DETERMINING THE CONTRIBUTION OF THE NATIONAL SCHOOL NUTRITION PROGRAMME TO THE TOTAL NUTRIENT INTAKE OF MOGALE CITY LEARNERS

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Research dissertation submitted in fulfilment of the requirements for the degree Magister Technologiae Food Service Management in the Department of Hospitality, Tourism and PR Management, In the Faculty of Human Sciences, Vaal University of Technology.

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DECLARATION

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

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DEDICATION

This study is dedicated to my mother, Fezeka and my father, Reverent Parker Monala. Thank you for your undying support.

ABSTRACT

The purpose of this study was to determine the contribution of the National School Nutrition Programme (NSNP) has made on the total nutrient intake of Kagiso learners. This was done by investigating the nutrient intake of school children participating in the NSNP (experimental group) and comparing this to the nutrient intake of learners participating in the tuck-shop or lunch box (control group) from one school. The research methodology was undertaken in two phases, namely phase one; planning and phase two; data collection and analysis. The following measuring methods were applied; socio-demographics, household food insecurity assessment scale, anthropometry measurements, food frequency questionnaires (FFQ), 24-hour recall and the observation of the NSNP during the school lunch breaks. Anthropometry measurements were analysed according to the World Health Organization standards (WHO 2008), socio-demographics, and household food insecurity assessment scale and FFQ were captured on an Excel spreadsheet by the researcher and analysed using the Statistical Package for Social Sciences (SPSS) version 22.0 for descriptive statistics such as frequencies, standard deviations and confidence intervals.

An expediency sample of 160 primary school children aged 6-13 years, including girls (n=84) and boys (n=76) and 106 caregivers were recruited into the study. The results showed that majority of caregivers (59%) completed secondary level education, followed by 39% with primary level or college completion (2%). The employment rate in the Kagiso households of the sampled group was low with 20% of caregivers being unemployed. Out of the 76% of the employed caregivers, 26% were permanently employed and 51% were temporarily employed with contract work and piece jobs. The highest monthly income (42%) was between R1000-R3000 and the lowest (38%) was less than R1000 with only R101-R200 to spend on food per week.

The food insecurity status of Kagiso learners showed that 44% of school children were food secure, and 56% were food insecure – of these, 29% experienced hunger. Height-for-age, weight-for-age and BMI-for-age were measured for all of the 160 children. The group was categorized as follows; school children participating in the NSNP (n=59) and

children using the tuck-shop foods (n=35) and lunch box (n=66). The nutritional status of Kagiso learners from the sampled group showed that more boys were stunted (13%) and wasted (12%) while of the girls, 30% were at risk of being overweight, with only 2% reported to be overweight. The majority of boys reported to be stunted and wasted were from the NSNP group and the girls reported to be overweight or at risk of being overweight were from the tuck-shop group. Thus, the learners from the lunchbox had optimum growth status when compared to the other two groups.

The respondents consumed a mainly high carbohydrate diet with a low consumption of vegetable and fruits. The results from the Food Variety Score (FVS) revealed a low individual mean (2.25±1.57) in the legume and nuts group, followed by a medium individual mean (7.9±2.81) in the fruits and other juices group, 7.16±2.68 in the vegetable group, and lastly, the highest individual mean (9.26±3.04) in the cereal, roots and tubers diversity. The results from the top 20 popular food items ranked as follows; maize meal stiff (1st), maize meal porridge (5th), white rice (6th), white bread (7th) brown bread (9th), potato fries (12th), breakfast cereal (13th) and samp and beans (14th). Cabbage (15th) and pumpkin (20th) were the most popular vegetables and there were no fruits within the top 20 popular list of food items.

The Nutrient Adequacy Ratio (NAR) of the NSNP (n=59) meals was below the 1/3 (33.3%) and 30% dietary requirements for lunch meals. This was very evident regarding vitamin A (16.85%), energy kilojoules (23.78%), calcium (18%), folate (26.72%), zinc (15.71%), dietary fiber (25.71%) and iodine (4.65%). Iron (38.98%) was slightly above the 1/3 and 30% dietary intake, but there were a high percentage (61%) of respondents who did not meet the EARs of 5.9mg for iron. The results revealed an inadequate contribution by the NSNP to the nutrient intake of Kagiso learners. The poor intake of folate, vitamin A and dietary fiber in this sampled group is linked to the low consumption of vegetable and fruits.

Results from this observational study showed that a majority of respondents do not participate in the NSNP when they do not have their own eating utensils. Respondents also revealed that the NSNP meals caused allergies such as skin rash while some

mentioned diarrhea as the cause of not eating meals from the NSNP. Hence, a larger percentage (41%) of school children preferred to participate in the lunch box rather than in the NSNP (37%).

The high prevalence of inadequate nutrient intake and the poor nutritional status of Kagiso learners in the sampled group, is an indication that strict monitoring of dietary measures needs to be implemented and continuously evaluated to ensure that positive nutritional results are obtained by the NSNP across South Africa.

Keywords: school children, NSNP, nutritional status, dietary intake.

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LIST OF ACRONYMS

AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Ranges
AIDS	Acquired Immunodeficiency Syndrome
ARV	Antiretroviral
BMI	Body Mass Index
BTech	Baccalaureus Technologiae
CHO	Carbohydrates
CVD	Cardio vascular disease
DDS	Dietary Diversity Score
DoA	Department of Agriculture
DoBE	Department of Basic Education
DoH	Department of Health
DoSD	Department of Social Development
Dr	Doctor
DRIs	Dietary Requirement Intakes
EAR	Estimated Average Requirement
EER	Estimated Energy Requirement
e.g	Example
ed	Edition
et al	and others
FAO	Food Agriculture Organization
FBDG	Food-Based Dietary Guidelines
Fe	Iron
FFQ	Food Frequency Questionnaires
FGDS	Food Group Diversity Score
FVS	Food Variety Score
g	Grams
GDP	Gross Domestic Product
HA	Height-for-age

HACCP	Hazard Analysis and Critical Points
HAZ	Height-for-age Z-score
HCSF	Health Care Stabilization Fund
Hb	Haemoglobin
HGSMP	Home Grown School Meals
HIV	Human Immunodeficiency Virus
INEGFP	Institoto Nacional de Estadìstica y Geografia
INP	Integrated Nutrition Programme
INS	Integrated Nutrition Strategy
IoM	Institute of Medicine
kg	Kilogram
kJ	Kilojoules
KZN	KwaZulu Natal
m	Meter
MA	Massachusetts
MAR	Mean adequacy ratio
MDG	Millenium Development Goals
MPMS	Mid-day Meal Scheme
mg	Milligrammes
µg	Microgram
mm	Millimeter
Mg	Magnesium
MoU	Memorandum of Understanding
n	Number
n.d.	Not dated
NAR	Nutrient Adequacy Ratios
NE	Nutrition Education
NFCS	National Food Consumption Survey
NGO	Non-Governmental Organisation
NSNP	Nutrition School Nutrition Programme
p	P-value for statistical significance
PEM	Protein Energy Malnutrition

PRSA	Parliament of Republic of South Africa
PSNP	Primary School Nutrition Programme
R	Rand
RDA	Reconstruction and Development Programme
RSA	Republic of South Africa
RSMP	Regular School Meal Programme
SA	South Africa
SANNANES	South Africa National Health and Nutrition Examination Survey
SAVACG	South Africa Vitamins A Consultation Consultative Group
SD	Standard Deviation
SDG	Sustainable Development Goals
SOSFW	State of School Feeding Worldwide
SPSS	Statistical Package for Social Sciences
SSA	sub-Saharan Africa
STATSSA	Statistics South Africa
TB	Tuberculosis
THUSA	Transition in Health during Urbanization in South Africa
TPFNS	The National Policy on Food and Nutrition Security
U5	Under age of five
UK	United Kingdom
UL	Tolerable Upper Intake Level
µm	Micrometres
UN	United Nations
UNAP	Uganda Nutrition Action Plan
UNAIDS	United Nations Programme on Acquired Immune Deficiency Syndrome
UNICEF	United Nations Children's Fund (United Nations International Children's Emergency Fund)
US$	United States Dollar
USA	United States of America
USAID	United States Acquired Immune Deficiency

VAD	Vitamin A Deficiency
VUT	Vaal University of Technology
WA	Weight-for-age
WAZ	Weight-for-age Z score
WFP	World Food Programme
WFS	World Food Summit
WHO	World Health Organization

CONCEPT CLARIFICATION

School feeding programme

School feeding programmes are defined as means of provision that deliver a meal or snack to children in the school setting, with the goal of improving attendance, enrolment, nutritional status and learning outcomes (Department of Basic Education 2010a:2).

National School Nutrition Programme

It is the government programme that is implemented to provide one nutritious meal to all disadvantaged learners in Primary and Secondary Schools across South Africa (Department of Basic Education 2010a:2).

Tuck shop

Tuck shop Is a small food vendor situated inside or outside school premises, with the aim of selling food items to school children (Faber, Laurie, Maduna, Magudulela, Muehlhoff 2013:1216).

Lunch box

Lunch box is a packed meal either cold or hot from home given to a school child by either a parent or a caregiver to take with to school (Gresse, Nomvete, Walter 2017).

Dietary Intake

Is a set of guidelines for the daily intake of nutrients such as vitamins and minerals that include recommended daily allowances, adequate daily intake values for nutrients (Institute of Medicine 2012).

School Governing Body

According to Macbeth (1989:128), the SGB of a school is the mouthpiece of all the stakeholders involved in the school that makes key decisions about the school's functioning and educational responsibilities. The South African Department of Education

(2010:7) regards SGBs as organisations comprising parents, educators, non-educators, learners and co-opted members of the community. This group of people is elected to represent the school and its community and must promote the school's best interests in all its actions and discussions

Caregiver

The South African Schools Act (SASA) (1996) defines caregivers of a learner as the person legally entitled to custody of a learner, or person who undertakes full responsibility of a person referred as a minor.

LIST OF SYMBOLS

&	And
=	Equals to
>	Greater than
≥	Greater than or equal to
<	Less than
≤	Less than or equal to
%	Percentage
$	US Dollar

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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The access to food is a human right and a legislated law written under National and International law (The National Policy on Food and Nutrition Security 2014:50) (TNPFNS). The law was passed in 1996 to protect the rights of people to access food in a fair and dignified manner by either sustainably producing their own food or purchasing it (Human Sciences Research Council 2010). The right to food in South Africa and globally is based on a fundamental concept of food security (World Health Organisation 2013a). Food security can be disrupted by political instability and environmental issues such as climate change causing inflation on food prices (Parry, Rosenzweig & Livermore 2005:25), unemployment, resulting in an increasing amount of food insecure households and a detrimental condition that impacts on social and economic factors (Human Science Research Council 2010). Bickel, Nord and Price (2000:21) state that food insecurity has a vast impact on the nutritional status, academic performance, cognitive and psychosocial functioning of children of school children. However, in the article "The nutrition status of school children: why should we care?", Best, Neufingerl, Van Geel, Van den Briel and Osendarp (2010:408) acknowledge the problem that food insecurity has on school children but, interestingly, they emphasize the lack of global nutritional surveys conducted to monitor the nutritional status of school children.

The World Food Programme (2013) is one of the prominent financial funders currently providing food aid to 22 million learners in 70 countries across the world. School feeding programmes are implemented to target serious issues such as school enrolment, school attendance and most importantly to decrease the rate of malnutrition by increasing the consumption of micronutrients in school meals that are provided to school children (State of School Feeding Worldwide (SOSFW) 2013:11). Tomlinson (2007:9), in the article "School feeding in East and Southern Africa", questions and criticises the contribution that school feeding schemes have on the nutrient intake of learners. This scepticism is derived from the speculation that increased nutrient intake through school

meals is a temporary solution that does not target underlying causes of malnutrition such as high food prices and nutritional controlling measures in schools.

1.2 RATIONALE AND MOTIVATION

School feeding programmes across the globe continue to gain recognition for their remarkable impact on social protection investments and particularly on vulnerable children from food insecure households (Caniello, Schneider, Pauli & Hunter 2016:10). Bundy *et al.* (2009) revealed that policy makers across the world use school feeding programmes to improve education, to fight malnutrition and improve the nutritional status of school children, and also to expand local agriculture. Children from middle-income and low-income countries suffer from different forms of malnutrition, namely; underweight, overweight and micronutrient diseases and, therefore, the impact of nutritious school meals should be taken seriously (Drake, Woolnough, Burbano & Bundy 2016:109).

Education and child health are fundamental tools used to reduce poverty and improve economic development (Buhl 2010). An estimated 67 million school children from developing countries struggle to attend school on a daily basis (World Food Programme 2013). According to Habib, Dhingra, Dutta, Sarkar, Deb, Alam, Husna and Black (2013:516) in Bangladesh, learners from low-income households are subjected to survival measures of child labour practices, simply to survive. In other cases, school children are reported not to attend school, based on their poor health and short-term hunger (WHO 2012). School feeding programmes in China operate on a slightly different policy structure involving a profit business system. Thus, this caters school meals solely to school children who can afford to purchase school meals, leaving hungry those school children from poor households to attend school with no meals available for lunch (Global Child Nutrition Policy review 2016). South African learners from different backgrounds face nutritional challenges that range from malnutrition to obesity and being underweight (Bhatia 2013:10). The South African government has urged schools to help make a difference in fighting malnutrition by ensuring that food provided by tuck shops meet the standards of good nutrition for learners (Vorster,

Badham & Venter 2013:10). This is especially imperative in communities where Caregivers struggle to provide balanced nutritious meals for their children (Buhl 2010). Bundy *et al*. (2009:60) also emphasises an overlooked challenge faced by primary schools in South Africa - the battle of school feeding programmes and school tuck shops working as different entities, that both provide food, but have different health goals that contradict each other. The practical implications of this research study relates to assisting school feeding programmes, particularly the NSNP in identifying the impact that school nutrition programmes have on the nutritional status of school children from food insecure households.

1.3 PROBLEM STATEMENT

School feeding programmes are initiatives that run in most developing countries to reduce hunger and malnutrition by providing nutritious meals to school children from food insecure households (Gonzalez 2013:1). To improve learning in South Africa, the fundamental goals of the National School Nutrition Programme (NSNP) are disturbed mainly by the lack of nutrient consumption and nutritional monitoring measures implemented by the Department of Basic Education (DoBE) (Bundy, Burbano, Grosh, Geli, Jukes & Drake 2009:84). According to the Department of Health (DoH), (2012:17) the effects of poor nutrition on learners have become a serious issue in South Africa and efforts to monitor the nutritional status of learners is a critical obstacle based on the shortage of reliable anthropometric data. The lack of proper kitchen equipment and measuring utensils, particularly the scarcity of eating utensils such as plates and cutlery, is a huge concern in primary schools across the country (DoBE 2011b:32). Menu repetition creates instability and disrupts the NSNP because learners get tired of unattractive meal plans and resort to other measures such as sourcing unhealthy food, meals from the tuck shops and lunch boxes, causing NSNP plate waste (Gonzalez 2013:1). The NSNP needs to implement methods that monitor quality control, specifically systems set to ensure proper nutritional consumption by learners (Labadarios 2005:240). Controlling nutrient intake is a challenge for the NSNP and needs to be controlled by ensuring that every learner receives a properly balanced meal

on a daily basis to prevent plate waste and lack of nutrient consumption (Gatenby 2007:540).

1.4 THE PURPOSE OF THE STUDY

The purpose of this study was to investigate the impact the National School Nutrition Programme has on the nutrient intake of learners in Kagiso, Mogale City by evaluating the overall nutrient intake of learners participating in the NSNP as well as learners who are not participating in the NSNP.

1.5 SCHOOL FEEDING CONCEPTUAL FRAMEWORK

The school feeding conceptual framework illustrates the relationship and the nutritional impact between school feeding programmes and learners.

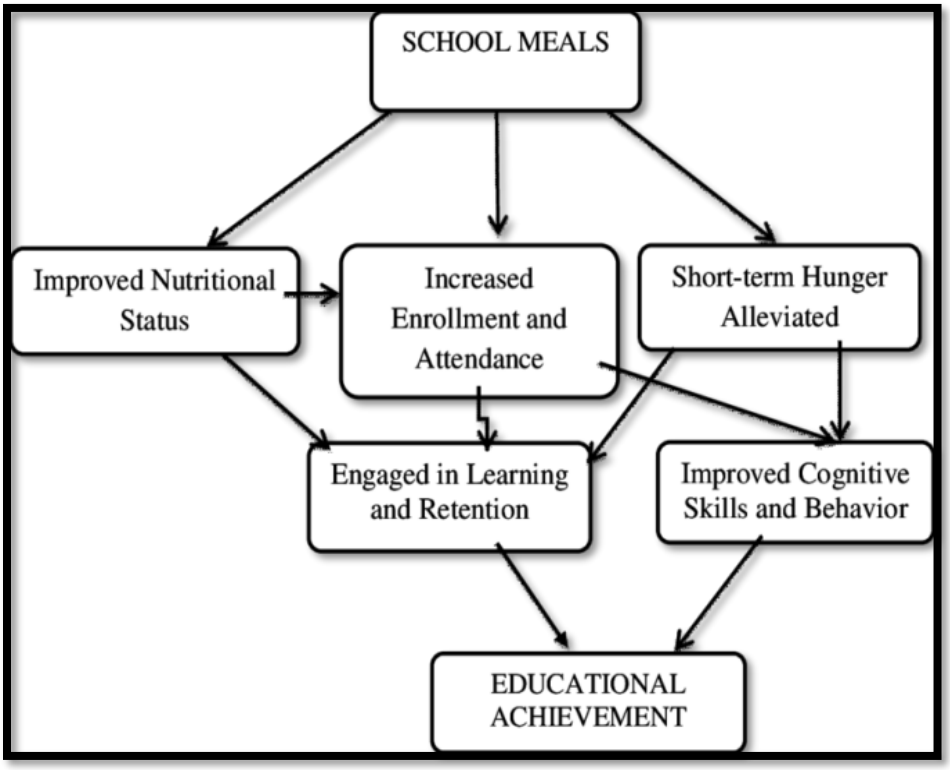


Figure 1.1 School feeding conceptual framework Source: Adapted from Grantham-McGregor Chang and Walker (1998:785).

1.5.1 School feeding meals

Almost every country in the world is involved in some form of school feeding programme (World Food Programme 2013a). Although the provision of school meals is regarded as a safety net for children, the World Bank (WB 2015a) emphasises the necessity of school feeding programmes to not only provide school children with meals but also to provide nutritious meals that contribute to the daily nutrient intake of the children. Schools in South Africa operate on a 13-grade system: primary school is compulsory for all races and genders and starts from grade R and ends at grade seven and secondary school which is not compulsory and starts from grade eight to grade twelve (DoBe 2010a). Based on the Universal Declaration of Human Rights (UDoHR 2008), every child of school-going age has the right to education. The South African government contributes 5.4% on its Gross Domestic Product (GDP) annually to education (Devereux & Waidler 2017:3). School enrolment in developing countries, particularly primary level, has increased to 91%, despite a shocking estimation of 57 million school children still not being enrolled in school and the majority of learners not enrolled in school living in sub-Saharan Africa (Sustainable Development Goals 2015, WFP 2016).

The determination and dedication to funding education by the South African government has put the country on the map as one of the few developing countries striving to meet its 2030 Sustainable Goals (WFP 2016). However, according to Saasa, McCoy, Saitowitz, Barron, Maclachlan, Sanders and Wigton (1997:13), there is no substantial data on school children that directly link school nutrition programmes with enrolment and school attendance. Overy (2010:47) encourages researchers to investigate and measure the impact that nutrition food programmes have on the educational system, particularly on learners. There are currently 70 school feeding programmes in 180 mainly low income, developing countries, most of which being funded by the World Food Programme (WFP) (2010). Based on the Food Agriculture Organization (FAO) (2010), school children across the globe still attend school on empty stomachs, which hinders their concentration abilities in class. In some impoverished communities

children are kept home to assist with house chores or help family members with farming in the fields (World Hunger & Poverty Facts Statistics 2013) (WHPFS). School meals are, therefore, seen as an incentive for Caregivers to keep their children in school (Kallaway 1996:27) so that a daily nutritious meal for school children not only impacts on their nutritional status but also increases their academic performance (World Food Programme 2015). School feeding programmes across the globe, especially in developing countries, are implemented to enhance and improve the following; increase enrolment, alleviate hunger, increase retention levels, improve concentration and learning capabilities of school children and improve academic results (Buhl 2010).

1.5.2 The impact of school feeding on the nutritional status of learners

In order to reduce child malnutrition, school feeding programmes are implemented in many parts of Africa and are known to provide educational and nutritional benefits (Ejekwu, Ene-Obong & Oguizu 2012:481). School feeding programmes are strategies used by policy makers to distribute food to children from food insecure households (Buhl 2010). Children from rural and peri-urban areas whose Caregivers do not have strong educational backgrounds and children who come from low-income households with poor living conditions are reported to be the most undernourished (Iversen, Du Plessis, Marais, Morseth, Hoisaether & Herselman 2011:74). In South Africa, one in ten children is recorded to be underweight and one in five children are recorded as stunted. These reports coexist with common micro-nutrient deficiencies, such as iron, vitamin A, and zinc deficiencies (Maunder, Nel, Steyn, Kruger & Labadarios 2015:21). Naicker (2015), states that children from insecure households consume more affordable meals high in carbohydrates such as bread, maize meal and samp and fewer fruits and vegetables. Therefore, the contribution from school feeding programmes comes highly recommended with the nutritional support that increases the nutrient intake of primary school children (Gresse, Nomvete & Walter 2017:379).

1.5.3 The impact of school feeding on alleviating hunger

An estimated 66 million primary school children across the world attend school on empty stomachs, and it is reported that 23 million from the latter estimation are children

from Africa (MDG 2015). A majority of hungry people in the world are from developing countries, with an estimated 12.9% of the population reported to be undernourished (Gelli 2015:72). According to the World Food Programme (2016), Asia is rated the continent with the most hungry people especially in southern Asia that has a population experiencing extreme poverty and hunger, with an estimated 281 million people reported to be undernourished. Inadequate and poor nutrition claims nearly half (45%) of deaths in children (WHO 2016).

When food monitoring measures focus on macronutrient and micronutrient deficiencies, assuring proper food distribution, proper portion sizes and appropriate meal preparation, school meals could improve the nutritional status of primary school children by decreasing morbidity and enhancing learners' health and lifestyle (World Food Programme 2017). Statistical analysis of various studies of school feeding programmes showed that learners who consumed a meal of 401 kcal (1678 kj) per day during 200 days of school feeding gained an average of 0.3 kg per year more than their peers who did not participate in the school feeding programmes (Kristjansson, Gelli, Welch, Greenhalgh, Liberato, Francis & Espejo 2016:82). A study done in Ghana also revealed that primary school learners participating in school feeding programmes receive better and adequate nutrients compared to learners not participating in school feeding programmes (Abizari, Buxton, Kwara, Mensah-Homiah, Amar-Klemesu & Brouwer 2014:1030).

1.5.4 The impact of school feeding on enrolment and education achievements

These feeding programmes play a crucial role in school enrollment, attendance and educational development of learners (Gelli 2015:6). School feeding programmes are motivational instruments used to facilitate access to school. School enrolment in developing countries, particularly primary level, has increased to 91% despite a shocking estimation that 57 million learners are still not enrolled and that a reported estimated 50% of learners not enrolled are from food insecure households (WHO 2015). Systematic reviews of 216 school feeding programs show that in 52 low-income countries, school meals are linked to positive results in school attendance and school

completion (Gertler, Heckman, Pinto, Zanoli, Vermeersch & Walker 2014:999). Across 32 sub-Saharan countries in low-income communities, school attendance increased by 10% in schools participating in school programmes (Gelli 2015:7). According to reports from the Sustainable Development Goal fact sheet (WFP 2016), literacy rates of school children participating in school feeding programmes have improved from 83% to 91% from 1990 to 2015, but that an estimated 50% of learners who were not enrolled are displaced and are from food insecure households.

1.6 GLOBAL CHILD MALNUTRITION

Malnutrition is a daunting challenge faced by many countries worldwide (International Food Policy Research Institute 2014). It is visible in many forms and is easy to detect in children through physical signs and symptoms (Black, Victora, Walker, Bhutta, Christian, de Onis, Ezzati, Grantham-Mcgregor, Katz & Martorell 2013:429). The consequences of malnutrition are distressing because they are linked to factors contributing to the global burden of disease (Forouzanfar, Alexander, Anderson, Bachman, Biryukov, Brauer, Burnett, Casey, Coates & Cohen 2013:2289). Malnutrition has dire consequences on the global financial scale (Horton & Steckel 2013:248, World Economics (WE) 2016). According to Horton and Steckel (2013:250), in the United States of America, every household with obese and diabetic children and adults incurs an extra 8% annual expenses just on health care costs. In China, households with individuals diagnosed with diabetes contribute 16.3% of their annual income on medical and hospital costs (Liu & Zhu 2014:75). The cost of malnutrition on the economy is extremely high because it slows the growth of the economy which, in turn, prolongs the fights against poverty (World Bank 2015). According to the FAO (2013), the overall cost of malnutrition on the global economy is an estimated $3.5 trillion. However, Kristjansson *et al.* (2016:86) state that investing on strategies and methods such as school feeding schemes, food fortification, micronutrient supplements and bio-fortification, could benefit the economy in the long run. Malnutrition does not discriminate as it affects all human beings from different financial scales, races, genders and sex (UNICEF 2013).

Table 1.1 Malnutrition global scales. Source: Adopted from the Global Nutrition Report (2016:26).

Deficiency	Source
• Out of a world's population of 7 billion, an estimated 2 billion people suffer from micronutrient malnutrition. • 800 million people suffer from under nutrition	World Health Organization (2014).
• Of the world's adult population, an estimated 2 billion people are overweight. • One in two has type 2 diabetes.	World Health Organization (2016).
• 41 million children under 5 in the world are overweight • Of every 667 million children under 5 and school going children in the world, an estimated 159 are stunted (height does not correspond with age) and an estimated 50 are wasted (weight does not correspond with age)	United Nations Children's Fund, World Health Organization & World Bank (2015a).

1.6.1 Child malnutrition in sub-Saharan countries

Sub-Saharan Africa consists of African countries situated south of the Sahara. Of 54 African nations, there are 49 sub-Saharan African countries located south of the Sahara (Fanzo 2012). Sub-Saharan Africa is known to have the most severe cases of malnutrition in the world and with nearly 17,000 children dying every day from infections (Fanzo 2012). The United Nations International Children's Emergency Fund (2016:17) reported that 10% of children living in extreme poverty are from sub-Saharan Africa, as well as the 60 million primary school learners are reported to have dropped out and not attending school in Africa, half of them are from Sub-Sahara Africa. However, despite several studies conducted on the burden of child malnutrition across developing countries, particularly in Africa, no study has managed to find a consistent prevalence of each malnutrition indicator (Mutisya, Kandala, Ngware & Kabiru 2015:1). Poor

infrastructure and limited resources accompanied by political conflict, HIV, and limited access to health services are dominating factors that contribute to the overwhelming levels of food insecurity and malnutrition in Africa (Black *et al*. 2013:430). Even though these challenges are huge, some African countries are dedicated to making progress in strategies concerning food and nutrition security and human development (United Nations 2015). Countries reported by the Global Nutrition Report (2016:17) with the highest commitment in fighting child malnutrition are Ethiopia, Malawi, Tanzania and Madagascar as opposed to countries such as Angola, Cameroon, Democratic Republic of Congo and Sudan that were reported as countries in Africa with the least commitment to fighting child malnutrition (GNR 2016:17).

1.6.2 Child malnutrition in South Africa

South Africa is a middle-income country located in the southern tip of Africa that forms part of the Southern African region. South Africa has nine provinces, namely Gauteng, Western Cape, KwaZulu-Natal, Eastern Cape, Northern Cape, Limpopo, North-West, Mpumalanga and Free State (Statistics South Africa 2017). In South Africa, the double burden of social and economic inequality is intertwined with child malnutrition (Moyeki, Awotidebe, Strydom, Ridder & Kemper 2015:1157). According to the Global Nutrition Report (2016), South Africa ranks 70th out of 132 countries with an increasing number of stunted children. The main causes of deaths in children under the age of 5 years in South Africa include perinatal respiratory and cardiovascular disorders, diseases associated with gastroenteritis, influenza and pneumonia, and malnutrition (Statistics South Africa 2017). According to the South African Demographic and Health Survey (2016) stunting in children is more prevalent in the North West (13%) and the Western Cape (12%) and wasting is prevalent with high percentages of children in the North West (6%), Free State (5%) and Limpopo with 4% children affected.

Despite South Africa being a middle-income country, an estimated 45% of the population lives below the poverty line, surviving with less than R620 per month, while another portion (22%) of the South African population survive on less than R321 per month (Stats SA 2016). Poverty is a curse that disrupts the livelihood of children and

Meintjies and Hall (2013:40) state that an estimated 70% of children in South Africa come from poverty-stricken households and half of those children are from three provinces; the Eastern Cape, Kwazulu-Natal and Limpopo. According to Hoogeveen and Özler (2006), these are three provinces that were known as apartheid homelands and still have not recovered from high levels of poverty.

1.7 AIM OF THE STUDY

The aim of this study was to determine the nutritional contribution that the National School Nutrition Programme (NSNP) has on school learners from Kagiso Primary School in Mogale City - West Rand District, Gauteng Province. This study was conducted by determining the nutrient intake of learners participating in the NSNP as well as the overall nutrient intake of learners not participating in the NSNP. In providing solutions for the research problem, various empirical objectives were formulated;

- to determine the socio-demographic status of caregivers and learners by completing a socio-demographic questionnaire.
- to determine the food insecurity status of school- children by study participants completing a Household Food Insecurity Access Scale questionnaire.
- to measure the nutritional status of learners between 6 and 13 year in a Kagiso Primary school (Mogale city), using anthropometric measuring tools.
- to determine the dietary intake of Kagiso learners, by their completing a Food Frequency questionnaire.
- to assess the overall nutrient intake of Kagiso learners measured by 24-hour recall.
- to assess the nutrient intake of learners participating in the NSNP compared to learners participating in the tuck shop and lunch box meals.
- to observe the NSNP, eating patterns and food choices of Kagiso learners.

1.8 METHODOLOGY

1.8.1 Study design

The study design used in this study to measure variables involved a quantitative comparative, cross-sectional and analytical survey design. The core of the study consisted of an experimental group and a control group; experimental group – learners participating in the NSNP and the control group that consisted of learners who obtained food from the tuck shop and lunch box.

1.8.2 Ethical consideration

The study was assessed using ethical standards that were required by the academic research committee. Information in this study was obtained from school children and caregivers from the sample group. Confidentiality was practiced when dealing with participant's information.

1.8.3 Study population

The target populations in this study are residents from (115.802) Kagiso township in the Mogale City district. The inclusion criteria consisted of primary school children from ages 6-13 years, as well as caregivers who provided socio-demographic background data. The total amount of Kagiso school primary school children was 956 and 160 school children participated in the study.

1.8.4 Sampling

The sample frame in this study consisted of school children from Kagiso Primary School. The sample consisted of girls (n=84) and boys (n=76) participating in the study. The study is broken down into two components, the experimental group, addressed in the study as the NSNP (n=59) and the control group addressed in the study as the tuck shop group (n=35) as well as the lunch box group (n=66). A purposive sampling was conducted to explore departure from the proposed sample of n=160 learners and corresponding caregivers. The sample calculation that was used to determine the sample size, as based on Krejche and Morgan (1970).

1.8.5 Measuring instruments

The measuring methods used for this study was designed to analyse the socio-demographic background, food insecurity status and the dietary intake of Kagiso school learners. Measuring instruments used in this study consisted of socio-demographic questionnaires, a household food insecurity access scale questionnaire, anthropometric measurements, a food frequency questionnaire, and a 24-hour recall questionnaire as well as observation methods conducted during school lunch breaks, to observe school children food choices, eating patterns and the NSNP food preparation process. The observation method used in this study was to take pictures of the NSNP processes during school lunch and to monitor using an observation list (see ANNEXURE K), without interviewing respondents and NSNP food handlers. The origins of the questionnaires used in this study were validated by Oldewage – Theron and Egal. The study pilot was not done, as pretested measuring instruments were used.

1.8.6 Data collection procedure

Data for this study were collected after school hours by trained fieldworkers during a period of four weeks at the Kagiso Primary School premises. The class list of learners whose Caregivers signed consent forms was given to the researcher by the headmaster. Each questionnaire took approximately 25 to 30 minutes per learner. Caregivers were also interviewed after school and on weekends in the Kagiso Primary School premises. The origin of the

1.8.7 Data analysis

Data in this study was analysed using the Statistical Package for Social Sciences (SPSS) for Windows (version 22.0) and anthropometric measurements were analysed using the World Health Organization's AnthroPlus (version 1.02) statistical software. The 24-hour recall questionnaire in this study was analysed by a registered dietician for mean nutrient intake, African Medical Research Council FoodFinder3® program.

1.9 THE PURPOSE OF THE STUDY

The purpose of this study was to investigate the impact the National School Nutrition Programme has on the nutrient intake of learners in Kagiso, Mogale City by evaluating the overall nutrient intake of learners participating in the NSNP as well as learners who did not participate in the NSNP.

1.10 CONCEPTUAL FRAMEWORK OF THE STUDY

The framework below indicates stages followed to the completion of the research study.

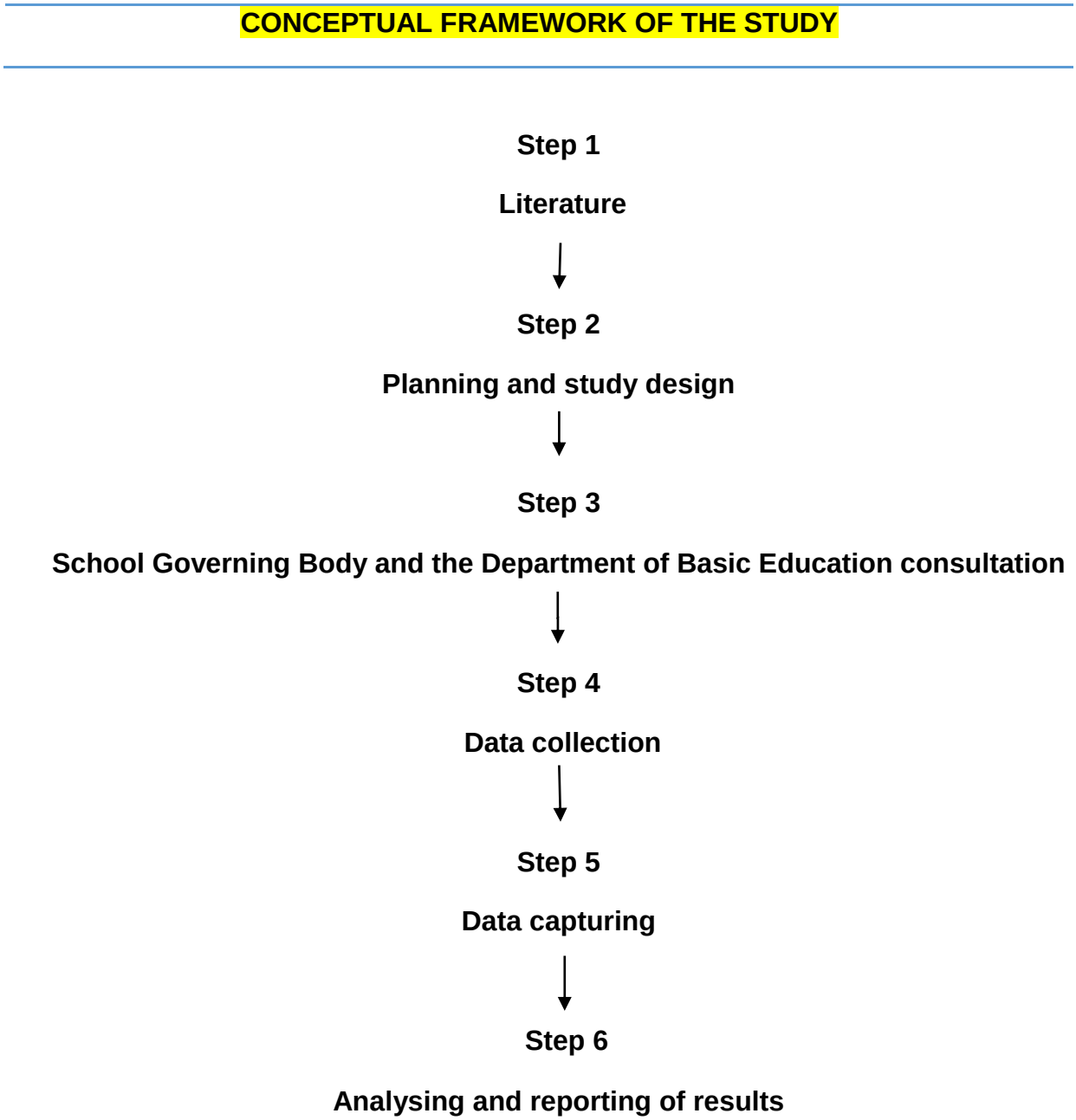


Figure 1.2 Conceptual framework of the study. Source: Researcher (2017).

Step 1 - Literature review

Literature reviews are known to assist researchers by increasing their knowledge base as well as acquainting them with different findings and discourse around the subject under study (Hart 1998). The process for this study involved checking available literature on the topics related to the study so as to complete Chapter 2 and the research proposal.

Step 2 – Planning and study design

The research structure of this study was planned based on the study empirical objectives.

Step 3 – School Governing Body (SGB) and The Department of Basic Education (DOBE) consultation

Consultation was arranged with the School Governing Body (SGB) and the Department of Basic Education (DoBE) to discuss the research structure, ethics as well as Caregivers notification of the dates and times for scheduled data collection.

Step 4 – Data collection

Trained fieldworkers were tasked to collect data using 24-hour recall information, FFQ, anthropometric measurements, household insecurity access information, and socio-demographic information and observation methods. Before interviews, fieldworkers explained to participants that participation in the study was on a voluntarily basis and there would be no negative consequences if they decided not to participate in the data collection process. The use of a coded method assured anonymity to protect the identities of all respondents willing to participate, including parents, school learners and food handlers.

Step 5 – Data capturing

Data were captured on an Excel spreadsheet, using the Statistical Package for Social Sciences (SPSS) for Windows (version 22.0). This programme was used to analyze the data for descriptive statistics, which determined percentages of all respondents who

answered questionnaires accurately. The 24-hour recall questionnaires were analysed by a registered dietician for mean nutrient intake using the South African Medical Research Council FoodFinder3® program. Anthropometric measurements were analyzed using the World Health Organization's AnthroPlus (version 1.02) statistical software.

Step 6 - Analysing and reporting of results

Results, findings and recommendations will be presented and discussed in Chapters 4 and 5.

1.11 CHAPTER OUTLAY

Chapter 1: Introduction: This chapter provides a synopsis and background to the study. The research methodology will be briefly discussed.

Chapter 2: Literature review: Provides a discussion on the previous and current state of school feeding programmes, and their nutritional impact on school children. The study highlights issues centered on malnutrition worldwide, and particularly in South Africa.

Chapter 3: Research methodology: The design and method of research developed in this study are highlighted. Sampling techniques, methods of data collection and analysis are provided in detail.

Chapter 4: Research results: Provides results and interpretation of research findings. The findings obtained will be evaluated against findings from previous studies.

Chapter 5: Conclusion and recommendations: Recommendations derived from the study will be provided. Conclusions will be made based on the findings; limitations, main findings, conclusion and recommendations for further research will be highlighted.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

Malnutrition is known as a deficiency, disproportion in an individuals energy intake and nutrients (WHO 2016). Malnutrition has a great impact on children's physical health and mental growth (Morseth, Hoisaether & Herselman 2011:72). A balanced diet consumed on a daily basis provides the essential nutrients to develop a human body (Rolfes, Pinna & Whitney 2015:200). Failure to consume nutrients, particularly by children, leads to malnutrition (Global Nutrition Report 2016) so that underweight and stunting will impede a child's potential to reach optimal biological growth and cause long-term malnutrition (Mauder *et al*. 2015:8). Reducing child malnutrition prevents negative outcomes such as deteriorating cognitive functions and chronic diseases that impede a child's ability to lead a productive and normal life (Mason, Mebrahtu & Horjus 2010:209). A comparative study done by Chedekal and Dearden (2014) found that children who were stunted at one year of age were often behind in school at age eight and scored extremely low on cognitive tests compared to their peers who were not stunted at age one. However, Chedekal & Dearden (2014), from the School of Public Health Centre for Global Health and Development, published research showing that the effects of early child malnutrition can be reversed if proper nutrient intake is provided to children during their primary school years.

2.2 HISTORICAL BACKGROUND TO SCHOOL FEEDING PROGRAMMES

School feeding programmes were successfully launched in the United Kingdom and the United States of America in the 1930s with a sole aim of improving the growth and development of children (Richter, Rose & Griesel 2000:93). In the United Kingdom, the initiative began with providing school learners with subsidised milk, but in the late 1960s and early 1970s the benefits were taken away from privileged school learners and only provided to school learners considered to be from low-income households (Baker, Elwood, Hughes, Jones & Sweetnam 1978:578). According to Gunderson (2011:12) the National School Lunch programme was passed by congress in the United States of

America in 1948, legislation that later became the predecessor of all child nutrition programmes today.

In 1875, the concept of school feeding programmes in Germany began with the Philanthropic School Society in Hamburg where school children from poor backgrounds were supplied with food, clothes and textbooks (Gunderson 2009:5). Similar societies began injecting funds into many cities to support the cause, which later resulted in a merged society called “Society for Feeding Needy School Children” in 1880 (Gunderson 2009:5). However, in 1887, major societies pulled out from the Society for Feeding Needy School Children, limiting its funding and allowing it to be subsidised by cities. Societies that pulled out and formed an organisation in Germany called “Vacation Colonies”, the programme was designed to target children from overcrowded areas with chronic ailments to go on an educational and health driven summer vacation in the country, sponsored by teachers and doctors. The progress and accomplishments of the vacation colonies were discussed at a convention held in Leipzig in 1890. An investigation on the importance of school feeding started in 1896, which lead to a bill being passed in the Reichstag in 1897 that all school meals backed by the government be provided in all cities (Gunderson 2009:6).

In 1900, the Netherlands sanctioned municipalities to supply food and clothes to both private and public schools to encourage pupils from poor backgrounds to attend school. Thus, the Netherlands became the first country to adopt a national legislation directed at providing school meals (Gunderson 2009:7). By 1901, Switzerland had established a mini school feeding programme funded by private societies that provided 8% of primary school children with lunch meals (Gunderson 2009:9). This was an initiative implemented to target and motivate school children who lived far from school and could not go home for a school break lunch meal. School feeding programmes later expanded following a survey that revealed the effect that teachers stating the positive influence school feeding programmes had on learners school attendance, learners attention span, and academic performance. In 1907, a study was done by Dr. Erismann (Brynt 1913:137) on school meals throughout Switzerland. The finding from the study revealed

school meals to be inadequate in protein and fat and recommended to the Swiss government that: “the school lunch should be a full nourishing meal”; that meal portions should contain 816 calories or one and a half times the daily requirement per child; that meals should be rich in protein and that fat and food values should be distributed as 40 grams of protein, 26 grams of fat and 100 grams of carbohydrate for primary school children.

2.2.1 School feeding programmes globally

Today an estimated 368 million children across the world receive school meals from school feeding programmes on a daily basis, in both developed and developing countries (WFP 2013a). According to the WFP (2013b), the global investment in school feeding programmes is around US$75 billion a year. The largest rated school feeding programme in the world, the Mid-day Meal Scheme (MDMS), operates in India where it is known to feed 105 million children on a daily basis (World Bank 2015b). India is one of the lowest-income and largest food insecure countries in the world (FAO 2013). India is known to be one of the largest producers of vegetables and fruits, milk and castor oil seed with a production that produces 85.9 million tons a year and is the second largest global exporter of rice and wheat (Prija & Mishra, 2011). However, India is still unable to feed its growing population and has an increasing number of food insecure and hungry citizens (WFP 2012a). Children are the most vulnerable to the food-deficit crisis in India resulting in an estimated 57% of children being undernourished and an increasing number of school children not attending school (Sarkar, 2013; Kumar, 2011). However, according to the Indian government (Government of India 2010), since the implementation of the Mid-Day Meal Scheme in 1995, enrollment has increased in primary schools from 78% to 93% between 2000 and 2008 and has improved the nutritional status of school children from impoverished areas.

Mexico, has adopted a different approach to eliminating the burden of underweight and overweight malnutrition amongst primary school children. Desayunos Escolares is a successful breakfast school feeding programme in Mexico, targeted to feed 6.1 million primary school children from low-income households (Camara de Diputados &

Congreso de la Union 2012). The objective of this breakfast school feeding programme was to initially tackle under-nutrition amongst school children by providing both nutritious food and nutrition education. However, since 2007, the approach has changed to solely tackling obesity amongst primary school children (INEGI, 2013). Mexico struggles with a population that has limited food resources and a population that has excessive resources of unhealthy food so that Mexico is rated the world's second-most obese country in the world (Gutiérrez *et al*. 2012).

2.2.2 School feeding in Africa

School feeding programmes in Ghana provide one hot meal for lunch only to children in 216 districts to eliminate hunger and malnutrition (World Bank 2013). The objectives of the school feeding programmes in Ghana are to increase school enrolment, improve academic results and to eliminate micronutrient deficiencies. Ghana has fed approximately 1.7 million school children in 5000 primary school children from the year 2013 and 2014 and the numbers continue to grow (Ghana School Feeding Programme 2014). School feeding programmes in Kenya have been operating since the 1980's, strictly providing milk to school children from low-income households (Meme, Kogi-Makau & Mukoki 1998:334). However, due to lack of funds, the programme was discontinued. Kenya today has a high percentage (76%) of school children suffering from micronutrient deficiencies, predominately iron and vitamin A (UNICEF 2013a). To tackle these micronutrient deficiencies, Kenya has two school feeding programmes currently running: the Regular School Meals Programme (RSMP) led by the World Food Programme as well as the Home Grown School Meals Programme (HGSMP) led by the government of Kenya (Meme *et al*. 1998:340). The effects of the HGSMP, according to the Government of Kenya (2013) has reduced anaemia amongst school children and improved sustainability amongst small farmers who are service providers to the HGSMP.

2.2.3 School feeding programmes in South Africa

School feeding programmes emerged in South African schools around the 1940s, only providing subsidised milk to white and coloured schools (Tomlinson 2007:12). Over

time, the initiative gradually diversified and school feeding programmes became fundamental tools designed to target social safety nets meant to provide educational and progressive nutritional outcomes in vulnerable learners from low-income households (World Bank 2013).

Many studies have linked food security to child growth and school nutrition, thus the two are inter-related (Jyoti, Diana, Edward, Frongillo & Jones 2005:831). "Food insecurity affects school children's academic performance, weight gain, and social skills (Hamm & Bellows 2005:136). South Africa is globally viewed as a middle-income, food secure country with a stable agricultural sector (Republic of South Africa 2012). However, with the latter mentioned, one in five South African households are reported to be food insecure (Republic of South Africa 2012). Household food insecurity is commonly experienced in urban and rural household but is relatively severe in rural households (Hendricks 2014:15). Based on the growing percentage of low-income households in South Africa, chronic malnutrition has increased to be a problem associated with increasing levels of stunting amongst children (UNICEF 2012). According to the National Food Consumption Survey (2005), findings revealed that 28% of children were anaemic, 45% school children were zinc deficient and 64% were vitamin A deficient.

Since 1994, school feeding programmes in South Africa have been funded by the South African government (Department of Basic Education 2011b). Today, South Africa's largest school feeding programme is the National School Nutrition Programme (NSNP) whose objectives are to eliminate hunger and malnutrition and increase enrolment in school children from low-income households (Buhl 2010). Since 1994, such programmes in South Africa have progressed from providing school children with fortified biscuits and peanut butter sandwiches to hot meals five days a week in all nine provinces (Case study of the National School Nutrition Programme 2013:14). Good nutrition has a positive effect on building a progressive metabolic function and an active healthy physical life in children (Semba 2016:79). According to Bevans, Sanchez, Teneralli and Forrest (2011:427), the importance of adequate nutrition during the development stages of school children impacts on their health and cognitive

development (Reilly & Kelly 2011:891). Children who suffer from protein- energy malnutrition, hunger and parasitic infections are likely to struggle academically throughout their school years compared to their properly nourished counterparts (Semba 2016:80). Hunger amongst school children causes difficulty in concentrating and performing complex tasks which also has an impact on their nutritional status (WHO 2012).

2.2.3.1 Pre-apartheid era

In 1916, the former Transvaal Provincial Council's Executive Committee made it a point to reserve funding for school feeding programmes to provide provisions to vulnerable children (Kallman 2005:43). Between the year 1937 and 1940, school feeding programmes progressed to three types of school feeding schemes; a milk and cheese food scheme, a dried fruit scheme and a citrus fruit food scheme (Kallaway 1996:34). In 1943, the United Party officially implemented school feeding programmes aligned with international trends, which were provided to vulnerable children of all races (Saasa, McCoy, Saitowitz, Barron & Maclachlan 1997). School feeding programmes in South Africa were funded by the government and handled by the Department of Social Welfare. It targeted close to a million children, half of them being black (National Treasury 2005). New developments surfaced in 1945, when Social Welfare no longer handled the administration of school feeding programmes and responsibilities were shifted over to the Department of Basic Education. Funding in native schools was removed, as political events evolved, eventually during the apartheid era, and school feeding programmes were completely discontinued (Parliament of Republic of South Africa (PRSA) 1994).

2.2.3.2 Apartheid era

During the apartheid era, South Africa discontinued school feeding programmes, poverty started to rise amongst native communities (PRSA 1994). However, children continued to receive school meals from private non-governmental organisations such as the African Children's Feeding Scheme, Grahamstown Areas Distress Relief Association, Cape Flats Distress Association, Students Health and Welfare Centres

Organization, Peninsula School Feeding Scheme and Operation Hunger (Kallaway 1996:56). Despite all the support provided by non-governmental organisations, there were too many children from impoverished communities and without the support from the apartheid government, it made it difficult to cater school meals to most communities.

2.2.3.3 Post-apartheid era

Based on Act 108 of 1996 passed by the Constitution of the Republic of South Africa, every South African has the right to have access to food and education, especially for every child in South Africa. Rights come with responsibilities and, therefore, the South African government had to ensure that these rights are honoured, protected and continuously motivated (Kallman 2005:56). The NSNP is an important tool used by the government to meet the rights of children from poor backgrounds to alleviate hunger and fight poverty and malnutrition (Parliament of the Republic of South Africa 1994; Public Service Commission 2008; Saasa *et al*. 1997).

2.3 BENEFITS AND CHALLENGES OF SCHOOL FEEDING PROGRAMMES

School feeding programmes have their benefits and shortfalls and according to the World Food Programme (2017), the outcomes of the benefits depend on a disciplined and structured management of the programme to counter shortfalls such as instability and inconsistencies within the programme.

2.3.1 Benefits

School feeding programmes are designed to reduce malnutrition and improve school learner's health by providing learners with a more balanced diet (Armstrong, Lambert & Lamert 2011:836). It progressively leads to an increase of school enrolment, school attendance, and increase concentration levels which have a high impact on educational outcomes (Tomlinson 2007:15). From an educational perspective, school feeding programmes allow government to penetrate and interact with communities and keep children in schools (Department of Basic Education 2012). School feeding programmes encourage a social policy domain that promotes education equality, access to nutritious meals and the promotion of opportunities for all (Shisana *et al* 2014:45). According to

Devados (1972:348) and Bundy *et al.* (2009:10), the positive outcomes of school feeding programmes result in dropping levels of infection and deaths from malnutrition, weight gain, improved concentration and learning abilities of school-aged children, increased school attendance and enrollment and empowerment of unemployed community members such as food handlers and tuck shop owners.

2.3.2 Challenges

School feeding programmes across the world have faced many challenges. The most prominent issue known to oppose school feeding schemes is the prioritisation of government in proper monitoring and measuring methods in the educational sector (Laurie & Faber 2011:6). Persistent problems that negatively impact school feeding issues include monitoring measures not being implemented to regularly check on the nutritional progress of school children; lack of visible evidence to show decreasing levels of malnutrition; less food being given to children at home who receive meals from school and; the NSNP does not operate during school holidays (Cockeril 1975:26; Saasa *et al.* 1997:48; Department of Basic Education 2011c). In addition, mismanagement of funds and distribution of food, inproper infrastructure, and the lack of training of food handlers in nutrition education was also highlighted as thwarting the progress of school feeding programmes. The criteria for inclusion in a school feeding programme excluded children who come from communities where schools were out of reach due to distance, secondary school children and children under five (Education Policy School Feeding Scheme 2011:2).

2.3.3 The Contribution of school feeding programmes to the Sustainable Development Goals030

SDG 1: Help reduce poverty – the aim of a school feeding programme is to keep children in school, for them to have a nutritional contribution. When individuals are educated and have a healthy lifestyle, they are less vulnerable to poverty, they have the opportunity to contribute to the economy through employment or creating employment and most importantly and, to make better financial and health choices to pass on to the next generations (Sustainable Development Goals (SDGs) 2015).

SDG 2: Zero hunger – the aim of school feeding programmes is to eliminate hunger in children and break the curse of malnutrition. The aim is to also encourage communities to start sustainable food production systems and to motivate small scale food producers to multiply their agricultural productivity by being service providers to school feeding programmes in their communities, and to embark in other entrepreneurial ventures (2015).

SDG 3: Good health and well-being – school feeding programmes are used to distribute food to children from a poor background, to help reduce malnutrition. Improved nutrient intake reduces deficiencies that could cause serious damage in the health status of children (SDGs 2015; WFP 2016).

SDG 4: Quality education – to ensure that all girls and boys complete primary and secondary education as healthy individuals. The aim of school feeding programmes is to also eliminate gender disparities in education and allow for equal education in all levels for children affected by poverty, disabled children and children from different indigenous groups (SDGs 2015; WFP 2016).

SDG 5: Gender equality - to end all discrimination against girls everywhere, by ensuring that girls are free from micronutrient deficiencies and that they remain in school to avoid the burden of poverty, abuse and exploitation. When women and girls are educated, harmful practices such early and forced child marriages, female genital mutilation can be eliminate (SDGs 2015; WFP 2016).

SDG 6: Contribution to the economy – when children complete quality primary and secondary level education, they get the opportunity to go through university and later contribute to the economy. The aim is to reduce youth unemployment, child slavery human trafficking and child soldiers, by implementing development programmes orientated to supporting productive initiatives that create decent jobs and create innovative entrepreneurial skills (SDGs 2015; WFP 2016).

SDG 8: Helping to reduce inequality – to produce educated individuals who can impact on social, economic and political agendas, irrespective of race, sex, disability and religion. In addition, they should also implement policies that will progressively protect and achieve equality (SDGs 2015; WFP 2016).

2.4 THE EFFECTIVENESS OF SCHOOL FEEDING PROGRAMMES ON NUTRITION

Malnutrition, especially under-nutrition, is known to be a continuing adverse effect on the cognitive development and school performance in school children (Faber, Lourie, Maduna, Magudulela & Muehlhoff 2013:1214). Child under-nutrition is determined and evaluated as (1) low height-for-age, referred to as stunting, (2) low weight-for-age, which is referred to as underweight and, (3) low weight-for-height, also known as wasting. Stunting and malnutrition impede a child's potential to reach biological growth, which means long-term under-nutrition (WHO 2012). Therefore, reducing or abolishing malnutrition will remove one-third of the worldwide burden of diseases and increase child health (Mason *et al*. 2010:209). Globally, it is estimated that 165 million children are chronically malnourished with malnutrition being the fundamental cause of death for 2.3 million children per year with an average of one death every 15 seconds (World Socialist Web Site 2013). In west and central Africa, it is estimated that 107,000 school children receive sufficient quality treatment for serious micronutrient deficiencies, while 460,000 children who are affected by conflict and nutrition deprivation have access to proper education and nutritional care (UNICEF 2013a). However, malnutrition continues to be a persistent, global problem amongst primary school children (WHO 2012).

In certain ethnic cultures there is a misconstrued belief that school children need to consume sufficient food to fill up their stomachs - ignoring the fact that a proper balanced diet is needed on a daily basis to stay healthy and perform better in school (McCann 2007:931). Proper meal planning is imperative as the lack of nutrient intake could cause lasting problems for children, iron deficiency in children has been linked as a cause of damage to intellectual performance, behavioural and learning problems

among school learners (Mcgregor 2001:649). It was reported that in Kenyan primary schools meals rich in animal source seem to improve children's mathematical skills (Aldeman 2008:310) and according to the Food for Thought Report in the UK (2013), chronically malnourished school-aged children are on average 20% less literate than children who consume nutrients on a daily basis.In Ethiopia, India, Peru and Vietnam, around 12.5% of stunted school-aged children from ages 8-9 make a mistake reading a simple sentence such as, "I like dogs" or 'The sun is hot".

Children from food insecure households and those exposed to poor diets are known to experience stomach aches and headaches while in school. Most of the children also experience extreme levels of anxiety and depression (Nord 2009:7). The implementation of breakfast programmes in feeding schemes could alleviate such issues, especially in children coming from insecure households. Children participating in breakfast programmes show improved cognitive function, higher concentration span, and have improved memory during the morning hours of school compared to children who do not consume breakfast (Wesnes *et al*. 2001:31). In South Africa, the NSNP only covers Gauteng for breakfast programmes and the rest of the remaining provinces get one meal a day (DoBE 2013). Based on study done by Adu-Afarwuahs, Lartey, Brown, Zlotkin, Briend and Dewey (2007:86) school feeding programmes in Ghana, specifically focus on food and nutrients that have a positive effect on education.

The information presented in Table 2.1 shows the type of food that should be included in the menu planning process of school meals in order to produce positive educational outcomes and eliminate micronutrient deficiencies.

Table 2.1 The impact of nutrition on education. Source from (Adu-Afarwuahs *et al.* 2007:86) and (DoBE 2010c).

School outcomes of interest	Nutrients	Foods with nutrients
Enrolment	Energy	Staple foods
Attendance	Energy	Staple foods
	Vitamin A	Animal foods; green, orange, yellow fruits and vegetables
	Vitamin B12	Chicken livers
	Vitamin C	Fruits and vegetables
	Zinc and Iron	Pilchards, liver, soya mince, legumes: lentils, beans
Attention span	Energy and iron	Staple Foods for energy, Soya mince, Lentils, Beans
	Iodine	Salt
Improved math learning	Iron	Soya Mince, spinach, Beans, Lentils
Adequate weight	Energy	Staple Food
	Iron and Zinc	Soya Mince, spinach, beans
	Calcium	Milk products
Improved development	Essential Fatty Acids	Animal Foods, Pilchards
General learning, IQ	Essential Fatty Acids	Animal Foods, Pilchards
	Iron	Soya beans, Soya mince
	Iodine	Iodized salt

2.5 THE NATIONAL SCHOOL NUTRITION PROGRAMME

In 1994, Nelson Mandela urged the South African government to introduce a Primary School Nutrition Programme (PSNP) designed to alleviate hunger and poverty in South Africa. The PSNP started as a programme that operated under the Department of Health before moving to the Department of Basic Education in 2004, and changed the name of the programme to the NSNP (DoBE 2011).

Table 2.2 Fact sheet: South African school feeding programme. Source: Adopted from Case study of the National School Nutrition Programme in South Africa (2013:11).

Start date	1994
Current lead Institution	Department of Basic Education
Purpose and objectives	The purpose of the NSNP is to provide nutritious meals to learners from food insecure households during school hours. The aim of the programme is designed to improve school attendance and enhance learners learning abilities. The programme is an educational and is aimed at fighting poverty and alleviating hunger in school children. Objectives of the NSNP: • To improve through school feeding the learning abilities of all school children. • To encourage food production and increase nutrition knowledge in communities.
Targeting	The programme targets schools all over the country in poor communities. The NSNP caters for children in schools from less privileged backgrounds.
Coverage	The Department of Basic Education's NSNP covers all nine provinces in South Africa. In 2011 an estimated 8,821,392 school children received cooked meals on a daily basis.
Implementation	The Department of Basic Education has a separate office with 19 full time employees specially allocated to run projects concerning the NSNP. These employees are required to conduct site visits at the NSNP targeted schools in all provinces as well as districts.
Start date	1994
Modality	Cooked meals consisting of the basic food groups; protein, starch, fruits or vegetable get served daily during school hours at 10:00 am. The programme works on a 1-week cycle menu for all nine provinces and the menu process is implemented to prevent repetitive meals, boredom, which could resort to other means of lunch (tuck-shop or lunch box) as well as ensuring food variety.
Funding source	Conditional grant from the Treasury of the Government of South Africa.
Annual budget	In 2012/13, the NSNP annual budget was an estimated R 4 906 464 000. The budget is calculated from an estimated amount of R2.56 per primary school leaner and R3.46 per high school learner included in the feeding cost. This includes other important factors that are required to make the school feeding process operate smoothly, operations such as cooking fuel, stipends for food handlers and payment for service providers.

The programme has reached and benefited school children in schools from different poor backgrounds, and based on the Case Study of the National School Nutrition Programme in South Africa (2013:7) the NSNP has increased from targeting 50.2% of learners in 2010/11 to 70% in 2011/12 and is currently catering for 8 million school-aged children in all nine provinces.

The information shown in Table 2.2 is an overview on the structure and objectives of the NSNP.

2.5.1 The objective of the National School Nutrition Programme

South Africa is one of the countries struggling to produce concrete results regarding malnutrition levels in school children (Monyeki, Awotidebe, Stydom, Hans de Ridder, Mamabolo & Kemper 2015:1167). Research on monitoring malnutrition, particularly underweight and overweight amongst school children in regional and provincial districts, would more easily persuade the South African government to implement progressive policies and nutritional guidelines when planning school feeding schemes (Monyeki, Neetens, Moss & Twisk 2012:340). Studies on tracking and monitoring malnutrition amongst primary school children would assist the government in identifying regional and provincial nutritional constraints when planning a menu for school feeding schemes (Stevens, Finucane, Paciorek, Flaximan, White, Dionner & Ezzati 2012:835).

According to the National School Nutrition Programme Annual report (2013/4:11) the objectives of the NSNP are (1) to provide nutritious meals to school children from improvised backgrounds on a daily basis, (2) enhance school children's learning capabilities through proper nutrition, (3) to promote nutrition knowledge and a healthy lifestyle for school children and (4) to encourage sustainable development by initiating food gardens in schools.

The NSNP receives funding via a Conditional Grant according to the Division of Revenue Act (DoRA) whose policies are drawn up from the NSNP Conditional Grant

Framework (CGF) that all provincial education departments should follow; all identified schools by the NSNP and the Department of Basic Education should receive nutritious food provisions on school days (DoBE 2011b).

2.5.2 The nutritional impact of the National School Nutrition Programme

Good nutrition, school attendance and school performance are factors that are all intertwined (South Africa Institute for Distance Education 2002:96). The NSNP is a food scheme initiative in South Africa designed to aggressively target all the latter factors (DoBE 2010a). The NSNP is known to be a successful programme, and according to the 2015 provincial statistics, the NSNP provides food to 60% of school children in South Africa on a daily basis (Department of Social Development 2015). However, in the "Executive summary of the national food consumption survey fortification baseline South Africa" Labadarios and his fellow researchers question the National School Nutrition Programme's aim and methods in ensuring that all nutritional objectives are met by providing sufficient nutrients to learners across the country (Labadarios, Swart, Mouder & Kruger 2008:245). School enrolment and school attendance are factors that show visible evidence, but there is lack of evidence available to show whether or not school feeding programmes have a positive impact on the nutritional status of school learners (World Bank 2010)**.** According to Adu-Afawuahds *et al.* (2007:71) foods rich in Iron, Zinc, Vitamin A and Iodine have increased the fundamental impact of school feeding programmes in Ghana. This was shown by focusing on the nutrient intake of school learners and positive results were achieved as noted by improving learner's health, school attendance and school performance. One of the weaknesses the Department of Basic Education (2010a) emphasises is the lack of quality assurance of meals served in schools and the struggle to enforce strict measures in meal preparation by ensuring that quality ingredients and measurements are followed correctly.

2.5.3 Targeting mechanism of the National School Nutrition Programmes

The education policy for school feeding programmes is implemented to target primary schools in all nine provinces with school learners from low-income households (DoBE, 2010a). According to Hachfeld, Graham, Peters and Nyathela (2013:10) there is a large

number of primary schools with learners from low-income households that do not qualify for such a provision, allowing initiatives such as the Nestlè Foundation and Tiger Brands Foundation to target children who do not benefit from the NSNP. Children who live in areas where schools are too far from home or are based in areas where schools are not operational are excluded from the NSNP (Education Policy School Feeding Scheme 2011:2).

2.5.4 Meal plan and serving portions

Meals served by the NSNP are specifically designed to meet at least 25–30% of the Recommended Daily Allowance (DoBE 2008). However, based on a study by Kloka (2009:7), the nutritional content prescribed by the NSNP shows that the meals served at schools in certain provinces only meet 15% of the Recommended Daily Allowance (RDA). The Department of Basic Education (2011a:13) indicates that reaching a proper RDA depends entirely on the appropriate use of measuring utensils and availability of ingredients during meal preparation. Reports from the KwaZulu-Natal District Draft Policy (DoBE 2011b**),** highlight the concerns and struggles of school children in KwaZulu-Natal rural and peri-urban areas, learners who are deprived of their right to receive proper and recommended portion sizes. This is an observation made during serving time that portions get smaller as the queue for school meals gets longer, so that portions decrease to ensure that all school children receive food.

Child nutrition can be improved by ensuring that children consume correct dietary nutrient ratios and that portion sizes appropriate for children are served accordingly (WFP 2010:5). Nutrient ratios and correct portion sizes could be improved if school feeding programmes lay down strict measures in determining the importance of nutrient adequacy (Galloway 2010:13). According to the WFP (2010:7), the recommended rations for primary school children should consist of 120g-150g of cereal, 30g-40g of pulses, 10g of fortified oil, 10g of iodized salt and, most importantly, meals should be combined with micronutrient powders to ensure proper dietary intake results.

The information presented in Table 2.3 shows the NSNP weekly menu plan along with appropriate portion sizes suitable for primary school children.

Table 2.3 NSNP meal plan with appropriate portion sizes. Source: Adopted from the Department of Basic Education (2010c).

Days of the week	Meal plan	Menu option	Serving portion size
Breakfast	Cereal (served in one province)	Instant porridge	50g
Monday	Protein	Soya mince/ chicken livers	45g
	Starch	Pap	45g
	Vegetable or fruit	Red/yellow vegetable in season	60g
Tuesday	Protein	Sour Milk /Fresh Milk	200ml
	Starch	Phuthu/pap	60g – 75g
	Vegetable or fruit	Fruit in season	60g
Wednesday	Protein	Soya mice, lentil stew	45g
	Starch	Boiled rice	60g
	Vegetable/fruit	Green vegetables in season	60g
Thursday	Protein	Beans	40g
	Starch	Samp	60g
	Vegetable or fruit	Green vegetables in season	60g
Friday	Protein	Pilchard stew	40g
	Starch	Potato, rice or brown bread	60g -75g
	Vegetable and fruit	Red/yellow vegetables in season	60g

2.5.5 The effects of nutrient inadequacy in school feeding meals

Plate waste is defined as a proportionally served meal that has not been eaten, particularly the amount of calories and nutrients not consumed (Guthrie & Buzby

2002:37). The prevention of malnutrition requires simple nutritional information - a human body needs nutrients such as carbohydrates for energy, protein for body building, fats for body insulation, as well as minerals and vitamins for body building and proper functioning of a human body (Uganda Nation Action Plan 2011:5) (UNAP). An article by Oldewage-Theron and Egal (2009:49) emphasises the importance of teaching school children basic nutritional knowledge in order for them to make better food choices. A study by Gatenby (2007:53) shows that children who lack nutritional knowledge are likely to choose unhealthy meals over nutritious school meals served by food schemes or the NSNP. The NSNP has strict instructions to feed every school learner participating in the programme. Failure to follow the rules and instructions of the NSNP hinders the overall nutrient intake of school children (DoBE 2012).

According to the Development of Food–Based Guidelines for South Africa ((Vorster *et al*. 2013:165), a variety of ethnic food choices that are familiar to learners with an added combination of traditional western food intakes that are nutritional and enjoyable to eat by school children are essential to the success of the programme. This could prevent plate waste problems and also control learners' nutritional intake, limit learners bad eating habits, spending habits from street vendors who pose a threat in the Food Safety Regulations in South Africa (Vorster *et al.* 2013:4). A survey conducted by the KZN Department of Basic Education (2011:21) states that learners find pilchards enjoyable and only complain about small portions. In the Eastern Cape, based on cultural differences, rather than pilchards and soya mince, learners prefer to be served meat resulting in food waste or plate waste.

2.5.6 Food handlers and safety in the National School Nutrition Programme food preparation area

The NSNP is an educational food programme designed to provide meals to school children as well as to empower the community local people, particularly unemployed women from semi–urban and rural communities. These women are recruited from their communities and appointed by the Department of Basic Education as volunteer food

handlers to prepare daily meals for school learners for a monthly stipend of R960.00 (DoBE 2010b).

Food handlers have an extremely important function regarding food safety and hygiene regulations (WHO 2013). The lack of adequate food safety knowledge by school feeding food handlers and tuck shop food handlers could cause a serious outbreak of food borne disease in schools (Rahman, Arif, Bakar & Tambi 2012:95). According to research findings conducted by Afolaranmi, Hassan, Bello and Misari (2015:17), about thirty three food service establishments in Nigeria, including schools and food street vendors, revealed that food handlers lacked basic knowledge on personal hygiene and food safety, particularly the prevention of cross-contamination of microorganisms.

In South Africa, a recent study done in Mpumalanga by Tabit, Sibanyoni and Tshabalala (2017:1399) revealed that about 91.4% of the NSNP food preparation areas/facilities did not have basic hazard analysis and critical points (HACCP) and 93.2% of food handlers had no knowledge on HACCP. Sixty percent of food handlers had not been trained on food safety measures, particularly sanitizing utensils and washing of cutting surfaces/boards after handling row meat. Food handlers need to be trained before being given the task of handling food, especially in areas such as personal hygiene, storage, chemical storage, pest control, equipment and cleaning procedures, especially in food safety procedures (Mclntyre, Vallaster, Wilcott, Henderson & Kosatsky 2015:150).

2.5.7 The role of tuck shops in school feeding programmes

The global consumption of unhealthy food increased between 1990 and 2010 and continues to increase (Imamura, Micha & Khatibzadeh 2015:134). Malnutrition is an epidemic that disturbs the nutritional well-being of school children and it impacts negatively on their capacity to develop both physically and mentally, particularly educational achievements (Fleming & Robinson 2013:769). With developing countries experiencing nutritional transitions, nutrition interventions targeting school children need to be implemented to prevent cases of school children being at risk of being overweight and obese (Best, Neufingerl & Geel 2010:410). According to the WHO (2006), the

Global Strategy on Diet, Physical Activity and Health School Policy Framework encourages schools to implement monitoring measures to ensure that food sold in tuck shops meets the nutritional requirements of school children. In South African schools, certain health programmes are structured to assist school tuck shops to sell healthier food snacks to school children (Institute of Medicine 2012) (IoM). However, proper facilities, such as shelter, cold and dry storage remain a major obstacle to this process (Nortje, Faber & de Villiers 2017:78).

Food items and snacks sold in South African tuck shops are generally high in sugar and fat and consist mainly of food such as meat pies, carbonated drinks, biscuits, sweets, chips, ice-cream and hamburgers (Wiles, Green & Veldman 2013:37). There is, however, a major difference between the food sold in urban and peri-urban school tuck shops where popular food items sold in peri-urban schools include vetkoek with polony and achaar (pickled mango), fried potato chips, bunny chow (and an estimated 6 slices of white bread stuffed with fried potato chips, polony, vienna, achaar and cheese), sweets, biscuits and chips (DoBE 2012; Wiles, Green & Veldman 2011:130). All these food items are generally low cost food items with none or little nutritional value (Nortje, Faber & de Villiers 2017:78). South African schools have a different system compared to the United States and the United Kingdom where they operate on a cafeteria and a canteen system, that provides a more structured and uniform system that facilitates monitoring and implementing dietary regulations (Hawkes, Smith & Jewell 2015:619).

2.5.8 The role of lunch boxes in school feeding programmes

The South African National Health and Nutrition Examination Survey (Shisana *et al*. 2012:95) revealed that obesity and overweight are on the rise in the South Africa, particularly in children, which is more prominent in urban and peri-urban areas. Shisana *et al*. 2012:96), also reported that overweight and obesity was prevalent in South Africa with an estimated 13.5% of school children aged 6-14 years, which is higher than the global occurrence of 10% in school children, and lower (32.6%) than the combined prevalence of obesity and overweight of school children age 6-11 years in the United States of America (Mchiza & Maunder, 2013:101).

The government of South Africa does not offer lunch box programmes to schools in urban, peri-urban and rural areas. Instead, it offers school feeding programmes to schools situated in impoverished communities (Feeley, Musenge, Pettifor & Norris 2012:4). School feeding programmes in South Africa are designed to provide meals to school children who come from low-income backgrounds and were also designed to target children who go to school without having breakfast at home and whose Caregivers do not have the necessary resources to pack lunch boxes (Feeley *et al*. 2012:). However, the Department of Basic Education (2014) encourages Caregivers to pack lunch boxes for their children as a safety measure, in case children do not receive meals from the NSNP, or in case school children get hungry later in the day after their NSNP meal at 10:00 in the morning. Gresse *et al*. (2017:59) focused on the poor dietary value of lunch boxes carried by children from low-income areas that are mainly packed with processed food products high in energy and low in fiber. The RDA for a packed lunch box should be 25% for school children aged 7-10 years and 20% for school children aged 11-14 years (Labadarios & Steyn 2001:5).

2.6 THE DETERMINANTS OF MALNUTRITION

This theoretical framework illustrates the immediate, underlying and basic causes of child malnutrition, by emphasising on factors that could affect the process of overcoming child malnutrition.

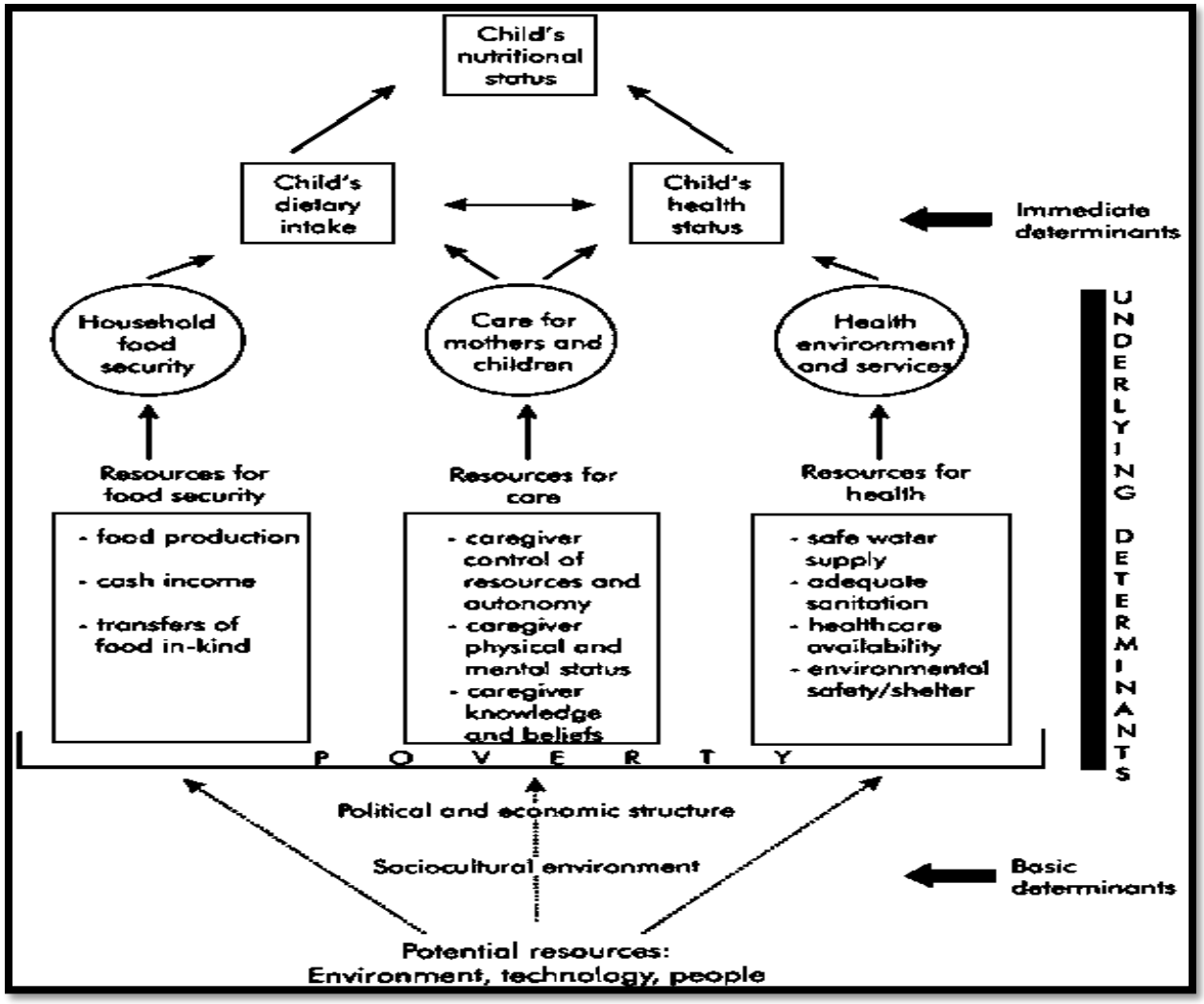


Figure 2.1 Malnutrition underlying determinants. Sources: Adapted from UNICEF (1990, 1998); (Engle, Menon & Haddad 1999).

2.6.1 Nutrition transition

School children across the world from developed and developing countries are struggling with the modern pandemic of obesity/overweight (WHO 2010) where it is considered to be one of the most ominous, impending health issues across the globe (Alamian & Paradis 2009:1279). Obesity has shifted a nutritional mindset that hunger and malnutrition is only linked to being skeletal/thin and undernourished (Reilly & Kelly 2011:891). Jones-Smith, Gordo-Larsen and Siddiqui (2011:179) write about the two types of malnutrition; one is due to lack of food and insufficient intake of nutrients, the

second being due to excessive food and continuous intake of unbalanced food. Obesity is a nutritional transition known to be one of the five leading causes of global mortality, accompanied with challenging chronic non-communicable health issues such heart disease, hypertension, diabetes and mental problems (WHO 2012b). Popkin and Drewnowski (1997:38) state that urbanisation in developing countries could be a leading force in the global increase in obesity, as immigrants from rural areas located in urban areas struggle to make a transition from traditional food to commercial food, leading to unhealthy food choices. The effects of urbanisation have been seen as a contribution to an evolving culture of high sugar consumption, unhealthy eating patterns such as fast foods/street food rich in unhealthy fats compounded with a declining rate in animal-source food intake (Malik 2010:123). Malik (2010:126) also states that processed food and high-energy snacks have become increasingly popular in school cafeterias where school children indulge in unhealthy snacks, food and beverages high in sugar and sodium. Monteria (2010:976) also highlights a nutrition transition in developed countries such as the US and the UK where school curriculums are slowly phasing out home economics and nutrition education studies.

School children who have healthier eating patterns and are physically active can maintain a healthy body, and have a better cardiovascular disease risk profile when compared to those who remain overweight (Lawlor, Benfield, Logue, Tilling & Howe 2011:349). Researchers across the globe have described nutrition, health and education as an intervention that is necessary to maintain a well – nourished free society (Norman, Bradshaw, Schneider, Joubert, Groenewald & Lewan 2007:639). These nutrition indicators are viewed to be strong fundamental tools that should be implemented to teach basic life skills to school children as well as build a progressively productive society both in developed and developing countries (Gluckman, Hanson, Zimmet & Forrester 2011:90). However, based on the unstable economic and environmental challenges that developing countries face, nutrition, health and education are indicators seen as being of secondary importance (Mchizd & Steyn 2011:896).

2.6.2 The role of HIV/AIDS

According to Statistics South Africa (2012), one of the effects of a society with a high rate of HIV infection has been the leaving of a number of orphans, particularly children. An estimated 18.8% of children in South Africa have either lost one or both caregivers to the HIV/AIDS disease (South African Statistics 2016). The burden is heavy as a majority of children affected are mainly from unstable backgrounds, households with unemployed and uneducated Caregivers and guardians (UNICEF 2010). This is a cycle that impacts negatively on South Africa, as children continue to be affected by the country's inequality struggles (Koch 2011:3). Based on the Sustainable Development Goals progress sheet (2015), by 2014, an estimated 13.6 million people are enrolled in antiretroviral treatment, HIV-related infections have decreased by 38% since 2001, but by 2014 in South Africa an estimated 35 million people were recorded to be living with HIV and 240,000 children were born infected with HIV.

2.7 DOUBLE BURDEN OF MALNUTRITION

Malnutrition, in the transitioning world, is defined as either under-nutrition or over-nutrition (Reddy, Resnicow, James, Kambaran, Omardien & Mbewu 2009:206). The World Health Organisation (2015) has repeatedly encouraged developing countries to focus on implementing strong monitoring measures to fight malnutrition amongst primary school children. South Africa, however, is a member of the developing countries that is struggling to produce physical evidence and results on regional distribution of malnutrition levels in school children (Monyeki, Awotidebe, Stydom, Hans de Ridder, Mamabolo & Kemper 2015:1167). The more information there is, regularly provided by researchers on the monitoring of malnutrition, especially underweight and overweight in provincial districts, the easier it would be for policy makers to implement progressive solutions and geographical nutritional guidelines to improve school feeding programmes (Monyeki, Neetens, Moss & Twisk 2012:340).

2.7.1 Under-nutrition

Under-nutrition can be defined as a malnutrition deficiency caused by the lack of proper nutrition, the lack of food or the poor consumption of food not containing essential

macro and micronutrients like protein, carbohydrate, fats, vitamins and minerals (Shisana *et al.* 2014:27). Conditions linked with under-nutrition are stunting, protein-energy malnutrition and wasting.

2.7.1.1 Stunting

Stunting is defined as a nutritional human growth deficiency (Veary 2011:3). According to the World Health Organisation (WHO 2014), stunting in children can be defined as "the height for age value that is less than two standard deviations of the WHO Child Growth Standards median". Stunting in children is associated with chronic malnutrition and poverty (Brown 1995; Kanashiro & Dewey 1995:32). Stunting in children is evaluated by health practitioners as a serious condition due to the fact that stunting may have long-term health defects, and is irreversible in children older than two years of age (Cogill 2003:98). Inadequate consumption of protein, high energy dense food, and inadequate nutrient intake are indicators that cause stunting in children (Labadarious, Steyn, Mgijima & Daldla 2005:102). Walsh, Dannhouser and Joubert (2002:8) also add that certain socio-economic intervention indicators could help fight stunting in children, including: proper sanitation, proper housing infrastructure, education and employment. However, De Villiers and Senekel (2002:1232), emphasise the power of empowering women through education and entrepreneurship, in order for women to sustain themselves and afford to provide nutritious meals for their children and possibly reduce cases of stunting. If the overall dominating factors that contribute to stunting are defused systematically, it could decrease the negative impact stunting has on the cognitive development, productivity and academic performance of school children (Chang, Walker & Grantham- McGregor 2002:776).

School children in South Africa with severe cases of stunting are reported to be from households with low-economic status and households that are extremely food insecure (WHO 2015). The highest dominance of stunting is found in school children living in rural and urban informal settlements (Shisana, Labadarious, Rehle, Simbayi, Zuma, Dhansay & Faber 2014:23). School children affected with severe stunting are reported to be from the Eastern Cape, Northern Cape, Free State, North West, Limpopo and

improvised communities in Johannesburg (Statistics South Africa 2013). These provinces have been surveyed to have a high percentage of unemployment, poverty and a lack of education and nutritional knowledge (Veary 2011:4).

2.7.1.2 Protein-energy malnutrition

Protein-energy malnutrition (PEM) was discovered in the 1920s predominantly in developing countries (Hendricks, Duggan & Gallagher 1995:1120). It is viewed to be the most threatening macronutrient malnutrition deficiency of all time (WHO 2013). Kwashiorkor and marasmus are deficiencies derived from PEM (Berk 2007:6). These deficiencies are prominent when there is a lack of adequate protein intake accompanied with carbohydrates and fats (Le Roux, Scott, Greco & Desmond 2010:59). Children affected with macronutrient deficiencies have visible physical attributes; their growth is affected (stunted) and other visible PEM symptoms are: change in skin and hair colour, loss of muscle mass, failure to grow and swelling of ankles and belly (Anwer & Awan 2003:2). These symptoms can be seen as early as two years of age in children, due to early weaning and lack of protein consumption (Muller & Krawinkel 2005:281).

Kwashiorkor (known as oedematous malnutrition) is present when there is hunger and a low or no protein diet (Beck 2007:5). Children suffering from kwashiorkor have damaged absorption functionalities, suffer from liver disease and diarrhoea and they have severe physical attributes such as oedema (swelling) of ankles, feet and belly and loss of body mass (Nyeko, Kalyesubula, Mworozi & Bachou 2010:3). Treatment for kwashiorkor involves a protein diet in a form of dried milk (Rolfes, Pinna & Whitney 2015:478). Marusmus (known as non–oedematous malnutrition) is present when there is an ongoing lack of nutrient intake (Muller & Krawinkel 2005:281). Children suffering from marusmus have strong physical attributes such as; severe wasting, no fat tissue around the buttocks and thighs (WHO 2008:13), the child usually has an extremely active appetite (Beck 2007:5). Treatment for marusmus is as follows: fortified food products with vitamin B and a nutritious diet (WHO 2010).

2.7.2 Over-nutrition

Overweight and obesity in children is a global health issue, with an estimated 43 million of children globally affected by obesity (UNICEF; WHO & World Bank 2012). Obesity is associated with many psychological and physical; health problems, emotional issues linked to depression and social anxiety accompanied with chronic health issues such as diabetes and heart disease (Rossouw, Grant & Viljoen 2012:108). On a global scale, South Africa is one of the countries graded with the highest rate of overweight and obesity (Femimg & Robinson 2013:770). In addition, South Africa is also amongst 34 countries battling with childhood stunting, malnutrition and macronutrient deficiencies (Bhutta, Rizvi & Das 2013:383). Children from food insecure households are provided with school meals but affordable cheap high-fat and energy dense snacks/food from the tuck shop interfere with plans to fight the burden of the overweight and obese nutritional transitions (Steyn, Nel & Nantel 2006:646). South Africa is going through a rapid nutrition and lifestyle transition linked to cases of obesity and non-communicable diseases as experienced in western countries (Abrahams, McHiza, Steyn & Diet 2011:801). Obesity is associated with the consumption of high-energy dense foods linked to a non-active physical lifestyle (Vorster, Venter & Margetts 2005:483). According to Vorster *et al*. (2010:436) it is unusual to find undernourished and overweight children residing in the same community. However, Poskitt (2009:9) states that it is possible to find stunted children and obese children residing in one community, as stunting is related to under-nutrition and obesity is linked to over-nutrition overall summed up as inadequate nutrient intake.

2.7.3 Global food security

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preference for an active and health life" (FAO 1996). According to reports produced in Rome by the United Nations Food and Agriculture Organisations, the Millennium Development goals (MDGs) drafted to reduce hunger and poverty from 1999 to 2015 have shown a slow progression followed by a significant decline after 2009 (FAO 2012a; WFP 2012b), and that new positive results need to surface with the implementation of the Sustainable

Development goals (2015). Dietz and Trawbridge (1990:917) state that “Hunger is a recurrent, involuntary lack of access to food and may produce malnutrition over time.” Therefore, food insecurity is viewed as a fundamental measure when considering the wealth and sustainability of a country and is done by considering important aspects such as food availability, the quality of dietary intake, financial stability and access to food (Deverex & Waidler 2016:10). Food insecurity continues to be a global threat, which mostly affects children and women. About 850 million people in the world are estimated to be chronically undernourished from year 2012 to 2014, half of them being children followed by a large portion of malnourished adult women (FAO 2013:12). Based on an article by Coleman, Nord, Andrews and Carlson, (2011:125), food insecurity is more prominent in households with children from a low social-economic status, inadequate dietary intake and poor nutritional status. Food insecurity is increased in households with uneducated and unemployed Caregivers (Hendriks 2014:18). Therefore, food insecurity may be measured as the main denominator for understanding the nutritional status of low-income households (Mauder *et al.* 2015:9). School children in Colombia are challenged by development deficiencies such as stunting and wasting and associated major micronutrient deficiencies caused by food insecurity (Hackett, Melgar-Quińonez & Alvarez 2009:114). Food insecurity is also described as an uncontrollable problem in Pakistan, as it affects millions of households with children, particularly school girls who get married off at a very young age (Baig-Ansari, Rahbar, Bhutta & Badruddin 2006:124). On the other hand, food insecurity in Korea is linked to an opposite modern pandemic, obesity among urban children (Global Nutrition Report 2016).

2.7.3.1 Food insecurity in South Africa

In South Africa, three national surveys conducted by Mchizd and Steyn (2011:894) reflected a decrease from 52.3% to 25.9% in food insecurity from 1999 to 2008. However, due to urbanisation, a study done in three major impoverished communities in Johannesburg shows that 56% of all household surveyed are food insecure and 60% households in informal settlements are food insecure (Rudolph, Kroll, Ruysenaar & Dlamini 2012:43). Children from food insecure households in South Africa are predicted

to have development deficiencies, with an increasing rate of under nutrition and underweight (May & Timaeus 2014:770).

According to Said-Mohamed, Micklesfield, Pettifor and Norris (2015:535), South Africa did not attain the first Millennium Development Goal (MDGs 2015) of reducing hunger and poverty. Despite the economic transition in South Africa over the past 40 years, stunting amongst school children is still a persistent problem (Veary 2011:58). Although South Africa is known to have advanced tremendously with infrastructure and private sector spending, its macro-economy can be viewed as stable (WHO 2015). However, the country still struggles with issues such as inequality in education, malnutrition in school children, accompanied by chronic illnesses (Sorsdahl, Slopen, Siefert, Seedat, Stein & Williams 2011:427). In the article "child health–related quality of life and household food security", Casey and Robbins (Monyeki, Neetens, Moss & Twisk 2012:1471) encourage the South African government to prioritise on the nutritional status of school children as food insecurity coexists with child malnutrition.

2.8 CONCEPTUAL MODEL DEPICTING THE ECOLOGICAL SYSTEM PERSPECTIVE IN SCHOOL FEEDING PROGRAMMES

McLaren (1976:6) encouraged many researchers to believe in the ideology that the ecological approach is one of the most reliable tools that can be used to examine malnutrition, on the basis that an individual's nutritional status is influenced by his biological, physical and psychological environment. Beaton and Bengoa (1976:3) at the World Health Organisation conference held in Geneva, stated that "The interactions of man with his environment are so complex that only an ecological approach to nutrition permits an understanding of the whole spectrum of factors determining the nutritional problems that exists in human society."Such philosophies allowed the development of feeding frameworks to illustrate the environmental factors which influence the food consumption behaviour of Caregivers which is passed on to children.

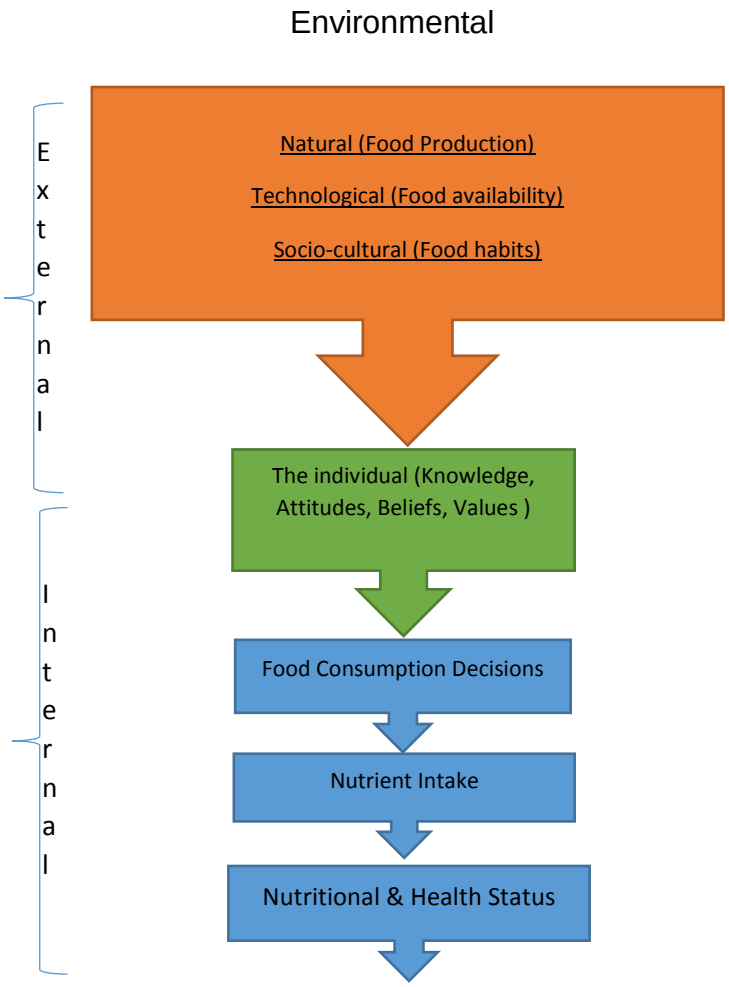


Figure 2.2 The conceptual model depicting the ecological system perspective. Source: Adopted from Sims & Smiciklas-Wright (1978:174).

Food choices of individuals are influenced by religion, ethnicity, socio-economic and cultural traditions (William 1993:296). Sims, Paolucci and Morris (1972:174) used these measures to assess the nutritional status of school children by investigating their ecological background to find the root cause of certain food habits leading to malnutrition or micronutrient deficiencies. “Man and his environment are intertwined, therefore, you cannot separate the two” (Ogden *et al.* 2006:1550). The first foundation required when implementing nutritional programmes in schools, is to investigate the targeted areas such as the ecological environment of individuals. In doing so, food

preferences could be better understood and inadequate nutrient intake could be prevented in schools and school feeding programmes (Dwyer & Mayer 1975:568).

2.8.1 Food availability

"Food availability describes the total amount of food in a place at a point in time," (Devereux & Waidler 2017:2). Low-income households endure the most food hardship when it comes to food availability and the affordability of nutritious foods for a healthy and productive lifestyle (Darman & Drewnowski 2015:644). A study done by the US Department of Agriculture revealed that monthly spending in low-income households on vegetables and fruits was extremely low compared to households with high-income, but instead, low-income household spend significantly on calorically dense food (Frazao, Andrews, Smallwood & Prell 2007:7). However, Darman and Drewnowski (2008:1108) state that the strong relationship between income and diet quality is disrupted by two factors; food prices and the area. Fluctuation in food prices affect food access and most impoverished communities have supermarkets and tuck shops that provide limited or no variety of nutritious food. Caspi, Sorensen, Subramanian and Kawachi (2012:1178) have another angle of looking at the issues affecting the relationship between income and diet quality, which is low-income, lack of education and limited nutrition knowledge.

2.8.2 Food habits

Food habits are embedded in an individual's lifestyle based on their surroundings. They are mainly influenced by factors such as environmental area, culture, religion, availability and access to food (Phillips, Starkey & Donald 2004:82). These aspects give a guideline to an individual's day to day dietary intake (Nielsen, Seiga-Riz & Popkin 2002:374). Children develop their eating patterns early in life based on learned behaviour from their caregivers or parents. They learn what to eat, how much to eat, portion control and when to eat (Ogden, Corroll, Curtin, McDwell, Tabak & Flegal 2006:1552). According to Nielsen and Popkin (1997:326) the methods in which Caregivers feed their children are influenced by elements of culture, particularly in African culture, with practices of providing and encouraging children to consume large portions of palatable food, including carbohydrates (Munoz, Krebs-smith, Ballard-

Bardash & Cleverland 1997:327). Another aspect that is seen to be threat in the influence of food habits is the evolving culture that has shifted from scarcity of food to an over excess and over consumption of food (Fox, Devaney, Redy & Razafindrako 2000:79). School children experience a major diet transition when they start primary school and all the way through secondary school. Their diet includes increased fat and energy dense food products (Lytle, Seifert, Greenstein & McGovern 2000:224). These are unhealthy foods/snacks consumed away from home (Siega-Riz, Carson & Popkin 1998:30). These behavioural food patterns transcend to school children skipping breakfast and avoiding healthy foods such as vegetables and fruits (Gillman, Rifas-Shiman, Frazeir, Rocket & Camorgo 2002:238). Therefore, Buhl (2010) highlights the importance of implementing monitoring measures to assist in meeting a majority of school children's dietary recommendations.

In QwaQwa, Free State, South Africa, Oldewage-Theron and Egal (2010:150) identified twenty popular food items consumed by 9 to 13 year old school children on a daily basis. They used dietary measuring tools such as 24-hr recall to determine the intake of food items such as stiff maize meal porridge, bread, tea and milk that were rated as popular food items. Faber, Smuts and Benade (1990:59) identified popular food items in Ndunakazi, a peri-urban area in KwaZulu-Natal. Here, popular food items amongst school children from the age 10 and 11 included bread, tea, sugar, sunflower oil, and fortified biscuits. However, dietary intake in school children from peri-urban and urban areas differs from that in rural areas where the urban area diet is mainly known to include highly fat and energy food items (Freely, Musenge, Pettifor & Norris 2012:5).

2.8.3 Factors affecting food intake

Based on literature, major determinants that affect the intake of food and nutrition security are income, education and food prices (Pieters, Guariso & Vandeplas 2013). However, there are three poorly understood social determinants that influence the intake of food, namely culture, religion and traditional knowledge (Alonso 2015:3). Holden (2012) also adds that in a social setting, especially amongst children, peer pressure is one overlooked factor that has a major influence on food intake.

2.8.3.1 Culture and religion

Culture, religion and tradition are three main influencers of food preferences in societies (Alonso 2015:4). Therefore, nutrition interventions in school feeding programmes need to be evaluated based not only on geographic location but also on the cultural traditions of school children (Fieldhouse 1995; Matsumoto & Juang 2012:464). Culture and tradition influence how children should be fed and how food should be prepared and it also influences the choice of ingredients used to prepare food (Benavides-Vaello 2005:27). Food is symbolic to many cultures where it has become a form of identity that communicates with the roots of an individual (Atkins & Bowler 2001). In most religions, strict dietary rules such as fasting are enforced, although children are excluded, and it can be a strenuous dietary process to the human body. Other religious dietary taboos such as no meat consumption, no pork, and no dairy products are practiced with limited knowledge of supplement intake (Sabaté 2004). However, Temple, Steyn, Myburg and Nel (2006:252) highlight how income and nutrition transition has infiltrated the cultural food beliefs in different ethnic groups through urbanisation and evolving food trends. Such a transition is perceived as a threat to the nutritional status of school children which could cause serious cases of obesity.

2.8.3.2 Peer pressure

When children start school, it represents a major transition in their lives. During this period, children begin to develop into their own physical and social setting, and that gives them the freedom to make dietary food choices (Story, Neumak-Sztainer & French 2013:20). According to Lachat, Nago, Verstraeten, Roberfroid and Kolstreren (2012:340), when children and adolescents gain more independence to choose their own food in school, the consumption of unhealthy energy-dense food increases and the intake of food high in fats and sugar is constantly selected over the intake of nutritious meals containing micronutrients such as Iron, Calcium, Zinc, Vitamin C and A. Peer pressure is also a social problem that may influence choice of lunch meals by many school children. The stigma of school feeding programmes is more prominent in peri-urban schools than it is in schools based in rural areas (Buhl 2010). Peer pressure can

influence school children's food choices so that in order to fit in they decide to consume popular and trendy food items sold in the tuck shop, or bring lunch boxes with trendy unhealthy food items (Holden 2012; Kroone & Alant 2012:71).

2.9 NUTRITIONAL REQUIREMENTS OF CHILDREN 9-13 YEARS OF AGE

Nutritional requirements between genders start to differ from the early age of six years. The dietary requirements become more intense when boys and girls begin to reach puberty, the stage of puberty for girls generally starts between the ages of twelve and thirteen and for the boys at eleven (Whitney & Rolfes 2010:560). The nutritional requirement for females and males differ based of their biological attributes - females have more body fat compared to males, and males have a much leaner body mass. As children grow the nutritional need for energy, zinc, iron, protein and calcium increases (IoM 2012). Boys usually grow faster than girls; therefore, the nutritional requirements for energy in boys becomes greater fat stores and lean body mass (Nutrition Information of the University of Stellenbosch 2007:10).

2.9.1 Dietary Reference Intake

The Dietary Reference Intakes (DRIs) is a term designed to cover four types of specific nutrient recommendations for individuals. They are known as Estimated Average Requirements (EAR), Adequate Intake (AI), Recommended Dietary Allowance (RDA) and Tolerance Upper Intake (UL). These are nutrient recommendations used in Canada and the United States of America for dietary assessment. In South Africa, dietary assessments are evaluated and measured using nutrient recommendations structured by the United States Institute of Medicine, which also include the proper use of the DRIs, RDA, EAR) and AIs (IoM 2006; NICUS 2007:7). Each reference refers to the average daily nutrient intake per day. Therefore, the dietary mean take estimate over time becomes an important nutrition reference value (NICUS 2007).

The DRIs framework includes the following objectives:

- To formulate nutrient recommendations that meet a variety of uses
- To contribute essential nutrients, in order to reduce risks of chronic diseases

- To include and review other food components
- To use the underlying principle
- To assess the estimates of proper upper safe levels of nutrient intake

2.9.2 Estimated Average Requirement

The EAR is described as the dietary nutrient intake value of both genders in a specified age to meet all estimated EAR requirements by 50%. The EAR is used to set Recommended Daily Requirements as well as measure any dietary nutrient adequacy in a group of people (Story & Stang 2005:21).

2.9.3 Recommended Daily Allowance

The RDA is defined as an average daily nutrient consumption set to meet nutrient requirements of about 97% to 98% of an individual life's stage in both genders and specified age groups (NICUS 2007:4

2.9.4 Adequate Intake I

The AI is the average intake of nutrients that is used when there is difficulty determining the RDA. The AI is an estimation of nutrient value requirement per individual in a specified gender and age (NICUS 2007:4).

2.9.5 Tolerable Upper Intake Level

The UL is the utmost nutrient level intake that is likely considered not to pose any adverse health risks. However, if the dietary nutrient level intake is above the UL, the possible threats of undesirable health effects could increase (IoM 2006).

2.9.6 Estimated Energy Requirement

The EER is the intake of kilojoules estimated to match with an individual's life stage (NICUS 2007:4).

2.10 MACRONUTRIENT INTAKE REQUIREMENTS

Macronutrients are essential nutrients required in moderation, particularly the consumption of fats and carbohydrates. Inadequate consumption of macronutrient can cause harm to the nutritional status of the human body. When not monitored, inadequate intake of macronutrients can lead to the development of chronic diseases (NICUS 2007:13). Individuals, especially children, are advised to consume moderate levels of macronutrients. The effects of a low and high intake of macronutrients could impede nerve impulses, repairing and development of new tissues and growth development, accompanied by health problems such as underweight and overweight (Vorster 2010:438).

The Acceptable Macronutrient Distribution Ranges (AMDR) is a range of intake for a specific energy source that is linked to reducing the risk of chronic diseases amongst individuals while providing adequate intake of nutrients. There are certain key fundamentals that need to be taken into consideration with regards to each AMDR, that being, lower and upper boundaries. If an individual continues to consume below or above the range, the chances of getting long-term chronic diseases may increase and interfere with the balance of adequate nutrient consumption (NICUS 2007:13). The AMDR energy intake value for children is an estimated 45-65% of carbohydrate for energy; fat is 25-35% of total energy, protein is 10-35% of energy and sugar is 25% (IoM 2006).

2.10.1 Energy

The energy dietary requirements of an individual are determined by the Estimated Energy Requirement. The appropriate EER is evaluated to measure balanced healthy energy levels of individuals, to sustain normal weight, height and physical activity of individuals in a specified gender and age group (NICUS 2007:16). For children aged of 9-13, proper nutrient intake has to be considered alongside physical activity in order to achieve optimal overall nutrition. When children consume energy dense food, the recommended physical activity should be at least 60 minutes or more in order to

prevent damaging causes on the weight and height of individuals (NICUS 2007:19; IoM 2006).

Table 2.4 illustrates height and weight reference values used to determine the DRI's for the energy requirement of children aged 9-13.

Table 2.4 DRIs of reference for height and weight in children aged 9-13 (NICUS 2007:12).

Gender	Age	Median body mass index (kg)	Reference of height (cm)	Reference of weight (kg)
Girls	9-13	18.3	147	40
Boys	9-13	18.5	148	40

Table 2.5 DRIs for the required energy consumption of girls and boys aged 9-13 (NICUS 2007:18).

Gender	Age	Active PAL EER kcal/day (kj)
Girls	9-13	2071 (8698)
Boys	9-13	2279 (9572)

Table 2.5 illustrates the DRIs for energy of physically active children from ages 9-13.

2.10.2 Carbohydrates

Carbohydrates are macronutrients that contain starch, sugars and dietary fibre. They are mainly found in food plants such as fruits, vegetables and cereals (Griel, Ruder & Kris-Etherton 2006:1959). The EAR of carbohydrates for school children should be 100 g/d (IoM 2006). The RDA which is known to be an everyday nutrient requirement, for carbohydrate intake for children, should be 100 g/d (IoM 2006). According to the WHO (2003), carbohydrate recommendations for children from 1- 13 years is 45 - 65%, as school children are mainly active and may need extra energy to meet their caloric needs. They may need carbohydrate food sources such as sugary products, milk and cereal (Story & Stang, 2005:27).

2.10.3 Protein

Proteins are essential molecules consisting of amino acids that are required by our cells to function properly. The structure and function of our bodies depends on proteins and the regulation of the body's cells, tissues, and organs cannot exist without them (Nordquist 2017:1). Food sources of protein plant foods such as grains, nuts, and legumes. They are also found in protein such as poultry, red meat, eggs, fish and milk (Petrie, Stover & Horswill 2004:622). Some of the functions of protein in our bodies are to build muscles and ensure proper growth and bone development (Story & Stang 2005:27). According to the Institute of Medicine (IoM 2012), the suggested recommended protein intake for school children should be 46g per day, although, a simple method could be used to determine the RDA of an individual: weight x 0.8g = the amount of protein you need to consume per day.

2.10.4 Fat

A high fat diet is a big threat to the health and nutritional status of school children (Story & Stang 2005:27). However, according to the Institute of Medicine (IoM 2016), omega 3 fatty acids are extremely important to a child's diet as they ensure proper cognitive development in school children. The RDA for fats in school children should be 25 – 35% of energy of their daily intake from fats (IoM 2006). There is a thin line between the consumption of fats and obesity, especially when accompanied by sugar - these are the two most over-indulged macronutrients that need intense monitoring (Kroone & Alant 2012:70). Saturated fats such as animal fat (136) could course obesity, cancer and heart diseases (Whitney & Rolfes 2010:136; 151 – 152). Food sources of fats include polyunsaturated fats such as fish oils, canola oils, soybean oil. The unsaturared fats include products such as peanut butter, avocados and nuts (Nishida, Uauy, Kumanyika & Shetty 2004:247).

2.10.5 Dietary fiber

Dietary fibre is a "type of carbohydrate that cannot be digested by our bodies' enzymes. It is found in edible plant foods such as cereals, fruits, vegetables, dried peas, nuts,

lentils and grains. Fibre is grouped by its physical properties and is called soluble, insoluble or resistant starch. All three types of fibre have important roles to play in the body" (Betterhealth 2010). According to the WHO (2012), the intake of fruit, vegetables and grain in a child's diet contribute 20g – 25g per day to their dietary fibre intake. However, children should be careful not to over consume fibre in their diet, as it will make them full and prevent them from eating other macronutrients (British Nutrition Foundation 2009).

2.11 MICRONUTRIENT INTAKE REQUIREMENTS AND DEFICIENCIES

Micronutrient deficiencies are an extreme threat to the development of school children across the globe, particularly in developing countries (Allen 2003:388). It hinders their developmental potential and possibly affects their health and productivity as adults (WHO 2014). School feeding programmes and school-based fortification programmes are methods used worldwide to fight the epidemic of malnutrition micronutrient deficiency among school children from food insecure households (Labadarios *et al.* 2011:35).

Based on a research study done by Bailey, West and Black (2015:23), micronutrient deficiencies are evident in a society infested with never ending struggles linked to malnutrition and issues such as poverty, health problems, low rate of education and unemployment. To develop nutrition knowledge within a growing number of peri-urban and rural communities could reduce the burden of malnutrition, diseases amongst children and adults (West, Stewert & Cabellero 2012:271). School children are extremely vulnerable to malnutrition, micronutrient deficiencies and infections, especially because they spend seven hours every day of the week at school and away from home (Wenhold, Muehlhoff & Kruger 2015:45). Schools and school feeding programmes should capitalize on the hours learners have in school to educate them regarding nutrition and ensure that school children are provided with nutritious meals on a daily basis while still in school (Steyn, Nel, Mauder & Labadaris 2006:67).

School children are generally known to make poor food choices (WHO 2005). Therefore, schools in South Africa need to implement strict monitoring measures in school feeding programmes, particularly tuck shops which frequently sell food items high in fat and sugar, and low in micronutrients (De Villiers, Steyn, Draper, Fourie, Barkhuizen, Lambord, Dalais, Abrahams & Lanbert 2012:794). This is a nutritional hazard that needs to be prevented as it is a major contributory factor towards obesity and micronutrient deficiencies (Tempel, Steyn, Myburg & Nel 2006:252). In South Africa, one in every ten child is underweight and affected by common micronutrient deficiencies involving vitamin A, iron and zinc (Maunder, Nel, Steyn, Kruger & Labadarios 2015:22).

2.11.1 Vitamin A

Vitamin A is a fat soluble compound needed by the body for proper adaptation of the eye to changes of light from bright to dark (Rolfes, Pinna & Whitney 2015:340). It plays an important role in shaping the structural integrity and the functions of the epithelial cells of the skin and the cornea (Johnson & Russel 2010:117). An estimated 250 million school children develop vision issues with a majority going blind every year (Rotondi & Khobzi 2010:297). Vitamin A is essential for a child's development process, particularly for bones, teeth and growth (Ochola & Masibo 2014:28). Sufficient intake of vitamin A can also prevent parasite infections, measles and diarrhoea in children (Mauder *et al.* 2015:24). Vitamin A food sources are egg yolk, liver, full cream dairy products (Grune, Lietz, Palou, Ross, Stahl & Tang 2010: 270). What about the green leafy vegetalbels as the examiner asked?

2.11.2 Vitamin D

Deficiencies involving vitamin D is known to be a global public health problem in school children and adults (Lee, O'Keefe, Bell, Hensrud & Holick 2008:198). Vitamin D is an essential source of calcium, which promotes calcium absorption in the gut, reabsorption of calcium in the kidneys and bones (Holick & Chen, 2008:1080). Vitamin D helps in preventing rickets in children and osteoporosis in adults (Lee *et al.* 2008:195). Food

sources of vitamin D are yeast, fish and liver oil, liver, fortified food products, milk and margarine (Grune *et al*. 2010:279).

2.11.3 Vitamin E

Vitamin E is also a fat soluble compound with antioxidant properties as associated with vitamin A and vitamin C (Traber 2006:398). It serves as a protector of red blood cells by preventing damage to the cell membrane (Traber 1999:119). Vitamin E food sources are vegetables oils and margarine (Traber 2006:400).

2.11.4 Iron

Iron deficiency is the most problematic micronutrient deficiency amongst children and pregnant women in developing countries (Nojilana, Norman, Dhansay, Labadaris, Van Stuijvenberg & Bradshaw 2007:741). Children need iron as they grow and develop for blood formation to prevent severe cases of anemia (Cavadini, Siega & Popkin 2000:20). Iron is an extremely important micronutrient that needs to be consumed by young girls and women particularly during their menstruation period as they lose a lot of iron during that period (Cavadini *et al*. 2000:18). Essential food sources of iron are beef, ox liver, chicken and fish, beans, dark green vegetables, enriched bread and cereals (Rolfes, Pinna & Whitney 2015:405).

2.11.5 Iodine

The human body needs Iodine for various health, mental and physiological functions (Rolfes *et al.* 2015:418). Iodine is an essential micronutrient needed to prevent mental retardation (Egli, Allen, Bahi, Andersson & Bennoist 2004:34). It plays a major role in the health status of school children, as it affects their resistance levels to infections, contributes to increasing learning and physical abilities (WHO 2013). Iodine is reported to be the main cause of a 25% population group in Africa affected with mental and physical disabilities (Groce, Challenger, Berman-Bieler, Farkas, Yilmaz, Schchlctink, Clark & Kerac 2014:309) that contributes negatively to the socio and economic factors required for the development of a country (Andersson, Karumbunathan & Zimmernann

2012:748). Iodine deficiency is a global health issue that is prominent in pregnant women and school children (Benoist, Mclean, Anderssson, & Rogers 2008:197).

A low level of Iodine in children is caused by an inadequate consumption of iodine in their diet (Amin, Rathod, Doshi & Singh 2011:748). According to a research study done by UNICEF South Africa (2002:4) “South Africa is close to eliminating Iodine Deficiency Disorders” following on from the 1995 legislation that made it compulsory for salt manufacturers to iodize table salt between 40 – 60 parts per million, while also making sure that all food insecure households have access to iodized salt. Iodine can be found in the following food sources: vegetables and fruits, vegetable and seafood, iodized salt, grain products, meat, milk and dairy products (Whitney & Rolfes 2015:418).

2.11.6 Zinc

Zinc deficiency in children is associated with a growing risk of gastrointestinal infections and is a major contributor to child deaths caused by diarrhoea (UNICEF 2013). Zinc deficiency disturbs the growth process of children, resulting in children being stunted; weight-for-age (WHO 2012). Lack of sufficient zinc in children affects their growth hormone metabolism and it also impairs their neurobehavioral functions (Brown, Peerson, Rivera & Allen 2002:1066). According to Allen (2009:22), zinc deficiency is common amongst children from low-income countries, particularly poor communities where their diet consists mainly of cereals and legumes, which contain an extensive amount of phytate, a compound known to interfere with absorption of zinc. Children are also at risk when a diet lacks animal source foods (Nishi 1996:342). Important food sources of zinc include red meat, shellfish, and potatoes with skin, mushrooms, nuts and whole grain cereals (Rolfes, Pinna & Whitney 2015:414).

2.12 FOOD-BASED DIETARY GUIDELINES

Food-based dietary guidelines (FBDGs) were formed in 2003 by the Nutrition Society of South Africa (NSSA) (Love 2003:70). These guidelines were structured as intervention tools used to target existing nutrient deficiencies in South African communities (Vorster, Love & Browne 2001:5). The sole purpose of the NSSA was to apply environmental

factors such as food availability, food access, income status and cultural beliefs in order to promote health for all South Africans (Love, Maunder, Green, Ross, Smale-lovely & Charlton 2001:12). These FBDGs are used to help individuals as to how to choose food and nutritious beverage combinations that will lead to proper diet consumption as well as lower risks of nutrient deficiencies (Vorster, Badham & Venter 2013:164). There are few studies motivating the effectiveness of FBDGs on school feeding programmes. The influence of FBDGs studies have only been tested in KwaZulu Natal and the Western Cape Province (Love *et al*. 2001:10; Love, Mounder & Green 2008:22). A more recent study done in twelve schools with 256 educators by Nguyen, De Villiers, Fourie, Bourne and Hendricks (2015:170) in the Western Cape revealed that implementing FBDGs in school curriculums could be necessary strategies to improve nutrition education. Ninety four percent educators agreed that FBDGs would be beneficial for school children and 97% educators supported the inclusion of FBDGs as part of the school curriculum and school feeding programme to improve dietary intake of school children.

The FBDGs presented in Table 2.6 are dietary messages designed for an individual to make better nutrition choice. These guidelines were structured in 2003 and updated in 2013 (Vorster *et al*. 2013:165).

Table 2.6 Food-based guidelines. Source: Adopted from Vorster *et al*. (2013).

South African food-based dietary guidelines
• Enjoy a variety of foods. • Be active. • Make starchy foods part of most meals. • Eat plenty of vegetables oils rather than hard fats. • Have milk, maas or yoghurt every day. • Fish, chicken, lean meat or eggs can be eaten daily. • Drink lots of clean, safe water. • Use fats sparingly. • Choose vegetable oils, rather than hard fats.

- Use sugar and foods high in sugar sparingly.
- Use salt and food high in salt sparingly.

2.13 SUMMARY

In this chapter, literature on school feeding programmes and malnutrition indicators were discussed. The literature focused on the background to school feeding programmes, the effects and efficiency of school nutrition programmes and the underlying effects of malnutrition on school children. The methods used to measure variables of this study will be discussed in Chapter Three.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to explain how data were collected in order to determine the overall dietary intake of school children attending Kagiso Primary School in, Mogale city. As mentioned in chapter one, the findings of this study were based on the following objectives;

- To determine the socio-demographic status of caregivers and learners by completing a socio-demographic questionnaire.
- To determine the food insecurity status of school-aged children by completing a Household Food Insecurity Access Scale questionnaire.
- To measure the nutritional status of learners between 6-13 years in a Kagiso primary school (Mogale city), using anthropometric measuring tools.
- To determine the dietary intake of Kagiso learners, by completing a Food Frequency questionnaire.
- To assess the overall nutrient intake of Kagiso learners measured by 24-hour recall.
- To assess the nutrient intake of learners participating in the NSNP meal compared to learners participating in the tuck shop and lunch box meals, measured by 24-hour recall.
- To observe the NSNP, eating patterns and food choices of Kagiso learners
- To make recommendations to the Department of Basic Education/policy makers and the NSNP based on findings and results of the research study.

Reliable and validated questionnaires to measure all participants were included in the study. The development of the questionnaire design, sample size, data collection and date analysis process will be included in this chapter. Ethical aspects along with the reliability and validity of this study will also be discussed in this chapter. Measuring instruments used for this study are as follows: socio-demographic questionnaire (SD-Q), household food insecurity access scale questionnaire (HFIAS), anthropometry measurements, food frequency questionnaire (FFQ), 24-hour recall questionnaire (24-

H-RQ), and observation methods during the school lunch breaks at a Kagiso primary school.

3.2 STUDY DESIGN

The study design used for this study measure a variety of variables and was a cross-sectional and analytical survey design. A quantitative approach was taken to collect data using validated questionnaires during a one on one interview.

3.3 ETHICAL CONSIDERATIONS

To ensure proper implementation of this study, ethical clearance was officially obtained from relevant bodies. The documents include an approved clearance letter from the Gauteng Department of Education (Annexure A), a signed and approved letter from the Headmaster of Kagiso Primary School to conduct research (Annexure B), approved ethical clearance from the Vaal University of Technology (VUT) (Annexure C) and most importantly, signed consent forms by parents/legal guardians (Annexure D) and signed assent forms (Annexure E) by school learners allowing participation in the study. Anonymity and privacy was assured to protect the identities of all respondents willing to participate including parents, school learners and food handlers.

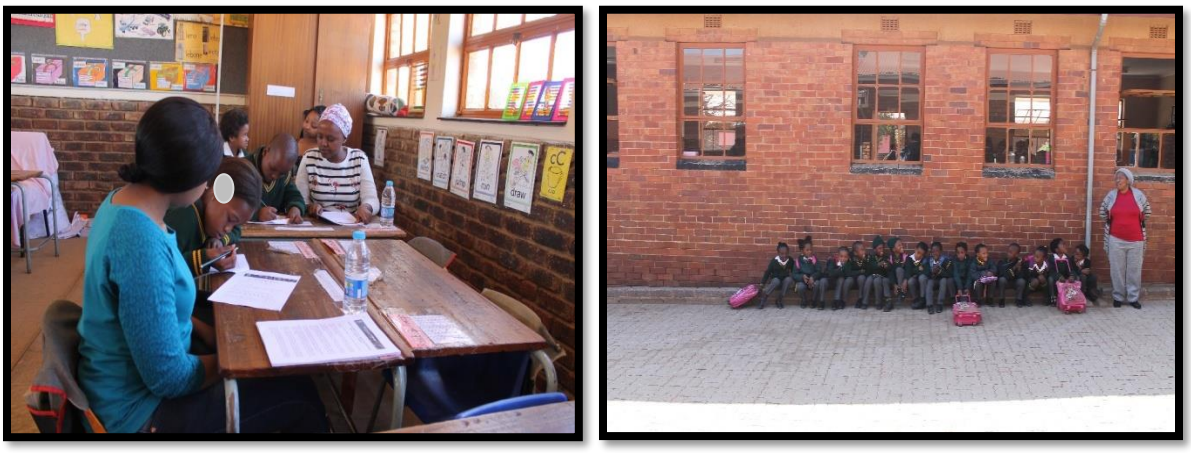


Figure 3.1 Learners signing assent forms before data collection, and learners waiting for data collection outside the classroom with a teacher present. Source: Researcher (2017).

University students were trained as fieldworkers to collect data ethically, based on the researchers VUT ethical clearance (see Annexure C), certificate number – ECN31-2017. School teachers were tasked to be present during data collection to ensure that proper conduct was practiced at all times.

3.4 DEMARCATION OF THE STUDY

This study was undertaken in a primary school in Kagiso, a township located between Randfontein and Johannesburg along the historic Main Reef Road that links the East and West Rand sections of the Gold Reef (Figure 3.2). The study setting is based at a non-fee public primary school, meaning that learners do not pay school fees. The school consist of black boys and girls aged 6-13 years, all residing in Kagiso.

3.4.1 Study setting

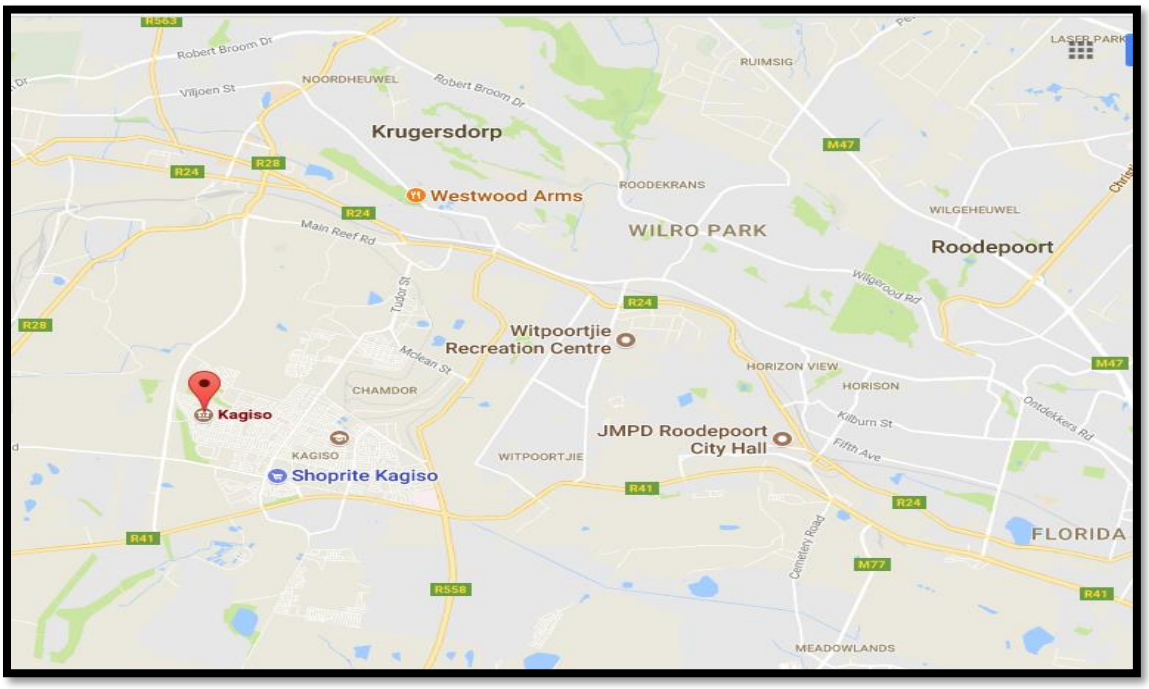


Figure 3.2 The study area – Kagiso, Mogale city.

In the 1950's during segregation, certain black South Africans were grouped and migrated to what was called, "locations" and so began settlement of miners in

Krugersdorp. Subsequently, the closing of gold mines left room for industries to relocate and settle in Chamdor 5 kilometres away from Kagiso and 15 kilometres away from white communities. Kagiso township evolved into an industrial location with a vast number of black semi-urban settlers (Khumalo 2004:4). Mogale City, previously known as the Krugersdorp Local council, was named after Chief Mogale-Wa-Mogale, "the young heir to the Chiefdom of the Batswana." Mogale City, Kagiso is rich in different cultures and tribes, mainly the Batswana-Bafokeng and Bakwena people, as well as Nguni, Xhosa and Zulu (Mogale City Local Municipality 2017). A recent updated census statistics regarding population groups and educational status from the study area is shown below.

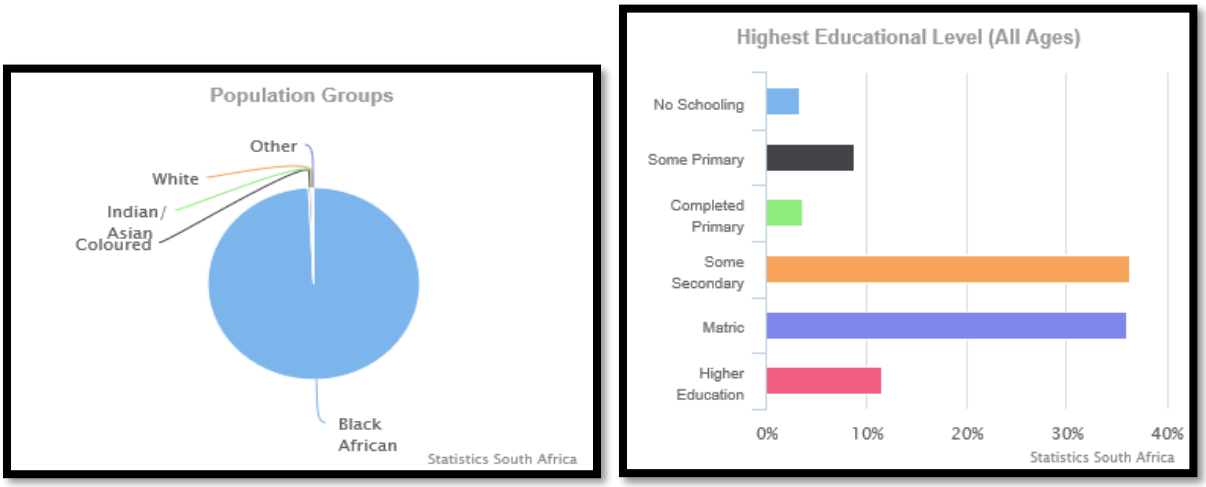


Figure 3.3 Kagiso (Mogale city) population group and educational status. Source: Adopted from Statistic South Africa (2011).

According to the 2011 census, Kagiso has an area of 14.17 km², a population of 115,802 comprising 35,098 households. The population of Kagiso is more than 99% black African people, 0.3% coloured people, 0.08 Indian and 0.6% of white people. The population statistics reflect the impact of migrant labour on the population profile of Kagiso where the gender profile of the Kagiso people consists of more men than female; male – 58,057 and female – 57,745. The educational level in the area is comparatively low with the higher education level at 11.6%, matric 36.1% and no schooling at 3.4% (Statistics Africa: 2011).

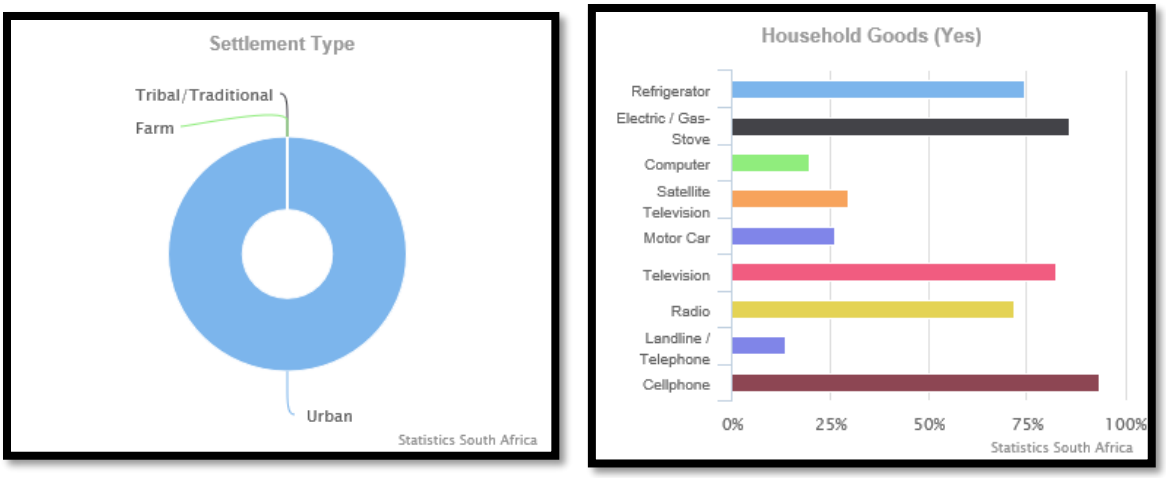


Figure 3.4 Source: Kagiso (Mogale city) living conditions. Source: Adopted from Statistics South Africa (2011).

The socio-economic indicators reflect that within the 35,098 households in Kagiso, 89.9% have electricity for lighting with 90.6% of houses have flush toilets connected to sewerage. The area can be described as a semi-urban area.

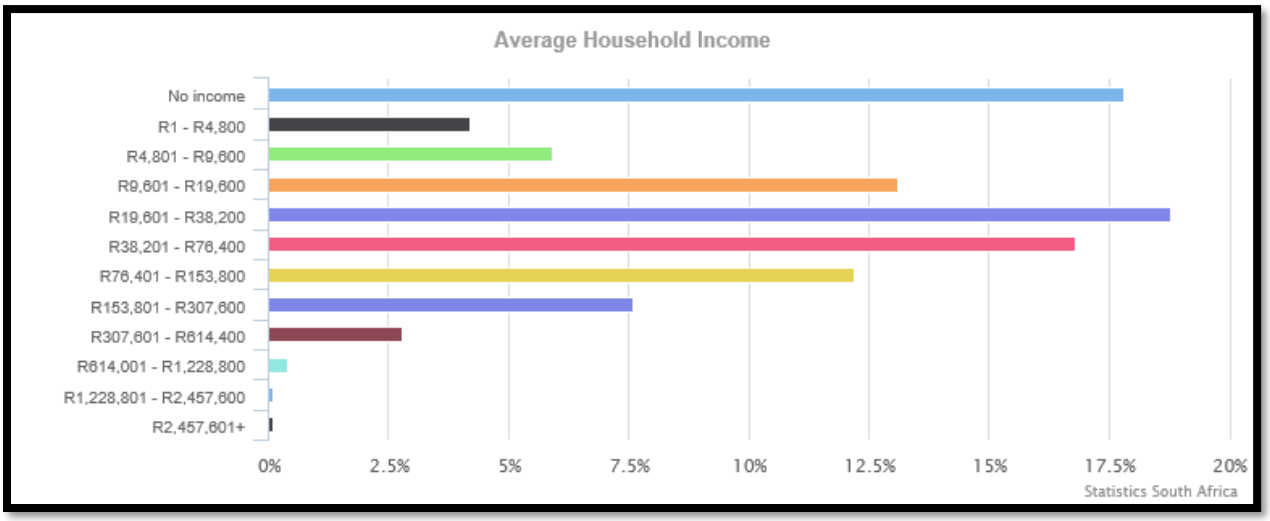


Figure 3.5 Kagiso (Mogale city) income profile. Source: Adopted from Statistics South Africa (2011).

According to census 2011 (Statistics South Africa: 2011), the working age in the area ranges from 15 to 64 years of age, with 71.9% of the population being temporarily and permanently employed. The average household income indicates that an average household wage income is at R30, 000, 17.8% of households generate no income and higher wage income per annum is at 0.1%.

3.5 METHODOLOGY

3.5.1 Sampling

The sampling frame is as an act of representing certain elements of a targeted population (Christensen 1997:417). According to Neuman (1997:203), it's a particular list that tightly estimates all the elements in the population. The sample frame in this study consisted of learners derived from the Kagiso Primary School database in Kagiso. The sample calculations required a total of 160 school learners, boys and girls from 6-13 years of age from grade one to grade seven. The inclusion criteria included learners participating in the National School Nutrition Programme, learners that bring lunch from home and learners buying food and snacks from the tuck shop. The aim was to assess the impact of the NSNP by comparing the nutrient consumption of school learners participating in the NSNP with school learners not participating in the NSNP. Five measuring instruments were used to interview the sample group, four measuring instruments were used to interview learners and one measuring instrument, the socio–demographic questionnaire, was used to interview 160 parents. Study-specific random sampling was conducted to explore any departure from the proposed sample size of 160 learners and a corresponding number of caregivers.

3.5.1.1 Sample size

A total population sample of n=160 of learners and n=160 Caregivers were selected as participants in this study. A sample calculation used to determine the sample size is as follows (Krejche & Morgan 1970).

SS= $\frac{Z*(p)*(1-p)}{C}$

Where:

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

P= percentage picking a choice, expressed as decimal

(.5 used for sample size needed)

C= confidence interval, expressed as decimal

3.5.1.2 Participation selection

The inclusion criteria were as follows;

- 6-13 year old school learners.
- Boys and girls.
- Primary school in Kagiso (n=160) learners participate in the NSNP and learners who do not participate in the NSNP.
- Caregivers (n=160) to participate in the socio-demographic data collection

  Food handlers, parents, teachers and headmasters will be included to ensure proper stability of the study.

  The exclusion criteria were as follows;
- learners whose Caregivers have not signed consent forms
- Learners who have not signed assent forms
- Secondary school learners

3.5.2 Fieldworkers

The objective of training fieldworkers is to ensure that data collection is conducted ethically and accurately. Fieldworkers were trained by a qualified researcher to use the following questionnaires; 24-H-RQ and FFQ, along with the use of food samples and measuring utensils for portion size estimations. They were also trained to measure weight and height using a scale and stadiometer. Fieldworkers were selected on their ability to connect with children, attributes such as; respect, compassion, empathy and warmth were considered in the selection process of the fieldworkers. The role of a fieldworker in this study was to assist the researcher with data collection/fieldwork.

Fieldworkers were, therefore, needed for the administration process to ensure that all data collection stations were properly organized, to monitor issuing of questionnaires and snacks to respondents and to ensure that all questionnaire were filled in correctly.

Figure 3.6 Trained fieldworkers preparing for data collection. Source: Researcher (2017).

3.5.3 Measuring tools

The methods that were chosen for the study were designed to record the dietary intake of school learners and their nutrient consumption contributed by the NSNP. These involved socio-demographic questionnaires, household food insecurity access questionnaires, anthropometry questionnaires, FFQ, 24-hour recall and observation methods to monitor food patterns and food choices of Kagiso learners during school lunch breaks.

3.5.3.1 Social demographic questionnaire

A socio demographic questionnaire is used to provide demographic background information of an individual. It gives the researcher an overview of the individual's environment. Information gathered is based on factors such as race, age, gender, education, state of employment, income status and living conditions. The S-DQ was used to determine the social demographics of learners by collecting data from their caregivers. The questions asked were used to determine the age, race, gender, living conditions, education, electricity assess, and income status of caregivers (Annexure F).

Fieldworkers at Kagiso Primary School interviewed parents, after school hours and during weekends with each interview process taking 20 to 30 minutes. Each parent/caregiver was asked questions by the interviewer, with the interviewer writing down answers, based on the sensitivity of question 4.4 (see Annexure F).

Figure 3.7 Caregivers and fieldworkers during socio–demographic data collection. Source: Researcher (2017).

3.5.3.2 Household Food Insecurity Access Scale

Food security is defined as “all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life” (United States Agency for International Development 1992; FAO 2012). The measuring of food insecurity has been used over many decades by researchers to determine the food security status of household’s (Hamilton, Cook, William, Lawrence, Buron, Edwaed, Frongillo & Wehler 1997:4). The approach used to monitor and measure food insecurity was developed in a form of a questionnaire that would determine how each household from a low-income background experienced food insecurity (Wehler, Scott & Anderson 1992:33). The following standardized questions were used to provide insights into household food insecurity status: Feelings of uncertainty or anxiety over food; perceptions that food is of insufficient quantity; reduction of food intake; consequences of reduced food intake (for adults and children); and feelings of shame for resorting to

socially unacceptable means to obtain food resources (Frongillo, Simeon & Wolfe 2004).

The HFIAS questionnaire was used to determine the food security status of Kagiso learners. The questionnaire consists of nine questions that monitor the increasing levels of food security known as “frequency-of-occurrence questionnaires” (Hamilto *et al.* 1997:42). Each question is divided into three sections that determine the severity of food security (see Annexure G).The nine questions asked were extremely sensitive as they are designed to give insight into the respondent’s (children) vulnerable views regarding their food insecurity status (Radimer *et al*. 1990:30). Fieldworkers were intensively trained to handle the HFIAS questionnaire using role play to carefully use recurring emotional key triggers, such as; “did you worry?” , “did you go to bed hungry?” and “how often did this happen?”

3.5.3.3 Anthropometry instruments

Anthropometry is defined as “the study and technique of taking body measurements” (FAO 2009). In certain medical and health professions anthropometry is used to evaluate the nutritional status of human beings, particularly of children (Labadarios 2005:245). Anthropometry played a major role in this study; it is a crucial tool used in identifying nutritional problems among school age children (FAO 2004). According to Armstrong, Lambert & Lambert (2011:835), anthropometry should be a continuous process used to monitor threats such as under-nutrition that pose serious implications for the health of school age children in South Africa and other developing countries.

A study conducted by Kallman (2005:6) on Food for Thought states that key indicators that researchers use in determining the level of under-nutrition in school children are as follows;

Height-for-age (H-a): School children with a low H-a are reported to be stunted and indicates chronic deficiencies and well as long-term dietary inadequacy. It also highlights issues related to food insecurity and socio-economic deprivation.

Weight-for-Height (W-H): School children with a low W-H ratio indicate wasting and is regarded to be a sign of a serious case of nutritional deprivation, not enough nutrients consumed and possibly lack of food.

Weight-for-age (W-a): School children with a low W-a indicates that a child is underweight and could be a result of children coming from food insecure household, and severe shortage of food.

Anthropometry measurements in this study were used to evaluate the nutritional status of school-age children from Kagiso Primary School. The questionnaires were designed to record the age, gender, weight and height that enabled the researcher to calculate the total Body Mass Index (BMI) of school-aged children (Annexure H). The researcher was responsible for measuring and recording of anthropometric results. Based on the sensitivity of dealing with children, a teacher had to be present during the measuring process. School aged learners were asked to participate in light clothing with their shoes off, and results were recorded on an anthropometric data sheet. Measurements had to be taken twice, to ensure accurate recording of results.

3.5.3.3.1 Scale

A Seca Personal Scale should be placed on a flat, hard, even surface. Turn on the scale before waiting for two zero's to appear, and then the scale is ready for the respondent to be measured. The respondent should remove heavy garments such as shoes, jackets and they should empty their pockets. The learner should than stand straight with both feet on the marked footprint and record weight to the nearest 0.1 kg (WHO, 2008:18).

Figure 3.8 Learner on a scale.

3.5.3.3.2 Stadiometer

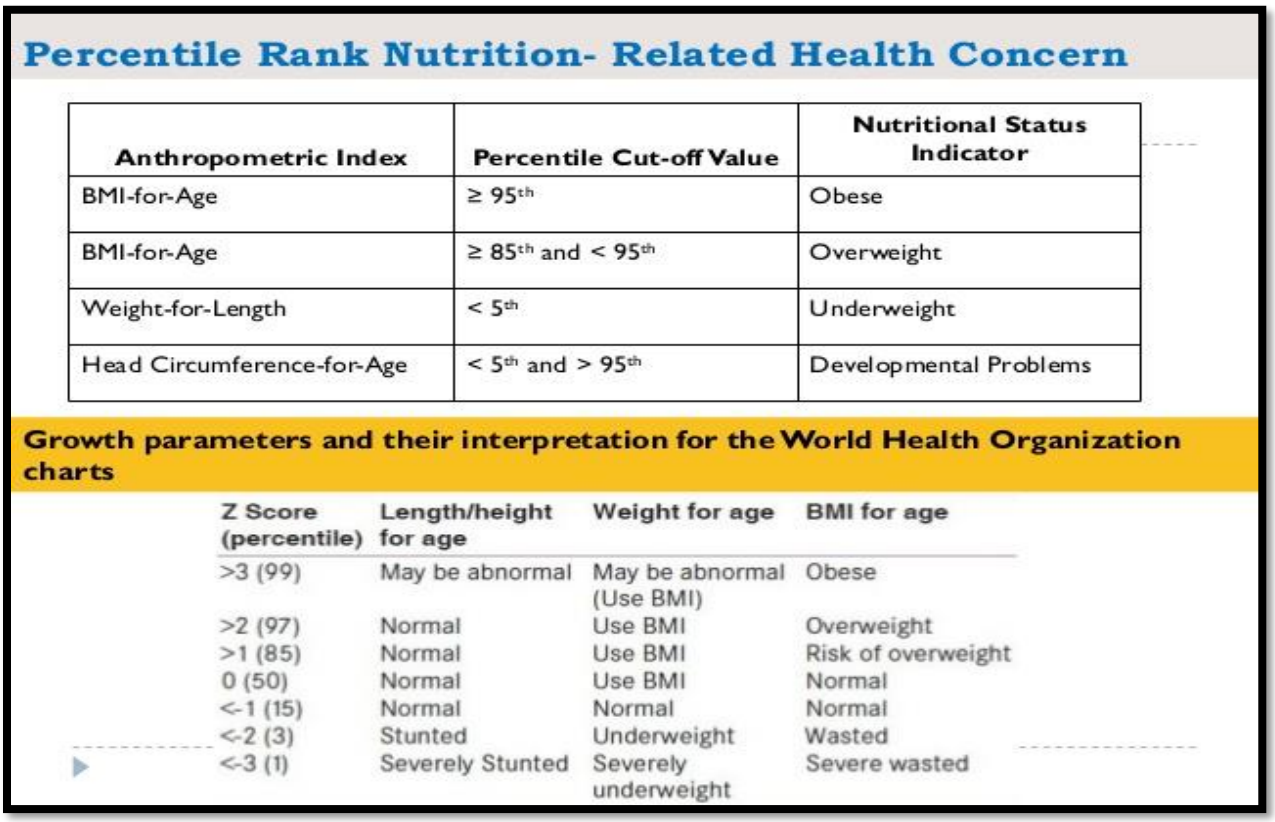
The stadiometer board must be positioned on level ground and respondents should stand on the board without shoes with the respondents back, shoulder blades, buttocks, calves and heels standing parallel and close to the vertical board. The respondent should also stand straight, with the head looking straight ahead, with the ear canal horizontal with the lower border of the eye socket (WHO, 2008:23).

Figure 3.9 Learner on a stadiometer.

3.5.3.3.3 Body Mass Index (BMI)

The researcher obtained weight and height measurements. The calculated BMI was used as a tool to measure the nutritional status of school-aged children - if a child was underweight or overweight. According to Halfon, Larson & Slusser (2013:13), BMI is used to monitor malnutrition and any health risks that could affect children. The BMI was calculated using the formula below;

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



Percentile Rank Nutrition- Related Health Concern

Anthropometric Index	Percentile Cut-off Value	Nutritional Status Indicator
BMI-for-Age	≥ 95th	Obese
BMI-for-Age	≥ 85th and < 95th	Overweight
Weight-for-Length	< 5th	Underweight
Head Circumference-for-Age	< 5th and > 95th	Developmental Problems

Growth parameters and their interpretation for the World Health Organization charts

Z Score (percentile)	Length/height for age	Weight for age	BMI for age
>3 (99)	May be abnormal	May be abnormal (Use BMI)	Obese
>2 (97)	Normal	Use BMI	Overweight
>1 (85)	Normal	Use BMI	Risk of overweight
0 (50)	Normal	Use BMI	Normal
<-1 (15)	Normal	Normal	Normal
<-2 (3)	Stunted	Underweight	Wasted
<-3 (1)	Severely Stunted	Severely underweight	Severe wasted

Figure 3.10 World Health Organization growth indicators. Source: Adopted from WHO (2007a).

3.5.3.4 The Food Frequency Questionnaire

The purpose of the FFQ was to assess respondents' dietary intake from seven days back. It does not require any food measurements/portion sizes (see Annexure I). A food frequency questionnaire is designed to assess an individual dietary intake, usually tracing from seven days ago (Ranklin, Levy & Warren 2011:1229). The questionnaire includes a list of food items broken down into a diversity of food groups, such as: fresh foods, eggs, dairy products, cereals, legumes, fruits and vegetables, oils and fats (Willet 1998:70). According to Ranklin *et al.* (2011:1232), FFQ is the best dietary assessment questionnaire to be used alongside the 24-H-RQ as it does not rely on the respondents' accuracy in remembering portion sizes, and can be used as an assessment to determine the long-term dietary intake of an individual. It was broken down into food groups, to measure what diversity groups were mostly consumed by the respondents. Because the study involved children, a book with food pictures divided in their groups was compiled to assist respondents to identify food items they consumed (Figure 3.12) in addition to food models. The groups are broken down as follows;

- Group one: Flesh foods (meat, poultry, fish) diversity,
- Group two: Eggs diversity
- Group three: Dairy products of diversity
- Group four: Cereal, roots and tubers diversity
- Group five: Legumes and nuts
- Group six: Vitamin A rich fruits and vegetables
- Group seven: Other fruits and vegetable
- Group eight: Vegetable diversity
- Group nine: Oil and fat diversity

Figure 3.11 Food pictures shown to learners during FFQ data collection. Source: Researcher (2017).

3.5.3.5 The 24-hour-recall questionnaire

A validated 24-H-RQ was used in this study as a tool to measure food consumption for all respondents participating in the study (see Annexure J). The central core of a nutrition study is determined by the dietary intake measurements of the population study group (Nelson, Bingham 1997:48). Dietary evaluation methods used in research methodologies are broken down into two categories, dietary intake measurements of a group or household and intake of individuals (Medlin, Skinner 1988:1252). The 24-H-RQ is a measuring tool that is highly valued by researchers and research institutions, as it is well known for its accurate way of simplifying administration, especially in a large scale

national survey (Nelson, Bingham 1997:45). The 24-H-RQ measuring tool was developed by Weihl in 1942 (Rankin *et al*. 2010:69) and it started to pick up momentum in the US around 1971 (Thompson and Byers (1994:224). It has been widely used by the following research institutions;

- National Health and Nutrition Examination Survey (NHANES I, II and III)
- Hispanic Health and Nutrition Examination Survey (HANES)
- Nationwide Food Consumption Survey (1977 and 1987)
- Continuing Survey of Food Intakes of Individuals (CSF II).

The structure and use of the 24-H-RQ is designed in a way that does not intimidate respondents. Instead it puts the responded at ease as literacy of the respondent is not required (Nelson & Bingham 1997:48). It is a verbal one on one interview style of a questionnaire, which takes around 20 minutes per respondent. The steps of the questionnaires are as follows: the interviewer will ask the respondent to remember what food items they consumed 24 hours ago/ the previous day. The interviewer will divide the day by asking the respondent what food they consumed during breakfast, after breakfast, for lunch, dinner and before going to bed. The interviewer will display food samples, measuring cups, plates, dishing spoons and pictures of food to help the respondent remember how much grams/food intake was consumed.

To ensure the reliability and validity of the 24-H-RQ, fieldworkers (interviewers) need to be trained in handling the administration of the questionnaire (Thompson & Byers 1994:226). Obstacles of the 24-H-RQ could be dealing with respondents that struggle to remember what they consumed the previous day, particularly children under 7 and the elderly. As shown in Figure 3.5, the questionnaire is accompanied by food samples and measuring utensils, food items/snacks popularly consumed by respondents, to assist fieldworkers in ensuring proper estimation of portion sizes. The questionnaire was designed to record meals consumed by respondents the previous day, from the morning up until dinner. As shown in (Annexure J) before starting with the questionnaire, the interviewer recorded the day of the week in which food recorded was consumed. The interviewer then asked the respondent to stipulate whether or not food consumed on the

day was their everyday normal food intake, as the aim was to record their normal day to day nutrient intake.

Figure 3.12 Food samples used for 24-H-RQ and FFQ. Source: Researcher (2017).

3.5.3.6 Study observation during school lunch

An observational study (see Annexure K) was done during school lunch to monitor the NSNP kitchen, food choices, eating habits and buying habits of school children. The study groups were divided into school children who choose to participate in the NSNP or to purchase food from the school tuck shop or bring lunch from home. An observation was also conducted in the NSNP premises where food handlers prepared NSNP meals.

This was done by observing meal preparation, prepared by food handlers, as well as food/ snacks sold from the school tuck shop.

Figure 3.13 School learners consuming food from the NSNP during school lunch. Source: Researcher (2017).

Photograph (A) in Figure 3.13 shows a picture that was taken during the observation process of the study. Pictures were taken at 10:00am during the school lunch break. The photograph labelled (A) shows learners that participate in the NSNP sitting together and enjoying their NSNP meal. The photograph also shows that learners participating in the NSNP consume NSNP meals from their own utensils brought from home (empty lunchbox from home and no spoons).

Figure 3.14 Learners at lunchtime, some prefer NSNP meals while other learners prefer to eat snacks and food from the tuck shop. Source: Researcher (2017).

Photograph (B) in Figure 3.14 shows a group of learners that preferred to purchase snacks from the tuck shop or to bring lunch boxes from home.

Figure 3.15 School tuck shops. Source: Researcher (2017).

The photograph labelled (C) in Figure 3.15 shows the school tuck shop and lack of infrastructure, as one of the challenges mentioned in Chapter 2 (section 4.5.7). The school tuck shop is located in the middle of the school playground, where learners can freely purchase snacks of their choice. The tuck shop women were permitted by the school to sell inside school premises.

Figure 3.16 Food items sold at the tuck shop. Source: Researcher (2017).

The photograph (D & E) in Figure 3.16 display a variety of snacks sold from the school tuck shop, mainly high in sugar and fat. The tuck shop also sold snacks that showed to

be very popular among learners. These snacks include white bread with polony, fried chips, achaar and vetkoeks with polony.

Figure 3.17 NSNP kitchen. Source: Researcher (2017).

The photographs labelled (F & G) in Figure 3.17 show the NSNP food preparation area. The NSNP meals are prepared and served by food handlers (community members) employed by the school to work under the NSNP. The NSNP food preparation area is a classroom that has been converted into a kitchen area.

The photographs in Figure 3.18 show preparation stations in the NSNP kitchen. The photograph labelled (H) shows that food handlers use gas stoves to prepare NSNP meals. It also shows a neatly organised cooking area with cooked food, dished in containers and ready to be served. Photograph (J) shows the lack of food storage facilities in the NSNP kitchen, so that maize meal and samp (dry ingredients) are stored on top of a table, vegetable are stored under a table on a floor and there is no refrigerator for cold storage. Photograph (K) shows the cleaning area and the level of cleanliness in the NSNP kitchen. Photograph (L) shows the NSNP food handlers responsible for meal preparation with their heads covered in hats as a hygiene precaution.

Figure 3.18 Cooking areas, storage area, cleaning area and food handlers. Source: Researcher (2017).

3.6 DATA COLLECTION PROCEDURES

Arrangements for data collection were discussed with the headmaster of the Kagiso Primary School six months prior to the data collection date. The researcher and the headmaster compiled school newsletters for caregivers, informing them of the data collection dates, grades and times and who should sign consent forms. On the data collection days, the researcher, schoolteachers and fieldworkers were always present to interview and complete questionnaires for learners and caregivers. The presence of a school teacher provided confidence and assistance to the learners and to ensure that proper conduct was followed. Data were collected after class at the school premises, with eight fieldworkers per station and a rotation of supervisory teachers. Each questionnaire, including anthropometric measurements, took approximately 25 to 30

minutes per learner. Caregivers were also interviewed at the school premises, during the week and on weekends to obtain socio-demographic information. The data collection schedule was structured purposely not to include meals over the weekend.

Table 3.1 Data collection schedule.

Date	Time	Grade	Respondents	Methods
29 August 2017 (Tuesday)	14:15 -16:00 p.m.	7	Girls (8 learners) Boys (8 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 16	SD-Q
30 August 2017 (Wednesday)	14:15 -16:00 p.m.	7	Girls (7 learners) Boys (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 14	SD-Q
5 September 2017 (Tuesday)	14:15 -16:00 p.m.	6	Girls (7 learners) Boys (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 14	SD-Q
6 September 2017 (Wednesday)	14:15 -16:00 p.m.	6	Girls (7 learners) Boys (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 14	SD-Q
13 September 2017 (Wednesday)	14:15 -16:00 p.m.	5	Girls (7 learners) Boys (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 14	SD-Q
14 September 2017 (Thursday)	14:15 -16:00 p.m.	5	Girls (7 learners) Boys(7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	14:15 -16:00 p.m.	/	Caregivers - 14	SD-Q

19 September 2017 (Tuesday)	13:45 – 15:00 p.m.	4	Girls (7 learners) Girls (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	13:45 – 15:00 p.m.	/	Caregivers - 14	SD-Q
20 September 2017	13:45 – 15:00 p.m.	4	Girls (7 learners) Girls (7 learners)	HFIAS FFQ 24-hour recall Anthropometry
	13:45 – 15:00 p.m.	/	Caregivers - 14	SD-Q
21 September 2017 (Thursday)	13:30 -14:30 p.m.	3	Girls (6 learners) Boys (6 learners)	HFIAS FFQ 24-hour recall Anthropometry
	13:30 -14:30 p.m.	/	Caregivers - 12	SD-Q
22 September 2017 (Friday)	13:30 -14:30 p.m.	/	Girls (6 learners) Boys (6 learners)	HFIAS FFQ 24-hour recall Anthropometry
23 September 2017 (Saturday)	10:00 – 12:00 p.m.	/	Caregivers - 12	SD-Q
26 September 2017 (Tuesday)	13:30 -14:30 p.m.	2	Girls (6 learners) Boys (6 learners)	HFIAS FFQ 24-hour recall Anthropometry
27 September 2017 (Wednesday)	13:30 -14:30 p.m.	2	Girls (6 learners) Boys (6 learners)	HFIAS FFQ 24-hour recall Anthropometry
6 October 2017 (Saturday)	09:00 – 11:30 a.m. 12:00 – 14:00 p.m.	/	Caregivers – 12 Caregivers - 12	SD-Q SD-Q
10 October 2017 (Tuesday)	13:30 -14:30 p.m.	1	Girls (6 learners) Boys (6 learners	HFIAS FFQ 24-hour recall Anthropometry
11 October 2017 (Wednesday)	13:30 -14:30 p.m.	1	Girls (6 learners) Boys (6 learners	HFIAS FFQ 24-hour recall Anthropometry

3.7 DATA ANALYSIS

3.7.1 Household Food Insecurity Access questionnaire and socio-demographic questionnaire

The HFIAS and S-DQ data were captured on an Excel spreadsheet by the researcher. Data was analysed using the Statistical Package for Social Sciences (SPSS) for Windows (version 22.0). This programme analyzed data for descriptive statistics (frequencies, means, standard deviations and confidence intervals), with the assistance of a statistician. Data were presented in tables and graphs to determine percentages and frequencies of all respondents who answered questionnaires accurately.

3.7.2 Anthropometric data

Anthropometry is defined as “the study and technique of taking body measurements” (Food and Agriculture Organization 2009). In certain medical and health professions anthropometry is used to evaluate the nutritional status of human beings, particularly of children (Labadarios 2005:245). Anthropometry played a major role in this study as it is a crucial tool used in identifying nutritional problems among school age children (FAO 2004). According to Armstrong and Lambert (2011:835), anthropometry should be a continuous process used to monitor threats such as under-nutrition that pose a serious threat to the health of school children in South Africa and other developing countries.

Weight and height measurement results were captured on an Excel spread sheet. Data was therefore converted into Z-score using the World Health Organisation growth standard reference values. Anthropometric data were, therefore, analyzed using the World Health Organization’s AnthroPlus (version 1.02) statistical software. Results determine the nutritional status of respondents by indicating height for age (stunting) and BMI for age (wasting), Z-scores < -2 SD below the reference median. The BMI was calculated using the formula below:

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

3.7.3 Dietary assessment

A registered dietician analyzed the 24-hour recall questionnaires for mean nutrient intake using the South African Medical Research Council FoodFinder3® program. This not only calculated the nutrient intake of respondents but also compared the nutrient intake of meals consumed at the tuck-shop, NSNP and lunch from home (lunch box). The FFQ data were captured by the researcher using an Excel spreadsheet, using the Statistical Package for Social Sciences (SPSS) for Windows (version 22.0) to determine the frequency and percentage of food groups and ranges consumed by respondents.

3.8 VALIDITY AND RELIABILTY OF THE STUDY

3.8.1 Validity

Validity refers to the scope to which an exploratory model measures what it intends to measure (Denzin & Lincoln 2005:297) and focuses on the end result of the measurement and whether it is effective after the choice of methods has been decided (Neuman 1997:138). Validity for anthropometric measurements was ensured by using a portable medical stadiometer (model number 213) and scale (Seca, Chino, CA, USA).

3.8.2 Reliability

According to Emory and Cooper (1991:179), reliability, validity and practicality are the most important factors used to evaluate a measuring tool. As described by Creswell (2007:37), reliability determines an indicator's dependability, and when in position of a reliable indicator you will get the same results every time the same item is measured. Based on methods that were conducted in this study, reliability is imperative. Standardized and tested questionnaires were used to ensure consistent results; trained fieldworkers were briefed and supervised during data collection to ensure reliable information.

3.9 ASSUMPTIONS

The following assumptions were made during the research study;

- The chosen sample size (n=160) represented the study population group (randomly calculated and selected see section 3.6.1.1)
- The study was conducted ethically; all the information given by respondents during data collection was recorded as is.
- Measurements taken using anthropometric instruments; scale and stadiometer, were captured accurately.

3.10 SUMMARY

In this chapter, all dietary intake instruments were discussed; socio-economic indicators were measured by discussing socio-demographics, household food insecurity and anthropometric instruments. Appropriate methods of collecting data and capturing techniques, software's were also discussed. The results and their interpretations of S-DQ, HFIAS, 24-H-RQ, FFQ and anthropometric data will be discussed in Chapter 4.

CHAPTER 4

RESEARCH RESULTS

4.1 INTRODUCTION

This chapter discusses the interpretations and findings from a set of five questionnaires (described in section 3.6.3) that were completed by 160 school children from Kagiso Primary School. The findings and results of the study are presented as based on the empirical objectives of the study. This study investigated the socioeconomic indicators, the overall dietary and nutrient intake of school children and most importantly, the contribution the NSNP has on the nutrient intake of Kagiso learners. The following results are reported and discussed;

- Impact of socio-demographic factors on the nutritional status of school children (S-DQ)
- Household food insecurity status of school learners (HFIAS)
- Anthropometry status of learners participating in the NSNP compared to learners participating in the tuck-shop and lunch box (AnthroPlus)
- Learners dietary intake (FFQ)
- Respondents' overall nutrient intake (24-HR)
- NSNP nutrient contribution to the respondents' daily dietary intake compared to the dietary intake of respondents participating in the tuck shop and lunch box (24-HR)
- The NSNP eating patterns and food choices of Kagiso learners (Observation)

4.2 PERSONAL DEMOGRAPHIC DATA

The section of the socio-demographic questionnaires (see Annexure F) covered the participants, gender, age, race, and grade. It also assessed caregivers' level of household income, employment status and the highest level of education. These were socio-demographic indicators used to assess the food insecurity status, affordability of food, availability of food, access of food and the nutritional status of Kagiso learners.

4.2.1 Respondents age, grade and gender

All respondents/learners (160) were asked for their age and grouped according to their grades. Table 4.1 shows the respondents personal profile based on their gender, age and grade.

Table 4.1 Respondents demographic profile.

Gender	**n=160**	**Percentage %**
Female	84	52.5
Male	76	47.5
Age		
6 years	7	4.2
7 years	21	13.1
8 years	21	13.1
9 years	19	11.8
10 years	22	13.7
11 years	31	19.3
12 years	28	17.5
13 years	11	6.8
Grade		
Grade 1	22	13.7
Grade 2	19	11.8
Grade 3	21	13.7
Grade 4	21	13.7
Grade 5	27	16.2
Grade 6	27	16.2
Grade 7	23	14.3

The largest sample groups (16.2%) in Table 4.1 were school learners from grade 5 and grade 6, respectively, followed by grade 7 (14.3%). A high proportion (36.8%) of school learners were in the age range of 11-12 years. The gender distribution results indicated that the majority of the learners sampled were girls (52.5%) while 47.5% of the boys, which is well within the average population gender distribution in South Africa with female (51.7%) and 48.2 percent male (Statistics South Africa 2017).

4.2.2 Personal data of parents/caregivers

The socio-demographic questionnaires (see Annexure F) were used to collect data from 106 households, focusing on 106 caregivers as more than one learner was from the same household.

Table 4.2 Personal profile of caregivers according to gender and age (n=106).

Gender	**Frequency**	**Percentage 100%**
Female	85	80
Male	21	20
Caregivers age		
23-34	30	28
34-45	51	48
45-56	18	17
56-67	7	7

The results in Table 4.2 indicate the age and gender of caregivers. A large percentage (76%) of caregivers was in the range of 23-45 years of age. Most (80%) were females and the low percentage of males is an indication that females are regarded as caregivers responsible for the food security status of children.

4.2.3 Accommodation and family composition

The results in Figure 4.1 show a significant difference between single Caregivers (52%) and married Caregivers (33%). This is followed by nine percent of caregivers who are widowed; divorced, separated and living together unmarried.

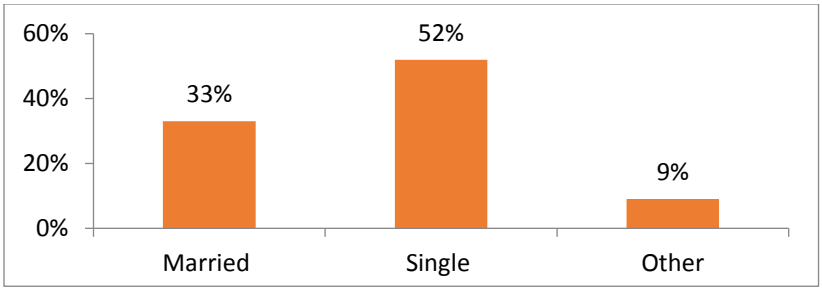


Figure 4.1 Marital status of the sampled group.

Table 4.3 Caregivers living conditions.

Type of house	**n=106**	**Percentage%**
Brick	78	73.6
Clay	0	0
Grass	0	0
Zinc/shack	28	26.4
Rooms in the house		
< 2 rooms	46	43
3-4 rooms	55	52
>4 rooms	5	5
Number of people in a household	**n=106**	**Percentage%**
3	9	8.5
4	11	10.4
5	30	28.3
6	52	49
7	4	3.8

The housing material mostly used by residents in Kagiso are known to be bricks, as a large share (73.6%) of caregivers live in brick houses and 26.4% live in shacks. Most of the households (52.8%) in the sampled group had more than five people living in one household. Forty three percent of households reported to live in a less than two - roomed house and 52% live in a three - or four - roomed house.

4.2.4 Educational level and home language

The results of Table 4.4 show the educational levels of caregivers. The majority of household heads (59%) attended schooling only at secondary level with another 39% of caregivers leaving school after primary school. Only two percent had college certificates. Most (77.3%) households were Tswana speaking, followed by Pedi (18%) and Zulu (4.7%).

Table 4.4 Level of education and home language.

Level of education	**n=106**	**Percentage %**
Primary school	41	39
Secondary school	63	59
College	2	2
Language		
Tswana	82	77.3
Zulu	5	4.7
Pedi	19	18

4.2.5 Employment and income status of caregivers

Although most (76.4%) of the caregivers were employed (Table 4.5), a relatively large proportion (50.9%) had temporary employment with no guarantee of full-time employment, while 19.8% were unemployed and 3.8% of respondents reported that they were retired. Not all caregivers reported to have spouses; however results from caregivers who indicated to have spouses, showed concern at the high unemployment rate (26.4%). According to Statistics South Africa Poverty Report (2017), one in three South Africans live below the 2017 food poverty line of R992 per person per month. A portion of the sampled population (37.7%) had a monthly income of R1001 – R2000, divided by the number of people living in a household (R1001/6 = R166.8) and (R2001/6 = R333.5 per person per month), which according to the Stats SA, is below the poverty line. Slightly more caregivers (42.4%) indicated a monthly income of R2001 - R3000, divided by a number of households living in a household (R3000/6 = R500), which according to Stats SA is below the poverty line.

The majority of caregivers (Table 4.5), (53.7%) reported that they sometimes do not have enough money to buy food and 67% of households purchased food once a month. Most basic food items were purchased at Spaza shops (40.5%) and 57.5% of food items were purchased from supermarkets, with 19% households spending less than R100 a week on basic food items and 53% of households spending R100-R301 a week.

Table 4.5 Employment and household income status.

Employment status	**n=106**	**Percentage %**
Permanent	27	25.5
Temporary	54	50.9
Unemployed	21	19.8
Retired	4	3.8
Spouse or partner employment status		
Permanent	9	8.4
Temporary	17	17.9
Unemployed	28	26.4
Retired	2	1.8
Household income		
< R1000	10	9.4
R1001-R2000	40	37.7
R2001-R3000	45	42.4
R3001-R4000	7	6.6
R4001-R5000	2	1.9
>R5000	2	1.9
Not enough money to buy food		
Always	3	2.8
Employment status	**n=106**	**Percentage %**
Often	14	13.2
Sometimes	57	53.7
Seldom	27	25.5
Not enough money to buy food		
Never	5	4.7
How often is food bought	**n=106**	**Percentage %**
Every day	0	0
Once a week	35	33
Once a month	71	67
Where is food bought		
Spaza shop	43	40.5
Street vendor	2	1.9
Supermarket	61	57.5
How much money is spent per week		
R0-R100	20	19
R101-R200	29	27
R201-300	27	26
R301-400	19	18
R401-R500	9	8.
R501-R600	2	2
>R600	0	0

Please note the following columns in Table 4.5 do not consist of n=106 respondents based on the following reasons; column “Spouse or partner employment status” not all 106 respondents reported to have partners or spouses. In the column “Not enough

money to buy food", five respondents out of 101 respondents were unwilling to supply information.

4.2.6 Caregivers household composition

Women, particularly mothers, are known to be the ones responsible for food preparation, feeding and caring for children (Olowu 2013:76). The results in Figure 4.2 shows that the caregivers (52%) responsible for food preparations were mothers, followed by fathers at 30 percent and 17% were grandparents.

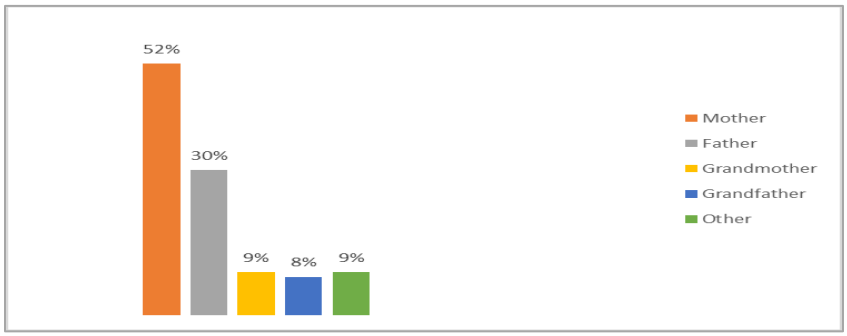


Figure 4.2 Caregivers responsible for food preparation.

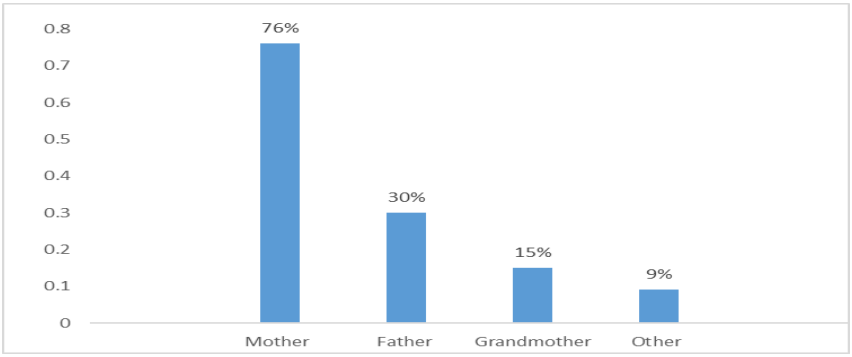


Figure 4.3 Caregivers responsible for household food selection.

Mothers are responsible for implementing strategies that stretch food resources and food selection (Baylies 1996:77) and Figure 4.4 indicates that a majority of caregivers (76%) responsible for the type of food purchased are mothers, followed by grandparents at 15 percent who decide on what type of food should be purchased. The results in

Figure 4.4 below are similar and indicate that a large group of caregivers who were responsible for the food budget is mothers (52%) and fathers 30 percent followed by grandmothers nine percent, grandfathers (8%) and others (9%).

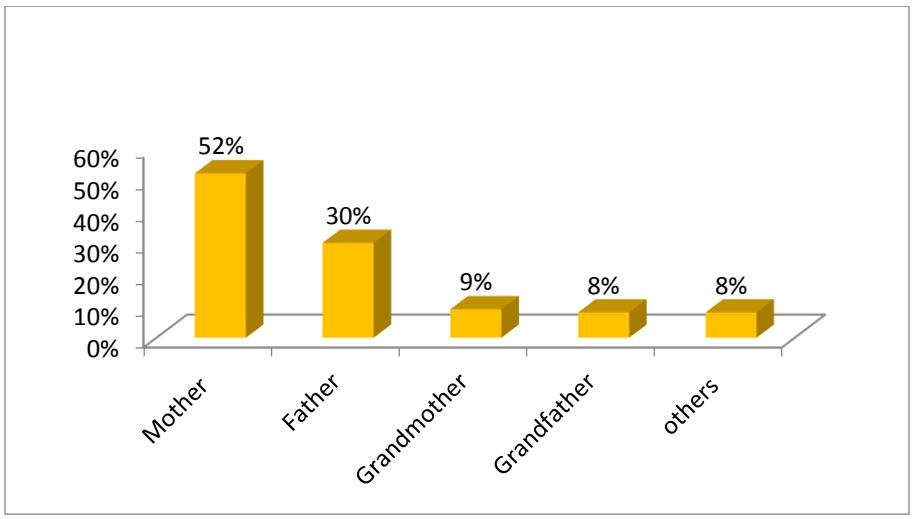


Figure 4.4 Composition of household members responsible for food expenditure.

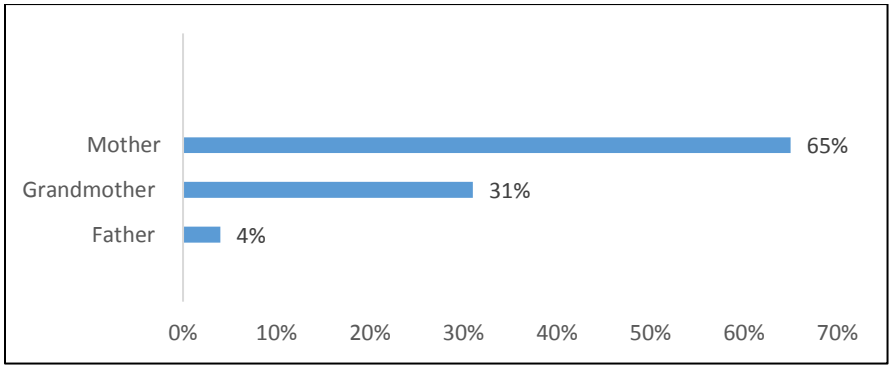


Figure 4.5 Household caregivers responsible for feeding children.

When there is scarcity of food in a household, mothers are known to be the ones who experience the most food hardship and challenges in ensuring that every child in the household receives a meal (Mclntyre, Glanville, Raine, Dayle, Anderson & Battaglia 2003:686). The results in Figure 4.5 show that those responsible for feeding children are mothers (65%) followed by the grandmother (31%) and fathers (4%).

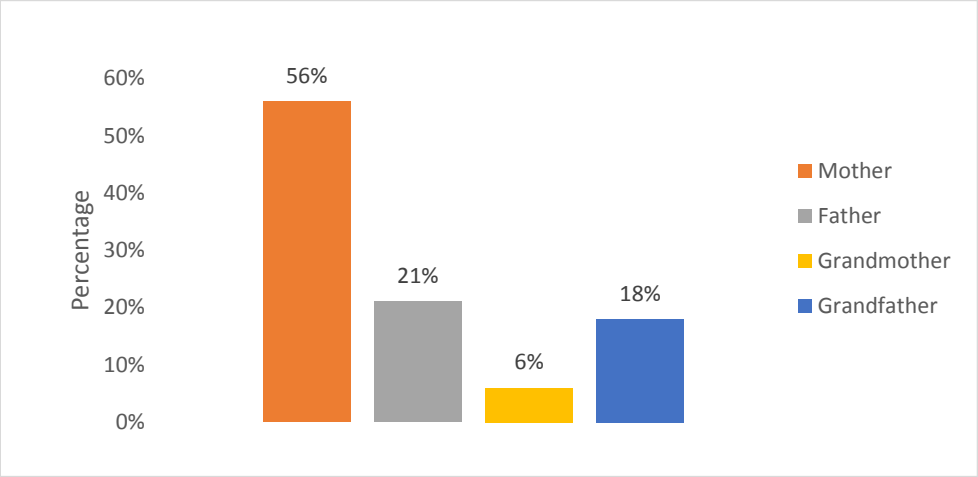


Figure 4.6 Composition of household heads.

The results in Figure 4.6 show a relationship between gender and household food security. According to Dungumaro (2008:430), there is a perception that female-headed households are prone to be victims of food insecurity. Figure 4.6 indicates that most household heads consists of mothers (56%) followed by fathers (21%), grandfathers (18%) and grandmothers (6%).

4.3 FOOD INSECURITY ASSESSMENT

This section of the chapter looks at household food insecurity findings reported by the sampled population group. Household Food Insecurity Access Scale (HFIAS) indicators were used to assess the prevalence household food insecurity's (see Annexure G).

The results in Table 4.6 represent the perception and behavioral responses to food hardships, vulnerability and stress in terms of food availability, food access and food stability. The results reported are a combination of responses in categories such as no, rarely, sometimes and often.

Table 4.6 Responses of Kagiso learners to the nine HFIAS questions.

Questions	No		Rarely		Sometimes		Often	
	F	%	F	%	F	%	F	%
Q1- Worry about food	60	37.5	46	28.7	41	25.6	13	8.1
Q2 - Unable to eat preferred food	73	44.0	42	25.3	33	19.9	12	7.5
Q3 - Eat limited variety of foods	63	39	42	25.3	36	22.5	19	11.8
Q4 - Eat foods they don't want	81	48	37	22.3	32	19.3	10	6.0
Q5 - Eat a smaller meal	71	44.3	46	27.7	32	19.3	11	6.6
Q6 – Eat fewer meals a day	83	52	41	25.6	29	18	7	4.2
Q7 – No food of any kind in the household	99	56.6	32	19.3	19	11.4	10	6.0
Q8 - Go to sleep hungry	113	70.6	25	15.1	15	9.0	7	4.2
Q9 - Whole day and night without food	131	78.9	10	6.0	14	8.4	5	3.0

The results in Table 4.6 from the first six questions (see Annexure F) illustrate the uncertainty of household food supply experienced by learners in Kagiso with 62.4% of school children reporting to worry about food, 52.7% not able to eat preferred foods, 59.6% percent of learners eating limited variety of foods, while 47.6% eat food they do not want, 53.6% eat smaller meals and 47.8% eat fewer meals a day. The results in Figure 4.7 below indicate an average from the first six questionnaires, showing 54% of learners as food insecure with 44% reported as food secure. Coates, Swindale and Bilinsky (2007:22), indicate that the most severe conditions of food security are experienced in last three questions (highlighted in Table 4.6) of the HFIAS questionnaire (see Annexure G). A summary of the responses from the last three questions in Table 4.6 indicates that 36.7% of learners had nothing to eat, followed by 28.3% of learners who went to sleep hungry and 17.4% who indicated that they go the whole day and night without eating. In conclusion (see Figure 4.8) the last three questions of the HFIAS revealed that an average of 29 percent learners experienced hunger and 71% reported not to experience hunger.

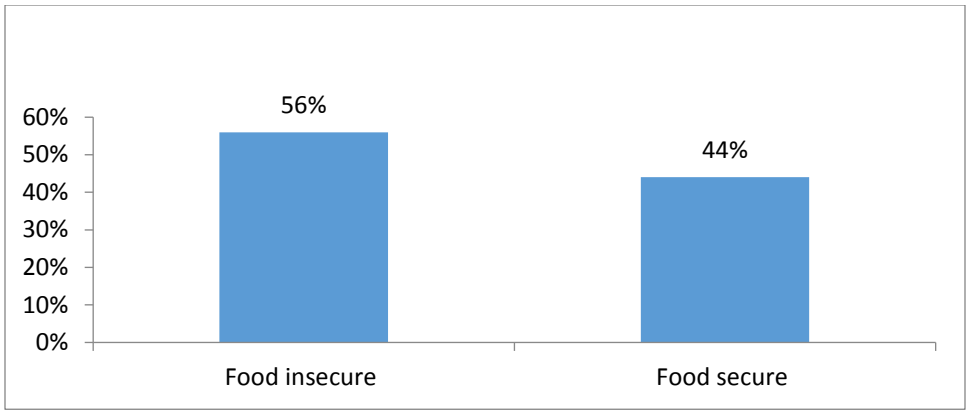


Figure 4.7 Average of the first six HFIAS questions.

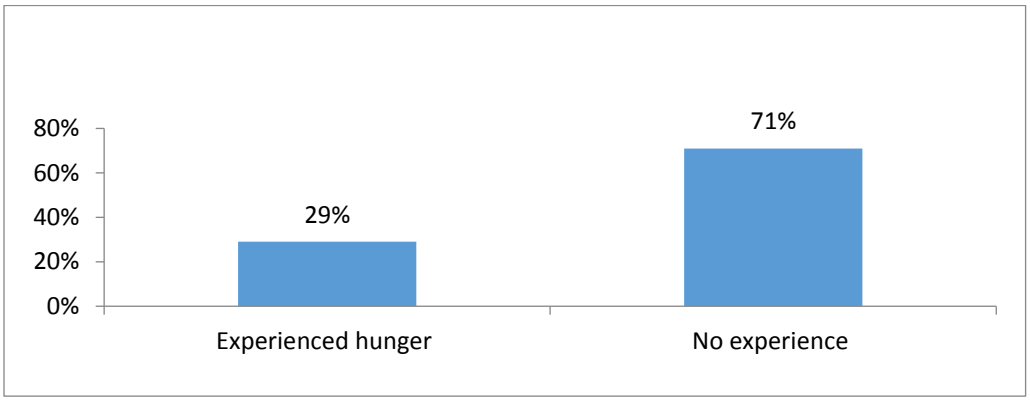


Figure 4.8 Average of the last three HFIAS questions.

4.4 ANTHROPOMETRIC RESULTS

All school learners (n=160) were weighed and measured (see Annexure H). The height and weight were used to determine the sampled groups BMI (weight [kg] squared divided by height [m]). The data were categorised according to the WHO-cut-off points, standard deviations and Z-scores (WHO 2003). The anthropometric indicators height-for-age and BMI-for-age were used. The data obtained were used to indicate stunting, wasting, overweight and obesity by comparing anthropometric results with respondents participating in the NSNP (experimental group) and respondents participating in the tuck-shop and lunch box (control group). See below BMI equation:

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

Table 4.7 The overall distribution of Kagiso learners based on WHO growth indicators (WHO 2003) n=160.

Z-score	Classification	Girls (n=84)	Boys (n=76)
	Stunting (Height-for-age)		
< -3SD	Severely stunted	0%	0%
≥ -2SD	Stunting	4% (3)	13% (10)
>-1SD to +3SD	Normal height-for-age	96% (81)	87% (66)
	Wasting/Thinness (BMI-for-age)		
<-3SD	Severely wasted	0% (0)	7% (5)
	Wasted	2% (2)	5.3% (4)
<-2SD to <+1SD	Normal	66% (55)	88% (67)
>+1SD to <+2SD	Possible risk of overweight	30% (25)	0%
>+2SD to <+3SD	Overweight	2% (2)	0%
>+3SD	Obese	0%	0%

The results in Table 4.7 show the occurrence of stunting, wasting, overweight and obesity in the sampled group. A few girls (4%) were stunted compared to the boys (13%), with 96% and 87% of the girls and boys, respectively, being of normal height. The relatively high (13%) prevalence of stunting in the boys suggests chronic under nutrition that could have happened earlier in life. The anthropometric results presented in Table 4.7 were converted into height-for-age and BMI-for-age Z scores to study the sampled group. BMI-for-age was used to measure and analyse the overweight and obesity status of the respondents in the sampled group. The study revealed that many (30%) of the girls were at risk of being overweight (>+2SD to <+3SD**),** with only 2% of the girls reported to be overweight. The possible risk of overweight amongst the girls is a concern for the development of chronic diseases related to weight gain.

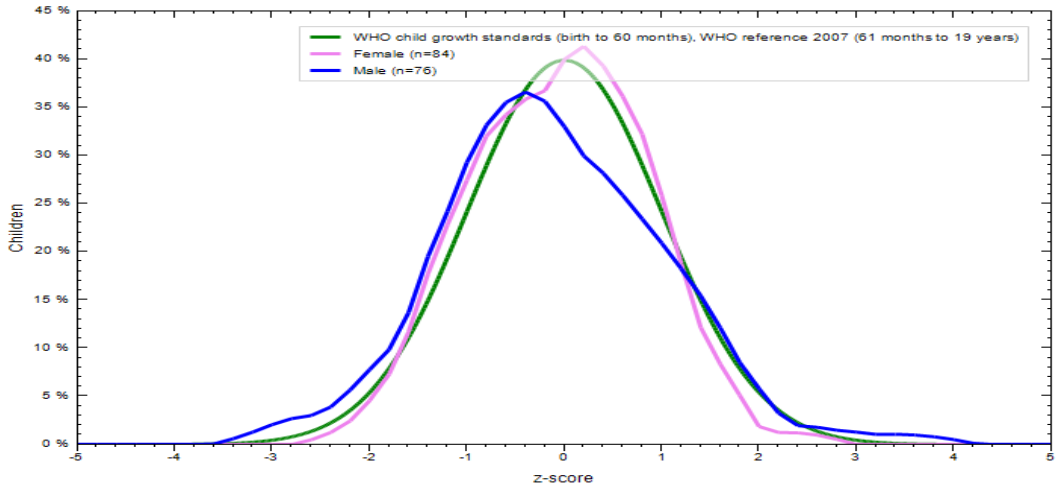


Figure 4.9 Height for age of the Kagiso learners (girls and boys).

The green line in Figure 4.9 represents the World Health Organisation (WHO) child standards. The pink line represents the girls (n=84) in the sampled group and the blue line represents the boys (n=76) in the sampled group. Malnutrition indicators associated with under nutrition such as stunting, wasting and underweight were identified by using the Z scores below -2 and severe under nutrition by using the Z score lower than -3. As indicated in Table 4.7 above, stunting, measured using height-for-weight Z score was reported to be more prevalent amongst the boys (13%) and 4% for girls.

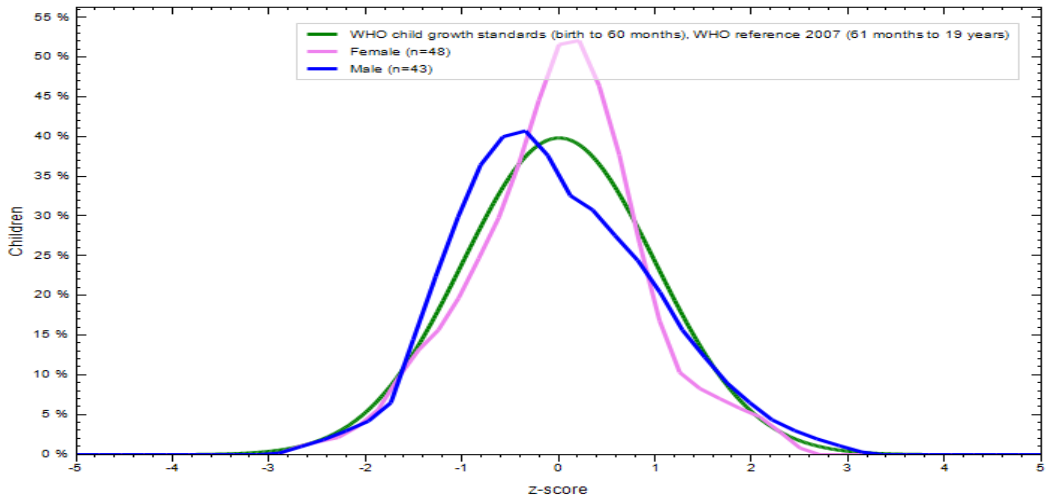


Figure 4.10 Weight for age of the Kagiso learners

The leaning of the blue and the pink line towards the left in Figure 4.10 reflects the percentage of the respondents that were severely wasted. Respondents that were reported to be severely wasted were only boys (7%), whereas the figures for those reported to be wasted were lower for girls (2%) and boys (5.2%).

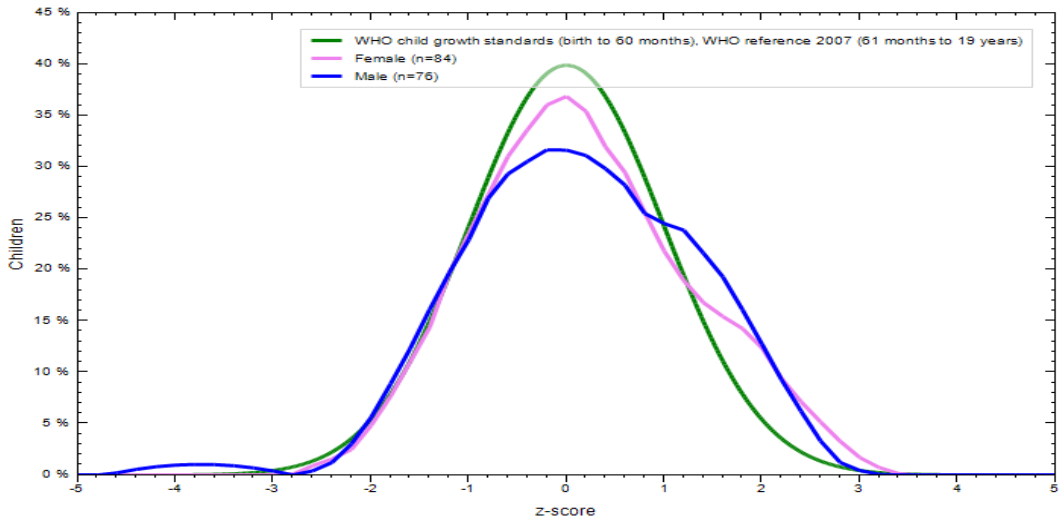


Figure 4.11 BMI for age of the cohort of 6-13 year old Kagiso learners.

The pink line leaning towards the right in Figure 4.11 shows the percentage of respondents that were overweight, which was prevalent in the girls (2%) with another cohort of girls at possible risk of being overweight (30%). No cases of obesity were reported in the sampled group.

Table 4.8 The distribution of learners participating in the NSNP compared to learners participating in the tuck-shop and lunch box based on WHO growth indicators (WHO 2007b).

Z-score	Classification	NSNP girls (n=32)	NSNP boys (n=27)	Tuck-shop girls (n=21)	Tuck-shop boys (n=14)	Lunch box girls (n=31)	Lunch box boys (n=35)
	Stunting (Height-for-age)						
< -3SD	Severely stunted	0%	0%	0%	0%	0%	0%
≥ -2SD	Stunting	6.25% (2)	26% (7)	0%	7% (1)	3% (1)	6% (2)
>-1SD to +3SD	Normal height-for-age	93.75% (30)	74% (20)	100% (21)	93% (13)	97% (30)	94% (33)
	Wasting/Thinness (BMI-for-age)						
<-3SD	Severely wasted	0%	18.5% (5)	0%	0%	0%	0
	Wasted	6.3% (2)	11.1% (3)	0%	0%	0%	8.6% (3)
<-2SD to <+1SD	Normal	84.3% (27)	70.4% (19)	52.4% (10)	0%	67.7% (20))	91.4% (32)
>+1SD to <+2SD	Possible risk of overweight	9.4% (3)	0%	47.6% (10)	0%	32.3% (10)	0%
>+2SD to <+3SD	Overweight	0%	0%	4.8% (1)	0%	3.2% (1)	0%
>+3SD	Obese	0%	0%	0%	0%	0%	0%

The results in Table 4.8 represent the anthropometric results of the respondents participating in the NSNP (n=59, 37%) compared to respondents that purchase lunch meals from the tuck shop (n=35, 22%) and respondents that bring lunch boxes (n=66, 41%) from home to school. Stunting was more prevalent in the boys (26%) participating in the NSNP, followed by the boys from the tuck-shop (7%) and lunch box (6%). According to the World Health Organization (2015), stunting has severe health consequences on children where it hinders their level of academic performance and causes poor cognition. The BMI-for-age results (Table 4.8) indicate that only boys (18.5%) participating in the NSNP were severely wasted. A few girls (6.3%) and more of the boys (11.1%) from the NSNP were wasted, as were 8.6% of the boys from the lunch box group.

None of the children in the NSNP group were overweight but 9.4% of girls in this group were at risk of being overweight. However, the prevalence of overweight was more associated with girls (4.8%) participating in the tuck-shop and lunch box (3.2%). The risk of possible overweight was very prominent amongst the girls participating in the tuck-shop (47.6%) followed by the lunch box (32.3%). This compares to the girls in the

NSNP group (9.4%). The net result from this study indicates that under-nutrition is prevalent in the NSNP experimental group while over-nutrition is prevalent in the control groups (tuck shop and lunch box). These results indicate that both the experimental and control have malnutrition issues that needs to be monitored constantly to prevent their increase.

4.5 DIETARY INTAKE RESULTS

4.5.1 Dietary diversity results

As mentioned in chapter 3, 160 Food Frequency Questionnaires (see Annexure I) were completed for school-aged children in the sampled population.

Table 4.9 Summary of the food groups as measured by FFQ (n=160).

Food groups	Mean	SD	Ranges of scores
Flesh food (meats, poultry, fish)	6.77	2.68	0-6
Egg diversity	1	0.	0-1
Dairy products diversity	5.18	2.27	0-7
Cereal, roots and tubers diversity	9.26	3.04	0-14
Legumes and nuts	2.25	1.50	0-6
Vitamin A rich fruits and vegetables diversity	4.21	2.05	0-4
Fruits and other juices	7.9	2.81	0-8
Vegetable diversity	7.16	2.68	0-7
Oils and fats diversity	2.47	1.57	0-7
Total items	45.15	18.08	0-69

A summary of the food groups along with the food variety scores are shown in Table 4.9 The results represent the mean intake of all 160 boys and girls in the sample group. Cereal, root and tubers diversity group reported the highest individual mean FVS (±SD) of 9.26 followed by fruits and other juices group of 7.9±2.81 and vegetable diversity of

7.16±2.60. The lowest reported individual mean of 2.25±1.50 was the legume group diversity and oils and fats group of 2.47±1.57. A total of 97 different food items were reported to be consumed in seven days by respondents in the sampled group. According to Matla (2008), this is a high food variety score for the group, bearing in mind that >60 food items consumed is considered a good food variety. Although, a majority of respondents (n=55), 68 percent consumed between 20 and 35 individual food items, according to Matla (2008), 30 food items is regarded as poor food variety.

4.5.2 Dietary intake and food consumption patterns

A total of 160, 24-hour recall questionnaires (see Annexure J) were completed and analysed for the dietary and nutrient intake of school children. The 24-hour recall results represents the core of the study as it provides a dietary and nutrient intake comparison between respondents participating in the NSNP (experimental group) and the control group that either purchased food items from the school tuck-shop or carried lunch boxes from home to school. Figure 4.12 indicates that 37% of respondents participated in the NSNP, 22% preferred meals from the tuck shop, while the largest sampled group (41%) indicated that they bring lunch boxes from home to school.

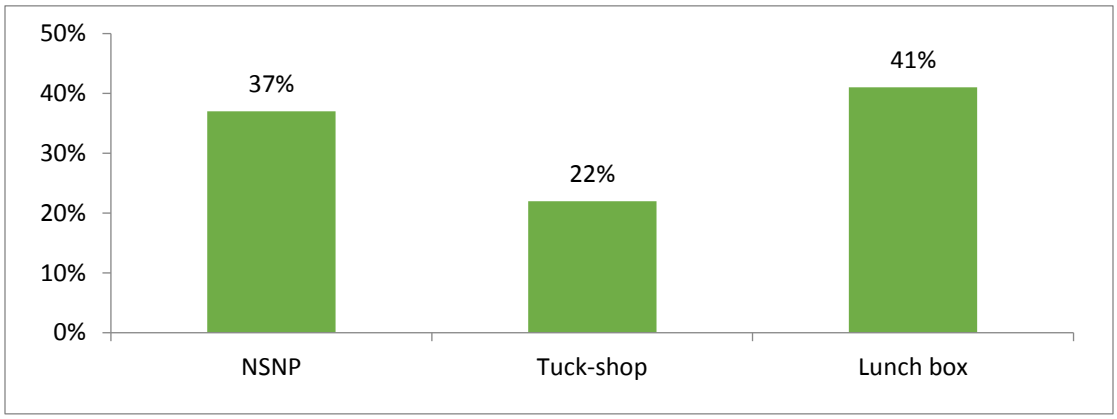


Figure 4.12 Distribution of study participants according to food source.

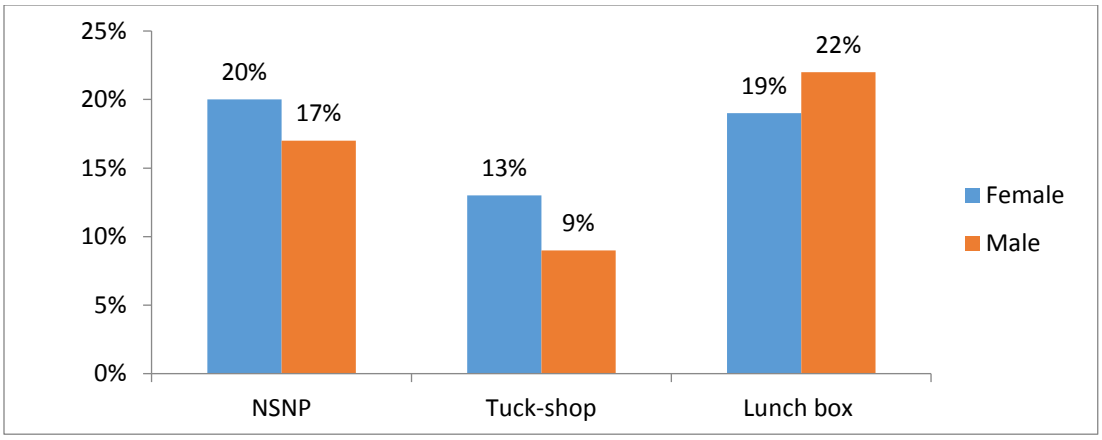


Figure 4.13 Gender analysis of respondents in the NSNP and control groups.

The results from Figure 4.13 indicate that 20% of the girls and 17% of the boys participated in the school feeding programme, 13% of the girls and 9% of the boys preferred to purchase lunch from the tuck shop and that the biggest group of the boys (22%) and girls (19%) preferred to carry lunch boxes from home to school.

Table 4.10 Popular top 20 food items ranked by the mean intake, portion sizes, per capita mean and number of participants measured by 24-hour-recall (n=160).

Rank	Food item	Weighted total daily intake (n=160)	Mean daily intake (per gram per person)	*Per capita* mean intake (mean gram per person)	Number of respondents
1	Maize meal, stiff (g)	40730	313	255	130
2	Milk, fresh full cream (ml)	22265	146	140	152
3	Cold drink, squash (ml)	16030	178	102	90
4	Water (ml)	15440	181	97	85
5	Maize meal, soft (g)	15070	313	95	48
6	Rice, cooked (g)	12400	172	78	72

Rank	Food item	Weighted total daily intake (n=160)	Mean daily intake (per gram per person)	*Per capita* mean intake (mean gram per person)	Number of respondents
7	Bread, white (g)	11605	114	73	101
8	Cold drink, carbonated (ml)	9810	213	62	46
9	Bread, brown (g)	7830	100	49	78
10	Tea, brewed (ml)	7560	168	47	45
11	Chicken, cooked , dry (g)	5849	158	37	37
12	Potato fries (g)	4175	130	26	32
13	Breakfast cereal (g)	3920	91	24.8	43
14	Samp and beans (g)	3780	270	30	14
15	Cabbage, cooked (g)	3590	76	22	47
16	Oats, cooked (g)	2990	332	19	9
17	Pilchards in tomato Sauce (g)	2895	93	18	31
18	Polony, beef & pork (g)	2310	30	14	77
19	Sugar, white (g)	1950	15	12	128
20	Pumpkin, cooked (g)	1600	72	10	22

Mean – Is the average of the number

Per capita – Is a measure of a quantity per person

The results in Table 4.10 show that the sampled group consumed a high carbohydrate diet with 7 of the 20 most food items consumed from the carbohydrate group. This carbohydrate diet consisted mainly of stiff maize meal porridge (313g), soft maize meal porridge (313g), bread, white (114g) bread, brown (100g), rice (172g), samp and beans (270g), potato fries (130g), breakfast cereal (91g) and cooked white rice (172g). Within the top 20 most consumed items, only two vegetable items were consumed and no fruits were in this list. The most consumed protein food items that appear on the top 20

items were chicken, cooked dry (158g), fresh full cream milk (146g) and a source of omega 3 fatty acids, pilchards (93g). Carbonated cold drinks (213g) were on the list of food items that contributed to the high intake of kilojoules, along with cold drink squash (178g).

Table 4.11 The overall dietary intake of respondents measured by 24-hour recall (n=160).

Nutrient and unit of measure	Adequate intake Mean (±SD)	(DRI 100%) Girls	(DRI 100%) Boys	(Prevalence of inadequate intakes)
Energy (kj) EER	7684 (± 2458)	8698	9572	0%
Total protein (g) RDA	57 (± 21)	34	34	41%
Plant protein (g) RDA	29 (±12.3)	-	-	-
Animal protein (g) RDA	28 (±17.2)	-	-	-
Total fat (g)	49.9 (± 27)	-	-	-
Total carbohydrate (g) EAR	252 (± 88.9)	100	100	49%
Total dietary fibre (g) AI	12.6 (± 7.6)	26	31	56%
Calcium (mg) AI	489.6 (± 245)	1300	1300	63%
Iron (mg) EAR	6.2 (± 7.5)	5.7	5.9	7%
Magnesium (mg)	242 (± 92.8)	200	200	18%
Phosphorus (mg) EAR	945.6 (± 322.7)	1055	1055	11%
Zinc (mg) EAR	3.2 (± 2.9)	7.0	7.0	48%
Cu (mg)	0.0 (± 0.4)	-	-	-
Chromium (mg) AI	38.8 (± 40.4)	21	25	41%
Selenium (mg) EAR	37.7 (± 32.6)	35	35	8%
Mn (mg)	2248.6 (±1304)	-	-	-
Iodine (mcg) EAR	22 (± 17)	73	73	70%

Nutrient and unit of measure	Adequate intake Mean (±SD)	(DRI 100%) Girls	(DRI 100%) Boys	(Prevalence of inadequate intakes)
Vitamin A (mcg) EAR	410 (± 1152)	420	445	6%
Thiamin (mg) EAR	0.3 (± 0.7)	0.7	0.7	58%
Folate (mcg) EAR	240 (± 198)	250	250	4%
Vitamin B12 (mcg) EAR	3.7 (± 11.3)	1.5	1.5	60%
Pantothenate Acid (mg) AI	0.3 (± 0.8)	4.0	4.0	92%
Biotin (mcg) AI	15.7 (± 20)	20	20	22%
Vitamin C (mg) EAR	18.6 (± 22)	39	39	53%
Vitamin D (Mcg) AI	2.6 (± 3.9)	5.0	5.0	48%
Vitamin E (mg) EAR	4.7 (± 5)	9.0	9.0	48%

kj – Kilojoules	g – Gram
mg – Micrograms	SD – Standard Deviation
EAR – Estimated Average Requirement	mg – Milligrams
RDA – Recommended Dietary Intake	Mean – is the average of the number

Table 4.11 shows the overall dietary intake of all respondents (n=160) measured by 24-hour recall. These show a deficient in dietary intake except for protein, carbohydrates, iron and vitamin B12, when compared to the DRI's for children 9-13 (IoM 2006). The dietary mean intake of protein 57±21 was slightly above the DRI of 34g, which however, still showed an inadequate intake in 41% of respondents not meeting DRI's of protein. Iron was a slightly different case; the dietary mean intake of iron 6.2±7.5 was also above the EAR of 5.7mg for the girls and 5.9mg for the boys. However, compared to the 41 percent of respondents not meeting protein RDA, only seven percent of participants did not meet the EAR for iron. Vitamin B12 (3.7±11.3) was slightly above the EAR of 1.5mcg, but had a high percentage (60%) of participants not meeting adequate EAR's for this vitamin.

The nutrients that were reported as below the DRI's with the highest percentage of participants included Iodine with 70% of respondents not meeting the EAR of 73mcg, followed by calcium with 68% of participants not meeting the AI of 1300mg and vitamin C, where 53% of participants did not meet the EAR of 39mg. These results were consistent with the results of the top 20 most popular food items (see Table 4.10) as carbohydrates showed to be on top of the list, as opposed to the low intake of vitamin C where only two vegetable (and no fruits) were present in the top 20 list.

Table 4.12 Contribution of the NSNP to the nutrient mean intake of respondents as measured by the 24-hour recall (n=59) with DRIs.

Nutrient and unit of measure	Dietary Reference Intakes (DRIs 100%)	NSNP (lunch meal) mean intake	Nutrient Adequacy Requirement (NAR) (%)	Percentage of participants not meeting DRIs	High or low %
Energy (kJ) EAR	9975	2365.6 ± 897.5	23.78	76	↑
Total protein (g) RDA	34	21 ±11.8	61.76	38	
Plant protein (g)	-	11 ± 9.0	-	-	
Animal protein (g)	-	10.1 ±10.7	-	-	
Total fat (g) AI	-	14.5 ±8.9	-	-	
Total Carbohydrate (g)	100	74.8 ±74.8	74.8	25	↓
Total dietary fibre (g)	31	5.4 ±5.4	25.71	74	↑
Calcium (mg) AI	1300	234 ±160	18	82	↑
Iron (mg) EAR	5.9	2.3 ±2.4	38.98	61	↑
Magnesium (mg) EAR	200	100.5 ±49.8	50.25	50	↑
Phosphorus (mg) EAR	1055	393 ±181.5	37.25	63.	↑
Zinc (mg) EAR	7.0	1.1 ±1.1	15.71	84	
Cu (mg)	-	-	-		
Chromium (mg) AI	25	3.8 ±9.3	15.2	85	↑
Selenium (mg) EAR	35	3.4 ±7.4	4.79	95	↑
Mn (mg)	-	884.6 ±574	-	-	

Nutrient and unit of measure	Dietary Reference Intakes (DRIs 100%)	NSNP (lunch meal) mean intake	Nutrient Adequacy Requirement (NAR) (%)	Percentage of participants not meeting DRis	High or low %
Iodine (mcg) EAR	73	3.4 ±3.9	4.65	95	↑
Vitamin A (RE) (mcg) EAR	445	75 ±100.6	16.85	83	↑
Thiamin (mg) EAR	-	-	-	-	
Folate (mcg) EAR	250	66.8 ±88.2	26.72	73	↑
Vitamin B12 (mcg) EAR	1.5	4.6 ±6.6	306.66	90	↑
Pantothenic acid (mg) AI	4.0	0.1 ±0.4	2.5	98	↑
Biotin (mcg) AI	20	4.8 ±3.1	24	76	↑
Vitamin C (mg) EAR	39	13.1 ±16.8	33.58	66	↑
Vitamin D (mcg) AI	5.0	3.0 ±4.4	60	40	↓
Vitamin E (mg) EAR	9.0	3.2 ±4.1	35	65	↑

kj – Kilojoules	g – Gram
mcg – Micrograms	SD – Standard Deviation (±)
EAR – Estimated Average Requirement	mg – Milligrams
DRI – Dietary Reference Intake	Mean – is the average of the number
High - ↑	Low - ↓

The two last columns in Table 4.12 indicate that a large number of study participants (both boys and girls) received NSNP meals that did not supply sufficient daily dietary requirements – many of the nutritional comparisons made by the NSNP were below the Nutrient Adequacy Ratio (NAR). According to the Department of Basic Education (2014), a balanced NSNP meal for the day should provide 30 percent of the daily nutritional requirement. In addition, Jeffery, Rydell, Dunn, Hamack, Levine, Pemtel, Baxter and Walsh (2007), a balanced lunch meal for children should be no more than 1/3 of their daily nutrient requirement.

Regarding the 30% and 1/3 of the NSNP daily nutrient requirement, column three indicates that while there appeared to sufficient carbohydrate, vitamin D and Vitamin

B12 and magnesium, 11 of 18 nutritional factors were below the 30% and 1/3 limit and another three nutrients were supplied in the range of 30% to 40% of the NAR. As examples of low NAR intake, energy (23.78%) involved 73% of participants and Vitamin A (16.85%) involved 83% of participants and calcium (18%) involved 82% of respondents. Folate (26.72%) involved 73% of participants resulting from certain foods not being consumed, including green leafy vegetables, oranges, and broccoli (Rolfes *et al*. 2015:309). The low intake of vitamin A, dietary fiber (with 74% of participant's not meeting the AI's of 31g) and folate are linked to the low consumption of vegetables and fruits not provided by the NSNP in the experimental group.

Iron, zinc, and iodine play a crucial role in fighting malnutrition amongst children (WHO 2013). Although the iron NAR percentage (38.98%) was slightly above the NSNP 30 percent nutrient daily intake of participants, 61% of participants did not meet the EAR's of 5.9mg for iron. The intake of zinc was extremely low, as results revealed a large percentage of participants (84%) who struggled to meet the EAR's of 7.0mg for zinc. Iodine, however, had the highest percentage (95%) of participants not meeting the EAR's of 73mcg, with the dietary mean intake of 3.4±3.9 and a low NAR percentage of 4.65% from the NSNP experimental group. As a collective, Iron, zinc and iodine deficiencies are known to disturb the cognitive development of children, which has a negative impact on their growth development, immune function and academic achievements (Afridi 2011:1638).

Table 4.13 Comparison of the dietary mean intake from the NSNP meals with the dietary meal intake from the tuck shop and the lunch box meals as measured by 24-hour recall (n=160).

Nutrient and unit of measure	Dietary Reference Intakes (DRIs)	NSNP(lunch meal) mean intake	High or low mean	Tuck-shop (lunch meal) mean intake	High or low mean	Lunch box (lunch meal) mean intake	High or low mean
Energy (kj) EER	9975	2365.6 ± 897.5	↓	3570.7 ± 1933.9	↑	2509.6 ± 1049.6	↓
Total protein (g) RDA	34	21 ±11.8	↑	21 ± 12	↑	14.8 ± 7.1	↓
Plant protein (g) RDA	-	11 ± 9.0		14.1 ± 9.7		9.5 ± 4.6	
Animal protein (g) RDA	-	10.1 ±10.7		6.8 ± 7.6		4.9 ± 5.8	
Total fat (g)	-	14.5 ±8.9		32 ± 20		22.9 ± 12	
Total carbohydrate (g) EAR	100	74.8 ±74.8	↓	105 ± 62.6	↑	71.4 ± 36.9	↓
Total dietary fibre (g) AI	31	5.4 ±5.4	↓	5.9 ± 5.2	↑	4.0 ± 2.7	↓
Ca (mg) AI	1300	234 ±160	↑	183.7 ± 185	↓	161 ± 147.8	↓
Iron (mg) EAR	5.9	2.3 ±2.4	↑	1.4 ±1.2	↓	0.8 ± 0.7	↓
Magnesium (mg) EAR	200	100.5 ±49.8	↑	80 ± 60.8	↓	64 ± 35	↓
Phosphorus (mg) EAR	1055	393 ±181.5	↑	338 ± 219	↓	251 ± 117.8	↓
Zinc (mg) EAR	7.0	1.1 ±1.1	↓	1.6 ± 1.8	↑	1.0 ± 0.9	↓
Cu (mg)	-	-		-		-	
Chromium (mg) AI	25	3.8 ±9.3	↓	39.7 ± 37	↑	22.9 ± 24.8	↓
Selenium (mg) EAR	35	3.4 ±7.4	↓	34 ± 29	↑	20.7 ± 19.6	↓
Magnesium (mg) EAR	-	884.6 ±574		820 ± 672		796 ± 493	
Iodine (mcg) EAR	73	3.4 ±3.9	↓	15.5 14	↑	9.9 ± 10.9	↓
Vitamin A (mcg) EAR	445	75 ±100.6	↓	66.7 ± 96.7	↓	105.6 ± 95.8	↑
Thiamin (mg) EAR	-	-		-		-	
Folate (mcg) EAR	250	66.8 ±88.2	↓	131 ± 105	↑	76.6 ±50.7	↓
Vitamin B12 (mcg) EAR	1.5	4.6 ±6.6	↑	0.1 ± 0.4	↓	0.1 ± 0.5	↓
Pantothenic -acid (mg) AI	4.0	0.1 ±0.4	↓	0.1 ± 0.2	↓	0.0 ± 0.2	↓
Biotin (mcg) AI	20	4.8 ±3.1	↑	3.3 ± 3.6	↓	2.4 ± 3.2	↓

Nutrient and unit of measure	Dietary Reference Intakes (DRIs)	NSNP(lunch meal) mean intake	High or low mean	Tuck-shop (lunch meal) mean intake	High or low mean	Lunch box (lunch meal) mean intake	High or low mean
Vitamin C (mg) EAR	39	13.1 ±16.8	↑	8.4 ± 10.8	↓	4.8 ± 17.3	↓
Vitamin D (Mcg) AI	5.0	3.0 ±4.4	↑	0.4 ± 1.0	↓	0.3 ± 1.0	↓
Vitamin E (mg) AI	9.0	3.2 ±4.1	↑	3.1 ± 4	↓	0.8 ± 1.9	↓

kj – Kilojoules	g – Gram
mcg – Micrograms	SD – Standard Deviation (±)
EAR – Estimated Average Requirement	mg – Milligrams
DRI – Dietary Reference intake	Mean – is the average of the number
High - ↑	Low - ↓

The results in Table 4.13 reflect the NSNP nutrient contribution to the Dietary Reference Intake (DRI) of both the boys and girls, in comparison to the nutrient content consumed from the tuck shop and lunch box meals. These three nutritional contributions indicate that the intake of most nutrients was below the Dietary Reference intake, especially dietary fibre, vitamin A, folate, calcium, phosphorus, magnesium, iodine and zinc. The dietary mean intake of vitamin A in this sample group was; NSNP (75±100.6mcg), tuck shop (66.7±96.7mcg) and lunch box (105.6±95.8mcg) per day. These did not meet the EAR of 445mcg (IoM 2006). With dietary fiber, NSNP (5.4±5.4g), tuck shop (5.9±5.2g, lunch box (4.0±2.7g) per day did not meet the AI of 21g. The tuck-shop dietary mean intake results were above the NSNP dietary mean intake. Results on folate show: NSNP (66.8±88.2mcg), tuck shop (131±105mcg), lunch box (76.6±50.7mcg) per day did not meet the EAR of 250mcg. Folate in the lunch box was close to meeting the EAR of 250mcg, in contrast to the NSNP not meeting the EAR and the dietary mean intake being lower than the tuck shop and lunch box dietary mean intake. The inadequate intake of fibre, folate and vitamin A show a link to the low and inadequate intake of fruits and vegetables (Moe 2008:216), consumed by respondents from the sampled group. These results (Table 4.13) were linked to the 24-hour recall of top 20 most consumed food items reflected in Table 4.10.

The low calcium, phosphorus and magnesium levels relate to the irregular consumption of food high in protein and dairy products (Quinn, Thomsen; Pang, Kantham, Pollark & Brown 2013:326). Collectively, the lack of calcium, phosphorus and magnesium could lead to disorders of bone mineral metabolism in children (Moe 2008:217). The calcium dietary mean intake (refer to Table 4.13) was less than the AI of 1300 mg per day. Although, the NSNP dietary mean intake was the highest (234±160mg) compared to the tuck shop (183.7±185mg) and the lunch box (161±147.8mg), the NSNP did not meet the AI's of 1300 mg for calcium. With phosphorus; the NSNP (393±181.5mg) was above the tuck shop (338±219mg) and lunch box (251±117.8mg) levels, but still could not meet the EAR of 1055mg. Low levels of magnesium in children are linked to many deficiencies such as attention deficit, loss of appetite, diarrhea and vomiting (Rude 1998:749). The magnesium dietary mean intake (Table 4.14) did not meet the EAR of 200mg. However, the NSNP (100.5±49.8mg) results compared to the tuck shop (80±60.8mg) and lunch box (64±35mg) show that the NSNP dietary mean intake was the closest to meeting the EAR of 200mg.

The top 20 most consumed food items (refer to Table 4.10) showed that the sampled group consumed a rich carbohydrate diet, followed by protein, kilojoules and fats. The dietary mean intake of carbohydrates (Table 4.13), show that the NSNP (74.8±74.8g) compared to the tuck shop (105±62.6g) and lunch box (71.4±36.9g), indicated that the tuck shop provided snacks high in carbohydrates and slightly above the EAR of 100g. The dietary mean intake of protein from the NSNP (21±11.8g) was the highest and but below the RDA of 34g. The energy kilojoules consumption from the tuck shop (3570.7±1933.9kj) was relatively high compared to the lunch box (2509.9±1049.6kj), with the NSNP providing the lowest (2365.6±897.5 kj), compared to the EER of 9975kj. The dietary mean intake of fats from the NSNP (14.5±8.9g) compared to the tuck shop (32±20g) was extremely low, indicating that the snacks from the tuck shop were high in fat and energy kilojoules.

4.6 STUDY OBSERVATION RESULTS

Table 4.14 Study observations.

Description	YES	NO
Are all learners participating in the NSNP		X
Are learners using the NSNP utensils to eat meals from the NSNP		X
DoBEs the NSNP have a kitchen	X	
Is the NSNP Kitchen clean	X	
Is hygiene practiced by the food handlers	X	
DoBEs the NSNP have storage facilitates		X
Are the NSNP meals served appropriately		X
Is there menu repetition	X	
DoBEs the NSNP serve fruits	X	X
DoBEs the NSNP serve vegetable	X	
DoBEs the NSNP practice proper portion size control		X

Observational results in Table 4.14 (see Annexure K) reveled that not all respondents chose to consume lunch meals from the NSNP. Food handlers' prepared NSNP meals every school day for learners who wished to participate in the NSNP, learners were not forced to participate in the NSNP. Learners that did not participate in the NSNP purchased lunch from the tuck shop or consumed lunch from their lunch boxes. School learners that participated in the NSNP could only receive NSNP meals if they brought their own eating utensils from home. A majority of respondents who did not participate in the NSNP, revealed that NSNP meals sometimes causes allergic reactions, such as skin rash and diarrhea, and some respondents don't enjoy NSNP meals.

The NSNP kitchen can be described as a classroom converted into a kitchen with limited facilities such as proper dry storage structures for dry ingredients such as maize meal, samp and beans that were placed on classroom school desks; vegetables were

stored in boxes and placed on the floor. The NSNP kitchen had no cold storage facilities. The NSNP kitchen was clean at all times, food handlers applied hygienic and followed safety measures at all times throughout the entire observation period. The NSNP meals were prepared in the NSNP kitchen before the prepared food was transferred into dishing containers and transported by food handlers to classrooms using a wheelbarrow to serve learners. Based on the inconsistent number of learners participating in the NSNP portion sizes were some days small and most days large. The NSNP only served fruits (apples) once throughout the five week observation period (therefore Table 4.6 indicates yes and no) but vegetables; particularly cabbage, were served most days. Menu repetition was observed in the NSNP where the most popular meals served by the NSNP were pilchards, stiff maize meal pap with cabbage, samp with soya rice followed by stiff maize meal pap with milk.

4.7 DATA INTEGRITY

Data integrity is the accuracy and consistency of data that are collected, captured and processed as result and findings (Dosal, 2013). The significance of data integrity is to eliminate data corruption that could transpire during the process of reading and analyzing the data (Crespi, 2007:3). The data collection process in the study was monitored throughout the three weeks of data collection. After data collection for the day, fieldworkers were allocated an hour to go through all the questionnaires in order to correct any mistakes or problems that might have accrued.

4.8 DISCUSSION

The main aim of this study was to determine the contribution the NSNP has on the nutrient intake of Kagiso respondents. This was done by analyzing the NSNP nutrient intake of meals compared to the nutrient intake provided by meals consumed at the tuck shop and from the lunch box. The aim of this comparative study was to emphasize the importance of consistent and reliable school nutrition feeding programmes in low-income communities. The first portion of this section was a background discussion of

the sampled group socio-demographic profile, followed by dietary intake patterns, the NSNP nutrient intake contribution and the nutritional status of Kagiso respondents. The discussion of the results and interpretation in this chapter will be compared to South African studies as well as relevant international studies.

4.8.1 Socio-demographic profile of Kagiso respondents

Malnutrition and household food insecurity are known to be the two most daunting factors affecting school children in low-income communities in South Africa (Wenhold & Faber 2012:30). This, especially since one third of a child's dietary intake is received in school. School feeding schemes are set to play an important role in the nutrient intake of school-aged children (Regan, Parnell, Gray & Wilson 2008:208). South Africa is still experiencing high rates of poverty and unemployment (Labadarios *et al*. 2011:891) and according to Statistics South Africa (2017); an estimated 30.4 million South Africans are still living in poverty. These were issues found in the Kagiso community as can be seen from the socio-demographic results.

The socio-demographic results showed that all sampled groups in Kagiso experienced major challenges in household food insecurity, employment and household income status. As explained in Chapter 3, household questionnaires were used to collect information from the sampled group. The results revealed adequate living conditions with access to electricity and proper waste removal systems. All caregivers were township residents (Kagiso), with a majority of respondents living in brick houses (73.7%) and a low percentage (26.4%) of respondents living in shacks. The Mogale City local municipality (2017) implemented a project to build 458 Reconstruction and Development Programme (RDP) houses. This project was allocated to the Mogale City municipality since 2010 and the project had been implemented to ensure suitable environmental and social conditions by having less informal settlements in the area. With many people moving from the rural areas to semi-urban areas to seek for employment, informal settlements will continue to be on the rise, most probably leading

to aggravation of the already bad living conditions and malnutrition among women and children in the aforementioned areas

According to Statistics South Africa (2017), the annual inflation of certain food products, particularly meat, fruits and vegetables increased tremendously in August 2017 due to severe drought conditions. Vegetables and fruits prices increased by 6% and meat increased by 15%, which was reported to be the highest price spike since 2011. In 2015, the lowest annual rainfall was measured in South Africa since 1904, which caused a costly drought. The drought crippled the national maize harvest by reducing it to 14% comparative to the 2011-2015 average. In addition, this was followed by a 25% reduction in the 2016 harvest which resulted in a drastic loss of 35% in two years (FAO 2016). Climate change is inevitable, and has upsetting effects, especially in countries that rely on agriculture for food security. It is unfortunate that in South Africa when such natural disasters negatively affect food prices, salaries or wages remain the same where there are no other relief programmes to mitigate the situation.

The sampled group in Kagiso experienced many challenges relating to food insecurity. The results from the sampled population showed temporary employment (50.6%) to be high compared to permanent employment (25.5%) while the unemployment rate soars at 19.8% percent. A majority of caregivers indicated temporary employment consisting of contract work and piece jobs - payment received solely based on the number of hours, days or pieces of work that a worker performs. Through all that, the highest household income (42.4%) was between R1000 – R3000 and the lowest (37.7%) was reported to be less than R1000, with only R101 – R200 to spend on food per week. This amounted to an average of R14.43 (101/7 days) – R28.57 (200/7 days). Since the average household size was six, a person per day amounted to R2.40 – R4.76, which is difficult to survive, considering the instability of food of prices. Bonti-Ankomah (2001) recommends that in order to survive, a household with at least five members requires a minimum of R38.20 to R47.75 per day.

Education is a variable linked to low household income, which leads to household food insecurity (Labadarios *et al* 2008:254). Thus, poor education leads to unemployment, underemployment, low wage income, food hardship and then it escalates to malnutrition. The educational status of the sampled group showed that a majority of caregivers (59%) attended schooling only at secondary level, 39% stopped schooling at primary level. Two percent only had higher education. These results explain the level of low-income among the sampled group. However, a study conducted by Gustafson (2013:398) states that factors affecting food household insecurity on a global scale could be the increasing number of female-headed households, meaning households that are headed by females only, and no male figure present as the head of the household. The reason female-headed households from rural and semi-urban areas in South Africa are prone to experience food insecurity is because they were formerly disadvantaged by traditional perceptions that women stay home to look after children, while the men go to the fields or mines to work (Dungumaro 2008:430). These are traditional perceptions that still persist in the masculine world today. These perceptions have caused trends for women to earn lower wages, and no ownership of land, particularly in rural areas (Dungumaro 2008:430). Results showed that Kagiso, female-headed households (56%) were featured to be more than the male-headed households (21%) that, according to a study conducted by Posel and Rogan (2012:101), low levels of poverty and less food hardship favoured male-headed households and disfavoured female-headed households. Mothers (65%) were determined to be, on average, the main caregivers responsible for food preparation, feeding of children and food selection (76%). These results support the fact that women are nurturers and caregivers responsible for making sure that every member of the household, particularly children, receive some form of a meal every day.

4.8.2 Food security status in Kagiso learners

Respondents from the sampled group revealed that although mothers (52%) are viewed as nurturers and caregivers responsible for making sure that every member of the household particularly children receive some form of a meal every day, respondents revealed concerning food hardship results.

A majority (62.4%) of school children respondents revealed that they worry in varying degrees from rarely too often about the availability of food while 59.6% indicated that they sometimes eat a limited variety of foods based on what the household can afford. The access of food also seemed to be a problem, with 53.6% of respondents reporting to eat smaller portions of certain foods such as meat products and 47.6% were unable to consume food of their choice. Therefore, the average of the first six questions of the HFIAS (see Annexure G & Figure 4.7) revealed that 44% of respondents were food secure and 56% food insecure.

Not all the results were negative with at least a large percentage (79%) of respondents from the most severe food insecurity results revealed that they never go to bed on a hungry stomach and 71% never go the whole day and night without a meal. Therefore, the average of the last three questions of the HFIAS (see Annexure G & Table 4.8) results in this study revealed that 29% of respondents experienced hunger and 71% did not experience hunger.

4.8.3 Nutritional status of Kagiso respondents

The long-term outcomes of a healthy individual are determined by their adequate dietary intake, active lifestyle and education (National Planning Commission 2012). Anthropometric data are predominantly used as an indicator to evaluate the nutritional status of an individual. Anthropometry was used in this study to evaluate the nutritional status of Kagiso learners. The results discussed in this study are categorized according to boys and girls participating in the NSNP (n=59, experimental group), tuck shop (n=35 Control group) and lunch box (n=66, control group). Based on the large percentage of low-income households in the sampled groups, the results in this study revealed that more NSNP boys (26%) compared to the NSNP girls (6.25%) were stunted. The NSNP boys (11.1%) and NSNP girls (6.3%) were reported to be wasted and 18.5% of the boys were severely wasted. Only 9.4% of the girls showed risks of being overweight. The results from the NSNP group showed the boys were slightly above the WHO reference standards of 10% (WHO 2008), and the girls were slightly below the WHO reference standards.

The results from this study of respondents participating in the tuck shop (control group) showed that acute malnutrition was prevalent with a nutrition transition problem present in the sampled group. Only the boys (7%) participating in the tuck shop were reported to be stunted, in contrast to tuck shop girls (47.6%) showing risks of being overweight, and 4.8% overweight. The results from the tuck shop group showed that the stunted boys and the overweight girls to be slightly below the WHO reference standards of 10% (WHO 2008), and the girls at risk of being overweight showed to be extremely high.

The nutritional status of children participating in the lunch box (control group) revealed that only six percent of the boys and three percent of the girls were stunted. The lunch box girls (32.3%) were at risk of being overweight and 3.2% of the girls reported as overweight. These results show that the stunted boys and the overweight girls below the WHO reference standards of 10% (WHO 2008), and only the girls reported to be at risk of being overweight were above the reference standards.

Stunting needs serious attention in South Africa. Although Save the Children (2016:5) praised South Africa for reducing stunting in children from 33% to 24% between 2004 and 2008, there were contradictory results reported in six studies, namely: Project for Statistics on Living Standards and Development (PSLSD 1993); South African Vitamin A Consultative Group (SAVACG 1994); National Food Consumption Survey (NFCS 1999); Demographic and Health Survey (DHS 2003); National Income Dynamics Study (NIDS 2008) and the South African National Health and Nutrition Examination Survey (Shisana *et al.* 2012). These studies were conducted between 1993 and 2012 and found that one in four children were stunted in South Africa (Labadarios *et al*. 2011:894). Thereafter, a 6.8% increase in child stunting was noted between 2005 and 2008, from 23.2% to 30% (Said-Mohamed, Micklesfield, Pettifor & Norris 2015: 534).

Weight-for-age or underweight is a sign that acute malnutrition was prevalent in the sampled group, due to a “deficit in tissue and fat mass” (Srinivasa, Dnyaneshwar & Ajay 2017:5). In this case, the reason for a slightly higher proportion of underweight learners in the study could be related to a shortage of food supply in households, or it

could be that caregivers give children smaller portions of food at home with the mindset that children receive bigger portions at school through the NSNP (Bulh 2010).

According to Wamani, Astrøm and Peterson (2007:17), boys are more likely to be wasted than girls. A BMI-for-age of below - 2SD is known as wasting (thinness) and is an indicator of severe malnutrition. Wasting in this study reflects poor levels of nutrient consumption - the percentages reflected are notably high and pose a serious concern in the Kagiso community because children who are wasted will need urgent treatment and medical care as they are at risk of contracting infections, illnesses that could lead to mortality. None of the children were reported to be obese. However, overweight and the risk of being overweight showed to be a concern, especially amongst school children partaking of meals in the tuck shop and the lunch box (control group). In this study, more girls were reported to consume meals from the tuck shop (n=21) followed by lunch box (n=31) which provided meals high in fat, sugar and carbohydrates. Thus, it is no surprise that some of the school children (girls) were reported to be overweight and at risk of being overweight.

4.8.4 Dietary patterns of Kagiso learners

Malnutrition among children is more prominent in low-income households, with food affordability, food access and food hardship being a major challenge in this sampled group. The food variety score (FVS) showed the highest individual mean FVS in the cereal, root and tubers diversity group with a mean of 9.26±3.04, followed by the fruits and other juices group with a mean of 7.9±2.81, and vegetable group (7.16±2.60). The lowest individual FVS was in the legume group with a shocking mean of 2.25±1.50, and the fats and oils diversity group (2.47±1.57). These results show that a majority of respondents in this study consumed a high carbohydrate diet.

Foods high in carbohydrates also appeared frequently in the top 20 most consumed food items measured by the 24-hour recall. Foods such as stiff maize meal (1st), soft maize meal porridge (5th), rice (6th), white bread (7th), brown bread (9th), potato fries (12th), breakfast cereal (13th) and samp and beans (14th) were the most popular

consumed food items. The dietary mean intake of carbohydrates for all the respondents is 252±88.9g, which is higher than the recommended DRI of 130g. The WHO dietary recommended goals of 55-77% of energy from carbohydrates (WHO 2010) was extremely low compared to the 193% obtained in the study findings. The portion sizes seemed to be extremely large in maize meal stiff and soft porridge (313g) for children and the National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003), states that the appropriate carbohydrate portion size should be 322g for the boys and 265g for the girls. However, the Department of Basic Education (2010) indicated the correct maize meal portion sizes for primary school children should be between 60g – 75g while the World Food Programme (2010b) recommended that portion sizes for starch should be between 120 g – 150g.

The capita from the top 20 food items- revealed smaller portion sizes of food consumption in vegetables and no fruits were listed in the top 20 food items. These results support the findings of Oosthurizen, Oldewage-Theron and Napier (2011:76) and Naicker, Mathee and Teare (2015:269) who stated that children from the Gauteng Province in peri-urban areas have a trend of consuming foods high in carbohydrate and fats as well a low consumption of vegetables and fruits.

4.8.5 Overall nutrient intake of Kagiso learners

The results from the overall nutrient intake of Kagiso learners showed inadequate mean intakes for iodine (22±17mcg) with 70% of participants not meeting the EAR's of 73mcg for iodine. The lack of Iodine in children is measured as one of the most common preventable causes of mental retardation and as a result it lowers the resistance against infections, which is also regarded as a contributor to poor school performance and lack of physical abilities in school children (WHO 2013b). The respondents in this study had a significantly low intake of calcium (489.6±245mg) with 63% of participants not meeting the DRI of 1300mg of calcium. Optimal calcium intake during a child's daily life is extremely important as it strengthens bones and teeth, helps maintain healthy body weight, and calcium is also known to binds proteins, which regulate muscle contractions, secretion of hormones, transmission and nerve impulses (Whitney & Rolfe

2015:384). A worrying 53% of participants did not meet the DRI of 39mg of vitamin C, another indication that vegetables and fruits lacked in their daily nutrient consumption.

Result in this study showed a highly inadequate overall intake of nutrients. A proper nutritional diet should meet all macronutrient and micronutrient dietary requirements, and if children from food insecure household cannot afford to receive such adequate nutrients, at least school feeding programmes should compensate by ensuring that each school learner receives a nutritious meal during school days (Abizari, Buxton, Kwara, Mensah-Hamiah & Armar- Klemesu 2014:1020).

4.8.6 The NSNP nutrient analysis

The NSNP was created to improve the nutritional status of primary school children, by providing healthy and nutritious meals (Department of Basic Education 2014a). According to Shisana *et al.* (2013), lunch boxes carried to school by children from low-income households lack foods with proper nutrients. Tuck shops fall in the same category by selling affordable meals and snacks with little nutritional value (Kroone & Alant, 2012:78). Findings in this study showed that 37% of respondents participated in the NSNP while the rest of the respondents in the sampled group preferred to consume meals from the tuck shop (22%) and lunch boxes (41%), showing the NSNP to be less favoured with the lunch box having the most respondents. The reason why Kagiso learners preferred tuck shop and lunch box meals over NSNP meals is unknown. However, based on general findings from other studies conducted on school feeding programmes, peer pressure or stigma (Buhl 2010) could be one of the reasons. Shishana, *et al.* (2012:) state that food affordability could be another reason for some children preferring foods high in fat, sugar and salt sold at the tuck shop over healthier meals provided by the NSNP (Department of Basic Education 2014b). Based on the study observation results, it could be due to the fact that Kagiso learners are required to bring their own eating utensils to school in order to receive an NSNP meal and some school children forget to bring eating utensils. In addition, children also complained about the NSNP meals causing allergies such as a rash. Some respondents also revealed that NSNP meals caused diarrhea.

Abizari *et al.* (2014:1023) conducted a comparison study in Ghana and revealed that energy, nutrient and micronutrient intake were considerably higher and more adequate among learners participating in a school feeding programme compared to those not participating in the school feeding programme. Another comparitive study conducted by Buhl (2010:) in South Africa, revealed that energy provided by meals from the NSNP did not meet the required 30% (RDA) and in this study the NSNP also did not meet the 1/3 and 30% of the nutrient requirements provided by the NSNP.

Therefore, the contribution of the NSNP to the total nutrient intake of Kagiso learners can be reported to be inadequate given their poor intakes for breakfast and supper at home. Results revealed a low Nutrient Adequacy Ratio, especially, in energy kilojoules (23.78%), vitamin A (16.85%), calcium (18%), folate (26.72%), zinc (15.71%) and iron (38.98%). The NAR for iron was slightly above the 1/3 NSNP nutrient requirement, which according to Jeffery *et al*. (2007) is adequate, but based on the percentage not meeting DRIs, iron was reported to be slightly high, with 61% of respondents not meeting the DRI of 5.9mg, which means inadequate nutrient consumption of iron. The consumption of vegetable, fruits and dairy products proved to be limited in the NSNP.

The NSNP (experimental group) along with the tuck shop and lunch box (control group) struggled to meet the dietary mean requirements of the DRIs, particularly regarding calcium, protein, phosphorus and magnesium. However, the dietary mean intake of carbohydrates, fats and energy kilojoules showed to be higher than the dietary mean intake of the NSNP and the tuck-shop groups.

4.9 SUMMARY

In this chapter, findings of the study were analysed and interpreted according to the measuring tools used to measure the study variables. The impact of socio-demographics on the nutritional status of school children, household food insecurity status, anthropometry status, dietary intake of school children (FFQ), the NSNP, tuck shop and the lunch box contribution to the nutrient intake of school children (24-hour recall) as well as the observation of NSNP and food preferences were analysed. These

results were discussed to conclude the main findings of this study. The study conclusion and recommendations will be discussed in Chapter Five.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In the previous chapter (chapter 4) the results, analysis and discussion of this study were presented based on the information provided in chapter 1, 2 and 3. The purpose of this study was to determine the impact the NSNP has on the nutrient intake of school children in Kagiso learners, by comparing the dietary intake of respondents participating in the NSNP (n=59) with respondents participating in the tuck-shop (n=35) and the lunch box (n=66) in one school. The study placed emphasis on household food insecurity, the nutritional status of Kagiso learners and, most importantly, the need for adequate nutrient consumption as provided by the NSNP.

5.2 THE MAIN FINDINGS

The main findings of this study are as follows;

The core principles of the NSNP are mentioned in Section 18 of the Constitution as part of the declaration and conditions of basic education as a right for all (Buhl 2010). School feeding programmes in South Africa have evolved since 1916, with the NSNP currently aiming to target Caregivers from impoverished communities to send and keep their children in school as a guarantee of receiving a cooked nutritious meal from the NSNP. This is of course a double benefit so that children receive nutritious meals at school thereby increasing school enrollment and school attendance. Malnutrition continues to be a persistent global problem that affects women and children, particularly children from low-income households. Caregivers from low-income households struggle with food affordability and this affects the processes of purchasing high valued nutritious food. The shortcomings of not being able to afford nutritious food hinders the nutrient intake of children, which is why the implementation of properly managed nutrition programmes are necessary in schools with children from low-income communities.

Although socio-demographic results from the study revealed that many caregivers (50.9%) had a complicated employment situation with caregivers recorded under temporary employment, and respondents living below the poverty line, caregivers could still afford to give their children tuck-shop money (22%) and pack lunch boxes (41%) for their children. The study revealed that a majority of school children preferred lunch box and the tuck-shop meals over the NSNP (37%) meals.

The underlying cause of malnutrition in this study relates to household food insecurity in the Kagiso community. The food security status of the sampled group showed that 44% of school children were food secure and 54% were food insecure. The results also revealed the level of hunger experienced by school children, with a low percentage (29%) of school children experiencing hunger, and a high percentage (71%) of learner's not experiencing hunger. South Africa experienced a harsh drought in 2015 and since then food prices have been on the rise particularly involving maize meal, meat and vegetables. This had an effect on the chain of food affordability, food availability and food access, which, based on study findings in the sampled group, had a negative impact on the nutrient intake of the sampled group.

Anthropometric results of school children in the sampled group showed signs of acute malnutrition with results higher than the WHO reference standards of 10%. More boys were reported to be stunted and wasted compared to the girls, and only the girls were overweight and showed risks of being overweight. Of the boys (n=27) participating in the NSNP, 26% were stunted, 18.5% were severely wasted and 11.1% were wasted. Of the boys eating at the tuck-shop (n=14), only 7% were stunted while of the boys eating from lunch boxes (n=35), 6% were stunted.

Of the girls receiving meals from the NSNP (n=32), 9.4% showed risks of being overweight compared to 47.6% of girls eating at the tuck shop girls (n=21) who are at risk of being overweight, 4.8% being overweight. Lunch box girls (32.3%) are also at risk of being overweight. The tuck shop appeared to be more popular amongst school girls (n=21) compared to the boys (n=14), and according to Kroone and Alanti

(2012:78), tuck shops are known to sell affordable meals with little or no nutritional value.

The dietary mean intake of the energy kilojoules consumption from the tuck shop group (3570.7±1933.9kj was higher than that from the NSNP (2365.6±5kj) and the lunch box (2509.9±6kj). The results of a majority of girls being at risk of being overweight from the tuck shop is evident in the nutrient analyses results from this study, with a high carbohydrate consumption from the tuck-shop (105±62.6g) compared to the NSNP (74.8±748g), and lunch box (71.4±36.9g). The dietary mean intake of carbohydrates from the tuck shop group was slightly above the DRIs of 100 g while the mean dietary intake of fats from the tuck-shop (32±20g) was also higher than the dietary mean intake of fats from the NSNP (14.5±89g) and the lunch box (22.9±12g).

The low, medium and high food variety score results in this study showed that a low individual mean of 2.25±1.50g was the legume group diversity, followed by the medium individual intake of 7.16±2.60g in the vegetable diversity group and the highest FVS (9.26±3.04g) in the cereal, roots and tubers diversity group. The results were also balanced by the top 20 popular items which along with the FVS revealed that the sampled group consumed an extremely high carbohydrate diet with a low consumption of vegetables and fruits. The following food items are ranked according to their top 20 score levels; Maize meal stiff (1st), maize meal porridge (5th), rice (6th), white bread (7th), brown bread (9th) potato fries (12th) breakfast cereal (13th), and lastly, samp and beans (14th), vegetables; cabbage (15th) and pumpkin (20th), with no fruits included in the top 20 food items.

The Nutrient Adequacy Ratio of the NSNP (n=59) meals was below the 1/3 (33.3%) and 30% dietary requirements for lunch meals. This was very evident in vitamin A (16.85%), energy kilojoules (23.78%), calcium (18%), folate (26.72%), zinc (15.71%), dietary fiber (25.71%) and iodine (4.65%). Iron (38.98%) was slightly above the 1/3 and 30% dietary intake, but had a high percentage (61%) of respondents not meeting the EARs of 5.9 mg for iron. The results revealed that the NSNP contribution to the nutrient intake of

Kagiso learners was inadequate. The poor intake of folate, vitamin A and dietary fiber in this sampled group is linked to the low consumption of vegetable and fruits.

A majority of respondents indicated that they do not participate in the NSNP when they do not have their own eating utensils. Respondents also revealed that the NSNP meals cause allergies, such as skin rash while some mentioned diarrhea as the cause of not eating meals from the NSNP. Hence, there was a reasonably large percentage (41%) of school children participating in the lunch box compared to school children participating in NSNP (37%).

5.3 LIMITATIONS OF THE STUDY

The study experienced a few limitations.

5.3.1 Study population

The limitations experienced with the study population group accrued during the data collection process. The headmasters along with the class teachers were responsible for the selection of school learners for the inclusion process. Despite the 378 consent forms signed by the parents/caregivers, 28 school learners per grade were selected by the headmaster and class teacher to participate in the study. The selection processes was based on three criteria: the availability of transport afterschool, the walking distance from school to home and the availability of caregivers willing to wait for their children after school during data collection. This impacted on the purposive selection of the study participants.

Due to the time constraints afterschool, data collection was a challenge. Based on an agreement between the researcher and the Department of Basic Education, data could not be collected during school hours and during lunch break, therefore, the study had to allocate two to three days per grade (one day; 14 girls, second day; 14 boys). Not all caregivers and school children that signed consent forms could attend for data collection. Caregivers were interviewed, either during the week or on weekends at the

school premises. Out of 378 signed consent forms only 160 respondents were present for data collection.

5.3.2 Data collection limitations

The Hawthorne effect is a term used to describe how individuals are prone to change their behaviour when given compassion or attention by an interviewer or a researcher (Wickstroom & Bendix 2000:365). There is a slight possibility that respondents could have provided researchers/fieldworkers with answers that were exaggerated and a bit untrue because of a feeling of shame. To control this effect, respondents were not interviewed in close proximity with other respondents. Respondents were also advised on the importance of providing honest and reliable information to assist researchers and policy makers with implementing strategies for better solutions that will benefit the community particularly the children.

5.3.3 Dietary intake limitations

When dealing with primary school children, especially from the lower grades, dietary assessment methods are always faced with challenges. Obstacles of the 24-hour recall and FFQ involved respondents who struggled to remember what they consumed the previous day, particularly children under seven (Thompson & Byers 1994:2246). Certain food items listed on the FFQ were difficult to translate from English to Setswana and Pedi and in order to prevent any misunderstandings and a book was compiled with pictures derived from the FFQ listed food items. Food models were also used to refresh the memory of respondents with food items and portions that

5.4 CONCLUSION

It can be concluded that household food insecurity might have contributed to the poor dietary intake of Kagiso learners. The poor dietary intake resulted in the poor nutritional status of Kagiso learners with the majority of the boys reported to be undernourished accompanied by a large amount of girls at risk of being overweight, and a small case of overweight respondents. This was an indication that malnutrition is prevalent in the

Kagiso community. The objective of this study was to determine the contribution of the NSNP to the total nutrient intake of Kagiso learners. The objective was reached by using measuring methods (see section 3.6.3) such as questionnaires, namely; socio-demographic, household food insecurity access scale, anthropometry instruments, food frequency questionnaire, 24-hour recall and study observation. The measuring methods were measured on 160 schools children and 106 caregivers. The results in this study revealed that low levels of education amongst caregivers were linked to the low household income that revealed a high case of food insecurity. The inadequate dietary intake results were an indication of a high prevalence of household food insecurity in the sampled group. The dietary results showed inadequate nutrient intake, particularly with the experimental group (NSNP), the NSNP did not meet the 1/3 and 30% dietary requirements and showed to have a low vegetable consumption with no fruit intake.

5.5 RECOMMENDATIONS

School feeding programmes are operational in many countries across the globe (WFP 2013a) where they are prominently viewed as a global “social safety net”. However, the high occurrence of inadequate nutrient intake contributed by the NSNP, and the poor nutritional status of the sampled group in Kagiso, demonstrates the need to implement monitoring and measuring systematic processes that will ensure proper management of the NSNP and nutrition education specifically structured for learners, caregivers and food handlers.

5.5.1 Recommendations for the community

The results in this study revealed inadequate intake of vegetables and fruits. Results further showed a lack of interest in household vegetable gardens, with only three households with vegetable gardens. This is a problem that can be resolved by the community and most importantly, schools. Based on literature, the NSNP has three pillars, the third pillar related to this recommendation involves community members and a school - the need for sustainable food production in schools. The implementation of school gardens can be used as a platform to enhance nutrition knowledge and transfer

skills to community members, learners and schools. The aim is to encourage impoverished communities from peri-urban areas to produce their own food, vegetables and fruits, and through that a variety of vegetables and fruits can be included in the NSNP school meals. School menus are planned based on the Food Based Dietary Guidelines, meaning that every school meal should include vegetables and a fresh fruit (Vorster, Badham, Venter 2013:12), and according to Laurie and Faber (2011:81) school gardens in South Africa have since declined from an estimated 6,503 in 2008 to 3,994 in 2011.

5.5.2 Recommendations for policy makers

Nutrition and hygiene education in schools should be made a priority. Although schools adhere to guidelines set by the NSNP, monitoring measures still need to be implemented. In the 2013/2014 financial year, a monitory visit was only conducted in nine schools from the Eastern Cape to check on the progress of the NSNP (DoBE 2014a). In Gauteng, a majority of schools participating in the NSNP did not have food delivery schedules, and districts only get involved when there are issues with payment. However, when there is a shortage of food delivery the district does not get involved (DoBE 2014b).

Nutrition Education, specifically quarterly training sessions, should be scheduled to train food handlers in hygiene and safety measures when preparing school meals. In food preparation, hygiene is extremely important including washing hands before and during preparation, cleaning cooking equipment and utensils as well as correct techniques to clean chopping boards. To prevent food-borne diseases, cooking surfaces should be constantly cleaned; vegetable chopping boards should be kept separate from meat chopping boards. Training should also focus on mass catering skills, portion control, and nutritious recipe ideas to improve food taste and to avoid recipe repetition. Buhl (2010) also suggests that when there is a lack of food resources, to avoid food repetition, cold menus should be considered - brown bread, margarine, jam or peanut butter with a glass of milk can be served as a school meal.

Quarterly monitoring checks should be on the progress of food distributors, NSNP food preparation facilities, cooking equipment and utensils, serving utensils and a surety that schools have eating utensils for all learners. In the 2013/2014 financial year, only nine schools in the Eastern Cape were visited to monitor the NSNP programme, and there is no record for Gauteng (DoBE 2014a).

School gardens – quarterly training sessions should be scheduled for community members and school learners on vegetable and fruit plantations. This can be used as a platform to educate the community and learners on nutrition knowledge and sustainable food production.

Tuck shops – monitoring food products sold to learners and training tuck-shop owners on what healthy snacks to sell in school tuck shops.

5.5.3 Recommendations for further research

The results in this study indicate that further research is needed in the following areas:

- A nutritional database that includes the nutritional status of learners from peri- urban and urban areas in Magale City
- The impact of adequate nutrient intake on the educational performance of Mogale City learners
- The impact of Home Economics education for food handlers (NSNP) on the dietary intake of Mogale City learners
- The association between anthropometry and fortified snacks given to learners during school and weekends in Mogale City

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ANNEXURE

ANNEXURE A

GAUTENG PROVINCE

Department of : Education

REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	04 April2017
Validity of Research Approval:	06 February 2017-29 September 2017 2017/59
Name of Researcher:	Monala P.K
Address of Researcher:	P O Box 473
	Kagiso 2
	Krugersdorp, 1754
Telephone Number:	011 410 6678 078 784 0093
Email address:	phumlapk@yahoo.com
Research Topic:	Determine the contribution of the National School Nutrition Programme to the total nutrient intake of Mogale City learners
Number and type of schools:	Two Primary Schools
Districtls/HO	Gauteng West

Re:Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of

this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the

06/04/2017

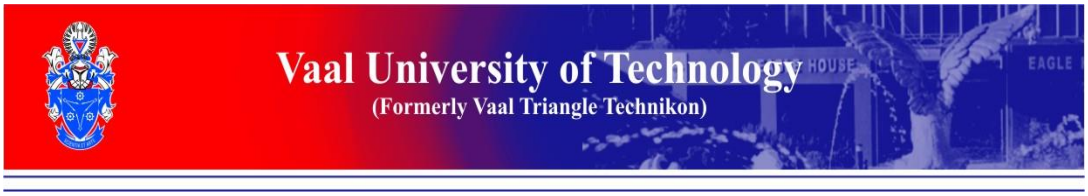
Office of the Director:Education Research and Knowledge Management

ih Floor, 17 Simmonds Street, Johannesburg, 2001Tel: (011) 355 0488

Email:Faith.Tshabalala@gauteng.gov.za

Website:

ANNEXURE B



Letter to Headmaster

My name is Phumla Monala, and I am a Masters student at the Vaal University of Technology (VUT). I am conducting research on the National School Nutrition Programme and the contribution it has on the nutritional status of primary school children. This study is under supervision of Professor Abdul Egal, from the Centre of Sustainable Livelihoods at the Vaal University of Technology. The Provincial Gauteng Department of Education has given approval to approach schools for my research. A copy of their approval is contained with this letter. I invite you to consider taking part in this research. This study will meet the requirements of the Research Ethics Committee (Human) of the VUT.

Aim of the research

- Determine cross-sectional, current nutrient intake and nutritional status of primary school children as a baseline measurement.
- Report the finding to both your school and my study
- Identify areas of strengths and improvements.

The purpose of the study

The purpose of the study is to investigate the impact the NSNP contributes to the on the nutrient intake of primary school learners of both genders between the ages of 6-13. The study will be conducted by comparing the nutritional consumption of primary school learners from two different primary schools in Mogale City, the first primary school with the NSPN currently operating and the second primary school without the NSNP operating.

Benefits of the study

Participants will **not be paid** for this study as it is **voluntary**. Furthermore, many health and nutritional status indicators of primary school learners will be measured. The school will receive feedback on the progress of the study. You will receive dietary advice in the form of a nutrition education programme at the end of the study, a recipe book will be compiled to assist the NSNP, school and food handlers to better improve food preparation with proper nutrients. The information collected will assist the school feeding programme.

Research plan and method

The project will take place over a period of three months. Approximately 158 school children participants, aged ≥ 6 and ≤ 13 years old, attending the Lengau Kagiso Primary school in Mogale City (experimental group) will participate in the study. (Parents/ Legal Guadians) will be requested to complete one questionnaire form (sociodemographic) and school leraners will be asked to participate in the following questionnaires; dietary intake, 24-hour - recall and food frequency questionnaire, it will structured as an interview with the assistance of a trained fieldworkers and a witness at the school where learners school during the month of March – July 2017. We will also measure school learners height and weight using a CSI weighing scale for weight and stadiometer for height. Children will only be required to take off their shoes and stand on the scales. The school and Caregivers will be supplied with the exact dates of the research study. The total amount of time required for the study participation will not exceed one hour per day and will add up to a maximum of 6 hours for the duration of the project. This will be done after school. School learners will be invited to be present during all these measurements and questionnaires.

School Involvement

Once I have received your consent to approach learners to participate in the study, I will;

- arrange for informed consent to be obtained from participants' parents

- arrange a time with your school for data collection to take place
- obtain informed consent from participants

Further information

Attached for your information are copies of the Parent Information and Consent Form and also the Participant Information leaflets and Consent Form.

Thank you for taking the time to read this information.

_____ _____

Principal Signature

_____

Date

ANNEXURE C

Vaal University of Technology

Your world to a better ruture

RESEARCH DIRECTORAT
E Tel: (016) 950 9531

Research and Innovation Ethical Clearance Certificate

Applicant:	PK Monala (MTech Food service Management)
Project:	Determining the contribution of the National School Nutrition Programme to the total nutrient intake of Mogale City learners
Institution:	Vaal University of Technology
Date Approved:	8 May 2017

Ethical Clearance Number:	ECN31-2017
Approved: Yes/No	Yes

DR SM NELANA
CHAIRPERSON: RESEARCH & INNOVATION ETHICS COMMITTEE

Date: 9 May 2017

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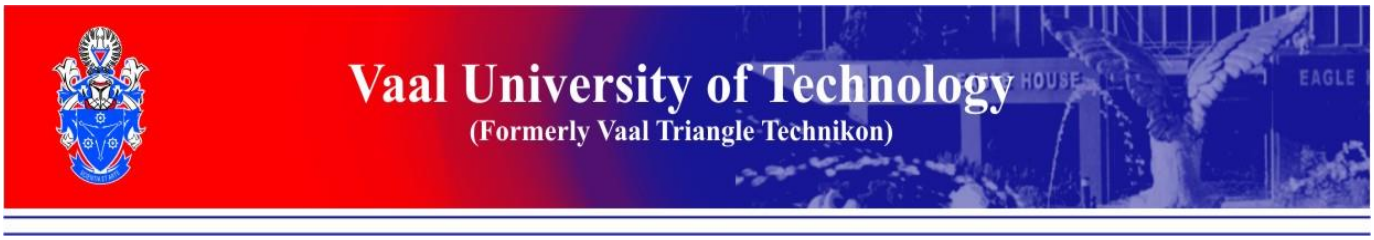
South Africa·Tel: +27(0)16 950 9000 ·Fax: +27(0)16 950 9999 •
www.vut.ac.za

ANNEXURE D



PROJECT INFORMATION AND INFORMED CONSENT CAREGIVERS: MOGALE CITY – NSNP PROJECT SCHOOL 1

Good day

My name is Phumla Monala; a student at Vaal University of Technology (VUT),I am currently studying towards a master's degree in Management of Food Service Management. Nutrition is important throughout your children's lifecycle and I would like to contribute to the assistance your children receive at school through the National School Nutrition Programme, by conducting a research study that will investigate the contribution the National School Nutritional Programme has on the nutritional status of your children. I, therefore, need your assistance in getting information for this project so that I can take your needs into consideration when I plan any interventions or projects. I will explain the project and will translate the project contents to you so that you will understand exactly what will be done, the reasons and what will be expected of you so that you can decide if you want to participate in this project.

You are invited to consider participating in this research project. **Participation is voluntary** and should you decide to participate, you may withdraw at any stage during the project. Your withdrawal will not effect on your children's school programme. I also retain the right to withdraw you from the study if it is considered to be in your best interest. I will provide you with any additional information that becomes available during the study, which may affect your willingness to continue on the study.

Before agreeing to participate, it is important that you read and understand the following explanation of the purpose of the study, the study procedures, benefits, risks, discomforts, and precautions as well as the alternative procedures that are available to you, and your right to withdraw from the study at any time. This

information leaflet is to help you to decide if you would like to participate. You and your child (ren) should fully understand what is involved before you agree to take part in this study. Your child will receive an information sheet as well and will only participate in the study if you (Parent/legal guardian) has given consent to participate.

If you have any questions, do not hesitate to ask me. You should not agree to take part unless you are satisfied about all the procedures involved. It is important that you may not participate in another investigational research study.

If you decide to take part in this study, you and your child will be asked to sign an agreement document to confirm that you understand the study. You will be given a copy to keep.

WHAT IS THIS PROJECT?

The main objective of this study is to investigate the nutritional status of your community and if school feeding programmes are necessary to make an impact on the nutritional status of school children.

The specific objectives are to:

- Determine cross-sectional, current nutrient intake and nutritional status of you and your child as a baseline measurement.
- Report the finding to both your school and my study
- Identify areas of strengths and improvements.

PROCEDURES

The project will take place over a period of three months. Approximately 158 school children participants, aged ≥ 6 and ≤ 13 years old, attending the Legaus Kagiso Primary school in Mogale City will participate in the study. You (Parents/ Legal Guadians) will be requested to complete one questionnaire form (socio-demographic) and your children will be ask to participate in the following questionnaires; dietary intake, 24-hour recall and food frequency questionnaire, it will be structured as an interview with the assistance of trained fieldworkers and a witness at the school your children attend during the month of March – July 2017.

We will also measure your children's height and weight using a CSI weighing scale for weight and stadiometer for height. Children will only be required to take off their shoes and stand on the scales. You will be supplied with the exact dates when all of this will be taking place. The total amount of time required for your participation in this study will not exceed one hour per day and will add up to a maximum of 6 hours for the duration of the project. This will be done after school. Your child will be invited to be present during all these measurements and questionnaires.

WHAT WILL BE MEASURED IN THE PROJECT?

- Eating and drinking habits (March and April 2017)
- Weight, height, (June 2017)
- Dietary food intake (July 2017)

WHO MAY PARTICIPATE?

All caregivers and their respective children aged 6-13 year old children. A random sample will be drawn from all the caregivers that completed this consent form.

WHAT DO WE EXPECT OF YOU?

The study will be conducted at Lengau Kagiso Primary School. All measurements will be taken during school break hours

- Please bring your children's ID or birth certificate, we need to know their birth date
- Then you will receive a **reference number** for the project.
- Your child will be weighed and measured.
- Your children will be questioned in detail about their eating habits. Our fieldworkers will assist your children in language issues in completing these questionnaires.

Furthermore, when we weigh and measure your children's height and weight, your child will have to take off their shoes and heavy outer garments. This may be invasive, but these will not be painful and privacy will be ensured, a witness will be present to ensure no harm is brought upon your children. Parents/legal

guardians will be given a Socio demographic questionnaire to complete and submit to the researcher.

Should you have problems with participation during the week, after school due to transport issues, an arrangement with the headmaster will made to conduct the study during the weekend (Saturday morning).

WHAT ARE THE BENEFITS FOR YOU?

You will **not be paid** to participate in this study as it is **voluntary**.
Furthermore, many health and nutritional status indicators of your child will be measured. You will receive feedback during the investigation about the health risk to your child. You will receive dietary advice in the form of a nutrition education programme at the end of the study, a recipe book will be compiled to assist the NSNP, school and food handlers to better improve food preparation with proper nutrients.
The information collected will assist the school feeding programme.

ETHICAL APPROVAL

Ethical clearance has been granted by the Department of Basic Education. The study has been structured in accordance with the declaration of principles of the Gauteng Department of Education. A copy may be obtained from me (researcher) should you wish to review it.

CONFIDENTIALITY

- All information obtained during the course of this study, including personal data and research data will be kept strictly confidential. Data that may be reported in scientific journals will not include any information that identifies you as a participant in this study.
- This information might also be inspected by the Vaal University of Technology (VUT) ethics committee and the Gauteng Department of Education. Therefore, you hereby authorise me to release your study records to the Vaal University of Technology (VUT) Ethics Committee (As they take an oath of confidentiality).

- These records will be utilised by them only in connection with carrying out their obligations relating to this observational study
- The identity of food distributors and food handlers will not be revealed.
- Any information uncovered regarding your children's state of health as a result of your children's participation in this study will be held in strict confidence. You will be informed of any finding of importance to your children's health or continued participation in this study but this information will not be disclosed to any third party in addition to the ones mentioned above without your written permission.

Thank you for your patience.

Phumla Monala
Researcher: Student
Masters of Management in Food Service Management
Cell: 0787840093

INFORMED CONSENT FOR PARENTS/LEGAL GUARDIANS

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 your name and/or Phumla Monala. You can 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 those measurements may be taken from my child.

PARTICIPANT ASSENT:

Printed Name	Signature / Mark or Thumbprint	Date and Time

STUDY DOCTOR:

Printed Name	Signature	Date and Time

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

Printed Name	Signature	Date and Time

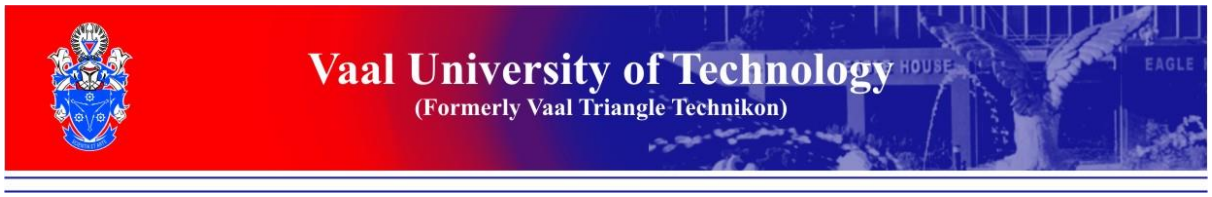
Address of volunteer participant:

……
……...
……
……
……

Contact telephone number:

……

ANNEXURE E



ASSENT TO PARTICIPATE IN A RESEARCH STUDY FOR PRIMARY SCHOOL CHILDREN

1. My name is Phumla Monala, I am a student at Vaal University of Technology.

2. We are asking you to take part in a research study because we are trying to learn more about the food you receive from school during lunch and what healthy food you eat at school.

3. If you agree to be in this study, we sit down with you after school and ask you questions about your eating habits, we will also take your weight and height with a scale.

4. The asking of questions and taking measurements will not be painful, you will sit down with a fieldworker and they ask you questions and when we weigh your weight and height, you only have to take off your shoes and heavy clothes.

5. This research will help me help you to have a better choice of healthy food at school and also help you become a strong and healthy young person

6. Please talk this over with your Caregivers before you decide whether or not to participate. We will also ask your Caregivers to give their permission for you to take part in this study. But even if your Caregivers say “yes” you can still decide not to do this.

7. If you don’t want to be in this study, you don’t have to participate. Remember, being in this study is up to you and no one will be upset if you don’t want to participate or even if you change your mind later and want to stop.

8. You can ask any questions that you have about the study now. If you have a question later that you didn’t think of now, you can call me on 0787840093. If you feel you have been treated unfairly please don’t be scared to tell your teacher or principal.

9. Signing your name at the bottom means that you agree to participate in this study. You and your Caregivers will be given a copy of this form after you have signed it.

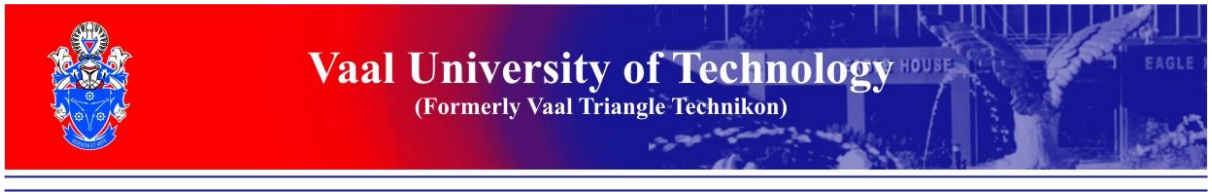
_____ _____

Name and surname Date

_____

Grade

ANNEXURE F



SOCIO-DEMOGRAPHIC QUESTIONNAIRE:

MOGALE CITY NSNP PROJECT

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

1. GENERAL INFORMATION

Date : ……

Fieldworker : ……

Age ……

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	Umtata	Durban

2. PERSONAL INFORMATION

2.1 When were you born? Year: _____

2.2 Gender:

Male	Female

2.3 Are you?

Single	Married	Widowed	Divorced	Other……..

3. ACCOMODATION AND FAMILY COMPOSITION

3.1. Do you share your accommodation with other people?

Yes

No

3.2. How many people are living in your house?

1	2	3	4	5	6	7	8	9	10	11

3.3. Are all members' permanent residents in this house?

Yes	No

3.4. In what type of house are you staying?

Brick	Clay	Grass	Zinc/shack	Other; Specify……

3.5. How many rooms in your house?

< 2 rooms	3-4 rooms	> 4 rooms

3.6. Do you have the following facilities at home?

3.6.1.	Waste removal	Yes	No
3.6.2.	Vegetable garden	Yes	No

3.6.3. If yes, what do you do with your vegetables (tick all options)?

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

3.7 How long have you been staying permanently in this house?

< 1 year	1-5 years	>5 years

3.9 Do you have another home elsewhere?

Yes	No

4. **INCOME**

4.1 Are you employed at the moment?

Yes, full time, permanent	
Yes, temporary	
No, unemployed	
No, retired	
No, other, specify…….	

4.2 If unemployed, for how long?

< 6 months	6-24 months	3-5 years	> 5 years

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

Yes, full time, permanent	
Yes, temporary	
No, unemployed	
No, retired	
No, other, specify…….	

4.4 What is the total household income per month?

< R1000	R1001-R2000	R2001-R3000	R3001-R4000	R4001-R5000	>R5000

4.5 How often DoBEs it happen that you do not have enough money to buy food?

Always	Often	Sometimes	Seldom	Never

4.6 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

4.7 How often do you buy food?

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

4.8 Where do you buy food?

Spaza shop	Street vendor	Supermarket	Other, specify……

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

R 0 – R 100	R 101 – R 200	R 201 – R 300	R 301 – R 400	R 401 – R 500	R 501 – R 600	> R 600	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…….

6 ASSETS

Tick one block for every question:	**Father**	**Mother**	**Grand-ma**	**Grandpa**	**Other**
6.1 Who is mainly responsible for food preparation in your house?					
6.2 Who decides on what types of food are bought for the household?					
6.3 Who decides how much is spent on food?					
6.4 Who is responsible for feeding the children?					
6.5 Who is the household head?					

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 Do you have the following?

	Yes
Electrical stove	
Gas stove	
Primus or paraffin stove	
Microwave	
Hot plate	
Refrigerator	
Freezer	
Refrigerator	
Kettle ,electrical	

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

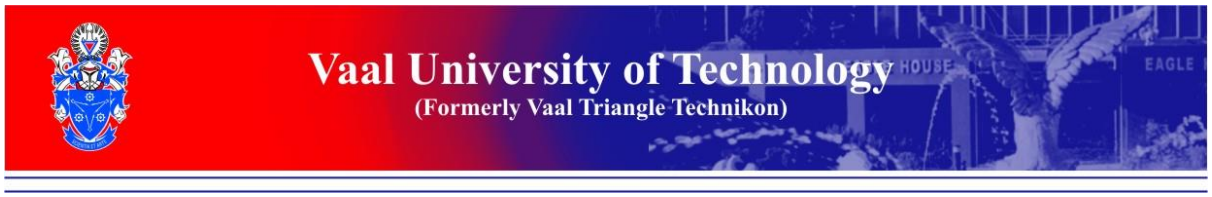
Food fire	Paraffin	Electricity	Gas	Coal	Other, specify……

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

Cast iron	Aluminium	Stainless steel	Clay	Other, specify……

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

ANNEXURE G



Household Food Insecurity Access Scale (HFIAS) Measurement Tool – Mogale City

Subject Age_____ Date:_____

Please mark with an x in the box.

1. In the past four weeks, did you worry that your household would not have enough food?

No (skip to question 2)	1
Yes	2

1.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?

No (skip to question 3)	1
Yes	2

2.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

3. In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?

No (skip to question 4)	1
Yes	2

3.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

No (skip to question 5)	1
Yes	2

4.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?

No (skip to question 6)	1
Yes	2

5.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

6. In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?

No (skip to question 7)	1
Yes	2

7.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?

No (skip to question 8)	1
Yes	2

7.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?

No (skip to question 8)	1
Yes	2

8.a. How often did this happen?

Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

No (questionnaire is finished)	1
Yes	2

9.a. How often did this happen?

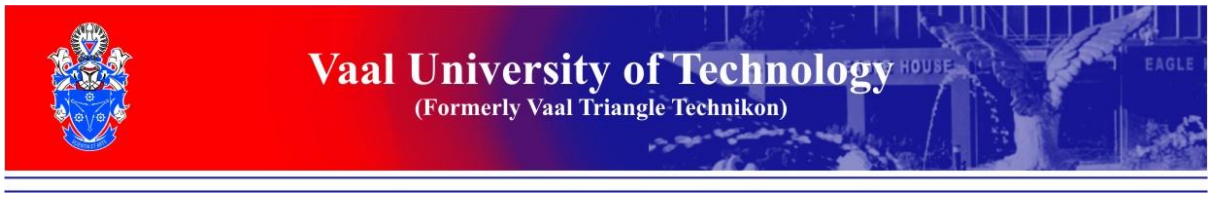
Rarely (once or twice in the past four weeks)	1
Sometimes (three to ten times in the past four weeks)	2
Often (more than ten times in the past four weeks)	3

Thank you for your cooperation, we appreciate your time.

Supervisor - Prof AA Egal
0169505091

Student – Phumla Monala
0787840093

ANNEXURE H



NSNP – Mogale City

Anthropometry Measurement Form

Subject ID number : _____ Gender: Male/Female

Interviewer: _____

Date: _____ / _____ / 2017

Gender	Age	Height	Weight	Body Mass Index

ANNEXURE I

Vaal University of Technology

MOGALE CITY NSNP PROJECT
FFQ LIST OF FOODS AND FOOD GROUPS DIVERSITY

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

Age…….
Gender…….

GROUP 1: Flesh foods (meat, poultry, fish) diversity	**Child**	
Chicken		
Beef		
Pork		
Tinned fish (pilchards, tuna)		
Fish (fresh / whole)		
Minced meat		
Mutton		
Chicken runners and heads		
Chicken livers		
Goat (meat)		
Tripe		
Dried meat (biltong)		
Viennas / polony / Russians		
Sausage (wors)		
Steak		
Other, specify		
Group 2: Eggs diversity		
Eggs		
Group 3: Diary products diversity		
Milk, unpasteurized (cow / goat)		
Evaporated milk (Ideal milk)		
Maas/ inkomasi		
Powdered milk		
Skim or low-fat milk (pasteurized)		

Full cream milk (pasteurized)		
Cheese		
Custard / Ultramel		
Ice cream		
Yoghurt / Yogisip		
Other, specify		

Group 4: Cereals, roots and tubers diversity	**Child**	
Rice		
Pap (Maize)		
Macaroni/pasta/spaghetti		
Maize rice (mielierys)		
Samp (stampmielies)		
Bread (white or brown)		
Dumpling / "Vetkoek"		
Scones		
Biscuits		
Buns / bread rolls		
Mabela (soft porridge)		
Corn flakes / Rice Krispies / Wheet Bix		
Oats		
Mageu		
Potatoes		
Sweet potatoes		
Traditional beer		
Other, specify		
Group 5: Legumes and nuts		
Dried beans		
Dried peas		
Peanut butter		
Peanut or any other nuts		
Soya		
Group 6: Vitamin A rich fruits and vegetables diversity		
Pumpkin		
Carrots		
Wild leafy vegetables (morogo) Fresh and dried		
Spinach		
Butternut		
Apricots (Appelkoos)		
Peach (yellow cling)		

Mango		
Group 7: Other fruits (and juices) diversity		
Deciduous fruits		
Apple		
Peaches		
Pear		
Grapes (black/green)		
Plum		

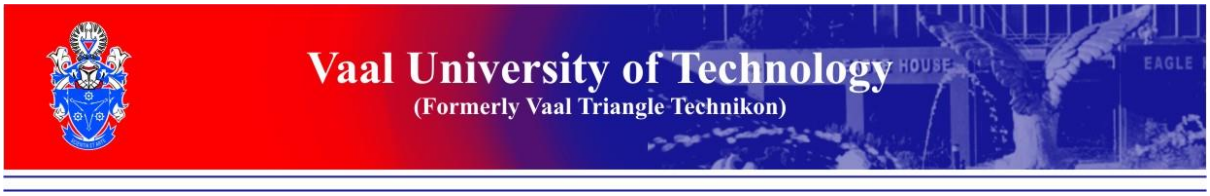
Sub – tropical fruit	**Child**	
Lemon		
Orange		
Naartjie		
Banana		
Pineapple		
Avocado		
Blueberry		
Cherry		
Kiwi fruit		
Raspberry		
Watermelon		
Wild watermelon(tsamma)		
Guava		
Juices		
Juice (100% pure juice e.g. Ceres/Liquifruit)		
Group 8: Other vegetables diversity		
Onions		
Cabbage		
Beetroot		
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: Oil and fat diversity		
Butter		
Sunflower oil		
Margarine		
Lard		
Salad oil		

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

Phumla Monala

ANNEXURE J



24 – HOUR RECALL
MOGALE CITY NSNP PROJECT

Subject ID number : _____ Gender: Male/Female

Age----------

Interviewer: _____

Date: _____ / _____ / 2010

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.

ime (approximately)	Place	Description of food	Amount	Amount in g (office use Only)	Code (office use only)
From waking up to going to school, 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 K

Researchers Observation questions	YES	NO	Sometimes	Reason (if No)
Are all learners participating in the NSNP				
Are learners using the NSNP utensils to eat meals from the NSNP				
DoBEs the NSNP have a kitchen				
Is the NSNP Kitchen clean				
Is hygiene practiced by the food handlers				
DoBEs the NSNP have storage facilitates				
Are the NSNP meals served appropriately				
Is there menu repetition				
DoBEs the NSNP practice proper portion size control				