, and not as a small part of life sciences. The retention of knowledge is dependent on the amount of exposure to the knowledge, the doses of information given and how the messages are communicated (Zoellner *et al.* 2008:102). Therefore the children should be taught weekly and continuously as per other subjects to encourage learning and positive change.

Secondly, bridged with the above recommendation, would be the training and educating of teachers at school. Children spend most of their time during the day at school and children view the teachers as role models. By empowering the teachers with the correct information may empower the children to follow.

A further recommendation is made to provide health workers with NE training. This will allow them to relay the necessary information to patients, and if the patients are part of a family or household where there are more members, the messages may be spread further. People who are exposed to and taught about nutrition can act as change agents by disseminating the message to a larger segment of the population (Vijayapushpam *et al.* 2008:108).

6.6.3 Future research

Furthermore, it is recommended that the impact of each of the NETs be tested separately in a NEP, and the results compared in order to establish which NET has the greatest impact on the increase and retention of nutrition knowledge.

Another recommendation is to consider simultaneously coordinating a NEP with other family members. This may assist researchers in implementing NEPs which

will have significant impact on dietary practices among poor rural communities. The dietary patterns of the children did not improve significantly due to poor economic circumstances, cultural obligations and as depicted with the baseline survey, food choices and preparation is the responsibility of the caregiver or mother. A study conducted in California found that coordinated learning, implying the involvement of other family members, may assist the process of change in family consumption patterns (Ritchie *et al.* 2010:S2-S10).

Improvement in food insecurity can be further encouraged by simultaneously incorporating other food-based strategies, such as vegetable gardens, with a NEP. This will increase food availability especially in communities where unemployment levels are high.

Incorporating food-aid programmes and feeding schemes within schools and communities, combined with nutrition education may alleviate food insecurity as people will understand what is being served or provided, what the basic nutritional requirements are and how to improve their dietary behaviours.

Future research may also encompass larger audiences to encourage and promote change within communities. By incorporating all the schools within a community, may contribute to a change within the whole community, as schools are embedded within communities. A large scale nutrition education study is thus recommended.

6.7 Outcomes and self-evaluation of the study

The achievement of the objectives set out in this research and benefits of the study include:

6.7.1 Reliability of the study

This study has proved valuable in understanding how a NEP can influence knowledge amongst children, but the surrounding environment has an important role in affecting the behavioural aspect of the intervention. Knowledge can be improved effectively but, without the resources available, the impact remains limited.

6.7.2 Data collection

The data collected during the intervention presented no difficulties and was easy to evaluate.

6.7.3 Achievement of objectives

Nutrition knowledge improved amongst the children participating in the intervention, although the benefits of this information could not be applied immediately.

The researcher was able to achieve the objective of providing the information in a manner which enabled the children to learn what was required. Great enthusiasm was shown every week by the children participating in the intervention, with other pupils wanting to be involved.

6.7.4 Benefits to children

The children were provided with an opportunity to learn, and because of the successful participatory approach, which included colouring-in sessions and games, the children were able to interact and improve their knowledge, concentration and coordination. The NEP has empowered the children to make better food choices in the future, when resources permit, which may lead to improved development into adulthood.

6.7.5 Success of this study

The successful completion of the study will lead to a post-graduate qualification. The training of fieldworkers provided an opportunity for capacity building.

Various articles can be published with co-authors, relating to the peri-urban community, impact of the NEP on nutrition knowledge, and how dietary practices are affected by NEPs in poor communities.

The successful use of the SA FBDG in the form of the NETs allows for the DoE to consider NE within the school curriculum as a permanent subject or permanent implementation as programmes at different phases.

The tools developed can be incorporated into other studies as they have proved to be successful in improving the knowledge of the primary school children.

6.8 Concluding remarks

The study has shown success in improving NK amongst primary school children, but the impact on dietary behaviour was deficient. This clearly defines the need for food aid and food diversification as a coordinated approached to encourage significant change within practice. The lack of dietary change was influenced by

the situation in which the children found themselves, namely poor food variety, low income levels within the household and food choices within the household decided upon by the caregivers and/or mothers. The majority of the studies have been shown to improve dietary practices amongst children but more emphasis needs to be placed on poor communities where food insecurity occurs. More emphasis also needs to be placed on caregivers and parents, as they are responsible for food procurement and preparation. Coordinated approaches may assist in encourage dietary changes. NE does not encourage behavioural change when economic resources, product availability, food procurement and preparation are the responsibility of others, especially those not involved in an intervention.

The method by which the study tools were developed and presented also confirms the theory, which emphasises the correct method of teaching in the correct environment and how gathering input from the participants can promote an improved learning pattern.

To conclude, challenges still exist for researchers in overcoming the barriers guarding the dilemma of malnutrition. Approaches require careful planning, commitment and involvement.

6.9 The role of the researcher

The role of the researcher in this project comprised of the following:

1. Literature study and proposal writing.
2. The involvement with fieldworkers in the training and collection of data for the baseline survey.
3. The development of a NKQ for the NEP.
4. Actual implementation of the reliability testing for a period of four weeks.
5. Assisting a registered dietician and other post-graduates with the training of fieldworkers over a day.
6. The actual presenting of the NEP to the participants at the primary school receiving the NE material, covering nine weeks.
7. Initially, a statistician assisted with the analysis of data and later the researcher completed further statistical analysis and interpretation of the data captured.

8. Writing of the dissertation.

6.10 Research outputs

6.10.1 Abstract 1

Accepted Symposium Abstract – Nutrition Education Symposium, 4 November 2009

NUTRITION KNOWLEDGE OF PRIMARY SCHOOL CHILDREN IN BOIPATONG

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OBJECTIVE: The focus of this project was to assess the level of poverty in Boipatong through the socio-economic analysis, and the level of nutrition knowledge amongst the primary school children with the aim of promoting a healthy wellbeing by improving nutrition knowledge amongst the children to allow them to make informed food choices and change food intake behaviour.
MATERIALS AND METHODS: Validated socio-demographic (n=52) and nutrition knowledge (n=45) questionnaires were completed by parents/caregivers and primary school children. The socio-demographic and nutrition knowledge questionnaires were captured on Microsoft Excel spreadsheets and analysed for descriptive statistics (means, standard deviations and frequencies) with the Statistical Package for Social Sciences (SPSS) program, version 12.
RESULTS AND FINDINGS: There were between two and five children per household, with a daily allowance for meals, per child, of R1.90 (US$0.23). Unemployment (60,9%) was predominant amongst the caregivers and their education levels ranged between primary (33,3%) and secondary school (54,9%), with only 7,8% (n=4) having a higher qualification. Nutrition knowledge amongst the children was evident as 66,7% of the children answered the true and false questions (n=24) correctly. The food choices of the children were made mainly by the mother (72,5%).
CONCLUSIONS AND RECOMMENDATIONS: Children and parents require improved nutrition knowledge to improve the type of food consumed. Teachers within the Vaal region have emphasized the importance of nutrition education to school-going children. The results of this analysis were used to promote the nutrition education approach in the management of malnutrition amongst primary school children in South Africa.

6.10.2 Abstract 2

Accepted Symposium Abstract – Nutrition Education Symposium, 4 November 2009

IMPACT OF A NUTRITION EDUCATION PROGRAMME ON THE FOOD CHOICES AND NUTRITION KNOWLEDGE OF PRIMARY SCHOOL CHILDREN IN BOIPATONG

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OBJECTIVE: Determining the impact a nutrition education programme (NEP) would have on the nutrition knowledge and behavioural change in food choices amongst primary school children in Boipatong.
MATERIALS AND METHODS: A nutrition knowledge questionnaire was developed and tested for internal reliability (Cronbach Alpha) on 10 children from a selected school. A pre- and post-test was completed to determine the level of nutrition knowledge before and after the intervention, and whether improvement occurred. The NEP was implemented with the assistance of fieldworkers at a selected school with 100 children, over a period of twelve weeks. The nutrition education tools included a food group puzzle, playing cards, board game and activity book. The questionnaires were analysed statistically for descriptive statistics on SPSS, version 12.0. A validated 24-hr recall questionnaire was completed before and after the NEP and analysed by means of the Food Finder Program. Paired t-tests were done to assess changes in dietary intake and food choices.
RESULTS AND FINDINGS: The preliminary results showed that in all the knowledge questions the number of correct answers improved in the post-test. The mean for correct answers was 0.48 in the pre-test and 0.61 in the post-test, with 0.13 (31.7%) improvement. Paired sample correlations indicated a significance of 0.26.
CONCLUSIONS AND RECOMMENDATIONS: A nutrition education programme can assist in improving the nutrition knowledge of primary school children. A recommendation is made to assess the level of nutrition knowledge retained over a longer period.

6.10.3 Abstract 3

Accepted abstract for 2010 Nutrition Congress, held in Durban, South Africa, 19/09/2010 – 22/09/2010.

A Nutrition Education Programme for Primary School Children: Short- and Long-term changes in Nutrition Knowledge

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Introduction:
The objective of this study was to improve nutrition knowledge amongst primary school children in an informal settlement.
Material & Methods:
The school environment was chosen to ensure attendance and familiarity with a learning environment. A nutrition knowledge questionnaire was developed and tested for internal reliability (Cronbach Alpha). Pre- and post-intervention tests were completed with an experimental and a control group. The questionnaires were analysed statistically for descriptive statistics on SPSS, version 17.0. The Nutrition Education Programme (NEP) was implemented over nine hours (11 weeks total), with seven hours for teaching information in the activity book and completion of the relevant activities, and two hours for the games.
Results:
An immediate improvement of 0.13 units from pre (0.47) to post (0.60) results. A slight decline in the long-term (0.54) measurements. Topics with significant improvement were related to the servings of foods to be consumed on a daily basis from each food group, nutrient content and function of specific fruits and vegetables.
Poor nutrition knowledge occurred in topics relating to the importance of specific nutrients, importance of variety within the diet, linking of fruits and vegetables to nutrients, identification of low-fat snack items, and the classification of the food group – starch, with serving size and daily requirements.
Poor long-term retention occurred for topics relating to calcium-rich foods and function thereof, linking of fruits and vegetables with specific nutrients, serving size of protein-rich foods, the importance of health and physical activity, and the importance of breakfast.
Conclusions:
Although nutrition knowledge retention occurred for certain nutrition-related topics, a method needs to be identified to encourage continuous revision of the work completed in the NEP.

6.10.4 Articles

This study will be reflected within three articles, namely the baseline survey (situational analysis) and the impact of the NEP, reflected as the dietary intake patterns of primary school children participating in a NEP, and the impact of a NEP on the nutrition knowledge of primary school children.

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ANNEXURE A

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

R14/29 Oldewage-Theron

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER M080365**
PROJECT	Open controlled trial of protein enhancement of dietary intake in HIV-infected or AIDS orphaned children in South Africa
INVESTIGATORS	Dr W Oldewage-Theron
DEPARTMENT	NRF
DATE CONSIDERED	08.03.25
DECISION OF THE COMMITTEE*	Approved unconditionally

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

DATE 08.04.07 **CHAIRPERSON** .....

(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof CS Venter

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

ANNEXURE B

Vaal University of Technology

HIV/AIDS / BOIPATONG INTEGRATED NUTRITION PROJECT
INVITATION LETTER TO PARENTS

Dear Parent

My name is Wilna Oldewage-Theron and I am working at the Vaal University of Technology with Valerie Erasmus. We are planning to do a project with school children, attending the Care Centre in Boipatong in order to assist these children to improve their health as well as school attendance and performance. We need your assistance in getting permission and information for this project. Participation is voluntary.

We hereby wish to **invite you and your child to come to the Centre on Saturday, 3 March 2007 at 09H00** so that we can explain the project to you and to complete the permission letter, as well as socio-demographic and health questionnaires.

We will be busy on Saturday from 09h00 to 13H00.
Chapter 2

We hope to see you on Saturday.
Thank you very much.

Prof Wilna Oldewage-Theron PhD RD (SA)
Tel: 016 950 9722

Private Bag X021, Andries Potgieter Boulevard, Vanderbijlpark, 1900, South Africa, Tel: 27 16 950 9000, Fax: 27 16 950 9999, E-mail: www.vut.ac.za

ANNEXURE C

INFORMED CONSENT FOR PARENTS/LEGAL GUARDIANS

(On behalf of minors under 18 years old)

I, the undersigned…… (full names in print), age…… have read the details of the project, or have listened to the oral explanation thereof, and declare that I understand it. I have had the opportunity to ask clarifying questions and discussed relevant aspects with Prof Wilna Oldewage-Theron and/or the fieldworker. It has been explained to me that I will be free to withdraw 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 to voluntarily participate in the project and that measurements and blood samples may be taken from me.

PARTICIPANT ASSENT: * (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/ WITNESS:……..…**(DESIGNATION):**

Printed Name	Signature
Date and Time	

Address of volunteer participant:
……....
……
……..
……..
……..
Contact telephone number:
……

ANNEXURE D

FIELDWORK CONTROL SHEET
HIV/AIDS / BOIPATONG INTEGRATED NUTRITION PROJECT

Participant study ID number:……..

Stations	Activity	Beginning of clinical trial	End of trial
Station 1: Check/control	Handing out of file and check consent form and details		
Station 2: Socio-demographic and health data	• Socio-demographic questionnaire • Health questionnaire		X X
Station 3: Clinical signs, blood	• Oral temperature…… • Clinical signs • Drawing of blood		
Station 4: Café	• Handing out of snacks		
Station 5: Anthropometry	• Weight…… • Height……		
Station 6: Dietary intake	• QFFQ • 24-hour recall • Compliance	X	
Station 7: Nutrition knowledge	• Nutrition knowledge questionnaire	X	
Station 1: Check/control	• Control that all fieldwork is complete		

ANNEXURE E

SOCIO-DEMOGRAPHIC QUESTIONNAIRE
HIV/AIDS / BOIPATONG INTEGRATED NUTRITION PROJECT 2007

This questionnaire must be completed by the caregivers and/or guardians of the HIV/AIDS affected children / Boipatong children and covers certain aspects of your life, including work and personal details, health and illness, lifestyle and social life, that are relevant to health. The answers to these questions will be kept strictly confidential and the information will not be identifiable from any reports or publications.

1. GENERAL INFORMATION

Date : …….
Participant Study ID Number : …….

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

Example: In what town do you live?

Johannesburg	Bloemfontein	Cape Town	Vanderbijlpark	Durban
X				

2. PERSONAL INFORMATION

2.1 Your role in the family

Grandmother	Grandfather	Caregiver	Guardian	Other, specify……..

2.2 When were you born? _____

2.3 Are you?

Single	Married	Widowed	Divorced	Other……..

3. ACCOMMODATION AND FAMILY COMPOSITION

3.1 Where do you live?

Alexandra	Boipatong	Sharpeville	Other, specify……..

3.2 Do other people live in your house?

Yes
No

3.3 How many people are living in your house?

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

3.4 Are all members permanent residents in this house?

Yes	No

3.5 If yes, how long have you been staying permanently in this house?

< 1 year	1-5 years	>5 years

3.5 In what type of house are you staying?

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

3.6 Indicate the number of rooms in your house.

≤ 2 rooms	3-4 rooms	> 4 rooms

3.7 Do you have the following facilities at home?

3.7.1 Water

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

3.7.2 Toilet facilities

None	
Pit latrine	
Flush / sewage	
Bucket system	

Other, specify…….	

3.7.3 Waste removal

Yes	No

3.7.4 Tarred road in front of house

Yes	No

Gravel road in front of house

Yes	No

3.8. Do you have problems with the following?

Mice / Rats	Cockroaches	Ants	Other pests, specify……..

4. **WORK STATUS AND INCOME**

4.1 Are you currently employed?

Yes	No

If YES, go to question 4.5.

4.2 If NO, how would you describe your current status?

Unemployed	Retired	Housewife	Other, specify…..

4.3 If UNEMPLOYED, are you actively looking for employment at the moment?

Yes	No

4.4 If RETIRED, how long have you been on pension?

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

4.5 Is your spouse (partner) in paid employment at present?

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

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

<	R501-	R1001-	R1501-	R2001-	>

4.7 How often does it happen that you do not have enough money to buy food or clothing for you or your family?

Always	Often	Sometimes	Seldom	Never

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

People	0	1	2	3	4	5	6	7	8	9

4.9 How often do you buy food?

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

4.10 Where do you buy food?

Spaza shop	Street vendor	Supermarket	Other, specify……

4.11 How much money is spent on food PER WEEK? (Tick only one box)

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

5 EDUCATION AND LANGUAGE

5.1. What is the highest education you have?

None	Primary School	Secondary school	College	Other post school

5.2 What language is spoken mostly in the house?

Sotho	Xhosa	Zulu	Pedi	Other, specify……

5.3 How many children are in the household?

1	2	3	4	≥5

5.4 How many children are attending school?

1	2	3	4	≥5

5.5 How do the children get to school?

Lift	Walk	Bus	Taxi	Other, specify……..

6 ASSETS

Tick one block for every question:	Father	Mother	Child	Grandm	Grandp	Other
6.1 Who is mainly responsible for food preparation in the house?						
6.2 Who decides on what types of food are bought for the household?						
6.3 Who is mainly responsible for feeding/serving the child?						
6.4 Who is the head of this household?						
6.5 Who decides how much is spent on food?						

6.6 How many meals do you eat at per day?

0	1	2	3	> 3

6.7 Where do you eat most of your meals?

Home	Friends	Work	Buy	Other, specify……..

6.8 Where do your children eat most of their meals?

Home	Friends	School	Buy	Other, specify……..

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

Fire	Paraffin	Electricity	Gas	Coal	Other, specify……

6.10 What type/s of pots do you use for cooking your food? (tick all relevant options)

Aluminium	Cast iron	Clay	Stainless Steel	Other, specify……

6.11 Does your home have the following and how many?

	Yes	**No**	**Quantity**
Electrical stove			
Electrical iron			
Electrical kettle			
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			
Kettle, electrical			

Thank you very much for your co-operation.

Wilna Oldewage-Theron (Prof)
Director: Institute of Sustainable Livelihoods

Tel: 016 950 9722
Fax: 086 612 8573

ANNEXURE F

FFQ LIST OF FOODS AND FOOD GROUP DIVERSITY

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

GROUP 1: Flesh foods (meat, poultry, fish) diversity	Y	N
Chicken		
Beef		
Pork		
Tinned fish (pilchards)		
Fish (fresh / whole)		
Lekgotlwane (finely chopped, cooked meat)		
Mutton		
Tinned fish (tuna)		
Chicken runners and heads		
Chicken livers		
Goat (meat)		
Mogodu and malana		
Dried meat (biltong)		
Viennas / polony		
Russians		
Sausage (wors)		
Steak		
Group 2: Eggs diversity		
Eggs		
Group 3: Diary products diversity		
Milk, unpasteurized (cow)		
Evaporated milk (unsweetened)		
Maas/ inkomasi		
Powdered milk		
Skim or low-fat milk (pasteurized)		
Full cream milk (pasteurized)		
Cheese		
Custard		
Ice cream		
Yoghurt		
Ultramel		
Yogisip		

Group 4: Cereals, roots and tubers diversity	Y	N
Rice		
Pap (Maize)		
Macaroni/pasta/spaghetti		
Maize rice (mielierys)		
Samp (stampmielies)		
Bread (white or brown)		
Whole wheat bread		
Dumpling		
Fat cakes		
Scones		
Biscuits		
Buns / bread rolls		
Mabela (soft porridge)		
Maize meal porridge		
Corn flakes		
Oats		
Wheat bix		
Mageu		
Potatoes		
Sweet potatoes		
Umqombothi		
Traditional beer		
Group 5: Legumes and nuts		
Sugar beans		
Peas (dried)		
Jugo beans		
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		
Apricots (Applelkoos)		
Peach (yellow cling)		
Mango		
Group 7: Other fruits (and juices) diversity		
Deciduous 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 squash (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: Oils and Fats diversity		
Butter		

Sunflower oil		
Margarine		
Lard		
Salad oil		

ANNEXURE G

24–HOUR RECALL

Subject ID number: _____ Gender: Male/Female

Interviewer: _____

Date: _____ / _____ / 2008

Tick what the day was yesterday:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

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

Yes	No

If not, why? _____

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

I want to find out about everything 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 use 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 use 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 going to sleep					
* Do you take any vitamins (tablets or syrup)?			Yes	No	
Give the brand name and dose of the vitamin/tonic:					

ANNEXURE H

Office Use Only

NUTRITION KNOWLEDGE QUESTIONNAIRE

INSTRUCTIONS

THE FOLLOWING QUESTIONNAIRE CONTAINS TWO TYPES OF QUESTIONS,

MULTIPLE CHOICE AND TRUE/ FALSE

1. MULTIPLE CHOICE: CHOOSE **ONE** THAT YOU THINK IS THE CORRECT ANSWER AND TICK THE CORRESPONDING NUMBER THAT IS NEXT TO THE ANSWER

2. TRUE/ FALSE: CHOOSE THE **TRUE** OR THE **FALSE** AND TICK THE ONE THAT YOU THINK IS THE CORRECT ANSWER

THE QUESTIONS REFER TO A HEALTHY PERSON WHO IS NOT ON ANY MEDICATION OR SPECIAL DIET

Please answer all the questions before moving on to the next ones.

Do not page back!

DATE	YY	MM	DD	
SUBJECT NUMBER				
AGE				
DATE OF BIRTH	YY	MM	DD	
GENDER	Male	Female		
SCHOOL/ INSTITUTION				
GRADE/ DEGREE				

1 You should eat a lot of sugar to have enough energy

TRUE	FALSE

2 You should not have starches at most meals because

They are not important for your health	1
Even eating small amounts can cause weight gain	2
They cause diseases	3
None of the above	4

3 How much water should you drink a day

You don't have to drink water everyday	1
1 to 3 glasses	2
4 to 6 glasses	3
7 to 9 glasses	4

4 You should add extra salt to your cooked food before you even eat it

TRUE	FALSE

5 What is a portion of cooked vegetables?

1 Tablespoon	1
Half a cup	2
1 Cup	3
2 Cups	4

6 Which of the following is a low fat snack

"Simba" Chips	1
Popcorn	2
Fried chips	3
"Niknaks"	4

7 From which group of foods should you eat the most every day?

Bread, samp, rice, porridge	1
Apples, bananas, spinach, carrots	2
Milk, yogurt, cheese	3
Chicken, fish, beans, eggs	4

8 People who are overweight should not be physically active

TRUE	FALSE

9 It is usually not necessary to wash vegetables before you cook them

TRUE	FALSE

10 The key to a healthy way of eating is to

Eat many different kinds of foods	1
Eat some foods more than other foods	2
Eat certain kinds of foods in moderate or small amounts	3
All of the above	4

11 Which foods contain a lot of calcium?

Chicken and eggs	1
Milk, yoghurt	2
Pilchards	3
2 and 3	4

12 Foods are classified into groups, namely

Cereals, fruits and vegetables	1
Fats, milk and meats	2
Milk, meats, fruit and vegetables	3
1 and 2	4

13 If you were trying to increase the amount of fiber in your diet, which one of the following foods should you eat more of?

Cakes and biscuits	1
Apples and carrots	2
Chips and pies	3
Chicken and fresh fish	4

14 Being physically active means

Going to the gym	1
Walking a lot	2
Playing sports like soccer or netball	3
All of the above	4

15 Which foods contain a lot of fibre?

Oats, apples, beans	1
Milk, yogurt, cheese	2
Beef, chicken, mutton	3
Butter, margarine	4

16 How many fruits and vegetables should be eaten

1 fruit and vegetable a day	1
3-4 fruits and vegetables a day	2
5 or more fruits and vegetables everyday	3
There is no need to eat fruits and vegetables daily	4

17 Fried foods, fats and oils can be eaten as much as desired

TRUE	FALSE

18 Drinking boiled water is a good way to lose weight

TRUE	FALSE

19 Salt should be added to all foods except fruits

TRUE	FALSE

20 If one wants to lose weight there is no need to be physically active, it is better that one simply diets

TRUE	FALSE

21 All water is safe to drink

TRUE	FALSE

22 A little sugar can be eaten when one is trying to lose weight

TRUE	FALSE

23 How much milk or maas should you have a day?

None	1
Half a cup	2
One cup	3
Two cups	4

24 Your body only needs a little bit of salt to be healthy

TRUE	FALSE

25 A well- balanced diet

Consists mostly of meat, with smaller amounts of starch, fruits, vegetables, and dairy products	1
Consists mostly of vegetables, and smaller amounts of meat and dairy products	2
Consists mostly of starches, vegetables and fruits, with smaller amounts of meat and dairy products	3
None of the above	4

26 Sugar and foods that contain sugar should be eaten in small amounts

TRUE	FALSE

27 Sugar contains a lot of vitamins and minerals

TRUE	FALSE

28 It is impossible to get all the vitamins and minerals you need from food, you need to take a vitamin and mineral pill

TRUE	FALSE

29 Which one of the following groups of nutrients are found in large amounts in fruits and vegetables?

Fibre, Vitamin A	1
Starches, fat, Vitamin D	2
Fats, Iron, Calcium	3
None of the above	4

30 Which of the following breakfast menus contain little fat

Whole-wheat toast with thinly spread margarine	1
Weet-Bix with 2% fat milk	2
Bacon and egg	3
1 and 2	4

31 Which food has the most fibre?

White rolls	1
Brown bread	2
White bread	3
Whole wheat bread	4

32 Starchy foods should not be eaten when one is trying to lose weight

TRUE	FALSE

33 To make sure that you stay healthy you should eat

Lean meat, fruits and vegetables, low fat dairy products, and breads and cereals	1
Fruit and vegetables only	2
Bread, cereals, fruit and vegetables only	3
Low fat dairy products and lean meat only	4

34 Eating bread always causes weight gain

TRUE	FALSE	

35 Which of the following foods are the lowest in fat:

Corn flakes and full cream milk	1
Grilled lean steak and boiled carrots	2
Pizza and milkshake	3
Fried lamb chops and creamed spinach	4

36 To protect yourself from disease you should avoid eating many different kinds of foods

TRUE	FALSE	

37 It is healthy to snack on foods that contain a lot of sugar

TRUE	FALSE	

38 Dry beans, peas, and lentils should be eaten often

TRUE	FALSE	

39 Soya mince is as healthy as meat

TRUE	FALSE	

40 You can eat as much meat as you want everyday

TRUE	FALSE	

41 Which group of foods has the most Vitamin A?

Oats, whole wheat bread, rice	1
Carrots, spinach, sweet potatoes	2
Pies, cakes, pudding	3
None of the above	4

42 Dry beans, peas, lentils are a healthy choice to eat in place of meat

TRUE	FALSE	

43 Meat/ fish/ chicken will not spoil if you store them

In the cupboard for a few days	1
In the fridge for 2 days only	2
In the freezer for 3-4 months	3
In 2 and 3 above	4

44 The reason why beans, peas and lentils are good for you is that

They contain only small amounts of fat	1
They contain a lot of fibre	2
They can protect you from some diseases	3
All of the above	4

45 Vitamin C is needed for building our immune system and is found in most green and yellow vegetables

TRUE	FALSE	

46 Keeping yourself, the food and water you drink clean, will reduce the amount of germs taken in

TRUE	FALSE	

47 It is not necessary to eat during the day, only a night or when you are hungry. Once a day is enough

TRUE	FALSE	

48 The only time I must wash my hands is when I bath or shower

TRUE	FALSE	

SELECT YES OR NO FOR ALL THE CHOICES

49 From where do you get your information about nutrition?

	YES	NO	
School	1	2	
Peers/ Friends	1	2	
Parents	1	2	
Radio/ TV/ Magazines	1	2	
Other (Specify)			
	1	2	

SELECT 1 OR 2 OR 3 OR 4 FOR ALL THE CHOICES THAT YOU CHOSE YES TO IN QUESTION 1

50 Of the choices you have selected above, how would you rate them as sources of
1= very unreliable
2= unreliable
3= reliable
4= very reliable

	very unreliable	unreliable	reliable	very reliable		
School	1	2	3	4	13G	
Peers/ Friends	1	2	3	4	13G	
Parents	1	2	3	4	13G	
Radio/ TV/ Magazines	1	2	3	4	13G	
Other (Specify)						
	1	2	3	4	13G	

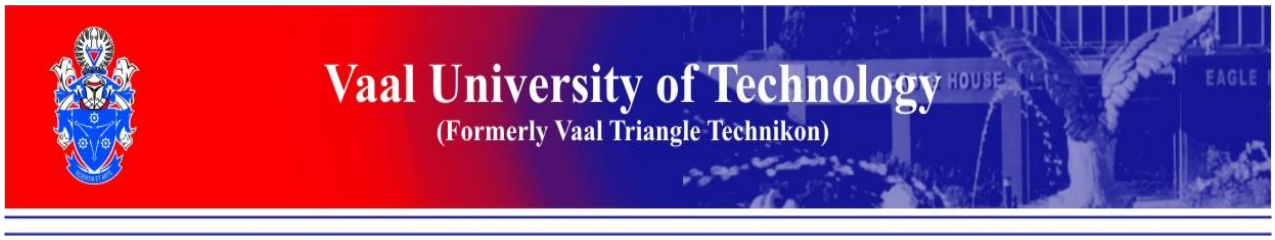
51 Do you think there is a need for nutrition education
Yes ☐
No ☐

52 Do you like to learn about food and nutrition in?
Black and white ☐
Bright colours ☐
Pastel colours ☐

53 Do you like to look at animated pictures or photographs?
Animated ☐
Photos ☐

54 What tools would you prefer to use when learning about nutrition education?
Card games ☐
Board games ☐
Puzzles ☐
Colouring books ☐

ANNEXURE I



ANTHROPOMETRIC, HEALTH, MEDICAL AND BEHAVIOURAL QUESTIONNAIRE

FIELDWORK CONTROL: HIV/AIDS INTEGRATED NUTRITION PROJECT

This questionnaire should be completed in the presence of the participating child's caregiver to provide the answers that the child does not know.

Section A:

Participant study ID number	
Gender	Male ❑ Female ❑

Section B:

HEALTH QUESTIONNAIRE:

ARE YOU SUFFERING OR HAVE YOU SUFFERED FROM	YES	NO	IF ANY ANSWER IS YES, GIVE DETAILS OF THE NATURE, SEVERITY AND DURATION OF ILLNESS
1. Any skin disease?			
2. Any affection of the skeleton and/or joints?			
3. Any affection of the eyes, ears, nose or teeth?			
4. Any affection of the heart or circulatory 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?			

11.

	YES	**NO**
Have you lost weight during the past month?		
Have you had a recent change in appetite?		
Do you have problems with the following:		
* chewing?		
* swallowing?		
* nausea?		
* diarrhoea?		
* vomiting?		
* constipation?		
Do you follow a special diet?		
If yes, specify…….		
Are you allergic to any foods?		
If yes, specify		

12.

Would you say your usual level of physical activity is:	**Tick the correct block**
12.1. Heavy/ rigorous (running, playing tennis, swimming, doing heavy gardening, etc., at least three times per week)	
12.2. Moderate (Taking rigorous exercise once or twice a week, or steady walking, or other moderate activities at least three times per week)	
12.3. Light (playing golf, taking a stroll, or doing non-rigorous activities occasionally)	
12.4. None (No exercise whatsoever)	

13.

How often do you get tired?	**Always**	**Sometimes**	**Never**

14.

	YES	**NO**
14.1. Do you suffer from any defect of hearing, speech or sight?		
14.2. Are you physically disabled and do you use artificial limbs?		

GIVE DETAILS OF THE NATURE AND SEVERITY OF THE DISABILITY …… …… ……		

	YES	**NO**
15. Do you smoke?		
16. Do you make use of snuff?		
17. Do you drink alcohol regularly?		
18. Do you use any other drugs?		

19.

	YES	**NO**
Have you undergone any operations during the past year?		
GIVE DETAILS OF THE NATURE AND DATE OF THE OPERATION/S …… …… ……		

Section C:

MEDICATION AND HEALTH FACILITY QUESTIONNAIRE:

1.

1. Do you use any medication or drugs?	YES	NO
2. If no, go to the next block.		
3. If yes, what? …… …… ……		

2.

Do you take any nutrient supplements?	**YES**	**NO**

3. If yes in previous question.

Specify the type	Vitamins, specify…… ……	Minerals, specify……. …….	Multivitamin	Other, specify…… ……

	……	……		……

4.

Which health facility is commonly used by you?	**Tick the correct 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 correct block**
1. On foot	
2. Taxi	
3. Bus	
4. Own transport	
5. Other (please state)	

6. When was the last time you visited your health practitioner (doctor/clinic/etc)?

……
……

7. What was the reason for this visit?

……
…

Section D:

FAACT QUESTIONNAIRE

Please complete the following section by ticking the appropriate questions.

1. Physical wellbeing

	Never	**Seldom**	**Sometimes**	**Often**	**Always**
1. I have a lack of energy (feel tired)					
2. I suffer from nausea					
3. I have pain					
4. I experience side-					

effects of my treatment					
5. I feel ill					
6. I am forced to stay in bed					

2. Social/family wellbeing

	Never	Seldom	Sometimes	Often	Always
1. I feel close to my friends					
2. I get emotional support from my family					
3. I get support from my friends					
4. I am satisfied with family communication about my illness					
5. I feel close to my caregiver/guardian					

3. Emotional wellbeing

	Never	Seldom	Sometimes	Often	Always
1. I feel sad					
2. I am satisfied with how I am coping with my illness					
3. I am losing hope in the fight against my illness					
4. I feel nervous					
5. I worry about dying					
6. I worry that my condition will get worse					

4. Functional wellbeing

	Never	Seldom	Sometimes	Often	Always
1. I am able to perform all my tasks					
2. I am able to enjoy life					
3. I have accepted my illness					
4. I am sleeping well					
5. I am enjoying the					

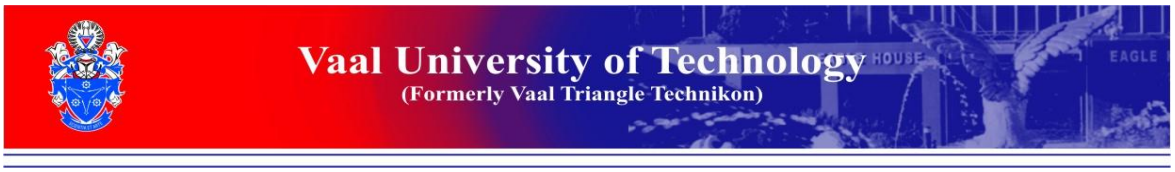
things I usually do for fun					
6. I am content with my life right now					

Thank you very much for your co-operation.

Wilna Oldewage-Theron (Prof)
Activity Leader: Sharpeville Integrated Nutrition Project

Tel: 016 950 9722
Fax: 086 612 8573

ANNEXURE J



HIV/AIDS / BOIPATONG INTEGRATED NUTRITION PROJECT
SIGNS OF MALNUTRITION

Participant study ID number: ……**Completed by**……..

	Signs/symptoms associated with malnutrition	Tick if yes
Hair	• Lack of natural shine, dull and dry • Dyspigmented • FLAG sign • Easily plucked (no pain)	□ □ □ □
Face	• Scaling of skin around nostrils • Swollen face • Paleness	□ □ □
Eyes	• Pale conjunctiva • Bitot's spots • Dryness of the eye • Corneal xerosis (dullness) • Corneal softening • Redness and fissuring of eyelid corners • White ring around the eye • Small, yellowish lumps around eyes	□ □ □ □ □ □ □ □
Lips	• White or pink lesions at corners of mouth • Magenta tongue • Filiform papillae • Atrophy or hypertrophy • Red tongue	□ □ □ □ □
Teeth	• Mottled enamel • Caries/cavities • Missing teeth	□ □ □
Gums	• Spongy, bleeding • Receding gums	□ □
Glands	• Front of neck swollen • Swollen cheeks	□ □
Nervous system	• Psychomotor changes • Mental confusion • Sensory loss • Motor weakness • Loss of positional sense • Loss of vibration • Loss of ankle and knee jerks • Burning and tingling of hands and feet • Dementia	□ □ □ □ □ □ □ □ □

ANNEXURE K

NUTRITION KNOWLEDGE QUESTIONNAIRE

AREA OF STUDY: BOIPATONG

NAME:.....

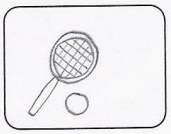
AGE:.....

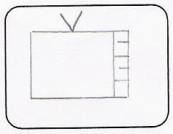
SCHOOL:.....

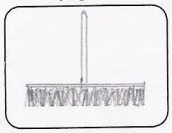
DATE:.....

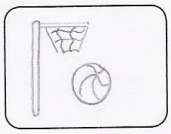
Complete all questions to the best of your ability. Circle the answers and associate with lines.

1. Choose the picture that does not fit with the others:

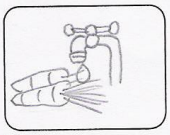
Tennis 

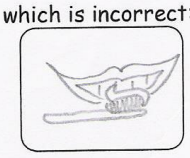
TV 

Sweeping 

Basket Ball 

2. Choose the picture which is incorrect:

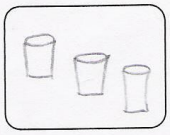

Wash vegetables

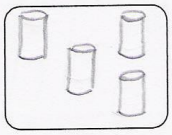

Brush your teeth

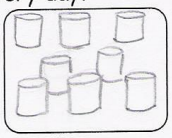

Wash your hands

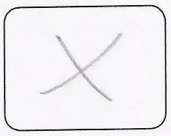

Drink water from the river

3. How many glasses of water must we drink every day?

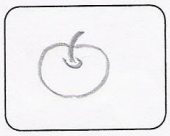

1-3 glasses

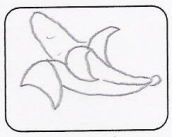

4-6 glasses

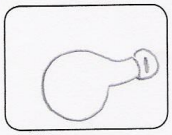

6-8 glasses

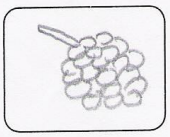

none

4. Which picture does not fit?

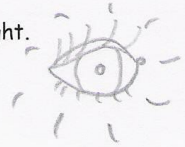

Apple


Banana


Chicken


Grapes

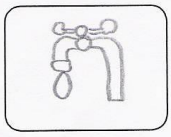
5. Choose the vitamin which improves eye-sight.



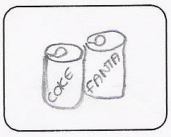
a) Vitamin A
b) Vitamin K
c) Vitamin D
d) Potassium

6. Which of the following fluids in the pictures can we drink to make out bones strong and healthy?

Milk

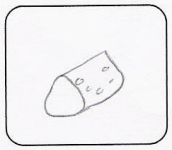


Water

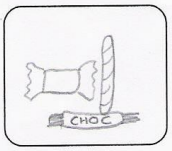


Soda drinks

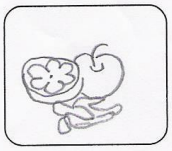
7. Which items in the pictures below can cause tooth decay?



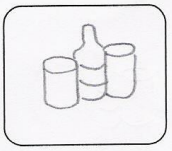
Cheese



Sweets

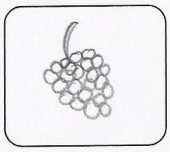


Fruits

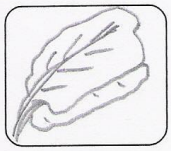


Soda drinks

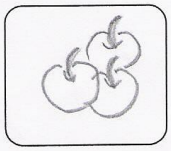
8. Link the fruits and vegetables to the appropriate colour using lines.



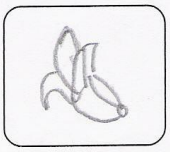
Grapes



Spinach



Apples



Bananas

Red

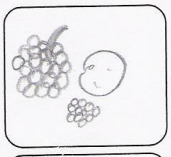
Purple

Yellow

Green

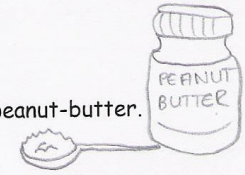
9. Which food groups do we need to eat from every day:
   a) Milk and fats
   b) Meats, fish, legumes and chicken
   c) Fats
   d) Starch
   e) Fruits and vegetables
   f) Sweets
   g) Take-aways / junk foods

10. Link the vitamins found with the fruit and vegetables.

POTASSIUM		Oranges, grapes and raisins
VITAMIN C		Broccoli
VITAMIN A		Carrots

11. How much is one serving of starch?
a) 1 slice of bread
b) Half a cup of porridge
c) Half a loaf
d) One small potato

12. How much is one portion of protein, i.e. peanut-butter.



a) 1-2 tablespoons
b) 4 tablespoons
c) 3 tablespoons

13. How many eggs can be eaten weekly?

a) 1
b) 6
c) 2

14. Link the food groups with the portions needed to be eaten daily

Fats	5 servings per day
Starch	2-3 servings per day
Milk and Milk products	6-8 servings per day
Fruits, Vegetables	Very Little

15. How often must be brush our teeth?

a) Once a day
b) Once a week
c) Twice a day

16. Fried foods, salt and oil must be eaten with every meal?
a) True
b) False

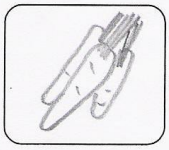
17. Which of the following is a low snack item?

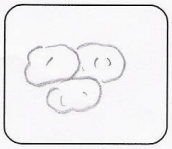
a) Simba chips
b) Popcorn
c) Fried chips
d) 'Niknaks'

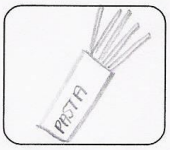
18. What is important to stay healthy?
a) Eat different types of foods
b) Eat only some types of foods
c) Eat certain foods in big amounts.

19. What happens if you do not eat breakfast?
a) Have plenty of energy to play
b) Sleepy at school

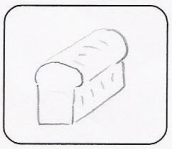
20. Choose which item which does not fit in this group.


Carrots

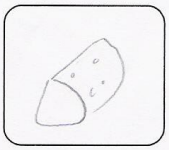

Potatoes

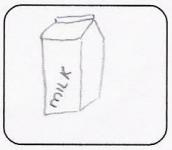


Spaghetti


Bread

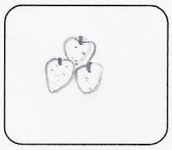
21. Choose which item which does not fit in this group.


Cheese

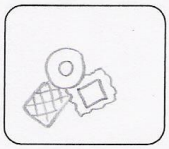


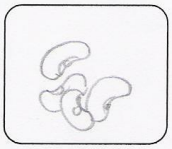
Milk

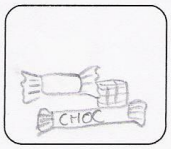

Yoghurt


Strawberry

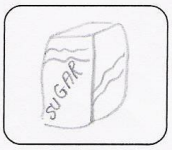
22. Choose which item which does not fit in this group.


Biscuits


Beans

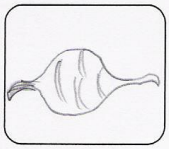


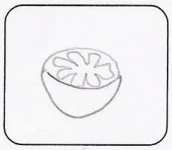
Sweets



Sugar

23. Choose which item which does not fit in this group.

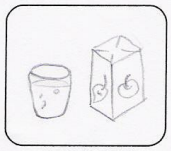

Beetroot

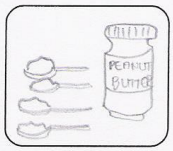

Oranges


Peaches

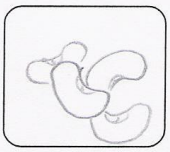

Bananas

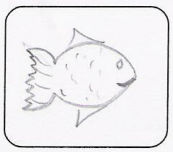
24. Choose which item which does not fit in this group.


Fruit Juice



Peanut Butter


Dried Beans


Fish

ANNEXURE L

IMPACT OF NUTRITION EDUCATION PROGRAMME ON NUTRITION KNOWLEDGE AND DIETARY INTAKE BEHAVIOUR PRACTICES OF PRIMARY SCHOOL CHILDREN IN BOIPATONG

Research proposal submitted in fulfillment of the requirements for the degree Doctoris Technologiae: FOOD SERVICE MANAGEMENT in the Faculty of HUMAN SCIENCES

D. Oosthuizen
MTech Food Service Management

9402500

Vaal University of Technology

Promoter: Prof. W.H. Oldewage-Theron.
Co-Promoter: Dr. C.E. Napier

Date: August 2007

1. INTRODUCTION

The global dilemma of malnutrition can be understood and addressed with the aid of the framework developed by the United Nations Children's Fund (UNICEF) (1990). This framework clearly indicates food insecurity, lack of proper education by parents and caregivers, insufficient health services and unsuitable environment as contributing towards malnutrition (UNICEF 1998, 2001).

2. MOTIVATION

A situational analysis completed by Oldewage-Theron, Napier, Dicks and Rutengwe (2005:13-26) within a peri-urban community in the Vaal Region, South Africa (SA), indicated that malnutrition within this community was caused by household food insecurity, illiteracy and limited accesses to health services. Malnutrition was further increased by the poor living conditions and low income levels of community members and households. As a result children are restricted in food choices which results in children consuming less than 30 per cent of their daily requirements and in the increasing prevalence of wasting [wasting refers to low Body Mass Index (BMI) for age and occurs when the Z-score is below the median by < -2SD (Elmadfa, Anklam and König, 2003). Furthermore, children do not have sufficient knowledge on correct food choices and mothers and caregivers are mostly illiterate (Napier, 2003).

The South African Food-Based Dietary Guidelines (SA FBDG) were developed as short, clear and simple messages, recommended and used as a basis for nutrition education in SA (Vorster, Love and Browne, 2001). One of the strategies of the Department of Health (DoH) is to promote nutrition through education with the hope of reducing malnutrition. Many studies have been done to assess the nutritional status of various sample populations in SA, but very little has been done on nutrition education as a means to improve nutritional status of South Africans.

The main purpose of this study will be to address malnutrition in children through the development, implementation and evaluation of a nutrition education programme (NEP). The aim of the NEP is to increase the knowledge on nutrition of primary school children (six to thirteen years old) in Boipatong, in order to allow them to make informed food choices and change their food intake behaviour.

3. OBJECTIVES OF THIS STUDY

The specific objectives of this research are to:

1) Develop a NEP based on a needs assessment (current knowledge and dietary intake practices) of the children, aged six to thirteen years, with the aim of addressing household food insecurity, growth failure and under-nutrition with the aid of the South African Food Based Dietary Guidelines (SA FBDG).
2) Implement the Nutrition Education Tools (NET) such as board games, cards and activity books with the aid of fieldworkers for a three month period.
3) Evaluate the NEP, over a short (three months) and long term (one year) period, by validated nutrition knowledge questionnaires, to determine the impact of the NEP on nutrition knowledge and dietary intake practices of the children

4. METHODOLOGY

4.1 Planning and ethics approval

Ethics application was obtained from the Medical Ethics Committee for Research on Human Beings at the Witwatersrand University. All fieldwork will be conducted in accordance with the SA Medical Research Council (MRC) ethics guidelines for research on human beings, which includes the written informed consent forms, signed by each participant and their caregivers.

4.2 Sampling

The intervention study will be implemented among primary school children, aged six to thirteen years, attending the Boipatong Care Centre. A random sample will be drawn, based on a power calculation, for representative data and statistical significance. A sample size of 200 is expected. The participants will be divided into an experimental group (n=100) and a control group (n=100).

4.3 Fieldworkers

Fieldworkers will be selected from hospitality students who are trained on fieldwork methods and questionnaire completion to avoid interviewer bias. The fieldworkers will be further trained on the purpose and objectives of this study and the use of the NET.

4.4 Empirical study

This will be an experimental study, using the framework for NEP as developed by Galbally (1992) and adapted for the Food and Agriculture Organisation of the United Nations (FAO) by Smith and Smitasiri (2007). The framework has been adapted for this study into four phases as follows: baseline and pre-evaluation survey (conceptualisation), development and testing (formulation), intervention study (implementation) and post evaluation.

4.4.1 Phase one (Conceptualisation)

A baseline survey will be conducted to determine the nutritional status of the children and dietary intake practices, and the pre-evaluation survey will involve the nutrition knowledge questionnaires which indicate the nutritional knowledge of the children. The baseline and pre-evaluation survey will include:

- Questionnaires: ⇉ Socio-demographic
  Health
- Dietary intake and food consumption patterns by means of a:
  ⇉ 24 hour recall, and
  Food Frequency Questionnaire (FFQ)
- Anthropometric measurements: ⇉ weight
  height
- Validated food and nutrition knowledge questionnaire (incorporating topics based on the SA FBDG)

4.4.2 Phase two (Formulation)

Phase two will consist of the development and testing of the nutrition education tools, for example an activity book, cards and board game. It will require the study of the SA FBDG, media methods, messaging, validity and reliability of images, training of fieldworkers and how to communicate the programme to the children. Postgraduate students from the Department of Visual Arts and Design will assist with the graphic design, validity and reliability testing of the images and messages.

4.4.3 Phase three (Implementation)

Phase three will be an intervention study where the nutrition education tools will be implemented, on a weekly basis, over a period of three months, with the experimental group. The control group will receive no nutrition education during the implementation phase. The same questionnaire will be completed at the end of the study to determine whether inter-lapping of information occurred.

4.4.4 Phase four (Post Evaluation)

The impact on knowledge will be a short-term measurement (three to six months) and the impact of dietary intake will be long-term (one year). Knowledge and dietary intake practices will be measured by the same validated knowledge questionnaires used in the baseline and pre-evaluation survey (24-hour recall, FFQ and nutrition knowledge questionnaire).

5. DATA ANALYSIS

Data from the 24hr recall questionnaires will be analysed by a qualified dietitian using the Food Finder program that is based on the SA food composition tables. The QFFQ questionnaires, socio-demographic questionnaires and nutrition knowledge questionnaires will be captured on Microsoft Excel spreadsheets. The anthropometric data will be analysed after weight-for-age, height-for-age and BMI-for-age have been evaluated for each child according to the National Centre for Health Statistics (NCHS) growth charts. All the data will be analysed for means and standard deviations and the Statistical Package for Social Sciences program, version 12, will be used. Paired t-tests will be done to determine statistically significant differences before and after the intervention, as well as between the control and experimental group, and a multivariate analysis will be done to examine relationships between variables.

6. EXPECTED OUTCOMES

When this study is completed the following outcomes are expected:

- The adherence and success of the components related to this study: improving nutritional knowledge of the Primary School children.
- Changing and improving dietary intake practices of Primary School children.
- To recommend relevant actions and strategies to teachers, community nurses, nutrition advisors and the scientific community.
- Various articles published with co-authors, relating to the peri-urban community and the impact of the NEP on nutrition knowledge and dietary intake behaviour.
- NET which are adaptable to other communities and designed for children, will be available for other researchers or teachers to implement NEP in schools.
- Providing information and encouragement of the DoH programmes and emphasising the use of the SA FBDG in NEP in SA.
- DTech qualification.

7. THE OUTLINE OF THE PROPOSED STUDY

The outline of this study will be presented in the following manner:

Chapter 1	-	Background and problem setting (Poor food choices resulting in malnutrition)
Chapter 2	-	Literature study (NEP globally and in SA)
Chapter 3	-	Baseline and Pre-evaluation survey
Chapter 4	-	Development and testing of the Nutrition Education Tools (NET) and programme requirements for implementation
Chapter 5	-	Intervention study and Post Evaluation
Chapter 6	-	Discussion, conclusion and recommendations

Each phase of the study will be treated as a separate chapter with methods, results and discussion.

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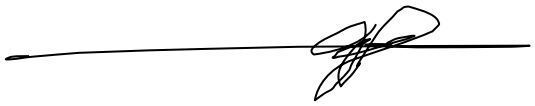
9. TIMEFRAME

January to June ’07	Defining problem of malnutrition and causes thereof (Chapter 1)
March	Baseline study to assess nutritional knowledge level of malnutrition and causes of malnutrition (Chapter 2)
April	Setup of objectives based on interpretation of baseline study (Chapter 2)
July	Language editing of proposal Study the implementation techniques and guidelines to NEP (Chapter 3)
September	Submission of proposal
October to December	Study of NEP tools developed by VUT Researchers (Chapter 3) Designing a structure for the implementation of the NEP tools (cards, books, board games) (Chapter 3)
January (two weeks) ’08	Training of fieldworkers on objectives of study and implementation of NEP tools (Chapter 3)
Mid-January to Mid-June	Implementation over 6 months
June	24 hour recall questionnaires Testing of impact of NEP tools with questionnaires (Chapter 4)
August	Interpretation of results, and discussion (Chapter 5 and 6)
October to March ’09	Thesis writing Four Articles

Proof that the Research Proposal has been edited by a qualified language editor.

This proposal has been language edited by Jan-Louis Kruger



Signed: Dr. Jan-Louis Kruger
Director: School of Languages
North-West University (Vaal Triangle Campus)
Tel: 016-9103481
Accredited member of the South African Translator's Institute, number 1000710

ANNEXURE M

Turnitin Originality Report

Thesis by Delia Oosthuizen

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ANNEXURE N

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12 August 2010

To Whom It May Concern

This certifies that the following doctoral thesis has been edited for language correctness and fluency.

.

I trust that the corrections made in the text have been applied after due consideration by the author of the document:

Impact of a nutrition education programme on nutrition knowledge and food choices of primary school children in Boipatong

By DELIA OOSTHUIZEN

***Magister Technologiae*: FOOD SERVICE MANAGEMENT**

Thesis submitted in fulfilment of the requirements for the degree of *Doctor Technologiae*

in the Department of Hospitality, Tourism and PR Management, Faculty of Human Sciences, Vaal University of Technology.

Mary Hoffman

(SATI Registration: 1001632)