



**Dietary Intake and Nutritional Status of Primary School Children
Participating in the Botswana School Feeding Programme,
South-east District, Botswana**

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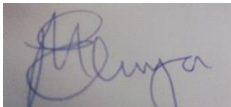
August 2019

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Signed:



Malebogo Eluya (Candidate)

Date: 25 August 2019

ACKNOWLEDGEMENTS

- The help and co-operation of the primary school children who participated in the study, their parents and authorities of the primary schools in South-east district, Botswana is highly appreciated.
- A number of key individuals have contributed to the development of this dissertation from the development of the topic to completion. I wish to recognize the tireless support of my main supervisor Dr. Susanna Maria Kassier and co-supervisor Professor Frederick Veldman who vigorously and willingly reviewed my work throughout the various stages of completion. Without their guidance and encouragement, I would not have reached the submission stage.
- I am grateful also, to the President and founder of Boitekanelo College, Dr. T.S. Mampane. With his approval, I received invaluable support from management of the college and colleagues when I had to take time off work on a regular basis.
- This study was sponsored by the Boitekanelo College. I therefore would like to express my special thanks to them for the funding that made this study possible.
- I would also like to thank my research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketlholegile who tirelessly assisted me with administrative work and data collection.
- The staff and management of South-east District, Botswana were very helpful in assisting with the process of data collection, I thank them.
- Lastly, I want to acknowledge the generous support of the Boitekanelo College, Nutrition and Dietetic department for their advice and encouragement.

ABSTRACT

Introduction: Optimal nutrition is essential for the growth and development of primary school children. School-based nutrition interventions, especially in resource limited settings, are important for addressing health problems and the improvement of health, as well as nutritional and educational outcomes. The majority of African countries such as Botswana, are currently experiencing nutrition transition. This concept contributes to the double burden of malnutrition (undernutrition and overnutrition) among children. A change in dietary habits, the adoption of a sedentary lifestyle, and limited dietary diversity are some of the outcomes linked to the nutrition transition. .

Aim: To determine the effect of the Botswana School Feeding Programme (SFP) (all government schools) on the nutritional status of primary school children in the South-east District when compared to non-beneficiaries of the SFP (private schools).

Study design: A school-based, comparative cross-sectional study was conducted among primary school children during the school term and immediately after the school holiday (period of no SFP).

Setting: This study was conducted in 13 public and private schools located in urban and peri-urban areas in the South-east District, Botswana.

Subjects: 392 sampled primary school learners from public and private schools aged 8 – 13 years of age were sampled.

Outcome measures: SFP impact was assessed using household food insecurity status (HFIAS), dietary diversity score (DDS) and anthropometric indices such as weight-for-age (WAZ z-scores), height-for-age (HAZ z-scores) and Body Mass Index-for-age (BAZ z-scores). For the calculation of WAZ, the Centre for Disease Control (CDC) tables were used to interpret weight-for-age of learners older than ten years, as WAZ is only available for children up to ten years of age on the World Health Organization (WHO) growth standards.

Results: Significant differences ($p < 0.000$) were documented for SFP beneficiaries (intervention) versus non-beneficiaries of the SFP (control) for mode of transport to school, HFIAS and DDS. Significant differences ($p < 0.000$) were also found when comparing urban to peri-urban learners for mode of transport to school, HFIAS and DDS. However, a significant difference between beneficiaries of the SFP (intervention) versus non-beneficiaries of the SFP (control) was not

documented for Physical Activity Level (PAL), whereas the PAL of peri-urban learners was significantly higher than that of urban learners ($p < 0.001$). Learners participating in the SFP were receiving inadequate energy, macro- and micronutrient from the food rations provided, as they only received 60% of the Dietary Reference Intake (DRI) for energy, 90% of the Recommended Dietary Allowance (RDA) for protein, 46% of the Estimated Average Requirement (EAR) for vitamin A and 28% of the Adequate Intake (AI) for calcium when comparing the ration scale to 33% of the DRIs.

Discussion: The low DDS of learners participating in the SFP indicated that school meals did not make a significant contribution to the DDS of its beneficiaries. When comparing SFP beneficiaries to SFP non-beneficiaries, despite the fact that the majority of learners in both groups had a normal BAZ, the disparity became more evident for those being at risk for becoming overweight. Nearly a third (29.0%) of non-beneficiaries were at risk for become overweight, whereas the same held true for 18.8% of beneficiaries. A similar trend was echoed when comparing the WAZ between the two groups, as the difference was significant. When comparing the WAZ between urban and peri-urban learners, a significant difference was documented, with learners from urban areas having a lower prevalence of normal weight and a higher risk of becoming overweight than their peri-urban counterparts. In addition, recipients of the SFP had a higher prevalence of underweight when compared to non-beneficiaries. A nutrient analysis of the SFP ration scale indicated that it supplied inadequate levels of energy, protein, vitamin A and calcium.

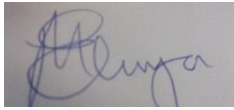
Conclusion and Recommendations: The study findings emphasise the need for targeted school feeding and community-based nutrition interventions and public health awareness campaigns to create an awareness of the importance of eating a diverse diet and being aware of the importance of being physically active for the promotion of health and wellbeing, as well as for the prevention of overweight and obesity among primary school learners. Although learners attending public schools in urban and peri-urban areas as well as private schools may face diverse nutritional challenges as a result of differences in socio-economic status and available resources, it is evident that the dietary diversity and prevalence of overweight and obesity among primary school learners attending both public and private schools in the South-east District, Botswana, requires special attention. Participation in the SFP and resultant food security, may have a positive impact on learner anthropometric status as indicated by the low prevalence of undernutrition and stunting documented in this study sample. In addition, as the BAZ categories did not differ significantly

between recipients of the SFP versus non-recipients, it could serve as an indicator that the SFP has a positive impact on learner anthropometric status in the South-east District of Botswana. It is however recommended that the SFP in its current form requires revision in order to enhance its contribution towards improving the dietary quality and diversity of the meals provided as part of the SFP such as the inclusion of more fruit and vegetables in order to improve the micronutrient content of the food rations.

PREFACE

The work within this thesis was conducted in the School of Agricultural, Earth and Environmental Sciences, College of Agriculture, Engineering and Science at the University of KwaZulu-Natal under the supervision of Dr Susanna Maria Kassier and Prof Frederick Johannes Veldman.

The research represents the original work by the author and has not otherwise been submitted in any form for any degree or diploma at any University. Where applicable, the work of others is acknowledged in text.



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Date: 25 August 2019

DEDICATION

This thesis is dedicated to my family. To my loving and loyal husband, Benjamin Eluya, my dear children Palesa, Leatile and Reneiloe and cherished parents, Janet Spivey and Michael Motshidi. Thank you for your love and support.

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ABBREVIATIONS

ADA	Academy of Dietetics and Nutrition
AFSUN	African Food Security Urban Network
AHA	American Heart Association
AI	Adequate Intake
AST	Active School Transport
BAZ	Body Mass Index-for-age z-score
BIDPA	Botswana Institute of Development Policy Analysis
BMI	Body Mass Index
BMTHS	Botswana Multi Topic Household Survey
BREC	Biomedical Research and Ethics Committee
CDC	Center of Disease Control
CSO	Central Statistics Office
DRIs	Daily Recommended Intakes
EAR	Estimated Average Requirement
FAO	Food and Agriculture Organization
FBDG	Food Based Dietary Guidelines
FFQ	Food Frequency Questionnaire
HAZ	Height-for-age z-score
HDDS	Household Dietary Diversity Score
HFIS	Household Food Insecurity Scale
HGSM	Home Grown School Meals
HIV	Human Immunodeficiency Virus
ICN2	Second International Conference on Nutrition
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
IPAQ-C	International Physical Activity Questionnaire for Children
ISPAAD	Integrated Support Programme for Arable Agriculture Development
kg	Kilogram

m	Metre
MDGs	Mellinium Development Goals
MRC	Medical Research Council
NSPR	National Strategy for Poverty Reduction
NASVI	National Association of Street Vendors in India
NCDs	Non-communicable Diseases
NGS	Nutrition Guidelines and Standards
NICUS	Nutrition Information Centre University of Stellenbosch
p	Significances
PA	Physical Activity
PAL	Physical Activity Levels
PTA	Parents Teachers Association
SD	Standard Deviations
SES	Socio-Economic Status
SFP	School feeding programme
SFPs	School Feeding Programmes
SHSF	School Health and School feeding
SPSS	Statistical Package for the Social Sciences
UKZN	University of KwaZulu-Natal
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
UNSCN	United Nations System Standing Committee on Nutrition
USAID	United States Agency International Development
WAZ	Weight-for-age z-score
WFP	World Food Programme
WHES	World Hunger Education Services
WHO	World Health Organization

CONTRIBUTIONS TO THESIS

All data was collected and entered by Malebogo Eluya and research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketlholegile. Technical advice regarding data coding, data entry and statistical analysis was given by Dr. Susanna Maria Kassier and Professor Fredrick Johannes Veldman.

CHAPTER ONE: INTRODUCTION, THE PROBLEM AND ITS SETTING

This chapter includes the introduction and background of the study, its purpose, the problem and its setting, statement of the problem, study aims and objectives, research hypotheses, definitions, abbreviations, assumptions and limitations of the study.

1.1 Introduction and background

Nutrition is fundamental for good health and development during the early childhood as reported by the Academy of Nutrition and Dietetics (ADA) (2014); World Health Organization (WHO); (2013) and Pepino (2014). Childhood hunger and malnutrition remain global challenges that have direct and adverse consequences as reported by the Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD); United Nations International Children's Emergency Fund (UNICEF); World Food Programme (WFP) and WHO (2017). Sub-Saharan Africa is one of the global regions most affected by hunger, with children being the most vulnerable [World Hunger Education Services (WHES) 2016]. In addition, the prevalence of numerous forms of the double burden of malnutrition is increasing at an alarming rate in many developing countries (FAO, IFAD, UNICEF, WFP & WHO 2018; Zhang *et al.*, 2016; Kimani-Murage *et al.*, 2010). An analysis of the prevalence of both undernutrition and overnutrition, suggests that the double burden of malnutrition exists in most communities, households and individuals in the majority of developing countries (WHO 2017; Abdullah 2015). This problem is especially prevalent amongst primary school learners (Elema 2018; Pangani *et al.*, 2016; Sahoo *et al.*, 2015).

Botswana was one of the world's fastest growing economies, and is well-known for its international performance in governance ratings despite poverty having an impact on the nutritional status of its children (World Bank 2015). Although the well-being of Botswana's children is considered to compare favourably in Sub-Saharan Africa terms, consistent and significant under-reporting through current information systems may be hampering the availability of valid and reliable data documenting childhood nutritional status (UNICEF 2017). It has therefore become evident that to

gauge an understanding of nutrition-related problems as a contributor to growing health problems, Botswana is hampered by a lack of data.

The prevalence of underweight among boys and girls has been steadily decreasing in Botswana in recent years (Figure 1). In the initial years (1999), the prevalence was high, especially among boys (46.8%). However, the prevalence of underweight among girls, was seemingly lower (27.6%).

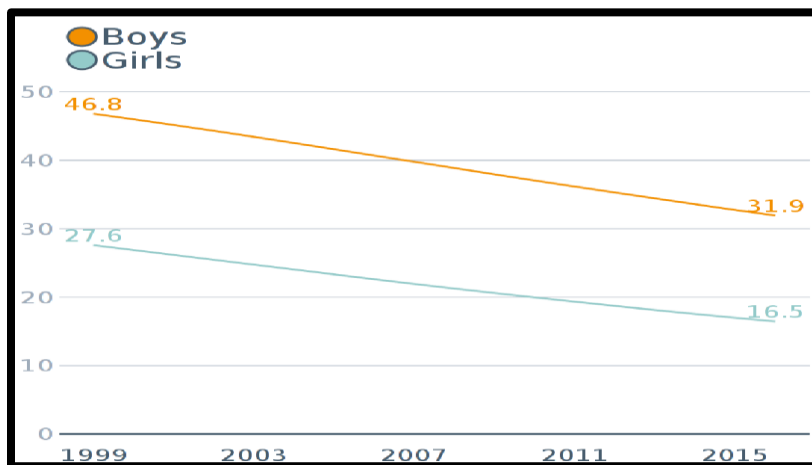


Figure 1.1: Prevalence of underweight in Botswana

Sources: UNICEF Division of Data Research and Policy (2018), UNICEF Global Databases: Infant and Young Child Feeding (2018).

However, UNICEF (2018), Shaibu *et al.*, (2012) and Maruapula *et al.*, (2011), refer to the extent to which overweight and obesity, especially among girls, has increased in recent years (Figure 1.2, Figure 1.3).

The prevalence of childhood overweight among Botswana children seems to be increasing, with the increase among girls being more marked than among boys. Figure 1.2 illustrates the latter, with the prevalence among girls having steadily increased from 1999 to 2015 at 10.5% and 24.6% respectively, while the prevalence among boys has increased from 3.1% to 10.4% over the same period.

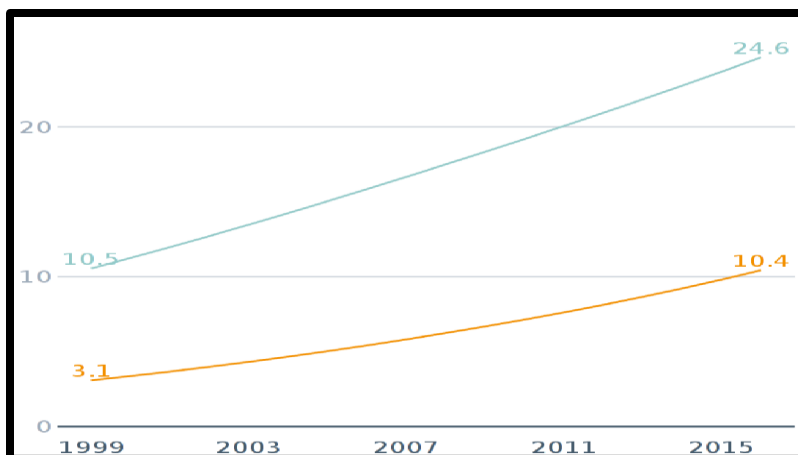


Figure 1.2: Prevalence of childhood overweight in Botswana

Sources: UNICEF, Division of Data Research and Policy (2018), Global UNICEF Global Databases: Infant and Young Child Feeding (2018).

Figure 3.1 below, illustrates the increased prevalence of childhood obesity among boys and girls in Botswana from 1999 to 2015. The increase among girls (2.1% to 9.2%) was more pronounced than the increase from 0.5% to 3.5% amongst boys over the same period.

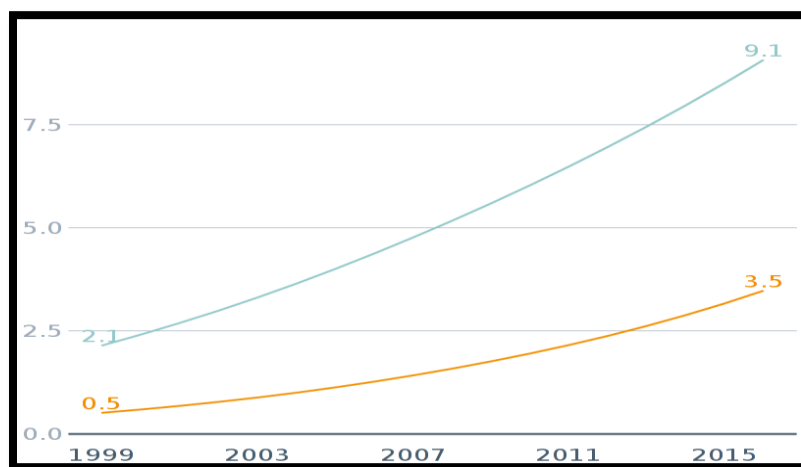


Figure 1.3: Prevalence of childhood obesity in Botswana

Sources: UNICEF, Division of Data Research and Policy (2018), Global UNICEF Global Databases: Infant and Young Child Feeding (2018).

Despite numerous global achievements regarding the 2003 millennium development goal two (MDG) regarding an increase in literacy levels among those aged 15 to 24 years, the

underprivileged are lagging behind by living in poverty and hunger due to targets regarding the MDG one not having been met [United Nations (UN) 2015]. In addition, Bain *et al.*, (2013) also highlighted that achievement of MDG one, namely to eradicate extreme poverty and hunger, has been unsuccessful in Africa, although access to primary education (MDG two) has significantly improved in many parts of the world. Unfortunately, corruption in most African countries have reversed efforts of achieving MDG one (Uchendu & Abolarin, 2015). However, it is not surprising that one of the major factors that have contributed to the increased prevalence of childhood malnutrition in Africa, is the HIV/AIDS pandemic which not only had a negative impact on the health status of the general population, but also had an effect on household food security status (UN 2010).

Milledz *et al.*, (2017), observed that since the launch of the MDGs, one of the most important interventions has been the implementation of School Feeding Programmes (SFPs). Jomaa *et al.*, (2011) add that SFPs have been successful, however the challenge lies in maintaining them so that they can reach as many children and their families as possible. In the current study, it was important to assess how the Botswana Government and Botswana schools have adopted and continued to implement the MDGs through SFPs by considering dietary intake and anthropometric status of primary school learners participating in the Botswana SFPs. In order to buy into SFPs and the achievement of MDG one, especially in terms of reducing the prevalence of childhood underweight, the Botswana government invested in interventions aimed at improving child nutrition (Moepeng, 2013).

The UNICEF conceptual framework presented in Figure 1.4, depicts the importance of inadequate access to food and inadequate dietary intake as underlying and immediate causes of malnutrition respectively.

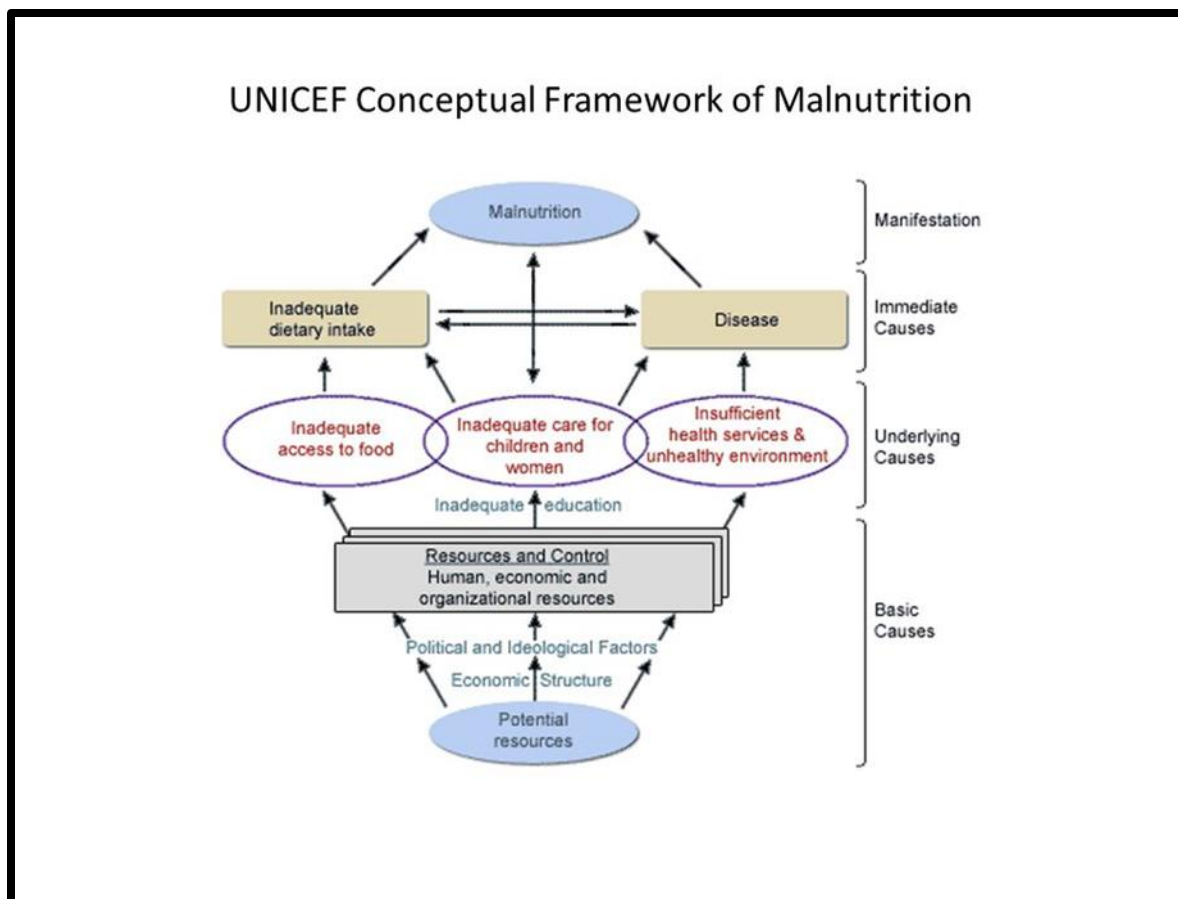


Figure 1.4: UNICEF conceptual framework of malnutrition
 Source: UNICEF (2013)

As is illustrated in Figure 1.4, malnutrition among children has many underlying and immediate causes. Poor feeding practices compromise the development of growing children (Martins *et al.*, 2011). In addition, the dietary intake of children can be suboptimal at either household level and/or within a school setting (Belachew *et al.*, 2013; Ochola & Masibo, 2014). In most developing countries, children’s diets are usually cereal-based and has limited dietary diversity (Schönfeldt & Hall, 2012). The latter can be attributed to limited access to other nutritious foods or limited knowledge regarding nutritious foods (Naeeni *et al.*, 2012). Despite the latter, children themselves may also consume unhealthy diets due to a lack of knowledge regarding healthy eating habits and lifestyle choices (Aliyar *et al.*, 2012). Despite a positive influence from family members and the school, a child could purchase unhealthy food items if given lunch money as was observed by various authors (Nortje *et al.*, 2017; Nonato *et al.*, 2016; Wiles & Veldman, 2013).

Results of a study conducted in South Korea found that the age and gender of primary school learners was associated with their nutritional status (Lee & Ham, 2015). Area of residence also impacts on the nutritional status of children. In Bangladesh, the prevalence of overweight and obesity among children aged 6 to 12 years, was found to be more prevalent in urban, when compared to rural areas (Majumder *et al.*, 2017). In Nigeria, the prevalence of malnutrition among primary school learners was found to be more prevalent in rural, as opposed to urban areas (Simeon *et al.*, 2015). A high prevalence of malnutrition was also found to be common in Sudan (Nabag, 2011). In a study assessing the nutritional status of primary school learners aged 5 to 15 years, the prevalence of underweight was found to be 59.1% in rural areas as opposed to 39.0% in urban areas. In addition, anthropometric status was also influenced by the type of school (Adu *et al.*, 2015; Gebreyohannes *et al.*, 2014). In the study by Gebreyohannes *et al.*, (2014) conducted in Ethiopia, it was found that obesity was more prevalent among learners from private schools when compared to those from public schools. In another study, gender did not seem to influence the nutritional status of primary school learners (Ogheneruese & Joy, 2016), while the study conducted by Sylvere *et al.*, (2016) documented that girls aged 8 to 10 years in Côte D'Ivoire were more obese when compared to boys.

In the majority of urban areas such as the capital city Gaborone in Botswana, it is perceived that there is sufficient access to and availability of food. However, urban food insecurity is a major problem in the majority of households (Crush *et al.*, 2018; FAO, 2018; Tawodzera *et al.*, 2016; Mosha, 2015). Some of the major factors influencing household food security in urban areas of Botswana include household income, gender and age of the household head and household size (Raboloko, 2016). The major barriers to food access include the affordability of nutritious foods (Acquah *et al.*, 2014; Mendoza *et al.*, 2014; Lane *et al.*, 2012). An urban food security baseline survey conducted in the socio-economically under-privileged areas of Gaborone, found that the prevalence of food insecurity was 82% (Nnyepi *et al.*, 2010; African Food Security Urban Network (AFSUN), 2009). Although a study by Moepeng (2013) highlighted the fact that poverty in Botswana has been decreasing, in households with more children, the prevalence of poverty is higher (World Bank, 2015).

There is a paucity of data documenting the prevalence of undernutrition and over nutrition among school-aged school children in Botswana. However, there are studies that have documented the link between the consumption of fast foods and the coexistence of food insecurity, undernutrition, overweight and obesity (Legwegoh, 2012; Emongor & Kirstein, 2009). It has been suggested that the prevalence of obesity among older learners may be indicative of older children having a higher risk of becoming obese young adults (Tapera *et al.*, 2018).

Despite WHO recommendations that developing countries such as Botswana (Mafela *et al.*, 2011; United Nations Development Programme [UNDP], 2009) should monitor the double burden of disease among children as they are risk factors for diseases of lifestyle in adulthood (WHO 2011; WHO 2002), there is a paucity of data regarding the nutritional status of school-aged children in Botswana. In addition, children affected by undernutrition, are more likely to suffer from anaemia and ill-health that can contribute to a lack of concentration, resulting in a greater likelihood of premature school drop-out (Martins *et al.*, 2011). As poverty and malnutrition are associated with delayed brain development and cognitive function in young children, it therefore also affects their education (Intiful *et al.*, 2013).

A hungry scholar is more likely to face health and nutrition-related problems (Faught *et al.*, 2017). This in turn, can affect academic performance (Littlecott *et al.*, 2016), cognitive function, capacity to attend school and ability to concentrate (Intiful *et al.*, 2013). However, some researchers have failed to document convincing evidence regarding the relationship between cognitive function, academic performance and school feeding (Jomaa *et al.*, 2011; Kazianga *et al.*, 2009). In addition, other researchers have also found that although SFPs improve energy and nutrient intake, it does not necessarily improve nutritional status (Abizari *et al.*, 2014). Despite the fact that there is evidence that SFPs have a wide range of benefits (UNSC, 2017; Moepeng, 2013; Evans *et al.*, 2015; Jomaa *et al.*, 2011), there is a need to conduct research that will enable an understanding of SFPs in terms of its impact on learner nutritional status at public schools with and without SFPs (Agbozo *et al.*, 2017).

An exploratory school-based cross sectional study conducted in rural and urban areas of Ghana, reported that when the nutritional status of children who were SFP beneficiaries were compared

to that of SFP non-beneficiaries, the difference in nutritional status was not significant. An Ethiopian study that investigated risk factors associated with malnutrition among school children, found that the odds of stunting and undernutrition was significantly associated with type of house, maternal age, age of the child, sex and birth order of those surveyed (Degarege *et al.*, 2015). Degarege *et al.*, (2015) reported that 31% and 19.6% of the children surveyed were undernourished and stunted respectively. In a cross-sectional study also conducted in Ethiopia by Wolde *et al.*, (2015), an association was also found between factors such as household food insecurity and prevalence of undernutrition among school going children. In Ghana, Kwabla *et al.*, (2018) compared the nutritional status of children who participated in SFPs to those who did not. Findings revealed that the prevalence of stunting among children attending schools with SFPs, was 16.2% compared to 17.2% among children attending schools that did not participate in the SFP. Overweight and thinness was also higher among children in SFP schools than among children attending schools without SFPs. Despite the recognition of the importance of school feeding by several authors (Malongane & Mbhenyane, 2017; Gelli, 2015; Uwameiye & Salami, 2013), it would therefore seem that the nutritional status of children benefitting from school feeding versus those who are not, is a topic that requires further investigation, especially in Botswana, as well as in Sub-Saharan Africa.

Schools are convenient locations for various interventions targeting children, as the setting provides a unique opportunity to reach children on a large scale (United Nations System Standing Committee on Nutrition (UNSCN), 2017; Bustos *et al.*, 2016; In-Iw *et al.*, 2012). As learners spend most of the day at school, SFPs have the ability to improve the nutritional status of children and school enrolment (UNDP 2012).

There is a paucity of data regarding the anthropometric status of primary school learners benefitting from the SFP in Botswana. In addition, Wrotniak *et al.*, (2012) and Letamo (2011) highlight the fact childhood overweight and obesity are increasingly becoming a serious public health problem in low and middle income countries such as Botswana, especially in urban settings where many children are growing up in an obesogenic environment that encourages unhealthy eating habits and a sedentary lifestyle (Brown *et al.*, 2015).

The purpose of this study was to investigate the anthropometric status and related factors of learners benefitting from SFPs in addressing malnutrition among primary school learners, as this stage of the lifecycle is characterised by increased nutritional requirements due to development and rapid growth (Soliman *et al.*, 2014). Furthermore, apart from increased energy requirements and sedentary lifestyles, factors such as school location also affects childhood nutritional status (Kambondo & Sartorius, 2018). As learners spend most of the day at school, SFPs have the ability to improve the nutritional status of children and school enrolment (UNDP 2012).

1.2 The problem and its setting

There has been a lack of research conducted in Botswana among schools that offer a SFP. As a result, there is a paucity of data regarding the impact of SFPs on the nutritional status of children of school going age, in addition to related factors such as household food security status, household dietary diversity and physical activity that could also have an impact on learner nutritional status. Previous studies conducted in Botswana primarily focused on the prevalence of malnutrition among children under five years of age (Madondo, MacIntyre & Ntuli, 2012). As was previously indicated, school aged children have increased nutritional requirements due to extra nutritional demands, not only related to growth, but also related to household chores such as gathering wood and fetching water (Makwinja-Morara, 2009), in addition to walking to school over long distances (Levitsky, 2005), especially in rural areas. In the current study, peri-urban areas which were used to conduct this investigation could be viewed as peri-urban due to the fact that they are located around the capital city, Gaborone. This study therefore provided an opportunity to investigate the anthropometric status of learners benefitting from the Botswana SFP as well as related factors that have an impact on the nutritional status of primary school learners in urban and peri-urban areas in the South-east District, Botswana.

1.3 Study aim

The study aim was to determine the nutritional status of primary school learners benefitting from the SFP in the South-east District of Botswana when compared to non-recipients of the SFPs, as well as related factors including household dietary diversity, household food security status,

physical activity level and socio-demographic variables that could have an impact on learner nutritional status.

1.4 Study objectives

In order to achieve the study aim, the following objectives were formulated:

Objective One:

To determine the socio-demographic characteristics, household dietary diversity, household food security status and physical activity level of primary school beneficiaries of school feeding versus non-school feeding beneficiaries according to the following criteria:

- recipients of school feeding;
- urban recipients of school feeding;
- peri-urban recipients of school feeding;
- non-recipients of school feeding (private schools).

Objective Two:

To determine the anthropometric status of primary school feeding beneficiaries versus non-school feeding beneficiaries at baseline and following a period of no school feeding (school holiday) according to the following criteria:

- recipients of school feeding during the school term versus after the school holiday (period of no school feeding);
- urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding);
- peri-urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding);
- Non-recipients of school feeding (private schools).

Objective Three:

To determine the contribution of school feeding ration scales to the dietary reference intake (DRI) and daily estimated average requirement (EAR) for energy, macronutrients and selected micronutrients.

1.5 Study hypotheses

1.5.1 There will not be a significant difference between the socio-demographic characteristics, household dietary diversity, household food security status and physical activity levels of primary school learners according to the following criteria:

- recipients of school feeding;
- urban recipients of school feeding;
- peri-urban recipients of school feeding;
- non-recipients of school feeding (private schools).

1.5.2 There will not be a significant difference between the anthropometric status of recipients versus non-recipients of school feeding at baseline (during the school term).

1.5.3 There will not be a difference between the anthropometric status of urban versus peri-urban recipients of school feeding at baseline (during the school term).

1.5.4 There will not be a difference between the anthropometric status of recipients of school feeding during the school term versus after the school holiday (period of no school feeding).

1.5.5 There will not be a difference between the anthropometric status of urban versus peri-urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding).

1.5.6 The school feeding ration scale will not provide the recommended EARs for energy, macronutrients and selected micronutrients in relation to scholar physical activity levels.

1.6 Study parameters

For the purpose of this study the following parameters were set:

1.6.1 Inclusion criteria

All learners (standard five to seven) attending primary schools in the South-east district, Botswana with documented parental/guardian informed consent who gave assent to participate in the study and attended school at the time of data collection.

1.6.2 Exclusion criteria

All learners (standard five to seven) attending primary schools in the South-east district, Botswana without documented parental/guardian informed consent as well as learners who were absent at the time of data collection.

1.7 Assumptions

For the purpose of this study, the following assumptions were made:

- Study participants (standard five to seven) were honest in their responses to the research instruments.

1.8 Definitions

Body Mass Index	Body weight in kilograms divided by height in meters squared (kg/m^2) (WHO, 2019).
Childhood	The period from the age of one year through to pre-adolescence (Insel <i>et al.</i> , 2014, p 692).
<i>Digaugau</i>	Corn chip snacks.
Fat cakes	Deep fried doughnut type bread.
Obesogenic environment	An environment promoting a high energy intake and sedentary lifestyle. This includes foods that are available, affordable, accessible and promoted; opportunities for physical activity; and the social norms related to food and physical activity (WHO, 2016; Monteiro <i>et al.</i> , 2013).

Obesity	BMI-for-age greater than 2 z-scores above the WHO growth reference median (WHO, 2018).
Overweight	BMI-for-age greater than 1 z-score above the WHO growth reference median (WHO, 2018).
Physical education	Physical education forming the foundation of a comprehensive school physical activity program (PAP) and an academic subject characterised by a planned, sequential curriculum (course of study) [Center for Disease Control and Prevention (CDC), 2013].
Physical activity	Includes all forms of activity, such as walking or cycling for everyday journeys, active play, work-related activity, active recreation such as physical exercise in the gymnasium, dancing, gardening or competitive sport (WHO, 2018; Monyeki, 2014).
Recess	A time during the school day that provides children with the opportunity for active, unstructured or structured free play (CDC, 2013).
Russian	Sausage also called kolbasa (The South African, 2015).
School feeding	The provision of food to school children.
Tuck shop	A small informal shop where food is sold (Collinsdictionary.com).
<i>Seswaa</i>	Traditional pounded or pulled beef.
Street vendor	A person who offers goods or services for sale to the public without having a permanently built structure but with a temporary static structure or mobile stall (or head-load) (National Association of Street Vendors in India (NASVI).

1.9 Summary

In this chapter the background of the study, rationale for conducting it, the study aim and related research objectives, study hypotheses, inclusion and exclusion criteria and assumptions were discussed. Undoubtedly, primary school children are vulnerable for the development of nutrition-related problems including undernutrition and overnutrition. The motivation for conducting this study was related to the lack of data documenting the anthropometric status of primary school children in Botswana. As all government primary schools in Botswana participate in the SFP, the study aim was to determine the anthropometric status of primary school learners in the South-east District of Botswana when compared to non-recipients of the SFP (private schools) as well as related factors that could have an effect on anthropometric status, including household dietary diversity, household food security status, physical activity level and socio-demographic variables.

The remaining chapters and their related content is as follows:

- **Chapter 2:** Review of related literature;
- **Chapter 3:** Research methods and materials;
- **Chapters 4-6** of the thesis was formulated so that each chapter is written as a stand-alone research paper that addresses each of the study objectives formulated in section 1.4;
- **Chapter 7:** Report on study findings prepared for the Ministry of Basic Education;
- **Chapter 8:** Conclusion and recommendations.

References

Abdullah (2015). The double burden of undernutrition and over-nutrition in developing countries: an update. **Current Obesity Reports**; doi: 10.1007/s13679-015-0170-y.

Abizari AR, Buxton C, Kwara L, Mensah-Homiah J, Armar-Klemesu M, Brouwer ID (2014). School feeding contributes to micronutrient adequacy of Ghanaian schoolchildren. **British Journal of Nutrition**; 112, 1019–1033. doi:10.1017/S0007114514001585.

Acquah B, Kapunda S, Legwegoh A (2014). The dimensions of urban food insecurity in Gaborone, Botswana. **Urban Forum**; 25:217–226. doi:10.1007/s12132-014-9222-8.

ADA (2014). Position of the Academy of Nutrition and Dietetics: Nutrition guidance for healthy children ages 2 to 11 years. **Journal of Academy of Nutrition and Dietetics**; 114:1257 – 1276.

Adu MD, Ajayi IO, Adu KT (2015). Reported Malnutrition Prevention Practices in Primary Schools in Ido Local Government Area of Ibadan, Oyo State, Nigeria. **International Journal of Elementary Education**; 4(5): 93 – 100. doi:10.11648/j.ijeedu.20150405.11.

AFSUN (2009). **AFSUN Policy brief Gaborone African Food Security Urban Network**. www.downloads/afsun-policy-briefs-gaborone-26-may-2009.pdf (Accessed on 10 July 2018)

Agbozo F, Atitto P, Abubakari A (2017). Nutritional status of pupils attending public schools with and without school feeding programme in Hohoe Municipality, Ghana. **Journal of Food and Nutrition Research**; 5(7):467-474. doi:10.12691/jfnr-5-7-3.

Aliyar R, Gelli A, Hamdani S (2012). A review of nutritional guidelines and menu compositions for school feeding programmes in 12 countries. **Public Health**; 3:148. doi:10.3389/fpubh.2015.00148.

Bain LE, Awah PK, Geraldine N, Kindong NP, Sigal Y, Bernard N, Tanjeko AT (2013). Malnutrition in Sub-Saharan Africa: Burden, causes and prospects. **The Pan African Medical Journal**; 15, 120. doi:10.11604/pamj.2013.15.120.2535.

Belachew T, Lindstrom D, Gebremariam A, Hogan D, Lachat C, Huybregts L, Kolsteren P (2013). Food insecurity, food based coping strategies and suboptimal dietary practices of adolescents in Jimma zone Southwest Ethiopia. **Public Library of Science One [PLOS One]**; 8(3):e57643. doi:10.1371/journal.pone.0057643.

Brown C, Shaibu S, Maruapula S, Maletle L, Compher C (2015). Perceptions and attitudes towards food choice in adolescents in Gaborone, Botswana. **Appetite**; 95: 29 – 35.

Bustos N, Olivares S, Leyton B, Cano M, Albala C (2016). Impact of a school-based intervention on nutritional education and physical activity in primary public schools in Chile (KIND) programme study protocol: cluster randomized control trial. **BioMedical Central Public Health**; 16: 1217. doi:10.1186/s12889-016-3878-z

CDC (2013). **Comprehensive School Physical Activity Programs: A Guide for Schools**. Atlanta, GA: Centers for Disease Control and Prevention, United States Department of Health and Human Services. https://www.cdc.gov/healthyschools/professional_development/e-learning/CSPAP/_assets/FullCourseContent-CSPAP.pdf (Accessed 26 April 2019).

Collinsdictionary.com. **Definition of 'tuck shop'**. <https://www.collinsdictionary.com/dictionary/english/tuck-shop> (Accessed 14 March 2019)

Crush J, Caesar M, Haysom G (2018). **The state of household Food security in Cape Town, South Africa. Hungry Cities Report No. 12**. <http://hungrycities.net/wp-content/uploads/2018/09/HCP12.pdf> (Accessed 26 April 2019).

Degarege D, Degarege A, Animut A (2015). Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia. **BioMedical Central Public Health**; 15:375. doi:10.1186/s12889-015-1714-5.

Elema TB (2018). Predictors for the prevalence of under-nutrition, wasting and stunting of 3 to 12 years' school aged children in the Asella Luther Child Development Project - Oromiyaa, Ethiopia. **Journal Nutrition and Human Health**; 2(2):1 – 10.

Emongor R, Kirsten J (2009). The impact of South African supermarkets on agricultural development in the SADC: a case study in Zambia, Namibia and Botswana. **Agrekon**; 48(1):60 – 84.

Evans CEL, Mandl V, Christian MS, Cade JE (2015). Impact of school lunch type on nutritional quality of English children's diets. **Public Health Nutrition**; 19(1):36 – 45 doi: 10.1017/S1368980015000853.

FAO (2018). African cities tackle food and nutrition security challenges. <http://www.fao.org/africa/news/detail-news/en/c/1118444/> (Accessed 26 April 2019).

FAO, IFAD, UNICEF, WFP, WHO (2018). **The State of Food Security and Nutrition in the World**. Building Climate Resilience for Food Security and Nutrition. Rome, FAO. <https://data.unicef.org/resources/sofi-2018/> (Accessed 26 April 2019).

Faught EL, Williams PL, Willows ND, Asbridge M, Veugelers PJ (2017). The association between food insecurity and academic achievement in Canadian school-aged children. **Public Health Nutrition**; 20(15):2778 – 2785.

Gebreyohannes Y, Shiferaw S, Demtsu B, Bugssa G (2014). Nutritional status of adolescents in selected government and private secondary schools of Addis Ababa, Ethiopia. **International Journal of Nutrition and Food Sciences**; 3(6):504 – 514. doi:10.11648/j.ijnfs.20140306.13.

Gelli A (2015). School Feeding and Girls' Enrollment: The Effects of Alternative Implementation Modalities in Low-Income Settings in Sub-Saharan Africa. **Frontiers in Public Health**; 3:76. doi:10.3389/fpubh.2015.00076.

In-Iw S, Saetae T, Manaboriboon B (2012). The Effectiveness of School-Based Nutritional Education Program among Obese Adolescents: A Randomized Controlled Study. **International Journal of Pediatrics**; doi:10.1155/2012/608920.

Intiful FD, Ogyri L, Asante M, Mensah AA, Steele-Dadzie RK, Boateng L (2013). Nutritional status of boarding and non-boarding children in selected schools in the Accra metropolis. **Journal of Biology, Agriculture and Healthcare**; 3(7). ISSN 2225-093X.

Jomaa LH, McDonnell E, Probart C (2011). School feeding programmes in developing countries: Impacts on children's health and educational outcomes. **Nutrition Reviews**; 69(2):83-98. doi.10.1111/j.1753-4887.2010.00369.

Kambondo G, Sartorius B (2018). Risk factors for obesity and overfat among primary school children in Mashonaland West Province, Zimbabwe. **International Journal of Environmental Research and Public Health**; 15(2):249. doi:10.3390/ijerph15020249

Kazianga H, de Walque D, Alderman H (2009). **Educational and Health Impacts of Two School Feeding Schemes: Evidence from a Randomized Trial in Rural Burkina Faso**. Policy Research Working Paper 4976. Washington: World Bank. doi.org/10.1596/1813-9450-4976.

Kimani-Murage EW, Holding PA, Fotso J-C, Ezech AC, Madise NJ, Kahurani EN, Zulu EM (2010). Food Security and Nutritional Outcomes among Urban Poor Orphans in Nairobi, Kenya. **Journal of Urban Health**; 88(2). doi:10.1007/s11524-010-9491-z

Kwabla MP, Gyan C, Zotor F (2018) Nutritional status of in-school children and its associated factors in Denkyembour District, eastern region, Ghana: comparing schools with feeding and non-school feeding policies. **Nutrition Journal**; 17:8: doi:10.1186/s12937-018-0321-6

Lane K, Hovorka A, Legwegoh A (2012). Urban food dynamics in Botswana: Insights from Gaborone's Central Business District. **African Geographical Review**; 31(2):111-125. doi:10.1080/19376812.2012.715975.

Lee G, Ham OK (2015). Factors Affecting Underweight and Obesity Among Elementary School Children in South Korea. **Asian Nursing Research**; 9: 298e304

Legwegoh AF (2012). **Urban food security in Gaborone, Botswana**. Unpublished thesis. University of Guelph, Guelph, Ontario, Canada. <https://atrium.lib.uoguelph.ca/xmlui/handle/10214/3864> (Accessed 26 April 2019).

Letamo G (2011). The prevalence of, and factors associated with, overweight and obesity in Botswana. **Journal of Biosocial Science**; 43(1):75e84. doi.org/10.1017/S0021932010000519.

Levitsky DA (2005). The future of school feeding programmes. **Food and Nutrition Bulletin**; 26: s286 - s287.

Littlecott H, Moore GF, Moore L, Lyons RA, Murphy S (2016). Association between breakfast consumption and education outcomes in 9 – 11-year-old children. **Public Health Nutrition**; 19(9): 1575-1582.

Madondo A, MacIntyre UE, Ntuli B (2012). The clinical and anthropometric profile of undernourished children aged under 5 admitted to Nyangabgwe Referral Hospital in Botswana. **South African Journal of Child Health**; 6(4):123-127. doi:10.7196/SAJCH.450.

Mafela L, Maundeni T, Mookodi G (2011). Introduction: Socioeconomic development in Botswana. **Journal of Social Development in Africa**; 26(1):7-14.

- Majumder SL, Islam H, Hossen M, Uddin J, Hasan I, Talukder AR, Sarowar A, Rahman M, Sultana I (2017). Assessment of nutritional status using anthropometric methods: a study of rural and urban primary children in Coastal Belt of Bangladesh. **Biochemistry and Molecular Biology**; 2(5):54-59. doi:10.11648/j.bmb.20170205.11
- Makwinja-Morara V (2009). Female dropouts in Botswana junior secondary schools. **Educational Studies**; 45(5): 440–462. doi.org/10.1080/00131940903190493.
- Malongane F, Mbhenyane XG (2017). Nutritional status of children on the National School Nutrition Programme in Capricorn District, Limpopo Province, South Africa. **South African Journal of Child Health**; 11(1):11-15. doi:10.7196/SAJCH.2017.v11i1.1124
- Martins VJB, Toledo Florêncio TMM, Grillo LP, Franco MP, Martins PA, Clemente APG, Santos CDL, Vieira AA, Sawaya AL (2011). Long-lasting effects of undernutrition. **International Journal of Environmental Research and Public Health**; 8(6):1817-1846.
- Maruapula SD, Jackson JC, Holsten J, Shaibu S, Malete L, Wrotniak B, Ratcliffe SJ, Mokone GG, Stettler N, Compher C (2011). Socio-economic status and urbanization are linked to snacks and obesity in adolescents in Botswana. **Public Health Nutrition**; 14(12): 2260–2267. doi:10.1017/S1368980011001339.
- Mendoza JA, Matshaba M, Makhanda J, Liu Y, Boitshwarelo M, Anabwani GM (2014). Food Insecurity and CD4% among HIV+ Children in Gaborone, Botswana. **Journal of Acquired Immune Deficiency Syndrome**. 66(4): 414-418. doi: 10.1097/QAI.0000000000000190
- Milledzi EY, Keney G, Amponsah MO (2017). Impact of School Feeding Programme on Access to Basic Education: The Case of South Tongu District of the Volta Region, Ghana. **International Journal of Education**; 9 (4): 103-117. doi: 10.5296/ije. v9i4.12124
- Moepeng P (2013). **Botswana National Primary School Feeding Programme: A Case Study**. https://www.researchgate.net/publication/318210413_Botswana_National_Primary_School_Feeding_Programme_A_Case_Study/download (Accessed 11 October 2018).
- Monteiro CA, Moubarac JC, Cannon G, Ng SW, Popkin B (2013). Ultra-processed products are becoming dominant in the global food system. **Obesity Reviews**; 14(2): 21–28.
- Monyeki MA (2014). Physical activity and health in children: How much do we know? **African Journal for Physical, Health Education, Recreation and Dance**; 20(2): 323-342.
- Mosha AC (2015). Urban agriculture in Botswana. **Commonwealth Journal of Local Governance**; 18: 4842. doi.org/10.5130/cjlg. v0i18.4842.
- Nabag (2011). Comparative Study of Nutritional Status of Urban and Rural School Girl's Children Khartoum State, Sudan. **Journal of Science and Technology**; 12 (02): 60 - 68.

Naeeni MM, Jafari S, Fouladgar M, Heidari K, Farajzadegan Z, Fakhri M, Karami P, Omidi R (2012). Nutritional Knowledge, Practice, and Dietary Habits among school Children and Adolescents. **International Journal of Preventative Medicine**; 5(2); S171–S178.

NASVI. **Defining street vendor**. <http://nasvinet.org/newsite/defining-street-vendors/> (Accessed 14 March 2019)

Nnyepi MS, Mmopelwa D, Cordjia P (2010). Child nutrition and household economic situation in the context of rising food prices: a baseline study in Mabutsane and Bobirwa. In: **ThariYaBana, Reflections of Children in Botswana 2010**. University of Botswana: UNICEF.

Nonato IL, de Almeida Minussi OL, Pascoal GB, De-Souza DA (2016). Nutritional issues surrounding street foods. **Journal of Clinical Nutrition and Dietetics**; 2(1):7. doi: 10.4172/2472-1921.100014

Nortje N, Faber M, de Villiers A (2017). School tuck shops in South Africa - an ethical appraisal. **South African Journal of Clinical Nutrition**; 30:3: 74 – 79. doi: 10.1080/16070658.2017.1267401

Ochola S, Masibo PK (2014). Dietary intake of schoolchildren and adolescents in developing countries. **Annals of Nutrition and Metabolism**; 64(2): 24-40. doi:10.1159/000365125.

Ogheneruese OJ, Joy E (2016). Gender Differences in Anthropometric Indices Among Primary School Children in Delta South-Senatorial District, Delta State Nigeria. **International Journal of Nutrition and Food Sciences**; 5(3): 22-223. doi: 10.11648/j.ijnfs.20160503.20

Pangani IS, Kiplamai FK, Kamau JW, Onywera VO (2016). Prevalence of Overweight and Obesity among Primary School Children Aged 8–13 Years in Dar es Salaam City, Tanzania. **Advances in Preventive Medicine**; Article ID 1345017. <http://dx.doi.org/10.1155/2016/1345017>

Pepino S (2014). **Nutrition, Education and Awareness Raising for the Right to Adequate Food. Thematic study**. FAO. <http://www.fao.org/right-to-food/resources/resources-detail/en/c/271824/> (Accessed 11 November 2018).

Raboloko M, Molebatsi K (2016). Time series modelling of inflation in Botswana using monthly consumer price indices. **Canadian Center of Science and Education**; 8(3): 15-22.

Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS (2015). Childhood obesity: causes and consequences. **Journal of Family Medicine and Primary Care**; 4(2):187 – 192.

Schönfeldt HC, Hall NG (2012). Dietary protein quality and malnutrition in Africa. **British Journal of Nutrition**; 108, S69–S76. doi:10.1017/S0007114512002553.

Shaibu S, Holsten JE, Stettler N, Maruapula SD, Jackson JC, Maletle, L, Mokone G, Wrotniak BH, Compher CW (2012). Adolescent Obesity Prevention in Botswana: Beliefs and

Recommendations of School Personnel. **The Journal of School Nursing**; 28(3) 220-229. doi: 10.1177/1059840511429003.

Simeon NA, Linus IA, Chukwunonye AE, Chidimma NN, Mmaduneme OK, Emeka OM, Grace EK, Chidiebere AC, Amara EC, Chetachukwu AC, Dabeluchukwu AE (2015). Assessment of nutritional status among primary school pupils in rural and urban areas of Anambra state. **European Journal of Preventive Medicine**; 3(2): 34 – 38.

Soliman A, De Sanctis V, Elalaily R (2014). Nutrition and pubertal development. **Indian Journal of Endocrinology and Metabolism**; 18(1): S39 - S47.

Sylvere ZKYA, AlassaneK M, Howelé O, Theodor D, Gustave KK, Odile A-T, Séraphin K-C (2016). Impact of the nutritional status of the schoolchildren of Yopougon, Town of the District Abidjan (Côte D'Ivoire) on their school performance. **International Journal of Nutrition and Food Sciences**; 5(6): 407 – 412. doi: 10.11648/j.ijnfs.20160506.16

Tapera R, Merapelo MT, Tumoyagae T, Maswabi TM, Erick P, Letsholo B, Mbongwe B (2017). The prevalence and factors associated with overweight and obesity among University of Botswana students. **Cogent Medicine**; 4: 1357249. doi.org/10.1080/2331205X.2017.1357249

Tawodzera G, Riley L, Crush J (2016). The Return of Food: Poverty and Urban Food Security in Zimbabwe after the Crisis. African Food Security Urban Network (AFSUN) Food Security Series, (22). <https://www.alnap.org/system/files/content/resource/files/main/afsun22.pdf> (Accessed 26 April 2019).

The South African (2015). **Sausages**. <https://www.thesouthafrican.com/6-south-african-foods-that-the-rest-of-the-world-knows-as-actual-things/> (Accessed 14 March 2019).

Uchendu FN, Abolarin TO (2015). Corrupt practices negatively influenced food security and live expectancy in developing countries. **Pan African Medical Journal**; 20:110. doi: 10.11604/pamj.2015.20.110.5311

UNDP (2009). **Assessment of Development Results: Evaluation of UNDP Contribution. Botswana**. <https://www.oecd.org/countries/botswana/46818033.pdf> (Accessed 20 October 2018).

UNICEF (2018). **UNICEF Global Databases: Infant and Young Child Feeding**. UNICEF, Division of Data Research and Policy, New York. <https://data.unicef.org/topic/nutrition/infant-and-young-child-feeding/> (Accessed 11 March 2019)

UNICEF (2017). UNICEF Annual Report 2017. Botswana. https://www.unicef.org/about/annualreport/files/Botswana_2017_COAR.pdf (Accessed 11 March 2019)

- UN (2015). **The Millennium Development Goals Report 2015**. [http://www.un.org/millenniumgoals/2015 MDG Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf) (Accessed 11 October 2018).
- UNICEF (2013). **Improving child nutrition, the achievable imperative for global progress**. https://www.unicef.org/nutrition/files/Nutrition_Report_final_lo_res_8_April.pdf (Assessed 15 March 2019).
- UNSCN (2017). **Schools as a System to Improve Nutrition: A new statement for school-based food and nutrition interventions**. <https://www.unscn.org/uploads/web/news/document/School-Paper-EN-WEB.pdf> (Accessed 14 March 2019).
- Uwameiye BE, Salami LI (2013). Assessment of the Impact of the UNICEF Supported School Feeding Programme on Attendance of Pupils in Federal Capital Territory. **International Journal of Academic Research in Progressive Education and Development**; 2 (1). 209 – 218.
- WHES (2016). **Africa hunger facts, Africa poverty facts- world hunger news**. <https://www.worldhunger.org/world-child-hunger-facts/> (Accessed 5 April 2019)
- WHO (2019). **BMI classification**. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html (Accessed 14 March 2019)
- WHO (2013). **Essential Nutrition Actions: improving maternal, new-born, infant and young child health and nutrition**. WHO Document Production Services. Geneva, Switzerland. https://www.who.int/nutrition/publications/infantfeeding/essential_nutrition_actions/en/ (Accessed 26 April 2019)
- WHO (2018). **Global action plan on physical activity 2018-2030**. <https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf?ua=1> (Accessed 11 March 2019).
- WHO (2010). **Global status report on non-communicable diseases 2010**. World Health Organization. http://www.who.int/nmh/publications/ncd_report_full_en.pdf (Accessed on 27 October 2018).
- WHO (2018). **Obesity and Overweight**. <http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweigh> (Accessed on 20 October 2018)
- WHO (2016). **Report of the Commission on Ending Childhood Obesity**. http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_8-en.pdf (Accessed 21 March 2019).
- WHO (2017). **The Double Burden of Malnutrition**. Policy brief. Geneva: World Health Organization.

Wiles N, Veldman F (2013). Tuck-shop purchasing practices of Grade 4 learners in Pietermaritzburg and childhood overweight and obesity. **South African Journal of Clinical Nutrition**; 26(1):37 – 42.

Wolde M, Berhan Y, Chala A (2015). Determinants of underweight, stunting and wasting among schoolchildren. **BioMedical Central Public Health**; 15:8. doi:10.1186/s12889-014-1337-2.

World Bank (2015). **Botswana poverty assessment**. Poverty Global Practice Africa Region. <http://documents.worldbank.org/curated/en/351721468184754228/Botswana-poverty-assessment> (Accessed 25 April 2019).

Wrotniak BH, Maletle L, Maruapula SD, Jackson J, Shaibu S, Ratcliffe S, Stettler N, Compher C (2012). Association between socioeconomic status indicators and obesity in adolescent students in Botswana, an African country in rapid nutrition transition. **Pediatric Obesity**; 7(2); e9ee13. <http://dx.doi.org/10.1111/j.2047-6310.2011.00023.x>.

Zhang N, Bécáres L, Chandola T (2016). Patterns and determinants of double-burden of malnutrition among rural children: Evidence from China. **PLoS ONE**; 11(7): e0158119. <https://doi.org/10.1371/journal.pone.0158119>.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

To underpin the research objectives formulated in Chapter 1, the literature review will provide insight into the factors that affect the anthropometric status of primary school learners, as well as the role that SFPs play in addressing learner undernutrition. These variables are presented in the following conceptual framework in Figure 2.1:

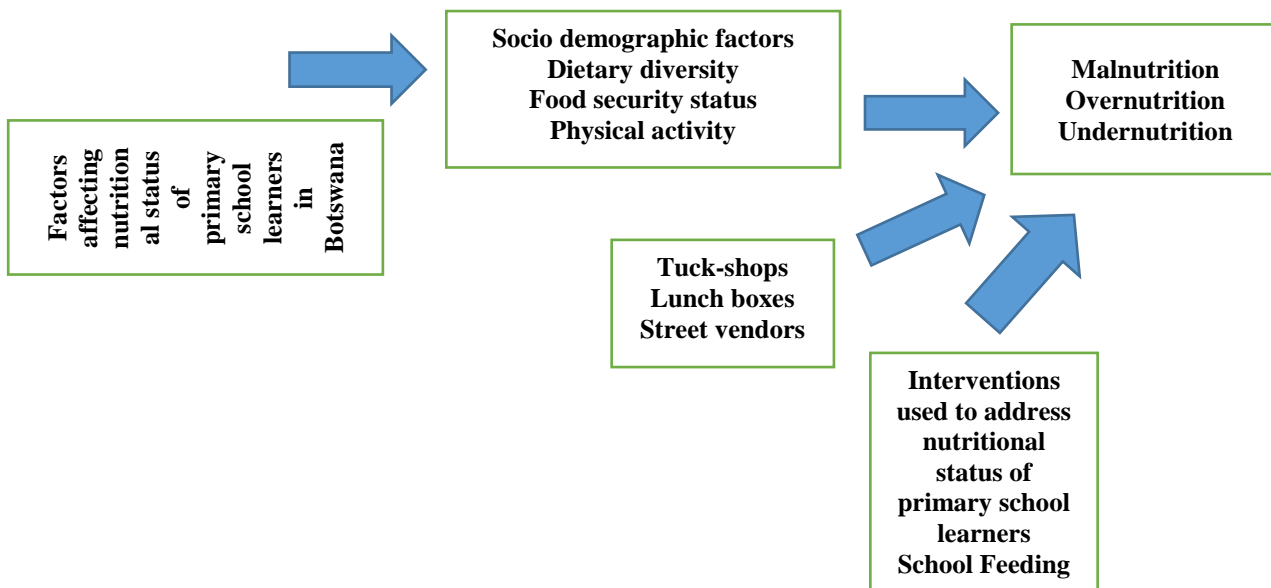


Figure 2.1: Conceptual framework for literature review

Source: Eluya (2019)

This chapter provides an overview of the factors that influence primary school learner's anthropometric status, followed by background information regarding Botswana. This will be followed by providing an overview of SFPs implemented in other countries with reference to benefits derived from such interventions. Studies that have investigated the physical activity of school children will also be reported. Lastly, an overview of studies investigating the SFPs delivered in low-income countries such as Ethiopia, Malawi and Tanzania will be provided.

Nutrition is a basic human right for all humans, including children, as is stated in the “Convention on the Rights of the Child” and other human rights agreements (UNICEF, 2004). The nutritional status of children depends on the quality of their nutrient intake and the body’s ability to utilize those nutrients (Tigga & Sen, 2016). It is therefore not surprising that one of the major factors that have an influence on the nutritional status of children, is their diet (Eggersdorfer *et al.*, 2016), as a diet that meets their energy and nutrient requirements is important for optimal growth and cognitive development (Annim & Imai 2014; Shepherd *et al.*, 2005). In addition, an excessive as well as inadequate dietary intake may contribute to overnutrition and undernutrition respectively (WHO, 2018).

School going children spend most of their day at school and social determinants at school such as friends, can have an impact on childhood eating habits that can continue into adulthood (Du Plessis, 2011). The relationship between learner nutritional status and academic performance is a well-researched (Lee & Manan, 2014; Ong *et al.*, 2014; Mhurchu *et al.*, 2013). In addition, learners are nutritionally very vulnerable. Hence, their dietary habits can have an immediate impact on their health as well as academic performance (Choudhury, 2018; Ruel, 2003). This implies that inadequate nutrition negatively affects learner health and academic success, especially those who grow up in developing countries where the diet is predominately starch-based with poor dietary diversity (Choudhury, 2018).

It would seem that there is a paucity of data regarding the dietary intake of primary school learners in Botswana, as well as the extent to which their dietary intake has an impact on their anthropometric status. As indicated earlier, good nutrition is essential throughout the lifecycle, but especially so during childhood, as it facilitates the achievement of optimal health, growth and cognitive development (Munthali *et al.*, 2014).

The South African Food-based Dietary Guidelines (2013), defined healthy eating as the consumption of a variety of foods in their correct proportions to help achieve and maintain a healthy weight, promote health, and prevent chronic disease (Vorster *et al.*, 2013). Dietary diversity on the other hand is defined as the number of different foods or food groups consumed over a given reference period and is a commonly used as a proxy to assess dietary quality in low-

income countries (Workicho *et al.*, 2016). It can therefore be used as a proxy of nutrient adequacy of individuals (Swindale & Bilinsky, 2006).

Due to the fact that many children are picky eaters, they may often have a limited dietary diversity and may therefore not have an adequate dietary intake to meet their energy and nutrient requirements (Chao, 2018). In the majority of rural settings, many children often walk long distances to get to school, as well as having to contribute to physically demanding household chores (Workicho *et al.*, 2016). As a result, they have to leave home early without eating breakfast. The latter can have a negative impact on their school performance (Danquah *et al.*, 2013).

2.2 Factors influencing dietary habits

There are numerous factors that influence dietary habits. These include the physical environment, macrosystem influences, social environmental influences and individual influences (Banna *et al.*, 2016; Story *et al.*, 2008; Story *et al.*, 2002). A study conducted by Brown *et al.*, (2015), suggested that in Botswana, children's food choices are influenced by time constraints, location where food is consumed and who children are with when they eat. In addition, despite being knowledgeable about healthy food choices, adolescents tend to prefer unhealthier choices due to time constraints, peer and family influences (Brown *et al.*, 2015). Learners have more freedom to make their own food choices at school than at home. However, these choices are often limited by the availability of especially healthy foods. Hence, the school environment plays an important role in shaping learner eating habits (Deliens *et al.*, 2014; Moore & Tapper, 2008; Cullen *et al.*, 2007). During the school term, children spend most of their waking hours at school. This means that their dietary intake at school will have an impact on their overall nutritional status (Velazquez *et al.*, 2017). Foods provided by school tuck-shops or through SFPs, are often missed opportunities for learners to acquire knowledge regarding healthy eating habits to complement the meals they eat at home. As a result, school-based settings for the procurement and consumption of food can be used to reinforce lessons regarding healthy nutrition that have been taught in class (Sadegholvad *et al.*, 2017).

A study conducted by Kim *et al.*, (2012) in South Korea, found that contrary to popular belief, learners do purchase healthy food options if it is made available to them. However, a study conducted by Bekker *et al.*, (2017) in South Africa, found that younger learners tend to be more accepting of healthy tuck-shop options than older learners. There is convincing evidence that SFPs improve learner dietary diversity by adding various food groups to their diet (Zenebe *et al.*, 2018; Bundy *et al.*, 2009). However, food items sold in and around schools during school hours, play an important role by serving as a source of refreshment and contributing to learner energy requirements (Mahreen *et al.*, 2010). Unfortunately, the majority of foods sold at tuck-shops are often snacks and fast foods that provide empty calories (Wiles *et al.*, 2011).

A South African study found that school lunch boxes made a positive contribution towards an adequate nutrient intake when compared to the usually unhealthy foods sold at tuck-shops and vendors (Abrahams *et al.*, 2011). Findings from the same study, also established that younger learners are more likely to bring a lunch box to school than older learners. Unlike developing countries, the availability of vending machines in higher income countries, have also been shown to contribute to a shift in learner's food choices from healthy school meal options to attractive unhealthy options (Oostindjer *et al.*, 2017). It has also been documented that parents of a low socio-economic status (SES) packed school lunch boxes based on convenience, child preference, cost, and accessibility instead of nutritional value (Lindberg *et al.*, 2016; Bathgate & Begley, 2011).

Despite the availability of healthy food options, a study conducted among adolescents attending private schools in Botswana, documented that learners from a higher SES were more likely to have a higher prevalence of overweight (OW) and obesity (OB) when compared to those attending public schools (Wrotniak *et al.*, 2009), while Scaglioni *et al.*, (2018), found that children with parents who have a higher level of education and SES, were more likely to consume healthier foods.

A study conducted by Shaibu *et al.*, (2011) in Botswana, reported that members of staff from public schools indicated that the majority of learners do not like the food provided through SFPs and rather opt to purchase food sold at tuck-shops. However, a study conducted among grade four

learners in South Africa by Wiles *et al.*, (2013), concluded that poor tuck-shop purchasing practices may contribute to the development of childhood overweight and obesity among learners.

Qualitative research conducted by Bathgate & Begley (2011) among parents of young children with a low SES, documented that poor nutrition knowledge due to limited formal education was a major factor contributing to poor food choices that were included in children's lunch boxes. To feed children effectively and appropriately, parents require some nutritional knowledge (Scaglioni *et al.*, 2018). A study by Ashok *et al.*, (2014), conducted in India, found that children enrolled in private schools and were of a higher SES, were better nourished compared to learners from government schools who were of a lower SES.

Another factor that has an impact on children's eating habits outside the school environment is screen time, as children spend a significant amount of time watching television (TV). It was found that food advertising targets children by promoting unhealthy foods during children's peak viewing times (Gonçalves *et al.*, 2014). However, according to Gonçalves *et al.*, (2018), Banna *et al.*, (2016) and Horne *et al.*, (2004), children who watch programmes that promote healthy eating, made healthier food choices. On the other hand, watching TV encourages a sedentary behaviour if viewing time is not regulated. However, targeted age appropriate programmes, can be used to educate children on cultivating lifelong healthy eating habits (Horne *et al.*, 2004).



Figure 2.2: Snacks sold close to a primary school in Gaborone, Botswana

Source: Eluya (2017a)

In developing countries, undernutrition often co-exists with OW/OB (Abdullah, 2015). Some of the factors that contribute to undernutrition among school-aged learners, include suboptimal dietary intakes, food insecurity, communicable diseases and infections (De Onis *et al.*, 2012). As is illustrated in Figure 2.2, it is not unusual to observe informal tuck-shops that predominantly sell unhealthy foods such as sweets, hotdogs and chips in close proximity to primary schools in Gaborone.

Despite the increased prevalence of OW and OB among school-aged children, undernutrition remains a serious public health problem in Sub-Saharan Africa (FAO, 2017). A study conducted by Degarege *et al.*, (2015) among learners in Ethiopia, found a high prevalence of undernutrition (19.6% stunting and 15.9% underweight respectively), especially among those from large families with limited household amenities. Among rural learners in Ghana, the prevalence of stunting is significantly associated with participation in SFP, that is children not participating in SFP were 38.3% less likely be stunted than those in schools on feeding programme (Prince & Laar, 2014).

Children's level of physical activity (PA) also has been shown to have a direct impact on their nutritional status (Müller *et al.*, 2019; Yulia *et al.*, 2018; Mogre *et al.*, 2013). Benefits of physical activity and health of children is a well-researched area (Gao *et al.*, 2018; Demetriou *et al.*, 2017; Watson *et al.*, 2017). The PA Guidelines Committee (2018) defines PA as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a resting level. Similar to adults, regular PA in children is recognized as an important lifestyle habit for the primary prevention of OW and OB (Physical Activity Guidelines Advisory Committee, 2018). Previous studies have found that learners from private schools are more likely to be classified as OW and OB compared to those attending public schools (Muthuri, Francis & Wachira 2014). A study conducted in Botswana by Wrotniak *et. al.* (2011) among adolescent private school learners found a significantly higher prevalence of OW and OB when compared to learners from public schools. As described by Popkin (2015), this may be because the country is going through nutrition transition, characterised by large shifts from a typical traditional diet to unhealthy diets and sedentary lifestyles. Although evidence exists that regular PA and sport have a positive effect on the physical and mental health of children, it has been found that the children, especially from a low SES in high income countries, do not engage in the recommended levels of physical activity

(Huang *et al.*, 2019). Research has linked participation in PA to improved academic performance in children (Singh *et al.*, 2012), in addition to promoting healthy bones and muscles, improvement in muscular strength and endurance, and improved self-esteem (PA Guidelines Advisory Committee, 2018).

Primary school learners typically engage in free play, running and chasing games, jumping rope, as well as age-appropriate sports that are aligned with the development of fundamental motor skills (CDC, 2010). However, these types of activities are increasingly being replaced by additional screen time such as video games, social media and watching TV. Children from urban compared to rural settings in lower and middle-income countries have been found to be less physically active (Elgar *et al.*, 2015; Muthuri *et al.*, 2014). The traditional *Batswana* (natives of Botswana) way of living forced people to engage in regular PA by working the fields, walking long distances and ploughing. This however, has been replaced by motorized transport and more urbanized lifestyles.

Several studies have established that parental level of PA has a positive impact on the PA levels of their offspring (Bronikowski *et al.*, 2016; Drenowitz *et al.*, 2014; Horsely & Oliver, 2013). The implication therefore is that parents have the ability to directly and indirectly influence the PA levels of their children, as the more physically active parents are, the more their children will mirror their behaviour (Chiarlitti & Kolen, 2017). The latter has the potential of reducing their risk for becoming overweight or suffering from obesity. Parents can also indirectly contribute to an increased level of PA by supporting their children's participation in PA through encouragement and attending events and sports matches their children participate in (Paszkowski, 2015).

Other factors that contribute to the level of PA among children is the environment in which they live, or recreational facilities available to them, as these facilities, safe walkways and playgrounds have been shown to facilitate PA (Ding *et al.*, 2011; Davison & Lawson, 2006). The main reason why children participate in PA is usually not related to the health benefits, but rather the enjoyment of activities that are playful but engages them physically (Hyndman, 2013). It would seem that there is limited available research regarding children's level of PA and possible sedentary behaviour in Botswana. In South Africa, the results from the Healthy Active Kids South Africa (HAKSA) (2014) report card suggests that only 50% of the children surveyed were meeting the

recommendations for daily PA, while most were spending a large proportion of their awake time on screen time (Draper *et al.*, 2014). However, by 2016, the HAKSA PA score seems to have improved (Uys *et al.*, and the HAKSA 2016 Writing Group, 2016). This therefore means that children's level of PA and possible curbing of sedentary behaviour with appropriate interventions, play an important role when it comes to encouraging children to be more physically active. PA in Botswana school settings, usually focus around physical education (PE). The most popular sport in Botswana is soccer (Wood, 2014). In Botswana, play areas are available for younger children at some schools such as that illustrated in Figure 2.3.



Figure 2.3: Playground area at one of the urban schools in South-East District, Botswana

Source: Eluya (2017b)

2.3 Defining School Feeding Programmes

School feeding is defined as the provision of food on-site or to take home from school (Aliwar 2012). SFPs vary in design, implementation, management structures and can either be nationally owned or administered by international organisations using locally procured or home-grown in-school meals and snacks prepared at school, in the community or from centralized kitchens (WFP, 2018; Aliyah *et al.*, 2012). Home-grown school feeding is a broad based definition for SFPs where goods and services for meal preparation are procured from small-holding farmers and businesses, thus it can also be used as a strategy to ensure that school menus contain nutritious food that schoolchildren are familiar with (Kristjansson *et al.*, 2016). These meals are often provided free

of charge, unlike in developed countries, where school meals are sold at a subsidized price (Cullen & Chen, 2017). Countries like Uganda, the Food-for-education programme model is implemented that provides meals to learners, provided that they attend school (Korugyendo & Benson, 2011).

The benefits of SFPs are well researched (Mahama, 2018; Rassas *et al.*, 2018; Awuor, 2016). Initially the purpose was to combat hunger among learners (Devereux *et al.*, 2018). However, these programmes also provide educational and health benefits to the most vulnerable children (Khatete *et al.*, 2013; World Bank, 2012). World Food Programme (WFP) (2019) reports that an estimated 310 million school children in low- and middle-income countries eat a daily meal at school with about 18.3 million foods being provided through the WFP (WFP, 2017). The nutritional, social protection and educational benefits of SFPs have been extensively explored (Drake *et al.*, 2017).

There is increasing global interest in evaluating the effect of school meals on the nutritional status of school-age children, because they are common interventions designed to provide complimentary meals in addition to home meals to learners (Abizari *et al.*, 2014). In most developing countries, the high prevalence of food insecurity and nutrition-related problems such as undernutrition, highlights the importance of SFPs (Petralias *et al.*, & DIATROFI Program Research Team, 2016), as hungry children are at risk of becoming under nourished, in addition to having a compromised ability to learn as well as suffering from poor health (Fiorentino *et al.*, 2013). Schools serve as a suitable, conveniently accessible environment that can be used to promote healthy eating behaviours and attitudes among learners, thereby laying the foundation for future eating habits in adulthood (Ip *et al.*, 2017; United Nations System Standing Committee on Nutrition (UNSCN), 2017; Juwara *et al.*, 2016). The above is vitally important, as childhood is an important stage of the lifecycle for both physical and mental development (Kwabla *et al.*, 2018)

Despite the above, Owusu *et al.*, (2016), have found that the nutritional content of SFP menus often do not provide adequate variety due to seasonal variability, which in turn influences the availability of some food commodities. Owusu *et al.*, (2016) also indicated that menu flexibility has an advantage of meeting the nutritional needs of learners. However, a downside of SFP observed by Kristjansson *et al.*, (2016), was that beneficiaries were often rationed with home food

due to being fed at school. In another study conducted in Chile, SFP seem to show no effects of SFP on education outcomes (McEwan, 2013).

It is however evident that the school meals provided in developing versus developed countries, have noticeable differences. A study conducted in the United Kingdom assessed the contribution school meals make to overall food consumption and nutrient intake among learners aged 4 to 18 years. Findings were that food choices made at school, were less healthy than choices made outside the school environment (Nelson *et al.*, 2006).

2.4 Benefits of school feeding

SFPs have been shown to make an important contribution to the daily dietary intake and academic success of learners (Lukindo, 2018). In addition, it improves school enrollment and addresses nutritional status (Zenebe *et al.*, 2018; Taylor & Ogbogu, 2013), as well as providing a platform for implementing public health and nutrition interventions such as de-worming campaigns, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) education, hand-washing, micronutrient supplementation and psycho-social support (Leo 2010). Figure 2.4 summarizes how SFPs can impact on educational and nutritional outcomes.

A study conducted in numerous Sub-Saharan countries, documented that SFPs had a positive impact on school enrollment, especially for girls (Gelli, 2015), as was confirmed by earlier studies (Gelli *et al.*, 2007). A study conducted by Zenebe *et al.*, (2018), also showed that in addition to improving enrollment, SFPs also improved school attendance and reduced the drop-out rates of beneficiaries (0.9%) compared to non-beneficiaries (1.7%) among learners in Southern Ethiopia.

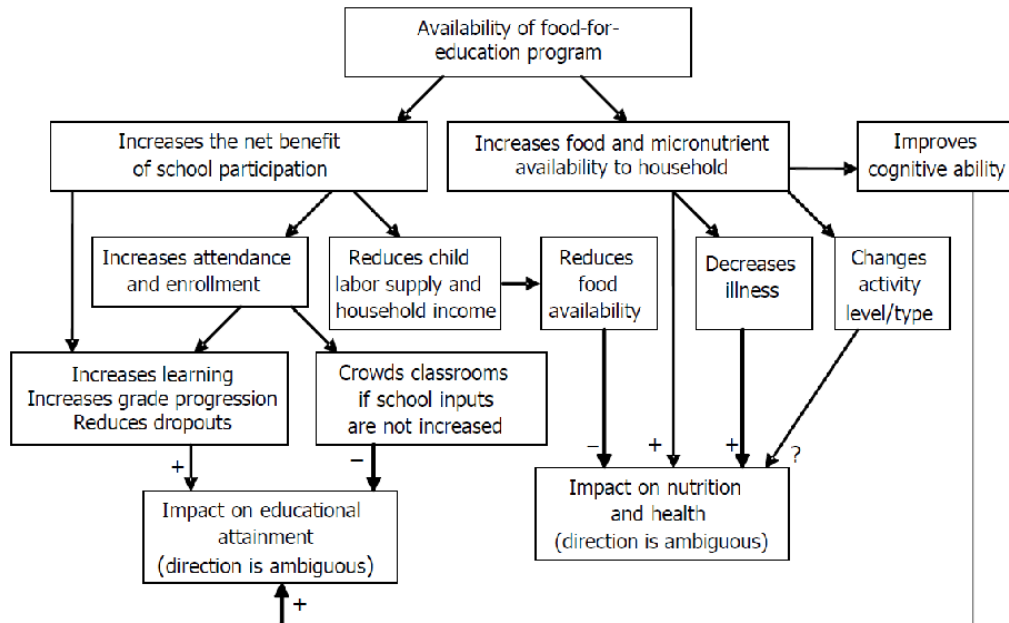


Figure 2.4: School Feeding Benefits

Source: Aldelman *et al.*, (2008)

There is convincing evidence regarding the benefits of SFPs on learning outcomes in developing countries (Jomaa *et al.*, 2011; Du *et al.*, 2004), although less evidence is available regarding the benefits obtained in developed countries (Belot & James, 2011). Although SFPs cannot reverse the outcome of earlier malnutrition, the provision of school meals can have a significant impact on the nutritional status of learners (Ogbole 2017; Nkhoma *et al.*, 2013). These benefits are especially tangible if the food is fortified with micronutrients (Fiorentino *et al.*, 2013). A systematic review of 18 studies conducted in Kenya, Jamaica, India, China and Indonesia, had difficulty in determining the clinical significance of conducting anthropometric measurements on children participating in SFPs as a measure of success, mainly due to a lack of available standards for weight and height gain in school aged children (Jomaa *et al.*, 2011; Kristjansson *et al.*, 2006). A study conducted in Ghana was also not able to demonstrate an improvement in nutritional status or a significant difference in nutritional status between participants and non-participants of SFPs (Danquah *et al.*, 2012).

An overall adequate diet, and not only participation in a SFP, should ensure that all nutrient requirements are met in order to protect the current and future health of learners (Falade *et al.*, 2012), as malnourished children have a diminished capacity to learn (Grantham-McGregor & Onley, 2016; Black, 2013). The latter is related to hungry children becoming easily distracted and having difficulty of concentrating in class (Gelli, 2010). In addition, compromised education accomplishments have been described as the most detrimental factor responsible for poverty (Payandeh *et al.*, 2013). Results from a study conducted in Jamaica, found that SFPs contributed to improved cognitive function among undernourished children when compared to those who are well nourished, as no effect on cognitive function was noted in the latter group. Undernourished children also performed better academically after they received breakfast ($P < 0.01$), whereas a change in score could not be demonstrated among adequately nourished children (Grantham-McGregor *et al.*, 1998). In addition, the negative effect of hunger on learners and their behaviour is well researched (Ayogu *et al.*, 2018). Hunger is a proven barrier to basic education (Mwambene *et al.*, 2013). A study conducted by Kristjansoon (2009), demonstrated that learners who often go to school hungry, are not well behaved in class. In addition to the potential for improving nutritional status, school meals also promote social interaction between learners and teachers, and serve as a practical learning opportunity regarding the role of food and social interactions which are important for children's emotional development (Cervato-Mancuso *et al.*, 2013). The latter authors also state that as children develop and learn through meals, it can also positively influence and encourage other family members at home to eat healthily.

Another benefit of SFPs that has been well researched, is school enrolment. Several studies have yielded convincing evidence regarding the positive impact of SFPs on school enrolment (Yendaw & Dayour, 2015), school attendance and a reduction in dropout (Akanbi & Alayande, 2011; Bundy *et al.*, 2009; Gelli *et al.*, 2007).

SFPs target vulnerable learners including those from very poor backgrounds, girls and children affected by HIV (Rassas *et al.*, 2018). In addition, Vinueza *et al.*, (2016), indicated that school gardens are useful educational tools as they can be used to influence the eating habits and practices of students. Furthermore, Soares *et al.*, (2016) explored the use of food produced by family farms on school menus of the SFP in southern Brazil and established that family farms can be viewed as

a source of healthy foods in school meals. The authors further explained that family farms can help with the provision of fresh food to SFPs at limited transport costs, as the farms are often located in relative close proximity to the school. In addition, family farms help with the provision of natural and organic foods which promote good health (Soares *et al.*, 2016). This has improved the quality of school meals, particularly the availability of fruits and vegetables increased (Sidaner, Balaban & Burlandy, 2012). As the prevalence OW and OB has been on the rise, it has been established that schools can help to reverse this situation through SFPs by providing healthy food to learners (WHO, 2013; WHO 2004). In addition, the produce from family farms can be used to bring about change in learner eating habits through SFPs (Soares *et al.*, 2016).

The objective of SFPs is not only to achieve educational goals, but to serve as a source of employment for local farmers and cooks (Grantham-McGrego *et al.*, 2005). Studies have shown that local farmers and other local businesses often benefit by selling food commodities to the government for use in SFPs (Yunusa *et al.*, 2012; Garram Children's School, 2010). Despite all the documented benefits of SFPs, its sustainability has been questioned (Oostindjer *et al.*, 2017).

2.5 History of SFP in Botswana

The Botswana government has successfully implemented its national school feeding program on a continuous basis over the past 45 years, resulting in a growth in enrollment and school attendance rates (World Bank, 2016). The SFP falls under the auspices of the Ministry of Local Government and Rural Development. As is the case with SFPs in other countries, a study conducted by the Botswana Institute for Development Analysis (BIDPA) (2013), also reported on the positive impact SFPs have on school enrollment and school attendance. However, despite the high enrolment rates at primary school level, a high number of children drop out of secondary school [United Nations Development Programme (UNDP), 2009].

The SFP was started around the time Botswana gained its independence in 1966 as one of the coping strategies to address widespread problems of malnutrition and hunger alleviation among school going children during a drought stricken period (BIDPA, 2013; Aliyar *et al.*, 2012). Another advantage of SFPs in Botswana is that it has been able to provide a source of employment to local

communities and generate income for local farmers (Grantham-McGregor & Smith, 2016). Data from the 2013 estimate is that there are 331 000 beneficiaries of the SFP in Botswana, providing learners with at least one meal per day, with a second meal being offered to children in Remote Area Districts (RADs) (FAO, 2013). Food items provided by Botswana SFPs include sorghum porridge served with beans or canned meat stew, alternating with bread, peanut butter and milk, and samp and beans as indicated on APPENDIX O. Privately owned schools, also known as English Medium Schools, do not participate in the SFP (BIDPA, 2013). As a result, learners are reliant on tuck-shops, lunch boxes and street vendors as a source of nutrition during the school day (BIDPA, 2013).

In 2001, an Inter-Ministerial Taskforce carried out a review of the menu used in the SFP. Findings generated by the report were that the menu was inadequate in terms of quality and quantity. In addition, the United Nations System Standing Committee on Nutrition [UNSCN] (2017) also confirmed these programme gaps that are summarized in Table 2.1.

Table 2.1: SFP gaps identified by the Government of Botswana, Ministry of Local Government and Rural Development (2013)

Study number	Programme gaps	Recommended activities to address identified gaps
1.	Inadequate menu composition	<ul style="list-style-type: none"> Conduct baseline studies to determine food and nutrition situation in Botswana including the prevalence of communicable and chronic diseases of lifestyle.
2.	Menu not regionally reflective in terms of variation and acceptability	<ul style="list-style-type: none"> Identify food availability and possible integration into menu focusing on variation and acceptability. Develop food composition data for Botswana Adapt ration design tool for menu and cost planning purposes
3.	Guidelines for school feeding outdated	<ul style="list-style-type: none"> Review and update SFP guidelines in terms of food safety, menu, procurement and management.
4.	Training cooks and other role players within the supply chains	<ul style="list-style-type: none"> Train cooks on health and safety standards to effectively use existing supporting infrastructures
5.	Procurement system requires improvement	<ul style="list-style-type: none"> Explore different procurement options and modalities to allow the SFP to benefit more smallholder suppliers. Review coordination mechanisms in relation to the various procurement agencies Create efficiency in the procurement system to avoid delays
6.	Enhance the link between producers and school feeding markets	<ul style="list-style-type: none"> Disseminate procurement guidelines to suppliers
7.	Present guidelines for procurement of agricultural produce is limited to <i>Letlhafula</i> (seasonal harvest period)	<ul style="list-style-type: none"> Revise guidelines to accommodate all produce
8.	Need to enhance storage and food safety	<ul style="list-style-type: none"> Upgrade the existing storage systems/condition
9.	Improve infrastructure/ logistics	<ul style="list-style-type: none"> Enhance availability and maintenance of vehicles for transporting food, ensure kitchens are well equipped, maintained and utilized
10.	Weak monitoring and evaluation system	<ul style="list-style-type: none"> Develop Monitoring and Evaluation unit
11.	No school feeding policy.	<ul style="list-style-type: none"> Design policy to guide implementation of SFP Review all existing relevant sector policy and strategy documents to identify the corresponding objective that can feed into a school feeding policy (e.g. revised national policy for rural development (RNPRD), National Food Strategy

The Botswana SFP has stakeholders who are key in the implementation of the programme at various levels (Table 2.4). School rations are calculated and distributed in the form of cooked meals. The daily ration per child presented in Table 2.2 is guided by the menu (**APPENDIX O**). However, there are challenges regarding the ration as it should include more fruits and vegetables (UNSCN, 2017). The menu has now started to include breakfast since 1st April 2019 as per circular correspondence from Ministry of Local Government and Rural Development (**APPENDIX P**). The details regarding this new development is however lacking the portion sizes or the

implementation plan. In order to calculate the weight of food needed for the school meal, the weight of the ration is multiplied by the number of children to be fed in a particular school.

Table 2.2: Food rations used in the Botswana SFP

Commodities	Measurements
Sorghum porridge	100g (raw)
Samp	100g (raw)
Stewed beef (canned)	100g (raw)
Bread (white or brown)	3 slices
UHT milk	340ml
Jam	45g
Peanut Butter	45g

Source: Government of Botswana, Ministry of Local Government and Rural Development (2013)

The food is prepared in often well-equipped kitchen facilities (Figure 2.5 & Figure 2.6). It was however observed by the researchers that older children are often given duty of dishing out cooked meals although under supervision of the class teachers (Figure 2.7). This may be may still interfere with the intended ration portions (under or overestimating). It can also cause the food to run out or left over.



Figure 2.5: Example of a primary school kitchen in Botswana

Source: BIDPA (2013)



Figure 2.6: Example of well-resourced school kitchen
Eluya (2019)



Figure 2.7: School children dishing out school meals
Source: Eluya (2018)

2.6 Between country comparisons

This section examines school meal provision in high-income countries, middle-income countries and low-income countries respectively. The purpose of this comparison is to determine whether there are any similarities regarding the implementation, delivery and nutritional assessment of food items between countries. SFPs in almost all countries, especially in low-middle income countries have been established with the aim of providing educational and nutritional benefits (Neervoort *et al.*, 2013). In high income countries the main focus is on improving the nutritional quality of the dietary intake of children (Bundy *et al.*, 2009). In relation to the above, the school food environment contributes to learners' overall dietary intake. Hence lunch boxes, meals provided through SFPs, school tuck-shops, and food items that can be purchased from street vendors, must be critically evaluated. However, it cannot be contested that learners are exposed to unhealthy food options in the school environment (Nortje *et al.*, 2017). Nortje *et al.*, (2017) argue that learners may be reluctant to buy healthy food options, resulting in a profit loss to the vendor who are often from resource-limited settings. However, for the purpose of this study, the focus will be on the SFPs and no other available options in the school environment.

Numerous governments in developing countries implement SFPs (also referred to as school lunch programs) as a way of addressing a high prevalence of malnutrition, short term hunger, school enrollment, absenteeism and dropout. As the aims of SFPs differ according to country, this part of the literature review will distinguish between SFPs in high-, middle-, and low-income countries. As illustrated in Figure 2.5, in some countries like Canada and Norway, there are no national SFPs (Oostindjer *et al.*, 2017). Table 2.1 also compares SFPs between selected countries of different economic levels.

2.6.1 SFPs in low income countries

In this section, the focus will be on SFPs in low income countries, specifically Malawi and Tanzania as per World Bank (2017) criteria. Unlike Botswana where the current study was conducted, the World Food Programme (WFP) is the main provider of school meals in Malawi to an estimated 954 669 primary school learners since 1999 (WFP, 2018). WFP (2018) reports that other sponsors include organizations like German Technical Cooperation (GTZ) and Action Aid.

The programme is administered by the district education managers and local schools (Nkhoma *et al.*, 2013). Malawi also has a Home Grown School Meals (HGSM) programme, whereby food used by the SFP is sourced locally, thereby providing food to learners timeously and creating an awareness about the use of locally produced food (WFP, 2018). Under this SFP, a daily ration of corn soy blend (CSB) porridge is provided to all school children in the selected schools (Nkhoma *et al.*, 2013). In Malawi, a study that assessed the prevalence of hunger using self-reported data, found that there was a higher prevalence in rural areas (18.9%) compared to 8.3% in urban areas (Mwambene *et al.*, 2013).

Tanzania is one of the poorest countries in Sub-Saharan Africa (Lukindo, 2018; World Bank, 2015). Undernutrition remains prevalent among primary-school-aged children in Tanzania [United States Agency International Development (USAID)], 2018; Action Against Hunger, 2017; Teblich *et al.*, 2017). A school-based cross-sectional study conducted in northern Tanzania among 1,379 primary school learners by Teblich *et al.*, (2017), found that 23.7% of children suffered from at least one form of undernutrition. In this study the prevalence was similar between males and females. The results correlated with another cross-sectional study that was conducted among a larger sample size targeting 150 000 children aged 8 to 13 years attending both government and private primary schools in Dar Es Salaam. Findings revealed a 15.9% prevalence of OW and 6.7% OB (Pangani *et al.*, 2016). These findings therefore confirm the double burden of malnutrition in Tanzania. The SFP in Tanzania was established in 1956 and is currently active in several regions, with the main objectives of increasing school enrolment and attendance in primary schools (Lukindo, 2018). WFP is in the process of implementing Home Grown School Feeding with the government of Tanzania (WFP, 2019).

2.6.2 SFPs in lower-middle-income economies

Ghana and Nigeria can be classified as countries with lower-middle-income economies (World Bank 2017). Ghana was one of the first African countries to develop an implementation plan for a home grown SFP in 2004 (Fisher, 2007). Fisher (2007) also reported that the SFPs were initiated in 1958 through the Catholic Relief Service (CRS) and the WFP. This programme aims at improving school enrolment, school attendance and to give all primary and pre-school children in remote areas a daily balanced meal (Aliyar *et al.*, 2012). It is however worth noting that in some

studies, despite the implementation of school feeding, the prevalence of stunting and thinness was found to be higher among SFP beneficiaries, while the prevalence of OW was higher among non-SFP beneficiaries (Prince & Laar, 2014). This finding may imply that SFP beneficiaries are often from resource-limited settings as well as from lower SES households that are at risk of developing malnutrition in the form of undernutrition.

Just like Uganda and Botswana, Ghana implemented HGSP. However, it was found to be difficult to link school feeding demands to smallholding farmers and women's groups (Gelli *et al.*, 2016). The latter authors also alluded to the fact that SFPs can influence school attendance and learning, as well as a child's physical and psychosocial health. Owusu *et al.*, (2016) reported that SFPs in Ghana aimed at improving the nutritional status of school children by detaching hunger and its effects on nutritional status from the ability to learn.

In addition, the Ghana School Feeding Program (GSFP) is a Comprehensive Africa Agricultural Development Program (CAADP) with the aim of improving food consumption and eliminating hunger and poverty while promoting primary school education (Bukar *et al.*, 2015). Kwabla *et al.*, (2018), added that the government of Ghana entered into a partnership with the Dutch Government with the aim of using SFPs to enhance the nutritional status of school-aged children.

The Federal Government SFP in Nigeria provides all primary school learners with one meal per day, with the goal of improving health, increasing school enrolment, retention and completing primary school education (Falade *et al.*, 2012). In addition, Falade *et al.*, (2012) explained that the Nigerian SFP aims to provide one school meal per day to all primary school learners, with goals such as improving health, increasing enrolment, increasing retention figures as well as the completion of a primary school education.

2.6.3 SFPs in upper-middle-income economies

South Africa, Botswana and Malaysia are referred to as countries with upper-middle-income economies (World NSNP) was started in 1994 as the SFP which aim of providing relief in the most poverty stricken areas (Aliyar *et al.*, 2017). For the implementation of the South African school feeding programme referred to as the National School Nutrition Programme (NSNP), the Department of Education in conjunction with the Department of Health, plan 22 menus that each province chooses from, depending on social acceptance, availability and cost (Aliyar *et al.*, 2012).

Devereux *et al.*, (2018) indicated that the major goals of the NSNP include nutrition education, deworming and sustainable food production. The authors further explained that school food gardens can improve children's intake of fruit and vegetables, in addition to serving as outdoor classrooms. The latter authors also explained that in 1994, the Peninsula School Feeding Association (PSFA) was replaced by the NSNP whose main goals are food security and education.

In Botswana, school feeding was designed to enable school children to get a meal of an acceptable standard, while at the same time encouraging better school attendance, and concentration [Botswana Home-grown School Feeding (HGSF) Technical Development/improvement Plan Meeting, 2013]. The Botswana government implemented the HGSF as part of the SFP initiative supporting the association between agricultural development and school feeding by encouraging schools to buy locally produced foods (Botswana HGSF Technical Development/improvement Plan Meeting, 2013). The authors further explain that the HGSF programme aims to enhance nutrition, health and children's education, especially that of girls (Botswana HGSF Technical Development/improvement Plan Meeting, 2013).

The president of Malaysia recognised the importance of agriculture in driving economic development (Ruzita *et al.*, 2007). Hence, the Ministry of Education in partnership with the Ministry of Health, developed programmes to enhance the health and nutritional status of school children in Malaysia (Ruzita *et al.*, 2007). The latter authors further explain that some of the programmes that are operational in Malaysia include the School Health Programme, School Health Education Programme, School Supplementary Feeding Programme and School Milk Programme that are aimed at assisting school children to enhance their knowledge, promote good health and nutrition, and also enable them to have healthy lifestyles. However, Lee & Manan, (2014) explained that health and nutrition measures that have been implemented in Malaysian schools for children living in rural areas, were related to the fact that a child's nutritional status, household SES, as well as parental beliefs and practices, were associated with their academic achievement. The authors also went on to highlight that deterioration in a child's nutritional status cannot be completely reversed as they get older.

Table 2.4 provides an overview of studies conducted in various countries of varying economies, that assessed the impact of SFPs on nutritional and /or educational factors. The results confirmed

the educational and nutritional benefits of SPFs. However, as some sample sizes were small (Lukindoi, 2018; Chinyoka, 2014) the findings need to be interpreted with caution.

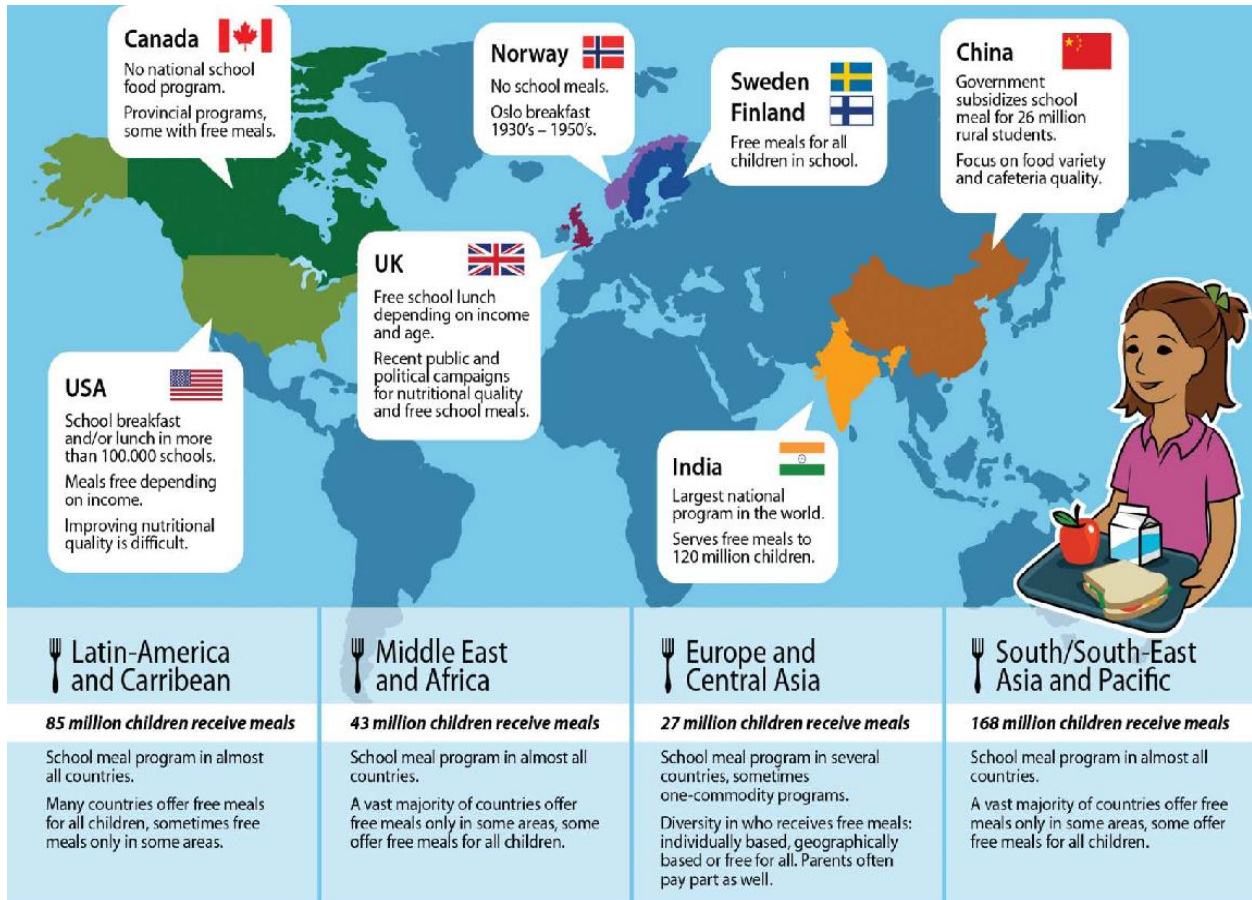


Figure 2.8: Provision of school meals around the world

Source: Oostindjer *et al.*, (2017)

Table 2.3: Government led SFP interventions in selected countries

Country	Income Level	Timing	Ration Contents	Ration calories	Net Enrollment (%)
Botswana	Upper middle	Daily mid-morning. Second meal provided in some districts	Sorghum porridge, stewed canned beef, beans, vegetable oil, bread, milk	572	90
Brazil	Upper middle	Modality varies across states and municipalities	At least 20% of daily nutritional needs provided including three portions of fruits and vegetables	335	-
Chile	Upper middle	Modality varies by age group	Food items vary by vendor but should include meat and fresh fruit and vegetables	850	94
China	Upper middle	Hot meal, midmorning snacks	Hot dishes include meat and vegetables, snacks include biscuits and bread	810 for meals, 300 for snacks	100
Ghana	Lower middle	Hot midday meal	Maize, legumes, rice, fish, yams, eggs, groundnuts, vegetables	800	76
Kenya	Lower middle	Hot midday meal	Cereals, pulses, vegetable oil and salt	700	82

Source: Drake *et al.*, (2017)

Table 2.4: Selected studies investigative the effectivity of SFPs

Authors	Country	Research Title	Main Objectives	Sample	Research Tools	Summary Findings
Lukindoi (2018)	Tanzania	Contribution of school feeding programmes (SFPS) in enhancing pupils' schooling in primary schools in Monduli district, Tanzania	To explore the contribution of SFPs in enhancing pupils' schooling in Monduli district in terms of learner enrolment and enhancing retention.	Two Ward Education Officers two head teachers, two parents, ten pupils from two selected primary schools in Monduli district.	Semi structured interviews, Focus group discussion	<ul style="list-style-type: none"> • SFPs enhanced pupil enrolment and the retention. • SFP resulted in pupils to be active in the learning process.
Zenebe <i>et al</i> (2018)	Ethiopia	SFP has resulted in improved dietary diversity, nutritional status and class attendance of school children	To determine the effect of a SFP on dietary diversity, nutritional status and school attendance.	290 school aged children 10 to 14 years of age from SFP beneficiary and non-beneficiary schools	Dietary Diversity Score (DDS), Anthropometric measurements: height-for-age (HAZ), Body Mass Index (BMI-for-age), Household Food Insecurity Access Scale (HFIAS)	<ul style="list-style-type: none"> • The mean \pm SD HAZ score among non-beneficiaries of SFP (-2.17 ± 1.15) was significantly lower than among beneficiaries (-1.45 ± 1.38) ($p < 0.001$). • The mean \pm SD DDS among SFP non-beneficiaries (3.5 ± 0.7) was significantly lower than for beneficiaries (5.8 ± 1.1) ($p < 0.001$). • Severe food insecurity was documented among more non-beneficiary households (83.4%) than their counterparts (77.2%)
Miyawaki <i>et al</i> (2018)	Japan	Impact of the school lunch program on overweight and obesity among junior high school students: a nationwide study in Japan	To investigate the impact of the School Lunch Programme (SLP) on overweight and obesity among young adolescents.	5% of all children aged 5 to 17 years in Japan.	Mean height and body weight data from two national survey reports and the percentage of overweight, obese, and underweight children in each prefecture by age and sex were extracted.	<ul style="list-style-type: none"> • 10% increase in the school lunch coverage rate was associated with a 0.37%-point decrease in the % overweight (95% confidence interval [CI]: 0.18–0.56)

						<ul style="list-style-type: none"> Percentage underweight and mean body weight and height were not significantly affected by changes in the school lunch coverage rate for either girls or boys.
Cullen & Chen (2017)	United States of America	The contribution of the USDA school breakfast and lunch program meals to student daily dietary intake	To evaluate the contribution of SBP and NSLP meals to the dietary intakes of children participating in the National Health and Nutrition Examination Surveys (NHANES) from 2007 through 2012.	Children aged 5 to 18 who consumed both the School Breakfast Programme (SBP) and National School Lunch Programme (NSLP) meals. 1035 reported only eating an NSLP meal, and 448 reported consuming both the SBP and NSLP meals on the day of the survey	In-person household interview, Full medical examination, 24-hour dietary intake, Anthropometric measurements (height, weight)	<ul style="list-style-type: none"> Mean breakfast intake did not meet the federal breakfast meal patterns and accounted for 21% of the daily energy intake. Mean daily energy intake from the school lunch meal was 27%. Vegetable and protein consumption was low. Almost a half of the days' energy intake (47%) was supplied to those eating both school meals. The range from the major food groups was 40.6% for total vegetables and up to 77.1% for milk.
Taylor & Ogbogu (2016)	Nigeria	The effects of School Feeding Programme on enrolment and performance of public elementary school pupils in Osun State, Nigeria	The School Feeding Programme of public elementary school pupils in Osun State, Nigeria was assessed to determine its effect on school enrolment, retention, and academic performance.	116 respondents from ten public elementary schools in Osogbo	Data from primary (structured questionnaire) and secondary sources	<ul style="list-style-type: none"> SFP resulted in an increase in enrolment (78.4%), retention (44.8%), as well as regularity (58.6%) and punctuality (69%) in school attendance. Learner performance in curricular and extracurricular activities was enhanced by 55.2%.

Hochfeld <i>et al</i> (2016)	South Africa	Does school breakfast make a difference? An evaluation of an in-school breakfast programme in South Africa	To evaluate the anthropometric and school performance outcomes for children receiving the school breakfast programme in six pilot schools in Alexandra	6656 learners	Anthropometric measurements (BMI), Focus group discussions	<ul style="list-style-type: none"> ● Improvement in nutritional status across all schools for height-for-age and BMI-for-age ● 4.7% reduction in severe stunting and a slight increase in levels of stunting. ● Baseline measurements indicated that 27.6% of learners were either overweight (16.9%) or severely overweight (10.7%). These figures decreased by the end of the measurement period to 13.8% and 6.4% respectively, with a percentage point reduction of 3.1% for overweight learners and 4.3% for severely overweight learners. The combined percentage point change of 7.4% was the most dramatic improvement observed. Although the improved health (weight loss) was encouraging, many children continued to be overweight or severely overweight (20.2%).
Evans <i>et al</i> (2015)	England	Impact of school lunch type on nutritional quality of English children's diets	To determine nutritional and dietary intakes by school meal type (school meals and packed lunches).	2709 children attending 54 primary schools randomly selected from all state schools across England.	Dietary data was collected using the Child and Diet Evaluation Tool (CADET), a validated 24-h estimated food diary.	<ul style="list-style-type: none"> ● Children having a packed lunch were more likely to consume snacks and a sweetened drink ● Children having a school meal were more likely to consume different types

						<p>of vegetables and drink water.</p> <ul style="list-style-type: none"> • There were no obvious differences between sexes for anthropometric measurements. • The anthropometric measurements were similar for children having school meals and those having packed lunches. • Children having a school meal had higher mean daily intakes of protein, and Zinc. • Mean daily intakes of carbohydrate, total sugars and Sodium were higher in children taking a packed lunch to school.
Geilli (2015)	Sub-Saharan Africa	School feeding and girls' enrollment: the effects of alternative implementation modalities in low-income settings in Sub-Saharan Africa	To examine the influence of different school feeding modalities on primary school enrollment, particularly for girls, in 32 countries across Sub-Saharan Africa.	WFP-targeted primary schools located in areas vulnerable to food insecurity and poor access to education.	Semi-structured, school-level questionnaires, interviews with school heads, teachers, parents, and pupils covering educational indicators, particularly enrolment and attendance. Data on school infrastructure, classrooms, teaching, and other school quality-related indicators.	<ul style="list-style-type: none"> • School feeding programs were found to have statistically significant increases in enrollment, with effect size of 10%. • After the first year of treatment, an increase in enrolment of girls (12%) was documented. In addition, it was higher than that documented for boys. • No statistically significant interactions across grades was observed. • The F-tests for the type of school feeding and gender interactions (F

						<p>=2.89, Prob. >F =0.0209) and the type of school feeding and grade interactions (F =2.96, Prob. >F =0.0001) rejected the hypotheses of zero coefficients at a 5% significance level.</p>
Abizari, <i>et. al</i> (2014)	Ghana	School feeding contributes to micronutrient adequacy of Ghanaian schoolchildren	To assess the nutrient intake adequacy and Iron (Fe) and nutritional status of schoolchildren participating in a government-supported SFP in northern Ghana relative to non-participating children.	Four rural primary schools in the northern region, Ghana. Children (aged 5 to 3 years) in classes 1 to 3. Mothers or alternate caregivers	Interviews Household questionnaire 24-h recall method Weighed food record Anthropometric measurements Energy and nutrient intake adequacy calculation Biochemical analysis	<ul style="list-style-type: none"> • Energy and nutrient intakes and their adequacies were significantly higher among SFP participants (P<0.001). • Micronutrient intake was significantly higher among SFP participants • In SFP participants, Hb concentrations were 6 g/l higher (P<0.001) • There was no significant difference in the prevalence of Fe deficiency and Fe-deficiency anaemia between SFP and non-SFP participants. • There was no significant difference in the prevalence of thinness, underweight and stunting.
Chinyoka (2014)	Zimbabwe	Impact of poor nutrition on the academic performance of grade seven learners: a case of Zimbabwe	To assess, examine and evaluate the impact of poor nutrition on the academic performance of grade seven learners in Zimbabwe,	Grade seven learners in two primary schools 12 grade seven learners (six males and six females), four teachers comprising (two	Interviews, Focus group discussions, Observations.	<ul style="list-style-type: none"> • Malnutrition affected physical growth, cognitive development, academic performance, and health. • Hungry and undernourished learners were not able to take

				males and two females) and three headmasters.		physical work and sporting activities seriously, were less able to attend school and if they did, were less able to concentrate and learn.
Neervoort <i>et. al.</i> (2013)	Kenya	Effect of a SFP on the nutritional status and prevalence of anaemia in an urban slum: A preliminary evaluation in Kenya	Evaluate the effect of a SFP on the prevalence of anaemia and nutritional status, as well as the SES determinants that may overrule this effect	67 primary school children (intervention), 81 (control).	Anthropometric measurements, Biochemical assessment (Hb)	<ul style="list-style-type: none"> • None of the participating children were underweight. • In the control group, 11% were underweight (p = 0.06). • In the participating group 12% were stunted. • 22% of the control group were stunted (p = 0.02). • In the participating group, none were wasted. • In the control group, 11% were wasted (p = 0.02) • In the participating group, 19% were anaemic. • In the control group, 42% were anaemic (p = 0.01). • No severe anaemia was reported.
Nkhoma <i>et. al.</i> (2013)	Malawi	Early-stage primary school children attending a school in the Malawian School Feeding Program (SFP) have better reversal learning and lean muscle mass growth than those attending a non-SFP school.	To evaluate the cognitive and anthropometric status of entry-level primary school children at two rural Malawian public schools (one an SFP school and the other a non-SFP school as a comparison) with the aim of generating evidence for the ongoing debate about SFPs	Standard one school children, aged between 6 to 8 year, 226 children, (SFP and non-SFP schools)	Anthropometric measurements (body weight and height), Cognitive testing with the Cambridge Neurological Test Automated Battery (CANTAB), Demographic/socio-economic questionnaire-based survey.	<ul style="list-style-type: none"> • Children attending both schools significantly increased in weight and height between the two time points. • MUAC significantly increased in the SFP school but did not undergo significant change in the non-SFP school.

			in Malawi and other developing countries.			
Napier <i>et al</i> (2009)	South Africa	Comparison of three school feeding strategies for primary school children in an informal settlement in Gauteng, South Africa	To compare the impact of three school feeding strategies on the nutritional status of primary school children aged 6 to 13 in an informal settlement in Gauteng.	160 primary school children allocated to three different school feeding interventions One group (n=60) received a whole wheat pilchard and spinach vetkoek, another group (n=60) received food according to the Government Primary School Nutrition Programme (PSNP) and the last group (n=40) received fruit.	Anthropometric measurements (weight and height), Socio-demographic questionnaire, 24-hour recall questionnaire, Biochemical assessment for full blood count (FBC), red blood cell count (RBC), mean corpuscular volume value (MCV) and white blood count (WBC).	<ul style="list-style-type: none"> • The post-intervention results indicated that the children in all three groups had improved significantly in weight, height, dietary intakes of Zinc and Iron. • Underweight in the boys increased from 13.6% to 15.8% after the vetkoek intervention. • PSNP group showed results similar to those of the vetkoek intervention group

2.7 Profile of Botswana

In this section, relevant literature related to the study site, Botswana and the SFP in Botswana will be reviewed.

2.7.1 Overview of Botswana

Botswana is a landlocked country located in Southern Africa bordering Namibia, South Africa, Zimbabwe and Zambia (Figure 2.6).

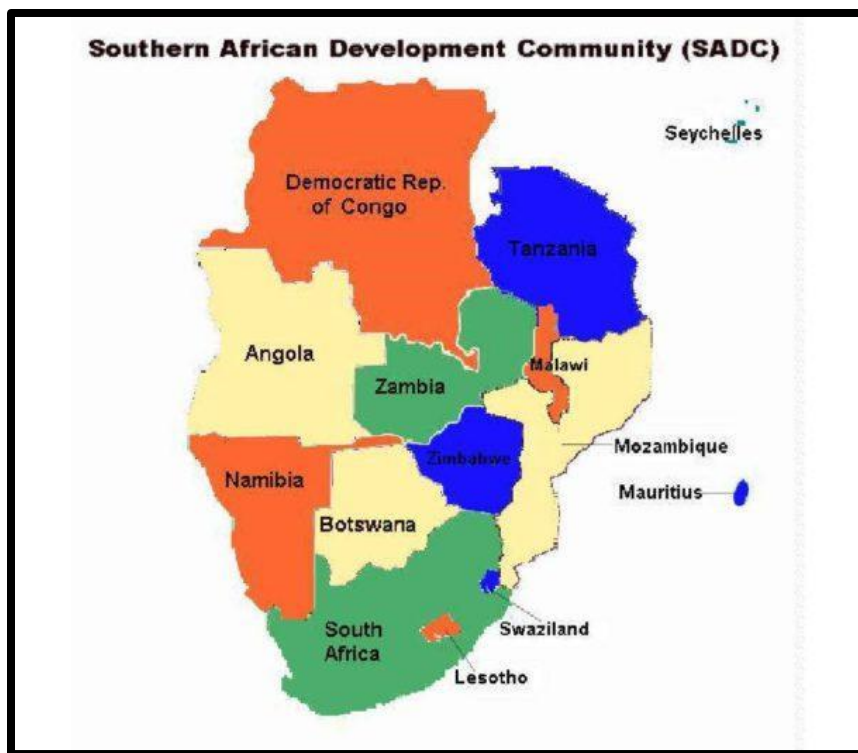


Figure 2.9: Map of Southern Africa

Source: Alternative Information and Development Centre (AIDC)

Botswana has been able to sustain economic growth since its independence in 1966 (Republic of Botswana, 2018). Botswana, a land-locked country located in southern Africa, is surrounded by South Africa, Namibia, Zimbabwe and Zambia (Figure 2.9). The 2017 Botswana Demographic survey estimated the population to be about two million (Statistics Botswana, 2017). In the same survey, at a national level, 90.2 % of children of primary school age were reported to be enrolled

in school. Despite this, there was a reported high drop-out rate, especially in urban areas. However, in comparison to other Sub-Saharan countries, the wellbeing of Botswana’s children’s is considered relatively good (UNICEF, 2017). Along with its economic success, Botswana is also faced with a double-burden of malnutrition due to rapid nutrition transitions (Nnyepi *et al.*, 2015; Tathiah *et al.*, 2013). Results from a cross-sectional study that targeted 746 adolescent schoolchildren in cities, towns and villages in Botswana, reported food intake behaviours that are consistent with nutrition transition, namely the consumption of empty calorie foods in lieu of traditional foods (Maruapula *et al.*, 2011). The factors that are contributing to this nutrition transition includes urbanisation, economic growth, technological changes, food processing and empty calorie diets (Azuike *et al.*, 2011). Botswana has successfully implemented school feeding since 1988 with the aim of preventing hunger, providing children with a balanced diet, keeping children in school for the duration of the school day, and to improve school attendance [Botswana Institute of Development Policy Analysis (BIDPA, 2013)].

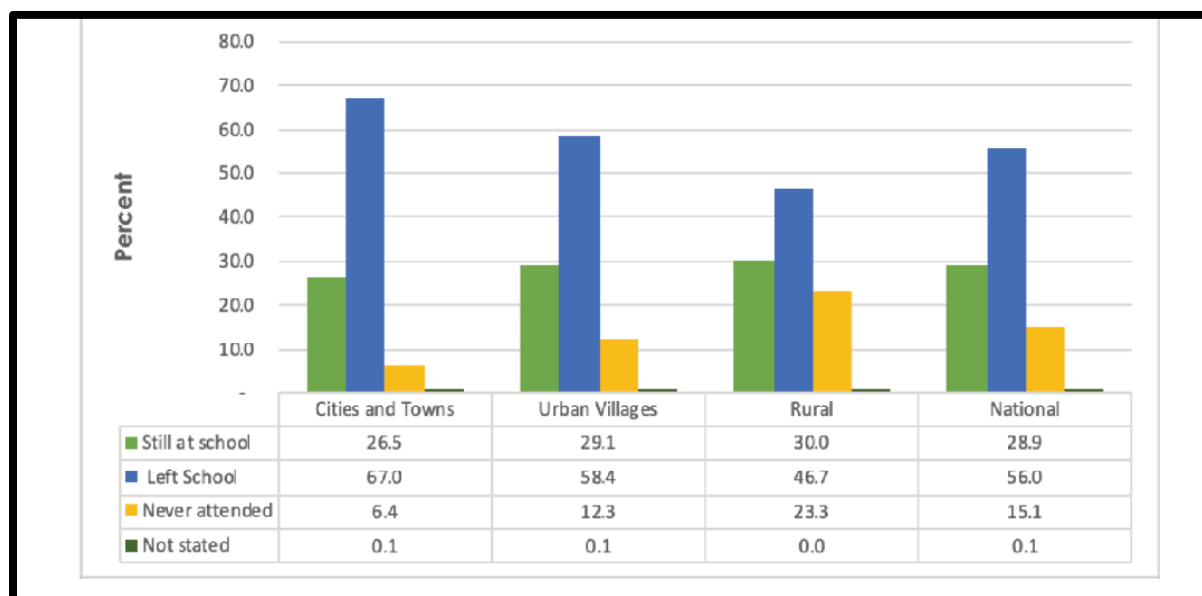


Figure 2.10: Percentage distribution of population aged six years and older by school attendance and area 2017 in Botswana

Source: Statistics Botswana, (2017)

Keng & Ikgopoleng, (2011) state that Botswana’s economy is mainly based on natural resources, especially in the mining industry. Botswana’s unfavourable climatic environment is one of the

major reasons why the country's food security is dependent on neighboring countries, especially South Africa (Acquah *et al.*, 2014). The latter has had an impact on food retail companies that dominate the country's food retail sector (Crush & Frayne, 2011). In addition to fresh produce, it has been observed that these outlets sell cooked foods resembling traditional Setswana cuisine. However, these foods are sometimes high in salt and fat in the form of oil. Provision of these cooked meals have directly influenced the dietary habits of the urban population as they consume most of their meals away from home. Hence, Botswana's nutrition transition has been characterised by a change from a healthier home-cooked traditional diet to westernized foods that are highly processed (Shaibu *et al.*, 2011). Due to employment opportunities, especially in the capital city Gaborone, a shift to a modern lifestyle has resulted in a growing number of shopping malls, business districts, service industries and other facilities (Acquah *et al.*, 2013).

Despite these positive economic indicators, there have been many developmental challenges such as a high unemployment rate and an increase in urban poverty levels which is especially rampant in peri-urban areas (Sekwati *et al.*, 2012). Crush *et al.*, (2012) also alluded to the fact that even in a low income population, easy access to often affordable fast foods has contributed to an increase in diet-related disease and an unhealthy body weight that is often associated with affluence. Even among children, these public health problems are not an exception. A study conducted among adolescent secondary school learners in Botswana, found that 16% of the 780 adolescents sampled, especially those from urban areas, were either overweight or obese while 5% were underweight (Wrotniack *et al.*, 2009). Another factor contributing to an unhealthy lifestyle among urban dwellers has been an increase in a sedentary lifestyle due to increased motorised transport and decreased manual labour (Maruapula *et al.*, 2011).

The country has made strides towards trying to reduce nutrition-related problems. In 2015, Botswana's Vice President declared nutrition a priority during a national nutrition conference referred to as "Nutrition Advocacy Conference" (National Conference, 2015). Despite the government's efforts, one of the major factors that contribute to undernutrition is the high prevalence of poverty and food insecurity, especially in rural areas. However, the country's good governance and political stability has had a positive impact on attracting Foreign Direct Investment (FDI), which should have ultimately had a positive impact on a reduction in poverty due to job

creation [International Monetary Fund (IMF), 2012]. Despite its transformation to a middle-income country, Botswana's national level of poverty in 2009/2010, was estimated to be at 23% decline from 60% at the time of independence (Statistics Botswana, 2013). Acquah *et al.*, (2014) estimated that 13% of rural households in Botswana are food insecure as a result of a lack of self-sufficiency in food production. This therefore means that the majority of household income is spent on food purchases. The widely and frequently consumed staple foods are carbohydrate based and include maize and sorghum (Bahta *et al.*, 2017).

A survey conducted by the African Food Security Urban Network (AFSUN) indicated that not everyone is benefitting the country's economic success as many of the country's population, especially the urban poor, experience extremely high levels of food insecurity (Acquah *et al.*, 2014). In some low-income groups of Gaborone, such as Old Naledi, this is worsened by poor living conditions such as lack of adequate water and sanitation, unsafe housing and overcrowding which also expose the majority of households to communicable diseases (Acquah *et al.*, 2014). However, the eradication of poverty is given very high priority by the government. Some of the programmes geared towards improving household wellbeing, include backyard gardening, bee keeping, destitution programmes, orphan care programmes, *Ipelegeng* Programme, and Food Relief Services for Primary Schools and Health Facilities (Sekwati *et al.*, 2012). The Orphan Care Programme was implemented during the onset of HIV/AIDS pandemic when the number of orphans in Botswana increased, while in 2008, the National Guidelines on the Care of Orphans and Vulnerable Children were adopted (UNICEF, 2016).

2.7.2 Botswana's education system

Education in Botswana did not begin with the introduction of formal schooling by European missionaries, but rather via informal education in the form of initiation ceremonies (Major & Tiro, 2012). Since universal primary school education was implemented in Botswana, it has raised the national literacy level to 81.2% [Central Statistics Office (CSO), 2003]. Data from the 2003 Literacy Survey, suggests that school non-attendance is very low with 0.6% of children of school going age that have never attended school (UNDP, 2009). The majority of children enrolled in primary schools are Botswana citizens (Table 2.2).

The typical academic school calendar commences in January and ends in December, with the official primary school entrance age being between six and eight years of age. (Monnathoko, 1999). A typical school day for primary school learners in Botswana, starts at 07:30 and ends at 13:00, with afternoon activities including sport, especially for learners from standard four to seven commencing in the afternoon. Furthermore, the primary school system in Botswana is sub-divided into two phases namely lower primary (standards one to four), and upper primary (standards five to seven). At primary school level, children have equal access to school, irrespective of gender. However, a study by Monnathoko, (1999) found that boys were more likely to remain in school longer than girls. A possible explanation for this phenomenon is that previously, girls who fell pregnant while at school, were often permanently expelled from the education system prior to implementation of the “Back to School Initiative” in 2012 which aimed to give eligible school drop outs a second chance to enroll into the education system [United Nations Educational, Scientific and Cultural Organization (UNESCO), 2015].

As is the case with many Sub-Saharan African countries, the highest proportion of school repeaters are from primary schools at 11.4 million. Grade repetition is a common problem in Botswana (UNESCO, 2012). In the Southern and Eastern Africa Consortium of Monitoring Educational Quality (SACMEQ III) survey, 4% of the learners surveyed reported that they had repeated at least two grades (Spaull, 2011).

2.7.3 Social interventions for orphaned and vulnerable children in Botswana

In Botswana, an orphan is defined as any child younger than 18 years of age who has lost his/her parent/s (Feranil *et al.*, 2010). Botswana ‘s 2008 National Guidelines on the Care of Orphans and Vulnerable Children (hereafter referred to as the National OVC Guidelines), define a vulnerable child as any child under the age of 18 years who lives in: (i) an abusive environment; (ii) a poverty-stricken family unable to access basic services; (iii) a child-headed household; (iv) a child who lives with sick parents or outside family care; or (v) who is HIV positive (Government of Botswana, 2008). In addition, there are various categories of vulnerable children in Botswana, including children living in remote areas, child labourers, street children, children in child headed households, children in conflict with the law, those with disabilities and orphans (UNICEF, 2011). As earlier stated, the HIV epidemic has had a negative impact on the welfare of children and placed

enormous strain on family and community support structures. Children who are orphaned are often at increased risk of becoming impoverished (UNICEF, 2014), and hence are at a high risk of food insecurity. The latter may ultimately have a negative impact on their nutritional status. This has been confirmed by a rapid assessment conducted by the Ministry of Health and Wellness (Muchiru, 1998). Although the SFP does not discriminate against children in need, by default, all children (including orphans) are catered for in the SFP programme. Especially those in remote areas (BIDPA, 2013).

Another programme which seeks to improve the livelihood of school children is the Destitute Programme that was implemented in 1981 (Government of Botswana, 1981). This programme also supplements children’s dietary needs under the Ministry of Local Government and Rural Development (Bank of Botswana, 2005). A summary of Botswana’s social interventions for poverty alleviation is illustrated in Table 2.3.

Table 2.5: Social interventions for poverty alleviation

Policy/ Programme	Objectives/principles	Key actions
Backyard gardening	<ul style="list-style-type: none"> ● Improvement of household food security ● Household income generating measures 	<ul style="list-style-type: none"> ● Training on gardening, marketing, financial management and drip irrigation
Integrated Support Programme for Arable Agriculture Development (ISPAAD)	<ul style="list-style-type: none"> ● Increase grain production ● Promote food security ● Commercialize agriculture ● Facilitate access to inputs and credit ● Improve extension outreach 	<ul style="list-style-type: none"> ● Cluster fencing ● Provision of potable water ● Provision of seeds and fertilizer ● Facilitation of access to credit ● Establishment of agricultural service centres
<i>Ipelegeng</i> Programme	<ul style="list-style-type: none"> ● Short term employment support and relief ● Provision of essential development projects 	<ul style="list-style-type: none"> ● Employment support for unskilled and semi-skilled labour ● Maintenance of public facilities
National Strategy for Poverty Reduction (NSPR)	<ul style="list-style-type: none"> ● Provision of opportunities for sustainable livelihoods ● Poverty reduction 	<ul style="list-style-type: none"> ● Provision of employment Opportunities ● Improvement of poor people’s access to investment resources ● Targeted assistance programmes e.g. safety nets, ISPAAD, <i>Ipelegeng</i> ● Promotion of community participation in development

Source: Sekwati *et. al.* (2012)

2.8 Conclusion

SFPs have been adopted globally as an intervention to address poor nutritional status among primary school children. Although SFPs are implemented in many countries in Africa, the objectives and implementation strategy could vary. In addition, the nutritional status of learners from countries with upper-middle-income economies, lower-middle-income and low-income economies may differ, resulting in different goals, implementation strategies and outcome measures. The majority of countries with low-income economies are being assisted by the WFP with governments assisting or partnering with the WFP. Many countries have engaged in home HGSP programmes to encourage partnerships between family farms or local farmers as suppliers of fresh food which is nutritious and meets the needs of the community. While SFPs have proved to be effective in some countries, they have not been as effective in others. However, because many countries have not evaluated their SFPs, short falls of the programme cannot be addressed.

References

- Abdullah (2015). The double burden of undernutrition and overnutrition in developing countries: an update. **Current Obesity Reports**. doi 10.1007/s13679-015-0170-y
- Abizari A-R, Buxton C, Kwara L, Mensah-Homiah J, Armar-Klemesu M, Brouwer ID (2014). School feeding contributes to micronutrient adequacy of Ghanaian schoolchildren. **British Journal of Nutrition**; 112: 1019–1033. doi:10.1017/S0007114514001585
- Abrahams Z, de Villiers A, Steyn NP, Fourie J, Dalais L, Hill J, Draper CE, Lambert EV (2011). What’s in the lunchbox? Dietary behaviour of learners from disadvantaged schools in the Western Cape, South Africa. **Public Health Nutrition**; 14(10):1752–1758.
- Action Against Hunger (2017). Overcoming the challenges of undernutrition in Tanzania through 2021 reflecting on trends, questions, and future scenarios for urgent nutrition action. <http://www.iris-france.org/wp-content/uploads/2017/03/Tanzania-Final-report.pdf> (Accessed 18 March 2019).
- Acquah B, Kapunda S, Legwegoh A (2014). The Dimensions of Urban Food Insecurity in Gaborone, Botswana. **Urban Forum**; 25:217–226. doi 10.1007/s12132-014-9222-8
- ADIC. Map of Southern Africa. <http://aidc.org.za/programmes/united-and-just-southern-africa> (Accessed 29 November 2018).
- Akanbi GO, Alayande E (2011). Home grown school feeding and health program in Nigeria: an innovative approach to boosting enrolment in public primary schools – a study of Osun State 2002 – 2010. **The African Symposium**; 11(2): 20-28.

Aldelman S, Gilligan DO, Lehrer K (2008). How Effective Are Food for Education Programs? A Critical Assessment of the Evidence from Developing Countries. 2020 Focus Brief on the World's poor and hungry people. Washington DC. International Food Policy Research Institute.

Aliyar R, Gelli A, Hamdani S (2012). A review of nutritional guidelines and menu compositions for school feeding programmes in 12 countries. **Public Health**; 3: 148.doi: 10.3389/fpubh.2015.00148

Annim SK, Imai KS (2014). Nutritional status of children, food consumption, diversity and ethnicity in Lao PDR. University of Manchester and Kobe University. Japan. www.rieb.kobe-u.ac.jp/academic/ra/dp/English/DP2014-17.pdf (Accessed: 23 October 2018).

Ashok NC, Kavitha HS, Kulkarni P (2014). A comparative study of nutritional status between government and private primary school children of Mysore city. **International Journal of Health and Allied Sciences**; 3(3):164 – 169

Awuor AC (2016). Institutional factors influencing implementation of school feeding programme in public primary schools in Matungulu sub county, Machakos county, Kenya. University of Nairobi. Unpublished thesis.

Azuike EC, Emelumadu OF, Adinma ED, Ifeadike CO, Ebenebe UE, Adogu PU (2011) “Nutrition transition in developing countries: A review”. **Afrimedical Journal** 2;2. <https://www.researchgate.net/publication/280035884> (Accessed 19 March 2019)

Bahta S, Wanyoike F, Katjuongua H, Marumo D (2017). Characterisation of food security and consumption patterns among smallholder livestock farmers in Botswana. **Agriculture and Food Security** 6:65. doi: <https://doi.org/10.1186/s40066-017-0145-1>

Bank of Botswana (2005). **Budget Speech 2005**. <http://www.bankofbotswana.bw/assets/uploaded/budget%20speech%202005.pdf>(Accessed 14 January 2018)

Banna JC, Buchthal OV, Delormier T, Creed-Kanashiro HM, Penny ME (2016). Influences on eating: a qualitative study of adolescents in a peri-urban area in Lima, Peru. **BMC Public Health** 16:40. doi:10.1186/s12889-016-2724-7.

Bathgate K, Begley A (2011). ‘It’s very hard to find what to put in the kid’s lunch’: What Perth parents think about food for school lunch boxes. **Nutrition and Dietetics** 68: 21–26.

Bekker F, Marais M, Koen N (2017). The provision of healthy food in a school tuck-shop: does it influence primary-school students’ perceptions, attitudes and behaviours towards healthy eating? **Public Health Nutrition** 20(7):1257–1266.

Belot M, James J (2011). Healthy school meals and educational outcomes. **Journal of Health Economics**; 30 (3): 489 – 504. <https://doi.org/10.1016/j.jhealeco.2011.02.003>.

BIDPA (2013). Botswana National Primary School Feeding Programme: A Case Study. [Downloads/Botswana%20NSFP%20Case%20Study%20\(4\).pdf](#) (Accessed 9 January 2019). **Journal of Health Economics** 30:489–504.

Bronikowski M, Bronikowska M, Pluta B, Maciaszek J, Glapa A (2016). Positive impact on physical activity and health behaviour changes of a 15-week family focused intervention program: “Juniors for seniors” **Biomed Research International**. Article ID 5489348. doi.org/10.1155/2016/5489348

Brown C, Shaibu S, Maruapula S, Maletle, Compher C (2015). Perceptions and attitudes towards food choices in adolescents in Gaborone, Botswana, **Appetite** 95: 29 – 35.

Bundy D, Burbano C, Grosh M, Gelli A, Jukes M, Drake L (2009). **Rethinking School Feeding: Social Safety Nets, Child Development, and the Education Sector**. The World Bank. http://siteresources.worldbank.org/EDUCATION/Resources/278200-1099079877269/547664-1099080042112/DID_School_Feeding.pdf (Accessed 20 March 2019).

Cervato-Mancuso AM, Westphal MF, Araki EL, Bógus CM (2013). School feeding programs’ role in forming eating habits. **Revista Paulista de Pediatria**. 31(3):324-30.

Chao HC (2018). Association of Picky Eating with Growth, Nutritional Status, Development, Physical Activity, and Health in Preschool Children. **Frontiers in Pediatrics**. 6:22. doi: 10.3389/fped.2018.00022. eCollection 2018.

Chiarlitti NA, Kolen AM (2017). Parental Influences and the Relationship to their Children's Physical Activity Levels. **International Journal of Exercise Science** 10(2): 205-212.

Chinyoka K (2014). Impact of Poor Nutrition on the Academic Performance of Grade Seven learners: A Case of Zimbabwe. **International Journal of Learning & Development**; 4 (3). doi:10.5296/ijld.v4i3.6169

Choudhury S (2018). **An Economic Analysis of Dietary Diversification in the Developing World**.

<https://digital.library.adelaide.edu.au/dspace/bitstream/2440/113353/2/02whole.pdf>
(Accessed 28 November 2018)

Crush J, Frayne B, McLachlan M (2012). Rapid Urbanization and the Nutrition Transition in Southern Africa. **AFSUN Urban Food Security Series** No. 7, Cape Town

Crush J, Frayne B (2011). Supermarket Expansion and the Informal Food Economy in Southern African Cities: Implications for Urban Food Security. **Journal of Southern African Studies** 37: 781-807.

CSO (2003). **Report of the Second National Survey on Literacy in Botswana.** www.cso.org.bw (Accessed 15 February 2018)

Cullen KW, Chen T-A (2017). The contribution of the USDA school breakfast and lunch program meals to student daily dietary intake. **Preventive Medicine Reports**; 5: 82 – 85. <http://dx.doi.org/10.1016/j.pmedr.2016.11.016>

Cullen KW, Hartstein J, Reynolds KD, Vu M, Resnicow K, Greene N, White MA (2007). Studies to Treat or Prevent Pediatric Type 2 Diabetes Prevention Study Group. Improving the school food environment: results from a pilot study in middle schools. **Journal of American Dietetic Association** 107:484-489.

Danquah AO, Amoah AN, Opare-Obisaw C (2013). Nutritional status of upper primary school pupils in a rural setting in Ghana **International Journal of Nutrition and Food Sciences** 2(6):320-326.

Danquah AO, Amoah AN, Steiner-Asiedu M, Opare-Obisaw C (2012). Nutritional status of participating and non-participating learners in the Ghana School Feeding Programme. **Journal of Food Research** 1:3. doi:10.5539/jfr.v1n3p263

Davison K, Lawson C (2006). Do attributes in the physical environment influence children's physical activity? A review of the literature. **International Journal of Behavioral Nutrition and Physical Activity** 3:19 doi: [10.1186/1479-5868-3-19](https://doi.org/10.1186/1479-5868-3-19)

Degarege D, Degarege A, Anmut A (2015). Undernutrition and associated risk factors among school age children in Addis Ababa, Ethiopia. **BioMedical Central Public Health** 15:375. <https://doi.org/10.1186/s12889-015-1714-5>.

Demetriou, Y, Gillison F, McKenzie TL (2017). After-School Physical Activity Interventions on Child and Adolescent Physical Activity and Health: A Review of Reviews. **Advances in Physical Education**; 7: 191 – 215. <https://doi.org/10.4236/ape.2017.72017>

De Onis M, Blössner M, Borghi E (2012). Prevalence and trends of stunting among preschool children, 1990–2020. **Public Health Nutrition** 15:142–148.

Deliens T, Clarys P, De Bourdeaudhuij I, Deforche B (2014). Determinants of eating behaviour in university students: a qualitative study using focus group discussions. **British Medical Central Public Health** 14:53. doi: [10.1186/1471-2458-14-53](https://doi.org/10.1186/1471-2458-14-53).

Devereux S, Hochfeld T, Karriem A, Mensah C, Morahanye M, Msimango T, Mukubonda A, Naicker S, Nkomo G, Sanders D, Sanousi M (2018). “School Feeding in South Africa: What we know, what we don’t know, what we need to know, what we need to do” **Food Security SA Working Paper Series No. 004**. DST-NRF Centre of Excellence in Food Security, South Africa.

Ding D, Sallis JF, Kerr J, Lee S, Rosenberg DE (2011). Neighborhood environment and physical activity among youth: a review. **American Journal of Prevention Medicine** 41:442-455.

Drake L, Fernandes M, Aurino E, Kiamba J, Giyose B, Burbano C, Alderman H, Mai L, Mitchell A, Gelli A (2017). Global School Feeding Sourcebook: Lessons from 14 countries. Child and Adolescent Health and Development, 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank. ISBN-13: 978-1-4648-0423-6 ISBN-13: 978-1-4648-0439-7.

<https://documents.wfp.org/stellent/groups/public/documents/communications/wfp284904.pdf>

(Accessed 22 April 2019)

Drake L, Fernandes M, Aurino E, Kiamba J, Giyose B, Burbano C, Alderman H, Mai L, Mitchell A, Gelli A (2017). School Feeding Programs in middle childhood and adolescence. Disease Control Priorities, Third Edition (Volume 8): Child and Adolescent Health and Development https://doi.org/10.1596/978-1-4648-0423-6_ch12.

https://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-0423-6_ch12 (Accessed 22 April 2019)

Draper C, Basset S, de Villiers A, Lambert EV (2014). HAKSA Writing Group. Results from South Africa's 2014 report card on physical activity for children and youth. **Journal of Physical Activity Health** 11(1): S98–S104.

Drenowartz C, Erkelenz N, Wartha O, Brandstetter S, Steinacker JM (2014). Parental characteristics have a larger effect on children's health behaviour than their body weight. **Obesity Facts** 388 – 398. <https://doi.org/10.1159/000369984>.

Du Plessis K (2011). Diet and nutrition: A literature review of factors influencing blue-collar apprentices. Carlton, Victoria, Australia: Incolink and Australian Clearinghouse for Youth. 11(6): 1713–1727. doi:10.1177/1557988315625775.

<http://www.nutritionaustralia.org/sites/default/files/Diet%20and%20nutrition%20chapter%20from%20Apprentices%20-%20young%20people%20in%20transition.pdf>

Du X, Zhu K, Trube A (2004). School-milk intervention trial enhances growth and bone mineral accretion in Chinese girls aged 10–12 years in Beijing. **British Journal of Nutrition** 92:159–168.

Eggersdorfer M, Kraemer K, Cordaro JB, Fanzo J, Gibney M, Kennedy E, Labrique A, Steffen J (2016). Good Nutrition: Perspectives for the 21st Century. Pp. 92–104. ISBN: 978-3-318-05964-9 e-ISBN: 978-3-318-05965-6. doi: 10.1159/000452378.

Elgar FJ, Pfortner TK, Moor I, De Clercq B, Stevens GW, Currie C (2015).

Socioeconomic inequalities in adolescent health 2002-2010: a time series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. **Lancet**; 385(9982):2088–2095.

Evans CEL, Mandl V, Christian MS, Cade JE (2015). Impact of school lunch type on nutritional quality of English children's diets. **Public Health Nutrition**: 19(1), 36 – 45. doi:10.1017/S1368980015000853

Falade OS, Otemuyiwa I, Oluwasola O, Oladipo W, Adewusi SA (2012) School Feeding Programme in Nigeria: the nutritional status of learners in a public primary school in Ile-Ife, Osun State, Nigeria. **Food and Nutrition Sciences** 3:596-605.

FAO (2017). 2017 Africa regional overview food security and nutrition report. <http://www.fao.org/3/a-i8053e.pdf> (Accessed 21 April 2019).

FAO (2013). Linking Nutrition to Agriculture through School Feeding: CAADP Nutrition Workshop, SADC http://www.fao.org/fileadmin/user_upload/wa_workshop/PPT_SA/DAY2_Ps1_HGSF2.pdf. (Accessed 9 January 2014)

Feranil I, Herstad B, Jallow W, Mbuya-Brown R (2010). Assessing implementation of Botswana's Program for Orphans and Vulnerable Children. http://www.healthpolicyplus.com/archive/ns/pubs/hpi/1265_1_PIBA_Botswana_FINAL_acc.pdf (Accessed 20 March 2019)

Fiorentino M, Bastard G, Sembe`ne M, Fortin S, Traissac P, Landais E, Icard-Verniere C, Wieringa FT, Berger J (2013) Anthropometric and Micronutrient Status of School-Children in an Urban West Africa Setting: A Cross-Sectional Study in Dakar (Senegal). **PLoS ONE**; 8(12): e84328. doi: 10.1371/journal.pone.0084328

Fisher E (2007). A Desk Review of the Ghana School Feeding Programme. Centre for Development Studies, University of Swansea. http://centaur.reading.ac.uk/74219/1/007_Cardiff_Ghana-Desk-Review_2007.pdf (Accessed 19 March 2019).

Gao Z, Chen S, Sun H, Wen X, Xiang P (2018). Physical Activity in Children's Health and Cognition. **BioMed Research International**; Article ID 8542403. <https://doi.org/10.1155/2018/8542403>

Gelli A, Masset E, Folsom G, Kusi A, Arhinful DK, Asante F, Ayi I, Bosompem KM, Watkins K, Abdul-Rahman L, Agble R, Ananse-Baden G, Mumuni D, Aurino E, Fernandes M, Drake L (2016). Evaluation of alternative school feeding models on nutrition, education, agriculture and other social outcomes in Ghana: rationale, randomised design and baseline data. 17:37. **Biomedical Central**. doi 10.1186/s13063-015-1116-0

Gelli A (2010). Food Provision in Schools in Low and Middle Income Countries: Developing an Evidenced Based Programme Framework. Partnership for Child Development. www.hgsf-global.org (Accessed 12 January 2017)

Gelli A, Meir U, Espejo F (2007). Does Provision of Food in School Increase Girls' Enrollment? Evidence from Schools in Sub-Saharan Africa. **Food and Nutrition Bulletin** 28 (2): 149–55

Gonçalves S, Ferreira R, Conceição E.M, Silva C, Machado P. P. P, Boyland E, Vaz A (2018) The Impact of Exposure to Cartoons Promoting Healthy Eating on Children's Food Preferences

and Choices. **Journal of Nutrition Education and Behavior** 50:5 doi:
<https://doi.org/10.1016/j.jneb.2017.12.015>

Government of Botswana (2013). National Guidelines on School Feeding. Ministry of Local Government and Rural Development. <http://www.gov.bw/en/Ministries--Authorities/Ministries/Ministry-of-Local-Government-MLG1/News/Food-for-Ipelegeng/> (Accessed 18 April 2017).

Government of Botswana. (2008). National Guidelines on the Care of Orphans and Vulnerable Children. Gaborone, Botswana. Ministry of Local Government and Rural Development, Department of Social Services.
https://www.unicef.org/evaldatabase/files/Assesment_of_OVC_Programme_Print_Botswana_2016-001.pdf (Accessed 18 April 2018).

Grantham-McGregor S, Smith JA (2016). "Extending The Jamaican Early Childhood Development Intervention,". **Journal of Applied Research on Children:** 7 (2) 4.
<http://digitalcommons.library.tmc.edu/childrenatrisk/vol7/iss2/4>

Horne P.J, Tapper K, Lowe C.F, Hardman C.A, Jackson M.C, Woolner J (2004) Increasing children's fruit and vegetable consumption: a peer-modelling and rewards-based intervention. **European Journal of Clinical Nutrition** 58:1649-1660.

Horsely S and Oliver C (2013) Positive impact and its relationship to wellbeing of parents of children with intellectual disability: A literature review. **International Journal of Development Disabilities**.61.10.1179/2047387713Y.0000000026.

Huanga WY, Wong SHS, Sit CHP, Wong MCS, Sum RKW, Wong SWS, Yub JJ (2019). Results from the Hong Kong's 2018 report card on physical activity for children and youth. **Journal of Exercise Science & Fitness**; 17 (1): 14 – 19. <https://doi.org/10.1016/j.jesf.2018.10.003>

Hyndman B (2013) Understanding the social-ecological influences within school playgrounds on children's enjoyment and participation in physical activity during school lunch breaks. (Thesis) RMIT University, Australia. doi: 10.5281/zenodo.29064.

International Monetary Fund (IMF). (2012). "Botswana" IMF Country Report. No. 12/235 page 4. Washington DC. <https://www.imf.org/external/pubs/ft/scr/2012/cr12235.pdf> (Accessed 15 April 2019).

Ip P, Ho FK-W, Louie LK-H, Chung TW-H, Cheung Y-F, Lee S-L, Hui SS-C, Ho WK-Y, Ho DS-Y, Wong WH-S, Jiang F (2017). Childhood Obesity and Physical Activity-Friendly School Environments. **The Journal of Pediatrics**; 191:110 – 116.
<https://doi.org/10.1016/j.jpeds.2017.08.017>

Jomaa LH, McDonnell E, Probart C (2011) School feeding programs in developing countries: impacts on children's health and educational outcomes. **Nutrition Reviews**. 69(2):83–98.

Juwara A, Huang N, Chien L-Y, Chen H-J (2016). Stunting and weight statuses of adolescents differ between public and private schools in urban Gambia. **International Journal of Public Health**; 61:717–726. doi 10.1007/s00038-016-0836-6.

Kim K, Seo A, Sung H.Y, Hyun J.R, Sang S.L, Mi Kyung K (2012). The effect of a healthy school tuck-shop program on the access of students to healthy Foods. **Nutrition Research and Practice**: 6(2):138-145. doi: 10.4162/nrp.2012.6.2.138.

Khatete IW, Pendo S, Oyabi JM (2013). School Feeding Program and Pupils' Participation in Primary Schools in Kenya. A Study of Taita Taveta and Nairobi Districts. **Journal of Emerging Trends in Educational Research and Policy Studies**; 4(6): 895 – 900

Korugyendo LP, Benson T (2011). Food-for-Education programs: Lessons for Uganda. www.ifpri.org/themes/ussp/ussp.htm (Accessed 22 March 2019).

Kristjansson EA, Gelli A, Welch V, Greenhalgh T, Liberato S, Francis D, Espejo F (2016) Costs, and cost-outcome of school feeding programmes and feeding programmes for young children. Evidence and recommendations. **International Journal of Educational Development**; 48, 79 - 83.

Kristjansson B, MacDonald B, Krasevec J, Janzen L, Greenhalgh T, Wells GA, MacGowan J, Farmer AP, Shea B, Mayhew A, Tugwell P and Welch V (2009) School Feeding for Improving the Physical and Psychosocial Health of Disadvantaged Learners (Review). **Cochrane Developmental** (Ed.), (p.74).

Kuczarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, Wei R, Curtin LR, Roche AF, Johnson CL. (2000) CDC growth charts for the United States: Methods and development. National Center for Health Statistics. **Vital Health Statistics** 11(246) https://www.cdc.gov/nchs/data/series/sr_11/sr11_246.pdf (Accessed 20 March 2018)

Kwabla MP, Gyan C, Zotor F (2018) Nutritional status of in-school children and its associated factors in Denkyembour District, eastern region, Ghana: comparing schools with feeding and non-school feeding policies. **Nutrition Journal** 17:8. <https://doi.org/10.1186/s12937-018-0321-6>

Lee YY, Manan WM (2014). Nutritional status, academic performance and parental feeding practices of primary school children in a rural district in Kelantan, Malaysia. **Progress in Health Science**; 4 (1). 144 – 152.

Lindberg L, Ek A, Nyman J, Marcus C, Ulijaszek S, Nowicka P (2016). Low grandparental social support combined with low parental socioeconomic status is closely associated with obesity in preschool-aged children: A pilot study. **Pediatric Obesity**; 11, 313–316. doi: 10.1111/ijpo.12049.

Lukindo (2018). Contribution of school feeding programmes in enhancing pupils' schooling in primary schools in Monduli district, Tanzania. **European Journal of Education Studies**; 4(8): 49 – 62.

Mahreen F, Basit A, Rahman F, Ajmal M, Tahirkheli S. A, Jumani N. B (2010) Food Sold in and Around the School: Is it Worth the Learners' Pocket money? **International Journal of Business and Social Science**; 1 (3): 172 – 181.

Mahama S (2018) The impact of Ghana school feeding programme on female enrolment, attendance and retention in the Wa municipality of the upper west region of Ghana. Unpublished thesis

Major ET, Tiro L (2012) Theory Vs Practice: The Case of Primary Teacher Education in Botswana. **International Journal of Scientific Research in Education**. 5(1), 63-70.

Maruapula SD, Jackson JC, Holsten J, Shaibu S, Maletle L, Wrotniak B, and Compher C (2011) Food patterns, socioeconomic status and urbanization are associated with obesity in adolescents in Botswana, an African country in rapid nutrition transition. **Public Health Nutrition**; 14(12): 2260-2267 <https://doi.org/10.1017/S1368980011001339>

McEwan PJ (2013). The impact of Chile's school feeding program on education outcomes. **Economics of Education Review** 32: 22– 139. doi.org/10.1016/j.econedurev.2012.08.006

Mhurchu NC, Gorton D, Turley M, Jiang Y, Michie J, Maddison R, Hattie J (2013) Effects of a free school breakfast programme on children's attendance, academic achievement and short-term hunger: results from a stepped-wedge, cluster randomized controlled trial. **Journal of Epidemiology and Community Health**; 67:257–264. doi:10.1136/jech-2012-201540

Miyawaki A, Lee JS, Kobayashi Y (2018). Impact of the school lunch program on overweight and obesity among junior high school students: a nationwide study in Japan. **Journal of Public Health**; 1–9. doi:10.1093/pubmed/fdy095.

Mogre V, Aneyire ES, Gyamfi EK (2013). Physical Activity and BMI Status of School-Age Children in Tamale, Northern Ghana. **Pakistan Journal of Nutrition**; 12 (5): 484 – 490. doi: 10.3923/pjn.2013.484.490

Moore L, Tapper K (2008) The impact of school fruit tuck-shops and school food policies on children's fruit consumption: a cluster randomized trial of schools in deprived areas. **Journal of Epidemiology and Community Health** 62:926-31.

Muchiru SM (1998) The rapid assessment on the situation of orphans in Botswana: report. Republic of Botswana, AIDS/STD Unit, Ministry of Health. www.moh.gov.bw (Accessed 19 January 2017)

Müller I, Schindler C, Adams L, Endes K, Gall S, Gerber M, Htun NSN, Nqweniso S, Joubert N, Probst-Hensch N, du Randt R, Seelig H, Smith D, Steinmann P, Utzinger J, Yap P, Walter C, Pühse U (2019). Effect of a Multidimensional Physical Activity Intervention on Body Mass Index, Skinfolts and Fitness in South African Children: Results from a Cluster-Randomised

Controlled Trial. **International Journal of Environmental Research and Public Health**; 16,232. doi:10.3390/ijerph16020232

Munthali AC, Mvula PM, Silo L (2014) Early childhood development: the role of community based childcare centres in Malawi. **Springer Plus**, 3, 305. doi: 10.1186/2193-1801-3-305.

Muthuri SK, Francis CE, Wachira LJM (2014) Evidence of an overweight/obesity transition among school-aged children and youth in Sub-Saharan Africa: a systematic review. **PLoS ONE**, 9:3 Article ID e92846.

Mwambene JB, Muula AS, Leo JC (2013) Prevalence and correlates of hunger among primary and secondary school children in Malawi: results from the 2009 Global School-based Health Survey. **Malawi Medical Journal**; 25 (2): 45 – 49.

Napier C, Oldewage-Theron W, Kearney J (2009). Comparison of three school feeding strategies for primary school children in an informal settlement in Gauteng, South Africa; **Health SA Gesondheid**; 14(1): 96 – 103. doi:10.4102/hsag.v14i1.458

Neervoort F, Rosenstiel I, Bongers K, Demetriades M, Shacola M, Wolffers I (2013) Effect of a School Feeding Programme on Nutritional Status and Anaemia in an Urban Slum: A Preliminary Evaluation in Kenya. **Journal of Tropical Pediatrics** 59: 3. :165-174. doi: 10.1093/tropej/fms070. Epub 2012 Dec 12.

Nelson M, Lowes K, Hwang V (2006). The contribution of school meals to food consumption and nutrient intakes of young people aged 4–18 years in England. **Public Health Nutrition** 10(7): 652–662.

Nkhoma OWW, Duffy ME, Cory-Slechta DE, Davidson PW, McSorley EM, Strain JJ, Brien GMO (2013). Early-Stage Primary School Children Attending a School in the Malawian School Feeding Program (SFP) Have Better Reversal Learning and Lean Muscle Mass Growth Than Those Attending a Non-SFP School. **The Journal of Nutrition**. 143: 1324–1330, 2013 doi:10.3945/jn.112.171280.

Nnyepi MS, Gwisai N, Lekgoa M, Seru T (2015). Evidence of nutrition transition in Southern Africa. **Proceedings of Nutrition Society**; 74(4): 478 – 486. doi: 0.1017/S0029665115000051.

Nortje N, Faber M, de Villiers A (2017). School tuck shops in South Africa—an ethical appraisal. **South African Journal of Clinical Nutrition**; 30(3):74–79. <https://doi.org/10.1080/16070658.2017.1267401>

Ogata BO, Hayes D (2014) Position of the Academy of Nutrition and Dietetics: Nutrition Guidance for Healthy Children Ages 2 to 11 Years. **Journal of Academy of Nutrition and Dietetics** 114:1257-1276.

Ong LC, Chandran V, Lim YY, Chen AH, Poh BK (2010). Factors associated with poor academic achievement among urban primary school children in Malaysia. **Singapore Medical Journal**. 51(3):247 – 252.

Oostindjer M, Aschemann-Witzel J, Wang Q, Skuland SE, Egelanddal B, Amdam GV, Schjøll A, Pachucki MC, Rozin P, Stein J, Almlí VL, Klee EV (2017). Are school meals a viable and sustainable tool to improve the healthiness and sustainability of children's diet and food consumption? A crossnational comparative perspective. **Critical Reviews in Food Science and Nutrition**; 57:18, 3942-3958, doi: 10.1080/10408398.2016.1197180

Owusu JS, Colecraft EK, Aryeetey RNO, Vaccaro1 JO, Huffman1 FG (2016). Comparison of Two School Feeding Programmes in Ghana, West Africa. **International Journal of Child Health and Nutrition**; 5, 56 – 62.

Pangani IN, Kiplamai FK, Kamau JW, Onywera VO (2016). Prevalence of overweight and obesity among primary school children aged 8–13 years in Dar es salaam city, Tanzania. **Advances in Preventive Medicine**; Article ID 1345017. <http://dx.doi.org/10.1155/2016/1345017>

Payandeh A, Saki A, Safarian M, Tabesh H, Siadat Z (2013) Prevalence of Malnutrition among Preschool Children in Northeast of Iran, A Result of a Population Based Study. **Global Journal of Health Science**; 5(2): 208 - 212. doi: 10.5539/gjhs.v5n2p208

Petralias A, Papadimitriou E, Riza E, Karagas M.R, Zagouras AB, Linos A, DIATROFI Program Research Team (2016) The impact of a school food aid program on household food insecurity. **European Journal of Public Health**; 26(2): 290-296.

Popkin BM (2015) Nutrition Transition and the Global Diabetes Epidemic. **Current Diabetes Reports**; 15(9): 64. doi: 10.1007/s11892-015-0631-4

Prince AK, Laar Laar A (2014). Nutritional status of school-age children in the Nkwanta South District-Volta region of Ghana. **European Scientific Journal**: 10(30): 310 – 327. doi: <http://dx.doi.org/10.19044/esj.2014.v10n30p%25p>

Rassas B, Ariza-Nino E, Peterson K (2018) School Feeding and Educational Outcomes in Developing Countries: A Systematic Review and Meta-Analysis. The McGovern-Dole International Food for Education and Child Nutrition Program.

Republic of Botswana (2018). Opportunities and policy actions to maximize the demographic dividend in Botswana: Demographic Dividend study report. Development Policy Research Unit. <https://botswana.unfpa.org/en/publications/opportunities-and-policy-actions-maximize-demographic-dividend-botswana> (Accessed 18 April 2019).

Republic of Botswana (2015). Education and Training Sector Strategic Plan (2015-2020). <http://www.gov.bw/en/Ministries--Authorities/Ministries/Ministry-of-Education-and-Skills-Development/Public-Notices--Press-Releases/Reports/Education-and-Training-Sector-Strategic-Plan/> (Accessed 19 April 2019).

- Ruzita AT, Wan Azdie MAB, Ismail MN (2007). The effectiveness of nutrition education programme for primary school children. **Malaysian Journal of Nutrition**; 13(1): 45-54.
- Sadegholvad S, Yeatman H, Omidvar N, Parrish A, Worsley F (2017). Essential nutrition and food systems components for school curricula; views from experts in Iran. **Iranian Journal of Public Health**; 46 (7), 938 – 947.
- Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, Agostoni C (2018) Factors Influencing Children's Eating Behaviours. **Nutrients**; 10 (6):706 doi: 10.3390/nu10060706
- Sekwati L, Narayana N, Rabolok M (2012) Understanding the nature of household poverty in Botswana. **PULA: Botswana Journal of African Studies**; 1(46): 71 – 81.
- Shaibu S, Holsten JE, Stettler N, Maruapula SD, Jackson JC, Maletle L, Mokone G, Wrotniak B H, Compher CW (2011) Adolescent Obesity Prevention in Botswana: Beliefs and Recommendations of School Personnel. **The Journal of School Nursing**; 28(3): 220-229.
- Shepherd J, Harden A, Rees R, Brunton G, Garcia J, Oliver S, Oakley A (2005) Young people and healthy eating: a systematic review of research on barriers and facilitators. **Health Education Research**; 21(2): 21(2):239-57.
- Sidaner E, Balaban D, Burlandy L (2012). The Brazilian school feeding programme: an example of an integrated programme in support of food and nutrition security. **Public Health Nutrition**; 16(6): 989–994 doi:10.1017/S1368980012005101
- Singh A, Uijtdewilligen L, Twisk JWR, Mechelen W, Chinapaw JM (2012) Physical Activity and Performance at School: A Systematic Review of the Literature Including a Methodological Quality Assessment. **Archives of Pediatric Adolescent Medicine**; 166(1):49-55.
- Soares P, Martinelli SS, Melgarejo L, Cavalli SB, Florianópolis C, Davó-Blanes MC (2016). Using local family farm products for school feeding programmes: effect on school menus. **British Food Journal**; 119(6):1289-1300. <https://doi.org/10.1108/BFJ-08-2016-0377>
- Spaull N (2011). Primary School Performance in Botswana, Mozambique, Namibia, and South Africa. Working paper. SACMEQ. www.microdata.worldbank.org/index.php/catalog/1246/download/22698 (Accessed 20 March 2019)
- Statistics Botswana (2017). Botswana demographic survey report. www.cso.gov.bw (Accessed 19 March 2019)
- Statistics Botswana (2013). Pre and Primary Education 2013 – Stats Brief. www.cso.gov.bw (Accessed 3 January 2018)

Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K (2008) Creating healthy food and eating environments: policy and environmental approaches. **Annual Reviews Public Health** 29: 253-272.

Story M, Neumark-Sztainer D, French S (2002) Individual and environmental influences on adolescent eating behaviours. **Journal of the American Dietetic Association**; 102(3): S40-S51.

Swindale A, Bilinsky P (2006) Household dietary diversity score (HDDS) for measurement of household food access: indicator guide, Version 2. Food and Nutrition Technical Assistance Project, (FANTA). Academy for Educational Development (AED), Washington, D.C.

Tathiah N, Moodley I, Mubaiwa V, Denny L (2013). South Africa's nutritional transition: Overweight, obesity, underweight and stunting in female primary school learners in rural KwaZulu-Natal, South Africa. **South African Medical Journal**; 103(10): 718-723.

Taylor AD, Ogbogu CO (2016). The Effects of School Feeding Programme on Enrolment and Performance of Public Elementary School Pupils in Osun State, Nigeria. **World Journal of Education**; 6 (3). ISSN 1925-0746 E-ISSN 1925-0754. <http://www.sciedupress.com/journal/index.php/wje/index/>

Teblick A, Deken SD, Vanderbruggen W, Vermeersch M, Teblick S, Ruymaekers M, Andries J, Colebunders R, Mmbando BP. (2017). Anthropometry and Nutritional Status of Primary School Children in a Sub-Urban Region in Tanzania. **International Journal of School Health**; 4(3): e46079. doi: 10.5812/intjsh.46079.

Tigga P, Sen J (2016) Maternal Body Mass Index Is Strongly Associated with Children Z-Scores for Height and BMI. **Journal of Anthropology**; doi.org/10.1155/2016/6538235.

UNICEF (2017). UNICEF Annual Report 2017- Botswana. www.unicef.org (Accessed 9 April 2019)

UNESCO (2015) Botswana National Education for All 2015 National Review. <http://unesdoc.unesco.org/images/0023/002315/231568e.pdf> (accessed 22 July 2018)

UNICEF (2016) Assessment of Orphan Care, Botswana. https://www.unicef.org/evaldatabase/files/Assesment_of_OVC_Programme_Print_Botswana_2016-001.pdf (last accessed 22 July 2018)

UNICEF (2004) Strategy for improving nutrition of children and women in developing countries. A UNICEF policy review. New York: UNICEF

United States Department of Agriculture and United States Department of Health and Human Services. (2010). Dietary Guidelines for Americans 2010. <http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf> (Accessed 29 June 2015)

UNSCN (2017) Schools as a System to Improve Nutrition, A new statement for school-based food and nutrition interventions. www.unscn.org (Accessed 29 November 2018).

USAID (2018). Tanzania: Nutrition Profile. <https://www.usaid.gov/sites/default/files/documents/1864/Tanzania-Nutrition-Profile-Mar2018.pdf> (Accessed 18 March 2019).

Uys M, Bassett S, Draper CE, Micklesfield L, Monyeki A, de Villiers A, Lambert EV, the HAKSA 2016 Writing Group (2016). Results from South Africa's 2016 Report Card on Physical Activity for Children and Youth. **Journal of Physical Activity and Health**; 13 (2): S265 - S273.

Velazquez CE, Black JL, Potvin KM (2017) Food and Beverage Marketing in Schools: A Review of the Evidence. **International Journal of Environmental Research and Public Health**; 14(9): 1054. doi: 10.3390/ijerph14091054.

Vorster HH, Badham JB and Venter CS (2013). Food-Based Dietary Guidelines for South Africa. **South African Journal of Clinical Nutrition**; 26(3): S1-S164

Vinueza D, Lera L, Salinas J, González CG, Barrios L, Vio F (2016) Evaluation of a Nutrition Intervention through a School-Based Food Garden to Improve Dietary Consumption, Habits and Practices in Children from the Third to Fifth Grade in Chile. **Food and Nutrition Sciences**; 7: 884-894. doi.org/10.4236/fns.2016.710088.

Wang Y, Lobstein T (2006) Worldwide trends in childhood overweight and obesity. **International Journal of Pediatric Obesity**; 1(1): 11-25. doi: 10.1080/17477160600586747.

Watson A, Timperio A, Brown H, Best K, Hesketh KD (2017). Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. **International Journal of Behavioral Nutrition and Physical Activity**; 14:114 doi 10.1186/s12966-017-0569-9

WFP (2016). Two minutes to learn about school meals. www.wfp.org/school-meals (accessed 28 January 2018)

WFP (2019). The Impact of School Feeding Programmes. https://docs.wfp.org/api/documents/WFP-0000102338/download/?_ga=2.89492573.730941107.1552849583-268132286.1552849583 (Accessed 17 March 2019)

WFP (2019). Tanzania, United Republic of. <https://www.wfp.org/node/3614/4092/39940> (Accessed 18 March 2019)

WFP (2017). School feeding. <https://www1.wfp.org/school-meals>. (Accessed 17 March 2019)

WFP (2018). WFP Malawi - School Meals Programme. <https://reliefweb.int/report/malawi/wfp-malawi-school-meals-programme-smp-april-2018> (Accessed 18 March 2019)

WFP (2018). Two Minutes on School Feeding. https://docs.wfp.org/api/documents/WFP-0000099841/download/?_ga=2.64769257.730941107.1552849583-268132286.1552849583 (Accessed 17 March 2019)

WFP (2009). School Feeding Reduces Hunger and Improves Education. www.wfp.org/school (accessed 13 January 2018).

WFP (2004). School feeding programmes: Why they should be scaled up now. http://www.unep.org/training/programmes/Instructor%20Version/Part_2/Activities/Dimensions_of_Human_Well-Being/Education/Strategies/School_Feeding_Programme.pdf (accessed 8 January 2018)

WHO (2018). Malnutrition. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>. (Accessed 17 March 2019).

WHO (2005). Software for assessing growth and development of the world's children. http://www.who.int/childgrowth/software/WHOAnthro2005_PC_Manual.pdf (accessed 30 August 2018)

Wiles NL, Green JM, Veldman FJ (2011). The variety, popularity and nutritional quality of tuck-shop items available for sale to primary school learners in Pietermaritzburg, South Africa. **South African Journal of Clinical Nutrition** 24 (3):129-135

Wiles NL, Green JM, Veldman FJ (2013). Tuck-shop purchasing practices of Grade 4 learners in Pietermaritzburg and childhood overweight and obesity. **South African Journal of Clinical Nutrition** 26 (1): 37 – 42. <https://doi.org/10.1080/16070658.2013.11734438>

World Bank (2016). Improving Africa's school feeding programs: analysis sheds light on strengths, challenges. <http://www.worldbank.org/en/news/feature/2016/06/09/improving-africas-school-feeding-programs-analysis-sheds-light-on-strengths-challenges> (Accessed 17 March 2019)

World Bank (2015). Tanzania Mainland Poverty Assessment: A New Picture of Growth for Tanzania Emerges. <http://www.worldbank.org/en/country/tanzania/publication/tanzania-mainland-poverty-assessment-a-new-picture-of-growth-for-tanzania-emerges> (Accessed 18 April 2019).

World Bank (2012). Scaling up school feeding: keeping children in school while improving their learning and health. <http://www.worldbank.org/en/news/feature/2012/04/25/scaling-up-school-feeding-keeping-children-in-school-while-improving-their-learning-and-health> (Accessed 17 March 2019)

Wrotniak B, Malet L, Compher C, Malet J, Stettler N, Shaibu S, Maruapula S (2009). Prevalence of obesity in adolescent learners in Botswana, an African country in rapid nutrition transition. **Obesity** 17, S218 <https://doi.org/10.1111/j.2047-6310.2011.00023.x>.

Yendaw E, Dayour F (2015). Effect of the National School Feeding Programme on pupils' enrolment, Attendance and Retention: A case study of Nyoglo of the Savelugu-Nanton Municipality, Ghana; **British Journal of Education, Society & Behavioural Science**; 5(3): 341 – 353.

Yulia C, Khomsan A, Sukandar D, Riyadi H (2018). Nutritional Status, Physical Activity, Sedentary Activity of School Children in Urban area, West Java, Indonesia. **Jurnal Gizi dan Pangan**; 13(3):123 – 130. doi: 10.25182/jgp.2018.13.3.123-130

Yunusa I, Gumel AM, Adegbusi K, Adegbusi S (2012) School Feeding Program in Nigeria: A Vehicle for Nourishment of Learners. The African Symposium: African Educational Research Network

Zenebe M, Gebremedhin S, Henry CJ, Regassa N (2018) School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children. **Italian Journal of Pediatrics**; 44(1):16. doi: 10.1186/s13052-018-0449-1.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

To address the aim of the current study, namely to determine the impact of SFPs on the nutritional status of primary school children in the South-east District of Botswana when compared to non-recipients of SFPs, as well as related factors including household dietary diversity, household food security status, physical activity and socio-demographic variables that could also have an impact on childhood nutritional status, the current chapter provides a description of the study methods and materials that were used to investigate the study aim and its related objectives. In addition, information regarding the study location, study design, study population and sample selection, fieldworker recruitment and training, piloting, data collection, statistical analysis, data quality control, reduction of bias and ethical considerations will be reported on.

3.2 Background and location of the study

3.2.1 Study location

This study was conducted in the South-east district, Botswana. Botswana has adapted two school systems namely public (government) schools which are non-profit, and private (known as English medium) profit making schools run by companies or individuals (Marumo, 2016). The estimated number of primary school learners in Botswana is 330,000 enrolled in 755 schools (Moepeng, 2016). The study location namely the South-east district in Botswana was selected, as the location was easily accessible but still provided access to both urban and peri-urban schools participating in the national SFP. The South-east District has the advantage of including the capital city, Gaborone as one of its urban areas, and has a relatively well-developed infrastructure since most of the major villages are connected by bitumen roads and various telecommunication networks (Gwebu, 2011). An additional advantage of the study location was that it has modern amenities which are uncommon in most rural areas (Sebego & Gwebu, 2013). The following peri-urban villages are located in the South-east district: Ramotswa, Mogobane, Otse, Tlokweng as well as the capital city, Gaborone from which primary schools were selected (Figure 3.1). As is the case sub-Saharan Africa, namely that most peri-urban areas are in close proximity to large cities,

Botswana is no different in the sense that peri-urban areas are centred around the capital city Gaborone (Toteng, 2009). In the current study, permission to conduct the study was granted by local authorities in 12 of the government primary schools in the South-east district. Hence random sampling of schools in the area was not possible (Appendix H).



Figure 3.1: Map of Botswana indicating its administrative districts

Source: www.mapsofworld.com

3.3 Study design

3.3.1 Cross-sectional study with a longitudinal component

This study was an exploratory, primary school based study employing a cross-sectional and longitudinal study design to address the respective research objectives.

A cross-sectional study is defined as a type of observational study where the investigator measures the outcome and exposures among the study participants, while at the same time, data is gathered from the study population at a given point in time (Setia, 2016; Sedgwick, 2014; Pierce, 2012). This is done so that the relationship of a particular target point and other variables of interest within the population can be studied (Setia, 2016).

A longitudinal study is an observational research method in which data is gathered for the same subjects repeatedly over a period of time (Caruana, Roman, Hernández-Sánchez & Solli 2015). Both the cross-sectional and longitudinal components of the study were observational, implying that researchers recorded information about their subjects without them interfering with the surroundings (Institute for Work & Health, 2015). In this case, primary school learners were studied in their school environment. Learner nutritional status was assessed during the school term and immediately after a three-week school holiday.

3.3.2 Strengths and limitations of study designs

The advantages of a cross-sectional study as outlined by various authors (Setia, 2016; Mann, 2012; Omair, 2015), is presented in Table 3.1.

Table 3.1: Strengths and limitations of a cross-sectional study

Strengths	Limitations
<ul style="list-style-type: none"> ● Relatively quick to conduct; ● All variables are collected at one point in time; ● Multiple outcomes can be researched at once; ● Prevalence of all variables can be measured; ● Good for descriptive analysis; ● Can be used as a springboard for further research; ● Affordable study design; ● Provides good control over the measurement process; ● Provides better precision in the sampling process; ● Provides researchers access to multiple outcomes and exposures; ● Offers information for a descriptive analysis. 	<ul style="list-style-type: none"> ● Cannot be used to analyze behaviour over a period to time; ● Does not help to determine cause and effect; ● Susceptible to biases such as respondent bias, recall bias, interviewer bias and social acceptability bias; ● Requires a larger sample size to provide accuracy.

The strengths and limitations of a longitudinal study as outlined by various authors (Roberts, Adams, Heussler, Keen, Paynter, Trembath, Westerveld & Williams, 2018; Caruana *et. al.* 2015; Sedgwick, 2014), is presented in Table 3.2.

Table 3.2: Strengths and limitations of a longitudinal study

Strengths	Limitations
<ul style="list-style-type: none"> • Powerful study of causal association between exposure and outcome; • Allows for high levels of validity; • Accuracy of data collection is almost always high. 	<ul style="list-style-type: none"> • Time consuming • Costly due to participant follow-up at different time points; • Potential for loss to follow-up; • Only effective if study sample is representative of the entire population.

3.4 Study population

The study population included 392 learners from 12 public primary schools and one private school located in both urban and peri-urban areas in the South-east District of Botswana. The public schools were conveniently sampled based on the schools' local authorities that gave permission to include them in the study sample. All public schools forming part of the study sample participated in the national SFP. Hence, these schools represented the intervention due to learners being beneficiaries of the SFP. The private school was used as a control due to its non-participation in the SFP. The control group consisted of learners of the same age and level of school enrolment as those recruited from public schools. As only one private school in the South-east District provided consent to participate in the study, the non-recipients of the SFP were represented by a single school.

3.5 Sampling procedure

Sampling entails the process of sampling select units from a population of interest in order to generalise results back to the selected population (Elfil & Negida, 2017). A list of all public schools in the South-east District was obtained from the district education office, revealing that there are 70 primary schools, both public and privately managed, in the District (Statistics Botswana, 2013) (Figure 3.2). Subsequently participating schools were conveniently sampled based on schools for which the Ministry of Basic Education gave permission to participate. This resulted in 18% of the schools in the District being sampled. Study participants consisted of learners aged 8 to 13 years from two categories, namely schools that implement the SFP

(recipients) versus those who do not (non-recipients). For each school that was granted permission, the number of participants per school was determined by means of proportionate sampling. Participants from the respective schools were then selected based on balloting. A ballot involving the selection of a YES or NO was made for pupils in the selected schools who were in standards five to seven. Respondents who picked YES were then requested to participate, subject to their parents or primary care givers providing informed consent while participating children have to provide assent.



Figure 3.2: Location of South-east District, Botswana

Source: <https://en.wikipedia.org>

The list of participating schools, as well as the number of participating learners per school is presented in Table 3.3. The sample size calculated for the purpose of this study, was 469 using an internet-based statistical calculator (www.surveysystem.com) with a 5% margin of error and 95% confidence interval. The sample size assigned to the intervention (government schools) versus the control group (private schools) was proportional to the size of the respective schools. Unfortunately, only one out of 17 registered private school in the area agreed to participate in the study. Proportionate sampling was used to determine the number participating learners per school, in accordance with the number of learners in standard five to seven. Hence, at the school level, stratified random sampling was used to select children from each standard. The sampling

procedure is presented in Figure 3.3. Of the 469 number of learners identified for this study using a sample calculator, all the learners from private schools were traceable after school holidays. However, in the public school group, there was loss-to-follow up. Reasons for the latter included school transfers, primary school leaving examinations for learners in standard seven, illness, and independence day preparations. Loss to follow-up is very important in determining a study's validity as >20% loss to follow-up poses serious threats to validity (Detorri, 2011). Abshire, Dinglas, Cajita, Eakin, Needham & Himmelfarb (2017) recommend various strategies that can be implemented curb loss to follow-up. These strategies include study reminders, emphasising study benefits, and contact/scheduling strategies, non-financial incentives and financial incentives. However, in the current study, appropriate strategies emphasised by Schoeppe, Oliver, Badland, Burke & Duncan (2013) including building trustful relationships between researchers and study partners, parents, and children; having project champions; optimizing consent and minimizing participant burden were more appropriate for consideration.

The list of participating schools and the respective number of learners sampled from standard five to seven per school is presented in Table 3.3.

Table 3.3: List of participating schools in the current study (N=392)

Area	Classification	Name of primary school	Number of learners surveyed per school
Mogobane	Public	Mogobane	54
Otse	Public	Baratani	53
Tlokweng	Public	Kgosi Kgosi	40
		Mafithakgosi	37
Gaborone	Public	Boitumelo	23
		Galaletsang	19
		Ledumang	19
		Tshwaragano	11
		Ikageng	14
		Segoditshane	22
		Tsogang	23
		Bontleng	14
	Private	Rainbow	62

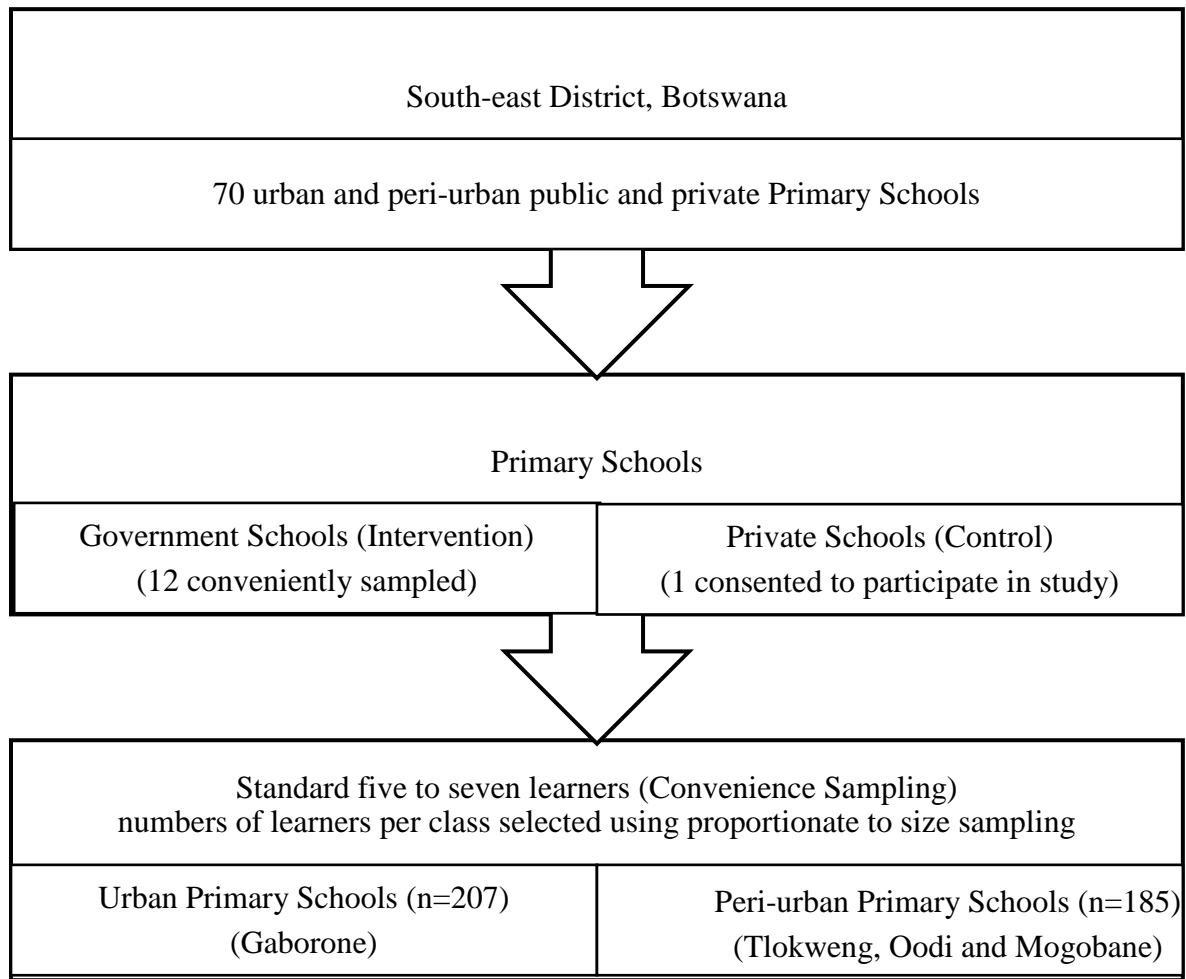


Figure 3.3: Study sampling procedure

This study included primary school learners from standard five to seven. Although children are a common target group in the majority of studies conducted in community settings such as schools, one of the major problems faced by researchers is participant attrition (Schoeppe *et. al*, 2013). The authors indicate that some of the recognized strategies for a successful recruitment and retention includes building trustful relationships between researchers, parents and children (Schoeppe *et. al*. 2013). In this present studies, the personal contact numbers of the principal researcher were availed to the participants and their caregivers to call if they had any queries related to the study. Another strategy used was addressing all learners of the targeted schools during gatherings such as morning prayer assemblies. The principal researcher also took advantage of Parents Teachers Association (PTA) meetings in some schools to brief the attendants on the particulars of the research. Another issue that was taken into consideration is that learners from younger age groups

require some assistance, since the age at which a child becomes an accurate self-reporter and ages 8 – 10 years of age need some assistance (Pérez-Rodrigo, Escauriaza, Bartrina, & Allúe, 2015). In this study, the targeted participants were ages ranging from 8 to 13 years of age and information relied on the children themselves, however a 24-hour recall method of dietary assessment was used to assist in determining the Household Dietary Diversity Score (HDDS). Pérez-Rodrigo *et. al.* (2015) however alludes to the fact that children do have limited knowledge of food and found that children's accuracy for reporting school meal intake was better for prior 24 hour recalls than previous day recalls.

In order to recruit study participants, the researcher liaised with the Ministry of Education, district education officers, parents, guardians, teachers, and head teachers. After obtaining permission from the South-east district education office to conduct the study, the head teachers from the respective schools provided consent for the researcher to discuss the study, its objectives and research methods with teachers and learners. After the abovementioned discussion, the researcher gave learners a letter of consent to take home for the parents/legal guardians of learners to complete for learners that showed an interest in participating in the study. Teachers were requested to collect the signed letters from learners once they were returned to school. Learners whose parents or legal guardians did not provide consent were not included in the study. However, learners were only allowed to participate after providing assent.

This exploratory study employed a cross-sectional study design for participating learners from private schools (control group), while learners from public schools (beneficiaries of the SFP serving as intervention), were surveyed during the school term, as well as after the school holiday. The group of primary school learners from both the intervention and control school, were selected using convenience sampling on an opportune basis. The comparison of public schools (intervention) to the private school (control) served as a proxy for socio-economic status (SES) to limit questions of a personal nature posed to learners.

A class was used as the sampling frame. Subsequently an equal number of boys and girls were systematically sampled from each class.

3.6 Research instruments

The following research instruments were used for data collection purposes that entailed each study participant being interviewed by trained fieldworkers.

- Socio-demographic questionnaire;
- Household dietary diversity score (HDDS)
- Household Food Insecurity Access Scale (HFIAS)
- Physical activity questionnaire (PAQ-C).

3.6.1 *Household Dietary Diversity Score (HDDS)*

Information on dietary diversification in most communities is scarce (Steyn & Ochse, 2013). Dietary diversity refers to the number of food groups consumed within a 24-hour period and is a qualitative measure of food consumption, reflecting household access to a variety of foods (Singh, Chaturvedi & Gupta, 2016; Kennedy & Ballard, 2010). In other studies, a seven-day food frequency questionnaire was used to determine HDDS (Madzorera, Duggan, Berthé, Grais & Isanaka, 2018). Household food access refers to the ability to acquire food of an adequate quality in sufficient quantities to meet all members of a household's nutritional requirements (Frempong & Annim, 2017; Bukania, Mwangi, Karanjia, Mutisya, Kombe, Kaduka & Johns 2014; Becquey, Martin-Prevel, Dembélé, Bambara & Delpuch, 2010). Household dietary diversity refers to the number of unique foods consumed by household members over a given period and has been validated as a useful approach for measuring household food access, especially when resources for undertaking such measurements are scarce (Swindale & Bilinsky 2006). A high level of dietary diversity is associated with a high socio-economic status and household food security (Hoddinot & Yohannes, 2002). Therefore, the Household Dietary Diversity Score (HDDS) was also used as a proxy for SES as it was indicative of study participants having access to a variety of foods (Kennedy & Ballard, 2010).

Dietary inadequacy is a major problem in Botswana. A regional study conducted among youth in Botswana found a recurrent pattern of poor dietary diversity (Wrotniak, Maletse, Maruapula, Jackson, Shaibu, Ratcliffe, Stettler & Compher, 2012) in rural areas compared to urban areas such as Gaborone. A study by Acquah, Kapunda, Legwegoh, Gwebu, Modie-Moroka & Gobotswang,

Mosha, (2013), also found that the majority of households in Gaborone had a more diverse diet. In an effort to improve dietary diversity, the government of Botswana established the Botswana Horticultural Market which gives households access to fresh produce to complement their predominantly grain and cereal based diets (Acquah *et. al.*, 2013). Although food items served as part of the Botswana SFP has a limited fruit and vegetable content [Botswana Institute for Development Policy Analysis (BIDPA, 2011) the HDDS was used to determine whether learners were consuming these food groups outside the school environment.

To determine HDDS, the following 12 food groups in Table 3.4 were used to calculate HDDS (Swindale & Bilinsky 2006) (**Appendix N**).

Table 3.4: Food groups used to calculate HDDS

Food group	Examples of foods
A Cereals	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products), porridge
B Roots and tubers	White potatoes, white yam, white cassava, or other foods made from roots
C Vegetables	Pumpkin, carrot, squash, sweet potato, red sweet pepper, dark green leafy vegetables, including wild forms and locally available leaves such as amaranth, cassava leaves, kale, spinach, tomato, onion, eggplant.
D Fruits	Apples, oranges, bananas, pears, peaches, mango, cantaloupe, apricot (fresh or dried), papaya, dried peach, and 100% fruit juice made from these, wild fruits and 100% fruit juice made from these
E Meat, poultry, offal	Liver, kidney, heart or other organ meats, beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects
F Eggs	Eggs from chicken, duck, guinea fowl or any other egg
G Fish and seafood	Fresh or dried fish or shellfish
H Pulses/legumes/nuts	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)
I Milk and milk products	Milk, cheese, yogurt or other milk products
J Oils/fats	Oil, fats or butter added to food or used for cooking
K Sugar/honey	Sugar, honey, sweetened soda or sweetened juice, sugary foods such as chocolates, candies, cookies and cakes
L Miscellaneous	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages

The HDDS variable was calculated for the household of each study participant. Therefore, the value for this variable ranged from 0 to 12 as is depicted in Table 3.5.

Table 3.5: Calculation of HDSS

HDSS (0 -12)	Total number of food groups consumed by members of the household. Values for A through L will be either “0” or “1” Sum (A+B+C+D+E+F+G+H+I+J+K+L)
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Source: Swindale & Bilinsky (2006)

3.6.2 Socio-demographic questionnaire

The socio-demographic questionnaire was developed by the researcher based on literature from numerous authors (Hughes, Camden, Yangchen & College, 2017; Pew Research Center, 2016; Rainbow Health Ontario & Hart, 2012). Hughes *et. al.* (2017) recommend that researchers should assess their demographic questions every time they conduct research for outdated or inappropriate terms and to use more inclusive questions, written with clarity, which allows researchers to better understand the samples they are recruiting. The socio-demographic questionnaire (**Appendix J**) include study variables such as age, gender, name and location of school, standard, household head, and other variables related to food consumption.

3.6.3 Household Food Insecurity Access Scale (HFIAS)

To investigate whether learners participating in the SFP are affected by food insecurity or food shortages, the HFIAS, a tool for measuring household food insecurity was used (Coates, Swindale & Bilinsky 2007). The HFIAS scale provides an indication of participants’ household food insecurity status, based on categories used by other researchers (Akinboade, Mokwena & Adeyefa, 2016).

Household food insecurity has been shown to impact negatively on learners’ educational and health outcomes (Tamiru & Belachew, 2017; Naicker, Mathee & Teare, 2015; Kimani-Murage, Holding, Fotso, Ezeh, Madise, Kahurani & Zulu 2010). A study by Ijarotimi & Erotu (2018) found a positive relationship between household food security status and nutritional status of children 10 – 19 years of age. HFIAS measures the accessibility dimension of food security at household level and consists of nine questions that cover all aspects and/or factors related to insecure access to food. Each question asks for a recall period of four weeks. Participants are required to answer an occurrence question followed by a frequency-of-occurrence question to determine if the condition

happened and how often it occurred (Coates *et al.*, 2007). The HFIAS (**Appendix L**) consists of one question regarding anxiety, three questions regarding food quality and five questions regarding dietary intake and consequences. The last three questions are used to determine household hunger levels. A short form of the HFIAS, a useful tool for surveys (Coates *et al.*, 2007), was also used in the current study to determine the level of household food security of the study sample. High food insecurity is an indication of inconsistent eating patterns and poor dietary intake due to a lack of resources. The HFIAS score ranges from 0 to 27, with a high score reflecting severe food insecurity (Coates *et al.*, 2007). Table 3.6 depicts how HFIAS is classified.

Table 3.6: HFIAS score classification

Food secure	Mildly food secure	Moderately food insecure	Severely food insecure
0 – 6.75	6.75 – 13.5	13.5 – 20.5	20.5 - 27

Based on the above classification, an HFIAS categorical variable was assigned to each participant, by assigning a code to each of the four food insecurity categories. The HFIAS category for each study participant’s household was subsequently classified as follows:

1 = food secure; 2 = mildly food secure; 3 = moderately food insecure; and 4 = severely food insecure.

A study conducted by Acquah *et al.* (2013) found that female headed households are more vulnerable to food insecurity. In the current study, one of the socio-demographic variables that were collected was household size and identification of the household head. This variable was then used to determine whether there was a relationship between the head of the household and HFIAS.

3.6.4 Physical activity (PA)

The increase in the prevalence of overweight and obesity is concurrent with increased levels of inactivity (Botha, Wright, Moss & Kolbe-Alexander, 2013). Despite its health benefits (Draper, de Kock, Grimsrud, Rudolph, Nmutandani, Kolbe-Alexander & Lambert, 2010), children have been found to be not active enough due to reasons such as a lack of parental support, an

environment which is not conducive to exercise, too much screen time (TV), and a lack of physical education in schools (Biljon, McKune, DuBose, Kolanisi & Semple, 2018; Monyeki, 2014). Learners who engage on Active School Transport (AST) such as walking or biking, lower likelihood obesity than those who travel using motorized transport (Denstel, Broyles, Larouche, Sarmiento, Barreira, Chaput, Church, Fogelholm, Hu, Kuriyan, Kurpad, Lambert, Maher, Maia, Matsudo, Olds, Onywera, Standage, Tremblay, Tudor-Locke, Zhao & Katzmarzyk, 2015; Sarmiento, Lemoine, Gonzalez, Broyles, Denstel, Larouche, Onywera, Barreira, Chaput, Fogelholm, Hu, Kuriyan, Kurpad, Lambert, Maher, Maia, Matsudo, Olds, Standage, Tremblay, Tudor-Locke, Zhao, Church & Katzmarzyk, 2015). In the current study, the validated Physical Activity Questionnaire (PAQ-C) (**Appendix M**) developed by Kowalski, Crocker & Donen (2004), appropriate for use among elementary school-aged children (grades four to eight and approximately aged 8 to 14 years) was used. This seven-day recall questionnaire measures general moderate to vigorous physical activity levels during the school term and was used to determine the level of physical activity among study participants as was used in a similar study by Voss, Ogunleye & Sandercock, (2013). Advantages of the PAQ-C includes that it has been supported as a valid and reliable measure of general physical activity among children, it utilises memory cues such as lunch and evening times to enhance recall, and is cost and time efficient. Limitations of the PAQ-C includes that it does not provide an estimate of energy expenditure or specific frequency, time and intensity of information. In addition, it does not discriminate between specific activity intensities such as moderate and vigorous activities, but merely provides a summary activity score (Kowalski *et al.*, 2004).

Scoring includes finding an activity score between one and five for each item in the questionnaire (excluding item ten), where the lowest activity response equates to one, while the highest activity response is scored as a five. Once a value from one to five has been allocated for each of the nine items, the mean value is calculated yielding the PAQ-C activity summary score. A score of one indicates low physical activity, whereas a score of five indicates high physical activity. Item ten can be used to identify learners who had unusual high physical activity during the previous week (Ronghe, 2016).

Self-report measures of PA are frequently used in research because they are relatively simple to administer, cost effective and have the ability to provide information on the type and context of PA in a large sample of individuals (Lee, Yu, McDowell, Leung, Lam & Stewart, 2011; Loprinzi & Cardinal, 2011).

To enhance the reliability of the questionnaire, trained field workers assisted with the administration of the questionnaire. Learners were encouraged to ask questions if they did not understand the meaning of individual questions to minimise missing data.

3.6.5 Anthropometric measurements

3.6.5.1 Weight

The principal investigator, assisted by trained field workers took the anthropometric measurements according to standard practices. Anthropometric measurements were taken during school term and within two weeks following after the school holiday in schools participating in the SFP. For the private school (serving as control due to non-participation in the SFP), anthropometric measurements were taken once.

Weight was measured according to the WHO (2008) protocol using a Pegaso digital scale with a capacity of 150kg to the nearest 0.1 kg. To calibrate the scale, an exercise weight of a known weight was used. The scale was placed on a hard, even surface and zeroed after every measurement was taken. Study participants were weighed wearing light clothing and without shoes.

3.6.5.2 Height

Height was measured using a SECA stadiometer to accurately measure height for the calculation of BMI-for-age z-scores, based on WHO (2007) growth charts. The following steps were followed (Figure 3.4).

- Learners had to remove their shoes, clothing such as tracksuit tops and unbraid their hair to ensure that height measurements were taken accurately.
- To measure height, the stadiometer was placed on uncarpeted, level flooring and was positioned against a flat vertical surface.

- Learners had to stand with feet flat, together, and with legs straight, arms are at their sides, and shoulders that are level, while looking straight ahead with the line of sight parallel with the floor.
- Measurements were taken while the learner stood with their head, shoulders, buttocks, and heels touching the flat surface of the stadiometer.
- Height measurements were recorded to the nearest 0.1 centimeter
- Measurements were taken three times and the mean of the three measurements were recorded.
- Each individual learner's measurements were recorded in a form developed by researcher (**APPENDIX K**)

The World Health Organization (WHO) Anthro software was then used to convert weight, height and age data into Z-scores using the 2006 WHO Growth Standards (Adhikari, 2017; WHO, 2011). Summary of anthropometric measurement reference values are illustrated on Table 3.7.

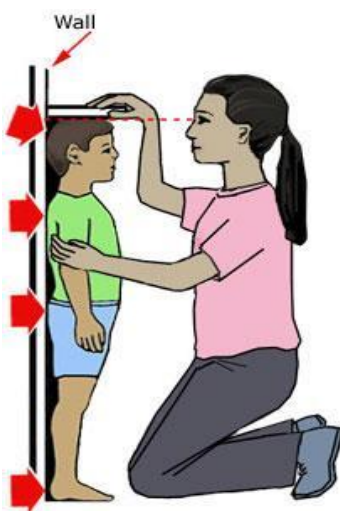


Figure 3.4: Illustration of how height was measured

Source: CDC (2016)

Table 3.7: WAZ, HAZ and WHZ z-score classification

Source: WHO Growth Reference (2007).

Indicator	Age (years)	-3 z-score	≥-3 to < -2 z-score	≥-2 to < -1 z-score	≥1 to ≤+1 z-score	>+1 to ≤+2 z-score	> +2 to ≤+3 z-score	> +3 z-score
WAZ	5 to 10	Severe U/W	Moderate U/W	Normal		Weight-for-age should not be used to determine overweight. A child or adolescent should rather be assessed with BMI-for-age.		
HAZ	5 to 19	Severe stunting	Moderate stunting	Normal				Extreme tallness is usually not nutrition related. May indicate endocrine disorder.
BAZ	5 to 19	Severe thinness	Moderate thinness	Normal	O/W ∅	Obesity		
WHZ	5 to 19	Severe wasting/ severe acute M/N# (SAM)	Moderate wasting/ moderate acute M/N# (MAM)	Normal	Possible risk of O/W ∅	O/W ∅	Obesity	

<p>*U/W refers to underweight # M/N refers to malnutrition ∅ O/W refers to overweight</p>

In the current study, weight and height measurements were interpreted as weight-for-age z-scores (WAZ), height-for-age z-scores (HAZ), body mass index (BMI) and BMI-for-age z-scores (BAZ) using WHO Anthroplus software (version 10.4). Z-score cut offs are used to define malnutrition according to anthropometric indices (Cashin & Oot, 2018). The table below identifies universally accepted international cut offs for children 5 to 19 years of age based on the WHO Growth Reference for several nutrition-related conditions namely stunting, wasting, underweight/thinness, and overweight/obesity. However, the reference data for BMI-for-age recommended by WHO are limited in that the age category only begins at nine years of age (de Onis, Onyango, Borghi, Siyam, Nishida & Siekmanna, 2007).

3.7 Reliability and validity of data

Validity and reliability is achieved through clarity of instructions and questions, clearly outlining the nature and purpose of the study before conducting the research and also incorporating ethical considerations to avoid biased responses (Gordis, 2013).

3.7.1 Reliability

Lee *at. al*, (2011) and Bolarinwa (2016) define reliability as exact replicability of the processes and the results which can be categorized as equivalence, stability and internal consistency (homogeneity). Bajpa & Bajpai (2014) explained that an instrument is said to be reliable if it consistently gives the same results to individuals or objects with equal values. Thus reliability shows the degree of unbiasedness of an instrument used for measuring a particular aspect measured across time and across various constructs in the instruments. In addition, reliability determines the stability and consistency of the research instrument which assists in analyzing the integrity of a measure (Bajpa & Bajpai, 2014). Kimberlin & Winterstein (2008) added that reliability approximations are used to assess the stability of measures or internal consistency with reliability coefficients ranging from 0 to 1, with higher coefficients showing higher levels of reliability.

The HFIAS is a globally recognised scale used to determine household food insecurity (Knueppel, Demment & Kaiser, 2010). Reliability of the socio-demographic questionnaire was ensured by compiling an extensive theoretical framework on which the variables included in this questionnaire were based. In addition, expert input was consulted to confirm inclusion of these variables in the questionnaire. The extensive training of fieldworkers in accordance with internationally recognised anthropometric measurement techniques (WHO, 2008) as well as training provided on interview techniques and administration of the survey instruments, pilot testing of the questionnaires to determine whether questions were clear and not ambiguous and thorough checking of questionnaires after participant completion ensured reliability. In addition, a consistent scoring system was used for interpretation of the results generated by the HDDS, HFIAS and PAQ-C.

3.7.2 Validity

Thompson, Kirkpatrick, Subar, Reedy, Schap, Wilson & Krebs-Smith (2015) defined validity as the extent to which an instrument measures what it is supposed to measure. Bolarinwa (2016) further elaborated that validity can be internal, by assessing the accuracy of the research findings in measuring the intended measures, or external validity which looks at the accuracy of the research findings in describing the reference population from which the study sample was drawn. Validity can be classified in several ways including face validity, construct validity, content validity and criterion validity (Bolarinwa, 2016). Furthermore, Thompson *et al.* (2015) added that when conducting dietary research, validation looks at a correct reference measure or an instrument that measures true intake. Similarly, Walker, Ardouin & Burrows (2018) referred to validity as the degree to which a dietary analysis procedure measures what it is supposed to measure but further explained that absolute validity is difficult to measure.

The published research instruments used in the current study were validated for various groups. However, validity in one group does not necessarily imply validity in another. The data generated by these instruments therefore need to be interpreted within the context of this limitation. Construct, content and face validity of the socio-demographic questionnaire was ensured by the construction of a theoretical framework, consultation with experts and pilot testing.

3.8 Fieldworker recruitment and training

Fieldworkers consisted of unemployed graduates from the department of health promotion and education department, Boitekanelo College with some research experience. In addition, they had to be fluent in English and *Setswana*, the official languages spoken in Botswana. Prior to data collection, fieldworkers were orientated with assistance provided by the Boitekanelo College, Research Department. Orientation included aspects such as professional conduct, dress code and ethics. The fieldworkers were also familiarised with and trained regarding the administration of the research instruments and taking of anthropometric measurements according to international standards. They also received on-going periodic debriefing sessions to provide them with feedback regarding challenges experienced during the data collection process. This was used as a quality

assurance exercise, since the debriefings were used to prepare fieldworkers for subsequent data collection sessions. They were also expected to diarise their daily experiences during the data collection period to facilitate the compilation of a detailed report at the end of the data collection period.

3.9 Pilot study

Ismail, Kinchin & Edwards (2017) define a pilot study as a small-scale research project conducted before the final full-scale study is conducted as it helps researchers to test in reality how likely the research process is to work, in order to help them decide how best to conduct the final research study. They are also important as a deciding factor on whether the main study can be undertaken in the estimated time frame, within the estimated budget and using appropriate study methods (Kannan & Gowri, 2015). In the current study, the pilot study was conducted to pre-test the research instruments for content, readability and comprehension. The pilot study was conducted on a random sample of learners from two selected schools in the South-east district located in an urban and peri-urban area respectively. These schools were not included in the main study sample.

The principal investigator and field workers assisted the learners with completing the research instruments. The research instruments were piloted on 5% (n=19) of the study sample in order to standardise the data collection procedures, determine the estimated time taken to complete data collection for each participant, to determine if questions posed were clear and unambiguous and if learners would be able to complete the questionnaire unaided. With feedback and experience gathered from the pilot study, it was determined that the IPAQ-C tool had unnecessary information that was not relevant to the study setting. For example, some of the sports where snow or ice is a prerequisite for participation like ice skating was omitted from the research instrument.

3.10 Data collection

The age of the study sample was limited to scholars in the upper classes of primary school (standards five to seven) due to their expected ability to complete the research instruments unaided. In addition, learners from this age group have been shown to have the ability to concentrate for a

reasonable amount of time, which in turn would have enhanced their ability to complete the research instruments (Harris, Cortina, Templin, Colabianchi & Chen, 2018).

The initial stages of data collection included obtaining consent from the Director, Regional Operations (South-east district), school heads of participating schools as stipulated by the relevant authorities and finally the parents/legal guardians of study participants. The sample letters (**APPENDIX A**) and approvals (**APPENDIX G**) and (**APPENDIX H**) are attached. The data was collected in the second term of the academic year from April to July to achieve the objectives of the study. The trained fieldworkers were deployed to collect data at the conveniently sampled primary schools. Learners and teachers were sensitised regarding the study aim and related objectives during the morning assembly period. The fieldworkers were subsequently allocated the relevant class teachers for standards five to seven to repeat the purpose of the study and what the process of data collection entailed for those learners who were interested in participating in the study. Letters of consent were given to interested learners who in turn had to give it to their parents for signature as well as signing of assent by learners (**APPENDIX C**). To minimise disruption of normal school activities, save time and minimise learner anxiety, participants were surveyed in groups. Weight and height was measured by the principal researcher and fieldworkers with subsequent calculation of BMI on-site. Although pens were provided for participants, it did not serve as an incentive to participate.

The process of data collection was divided into two phases. The first phase took place during the school term while the second phase took place within two weeks after school holiday. The duration of the holiday was three weeks with the purpose of comparing pre- and post-school holiday anthropometric status. After data collection, data sets were checked for completeness and subsequently captured on Excel spreadsheets for statistical analysis.

Data was analysed using the Statistical Package for the Social Sciences (SPSS) ® version 25 taking into consideration the study objectives that are shown on Table 3.9. Frequency distributions were calculated for categorical variables, while means and standard deviations were calculated for all continuous variables. Associations between categorical variables were determined using chi-square tests, while Pearson correlation coefficients were calculated to determine the association

between continuous variables. Between group comparisons for continuous variables were done using an independent samples t-test.

3.11 Reduction of bias

Bias can be defined as a systematic deviation from the truth and is therefore a form of systematic error that can occur in sampling or testing by selecting or favouring a particular result or response over others, thereby preventing fair consideration of a situation (The Institute for Work and Health 2014; Pannucci & Wilkins 2010). As a result, bias can occur at any stage of the research process and can influence research conclusions (Smith & Noble, 2014; Pannucci & Wilkins, 2010).

3.11.1 Selection bias

Selection bias is the error that occurs when individuals, groups or data for analysis are selected in such a way that there is no randomness, meaning that the sample obtained will not be representative of the target population as intended and that the investigator manipulates the results to generate findings that supports their hypothesis (LaMorfe, 2016). Selection bias also occurs when the investigator decides on the research participants (Institute for Work & Health, 2014) or can also be defined as experimental error that happens when the sample, or the upcoming data is not a true reflection of the target population (Pannucci & Wilkins, 2010). Biased results can lead to incorrect findings (Keeble, Law, Barber, Baxter 2015; Hegedus & Moody, 2010; Pannucci & Wilkins, 2010). In the current study, selection bias was minimised by using a class register to randomly select learners for participation in the study in both public and private schools in urban and peri-urban areas.

3.11.2 Observer bias

Observer bias relates to the tendency of an observer to see what is expected or wanted rather than what is actually there and is often caused by the conscious or unconscious predispositions of a non-blinded observer due to hope or expectations (Hróbjartsson, Thomsen, Emanuelsson, Tendal, Rasmussen, Hilden, Boutron & Brorson 2014). To minimize observer bias, the principal researcher and field workers were trained as per protocol for the collection, measurement and interpretation of data prior to study commencement.

3.11.3 Recall bias

Recall bias refers to an occurrence whereby information is misclassified or falsely reported and where the results of treatment may influence participants' recollection of events prior to or during the treatment process (Pannucci & Wilkins, 2010). Carneiro (2017) states that recall bias may result in either an underestimation or overestimation of the association between exposure and outcome, or when participants over and/or underestimate food intake. In the current study this was minimised by not informing study participants about the study hypothesis and limiting the recall period.

3.11.4 Measurement bias

Measurement bias is defined as a systematic measurement error that skews all data (Rosenman, Tennekoon & Hill, 2011). In this study measurement bias was reduced by using validated research tools, calibrating scales with a known weight, and taking all anthropometric measurements three times, thereafter using the mean value for statistical analysis.

Study objectives, corresponding variables and related statistical analysis is presented in Table 3.9.

Table 3.9: Study objectives, corresponding variables and related statistical analysis

Objectives	Variables required for the analysis	Statistical tests to be applied
<p><u>Objective One:</u></p> <p>Socio-demographic characteristics, household dietary diversity, household food security status and level of physical activity of primary school beneficiaries of school feeding (intervention) versus non-school feeding beneficiaries (control) according to the following criteria:</p> <ul style="list-style-type: none"> - recipients of school feeding; - urban recipients of school feeding; - peri-urban recipients of school feeding; - non-recipients of school feeding (private schools). 	<p>Participation in SFP as proxy for SES, HDDS, HFIAS PA</p>	<p>Frequency distributions, Means \pm SD, Chi-square test, t-tests</p>
<p><u>Objective Two:</u></p> <p>Anthropometric status of primary school feeding beneficiaries (intervention) versus non-school feeding beneficiaries (control) at baseline and following a period of no school feeding (school holiday) according to the following criteria:</p>	<p>Participation in SFP as proxy for SES. Weight, height, BMI</p>	<p>Frequency distributions, Means \pm SD, Chi-square test, t-tests</p>

<ul style="list-style-type: none"> - recipients of school feeding during the school term versus after the school holiday (period of no school feeding); - urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding); - peri-urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding); <p>Non-recipients of school feeding (private schools).</p>		
<p><u>Objective Three:</u></p> <p>Contribution of school feeding ration scales to the dietary reference intakes (DRIs) and daily estimated average requirement (EAR) for energy, macronutrients and selected micronutrients</p>	<p>SFP ration scales, energy, protein, carbohydrate, fat and micronutrient of the ration scales, PA.</p>	<p>Frequency distributions, Means \pm SD, t-tests</p>

3.11.5 Participation bias

Participant bias occurs when there is a significant difference between those who responded to a survey for various reasons versus those who did not and therefore occurs due to factors that determined the final sample size (Caneiro, 2017). It therefore occurs when not all potential participants agree to participate in a particular study. In the current study, the phenomenon was minimised by noting the learners who agreed to take the consent and assent forms home and also encouraging the learners to contact the principal investigator should they have any questions regarding the study. Reminders were also sent through the class teachers to return the consent and assent forms. In all the schools 496 learners were interested in the study, however only 419 brought the the consent forms back. The deduction could be attributed to loss of forms, absenteeism and other factors such as loss of interest.

3.11.6 Loss-to-follow-up bias

According to Detorri (2011), loss-to-follow-up bias occurs when participants lost to follow-up differ from those who remain in the study until its conclusion. It is therefore important to take cognisance of this phenomenon as it can influence the validity of results. Chanelle, Howe, Cole, Lau, Napravnik, & Eron (2016) recommend that loss-to-follow-up can be minimised during the design and implementation stages of a study in order to minimise losses. However, there are aspects of loss to follow-up which the researcher has no control over. In the current study, there were learners that were lost to follow-up due to being transferred to other schools. Others were

involved in independence day rehearsals which could not be predicted, as schools are often randomly selected for national activities such as these. Other learners were absent due to illness. Out of 419 interested participants, 392 sample study participants were used in this study. However, in the phase two of the study, only 93 were traced for follow up. That means 76% of the study participants were lost to factors and therefore means it was deemed to be a significant loss to follow up (Detorri, 2011).

Precautions that were taken in this present study to limit bias in the current study included the following:

- Validated questionnaires reduced respondent fatigue by limiting the amount of writing required to complete it as the majority of questions could be answered by merely ticking the correct answer.
- Field workers received continuous refresher training in order to administer questionnaires appropriately and accurately taking anthropometric measurements according to international standards.
- The principal researcher carried out quality assurance checks that included random checks while fieldworkers collected data.
- All the questionnaires were allocated a code to maintain participant anonymity but were used to identify the questionnaires and anthropometric measurements of a particular participant in order to maintain confidentiality but at the same time to be able to keep track of the study participants.

3.12 Ethical considerations

Study participants were considered as a vulnerable group due to their age, thereby classifying them as minors. Hence parental/legal guardian informed consent (**Appendix B**) was required to facilitate learner participation in this study. Following parental/legal guardian written consent, learners were required to sign informed assent prior to participation. Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research and Ethics Committee (BREC) prior to commencement of data collection (REF: BE 104/18). In Botswana where the study was conducted, it was a requirement to obtain ethics approval from the Botswana Ministry of Health and Wellness, Research Unit (REF: HPDME 13/18/1 X (534)). To facilitate the above, the

necessary approval from relevant local authorities, namely the Ministry of Education and South-east district education authorities had to be obtained. Consent was also sought from the head teachers of the conveniently sampled schools who served as the key gatekeepers. Participants did not receive any form of remuneration or incentives which could have influenced their participation. Participation was voluntary and participants were free to withdraw from the study at any time without any negative consequences. All participant information was treated as confidential and anonymous as their only form of identification was a study code that was allocated to them. The contact details of the primary researcher and study supervisors was indicated on the written informed and assent forms in event of study participants or their parents/legal guardians requiring any additional information or clarification regarding the study aims, objective and data collection techniques.

3.13 Study Limitations

One of the major limitation of this study was the inability to obtain permission for participation School Heads of private schools, despite having the necessary clearance from the Ministry of Education and South-east District education office. In addition, some school authorities complained that the study was disruptive to normal school activities. This affected the planned time lines for data collection, resulting in the period of data collection coinciding with rehearsals for national independence celebrations termed ‘Bots50’, which was 50th independence celebration for the country. Hence, the majority of learners who were lost to follow-up were involved in daily rehearsals for the main celebratory events. This was not anticipated by the researcher, since learners from different schools are often randomly selected for these activities as was reported by school management.

3.14 Conclusion

This chapter provided an overview of the study design, study sample, sampling technique used as well as research methods and research instruments used for the purpose of data collection. Ethical considerations, validity, reliability and bias were also discussed as well as the methods used to enhance reliability and validity, in addition to curbing bias. Lastly the study limitations were alluded to. The next chapter will report on the findings of the study according to the study objectives and related hypothesis that were indicated in chapter one.

References

- Abshire M, Dinglas VD, Cajita MIA, Eakin MV, Needham DM, Himmelfarb CD (2017). Participant retention practices in longitudinal clinical research studies with high retention rates. **Biomedical Central Research Methodology** 17:30. doi: 10.1186/s12874-017-0310-z
- Acquah B, Kapunda S, Legwegoh A (2014). The Dimensions of Urban Food Insecurity in Gaborone, Botswana. **Urban Forum** 25:217–226. doi:10.1007/s12132-014-9222-8
- Acquah B, Kapunda S, Legwegoh A, Gwebu T, Modie-Moroka T, Gobotswang K, Mosha A (2013). **The State of Food Insecurity in Gaborone, Botswana**. African Food Security Urban Network (AFSUN)
- Adhikari S (2017). Z-score and its Classification. <http://www.publichealthnotes.com/z-score-nutritional-indication> (Accessed 2 May 2018).
- Akinboade OA, Mokwena PM, Adeyefa SA (2016). Determinants of Food Insecurity among the Urban Poor in the City of Tshwane, South Africa. **Journal of Economics and Development Studies** 4 (2):101-114. doi:10.15640/jeds.v4n2a9
- Bajpa S, Bajpai R (2014). Goodness of Measurement: Reliability and Validity. **International Journal of Medical Science and Public Health** 3(2). doi: 10.5455/ijmsph.2013.191120133
- Bajpa S, Bajpai R (2014). Goodness of measurement: Reliability and validity. **International Journal of Medical Science and Public Health** 13(2). doi: 0.5455/ijmsph.2013.191120133.
- Becquey E, Martin-Prevel Y, Traissac P, Dembélé B, Bambara A, Depeche, F (2010). The BIDPA (2007). **The feasibility of mandatory fortification of cereals in Botswana**. <https://www.africaportal.org/dspace/articles/feasability-mandatory-fortification-cereals-botswana> (Accessed 13 June 2018)
- BIDPA (2013). **Botswana National Primary School Feeding Programme: A Case Study**. [Downloads/Botswana%20NSFP%20Case%20Study%20\(4\).pdf](Downloads/Botswana%20NSFP%20Case%20Study%20(4).pdf) (Accessed 9 January 2018).
- BIDPA (2011). Report on the Botswana national school feeding stakeholder workshop. Gaborone, Botswana. 22-24 November 2011. <https://hgsf-global.org/.../232-report-on-the-botswana-national-school-feeding-stakeholder> (Accessed 31 March 2019)
- Biljon AV, McKune AJ, DuBose KD, Kolanisi U, Semple SJ (2018). Physical activity levels in urban-based South African learners: A cross-sectional study of 7 348 participants. **South African Medical Journal** 108(2):126-131. doi:10.7196/SAMJ. 2018.v108i2.12766
- Bolarinwa O (2016). Principles and methods of validity and reliability testing of questionnaires used in social and health science researches. **Nigerian Postgraduate Medical Journal**. 22:195-201. doi10.4103/1117-1936.173959.

Botha CR, Wright HH, Moss SJ, Kolbe-Alexander TL (2013). “Be active!” Revisiting the South African food-based dietary guideline for activity. **South African Journal of Clinical Nutrition**; 6(3): S18-S27.

Bukania ZN, Mwangi M, Karanja RM, Mutisya R, Kombe Y, Kaduka LU, Johns T (2014). Food Insecurity and Not Dietary Diversity Is a Predictor of Nutrition Status in Children within Semiarid Agro-Ecological Zones in Eastern Kenya. **Journal of Nutrition and Metabolism**; 2014:907153. doi.org/10.1155/2014/907153.

Carneiro I (2017). **Introduction to Epidemiology**. 3rd ed. Open University Press. Philadelphia, Pennsylvania.

Caruana EJ, Roman M, Hernández-Sánchez J, Solli P (2015). Longitudinal studies. **Journal of Thoracic Disease**; 7(11): E537- E540. doi: 10.3978/j.issn.2072-1439.2015.10.63.

Cashin K, Oot L (2018). **Guide to anthropometry a practical tool for program planners, managers, and implementers**. <https://www.fantaproject.org/sites/default/files/resources/FANTA-Anthropometry-Guide-May2018.pdf> (Accessed 26 March 2019).

CDC (2016). **Middle Childhood (9-11 years of age), developmental milestones**. <https://www.cdc.gov/ncbddd/childdevelopment/positiveparenting/middle2.html> (Accessed 16 December 2018)

Coates J, Swindale A, Blinsky P (2007). Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide. Version 3. Food and Nutrition Technical Assistance. http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf (Assessed 19 April 2017).

Collins S, Dent N, Binns P, Bahwere P, Sadler K, Hallam A (2006). Management of severe acute malnutrition in children. **Lancet**; 368(9551):1992-2000. doi:10.1016/S0140-6736(06)69443-9

Denstel KD, Broyles ST, Larouche R, Sarmiento OL, Barreira TV, Chaput J-P, Church TS, Fogelholm M, Hu G, Kuriyan R, Kurpad A, Lambert EV, Maher C, Maia J, Matsudo V, Olds T, Onywera V, Standage M, Tremblay MS, Tudor-Locke C, Zhao P, Katzmarzyk PT (2015). **International Journal of Obesity Supplements**; 5: S100–S106. doi:10.1038/ijosup.2015.26.

de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmanna J (2007). Development of a WHO growth reference for school-aged children and adolescents. **Bulletin of the World Health Organization** 85:9 doi:10.2471/BLT.07.043497.

Detorri JR (2011). Loss to follow up. **Evidenced-based Spine-Care Journal**; 2(1):7–10. doi: 10.1055/s-0030-1267080.

Doctors Without Borders (2013). **Mauritania: Significant needs remain for Malian refugees in Mbera camp.** <https://www.msfindia.in/mauritania-significant-needs-remain-malian-refugees-mbera-camp> (Accessed 11 December 2018).

Draper CE, de Kock L, Grimsrud AT, Rudolph M, Nmutandani S, Kolbe-Alexander T, Lambert EV (2010). Evaluation of a school-based physical activity intervention in Alexandra Township. **South Africa journal of Sports Medicine**; 22(1): 12 – 19.

Ekpa E, Okpanachi P, Mohammed A, Iyayi A (2017). Anthropometric studies on some primary school children of Ajaokuta local Government area of Kogi State, Nigeria. **International Journal of Biotechnology and Bioengineering**; 1-7. Doi:[10.25141/2475-3432-2017-1.0001](https://doi.org/10.25141/2475-3432-2017-1.0001)

Elfil M, Negida A (2017). Sampling methods in Clinical Research: An Educational Review. **Emergency (Tehran)**; 5(1): e52

FANTA (2018). **Anthropometry: Children and Adolescents 5–19 Years.** <https://www.fantaproject.org/sites/default/files/resources/FANTA-Anthropometry-Children-Adolescents-5-19-Jun2018.pdf> (Accessed 11 December 2018)

FANTA (2007). **Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide.** www.fantaproject.org/sites/default/files/resources/HFIAS_ENG_v3_Aug07.pdf (Accessed 9 February 2018)

FANTA (2006). **Household Dietary Diversity Score for Measurement of Household food access: Indicator guide.** www.fantaproject.org/sites/default/files/resources/HDDS_v2_Sep06_0.pdf (Accessed 9 February 2017)

Frempong RB, Annim SK (2017). Dietary diversity and child malnutrition in Ghana. **Heliyon** 3: e00298. doi.org/10.1016/j.heliyon.2017.e00298

Gordis L (2013). **Epidemiology.** 5th Edition. Philadelphia, Pennsylvania.

Gwebu, TD (2011). **Policy Implications of Urbanization Patterns and Processes in Botswana.** Special Issue on the 2011 Botswana Population and Housing Census.

Harris HB, Cortina KS, Templin T, Colabianchi N, Chen W (2018). Impact of Coordinated-Bilateral Physical Activities on Attention and Concentration in School-Aged Children. **BioMed Research International**; doi.org/10.1155/2018/2539748

Hegedus EJ, Moody J (2010). Clinimetrics corner: the many faces of selection bias. **The Journal of Manual & Manipulative Therapy**; 18(2): 69–73.

Hoddinott J, Yohannes Y (2002). Dietary diversity as a food security indicator. FANTA, Washington DC. www.aed.org/Health/upload/dietarydiversity.pdf (Accessed 3 January 2018).

Howe CJ, Cole SR, Lau B, Napravnik S, Eron JJ (2017). Selection bias due to loss to follow up in cohort studies. **Epidemiology**; 27(1):91–97.

Hróbjartsson A, Thomsen ASS, Emanuelsson F, Tendal B, Rasmussen JV, Hilden J, Boutron I, Ravaud P, Brorson S (2014). Observer bias in randomized clinical trials with time-to-event outcomes: systematic review of trials with both blinded and non-blinded outcome assessors. **Internal Journal of Epidemiology** 43(3):937–948.

Hughes JL, Camden AA, Yangchen T, College AS (2017). Rethinking and Updating Demographic Questions: Guidance to Improve Descriptions of Research Samples. **Journal of Psychological Research**; 21(3). doi:10.24839/2164-8204.JN21.3.138.

Ijarotimi OS, Erola ML (2018). Assessing household food security status and nutritional outcome among underprivileged children (10-19 Years) from East Senatorial District of Lagos State, Nigeria. **Annals of Nutrition & Food Science**; 1(2): 1008

Institute for Work & Health (2015). **Cross-sectional vs. longitudinal studies**. <https://www.iwh.on.ca/what-researchers-mean-by/cross-sectional-vs-longitudinal-studies>, (Accessed 21 October 2018).

Institute for Work & Health (2014). **Selection bias**. <https://www.iwh.on.ca/what-researchers-mean-by/selection-bias> (Accessed 6 November 2018).

Ismail N, Kinchin G, Edwards JA (2017). Pilot Study, Does It Really Matter? Learning Lessons from Conducting a Pilot Study for a Qualitative PhD Thesis. **International Journal of Social Science Research**; 6(1). doi:10.5296/ijssr. v6i1.11720.

Kannan S, Gowri S (2015). Pilot studies: Are they appropriately reported? **Perspective in Clinical Research**; 6(4):207–210. doi:10.4103/2229-3485.167097

Keeble C, Law GR, Barber S, Baxter PD (2015). Choosing a Method to Reduce Selection Bias: A Tool for Researchers. **Open Journal of Epidemiology** 5:155-162. doi.org/10.4236/ojepi.2015.53020

Keng A, Ikgopoleng H (2011). Gaborone. Cities. **International Journal of Urban Policy and Planning**; 28 (5): 478 – 494.

Kennedy G, Ballard T (2010). **Guidelines for measuring household and individual dietary diversity**. Nutrition and Consumer Protection Division, Food and Agriculture Organization of the United Nations.

Kimani-Murage EW, Holding PA, Fotso J-C, Ezech AC, Madise NJ, Kahurani EN, Zulu EM (2010). Food Security and Nutritional Outcomes among Urban Poor Orphans in Nairobi, Kenya. **Journal of Urban Health**; 88(2). doi:10.1007/s11524-010-9491-z

Kimberlin CL, Winterstein AG (2008). Validity and reliability of measurement instruments used in research. **American Journal of Health-System Pharmacists** 65. doi: 10.2146/ajhp070364.

Knueppel D, Demment M, Kaiser L (2010). Validation of the Household Food Insecurity Access Scale in rural Tanzania. **Public Health Nutrition**; 13(3):360 – 367.
doi:10.1017/S1368980009991121

Kowalski KC, Crocker PRE, Donen RM (2004). **The Physical Activity Questionnaire for Older Children (PAQ-C) and Adolescents (PAQ-A) Manual**. College of Kinesiology, University of Saskatchewan, Saskatoon, 11-15.

LaMorfe WW (2016). Selection Bias. Boston University School of Public Health.
http://sphweb.bumc.bu.edu/otlt/MPH-Modules/EP/EP713_Bias/EP713_Bias2.html (Accessed 18 December 2018).

Lee P, Yu YY, McDowell I, Leung GM, Lam TH, Stewart SM (2011). Performance of the international physical activity questionnaire (short form) in subgroups of the Hong Kong Chinese population. **International Journal of Behavioral Nutrition and Physical Activity** 1(8):81.
doi:[10.1186/1479-5868-8-81](https://doi.org/10.1186/1479-5868-8-81)

Loprinzi PD, Cardinal BJ (2011). Measuring children’s physical activity and sedentary behaviors. **Journal of Exercise Science and Fitness**; 9(1):15–23.

Mann CJ (2012). Observational research methods - cohort studies, cross sectional studies and case control studies. **African Journal of Emergency Medicine**; 2:38-46.

Madzorera I, Duggan C, Berthé F, Grais RF, Isanaka S (2018) The role of dietary diversity in the response to treatment of uncomplicated severe acute malnutrition among children in Niger: a prospective study. **Biomedical Central Nutrition**; 4:35. <https://doi.org/10.1186/s40795-018-0242-y>

Marumo BB (2016). Early School Withdrawals and Underperformance as Indicators of Poor Attention to Learner’s Welfare: Botswana in 50 Years of Self-Rule. **Journal of Educational Issues**; 2(2). doi:10.5296/jei. v2i2.10270.

Moepeng P (2016). Botswana National Primary School Feeding Programme: A Case Study. https://www.researchgate.net/publication/318210413_Botswana_National_Primary_School_Feeding_Programme_A_Case_Study/download (Accessed 12 November 2018).

Monyeki MA (2014). Physical activity and health in children: How much do we know? **African Journal for Physical, Health Education, Recreation and Dance**; 20(2:1): 323 – 342.

Naicker N, Mathee A, Teare J (2015). Food insecurity in households in informal settlements in urban South Africa. **South African Medical Journal** 105 (4): 268-270.
doi:10.7196/SAMJ.8927

Omar A (2015). Selecting the appropriate study design for your research: Descriptive Study designs. **Journal of Health Specialities**; 3:153-156.

Open University (2019). Nutrition Module: 5. Nutritional Assessment. <http://www.open.edu/openlearncreate/mod/oucontent/view.php?id=318&printable=1> (Accessed 19 April 2019)

Pannucci CJ, Wilkins EG (2010). Identifying and avoiding bias in research. **Plastic and Reconstructive Surgery**; 126(2):619-25.

Pérez-Rodrigo C, Escauriaza BA, Bartrina JA, Allúe IP (2015). Dietary assessment in children and adolescents: issues and recommendations. **Nutrición Hospitalaria** 31(3):76-83.

Pew Research Center. (2016). **Questionnaire design**. <http://www.pewresearch.org/methodology/u-s-survey-research/questionnaire-design/> (Accessed 24 March 2019)

Pierce N (2012). Classification of epidemiological study design. **International Journal of Epidemiology**; 41(2):393 – 397. <https://doi.org/10.1093/ije/dys049>

Rainbow Health Ontario, Hart, T. (2012). **Research methods: Designing surveys and questionnaires**. <http://www.rainbowhealthontario.ca/> (Accessed 24 March 2019)

Reilly JJ, Kelly J (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: Systematic review. **International Journal of Obesity**; 35:891–898.

Ronghe R (2016). Physical activity level of school children of age 10-13 years. **International Journal of Biomedical and Advance Research**; 7(6): 281-285.

Roberts JMA, Adams D, Heussler H, Keen D, Paynter J, Trembath D, Westerveld M, Williams K (2018). Protocol for a prospective longitudinal study investigating the participation and educational trajectories of Australian students with autism. **British Medical Journal**; 8: e017082. doi:10.1136/ bmjopen-2017-017082.

Rosenman R, Tennekoon V, Hill LG (2011). Measuring bias in self-reported data. **International Journal of Behavioural & Healthcare Research**; 2(4): 320 – 332. Doi:10.1504/IJBHR.2011.043414.

Sarmiento OL, Lemoine P, Gonzalez SA, Broyles ST, Denstel KD, Larouche R, Onywera V, Barreira TV, Chaput J-P, Fogelholm M, Hu G, Kuriyan R, Kurpad A, Lambert EV, Maher C, Maia JC, Matsudo V, Olds T, Standage M, Tremblay MS, Tudor-Locke C, Zhao P, Church TSM, Katzmarzyk PT (2015). Relationships between active school transport and adiposity indicators in school-age children from low-, middle- and high-income countries. **International Journal of Obesity Supplements**; 5, S107–S114. doi:10.1038/ijosup.2015.27.

Schoeppe S, Oliver M, Badland HM, Burke M, Duncan MJ (2013). Recruitment and retention of children in behavioral health risk factor studies: REACH Strategies. **International Society of Behavioral Medicine**; doi: 10.1007/s12529-013-9347-5.

Sebego RJ, Gwebu TD (2013). Patterns, determinants, impacts and policy implications of the partial expansion of an African capital city: the greater Gaborone example. **Internal Journal of Sustainable Built Environment**; 2: 193 – 208.

Sedgwick P (2014). Cross-sectional studies: advantages and disadvantages. **British Medical Journal**; 348: 2276. doi:10.1136/bmj.g2276

Setia MS (2016). Methodology Series Module 3: Cross-sectional Studies. **Indian Journal of Dermatology**; 61(3): 261–264.

Shaibu S, Holsten JE, Stettler N, Maruapula SD, Jackson JC, Maletle L, Mokone G, Wrotniak BH, Compher CW (2011). Adolescent Obesity Prevention in Botswana: Beliefs and Recommendations of School Personnel. **Journal of School Nursing**; 28(3):220-229

Singh Z, Chaturvedi R, Gupta E (2016). Nutrient adequacy of school going children can be determined by dietary diversity scores within different food groups. **International Journal of Interdisciplinary and Multidisciplinary Studies**; 3(4): 74-79.

Smith J, Noble H (2014). Bias in research. **Evidence Based Nursing**; 17(4)1. doi: 10.1136/eb-2014-101946.

Solem RC (2015). Limitations of cross-sectional study. **American Journal of Orthodontics and Dentofacial Orthopedics**; 148(2)205. doi: <https://doi.org/10.1016/j.ajodo.2015.05.006>

Statistics Botswana (2018). **Botswana Multi-topic household survey 2015/2016 poverty stats brief**. www.cso.gov.bw (Accessed 9 April 2019).

Steyn NP, Ochse R. (2013). “Enjoy a variety of foods”: a food-based dietary guideline for South Africa. **South African Journal of Clinical Nutrition**; 26 (3): S13-S17.

Swindale A, Bilinsky P (2006). Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide. Version 2. Food and Nutrition Technical Assistance. https://www.fantaproject.org/sites/default/files/resources/HDDS_v2_Sep06_0.pdf (Accessed 19 April 2017).

Tamiru D, Belachew T (2017). The association of food insecurity and school absenteeism: systematic review. **Agriculture and Food Security**; 6:5. doi:10.1186/s40066-016-0083-3

Thompson FE, Kirkpatrick SI, Subar AF, Reedy J, Schap TE, Wilson MM, Krebs-Smith SM (2015). The National Cancer Institute's Dietary Assessment Primer: A Resource for Diet Research. **Journal of the Academy of Nutrition and Dietetics**; 115(12):1986-1995.

Toteng EN (2009). Access to Services and Infrastructure in Peri-urban Areas in Botswana: Case studies of Mogoditshane and Tlokweng. **Botswana Notes & Records**; 41: 64 – 75.

Voss C, Ogunleye AA, Sandercock GR (2013). Physical Activity Questionnaire for children and adolescents: English norms and cut-off points. **Pediatric International**; 55(4): 498 - 507. doi: 10.1111/ped.12092. Epub 2013

Walker JL, Ardouin S, Burrows T (2018). The validity of dietary assessment methods to accurately measure energy intake in children and adolescents who are overweight or obese: a systematic review. **European Journal of Clinical**; 72(2):185–197. doi: [10.1038/s41430-017-0029-2

WHO (2011) WHO Anthro for Personal Computers, Version 3.2.2. Software for Assessing Growth and Development of the World's Children; World Health Organization: Geneva, Switzerland, 2011. http://www.who.int/childgrowth/software/anthro_pc_manual_v322.pdf?ua=1 (Accessed 20 September 2017).

WHO (2008). **Training course on child growth assessment WHO child growth standards.** https://www.who.int/childgrowth/training/module_b_measuring_growth.pdf. (Accessed 26 March 2019).

WHO (2007). **Growth Reference Data for 5–19 Years.** <https://www.who.int/growthref/en/> (Accessed 26 March 2019).

Wrotniak B, Malete L, Maruapula S, Jackson J, Shaibu S, Ratcliffe S, Stettler N, Compher C (2012). Association between Socioeconomic Status Indicators and Obesity in Adolescent Learners in Botswana, an African Country in Rapid Nutrition Transition. **Pediatric Obesity**; 7: e9-e13.

CHAPTER 4
HOUSEHOLD DIETARY DIVERSITY, HOUSEHOLD FOOD SECURITY STATUS AND LEVEL OF PHYSICAL ACTIVITY OF PRIMARY SCHOOL BENEFICIARIES OF SCHOOL FEEDING (INTERVENTION) VERSUS NON-SCHOOL FEEDING BENEFICIARIES (CONTROL)

Abstract

Background: Household dietary diversity, household food security status and physical activity levels of children has an impact on their nutritional status. High dietary diversity scores are associated with diets that have acceptable macronutrient and micronutrient levels and are also associated with a reduced risk of developing obesity and nutrient deficiencies. Food insecure households have a negative impact on children's nutritional status. Despite the health benefits associated with regular physical activity, children living in urban areas often have sedentary lifestyles with a resultant negative impact on their nutritional status.

Objective: To determine the socio-demographic characteristics, household dietary diversity, household food security status and level of physical activity of primary school beneficiaries of school feeding (intervention) versus non-school feeding beneficiaries (control).

Methods: Household Dietary Diversity Score (HDDS), Household Food Insecurity Access Scale (HFIAS) and the Physical Activity Levels (PALs) of 392 conveniently sampled primary school learners recruited from public schools and a private primary school in South-east district, Botswana who are beneficiaries of the School Feeding Programme (SFP) (n=330) and non-beneficiaries (n=62) respectively of the SFP were surveyed using a cross-sectional descriptive study design.

Results: Comparisons between beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) yielded significant differences ($p < 0.000$) for mode of transport to school, food security status and dietary diversity. When comparing urban versus peri-urban learners, significant differences between the two groups ($p < 0.000$) were also documented for mode of transport to school, food security status and dietary diversity. However, a significant difference between beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) was not documented for PAL, whereas the difference between urban and peri-urban learners for the same variables was significant ($p < 0.001$).

Conclusion: The significant differences between beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) documented for food security status and dietary diversity, indicated that the SFP was not able to adequately address the household food insecurity and lack of dietary diversity experienced by beneficiaries of the SFP among learners that participated in the study.

4.1 Introduction

Botswana is a middle income country that is currently experiencing a slower economic growth, high unemployment, poverty and food insecurity (Lekobane & Mooketsane, 2015; Mosha, 2015). Estimates by Statistics Botswana (2016) indicate that in the South-east district of Botswana, there are 51 government schools and 19 private schools with higher enrolment figures when compared to other districts in Botswana. In addition, this region has one of the lowest drop-out rates at 0.7% with the main reason being truancy (Statistics Botswana, 2016; Republic of Botswana, 2015). For enrolment, Botswana has a very strict cut-off date as learners have to be six years old by the third of January upon school enrollment with the implication being that some learners are older than others upon school admission. The age disparity between learners is a major contributor to negative academic performance in Botswana (Angrist, Pansiri, Tsayang 2017).

The 2015/2016 Botswana Multi Topic Household Survey (BMTHS), found that the number of female headed households were higher than male headed households, especially in peri-urban areas (Statistics Botswana, 2018; Lekobane & Mooketsane, 2015; Acquah, Kapunda, Legwegoh, Gwebu, Modie-Moroka, Gobotswang, Mosha, 2013). At a national level, unemployment was higher among women (34%) compared to their male counterparts (25%), with female headed households being found to be at risk of food insecurity due to inadequate income (Acquah *et. al*, 2013). Unfavourable climatic conditions are another cause of food insecurity in Botswana as it negatively affects arable crop production, resulting in food shortages (Legwaila, Mojeremane, Madisa, Mmolotsi, Rampart, 2011). Acquah *et. al* (2013) also found that in urban areas such as Gaborone, the level of food security was better (HFIAS of 10.9 compared to 5.3 for Blantyre, Malawi) with the HDDS indicating a low mean dietary diversity score (6.5) and a high consumption of foods from cereals (97%), sugars (74%) and “others” such as coffee and tea (76%). Studies by Kasimba, Mots wagole, Covic & Claasen (2017); Raboloko (2016) and Maruapula & Novakofski (2010) that investigated both rural and urban areas of Botswana, found a significantly

higher prevalence of severe food insecurity in rural compared to urban areas. A low consumption of fruit and vegetables was mirrored by national statistics that indicate how less than half of the population (43.5%) consume vegetables on a daily basis (Statistics Botswana, 2018). A double blind randomised nutrition trial conducted in Botswana among HIV positive children aged 6 to 15 years comparing children receiving a high protein bean-sorghum based (bean) flour to those receiving a sorghum-based (cereal) flour, found a significant improvement ($p=0.007$) in the nutritional status of younger children in both the intervention and the control group (Nnyepi, Bennink, Jackson-Malete, Venkatesh, Malete, Mokgathe, Lyoka, Anabwani, Makhanda, Weatherspoon, 2015).

There have been no studies that have determined the physical activity levels of primary school learners in the South-east district of Botswana (Tladi, Monnaatsie, Shaibu, Sinombe, Mokone, Gabaitiri, Malete, Omphile, 2018). However, a national study found that 25.2% of the population aged 15 to 29 years had a low level of physical activity (Ministry of Health, 2015). Tladi *et. al* (2018) found that 20% of school going children (exact ages not indicated), especially from rural areas, play actively. However, in this particular study, one of the major study limitations were that grey literature and expert opinion were used which could have resulted in the study findings being biased. There is a great need for implementing a comprehensive national survey investigating the PA of school-aged children and youth in Botswana due to a paucity of data. In the majority of private schools in Gaborone, there is a wide range of extracurricular activities available including mandatory physical education (PE) classes that are not offered in government schools (Shaibu, Holsten, Stettler, Maruapula, Jackson, Malete, Mokone, Wrotniak, Compher, 2012).

Due to the above disparities, not only between urban and rural areas, but between government and private schools, the objective of the current study was to determine and compare the socio-demographics characteristics, household dietary diversity, household food security status and level of physical activity of primary school learners in the South-east district of Botswana between urban and peri-urban recipients of the SFP as well as between recipients of the SFP (government schools) and non-recipients of the SFP (private schools).

Based on the above objective the null hypothesis that was formulated was that there will not be a difference in the socio-demographic characteristics, household dietary diversity, household food security status and physical activity levels of primary school learners in the South-east district of

Botswana between urban and peri-urban recipients of the SFP as well as between recipients of the SFP (government schools) and non-recipients of the SFP (private schools).

4.2 Methodology

4.2.1 Study design

A cross-sectional descriptive survey was conducted to determine the baseline characteristics of recipients of the SFP as well as that of non-recipients.

4.2.2 Study population and sample selection

A convenience sample of standard five to seven learners (aged 8 to 13 years) representing 12 government and one private schools from urban and peri-urban areas in the South-east district of Botswana was surveyed during the school term. Unlike in government schools, learners start standard one at five years of age and for students who excel and meet the required criteria, they are often considered to skip some class levels. Hence, all the learners who are 8 years of age were from private school. A list of all public schools in the South-east District was obtained from the district education office, revealing that there are 70 primary schools, both public and privately managed, in the South-east district. Fifteen private schools could have potentially participated in this study. However, one common reason for declining participation was that the school management felt that because they do not participate in the SFP, they saw no need for participating in the study. Despite numerous attempts to clarify the objective of the study, it was not successful. Hence the reason why only one private school represented the control group (non-school feeding beneficiaries), while participating government schools represented the intervention group due to them being beneficiaries of the government SFP.

4.2.3 Research instruments

Data was collected by means of the following research instruments.

Socio-demographic questionnaire

The questionnaire, developed for the purpose of the study, determined the socio-demographic characteristics of the study sample including learner age, gender and socio-demographic background (Annexure J).

Household Dietary Diversity Score (HDDS)

The household dietary diversity score (HDDS) is defined as the quantitative measure of food groups consumed, usually within the previous 24 hours by an individual inside and outside the home (Meng, Wang, Li, van Loo-Bouwman, Zhang, Szeto 2018; Ogechi & Chilezie 2017; Nair, Augustine, Konapur 2016). High dietary diversity scores are associated with diets that contain acceptable macronutrient and micronutrient levels and are also related to a reduced risk for developing obesity (Hooshmand & Marhamati 2018). The measurement of dietary diversity, when used in isolation, has the advantage of being less time consuming with minimal respondent burden (Kennedy, Ballard, Dop, 2010). Limitations include not generating quantitative data regarding actual food consumption and not taking seasonal variation of certain foods into consideration (Nithya & Bhavani, 2018). This tool has been used to collect data in rural as well as urban areas Botswana (Kasimba *et. al.*, 2018). The HDDS that was used in this present study (Annexure L), was intended to represent household food access.

The HDDS (including the 24-hour recall) was administered by trained field workers as described in the study conducted by Rankin, Hanekom, Write & Macintyre (2010). In the current study, food models were used to assist learner recall of foods eaten in the previous 24 hours. This was followed by classifying the foods into food groups containing foods frequently consumed in Botswana such as *letlhodi*, *dinawa tsa Setswana* and *phane*. The response categories in the DDS questionnaire included “Yes” if consumed and “No” if not consumed within the previous 24 hours. This was followed by adding up the number of “Yes” responses from of each learner that was interviewed to determine the DDS of each learner. Although there are 16 food groups in the HDDS, similar foods (for example cereals were combined with white tubers and roots) as recommended by Kennedy *et. al.* (2010). This resulted in the HDDS food group range being 0 to 12. Due to a lack of national and international DDS cut-offs (Assenga & Kayunze, 2016; McDonald, McLean, Kroeun, Talukder, Lynd & Green 2015), the DDS of participating learners were classified as being low (≤ 4 food groups), medium (5 to 8 food groups) and high (9 to 12 food groups) as was classified by Ogechi & Chilezie, (2017), in addition to mean scores being calculated for each food group.

Household Food Insecurity Access Scale (HFIAS)

The HFIAS has been used to determine learner food security status at household level in studies conducted by Ijarotimi & Erola (2018) among school going learners aged 10 – 19 years of age from both private and public schools. The association between participant HFIAS and nutritional status was significantly and positively associated with household food security status (OR=1.03, p=0.004). HFIAS has been validated by several studies (Mohammadi, Omidvar, Houshiar-Rad, Khoshfetrat, Abdollahi & Mehrabi, 2012; Salarkia, Abdollahi, Amini & Neyestani, 2014; Knueppel, Demment & Kaiser, 2010). It was also found to be a valid tool for measuring household food insecurity in both urban and rural settings, similar to the study conducted by Gebreyesus, Lunde, Mariam, Woldehanna & Lindtjorn (2015) in nine rural and one urban area in Ethiopia. This tool has also been used by Kasimba *et. al*, (2018) in both urban and rural settings in Botswana in order to assess the HFIAS of women.

The HFIAS that was administered by a trained field worker, consisted of a set of questions where learners had to answer occurrence questions based on a recall period of the past month. If the answer was “Yes”, to an occurrence question, a follow-up question was asked on the frequency of the occurrence. Responses were coded as follows: rarely = 1 (once or twice in the past four weeks), sometimes = 2 (three to ten times in the past four weeks), and often = 3 (more than ten times in the past four weeks).

The HFIAS occurrence questions relate to three different domains of food insecurity (access) found to be common to the cultures examined in a cross-country literature review (FANTA 2004, Coates, 2004). The generic occurrence questions, grouped by domain, are:

1. Anxiety and uncertainty about the household food supply,
2. Insufficient quality (includes variety and preferences of the type of food), and
3. Insufficient food intake and its physical consequences.

Based on participant response, the HFIAS was calculated as a continuous variable to document the degree of food insecurity for each individual study participant. Hence learners were categorised as: Food secure (score 0 – 6.75), mildly food secure (score 6.75 – 13.5), moderately food insecure (score 13.5 – 20.5) and severely food insecure (score 20.5 – 27).

Physical Activity Questionnaire for Older Children (PAQ-C)

For healthy children between five to seven years of age, the WHO (2011) recommends that they should accumulate at least one hour of moderate to vigorous-intensity physical activity on a daily basis that includes playing games, sports, conducting chores and other activities that improve cardiorespiratory fitness.

The PAQ-C developed by Crocker, Bailey, Faulkner, Kowalski & McGrath (1997) was deemed suitable for use in the current study as it was developed for primary school children aged 8 to 14 years which is similar to that of the study sample. The PAQ-C was administered in a classroom setting and within a time-related reference frame of seven days as per the questionnaire protocol (Kowalski, Crocker & Donen 2004). This research instrument has been validated by various authors in different populations (Wang, Baranowski, Lau, Chen & Pitkethly, 2016; Zaki, Sahril, Omar, Ahmad, Baharudin & Nor, 2016; Manchola-Gonzalez, Bagur-Calafat & Girabent-Fareès, 2015). The questionnaire manual (Kowalski *et. al*, 2004) was used to guide the methodology used for data collection and analysis. The instrument consists of nine structured questions. Each question was given a value of one (lowest) to five (highest). Once the value for each question was recorded, the mean value was calculated, thus generating the final PAQ-C activity summary score. Other researchers (Zaki *et. al*, 2016) have categorized the level of physical activity into three categories, namely: 1.2 – 3.3 = low, 2.34 – 3.66 = moderate, and 3.67 – 5.00 = high. For the purpose of this study, similar categories were used.

4.2.4 Data Analysis

Data was entered into Microsoft Excel and imported into the Statistical Package SPSS (version 25). Frequency distributions were calculated for categorical variables, while means and standard deviations were calculated for all continuous variables. Associations between categorical variables were determined using chi-square tests.

Study variables included the following:

- Socio-demographic variables such as schools, school location, gender, race, mode of transport and household head;
- Household food security status;
- Dietary diversity score categories; and

- Physical activity levels categories.

Between group comparisons of continuous variables were done using an independent samples t-test. Variables included the following:

- Comparison of food groups in the HDDS in SFP beneficiaries versus SFP non-beneficiaries; and
- Socio-demographic variables such as age.

4.2.5 Ethical considerations

Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (BREC), South Africa (BE 104/18), and the Health Research Unit of the Ministry of Health, Botswana (HPDME 13/18/1). Permission for data collection at the study site was also obtained from the Ministry of Basic Education, Botswana (DPRS 7/1/6 I (53) PEO II-RESEARCH). Consent approval was obtained from parents or legal guardians and the learners were also required to consent to participating in the study.

4.3 Results

4.3.1 Socio-demographic characteristics

The socio-demographic characteristics of the study sample is presented in Table 4.1. The majority of study participants (84.2%) were from 12 government schools, but the school with the highest sample size (n=62) was the private school, Rainbow Primary School (Figure 4.1). It is evident from the results presented in Table 4.1 that the gender distribution between learners from the private school was similar. However, in the sampled government schools, girls (58.8%) were more prevalent than boys (41.2%), despite the gender difference between the two groups of not differing significantly ($p=0.129$). The majority of learners from government and private schools were black (98.8% versus 77.8% respectively). The private school was situated in Gaborone and hence an urban area. However, the government schools sampled, included both urban and peri-urban areas. The majority of learners in the private school (93.5%) came from father/male-headed household while this only held true for 49.4% of learners from government schools. More than two thirds of

learners from government schools (69.7%) walked to school while the majority (48.4%) of learners from private schools made use of public transport to get to school.

Table 4.1: Socio-demographic characteristics of primary school learners (school feeding beneficiaries versus non-school feeding beneficiaries (n=392))

Socio-demographic characteristics	School feeding beneficiaries (Government schools) 84.2% (n=330)	School feeding non-beneficiaries 15.8% (Private school) (n=62)	p-values
Age (years) Mean ± SD	11.32 ± 1.404	8.89 ± 0.889	0.000 #
Gender Male Female	41.2% (n=136) 58.8% (n=194)	51.6% (n=32) 48.4% (n=30)	0.129§
Race Black White Mixed ancestry Asian	98.8% (n=326) - 0.6% (n=2) 0.6% (n=2)	77.8% (n=49) 14.5% (n=9) 6.4% (n=4) -	0.000§
School location Gaborone Tlokwenq Oodi Mogobane	52.8% (n=145) 19.9% (n=78) 13.5% (n=53) 13.8% (n=54)	100% (n=62) - - -	0.000§
Standard Five Six Seven	39.7% (n=131) 32.1% (n=106) 28.1% (n=93)	46.8% (n=29) 21.0% (n=13) 32.3% (n=20)	0.100§
Mode of transportation to school Walking Vehicle from home Public Transport*	69.7% (n=230) 7.3% (n=24) 23.0% (n=76)	8.1% (n=5) 43.6% (n=27) 48.4% (n=30)	0.000§
Head of household Father Mother Sibling Grandparents	49.4% (n=163) 32.7% (n=108) 7.9% (n=26) 10.0% (n=33)	93.5% (n=58) 6.5% (n=4) - -	0.000§

t-test

§ Chi-square test

*taxi, mini-buses

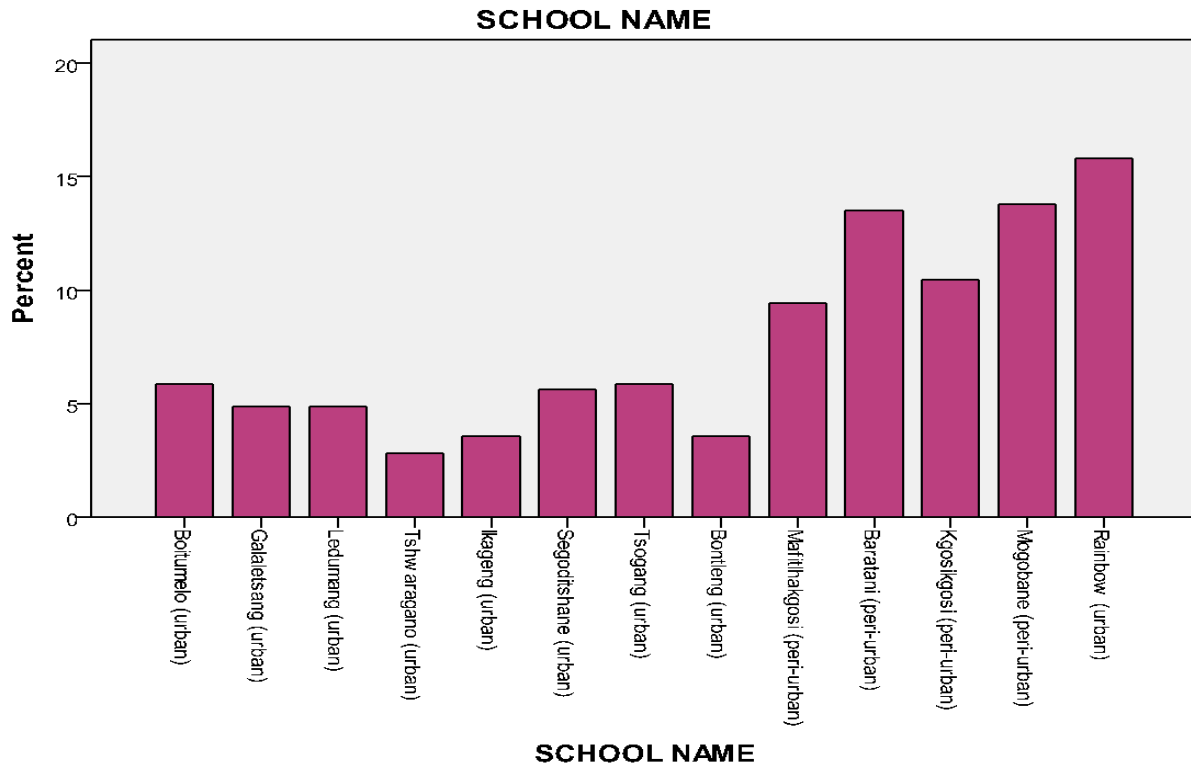


Figure 4.1: Participating Schools

The age distribution of the learners was 8 to 13 years of age as is shown in Figure 4.2. The majority of learners were ten, eleven and twelve years of age. All the younger learners were from the private school.

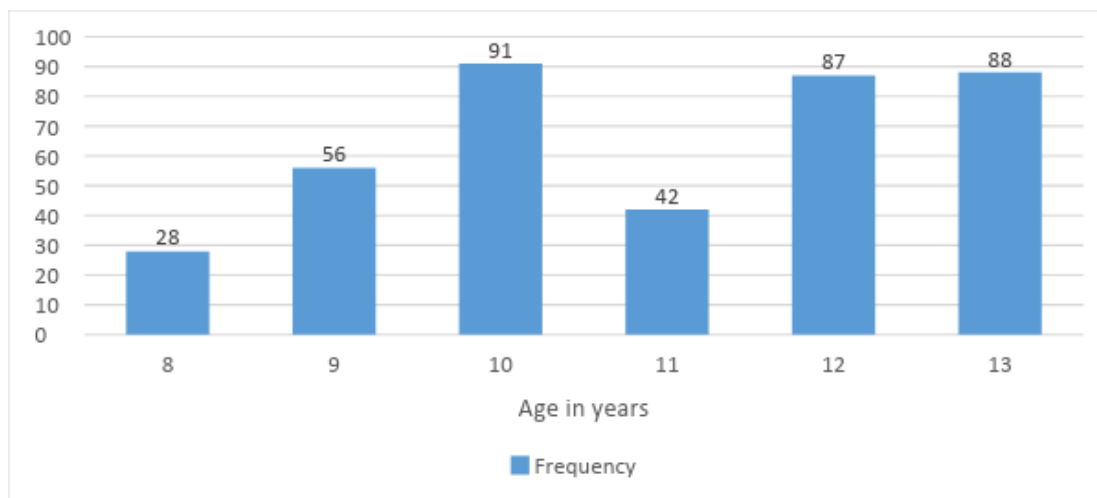


Figure 4.2: Study sample age distribution

Due to the high rejection rate for participation from the management of private schools, the majority of study participants were from public schools as illustrated in Figure 4.3. The unequal distribution of participating learners between government and private schools also proved to be one of the limitations of the current study.

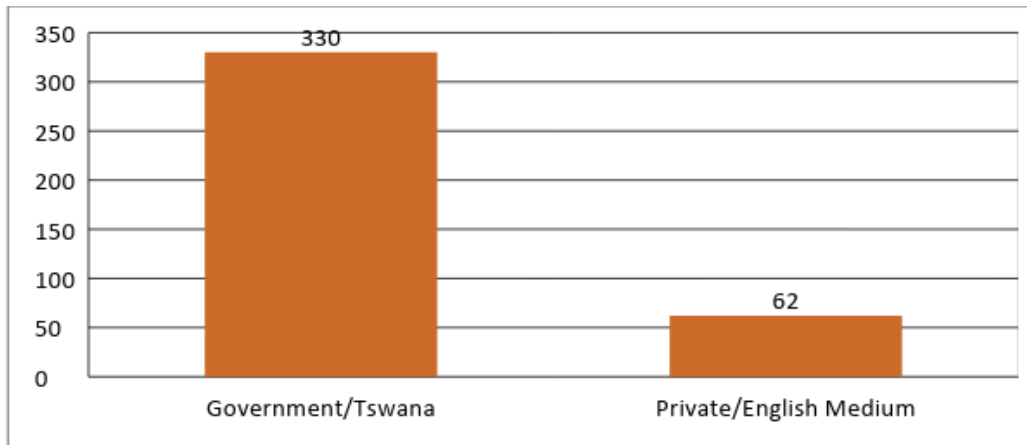


Figure 4.3: Type of school attended by study sample

Participating government schools were located in both urban and peri-urban areas, whereas the only participating private one was located in an urban area. In Table 4.2, the mode of transport of learners between urban and peri-urban urban areas are compared.

Table 4.2: Mode of transport for learners in urban areas versus peri-urban areas, irrespective of type of school attended (N=392).

Variable		Urban (n=207)	Peri-urban (n=185)	p-value#
Mode of transport to school	Walking (59.9%)	42.0% (n=87)	80.0% (n=148)	0.000
	Vehicle from home (13.0%)	18.4% (n=38)	7.0% (n=13)	
	Public transport (27.0.1%)	39.6% (n=82)	13.0% (n=24)	

Chi-square test

From Table 4.2 it is evident that more learners from peri-urban areas (80.0%) walked to school when compared to those from urban areas (42%). The association between mode of transport and area of school attendance was highly significant ($p < 0.000$).

4.3.3 Household Food Security

The results of the household food security status of school feeding beneficiaries versus non-beneficiaries are presented in Table 4.3.

Table 4.3: Household food security classification of school feeding beneficiaries (government schools) versus non-beneficiaries (private schools) (N=392)

		School feeding Beneficiaries (n=330)	Non-school feeding beneficiaries (n=62)	p-value#
Food Security Category	Food secure (48.2%)	38.8% (n=128)	98.4% (n=61)	0.000
	At risk of food insecurity (35.5%)	41.8% (n=138)	1.6% (n=1)	
	Food insecure (11.2%)	13.3% (n=44)	-	
	Severely food insecure (5.1%)	6.1% (n=20)	-	

#Chi-square test

From the results reported in Table 4.3, it is evident that nearly all learners from private schools (non-school feeding beneficiaries) (98.4%), were food secure, versus nearly four out of ten learners who were receiving school feeding (and therefore enrolled in government schools) were food secure. In addition, the majority of school feeding recipients could be classified as being at risk of food insecurity (41.8%) while only one learner from a private school fitted that description. The association between level of food security and beneficiaries of school feeding was highly significant ($p < 0.000$). Table 4.4 provides an overview of the household food security status of urban versus peri-urban learners enrolled in this study.

Table 4.4: Household food security classification of learners from urban versus peri-urban areas (N=392)

		School Area		p-value#
		Urban (n=207)	Peri-urban (n=185)	
Food Security Category	Food secure (48.2%)	75.6% (n=152)	20.0% (n=37)	0.000
	At risk of food insecurity (35.5%)	20.9% (n=42)	52.4% (n=97)	
	Food insecure (11.2%)	5.5% (n=11)	17.8% (n=33)	
	Severely food secure (5.1%)	1.0% (n=2)	9.7% (n=18)	

Chi-square test

The majority (75.6%) of learners from urban areas were food secure, while only 20.0% from peri-urban areas were food secure. When it came to being at risk of food insecurity, 20.9% of urban versus 52.4% of peri-urban learners fell into that category. This finding is not surprising, seeing that all the learners from the private school were urban and nearly all (98.4%) were food secure. Nearly half (48.2%) of the learners included in this study sample were food secure, irrespective of whether they were classified as beneficiaries of school feed or nor, or were classified according to geographic location (urban versus peri-urban). The association between level of food security and area of school attendance was highly significant ($p < 0.000$). When it came to learners that were food secure, mildly, moderately or severely food insecure, the prevalence was 48.2%, 35.5%, 11.2% and 5.1% respectively. This is illustrated in Figure 4.4.

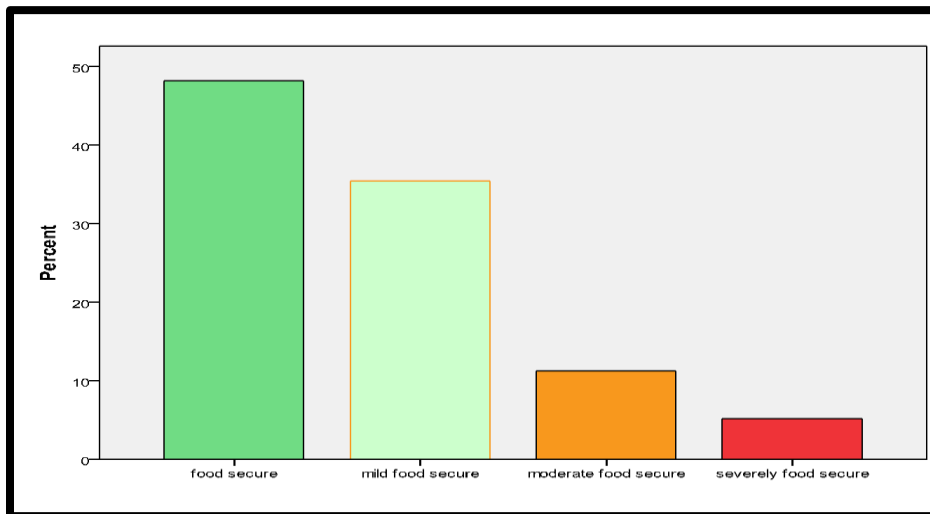


Figure 4.4: Food security classification of the study participants (N=392)

When investigating the relationship between household food security status and dietary diversity, the results presented in Table 4.5.

Table 4.5: Household food security and dietary diversity classification of the study sample

		Dietary Diversity Score category			p-value #
		Low dietary diversity (n=138)	Medium dietary diversity (n=232)	High dietary diversity (n=22)	
Food Security Category	Food secure (48.2%)	7.9% (n=31)	34.7% (n=136)	5.6% (n=22)	0.000
	At risk of food insecurity (35.5%)	17.9% (n=70)	17.6% (n=69)	-	
	Food insecure (11.2%)	6.1% (n=24)	5.1% (n=20)	-	
	Severely food insecure (5.1%)	3.3% (n=13)	1.8% (n=7)	-	

#Chi-square test

From the above table it can be seen that the majority (34.7%) of learners who were food secure, had a medium dietary diversity. Thus illustrating that in this study sample, food security was not necessarily related to a high level of dietary diversity. However, all learners with a high dietary diversity were food secure. It is worth noting that virtually equal numbers of learners who were at risk of food insecurity had either a medium or low dietary diversity. The association between level of food security and dietary diversity was highly significant ($p < 0.000$).

4.3.2 Household dietary diversity

The dietary diversity of learners forming part of the study sample is presented in Table 4.6 with reference to whether they were enrolled in government schools offering school feeding (school feeding beneficiaries) or private schools that do not offer school feeding (school feeding non-beneficiaries).

Table 4.6: Food groups included in the Dietary Diversity Score (N=392)

Food Groups	School feeding beneficiaries (n=330)	School feeding non-beneficiaries (n=62)	p-values#
Starches	100% (330)	100% (62)	N/A
Roots and tubers	7.8% (n=26)	21.0% (n=13)	0.002
Meat, poultry and offal	97.9 (n=323)	93.5% (n=58)	0.058
Fish and seafood	1.2% (n=4)	19.4% (n=12)	0.00
Eggs	5.8% (n=19)	64.5% (n=40)	0.00
Milk and milk products	12.7% (n=42)	87.1% (n=54)	0.94
Vegetables	33.9% (n=112)	83.9% (n=52)	0.00
Fruits	8.5% (n=28)	61.3% (n=38)	0.00
Pulses, beans and legumes	88.5 (n=292)	33.8% (n=21)	0.00
Fats and oils	81.2% (n=268)	100% (n=62)	0.00
Sweets, sugar and honey	100% (n=330)	100% (n=62)	N/A
Miscellaneous	93.3% (n=308)	100% (n=62)	0.036

#Independent samples t-test

*N/A=not applicable

All learners, irrespective of whether they were school feeding beneficiaries or not, reported the consumption of food from the starches food group during the previous 24 hours. However, SFP beneficiaries had a significantly lower consumption of fruit and vegetables when compared to SFP non-beneficiaries with 33.9% of beneficiaries consuming vegetables, whereas 83.9% of non-beneficiaries having consumed vegetables in the previous 24 hours. Fruit consumption was 8.5% versus 61.3% between the two groups, again indicating that non-beneficiaries of the SFP had a higher fruit consumption. Both groups had a low consumption of fish at 1.2% for the SFP group and 19.4% for the SFP non-beneficiary group. In summary, it is worth noting that non-beneficiaries of the SFP consumed a wider variety of food groups that included roots and tubers, fish and seafood, eggs, dairy, vegetables, fruits, fats and oils.

Table 4.7 provides an overview of the mean DDS and HFIAS score per school included in the study sample. In terms of DDS per school category, learners from the SFP non-beneficiary school had a higher DDS of 7.8 versus a mean score of 4.6 for learners from SFP beneficiary schools.

The school with the lowest mean DDS (2.6 ± 0.5) was Bontleng Primary School located in an urban area, while the school with highest mean DDS (7.8 ± 1.3) was the SFP non-beneficiary school, Rainbow primary school. Rainbow primary school also had the lowest mean HIAFS (0.2 ± 4.8), while Baratani primary school located in a peri-urban area had the highest mean HIAFS (13.3 ± 3.0).

Table 4.7: Mean DDS of and Household Food Security status of participating school

School Name*	School Area	School category	DDS	HFIAS
01 5.9% (n=23)	Urban	SFP beneficiary	5.9±1.1	5.7±3.8
02 4.9% (n=19)	Urban	SFP beneficiary	5.6±0.8	5.9±2.6
03 4.9% (n=19)	Urban	SFP beneficiary	5.9±1.0	6.0±2.0
04 2.8% (n=11)	Urban	SFP beneficiary	6.1±1.1	6.6±2.3
05 3.6% (n=14)	Urban	SFP beneficiary	4.9±0.6	5.5±2.7
06 5.6% (n=22)	Urban	SFP beneficiary	6.1±1.2	5.1±2.4
07 5.9% (n=23)	Urban	SFP beneficiary	6.2±1.3	4.4±2.9
08 3.6% (n=14)	Urban	SFP beneficiary	2.6±0.5	9.5±3.0
09 9.4% (n=37)	Peri-urban	SFP beneficiary	3.0±0.7	12.7±3.6
10 13.5% (n=53)	Peri-urban	SFP beneficiary	3.3±0.8	13.3±3.0
11 10.5% (n=41)	Peri-urban	SFP beneficiary	2.9±0.8	13.0±3.5
12 13.8% (n=54)	Peri-urban	SFP beneficiary	3.1±0.7	10.5±1.8
13 15.8% (n=62)	Urban	SFP non-beneficiary	7.8±1.3	0.2±4.7

*code name

In terms of overall dietary diversity of the study sample, Figure 4.5 illustrates that the majority of the study sample had a medium dietary diversity while a high dietary diversity was applicable to the minority of study participants.

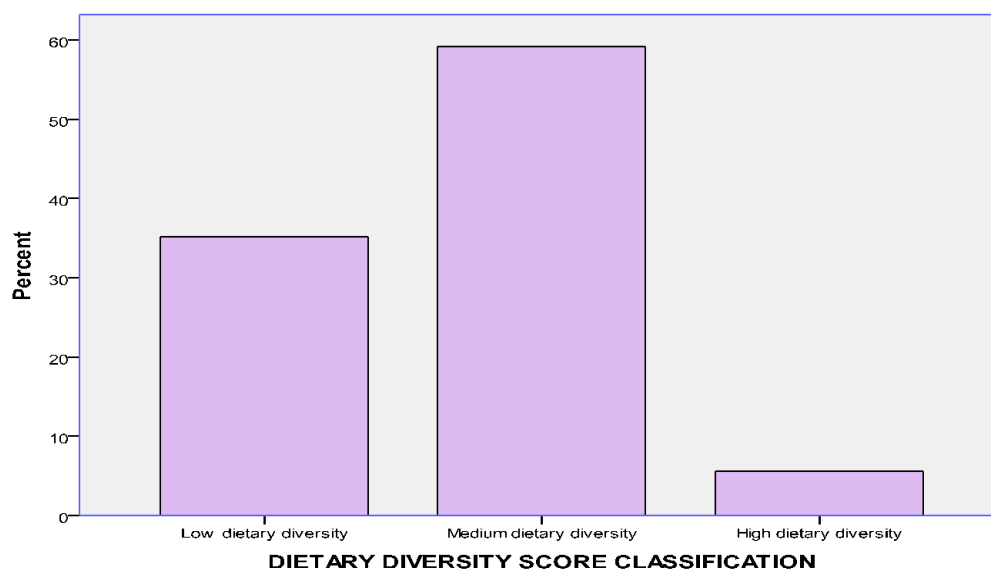


Figure 4.5: Dietary diversity score classification of the study participants

Table 4.8 provides detail regarding the association between level of dietary diversity attained by school feeding beneficiaries versus non-beneficiaries.

Table 4.8: Dietary diversity score of school feeding beneficiaries versus non-school feeding beneficiaries

		School Type		p-value#
		School Feeding Beneficiaries (n=330)	Non-school feeding beneficiaries (n=62)	
DDS	Low (35.2%)	41.5% (n=137)	1.6% (n=1)	0.000
	Medium (59.2%)	58.5 (n=193)	62.9% (n=39)	
	High (5.6%)	-	35.5% (n=22)	

#Chi-square test

The above table indicates that a high level of dietary diversity was attained by 35.5% of the learners attending private schools and therefore non-beneficiaries of school feeding, while none of the learners enrolled at government schools (beneficiaries of the SFP) had a high dietary diversity. As was illustrated in Figure 4.5, the majority of learners from both school groups had a medium dietary diversity with 62.9% of learners from private schools attaining a medium dietary diversity while 58.5% of those from government schools attaining the same level of dietary diversity.

Table 4.9 depicts the relationship between the level of dietary diversity attained by learners from urban versus peri-urban areas.

Table 4.9: DDS of learners from urban versus peri-urban areas

		School Area (n=392)		
		Urban (n=207)	Peri-urban (n=185)	p-value#
DDS	Low (35.2%)	8.7% (n=18)	64.9 (n=120)	0.000
	Medium (59.2%)	80.7% (n=167)	35% (n=65)	
	High (5.6%)	10.6% (n=22)	-	

#Chi-square test

From the above it is evident that a high dietary diversity was only attained by urban learners while a low dietary diversity was the most prevalent among peri-urban learners. This finding echoes the fact that learners enrolled at the private school forming part of the study sample was located in an urban area. The association between level of dietary diversity and area of school attendance was highly significant ($p < 0.000$).

Table 4.10 illustrates the relationship between the level of dietary diversity and level of food security documented amongst learners forming part of the study sample.

Table 4.10: Level of dietary diversity related to the level of food security attained by learners forming part of the study sample

		Food Security Category				p-value#
		Food secure	At risk of food insecurity	Food insecure	Severely food secure	
DDS	Low dietary diversity (35.2%)	22.5% (n=31)	50.7% (n=70)	17.4% (n=24)	9.4% (n=13)	0.000
	Medium dietary diversity (59.2%)	58.6% (n=136)	29.7% (n=69)	8.6% (n=20)	3.0% (n=7)	
	High dietary diversity (5.61%)	100% (n=22)	-	-	-	

#Chi-square test

The above table illustrated how learners with a high dietary diversity were all food secure, while those with a medium dietary diversity spanned across various levels of food security status with the majority being food secure, followed by learners who were at risk of food insecurity. Learners

with a low dietary diversity, also spanned across various levels of food security status, however the majority were at risk of being food insecure. The association between level dietary diversity and level of food security was highly significant ($p < 0.000$).

4.2.4 Physical Activity Levels

In Table 4.11, the level of physical activity of school feeding beneficiaries versus non-school feeding beneficiaries is depicted.

Table 4.11: Physical Activity Level (PAL) category of school feeding beneficiaries versus non-school feeding beneficiaries

		School Type (n=392)		p-value#
		School feeding beneficiaries (n=330)	Non-school feeding beneficiaries (n=62)	
PAL category	Low (1.0%)	1.2% (n=4)	-	0.680
	Moderate (91.3%)	91.2% (n=301)	91.9% (n=57)	
	High (7.7%)	7.6% (n=25)	8.1% (n=5)	

Chi-square test

The above table depicts the fact that the majority of learners that were beneficiaries of the SFP as well as those who were not, were moderately active. The association between the category of PAL and being a beneficiary of school feeding versus not, was not significant.

Table 4.12 shows the relationship between category of PAL and whether schools included in the study sample were located in an urban or peri-urban area.

Table 4.12: PAL category of learners from urban and peri-urban areas

		School Area (n=392)		p-value#
		Urban (n=207)	Peri-urban (n=185)	
PAL category	Low (1.0%)	1.40% (n=3)	0.5% (n=1)	0.001
	Moderate (91.3%)	95.6% (n=198)	86.5% (n=160)	
	High (7.65%)	2.9% (n=6)	13.0% (n=24)	

#Chi-square test

The majority of learners attending schools in urban as well as peri-urban areas were moderately active. However, more learners attending school in a peri-urban area fell within the high PAL category, possibly because as was earlier illustrated, the majority of peri-urban learners walked to school compared to urban learners who walked and made use of public transport to get to school.

The association between the category of PAL and area where participating schools were located was significant ($p=0.001$).

4.4 Discussion

4.5.1 Socio-demographic characteristics

Household Head

In light of the findings of this study that was conducted in primary schools in urban and peri-urban areas of the South-east district Botswana, the results showed that less than half of the learners (41.6%) came from male-headed households, which is similar to national statistics (Statistics Botswana, 2018). The association between female headed households and being of a low socio-economic status is well-documented (Nwosu & Ndinda, 2018; Muleta & Deressa, 2014). It is therefore not surprising that a higher percentage of learners from the private school came from father/male-headed households.

Mode of Transport

When comparing the mode of transport to type of school, the majority of learners attending government schools (SFP beneficiaries), walked to school while learners from the private school used either public transport or were transported with a vehicle from home. When comparing learners from urban versus peri-urban areas, the mode of transport to get to school was public transport or walking, while peri-urban learners most often walked to school. A study conducted by Porter, Abane, Munthali, Robson & Mashari (2011), investigated the mode of transport used by learners to get to school in Ghana, Malawi and South Africa. The finding was that the majority of children from both urban and rural areas walked to school. These findings are not in agreement with that of the current study, possibly due to a difference in the socio-economic status of the learners surveyed or the fact that learners attending peri-urban schools in the current study, do not equate to the rural participants in the study cited. In addition, the study also highlighted the fact that despite the availability of good transport systems in urban areas, affordability thereof could be a barrier to making use of it, despite unfavourable weather conditions, harsh terrain and safety risks associated with walking. A study by Rothman, Macarthur, To, Buliung & Howard (2015) that examined the risk of walking to school in urban areas, found that a higher prevalence of walking was associated with higher pedestrian collision rates (IRR=3.47; 95% CI=1.15). It was

also observed that some of the younger learners that did not form part of the study sample, were seen walking to school unaccompanied by an adult. Despite the risks involved in walking to school, the health benefits of walking are well documented (Chillon, Panter, Corder, Jones & Sluijs, 2015; Roth, Millett & Mindell, 2012). However, when comparing studies conducted in westernized countries, the distance to school was found to be a major barrier to walking to school (Su, Jerrett, Macconnell, Berhane, Dunton, Shankardass, Reynolds, Chang & Wolch 2013). However, the latter study showed that learners enrolled in the free lunch program, were positively associated with walking to school (OR=3.66; 95%CI = 1.64 – 8.21).

4.5.2 Dietary diversity

Although school feeding is associated with improved dietary diversity (Zenebe, Grebremedhin, Henry & Regassa, 2018), in the current study, 41.5% (n=137) of the learners that were beneficiaries of the SFP, had a low dietary diversity score. In addition, despite the SFP intervention, there was significant difference between the learners in government and private schools regarding the dietary diversity scores. The current study therefore demonstrated that other factors may contribute to the lack of dietary diversity observed, or that the SFP did not make a significant contribution to the dietary diversity of its beneficiaries. This indicates that there is a need to assess the nutritional impact of the SFP and assess the efficiency of the programme in timeously providing food according to the set food ration scales that guide meal provision at government schools. Although not captured by the data collection tools, one of the major concerns regarding the SFP expressed by recipients, was the inconsistent availability and delivery of certain food items. Another reason for the suboptimal DDS documented for so many learners, is that their home diets might centre around the consumption of food groups similar to that provided by the SFP which is also deficient in fruit and vegetables. However, 64.9% of peri-urban learners had a low DDS, indicating that that a possible reason for this finding could be affordability as well as availability. Other studies have linked seasonality to low dietary diversity (Abizari, Azupogo, Nagasu, Creemers & Brouwer, 2017). Hence this may also contribute to a lack of dietary diversity as some of the home grown foods provided through *letlhafula* food programme are based on seasonal produce. A study by Taruvinga, Muchenge & Mushunje (2013) found that female headed households have a greater likelihood of attaining a high dietary diversity compared to male headed households. However, in the current study, the majority of learners were from female headed

households. The low DDS of learners from peri-urban areas was similar to the findings of a study that examined DDS among rural households in North Central Nigeria, as results also revealed a lack of dietary diversity (Agada & Igbokwe, 2015). It is therefore important to note that children consuming a diet that lacks variety and hence has a low dietary diversity, are at risk of developing nutritional deficiencies (Ochola & Masibo, 2014; Olumakaiye, 2013).

In terms of DDS documented per school surveyed, the school with the lowest mean DDS (2.6 ± 0.5) was located in an urban area, while the school with highest mean DDS was the private school and therefore a not a beneficiary of the SFP. The private school also had the lowest score for the HFIAS. Baratani primary school, located in peri-urban area had the highest mean HFIAS score. Assuming that learners from the private school are from higher socio-economic status and are food secure, the results are consistent with a study by Faber, Schwabe & Drimi (2009). In the latter study, households with a low DDS (< 4) had a higher HFIAS than households with a DDS above 4. In a study by Zenebe *et. al* (2018), beneficiaries of the SFP had a higher mean DDS (5.8 ± 1.1) than the non-beneficiaries (3.5 ± 0.7) ($P < 0.001$). However, the low DDS among learners participating in the SFP can be attributed to school meals with limited variety, especially with regards to fruits and vegetables (**APPENDIX O**).

4.5.3 Food security

The majority of learners who were severely food insecure attended schools that were located in peri-urban areas. Availability and access to nutritious foods have been found to be an obstacle to improved dietary diversity among rural populations (Govender, Pillay, Siwela, Modi & Mabhaudhi, 2017).

4.5.4 Physical Activity Levels

The current study documented that the majority of learners from urban areas had a moderate PAL. Although the same held true for learners from peri-urban areas, more learners in peri-urban areas had a high PAL than their urban counterparts. A cross-sectional study that surveyed urban South African learners 8 to 14 years of age, found that there was a gender and regional difference in physical activity levels of the study participants (Van Biljon, Mckune, DuBose, Kolanisi & Semple, 2018). The difference in PAL documented for urban versus peri-urban learners in the current study, could be attributed by the fact that the majority of learners walked to school whereas

learners in urban areas walked to school and were dropped off at school, either by a vehicle from home or due to using public transport.

4.6 Study hypothesis

Based on the null hypothesis that was formulated for this chapter namely that there will not be a significant difference in the socio-demographic characteristics, household dietary diversity, household food security status and physical activity levels of primary school learners according to whether they were recipients of school feeding, urban recipients of school feeding, peri-urban recipients of school feeding or non-recipients of school feeding (private schools), the null hypothesis can be rejected for the following variables due to significant differences documented:

For beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control):

- Mode of transport to school ($p < 0.000$)
- Food security status ($p < 0.000$)
- Dietary diversity ($p < 0.000$)

For urban versus peri-urban learners:

- Mode of transport to school ($p < 0.000$)
- Food security status ($p < 0.000$)
- Dietary diversity ($p < 0.000$)

However, the null hypothesis is accepted for PAL in terms of beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control), as there was not a significant difference between the two groups. Regarding the PAL of urban versus peri-urban learners, the null hypothesis is accepted, due to the difference between the two groups being highly significant ($p < 0.001$).

4.7 Strengths

This study investigated a concept that was the first of its kind for Botswana, namely the comparison of household dietary diversity, household food security status and level of physical activity of primary school beneficiaries of school feeding (intervention) versus non-school feeding

beneficiaries (control) in the form of learners attending a private school. Apart from the variables stated, a comparison was also made between urban and peri-urban learners.

4.8 Limitations

The main limitation of this study was related to the small sample of learners attending a private school that served as a control group due to the fact that private schools are not eligible for participating in the government subsidized school feeding programme. The reason that only one school represented the control group was that the primary investigator was not able to obtain approval from other eligible schools, due to the fact that the perception was held that the findings of the current study would not benefit private schools in event of them providing consent to be included in the study. This limited the extrapolation of study findings to other private schools in the South-east District of Botswana. Hence, the findings of the current study should be interpreted with caution. In addition, the cross-sectional study design did not allow for a causal relationship to be explored between study variables, especially in terms of differences between school feeding beneficiaries versus non-school feeding beneficiaries in relation to the independent variables. It is also possible that especially the younger learners, may not have been a reliable source of information. Learners also expressed their concern regarding the length of the measurement tool that measured physical activity levels (PAQ-C). However, the pilot study did reveal the length of the questionnaire as problematic.

4.9 Conclusion

The study objective was to determine and compare the socio-demographic characteristics, household dietary diversity, household food security status and physical activity levels of primary school feeding beneficiaries to non-school feeding beneficiaries. Findings included that despite being beneficiaries of the school feeding programme, learners still had a significantly lower dietary diversity than non-beneficiaries of the SFP from private schools. This especially held true for the consumption of fruit and vegetables as these food groups do not form part of the SFP ration scales. A medium to low level of dietary diversity was documented for all learners participating in the SFP, while a medium to low dietary diversity was documented for 64.5% of learners that did not

benefit from the SFP. In addition, despite being food secure, 42.6% of the entire study sample (N=392), had a medium to low dietary diversity. The implication therefore is that a suboptimal level of dietary diversity may not necessarily be related to an inability to access food. Although the PAL of SFP beneficiaries did not differ significantly from that of non-beneficiaries, there was a significant difference between the PAL of urban versus peri-urban learners. To determine whether the PAL of learners had an impact on their nutritional status, the next chapter will explore the nutritional status of SFP beneficiaries versus non-SFP beneficiaries, as well as whether there was a significant difference between the nutritional status of urban versus peri-urban learners.

4.10 Recommendations

Based on the results of the current chapter, the following recommendations regarding the SFP policy in Botswana is recommended:

- There is a need to develop and implement nutrition education strategies targeting teachers, primary school learners and their caregivers regarding the importance of dietary diversity for optimal health and growth of primary school learners by utilizing more affordable, home-grown foods, especially in households of a low-socio economic status. This recommendation can be implemented by the promotion of school- and backyard gardens to improve the dietary diversity of the SFP as well as the household diet of primary school learners in urban and peri-urban areas.

Recommendations regarding future research opportunities that could be explored include the following:

- An investigation of learner attitude towards the SFP,
- Plate waste studies of meals offered as part of the SFP, and
- Nutrition knowledge of primary school learners, their caregivers and school officials regarding dietary diversity.

It is recommended that the above studies should be conducted in districts characterised by a high prevalence of poverty.

References

- Abizari AR, Azupogo F, Nagasu M, Creemers N, Brouwer ID (2017). Seasonality affects dietary diversity of school-age children in northern Ghana. **PLoS ONE**; 12(8):1 - 16
- Acquah B, Kapunda S, Legwegoh A, Gwebu T, Modie-Moroka T, Gobotswang K, Mosha A (2013). **The state of food insecurity in Gaborone, Botswana**. African Food Security Urban Network (AFSUN).
- Agada MO, Igbokwe EM (2015). Dietary diversity of rural households in North Central Nigeria. **European Journal of Nutrition and Safety**; 5(3):150 – 155
- Angrist N, Pansiri O, Tsayang G (2017). Effect of entry age on school performance: evidence from Botswana. **Lonaka JoLT**; 8 (1):47 – 53.
- Assenga EA, Kayunze K (2016). Food security incidences based on dietary energy consumption, dietary diversity and household food insecurity access score in Chamwino District, Tanzania. **International Journal of Asian Social Science**; 6 (11):644 – 658.
- Chillon P, Panter J, Corder K, Jones AP, Van Sluijs EMF (2015). A longitudinal study of the distance that young people walk to school. **Health and Place**; 31:133 – 137.
- Crocker PRE, Bailey DA, Faulkner RA, Kowalski KC, McGrath R (1997). Measuring general levels of physical activity: preliminary evidence for the physical activity questionnaire for older children. **Medicine and Science in Sports and Exercise**; 29:1344 – 1349.
- Faber M, Schwabe C, Drimi S (2009). Dietary diversity in relation to other household food security indicators. **International Journal of Food Safety, Nutrition and Public Health**; 3(1): doi: 10.1504/IJFSNPH.2009.026915
- Govender L, Pillay K, Siwela M, Modi A, Mabhaudhi T (2016). Food and nutrition insecurity in selected rural communities of KwaZulu-Natal, South Africa – linking human nutrition to agriculture. **International Journal of Environmental Research and Public Health**; 14(1): 17: 1 – 21.
- Gebreyesus SH, Lunde T, Mariam DM, Woldehanna T, Lindtjorn B (2015). Is the adapted Household Food Insecurity Access Scale (HFIAS) developed internationally to measure food insecurity valid in urban and rural households of Ethiopia? **Biomedical Central Nutrition**; 1:2. doi.org/10.1186/2055-0928-1-2.
- Hooshm S, Marhamati F (2018). High Dietary Diversity is associated with child obesity in Iranian school children: an evaluation of Dietary Diversity Score. **Journal of Nutrition and Human Health**; 2(1):46 – 51
- Ijarotimi OS, Erola ML (2018). Assessing Household Food Security Status and Nutritional Outcome among Underprivileged Children (10-19 Years) from East Senatorial District of Lagos State, Nigeria. **Annals of Nutrition & Food Science**; 1(2): 1008. http://www.remedypublications.com/annals-of-nutrition-and-food-science/articles/pdfs_folder/anfs-v1-id1008.pdf
- Kalabamu F, Bolaane B (2014). **Rapid urbanization and housing transformation in Tlokweng, Botswana**. www.wsb14barcelona.org (Accessed 24 January 2019)

Kasima SN, Motswagole BS, Covic NM, Claasen N (2018). Household access to traditional and indigenous foods positively associated with food security and dietary diversity in Botswana. **Public Health Nutrition**; 21(6):1200 – 1208.

Kennedy G, Ballard T, Dop M (2010). **Guidelines for measuring household and individual dietary diversity**. Food and Agriculture Organization of the United Nations, Nutrition and Consumer Protection Division.

Knueppel D, Demment M, Kaiser L (2010). Validation of the Household Food Insecurity Access Scale in rural Tanzania. **Public Health Nutrition**; 13(3):360 – 367. doi:10.1017/S1368980009991121

Kowalski KC, Crocker PRE, Donen RM (2004). **The physical activity questionnaire for older children (PAQ-C) and adolescents (PAQ-Q) Manual**. Saskatoon: University of Saskatchewan. <https://www.researchgate.net/publication/228441462> The Physical Activity Questionnaire for Older Children PAQ-C and Adolescents PAQ-A Manual (Accessed 8 April 2019)

Legwaila GM, Mojeremane W, Madisa ME, Mmolotsi RM, Rampart M (2011). Potential of traditional food plants in rural household food security in Botswana. **Journal of Horticulture and Forestry**; 3(6):171 -177.

Lekobane KR, Mooketsane KS (2015). **Examining Evidence of Feminization of Poverty in Botswana**. Botswana Institute for Development Policy Analysis (BIDPA) Working Paper 43

Manchola-Gonzalez JD, Bagur-Calafat C, Girabent-Farrès M (2015). Validation of the PAQ-C questionnaire to assess physical activity in Spanish older children. **Physiotherapy**; 101(1): e945-e946.

Mohammadi F, Omidvar N, Houshiar-Rad A, Khoshfetrat MR Abdollahi M, Mehrabi Y (2012). Validity of an adapted Household Food Insecurity Access Scale in urban households in Iran. **Public Health Nutrition**; 15(1):145 – 157.

Maruapula SD, Novakofski C (2010). Nutrient intake and adequacy of Botswana elderly. **African Journal of Agriculture and Nutrition Development**; 10:1 –12

McDonald CM, McLean J, Kroeun H, Talukder A, Lynd LD, Green TJ (2015). Correlates of household food insecurity and low dietary diversity in rural Cambodia. **Asia Pacific Journal of Clinical Nutrition**; 24 (4):720 – 730.

Meng L, Wang Y, Li T, van Loo-Bouwman CA, Zhang Y, Szeto IM-Y (2018). Dietary diversity and food variety in Chinese children aged 3 – 17: Are they negatively associated with dietary micronutrient inadequacy? **Nutrients**; 10(11): 1674. Doi: 10.3390/nu10111674.

Ministry of Health (2015). **Botswana steps survey report on non-communicable disease risk factors**. **World Health Organization**. www.who.int/ncds/surveillance/steps/STEPS_BOTSWANA_2014_Report_Final.pdf (Accessed 23 January 2019)

Mosha AC (2015). Urban agriculture in Botswana. **Commonwealth Journal of Local Governance**; 18: 4842. <http://dx.doi.org/10.5130/cjlg.v0i18.4842>

Muleta AN, Deressa DF (2014). Female headed households and poverty in rural Ethiopia. **Science, Technology and Arts Research Journal**; 3(1):152 – 155. <Dx.doi.org/10.4314/star.v3i.25>

Nair MK, Augustine LF, Konapur A (2016). Food based interventions to modify diet quality and diversity to address multiple micronutrient deficiency. **Front Public Health**; 3:277. <doi:10.3389/fpubh.2015.00277>.

Nithya DJ, Bhavani RV (2018). Dietary diversity and its relationship with nutritional status among adolescents and adults in rural India. **Journal of Biosocial Science**; 50(3): 397 – 413. <https://doi.org/10.1017/S0021932017000463>

Nnyepi M, Bennink MR, Jackson-Malete J, Venkatesh S, Malete L, Mokgathe L, Lyoka P, Anabwani GM, Makhanda J, Weatherspoon LJ (2015). Nutrition status of HIV+ children in Botswana. **Health Education**; 115(5):495-514. <Doi.10.1108/he-04-2014-0052>

Nwosu C, Ndinda C (2018). Gender-based households compositional changes and implications for poverty in South Africa. **Journal of International Women's Studies**, 19(6):82 – 94.

Ochola S, Masibo PK (2014). Dietary intake of schoolchildren and adolescents in developing countries. **Annals of Nutrition and Metabolism**; 64(2):24 – 40. <Doi.org/10.1159/000365125>.

Ogechi UP, Chilezie OV (2017). Assessment of Dietary Diversity Score, nutritional status and socio-demographic characteristics of under 5 children in some rural areas in Imo State, Nigeria. **Malaysia Journal of Nutrition**; 23(3):425 – 435.

Olumakaiye MF (2013). Adolescent girls with low dietary diversity score are predisposed to iron deficiency in Southern western Nigeria. **ICAN: Infant, Child and Adolescent Nutrition**; 5(2): 85 – 91.

Porter G, Abane A, Hampshire K, Tanle A (2011). Young people's transport and mobility in sub-Saharan African: The gendered journey to school. **Documents d'analisi Geografica**; 57 (1):61 – 79.

Raboloko M (2016). Determinants of urban household food security in Botswana. **Journal of Biomedical Clinical Science**; 1: 17 –21.

Rankin J, Matthews L, Cogley S, Han A, Sanders R, Wiltshire HD, Baker JS (2016). Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. **Adolescent Health Medicine and Therapeutics**; 7: 125–146. [doi: 10.2147/AHMT.S101631](doi:10.2147/AHMT.S101631)

Rothman L, Macpherson A, Buliung R, Macarthur C, To T, Larsen K, Howard A (2015). Installation of speed humps and pedestrian-motor vehicle collisions in Toronto, Canada: a quasi-

experimental study. **Biomedical Central Public Health**; 15: 774. doi 10.1186/s12889-015-2116-4

Republic of Botswana (2015). **Botswana: Millennium Development Goals Status Report 2015 sustaining progress to 2015 and beyond**. United Nations.

Roth MA, Millett CJ, Mindell JS (2012). The contribution of active travel (walking and cycling) in children to overall physical activity levels: a national cross sectional study: **Preventative Medicine**; 54:134 – 139.

Salarkia N, Abdollahi M, Amini M, Neyestani TR (2014). An adapted household food insecurity access scale is a valid tool as a proxy measure of food access for use in urban Iran. **Food Security**; 6:275 – 282.

Shaibu S, Holsten J E, Stettler N, Maruapula SD, Jackson JC, Maletle L, Mokone G, Wrotniak BH, Compher CW (2012). Adolescent Obesity Prevention in Botswana: Beliefs and recommendations of School Personnel. **The Journal of School Nursing**; 28(3):220-229. doi: 10.1177/1059840511429003

Statistics Botswana (2018) **Botswana multi-topic household survey poverty stats brief**. www.statsbots.org/bw/sites/ (Accessed 23 January 2019).

Statistics Botswana (2016) Pre & primary education stats brief - Statistics Botswana 2014. www.statsbots.org/bw/sites/default/files/BotswanaDemographicSurveyReport2017.pdf. (Accessed 23 January 2019)

Su JG, Jerrett M, Macconnell R, Berhane K, Dunton G, Shankardass K, Reynolds K, Chang R, Wolch J (2013). Factors influencing whether children walk to school, **Health Place**; 22:153 – 161. doi: 10.1016/j.healthplace.2013.03.011.

Tavuringa A, Muchenge V, Mushunge A (2013). Determinants of rural households dietary diversity: a case of Amatole and Nyandeni districts, South Africa. **International Journal of Development and Sustainability**; 2(4):2233 – 2247.

Tladi MD, Monnaatsie M, Shaibu S, Sinombe G, Mokone GG, Gabaitiri L, Maletle L, Omphile H (2018). Results from Botswana's 2018 Report Card on Physical Activity for Children and Youth. **Journal of Physical Activity and Health**; 15(2): S320-S322. <https://doi.org/10.1123/jpah.2018-0420>

Van Biljon A, McKune AJ, DuBose KD, Kolanisi U, Semple SJ (2018). Physical activity levels in urban-based South African learners: a cross-sectional study of 7348 participants. **South African Medical Journal**; 108(2):123 – 131. doi: 10.7196/SAMJ.2018.v108i2.12766

Wang JJ, Baranowski T, Lau WP, Chen TA, Pitkethly AJ (2016). Validation of the physical activity questionnaire for older children (PAQ-C) among Chinese children. **Biomedical and Environmental Science**; 29(3):177 – 186. doi: 10.3967/bes2016.022.

WHO (2011) **Global recommendations on physical activity health: 5 – 7 years old.** www.int/dietphysicalactivity/publications/physical-activity-recommendations-5-17years.pdf?ua=1 (Accessed on 11 January 2019).

Zaki NMM, Sahril N, Omar M, Ahmad M H, Baharudin A, Nor NSM (2016). Reliability and validity of the physical activity questionnaire of older children in Malay language. **International Journal of Public Health Research**; 6(1): 670-676.

Zenebe M, Grebremedhin S, Henry CJ, Regassa N (2018). School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children. **Italian Journal of Pediatrics**; 44 (16):1 – 7. Doi.10.1186/s13052-018-0449-1

CHAPTER 5

ANTHROPOMETRIC STATUS OF PRIMARY SCHOOL FEEDING BENEFICIARIES (INTERVENTION) VERSUS NON-SCHOOL FEEDING BENEFICIARIES (CONTROL)

Abstract

Background: Underweight and overweight is a major public health problem among children of school going age. This double burden of malnutrition is the result of the nutrition transition, as well as household food insecurity. However, SFP have been implemented in Botswana nearly five decades ago to address undernutrition among primary school learners.

Objective: To determine and compare the nutritional status of primary school learners who participated in the SFP (intervention) to non-participants (learners attending a private school) who served as the control group.

Methods: Weight and height was measured according to standard techniques. This was followed by the calculation of weight-for-age (WAZ), height-for-age (HAZ) and Body Mass Index-for-age (BAZ) using WHO AnthroPlus software version 1.0.4. For the calculation of WAZ, the Centre for Disease Control (CDC) tables were used to interpret weight-for-age for learners older than ten years, as WAZ is only available for children up ten years of age on the WHO growth standards.

Results: BAZ indicated that the majority of learners from both the intervention and control group had a normal weight. However, learners from the control group had a higher prevalence of being at risk for becoming overweight or being overweight (29.0% and 9.7%) compared to those in the intervention group (18.8% and 4.8%). While the WAZ categories of recipients versus non-recipients of the SFP differed significantly ($p=0.005$), BAZ categories between the two groups was not significant. A comparison of WAZ and BAZ categories between urban and peri-urban learners both differed significantly ($p<0.000$). As all private school learners were urban, these results should be interpreted with caution.

Conclusion: Despite the fact that the majority of learners had a normal WAZ and BAZ, two out of ten learners from government schools (intervention) were at risk of becoming overweight, while 5% were overweight. Three out of ten learners from the private school (control) were at risk of becoming overweight while 10% were overweight. Hence the risk of learners becoming overweight as well as those who were overweight at the time of the study, justifies further investigation. As the categories of BAZ did not differ significantly between the intervention and control group, it could be an indicator that the SFP has a positive impact on learner nutritional status in the South-east District of Botswana.

5.1 Introduction

The increasing prevalence of overweight and obesity among school going children in most African countries is becoming a public health problem (Adiele & Morgan, 2017; Pangani, Kiplamai, Kamau & Onywera, 2016; Kruger, 2014). As an upper middle income country (World Bank 2019), Botswana has not been spared the nutrition transition, resulting in a double burden of malnutrition, characterized by undernutrition and childhood obesity (Tapera, Merapelo, Tumoyagae, Maswabi, Erick, Letsholo & Mbongwe, 2017; Wrotniak, Malete, Maruapula, Jackson, Shaibu, Ratcliffe, Stettler & Compher, 2012). Urbanization is the main cause of the nutrition transition, associated with a sedentary lifestyle and changing dietary habits (Azuike, Emelamadu, Adinma, Ifeadike, Ebenebe & Adogu, 2011). A food insecurity assessment study conducted in Gaborone by Acquah, Kapunda, Gwebu, Modie-Moroka, Gobotswana & Mosha (2013) noted that in the surveyed households, although the majority of household diets were relatively balanced, children consumed mostly empty calorie foods and had an infrequent consumption of traditional meals (Shaibu, Holsten, Stettler, Maruapula, Jackson, Malete, Mokone, Wrotniak & Compher, 2012).

There is a correlation between place of residence and childhood growth parameters (Lardner, Giordano, Jung, Passafaro, Small, Haar & Beria, 2015). Previous studies have found disparities in nutritional status between children residing in urban versus rural or peri-urban areas, with a higher level of undernutrition in rural compared to urban areas (Majumder, Islam, Hossen, Uddin, Hasan, Talukder, Sarowar, Rahman & Sultana, 2017; Danquah, Amoah & Opare-Obisaw, 2013). Other determinants of undernutrition among school going children are household food insecurity and a low dietary diversity (Wolde, Berhan & Chala, 2015). Several studies have examined the anthropometric status of primary school children in other African countries (Teblick, De Deken, Vanderbruggen, Vermeersch, Teblick, Ruymaekers, Andries, Colebunders & Mmbando, 2017; Goon *et. al*, 2011) and found a relationship between socioeconomic status, gender, area of residence and nutritional status.

School feeding has been shown to have a positive effect on the nutritional status of primary school children in a study which was conducted in Kenya (Neervort, Rosenstiel, Bongers, Demetriades,

Shacola & Wolffers 2013). In this particular study, the learners who were participating in the School Feeding Programme (SFP) were less likely to be nutrition related problems than children in the control group. A previous cross-sectional study which was conducted in India, which highlighted dual nutritional problems of learners from private schools and government schools found that most of the learners who were malnourished were from government schools and those that were obese were from private schools (Ashok, Kavitha & Kulkarni, 2014). In the majority of studies conducted in India and Nigeria (Kar, Pradhan, Samal, 2018; Nwoke, Nkoro, Ibe, Nwifo & Nwokor, 2017; Sehgal, Shankar, Singh, Alvi & Jain, 2017), the prevalence of underweight was usually higher in government schools compared to private primary schools, while the prevalence of overweight was usually higher in private schools. Stunting has also been found to be higher in government (non-paying) compared to fee paying (private schools) (El-Sabely, Tok & Hussien, 2013).

In studies that investigated the nutritional status of learners from urban and peri-urban areas, there is a coexistence of overweight and undernutrition with results being somewhat conflicting, as Dabone, Delisle & Receveur (2011) found that undernutrition was more prevalent in urban areas. Gender also seems to have an impact on the type of malnutrition (Ogheneruese & Joy, 2016), as a study conducted by Audain, Veldman & Kassier (2015) found that prevalence of overweight and obesity was higher among peri-urban girls with a higher prevalence of stunting among boys from peri-urban areas. Undernutrition in urban areas is also not uncommon. A study conducted in Nigeria, found a 31.3% prevalence of severe malnutrition that was higher among boys (Goon, Toriola, Shaw, Amusa, Monyeki, Akinyemi & Alabi, 2011).

This present study also assessed the level of physical activity among primary school learners in relation to their nutritional status. Although the benefits of physical activity is well-researched, very few studies have been conducted in Botswana among school-aged children (Tladi, Monnaatsie, Shaibu, Sinombe, Mokone, Gabaitiri, Maletle & Omphile, 2018). School aged children spend the greater part of the day at school and the school environment with physical activity related extracurricular activities being recognized to reduce the risk of children becoming overweight (Ip, Ho, Louie, Chung, Cheung, Lee, Hui, Ho, Ho, Wong, Jiang, 2017). There is a great disparity in type of physical activity being conducted in urban versus rural areas. In rural

areas, the children of a low socioeconomic status tend to be more physically active through walking as a means of transport (Micklesfield, Pedro, Kahn, Kinsman, Pettifor, Tollman & Norris, 2014). Monyeki (2014) recommends that governments should promote and encourage active lifestyles among children by creating a conducive environment. Cape Town is one of the first few cities in South Africa to provide free outdoor gym access to the community (van Biljon, McKune, DuBose, Kolanisi & Semple, 2018).

The purpose of this study was to determine and compare the nutritional status of recipients of school feeding to that of non-recipients during the school term (baseline), as well between urban and peri-urban learners during the school term. In addition, a comparison was drawn between the nutritional status of recipients of school feeding during the school term to that of their nutritional status after the school holiday (period of no school feeding), as well as between urban and peri-urban recipients of school feeding during the school term versus after the school holiday (period of no school feeding). As recipients of school feeding were sampled from government schools while all non-recipients were from a private school, school feeding could serve as a proxy of socioeconomic status in the current study which was conducted in the South-east district, Botswana.

The resultant null hypotheses were that:

- (i) there will not be a significant difference of the anthropometric status of recipients versus non-recipients of school feeding at baseline (during the school term);
- (ii) there will not be a difference of the anthropometric status of urban versus peri-urban recipients of school feeding at baseline (during the school term);
- (iii) there will not be a difference of the anthropometric status of recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding);
- (iv) there will not be a difference of the anthropometric status of urban versus peri-urban recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding).

5.2 Methodology

5.2.1 Study design

A cross-sectional descriptive study was conducted to determine the baseline anthropometric status of recipients of the SFP versus non-recipients of the SFP. To determine whether the absence of school feeding during the school holiday had an impact on the nutritional status of learners, SFP recipients were followed up directly after the school holiday. Hence the latter aspect of the study formed the longitudinal component.

5.2.2 Study sample

The study sample consisted of primary school learners, aged 8 to 13 years, from 12 government schools and one private school from urban (Gaborone) and peri-urban areas (Tlokweng, Otse and Mogobane). The majority of learners were classified as early adolescents. This age group is considered to be nutritionally vulnerable due to increased nutritional requirements as a result of rapid growth and development (Danquah *et. al*, 2013). Nearly four hundred (N=392) primary school learners participated in the anthropometric component of this study during the school term (period of school feeding for government schools). Of the study sample, 330 were from government schools, while 62 were from private schools and therefore non-recipients of the SFP. Following the school holidays (period of no school feeding), it was only possible to follow up 93 learners, representing a drop out of 71.8% of recipients of school feeding as the majority of learners from government schools were lost to follow up due the following reasons: (i) transfer to other schools; (ii) participation in independence celebration; and (iii) writing of exams for standard seven learners (iv) Absence from school

5.2.3 Anthropometric measurements

For the assessment of learner nutritional status, the following anthropometric measurements were taken.

Weight

To measure the weight of study participants, standard weight measurement protocols were followed as described in Chapter 3 and according to WHO (2014) standards. Weight measurements were used to calculate weight-for-age (WAZ) using WHO AnthroPlus version 1.0.4. For the calculation of WAZ, the Centre for Disease Control (CDC) tables were used to

interpret weight-for-age for learners older than ten years, as WAZ is only available for children up to ten years of age on the WHO growth standards. There is a lack of published studies conducted in Botswana using the WHO growth standards, in addition to there being a paucity of published data regarding the nutritional status of school age children. The WHO Anthroplus software has been found to be an accurate tool for assessing the nutritional status of children (Ramesh, Madhusudan & Gangaboraiah, 2017). Based on the calculation of WAZ, the prevalence of severe underweight (-3 z-scores), underweight (-2 z-scores), normal weight (zero), overweight (+2 z-scores) and obesity (+3 z-scores) was calculated for the study sample.

Height

To measure the height of study participants, standard height measurement protocols were followed as described in Chapter 3 and according to WHO (2014) standards. Height measurements were used to calculate height-for-age (HAZ) using WHO AnthroPlus version 1.0.4. Based on the calculation of HAZ, the prevalence of severe stunting (-3 z-scores) and stunting (-2 z-scores) was calculated for the study sample.

Body Mass Index-for-age

Using weight and height measurements, Body Mass Index-for-age (BAZ) was calculated using WHO AnthroPlus version 1.0.4. Based on the calculation of BAZ, the prevalence of severe wasting (-3 z-scores), wasting (-2 z-scores), normal weight (zero), overweight (+2 z-scores) and obesity (+3 z-scores) was calculated for the study sample.

5.2.4 Data analysis

Height, weight, age, gender and date of birth of study participants were entered into WHO AnthroPlus version 1.0.4 software (WHO, 2009). According to Masthi, Madhusudan & Gangaboraiah, (2017), this software is accurate, easy to use and appropriate for assessment of nutritional status in children. Weight and height measurements were converted into weight-for-age z-scores (WAZ), height-for-age z-scores (HAZ) and body mass index (BMI)-for-age z-scores to determine learner nutritional status. These outputs were then entered into Microsoft Excel and transferred into the Statistical Package for Social Sciences (SPSS) Version 25. Means and standard deviations were calculated for WAZ, HAZ and BAZ.

Chi-square tests were performed to determine the relationship between the following categorical variables:

- Weight-for-age (WAZ), height-for-age (HAZ) and body mass index-for-age (BAZ) for school feeding beneficiaries (government schools) versus non-school feeding beneficiaries (private school) during the school term;
- Weight-for-age (WAZ), height-for-age (HAZ) and body mass index-for-age (BAZ) for urban versus peri-urban learners during the school term;
- WAZ and BAZ (after the school holidays) for school feeding beneficiaries versus non-school feeding beneficiaries;
- WAZ and BAZ (after the school holidays) for urban versus peri-urban learners.

The independent samples t-test was performed to determine the mean differences between BAZ, HAZ and WAZ for boys and girls per age category before the school holiday (baseline) and after the school holiday (end line).

The type of school attended (government school recipients of school feeding and private school non-recipients of school feeding) was used as a proxy for primary caregiver socio-economic status.

5.3 Ethical considerations

Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (BREC) (BE 104/18), and the Health Research Unit of the Ministry of Health, Botswana (HPDME 13/18/1). Permission for data collection was also obtained from the Ministry of Basic Education, Botswana (DPRS 7/1/6 I (53) PEO II-RESEARCH). The individual school heads also gave permission for the school participate in the study. Parents gave consent, while learners gave assent to participate in the study.

5.4 Baseline Results

For the purpose of this study, the term baseline was used to describe the anthropometric status of beneficiaries of school feeding (intervention) and non-beneficiaries of school feeding (control)

during the school term, while the term end line was used to report the nutritional status of participants immediately following the period of no school feeding (school holiday).

Table 5.1 provides an overview of the anthropometric characteristics of the study sample at baseline.

Table 5.1: Anthropometric characteristics of learners by age and gender (N=392)

Age (years)	Weight (kg)					Height (cm)			BMI (kg/m ²)		
	Boys (n=168)	Girls (n=224)	Boys Mean (SD)	Girls Mean (SD)	p-value #	Boys Mean (SD)	Girls Mean (SD)	p-value #	Boys Mean (SD)	Girls Mean (SD)	p-value #
8	5.4% (n=9)	8.5% (n=19)	50.8±4.1	49.2±7.6	0.588	157.6±1.7	155.5±3.4	0.920	20.4±1.5	20.3±2.9	0.890
9	11.3% (n=19)	16.5% (n=37)	40.0±8.2	39.8±7.9	0.939	145.6±8.3	145.9±7.8	0.090	18.7±2.8	18.5±2.5	0.760
10	30.4% (n=51)	17.9% (n=40)	43.6±9.4	40.2±8.3	0.079	148.7±9.0	144.8±8.5	0.035	19.5±2.8	19.0±2.6	0.415
11	11.3% (n=19)	10.3% (n=23)	34.7±8.1	36.8±10.0	0.476	140.6±6.6	142.0±8.0	0.588	17.4±2.7	18.0±3.6	0.518
12	16.1% (n=27)	26.8% (n=60)	33.4±4.6	37.4±7.9	0.016	140.0±6.4	143.2±6.9	0.048	17.0±1.9	18.1±2.8	0.076
13	25.6% (n=43)	20.1% (n=45)	40.2±8.1	38.7±6.5	0.939	146.4±7.4	145.8±6.0	0.909	18.6±2.6	18.2±2.4	0.790

Independent samples t-test

As can be seen from **Table 5.1**, the only significant difference between boys and girls was actual weight and actual height among 12 year olds.

Table 5.2 provides an overview of learner height-for-age (HAZ) and weight-for-age (WAZ) z-scores according to age.

Table 5.2: Height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ) of learners by age and gender at baseline (N=392)

Age (years)	Column percentage (%)	Height-for-age z-score		Weight-for-age z-score	
		Mean	SD	Mean	SD
Boys (n=168)					
8	5.4% (n=9)	-0.7	0.2	0.5	1.1
9	11.3% (n=19)	-0.1	0.8	0.9	1.0
10	30.4% (n=51)	-0.2	0.9	0.9	0.8
11	11.3% (n=19)	0.3	0.7	0.2	1.1
12	16.1% (n=27)	0.5	0.6	0.7	0.7
13	25.6% (n=43)	0.0	0.8	0.2	0.6
Girls (n=224)					
8	8.5% (n=19)	-0.6	0.5	0.1	0.7
9	16.5% (n=37)	-0.1	0.9	0.6	0.8
10	17.9% (n=40)	-0.1	0.7	0.6	0.9
11	10.3% (n=23)	0.3	1.0	0.2	1.2
12	26.8% (n=60)	0.2	0.6	0.2	0.8
13	20.1% (n=45)	-0.1	0.9	0.8	1.0

Table 5.3 indicates the mean \pm standard deviation of learner weight-for-age (WAZ), height-for-age (HAZ) and body mass index-for-age (BAZ) at baseline (during the school term).

Table 5.3: Mean WAZ, HAZ and BAZ of learners by age at baseline (N=392)

Age	WAZ	HAZ	BAZ
8	1.1 \pm 0.9	-0.7 \pm 0.4	0.2 \pm 0.9
9	0.8 \pm 1.0	-0.1 \pm 0.8	0.3 \pm 1.0
10	0.1 \pm 1.0	-0.2 \pm 0.8	0.6 \pm 1.0
11	-0.1 \pm 1.0	0.3 \pm 0.9	0.2 \pm 1.2
12	0.3 \pm 0.9	0.3 \pm 0.6	0.3 \pm 1.1
13	0.5 \pm 0.9	-0.4 \pm 0.8	0.3 \pm 1.1

The mean WAZ, HAZ and BAZ for all learner age categories had normal z-scores (Table 5.3). However, WAZ proved to have the highest mean z-score for all indicators of nutritional status among eight-year-old learners, possibly because non-school feeding beneficiaries (learners from the private school) were significantly younger (8.89 ± 0.889) than that of school feeding beneficiaries (11.32 ± 1.404) ($p < 0.000$) and therefore learners of a different socio-economic status (See Chapter 4).

Table 5.4 depicts the comparison of WAZ between SFP beneficiaries (intervention) and non-school feeding beneficiaries (control) as well as between urban versus peri-urban learners. Seeing

that learners from the control group (private school) were urban, peri-urban learners were all beneficiaries of the SFP.

Table 5.4: WAZ for school feeding beneficiaries versus non-school feeding beneficiaries and urban versus peri-urban learners at baseline (N=392)

WAZ		SFP beneficiaries 84.2% (n=330)	SFP non-beneficiaries 15.8% (n=62)	p-value#	Urban 52.80% (n=207)	Peri-urban 47.19% (n=185)	Total	p-value#
	SU	0.3% (n=2)	0.0% (n=0)	0.005	0.0% (n=0)	0.1% (n=2)	0.5% (n=2)	0.000
	UW	1.2% (n=43)	0.0% (n=0)		3.4% (n=7)	19.5% (n=36)	11.0% (n=43)	
	NW	66.1% (n=218)	62.9% (n=39)		58.9% (n=122)	73.0% (n=135)	65.5% (n=257)	
	OR	16.7% (n=55)	30.6% (n=19)		30.4% (n=63)	2.8% (n=11)	18.9% (n=74)	
	OW	3.6% (n=12)	6.5% (n=4)		3.1% (n=15)	0.3% (n=1)	4.1% (n=16)	
	Obese	-	-		-	-	-	

#: Chi-square

SU: Severely underweight

UW: Underweight

NW: Normal weight

OR: Overweight Risk

OW: Overweight

When comparing SFP beneficiaries to SFP non-beneficiaries, the majority of learners were of a normal weight (66.1% and 62.9% respectively), followed by those being at risk for becoming overweight (16.7% and 30.6% respectively). However, the WAZ significantly differed between the intervention (school feeding beneficiaries) and control group (non-school feeding beneficiaries) ($p=0,005$). In addition, a comparison of WAZ between urban and peri-urban learners also yielded a significant difference between the two groups ($p<0.000$). Learners with a higher prevalence of underweight were from the peri-urban group (19.5%) and therefore the group consisting of only beneficiaries of the SFP, while the highest prevalence of overweight was among urban learners (3.1%) that included learners from the private school that did not qualify for the SFP. There were no SFP beneficiaries or SFP non-beneficiaries classified as obese based on their WAZ.

Table 5.5 presents the comparison of HAZ between SFP beneficiaries (intervention) and non-school feeding beneficiaries (control) as well as between urban and peri-urban learners.

Table 5.5: HAZ for school feeding beneficiaries versus non-school feeding beneficiaries and urban versus peri-urban learners at baseline (N=392)

		School feeding beneficiaries (n=330)	Non-school feeding beneficiaries (n=62)	p-value#	Urban (n=207)	Peri-urban (n=185)	p-value#
HAZ	Stunted	0.5% (n=2)	1.3% (n=1)	0.404	1.4% (n=3)	-	0.146
	Normal	99.5% (n=328)	98.4% (n=61)		98.6% (n=204)	98.9% (n=185)	

#: Chi-square

Very few learners were stunted (n=3) with the difference in HAZ between school feeding beneficiaries not differing from that of non-school feeding beneficiaries. The association was also not significant when comparing urban to peri-urban learners.

Table 5.6 shows the comparison of BAZ between SFP beneficiaries (intervention) and non-school feeding beneficiaries (control), as well as between urban versus peri-urban learners.

Table 5.6: BAZ for school feeding beneficiaries versus non-school feeding beneficiaries and urban versus peri-urban learners at baseline.

		School feeding beneficiaries (n=330)	Non-school feeding beneficiaries (n=62)	p-value#	Urban (n=207)	Peri-urban (n=185)	p-value#
BAZ	Severely wasted - 3SD	0.9% (n=3)	-	0.138	1.0% (n=2)	0.5% (n=1)	0.000
	Wasted -2 SD	3.0% (n=10)	-		2.4% (n=5)	2.7% (n=5)	
	Normal	72.1% (n=238)	61.3% (n=38)		59.4% (n=123)	82.7% (n=153)	
	Overweight risk +1SD	18.8% (n=62)	29.0% (n=18)		27.1% (n=56)	13.0% (n=24)	
	Overweight +2SD	4.8% (n=16)	9.7% (n=6)		9.7% (n=20)	1.2% (n=2)	
	Obese +3SD	0.3% (n=1)	-		0.5% (n=1)	-	

#: Chi-square

The association between BAZ and school feeding beneficiaries versus non-beneficiaries was not significant (p=0.138). None of the non-school feeding beneficiaries were wasted or severely

wasted, while 3% (n=10) and 0.9% (n=3) of the school feeding beneficiary group were wasted or severely wasted respectively. Of the learners who were at risk of becoming overweight, a higher percentage (29.0%) did not receive school feeding and were urban (27.1%). The same trend was evident among overweight learners where a higher percentage were non-school feeding beneficiaries (9.7%) and urban (9.7%). The relationship between school feeding beneficiaries versus non-school feeding beneficiaries was not significant, while the association between urban versus peri-urban learners differed significantly ($p<0.000$).

5.5 End line results

To determine whether the school holiday (period of no school feeding) had an impact on the nutritional status of recipients of school feeding, baseline values of anthropometric status (during the school term), were compared to end line values (immediately after the school holiday). The anthropometric status of non-recipients of school feeding was also determined at these two time points as they served as the control group.

Table 5.7 illustrates the anthropometric status of recipients of school feeding after the school holiday. The difference between the number learners assessed at baseline (N=392) is as a result of loss to follow-up after the holiday period due to learners that were transferred to other schools and learners that were involved in independence day rehearsals that could not be predicted, as schools are often randomly selected for national activities such as these.

Table 5.7: Anthropometric status of learners after the school holiday according to age and gender (N=93)

Age (years)	Weight					BMI (kg/m ²)		
	Boys (n=46)	Girls (n=47)	Boys (mean±SD)	Girls (mean±SD)	p-value#	Boys (mean±SD)	Girls (mean±SD)	p-value#
9	33.3% (n=5)	66.7% (n=10)	38.3±7.1	31.0±4.6	0.047	19.9±4.0	16.6±2.0	0.141
10	51.9% (n=14)	48.1% (n=13)	38.5±6.4	35.2±4.3	0.647	19.1±3.1	18.7±2.5	0.125
11	66.7% (n=6)	33.3% (n=3)	33.2±10.5	33.7±9.3	0.895	17.3±4.0	17.0±2.3	0.943
12	54.5% (n=12)	45.5% (n=10)	32.2±3.9	31.9±4.5	0.316	17.7±2.0	16.8±1.8	0.862
13	45.0% (n=9)	55.0% (n=11)	33.9±6.0	37.3±6.2	0.325	17.2±2.0	18.1±2.2	0.222

Independent samples t-test

When comparing boys and girls, the only significant difference was documented for the weight of ten-year-old boys and girls ($p=0.047$).

Table 5.8 presents the BAZ documented for school feeding beneficiaries versus non-beneficiaries as well as between urban and peri-urban learners after the school holiday.

Table 5.8: BAZ for school feeding beneficiaries versus non-school feeding beneficiaries and urban versus peri-urban learners at end line (after the school holiday) (N=93)

		School feeding beneficiaries (n=32)	Non-school feeding beneficiaries (n=61)	p-value#	Urban (n=92)	Peri-urban (n=1)	p-value#
BAZ	Wasted (- 2 z-score)	3.1% (n=1)	-	0.138	1.1% (n=1)	-	0.968
	Normal	84.4 % (n=27)	54.1% (n=33)		64.1% (n=59)	100% (n=1)	
	Overweight risk (+1 z-score)	9.4% (n=3)	34.4% (n=21)		26.1% (n=24)	-	
	Overweight (+2 z-score)	3.1% (n=1)	9.8% (n=6)		7.6% (n=7)	-	
	Obese (+3 z-score)	-	1.6% (n=1)		1.1% (n=1)	-	

#Chi-square test

As was the case for learners during the school term, the majority of learners had a BAZ indicative of a normal weight at end line. However, despite the fact that the relationship between BAZ and SFP recipients versus non-recipients did not differ significantly, the 90.3% drop-out of SFP beneficiaries between baseline and end line affected the validity of these results as only one urban and two peri-urban schools participated in the end line screening. The availability of the remaining schools was such that if they were screened, the time line after the school holiday would not have generated results that were a reliable indicator of the effect, if any, of the absence of school feeding during the holiday period.

5.4 Discussion

An assessment of primary school learner nutritional status was conducted in the South-east District of Botswana by conveniently sampling learners from urban and peri-urban areas attending government schools and a private school. As the former group are recipients of the SFP while

learners attending private schools do not qualify for the SFP, the purpose of the study was to determine whether the SFP had an impact on learner nutritional status by comparing their anthropometric status to that of learners from a private school that served as control. In addition, the Botswana SFP serves to alleviate hunger and curb undernutrition. In this sense, the programme can also be viewed as a proxy for socio-economic status by providing learners with a daily meal during the school week. If the programme proved to be effective, there should not be a disparity between the nutritional status of recipients versus non-recipients. Although the results cannot be extrapolated to learners attending government and private schools across Botswana, the study adds to the paucity of data regarding the nutritional status of primary school learners in the country. The key findings included the following. WAZ proved to have the highest mean z-score for all indicators of nutritional status among eight-year-old learners, possibly because non-school feeding beneficiaries (learners from the private school) were significantly younger (8.89 ± 0.889) than that of school feeding beneficiaries (11.32 ± 1.404) ($p < 0.000$) and therefore learners of a different socio-economic status. Inadequate nutrition in early life is a major contributing factor to obesity rates in most African countries, including Botswana (Abdullah, 2015). However, a high socio-economic status has been linked to an intake of calorie dense foods and a sedentary lifestyle among children (Ashok *et. al.* 2014). When comparing SFP beneficiaries to SFP non-beneficiaries, despite the majority of learners having a normal weight, the disparity between the two groups became more evident for those being at risk for becoming overweight as was documented for learners attending the private school versus those attending a government school. This was echoed when comparing the WAZ between the two groups as the difference was significant. Studies that compared the nutritional status of government schools versus private schools found a higher prevalence of obesity among learners from private schools and of undernutrition among government school learners (Prakash, Kiranmayi, Parvathi, 2016; El-Sabely, Tork & Hussien, 2013). Hence confirming the trends in the current study where the type of school was also used as a proxy of socio-economic status.

When comparing the WAZ between urban and peri-urban learners, a significant difference between the two groups was documented with learners from peri-urban areas, and therefore recipients of the SFP, having a higher prevalence of underweight. The opposite held true for urban learners that included the learners from the private school, where the highest prevalence of

overweight was documented. A study by Kambondo & Sartorius (2018) that investigated the anthropometric status of primary school learners in Mashonaland West Province, Zimbabwe, also documented that learners from urban areas were more likely to be associated with obesity (COR = 2.87, 95% CI: 1.93–4.28, $p \leq 0.000$). Similar trends were also documented by Berheto, Mikitie and Argaw (2015) and Nabag (2011) in studies conducted in Ethiopia and Sudan respectively.

The prevalence of overweight among learners from the private school is not only unique to the South-east District only, as a national cross-sectional study of secondary school learners in Botswana found that those from private schools had a higher prevalence of overweight compared those from public schools [private: 27.1%, 95% CI: 20.4 – 34.5; public] (Agbozo, Atitto & Abubakari, 2017; Owusu, Colecraft, Aryeetey, Vaccaro & Huffman, 2017; Wrotniak *et. al*, 2012). Although the prevalence of overweight was higher among non-school feeding beneficiaries in the current study, a study that compared nutritional status of primary school learners enrolled in a SFP to those that were not, revealed that the prevalence of overweight (1.9% versus 0.0%) and thinness (9.3% versus 4.6 %) ($p=0.028$) was higher among learners benefiting from the SFP compared to those that were non-recipients (Kwabla, Gyan, Zotor, 2018; Ashok, Kavitha & Kulkarni, 2014). Despite the fact that Botswana is going through a nutrition transition, the majority of the learners in the current study had a normal BAZ. These findings are similar to that of a study that assessed the nutritional status of learners in the Limpopo Province, South Africa (Malongane & Mbhenyane, 2017). A possible reason for the findings documented in the current study as well as that of others, could be that for learners from homes where there is a high prevalence of food insecurity and therefore risk of becoming malnourished, are benefitting from the SFP.

However, the prevalence of learners being at risk for becoming overweight as well as those who are overweight in both the intervention schools as well as the control school as well as between urban and peri-urban areas should not be overlooked. Abdullah (2015) points out that the double burden of malnutrition will become a major cause for concern in developing countries. Unlike previous studies (Iyalomhe, Iyalomhe, Nwadike, Osunde & Iyalomhe, 2018; Nwabueze, Ilika, Azuike, Nwabueze, Obi, Onebunne, Enwonwu, Aniagboso, Ezenyeaku, Ajator & Azuike, 2015; Oldewage-Theron, Napier & Egal, 2011) that documented a high prevalence of undernutrition among learners in rural areas (70.5%), the prevalence of acute and chronic undernutrition in the current study was comparatively low in both urban and peri-urban areas. In the study by Nwabueze

et al, (2015), conducted in rural and urban areas of Anambra State, Nigeria among primary school children aged 4 – 15 years, undernutrition was a problem in rural areas (18.8%) than in the urban area (2.7%) and the difference was statistically significant.

5.5 Study hypothesis

The purpose of this study was to determine and compare the nutritional status of recipients of school feeding to that of non-recipients during the school term (baseline), as well as between urban and peri-urban learners during the school term for WAZ, HAZ and BAZ. In addition, the nutritional status of recipients of school feeding as well as those that did not benefit from school feeding (learners from a private school that served as the control group) was conducted after the school holiday (period of no school feeding) to determine if the period of no school had an effect on learner nutritional status. As recipients of school feeding were sampled from government schools while non-recipients were from a private school, the SFP could serve as a proxy of socio-economic status in the current study which was conducted in the South-east District of Botswana.

Based on the null hypothesis that was formulated for this chapter namely that there will not be a significant difference between the anthropometric status (measured as z-scores for WAZ, HAZ and BAZ) of primary school learners according to whether they were recipients or non-recipients of school feeding, urban recipients of school feeding or peri-urban recipients of school feeding, the null hypothesis can be rejected for the following variables due to significant differences documented and hence the alternative hypotheses namely that there will be a significant difference between WAZ and BAZ will be accepted:

For beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) at baseline:

- WAZ ($p < 0.005$)

For urban versus peri-urban learners at baseline:

- WAZ ($p < 0.000$)
- BAZ ($p < 0.000$)

Based on the null hypothesis formulated for this chapter namely that there will not be a significant difference between the anthropometric status (measured as z-scores for WAZ, HAZ and BAZ) of primary school learners according to whether they were recipients or non-recipients of school feeding, urban recipients of school feeding or peri-urban recipients of school feeding, the null hypothesis can be accepted for the following variables due to an inability to prove the presence of significant differences:

For beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) at baseline:

- HAZ (p=0.404)
- BAZ (p=0.138)

For urban versus peri-urban learners at baseline:

- HAZ (p =0.146)

The testing of the null hypotheses formulated for the comparison of anthropometric status of recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding) with non-recipients of the SFP serving as control, as well as the comparison of anthropometric status of urban and peri-urban recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding) was not possible for reasons discussed under 5.5..

5.6 Strengths

As there is no documented study that investigated the nutritional status of primary school learners in the South-east district of Botswana (which includes the city of Gaborone), results of the current study could fill this gap in the available body of evidence. In addition, it is hoped that the study findings could serve as a spring board for the development and implementation prevention initiatives that address both undernutrition as well as overnutrition among primary school learners in the district. In addition, the current study could pave the way for conducting studies of a similar nature among primary school learners in other districts, as to date, the majority of studies conducted among children, have targeted those under five years of age.

5.7 Limitations

As the study was conducted in a single geographic area, it proved to be a limitation for extrapolation of findings to the remainder of Botswana. Another limitation was loss-to-follow-up of SFP beneficiaries after the school holiday. This prevented the ability to determine whether the school holiday (period of no school feeding) had an impact on the nutritional status of SFP recipients.

5.8 Conclusion

Based on the results of the current study, it was evident that the majority of learners surveyed had a normal BAZ. However, the fact that two out of ten learners from government schools (recipients of the SFP) were at risk of becoming overweight and 5% were overweight and that three out of ten of the learners from the private school (non-recipients of the SFP) were at risk of becoming overweight while 10% were overweight, was cause for concern and justifies further investigation. However, the fact that the categories of BAZ did not differ between significantly between recipients of the SFP compared to non-recipients, attests to the fact that the SFP has a positive impact on learner nutritional status.

5.9 Recommendations

There is dire need for integrated initiatives among primary school learners that not only addresses undernutrition, but also prevents the development of obesity. Hence the objectives of the SFP in Botswana need to be revised to address the emerging public health problem of childhood obesity, especially in developing middle-income countries. Despite the fact that nutrition interventions such as the SFP is addressing learner hunger, interventions such as these should be stepped up to improve the nutritional status of both urban and peri-urban learners as well as the community at large in the South-east District of Botswana. While the current study highlighted the positive impact of the SFP on learner nutritional status, emerging public health problems such as childhood overweight and obesity should not be overlooked. A study by Gewa, Murphy, Weiss & Neumann (2012) that examined learner dietary intake when school feeding was provided, found that learners who received a supplementary meal did not reduce their home food intake which could contribute to a high energy intake and concomitant weight problems. Strategies to emphasize the importance of early-life nutrition in school settings should be receive the attention it deserves by policy makers

when addressing the prevalence of obesity among children and adults alike. It is therefore recommended that the government should channel interventions to reduce the double burden of malnutrition strategically, without compromising the initial objectives and mandate of the SFP. Hence, further longitudinal studies should be conducted among learners on a national level. In a study conducted by Igbokwe, Adimorah, Ikefuna, Ibeziako, Ubesie, Ekeh & Iloh (2017) parental level of education which was not explored in the current study, was an important determinant of childhood nutritional status. Hence parental socio-demographic variables and their impact on primary school learner nutritional status in Botswana should be explored in future studies.

References

Abdullah A (2015). The Double Burden of Undernutrition and Overnutrition in Developing Countries: An Update. **Current Obesity Reports**. Doi 10.1007/s13679-015-0170-y

Adiele D, Morgan GPD (2017). Elevated blood pressure among Zimbabwean urban primary school children aged 5 – 11 years. **American Journal of Pediatrics**. 3(5):51-55. Doi: 10.11648/j.ajp.20170305.15

Agbozo F, Atitto P, Abubakari A (2017). Nutritional status of pupils attending public schools with and without school feeding programme in Hohoe Municipality, Ghana. **Journal of Food and Nutrition Research**. 5(7):467-474. Doi:10.12691/jfnr-5-7-3.

Ashok NC, Kavitha HS, Kulkarni P (2014). A comparative study of nutritional status between government and private primary school children of Mysore city. **International Journal of Health and Sciences**. 3(3):164-169.

Audain KA, Veldman FJ, Kassier SM (2015). A comparative analysis of nutritional status in adolescents from an urban versus a peri-urban school in KwaZulu-Natal, South Africa. **Central African Journal of Public Health**. 1(2):21-27. oi: 10.11648/j.cajph.2015102.12

Azuike EC, Emelamadu OF, Adinma ED, Ifeadike CO, Ebenebe UE, Adogu PU (2011). Nutrition transition in developing countries: A review. **Afrimedical Journal**, 2(2): 1 -5

Berheto TM, Mikitie WK, Argaw A (2015). Urban-rural disparities in the nutritional status of school adolescent girls in the Mizan district, southwestern Ethiopia. **Rural and Remote Health** 15:2687. (Online) Available: <http://www.rrh.org.au> (Accessed 01 February 2019)

Dabone C, Delisle HF, Receveur O (2011). Poor nutritional status of school children in urban and peri-urban areas of Ouagadougou (Burkina Faso). **Nutrition Journal**, 10:34. doi: 10.1186/1475-2891-10-34

- Danquah AO, Amoah AN, Opare-Obisaw C (2013). Nutritional status of upper primary school pupils in a rural setting in Ghana. **International Journal of Nutrition and Food Sciences**, 2(6): 320-326. doi: 10.11648/j.ijnfs.20130206.19.
- El-Sabely AA, Tok HMM, Hussien YE (2013). Comparative study of nutritional status and dietary habits of children from public and private schools in Zagazig city, Egypt. **Journal of Nursing and Health Sciences**; 3(1):47-52.
- Gewa CA, Murphy SP, Weiss RE, Neumann CG (2012). A school-based supplementary food programme in rural Kenya did not reduce children's intake at home. **Public Health Nutrition**, 16(4):713–720. doi:10.1017/S1368980012003266.
- Goon DT, Toriola AL, Shaw BS, Amusa LO, Monyeki MA, Akinyemi O, Alabi OA (2011) Anthropometrically determined nutritional status of urban primary school children in Makurdi, Nigeria. **Public Health**, 11(769):1-8.
- Igbokwe O, Adimorah G, Ikefuna A, Ibeziako N, Ubesie A, Ekeh C, Iloh K (2017). Socio-demographic determinants of malnutrition among primary school aged children in Enugu, Nigeria. **Pan African Medical Journal**, 28:248. doi.org/10.11604/pamj.2017.28.248.13171
- Ip P, Ho FK, Louie LH, Chung TW, Cheung YF, Lee SL, Hui SS, Ho WK, Ho DS, Wong WH, Jiang F (2017). Childhood obesity and physical activity-friendly school environments. **Journal of Pediatrics**, 191:110-116. doi.org/10.1016/j.peds.2017.08.017.
- Iyalomhe SI, Iyalomhe SE, Nwadike IG, Osunde RN, Iyalomhe GBS (2018). Assessment of Dietary Habits and Nutritional Status of Adolescents in a Resource – Poor Environment in Nigeria. **International Journal of Nutrition and Food Sciences**, 7(4):121-128 doi: 10.11648/j.ijnfs.20180704.12
- Kambondo G, Sartorius B (2018). Risk Factors for Obesity and Overfat among Primary School Children in Mashonaland West Province, Zimbabwe. **International Journal of Environmental Research and Public Health**, 15:249. doi:10.3390/ijerph15020249
- Kar K, Pradhan S, Samal BP (2018). Nutritional status of school children in an urban area of Odisha- a comparative study in government versus private school. **Journal of Medicine Science and Clinical Research**, 6(6):73-78. doi.org/10.18535/jmscr/v6i6.14
- Kruger HS (2014). The double burden of underweight and overweight in South African adolescents: a challenge and an opportunity for nutritionists and dietitians. **South African Journal of Clinical Nutrition**, 27(1): 5 – 6. doi: 10.1080/16070658.2014.11734477
- Kwabla MP, Gyan C, Zotor F (2018). Nutritional status of in-school children and its associated factors in Denkyemba District, eastern region, Ghana: comparing schools with feeding and non-school feeding policies. **Nutrition Journal**, 17(8):1- 8.
- Lardner DA, Giordano J, Jung MK, Passafaro MD, Small A, Haar M, Beria JS (2015). Evaluation of nutritional status among school-aged children in rural Kwahu-Eastern region, Ghana; Anthropometric measures and environmental influences. **African Journal of Food, Agriculture**, 15(3):9996-10012.

- Majumder SL, Islam H, Hossen M, Uddin J, Hasan I, Talukder AR, Sarowar A, Rahman M, Sultana I (2017). Assessment of nutritional status using anthropometric methods: a study of rural and urban primary children in Coastal Belt of Bangladesh. **Biochemistry and Molecular Biology**, 2(5):54-59. doi: 10.11648/j.bmb.20170205.11
- Malongane F, Mbhenyane XG (2017). Nutritional status of children on the National School Nutrition Programme in Capricorn District, Limpopo Province, South Africa. **South African Journal of Child Health**, 11(1):11-15. Doi:10.7196/SAJCH. 2017.v11i1.1124
- Masthi RNR, Madhusudan M, Gangaboraiah (2017). Nutritional status of school age children (6-15 years) using the new WHO growth reference in a rural area of Bengaluru, South India. **National Journal of Research in Community Medicine**. 6(2):2277-1522.
- Micklesfield LK, Pedro TM, Kahn K, Kinsman J, Pettifor JM, Tollman S, Norris SA (2014). Physical activity and sedentary behavior among adolescents in South Africa: levels, patterns and correlates. **BioMedical Central Public Health**; 14:40. doi.org/10.1186/1471-2458-14 - 40
- Monyeki (2014). Physical activity and health in children: How much do we know? **African Journal for Physical, Health Education, Recreation and Dance**; 20(2:1):323-342.
- Nabag FO (2011). Comparative study of nutritional status of urban and rural school girl's children Khartoum State, Sudan. **Journal of Science and Technology** 12(2):60-68.
- Neervort F, Rosenstiel I, Bongers K, Demetriades M, Shacola M, Wolffers I (2013) Effect of a school feeding programme on nutritional status and anaemia in an urban slum: a preliminary evaluation in Kenya. **Journal of Tropical Pediatrics**, 99(3):165-174.
- Nwabueze AS, Ilika AL, Azuike EC, Nwabueze NC, Obi KM, Onebunne ME, Enwonwu KG, Aniagboso CC, Ezenyeaku CA, Ajator CC, Azuike ED (2015). Assessment of Nutritional Status Among Primary School Pupils in Rural and Urban Areas of Anambra State. **European Journal of Preventive Medicine**, 3(2):34-38. Doi: 10.11648/j.ejpm.20150302.14
- Nwoke EA, Nkoro NV, Ibe SNO, Nwufu RC, Nwokor O (2017) Comparative study of nutritional status of adolescents attending public and private secondary schools in Abia State, Nigeria. **European Journal of Biomedical and Pharmaceutical Sciences**, 4(2): 37-45.
- Ogheneruese OJ, Joy E (2016) Gender differences in anthropometric indices among primary school children in Delta South-Senatorial District, Delta State Nigeria. **International Journal of Nutrition and Food Sciences**; 5(3):220-223. Doi.10.11648/j.ijnfs.20160503.20.
- Oldewage-Theron W, Napier C, Egal A (2011) Dietary fat intake and nutritional status indicators of primary school children in a low-income informal settlement in the Vaal region. **South African Journal of Clinical Nutrition**; 24(2):99-104
- Owusu JS, Colecraft KE, Aryeetey R, Vaccaro JA, Huffman FG (2017). Nutrition intake and nutritional status of school age children in Ghana. **Journal of Food Research**, 6(2) 11 – 23.

Pangani IS, Kiplamai FK, Kamau JW, Onywera VO (2016). Prevalence of overweight and obesity among primary school children age 8 – 13 years in Dar es Salaam City, Tanzania. **Advances in Preventive Medicine**, Doi.org/10.1155/2016/1345017

Prakash PS, Kiranmayi Y, Parvathi R (2016). A Comparative Study of Nutritional Status in Government vs. Private School Children. **Journal of Community Medicine & Health Education**. 6:5. Doi:10.4172/2161-0711.1000471

Ramesh MNR, Madhusudan M, Gangaboraiah B (2017). Nutritional status of school age children (6-15 years) using the new WHO growth reference in a rural area of Bengaluru, South India. **National Journal of Research in Community Medicine**; 6(2):144-150.

Sehgal S, Shankar R, Singh JV, Alvi T, Jain S (2017) An epidemiological cross-sectional comparative study of nutritional status between government and private primary school children of Meerut City, Uttar Pradesh. **National Journal of Community Medicine**, 8(8):477-481.

Shaibu S, Holsten JE, Stettler N, Maruapula SD, Jackson JC, Maletle L, Mokone G, Wrotniak B. H, Compher CW (2012) Adolescent Obesity Prevention in Botswana: Beliefs and Recommendations of School Personnel. **The Journal of School Nursing**; 28(3): 220 – 229. Doi: 10.1177/1059840511429003.

Tapera R, Merapelo MT, Tumoyagae T, Maswabi TM, Erick P, Letsholo B, Mbongwe B (2017) The prevalence and factors associated with overweight and obesity among University of Botswana students. **Cogent Medicine**; 4: 1357249. <https://doi.org/10.1080/2331205X.2017.1357249>

Teblick A, De Deken S, Vanderbruggen W, Vermeersch M, Teblick S, Ruymaekers M, Andries J, Colebunders R, Mmbando BP (2017) Anthropometry and nutritional status of primary school children in a Sub-urban region in Tanzania. **International Journal of School Health**, 4(3): e46079. Doi.10.5812/intjsh.46079.

Tladi DM, Monnaatsie M, Shaibu S, Sinombe G, Mokone GG, Gabaitiri L, Maletle L, Omphile H (2018) Results from Botswana's 2018 Report Card on Physical Activity for Children and Youth. **Journal of Physical Activity and Health**; 15(2), S320-S322 <https://doi.org/10.1123/jpah.2018-0420>

van Biljon A, McKune AJ, DuBose KD, Kolanisi U, Semple SJ (2018) Physical activity levels in urban-based South African learners: A cross-sectional study of 7 348 participants. **South African Medical Journal**; 108(2):126-131. Doi:10.7196/SAMJ. 2018.v108i2.12766

WHO (2014). **Measuring a child's growth**. www.int/childgrowth/traiing/eng/ (Accessed 31 January 2019)

WHO (2009). WHO AnthroPlus for personal computers: Software for assessing growth of the world's children and adolescents. Geneva. www.who.int/growthref/tools/en (Accessed 5 January 2019).

Wolde M, Berhan Y, Chala A (2015). Determinants of underweight, stunting and wasting among school children. **BioMedical Central Public Health**, 15(8):1-9. Doi.10.1186/s12889-014-1337-2.

World Bank (2019). **Upper middle income data**. <https://data.worldbank.org/income-level/upper-middle-come> (Accessed 9 April 2019).

Wrotniak BH, Malete L, Maruapula SD, Jackson J, Shaibu S, Ratcliffe S, Stettler S, Compher C (2012) Association between socioeconomic status indicators and obesity in adolescent students in Botswana, an African country in rapid nutrition transition. **Pediatric Obesity**, 7: e9 – e13.

CHAPTER SIX

CONTRIBUTION OF SCHOOL FEEDING RATION SCALES TO THE DIETARY REFERENCE INTAKE (DRI) AND DAILY ESTIMATED AVERAGE REQUIREMENT (EAR) FOR ENERGY, MACRONUTRIENTS AND SELECTED MICRONUTRIENTS

Abstract

Background: School Feeding Programmes (SFPs) in low income countries are ideal in addressing malnutrition problems whereas in developed countries, the objective of school meals is to address childhood obesity.

Objective: To analyze the nutritional menu contribution of school meal rations provided in the Botswana SFP to the Dietary Reference Intakes (DRIs) and Estimated Average Requirements (EAR) for energy and selected nutrients.

Methods: The food rations provided in the Botswana SFP was analyzed for nutritional content using FoodFinder 3.0.

Results: From the results of this study, the energy and nutrients supplied by the ration scale compared to age appropriate reference intakes of the learners participating in the SFP in the current study, was inadequate in terms of energy (60%), protein (90%), vitamin A (46%) and calcium (28%).

Conclusion: The current food rations provided to learners who participate in SFP, may not be adequate in selected nutrients, it is anticipated that with the introduction of breakfast in addition to the SFP ration scale that was evaluated in the current study, it may improve the energy and protein content of meals provided as part of the SFP to 66% of the EAR in accordance with the age of the learners. However, the food rations still lack food sources such as fruits and vegetables that provide specific micronutrients.

6.1 Introduction

A school setting serves as an ideal platform for nutritional interventions aimed at children. Examples of such interventions are SFPs that aim to complement the food intake and nutritional needs of learners, especially in resource limited settings [Food and Drug Organization (FAO), 2018]. Kwabla, Gyan & Zotor, 2018; Jomaa, McDonnell & Probart, 2011]. School health and school feeding (SHSF) programs can help to overcome barriers to learning such as an inability to concentrate experienced by food insecure children (World Bank Group, 2016). The long term objective of the SFP is to assist in the promotion of Universal Primary Education to socio-

economically disadvantaged and nutritionally vulnerable children such as in low income countries like Kenya (Khatete, Pendo & Oyabi, 2013).

The Academy of Nutrition and Dietetics (ADA) recommends that school going children should achieve optimal physical fitness, maintain health and follow appropriate eating habits to reduce the risk of chronic diseases (Hayes, Contento & Weekly 2018). In developing countries, the objectives of school meals are to promote nutritional and educational outcomes such as improve school enrollment and alleviate hunger (Zenebe, Gebremedhin, Henry & Regassa, 2018; Graham, Hochfeld, Stuart & Gent, 2015; Yendaw & Dayour, 2014; McDonnell & Probart, 2011). SFPs have also been shown to have a positive effect on academic outcome (Bukari, Hajara & Oloruntoba, 2012). However, there are nutritional, social, practical, educational, economic, political, and cultural perspectives and challenges linked to the implementation of healthy and sustainable school meals (Oostindjer, Aschemann-Witzelb, Wanga, Skulandc, Egelanddsdala, Amdama, Schjøllc, Pachuckie, Rozinf, Steing, Almlih & Kleefi, 2017).

In developed countries, the focus on school meals is to modify energy intake, fat and sodium content to address high levels of childhood overweight and obesity (Aliyar, Gelli & Hamdani, 2015; Hurley, Cross & Hughes, 2011; McGuire, 2011). However, studies by Nelson (2011) and Tian, Zhang, Loustalot, Yang & Cogswell (2013), documented the fact that the majority of school meals provided and consumed were typically high in fat, salt and sugar, contradictory to the guidelines on healthy eating (Nelson, 2011). In another study by Cullen & Chen (2017), the results indicated that children's intake from school meals did not meet federal guidelines. **?where?** The American Heart Association (2019) has also advocated for healthier school meal options in line with national guidelines. Another cross-sectional study conducted in Sweden found that the nutritional quality of school meals also did not meet the reference values but the intake of saturated fatty acids and sodium exceeded the reference (Osowski, Lindroos, Barbieri & Becker, 2015). A study conducted by Vieux, Dubois, Duchêne & Darmon (2018) assessed 20 lunches that were served in French primary schools for their nutritional quality. It was concluded that the meals were of a good nutritional quality in line with the French school food guidelines. An earlier study that also analyzed the nutritional quality of food served at French schools found that the food served did not meet the meal composition criteria in accordance with prescribed guidelines (Dubuisson, Lioret, Calamassi-Tran, Volatier & Lafay, 2008). When the implementation of the National

School Feeding Program was analysed in Brazil, findings were that learners usually brought food from home as there was low adherence to the SFP and that the food on offer was not nutritionally adequate (Rocha, Filgueiras, Albuquerque, Milagres, Castro, Silva, Costa, Priore & de Novaes, 2018; Sidaner, Balaban & Burlandy, 2012).

Similar challenges to the implementation of SFPs have also been observed in African countries. In South Africa, the nutritional analysis of school meal menus revealed that the majority of schools did not adhere to the regulations (Nhlapo, Lues, Kativu & Groenewald, 2015). A later study found that schools frequently prepared more starch and fewer vegetables and protein than they should (JET Education Services, 2016).

The Second International Conference on Nutrition (ICN2) Framework for Action, Global Panel on Agriculture and Food Systems for Nutrition, Healthy Meals in Schools Policy Brief and the WHO Global Action Plan for the Prevention and Control of non-communicable diseases 2013–2020 are among international organizations that development nutrition guidelines and standards (NGS) to ensure that school meals are in line with target children's needs and context [Food and Agriculture Organization (FAO) 2019]. The development of NGS has been recommended and prioritized internationally as a first step to ensure that school meals and other available foods are in line to target children's needs.

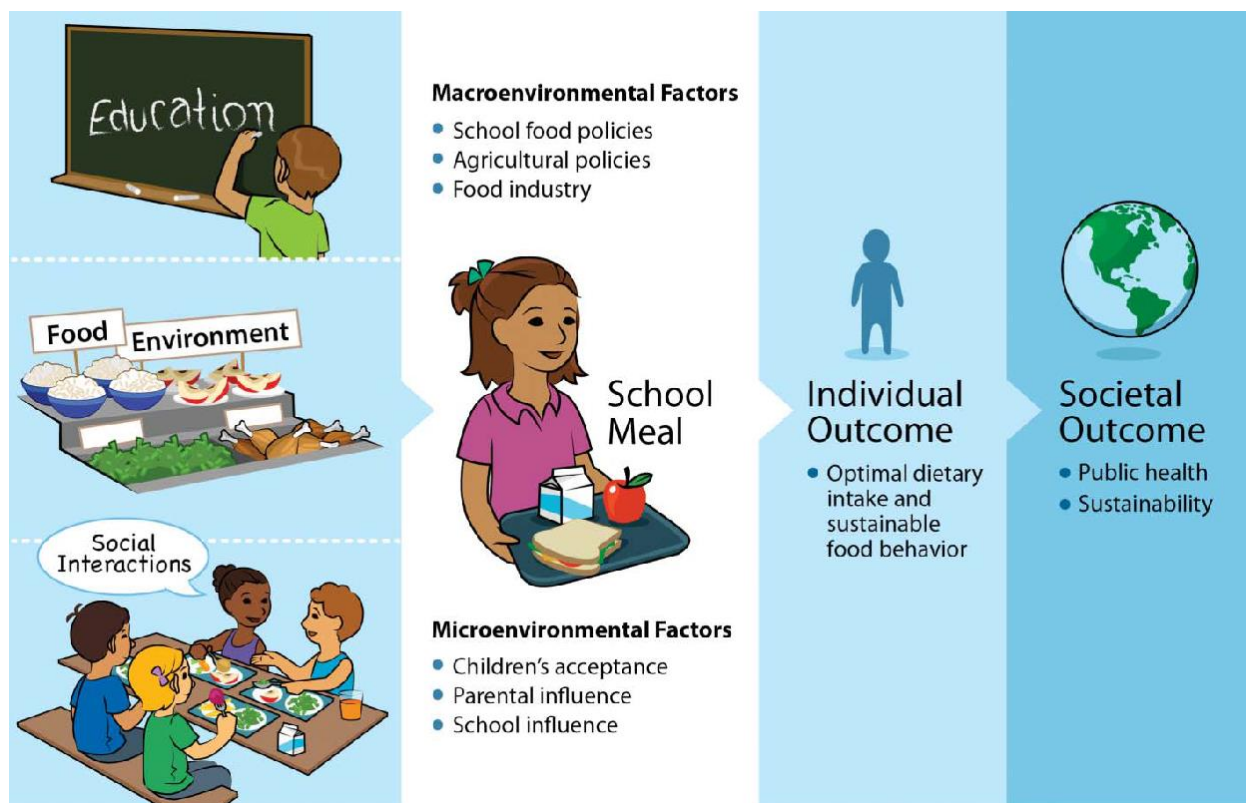


Figure 6.1: Model of influences and potential outcomes of school meals in children

Source: Oostindjer *et. al.*, (2017)

Based on the above literature, the purpose of the current study was to evaluate the school feeding ration scale used to guide the implementation of the national SFP among primary school learners attending government schools in Botswana, to determine the contribution it makes towards meeting the daily estimated average requirements (EARs) for energy, macronutrients and selected micronutrients in relation to the level of physical activity of learners described in chapter 4.

6.2 Methodology

6.2.1 Research instruments

In Botswana, only one lunch meal is provided with additional meals for critically vulnerable children and/or remote schools (FAO, 2019). Despite the fact that a breakfast meal was introduced on 1 April 2019 (**APPENDIX P**), this was not taken into consideration as it had not been implemented at the time of data collection of analysis of the current study. Hence the existing SFP ration scales were assessed.

6.2.2 Ethical considerations

Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (BREC) in South Africa (BE 104/18), and the Health Research Unit of the Ministry of Health, Botswana [HPDME 13/18/1]. Permission for data collection at the study site was also obtained from the Ministry of Basic Education, Botswana (DPRS 7/1/6 I (53) PEO II-RESEARCH).

6.3 Data Analysis

When the current study was conducted, only one meal per day (lunch) was served at schools forming part of the study sample in the South-east district of Botswana. However, a breakfast meal has since been introduced (**APPENDIX P**). This new development was not included in the in the food ration scale analysis, as it was not applicable during the period of data collection or analysis of the current study. According to recommendations by Moepeng (2013), school meals should contribute 33% of recommended daily energy intake of learners (Moepeng, 2013). The daily food ration scale can be found in **APPENDIX O**.

For the purpose of the food analysis the weekly rations were used. The school food rations used to guide the implementation of the SFP was analysed for nutritional content using FoodFinder 3.0 developed by the Medical Research Council (MRC) in South Africa.

The ration scale was analysed according to the following Dietary Reference Intakes (DRIs) depicted in Table 6.1. As the boys and girls in the study sample were aged 8 to 13 years of age the DRIs for boys and girls aged 9 to 13 years of age were used as a reference value. As the EAR is used to estimate the prevalence of inadequate intake within a group [Nutrition Information Centre University of Stellenbosch (NICUS) 2003], this value was used where it was available for specific nutrients.

Table 6.1: Dietary Reference Intakes (DRIs) used to evaluate the weekly ration scale of the SFP in Botswana

Energy and nutrients	Dietary Reference Intake
Energy (kcal/kj)	DRI for boys/girls 9-13 years of age (average between genders)
Protein (g/kg/day)	RDA
Carbohydrate (g/day)	EAR
Vitamin A (µg/day)	EAR for boys/girls 9-13 years of age (average between genders)
Folic acid (µg/day)	EAR for boys/girls 9-13 years of age
Calcium (mg/day)	Adequate intake (AI) for boys/girls 9-13 years of age
Iron (mg/day)	EAR for boys/girls 9-13 years of age (average between genders)
Zinc (mg/day)	EAR for boys/girls 9-13 years of age

The above macro- and micronutrients were selected for analysis, based on the role they play in growth promotion among children, as well as their role in the prevention of infectious diseases. The total ration scale allocation per child per week was calculated, followed by the calculation of energy, macro- and selected micronutrients provided by each food item as cooked weights. This was followed by calculating the total energy, macro- and micronutrients supplied by the food items included in the ration scale. Totals were then divided by five to obtain a mean value for each of the five school days in a week to determine the contribution the SFP makes to a child's daily macro- and micronutrient intake. For comparative purposes, the respective DRI, EARs and AI were divided by three as in theory, the SFP should provide 33% of a child's daily energy and nutrient requirements.

6.4 Results

Table 6.2 below provides an overview of the foods included in the weekly SFP ration scale, as well as the nutrient contribution they make towards a child's macro- and micronutrient intake.

Table 6.2: Nutritional analysis of food items provided by the SFP ration scale

Food item	Portion	Energy (kj)	Protein (g)	CHO* (g)	Iron (mg)	Calcium (mg)	Zinc (mg)	Vitamin A (µg)	Folic acid (µg)
Sorghum	100g x 3/ week	1419	10	72	4.5	28	2.6	72	-
		4257	29	216	13.5	84	7.9	216	
Canned beef stew	100g x 1/ week	398	5	7	0.7	12	0.8	0.5	3.2
		398	5	7	0.7	12	0.8	0.5	3.2
Samp	100g x 1/ week	1550	7	86	2.7	3	0.5	-	10
		1550	7	86	2.7	3	0.5	-	10
Beans	100g x 3/ week	338	22	44	7.5	1	2.8	-	395
		1014	655	133	22.5	2	8.5	-	1185
Bread	2 slices x 1/ week	556	4	25	1.8	76	0.4	-	30
		556	4	25	1.8	76	0.4	-	30
Milk	340ml x 1/ week	873	11	16	0.3	405	1.3	105	17
		873	11	16	0.3	405	1.3	105	17
Jam	45g x 1/ week	502	1	31	0.5	11	9	1.4	0.9
		502	1	3	0.5	11	9	1.4	0.9
Peanut butter	45g x 1/ week	246	12	5	0.7	15	1.1	-	35
		246	12	5	0.7	15	1.1	-	35
TOTAL		5882	105	287	18.7	550	18.6	179	482
		8993	132	520	42.7	607	32.4	323	1254
DAILY CONTRIBUTION		1799	27	104	8.5	121	6.5	65	251

*CHO: Carbohydrate

Table 6.3 below depicts a comparison of the daily energy, macro- and micronutrients supplied by the ration scale in terms of its comparison to the respective DRI, RDA, EAR and AIs referred to in Table 6.1.

Table 6.3: Estimated Average Requirement (EAR) provided by the school meals

Energy and nutrients and their related reference intakes	Daily required value	33% of daily value	Daily contribution from ration scale	Contribution by ration scale to 33% of daily value	Achievement of 33% target
Energy (DRI)	9135 kJ	3015 kJ	1799kJ	60%	INADEQUATE
Protein (EAR)	0.76 g/kg/day*	30 g	27g	90%	INADEQUATE
Carbohydrate (EAR)	100 g	33 g	104g	315%	ADEQUATE
Iron (EAR)	5.8 mg	1.91 mg	8.5mg	445%	ADEQUATE
Zinc (EAR)	7.0 mg	2.3 mg	6.5 mg	283%	ADEQUATE
Vitamin A (EAR)	432 ug	143 ug	65 ug	46%	INADEQUATE
Folic Acid (EAR)	250 ug	83 ug	251 ug	302%	ADEQUATE
Calcium (AI)	1300 mg	429 mg	121 mg	28%	INADEQUATE

*Median weight of study sample

From the results in Table 6.3 it is evident that the energy and nutrients supplied by the ration scale compared to age appropriate reference intakes of the learners participating in the SFP in the current study, was inadequate in terms of energy, protein, vitamin A and calcium.

6.5 Discussion

The nutritional inadequacy of school meals can have a negative impact on the nutritional status of school going children (Ayogu, Eme, Anyaegbu, Ene-Obong & Amazigo, 2018). A summary of selected nutrient based standards for school meals in selected countries is illustrated in Table 6.4. From the information provided, it would seem that Brazil and Kenya had higher energy and protein guidelines for school feeding compared to other countries. However, it is possible that three school meals are provided in Brazil, compared to the one meal provided in other countries. In the current study, the energy provided by the SFP ration scale did not meet 33% of the daily energy and

selected nutrients analysed in terms of age appropriate recommendations as per the age category of the study sample. These results are consistent observations made by other studies (Osowski *et. al*, 2015; Spence, Delve, Stamp, Matthews, Whit, & Adamson, 2013).

In the cross-sectional study conducted by Osowski *et. al*, (2015) amongst school aged children in Sweden, the results indicated that the mean energy intake from school meals did not meet the reference values. Unlike the latter study, a study conducted among Nigerian scholars showed that the energy content of school meals provided by rural schools, exceeded recommended guidelines (Ayogu *et. al*, 2018). It is possible that in developing countries, one of the nutritional aims of SFPs is to alleviate hunger and malnutrition, hence the higher energy content of the meals. However, in the current study, it is possible that the energy expended through e.g. walking to school, especially among peri-urban learners that seemingly had higher PALs when compared to their urban counterparts, would imply that the energy requirements of peri-urban learners are higher than that of urban learners who were more likely to make use of motorised transport or public transport to get to school (see Chapter 4).

One of the most important nutrients that promotes growth and development among children is protein (Hornell, Lagstrom, Lande & Thorsdottir, 2013). Other functions of protein that are also important for growing children include tissue repair, enhancing the immune system and providing energy (Xu & Xue, 2016). Sources of protein include meat and animal products such as milk, insects, legumes and nuts (Henchion, Hayes, Mullen, Fenelon & Tiwari, 2017). An adequate protein intake is important, as a protein deficiency in children can cause serious health problems (Abubakar, Atiku, Alhassan, Mohammed, Garba & Gwarzo, 2017). In the current study, the inadequate contribution to the EAR for protein made by the SFP ration scale, could have been attributed to a lack of dietary diversity (see Chapter 4), similar to a study that was conducted in Ethiopia among 514 learners (Herrador, Perez-Formigo, Sordo, Gadisa, Moreno, Benito, Aseffa & Custodio 2015). Result of the latter study showed that animal sources of protein were lacking in the children's diet, especially among those that resided in rural areas. Despite the fact that the SFP ration scale did not supply sufficient protein in the current study, the results from the DDS reported in Chapter 4, indicated the majority of SFP beneficiaries consumed meat, poultry, offal, pulses, beans and legumes. However, the minority of learners consumed eggs, fish, seafood, milk and milk products in the 24 hours preceding the study. The results from this cross-sectional survey

conducted in 12 primary schools documented results that are inconsistent with a study conducted in England by Spence *et. al* (2013). Learners in the latter study that participated in the school lunch programme had a significantly higher daily intake of protein compared to learners in the current study. It should however be remembered that England is a high income country, whereas Botswana is classified as a middle income country. Hence the socio-economic status of learners that participated in the respective studies should be taken into consideration when appraising the findings of the two studies. It is however surprising that a study conducted among Nigerian learners by Ayogu *et. al* (2018), found that the school meals served in three schools that were surveyed, provided adequate protein amounting to 159.5% of the recommended guidelines. The reason for this finding could be that pulses were consumed on four out of five school days.

The vitamin A provided by the SFP ration scale in the current study proved to be inadequate. Vitamin A is a fat soluble vitamin that is necessary for the maintenance of optimal vision in dim light, the maintenance of a healthy immune system, as well as the promotion of optimal growth and development (Gilbert, 2013). A vitamin A deficiency is now referred to as Vitamin A deficiency disorders because it supports many systems in the body and a vitamin A deficiency is the leading cause of preventable childhood blindness [United Nations Children's Fund (UNICEF), 2019].

Calcium was another micronutrient that was not supplied in adequate amounts by the SFP ration scale, as milk which is the best source of calcium is only provided as part of school meals once a week. The importance of calcium in bone and dental health is well recognized (Bouziani, Saeid, Benkirane, Qandoussi, Taboz, Hamdouchi, Kari, Mzibri & Aguentaou, 2018; Thandrayena & Pettifor, 2018; Aggarwal, Seth, Aneja, Sharma, Sonkar, Singh & Marwaha, 2012). When the results of the current study are compared to that of the calcium content provided by other school menus, only a study conducted on the SFP in Turkey found the calcium content of school meals to be adequate (Ongan, Inanc & Cicek, 2014), as studies conducted by Ayogu *et. al*, (2018) and Nhlapo *et. al*, (2015) found that the calcium content of school meals was inadequate.

Studies investigating the prevalence of micronutrient deficiencies among children in Botswana are lacking. A study conducted by Abrams, Mushi, Hilmers, Griffin & Allen (2003) among urban primary school learners aged 6 to 11 years from lower income areas in Botswana, found that an

intervention consisting of beverages supplemented with micronutrients, improved the nutritional status of children forming part of the study sample.

Table 6.4: Summary of selected energy and nutrient standards for school meals in selected countries

Country	Age years	Energy (kcal) % of total req.	Protein (g) % of total requirement	Fat (g) % of total requirement	Carbohydrates (g) % of total requirement	Vitamin A (µg) % of total requirement	Iron (mg) % of total requirement	Zinc (mg) % of total requirement
Ghana	-	30% (664)	33% (16.3)	26% (11.1)	-	68% (375)	16% (3.7)	-
South Africa	-	30% (lunch)	30% (lunch)	-	-	30% (lunch)	30% (lunch)	30% (lunch)
Kenya	-	32% (706)	50% (24.8)	27% (11.5)	-	50% (275)	24% (5.8)	-
Mexico	-	25% (breakfast)	15% of calories	25% of calories	60% of calories	-	-	-
Brazil	1-15	70% (1500l) #	70% (46.9)	70% (37.5)	70% (243)	70% (490)	70% (7.5)	70% (6.3)
Columbia	7-12	30% (596l)	12-14% of calories (20.8)	28-32 % of calories (19.8)	55-64% of calories (83.4)	-	-	-
England	-	30% (663)	30% (15)	35% (15)	-	-	35% (8g)	-
USA	-	45% (995)	20% (10)	30% (13)	-	40% (220)	-	-

#: provision of three meals/day

Source: FAO (2019)

6.6 Study hypothesis

As the objective of the current study was to determine the contribution of the school feeding ration scale to the EARs for energy, macronutrients and selected micronutrients, the null hypothesis proposed that the SFP ration scale will not provide 33% of the EARs for energy, macronutrients and selected micronutrients. Based on the finding that the ration scale provided adequate amounts of carbohydrate, Iron, Zinc and Folic Acid but inadequate amounts of energy, protein, vitamin A and Calcium, the null hypothesis can be rejected for carbohydrate, Iron, Zinc and Folic Acid, but accepted for energy, protein, vitamin A and Calcium.

6.7 Strengths

The current study explored a topic that has not been investigated in Botswana recent years. Hence there is a paucity of data regarding a comparison of the nutrient requirements of primary school learners that are recipients of the SFP and the ration scale on which the SFP is based.

6.8 Limitations

The limitation of the current study was that the nutrient intake of learners from food sources other than that supplied by the SFP was not investigated as the 24-hour recall used to determine the DDS in Chapter 4 was a non-quantified 24-hour recall. In addition, the nutrient intake of non-beneficiaries of the SFP (learners from a private school) was also not investigated.

6.9 Conclusion

The objective of the current study was to determine the nutrient content of the ration scale used to implement the SFP in Botswana in urban as well as peri-urban areas. Although the total nutrient content of foods forming part of the ration scale proved to be adequate in certain nutrients, it provided to be inadequate in others including energy and protein content. However, it is hoped that with the introduction of breakfast in addition to the SFP ration scale that was evaluated in the current study, it may improve the energy and protein content of meals provided as part of the SFP to 66% of the EAR in accordance with the age of the learners. The same applies to the vitamin A and calcium content. However, the food rations are still likely to be inadequate in terms of certain micronutrients due to the lack of fruit and vegetables in the ration scale.

6.10 Recommendations

Based on the results of the current study, the following recommendations are made regarding the SFP policy in Botswana:

- There is a need to develop and implement nutrition programs, especially for vulnerable learners who may require additional care and nutrition. However, the standardisation of menu items that are meant to reduce the prevalence of acute and chronic malnutrition (undernutrition and stunting) among learners who are at nutritional risk can also increase the risk of developing obesity among some learners, especially those that reside in homes

where there are adequate financial resources as well as those who do not engage in regular physical activity.

As a follow-up to the current study, it will be beneficial to thoroughly explore the following research opportunities:

- The nutrient content of learner lunch box items,
- The nutrient content of food eaten from home, food vendors and school tuckshops for learners participating in SFPs
- The evaluation of nutrient content of the newly introduced breakfast meal as part of the Botswana SFP

References

Abrams SA, Mushi A, Hilmers DC, Griffin IJ, Davila P, Allen L (2003). A Multinutrient-Fortified Beverage Enhances the Nutritional Status of Children in Botswana. **The Journal of Nutrition**; 133(6):1834–1840. Doi.org/10.1093/jn/133.6.1834

Abubakar N, Atiku MK, Alhassan AJ, Mohammed IY, Garba RM, Gwarzo GD (2017). An assessment of micronutrient deficiency: A comparative study of children with protein energy malnutrition and apparently healthy controls in Kano, Northern Nigeria. **Tropical Journal of Medicine Research**; 20:61 – 65. Doi:10.4103/1119-0388.198124

Academy of Nutrition and Dietetics (2014). Position of the Academy of Nutrition and Dietetics: Nutrition Guidance for Healthy Children Ages 2 to 11 Years. **Journal of the Academy of Nutrition and Dietetics**; 114:1257 – 1276.

Aggarwal V, Seth A, Aneja S, Sharma B, Sonkar P, Singh S, Marwaha RK (2012). Role of Calcium Deficiency in Development of Nutritional Rickets in Indian Children: A Case Control Study. **The Journal of Clinical Endocrinology & Metabolism**; 97(10): 3461–3466, Doi.org/10.1210/jc.2011-3120

Aliyar R, Gelli A, Hamdani SH, (2015). A review of nutritional guidelines and menu compositions for school feeding programs in 12 countries. **Public Health**, 3:148. Doi.org/10.3389/fpubh.2015.00148.

American Heart Association (2019). Stepping Up to the Plate: Nutrition Standards and School Meals. <https://www.heart.org/-/media/files/about-us/policy-research/fact-sheets/healthy-schools-and-childhood-obesity/nutrition-standards-and-school-meals-fact-sheet-2019.pdf?la=en&hash=65A283F35E8B24CF601EB759BB5F84BB87CE77E8> (Accessed 29 March 2019).

Ayogu RNB, Eme PE, Anyaegbu VC, Ene-Obong HN, Amazigo UV (2018). Nutritional value of school meals and their contributions to energy and nutrient intakes of rural school children in Enugu and Anambra States, Nigeria. **BioMedical Central Nutrition**; 4:9. Doi.org/10.1186/s40795-018-0216-0.

Bouziani A, Saeid N, Benkirane H, Qandoussi L, Taboz Y, Hamdouchi AEI, Kari KEI, Mzibri MEI, Aguenau H (2018). Dietary Calcium Intake in Sample of School Age Children in City of Rabat, Morocco. **Journal of Nutrition and Metabolism**; Article ID 8084623. Doi.org/10.1155/2018/8084623

Bukari M, Hajara IPN, Oloruntoba A (2012). School Feeding Program in Ghana: Factors Affecting Academic Performance among Public Primary School Pupils in Garu-Tempene District. **International Journal of Innovation and Applied Studies**; 10(2): 632-640

Cullen KW, Chen T-A (2017). The contribution of the USDA school breakfast and lunch program meals to student daily dietary intake. **Preventive Medicine Reports**; 5:82–85. Doi.org/10.1016/j.pmedr.2016.11.016.

Dubuisson C, Lioret S, Calamassi-Tran G, Volatier J-L, Lafay L (2008). School meals in French secondary state schools with regard to the national recommendations. **British Journal of Nutrition**; 102, 293–301 Doi:10.1017/S0007114508149212.

FAO (2019). **Nutrition guidelines and standards for school meals A report from 33 low and middle-income countries**. Rome. 106 pp. Licence: CC BY-NC-SA 3.0 IGO.

FAO (2018). **School meals programmes boost health, education and development**. <https://www.fao.org/publications/highlights-detail/en/c/1107065/> (Accessed 24 April 2019).

Gilbert C (2013). What is vitamin A and why do we need it? **Community Eye Health Journal**. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3936685/pdf/jceh_26_84_065.pdf

Graham L, Hochfeld T, Stuart L, Gent MV (2015). Evaluation Study of the National School Nutrition Programme and The Tiger Brands Foundation In-School Breakfast Feeding Programme in The Lady Frere and Qumbu Districts of the Eastern Cape. Centre for Social Development in Africa, University of Johannesburg. <https://www.uj.ac.za/faculties/humanities/csda/Documents/TBF%20Nutrition%20Report%202015%20FINAL%20WEB%20VERSION.PDF>

Hayes D, Contento IS, Weekly C (2018). Position of the Academy of Nutrition and Dietetics, Society for Nutrition Education and Behavior, and School Nutrition Association: comprehensive nutrition programs and services in schools. **Journal of the Academy of Nutrition and Dietetics**; 118(5): 913 – 919.

Henchion M, Hayes M, Mullen AM, Fenelon M, Tiwari B (2017). Future Protein Supply and Demand: Strategies and Factors Influencing a Sustainable Equilibrium. **Foods**; 6, 53. Doi:10.3390/foods6070053

Herrador Z, Perez-Formigo J, Sordo L, Gadisa E, Moreno J, Benito A, Aseffa A, Custodio E (2015). Low Dietary Diversity and Intake of Animal Source Foods among School Aged Children in Libo Kemkem and Fogera Districts, Ethiopia. **PLOS ONE** 10(7): e0133435. <https://doi.org/10.1371/journal.pone.0133435>

Hornell A, Lagstrom H, Lande B, Thorsdottir I (2013). Intake from 0 to 18 years of age and its relation to health: A systematic literature review for the 5th Nordic Nutrition Recommendations. **Food Nutrition Research**:57. doi: 10.3402/fnr.v57i0.21083

Hurley KM, Cross MB, Hughes SO (2011). A Systematic Review of Responsive Feeding and Child Obesity in High-Income Countries. **Journal of Nutrition**; 141(3): 495–501. Doi: 10.3945/jn.110.130047

Jomaa L, McDonnell E, Probart C (2011) School feeding programs in developing countries: impacts on children's health and educational outcomes. **Nutrition Reviews**; 69(2):83 – 98. Doi:10.1111/j.1753-4887.2010.00369.x,

JET Education Services (2016). Report on the Implementation Evaluation of the National School Nutrition Programme. Department: Planning, Monitoring and Evaluation, Basic Education.

Khatete IW, Pendo S, Oyabi J M (2013). School Feeding Program and Pupils' Participation in Primary Schools in Kenya. A Study of Taita Taveta and Nairobi Districts. **Journal of Emerging Trends in Educational Research and Policy Studies**; 4(6): 895-900.

Kwabla MP, Gyan C, Zotor F (2018). Nutritional status of in-school children and its associated factors in Denkyembour District, eastern region, Ghana: comparing schools with feeding and non-school feeding policies. **Nutrition Journal**; 17:8: doi 10.1186/s12937-018-0321-6.

McGuire S (2011). Institute of Medicine. 2009. School Meals: Building Blocks for Healthy Children. Washington, DC: The National Academies Press. **Advanced Nutrition**; 2(1): 64 – 65. Doi: 10.3945/an.110.000018

Moepeng (2013). **Botswana National Primary School Feeding Programme: A Case Study**. Botswana Institute of Development Policy Analysis (BIDPA). https://www.researchgate.net/publication/318210413_Botswana_National_Primary_School_Feeding_Programme_A_Case_Study (Accessed 4 April 2019).

Nelson M (2011). The School Food Trust: transforming school lunches in England. **British Nutrition Foundation Nutrition Bulletin**, 36, 381–389.

Nhlapo N, Lues RJF, Kativu E, Groenewald WH (2015). Assessing the quality of food served under a South African school feeding scheme: A nutritional analysis. **South African Journal of Science**; 111(1/2). Doi.org/10.17159/sajs.2015/20140044

Nutrition Information Centre University of Stellenbosch (NICUS) (2003). Dietary Reference Intakes (DRIs).

Oostindjer M, Aschemann-Witzel J, Wang Q, Skuland SE, Egelanddal B, Amdam GV, Schjøll A, Pachucki MC, Rozin P, Stein J, Almli VL, Kleef EV (2017). Are school meals a viable and sustainable tool to improve the healthiness and sustainability of children's diet and food consumption? A cross-national comparative perspective. **Critical Reviews in Food Science and Nutrition**; 57:18: 3942-3958, Doi: 10.1080/10408398.2016.1197180.

Ongan D, Inanc N, Cicek B (2014). Comparing School Lunch and Canteen Foods Consumption of Children in Kayseri, Turkey. **Pakistan Journal of Medical Science**; 30(3): 549-553. Doi: 10.12669/pjms.303.4651

Oowski CP, Lindroos AK, Barbieri HE, Becker W (2015). The contribution of school meals to energy and nutrient intake of Swedish children in relation to dietary guidelines. **Food and Nutrition Research**; 59:27563. Doi: 10.3402/fnr.v59.27563.

Rocha NR, Filgueiras MDS, Albuquerque FMD, Milagres LC, Castro APP, Silva MA, Costa GDD, Priore SE, Novaes JFD (2018). Analysis of the national school feeding program in the municipality of Viçosa, state of Minas Gerais. **Revista de Saude Publica**; 52:16. Doi.org/10.11606/S1518-8787.2018052007090

Sidaner E, Balaban D, Burlandy L (2012). The Brazilian school feeding programme: an example of an integrated programme in support of food and nutrition security. **Public Health Nutrition**; 16(6), 989-994. Doi:10.1017/S1368980012005101

Spence S, Delve J, Stamp E, Matthews JNS, White M, Adamson AJ, (2013). The Impact of Food and Nutrient-Based Standards on Primary School Children's Lunch and Total Dietary Intake: A Natural Experimental Evaluation of Government Policy in England. **PLOS ONE** 8(10): e78298. Doi: 10.1371/journal.pone.0078298

Thandrayena K, Pettifor JM (2018). The roles of vitamin D and dietary calcium in nutritional rickets. **Bone Reports**; 8: 81-89. Doi.org/10.1016/j.bonr.2018.01.005.

Tian N, Zhang Z, Loustalot F, Yang Q, Cogswell ME (2013). Sodium and potassium intakes among US infants and preschool children, 2003-2010. **American Journal of Clinical Nutrition**. Doi: 10.3945/ajcn.113.060012.

UNICEF (2019). Vitamin A deficiency. <https://data.unicef.org/topic/nutrition/vitamin-a-deficiency/> (Accessed 4 April 2019).

Vieux F, Dubois C, Duchêne C, Darmon N (2018). Nutritional Quality of School Meals in France: Impact of Guidelines and the Role of Protein Dishes. **Nutrients**;10, 205: Doi:10.3390/nu10020205 www.mdpi.com/journal/nutrients

World Bank Group (2016). **School Health and School Feeding**. www.worldbank.org/education (Accessed 29 March 2019).

Xu S, Xue Y (2016). Protein intake and obesity in young adolescents. **Experimental and Therapy Medicine**; 11(5): 1545–1549. Doi: 10.3892/etm.2016.3137

Yendaw E, Dayour F (2014). Effect of the National School Feeding Programme on Pupils' Enrolment, Attendance and Retention: A Case Study of Nyoglo of the Savelugu-Nantong Municipality, Ghana. **British Journal of Education, Society and Behavioural Science**; 5(3): 341-353.

Zenebe M, Gebremedhin S, Henry CJ, Regassa N (2018). School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children. **Italian Journal of Pediatrics**; 44:16. Doi 10.1186/s13052-018-0449-1

**CHAPTER SEVEN:
RESEARCH REPORT TO BOTSWANA MINISTRY OF LOCAL GOVERNMENT AND
RURAL DEVELOPMENT**

7.1 Executive Summary

The Botswana government has successfully implemented its national school feeding programme (SFP) on a continuous basis over the past 50 years, resulting in an increase in enrollment and school attendance figures among public school learners (World Bank, 2016). The SFP was first implemented at the time Botswana gained its independence as a coping strategy to address malnutrition and alleviate hunger among school going children during a drought stricken period. (Aliyar, Gelli & Hamdani, 2012). Statistics generated in 2013 by the FAO (2013) estimate that there are 331 000 beneficiaries of the SFP in Botswana, providing learners with at least one meal per day. Until recently when a breakfast meal was introduced on 1 April 2019, only one meal has been provided through the SFP. However, an additional meal is offered to children in Remote Area Districts. The food items that have been provided before the introduction of breakfast, included sorghum porridge, beans, samp, canned meat stew, bread, peanut butter and milk. In an unpublished document in 2001, an Inter-Ministerial Taskforce conducted a review of the menu used in the SFP. Findings generated by the report were that the menu was inadequate in terms of quality and quantity.

7.2 Main objective of the study

The aim of the current study was to determine the impact of the SFP by assessing learner dietary diversity, food security status and nutritional status of government primary school learners sampled from the South-east district of Botswana.

7.3 Ethics approval

As participating learners were considered vulnerable and as minors on account of their age, parental/legal guardian informed consent and learner assent was required before learners could participate in the current study. Ethics approval was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee prior to commencement of data collection (REF: BE 104/18). Ethics approval was also obtained from the Botswana Ministry of Health and

Wellness, Research Unit (REF: HPDME 13/18/1 X (534). To facilitate the above, the necessary approval from relevant local authorities, namely the Ministry of Education and South-east district education authorities had to be obtained. Consent was also sought from the head teachers of the conveniently sampled schools who served as the key gatekeepers. Learner information was treated as confidential and anonymous as their only form of identification was a code that was allocated to them.

7.4 Study setting

The list of participating schools in the South-east District were located in Gaborone, Otse, Tlokweng and Mogobane. The area, corresponding primary schools and number of participating learners per school is presented in Table 7.1. Proportionate sampling was used to determine the number of learners per school, in accordance with the total number of learners enrolled in standard five to seven. Hence, at the school level, stratified random sampling was used to select learners from each standard. As is illustrated in Table 7.1, the number of learners surveyed was 330. Instead of using actual school names, code names were used per school that is easily identifiable and same as the one used for data analysis.

Table 7.1: List of participating schools and numbers of learners sampled per school.

Area	Name of primary school*	Number of participating learners per school
Mogobane	01	54
Otse	02	53
Tlokweng	03	40
	04	37
Gaborone	05	23
	06	19
	07	19
	08	11
	09	14
	10	22
	12	23
	13	14

*school code names

7.5 Methodology

Data collection tools that were used to achieve the study objective included the Household Dietary Diversity Score (Swindale & Bilinsky 2006.) and Household Food Insecurity Access Scale (Coates, Swindale & Bilinsky 2007). Physical Activity Levels of the learners were assessed using International Physical Activity Questionnaire for Children (IPAQ-C) developed by Crocker, Bailey, Faulkner, Kowalski & McGrath (1997). To determine learner nutritional status, weight and height was measured. The latter two measurements were used to calculate Body Mass Index-for-age, weight-for-age and height-for-age that was interpreted according to World Health Organisation Standards (WHO 2009). In addition, the food rations provided to the learners as part of the SFP was also analysed to determine whether the energy, macronutrient and micronutrient content of the ration scale met the Estimated Average Requirement (EAR) of learners in accordance with their age and sex [Nutrition Information Centre University of Stellenbosch (NICUS) 2003].

7.6 Overview of main study findings

7.6.1 Dietary diversity

Although school feeding is associated with improved dietary diversity (Zenebe, Grebremedhin, Henry & Regassa, 2018), in the current study, none of the learners surveyed had a high dietary diversity score (DDS), while 58.5% had a medium DDS, followed by 41.5% having a low score (Table 7.2). The current study therefore demonstrated that numerous factors may contribute to the lack of dietary diversity observed, and/or that the SFP did not make a significant contribution to the dietary diversity of its beneficiaries.

Table 7.2: Dietary diversity of participating learners

DDS	Low	41.5% (n=137)
	Medium	58.5 (n=193)
	High	-

7.6.2 Food security status

Nearly four out of ten learners surveyed were food secure. However, the majority of learners could be classified as being at risk of food insecurity (41.8%), food insecure (13.3%) or severely food insecure (6.1%) (Table 7.3).

Table 7.3: Food security of participating learners

Food Security Category	Food secure	38.8% (n=128)
	At risk of food insecurity	41.8% (n=138)
	Food insecure	13.3% (n=44)
	Severely food insecure	6.1% (n=20)

7.6.3 Learner nutritional status

The majority of learners (72.4%) had a normal weight. However, it was concerning that 20.6% of the study sample were at risk of becoming overweight.

Table 7.4: Weight-for-age of participating learners

WAZ	Severely underweight	0.3% (n=1)
	Underweight	1.2% (n=4)
	Normal weight	72.4% (n=239)
	Overweight risk	20.6% (n=68)
	Overweight	5.5% (n=18)

The majority of learners (72.1%) had a normal body mass index-for-age. However, 18.8% were at risk of becoming overweight.

Table 7.5: Body Mass Index-for-age of participating learners

BAZ	Severely wasted (- 3 z-scores)	0.9% (n=3)
	Wasted (- z-scores)	3.0% (n=10)
	Normal	72.1% (n=238)
	Over weight risk (+1 z-score)	18.8% (n=62)
	Over weight (+2 z-score)	4.8% (n=16)
	Obese (+3 z-score)	0.3% (n=1)

From the above results, it is evident that the risk of becoming overweight and being overweight was of greater concern among study participants as opposed to being under weight or wasted.

7.6.4 Contribution of SFP ration scale to the Dietary Reference Intake (DRI) and Daily Estimated Average Requirement (EAR) for energy, macronutrients and selected micronutrients

For the purpose of this study, the SFP ration scale allocation per child per week was determined, followed by the calculation of energy, macro- and selected micronutrients provided by each food item as cooked weights. This was followed by calculating the total energy, macro- and micronutrients supplied by the food items included in the ration scale. Totals were then divided by five to obtain a mean value for each of the five school days in a week to determine the contribution the SFP makes to a child's daily macro- and micronutrient intake. For comparative purposes, the respective DRI, EARs and AI were divided by three as in theory, the SFP should provide 33% of a child's daily energy and nutrient requirements. The results obtained from this analysis in Table 7.6 indicate that the SFP ration scale made an adequate contribution to learner carbohydrate, Iron, Zinc and Folic Acid intake but that the provision of energy, protein, vitamin A and Calcium was inadequate to meet learner nutrient requirements.

Table 7.6: Contribution of SFP ration scale to the daily energy, macro- and micronutrients supplied by the ration scale in terms of its comparison to the respective DRI, RDA, EAR and AIs

Energy and nutrients and their related reference intakes	Daily required value	33% of daily value	Daily contribution from ration scale	Contribution by ration scale to 33% of daily value	Achievement of 33% target
Energy (DRI)	9135 kJ	3015 kJ	1799 kJ	60%	INADEQUATE
Protein (EAR)	0.76 g/kg/day*	30 g	27 g	90%	INADEQUATE
Carbohydrate (EAR)	100 g	33 g	104 g	315%	ADEQUATE
Iron (EAR)	5.8 mg	1.91 mg	8.5 mg	445%	ADEQUATE
Zinc (EAR)	7.0 mg	2.3 mg	6.5 mg	283%	ADEQUATE
Vitamin A (EAR)	432 ug	143 ug	65 ug	46%	INADEQUATE
Folic Acid (EAR)	250 ug	83 ug	251 ug	302%	ADEQUATE
Calcium (AI)	1300 mg	429 mg	121 mg	28%	INADEQUATE

*Median weight of study sample

7.7 Conclusion

Based on the findings from the current study and nutrient analysis of the food items from the Botswana SFP menu, carbohydrates are three times more than the EAR and hence may be a contributing factor in risk of overweight in the learners. It can be concluded that learners had inadequate dietary diversity, while the majority of those surveyed were either at risk of being food insecure, food insecurity being a proxy of lower socio-economic status, often associated with overweight and obesity (Kral, Chittams & Moore, 2017; Kaur, Lamb & Ogden, 2015; Dranklin, Jones, Love, Puckett, Macklin, & White-Means, 2012), it was not surprising that nearly three out of ten learners were either at risk of becoming overweight or overweight as was illustrated by weight-for-age as well as Body Mass Index-for-age.

The above findings indicate that the SFP in the form that it was surveyed, i.e. before the introduction of the breakfast meal on 1 April 2019, was not able to adequately address the prevalence of inadequate dietary diversity and food insecurity documented for the majority of learners sampled. A possible contributor to this finding is that the nutrient analysis of the SFP ration scale revealed that it did not make an adequate contribution to the energy, protein, vitamin A and Calcium intake of learners. In addition, the ration scale does not make provision for the inclusion of fruit and vegetables that could make a contribution to consumption of Beta carotene, otherwise known as pro-vitamin A (Bationo, Zeba, Abbeddou, Coulibaly, Sombier, Sheftel, Bassole, Barro, Ouedraogo & Tanumihardjo, 2018) and other important micronutrients that were not discussed in this document.

The low prevalence of undernutrition among the study sample could serve as an indicator that the SFP is making a positive contribution to curbing undernutrition and hunger (Neervoort, Rosenstiel, Bongers, Demetriades, Shacola & Wolffers, 2013). However, the prevalence of learners who are at risk of becoming overweight and those who are overweight is a cause for concern as was previously mentioned. It is therefore also possible that learners are consuming affordable high energy foods purchased from home, vendors and tuck shops and are consuming a lunch box in addition to not engaging in sufficient physical activity. However, this is merely speculative as an

investigation of the home meals, tuck shop and lunch box habits of learners did not fall within the scope of the current study.

Policy implications and recommendations

The Ministry of Local Government and Rural Development in Botswana as well as relevant stakeholders should prioritise the delivery of nutrition messages to learners, teachers, school authorities and caregivers to highlight the importance of the SFP in minimising nutrition-related problems such as undernutrition and overnutrition. In addition, a concerted effort should be made to address the dietary variety provided by the SFP ration scale to improve the dietary diversity of learners. In addition, learners and their parents/caregivers should be educated about the importance of selecting healthy snack foods and tuck shop items to contribute towards learner dietary diversity and preventing the development of overweight/obesity.

References

Aliyar R, Gelli A, Hamdani S (2012). A review of nutritional guidelines and menu compositions for school feeding programmes in 12 countries. **Public Health**; 3: 148. doi:10.3389/fpubh.2015.00148.

Bationo JF, Zeba AN, Abbeddou S, Coulibaly ND, Sombier OO, Sheftel J, Bassole IHN, Barro N, Ouedraogo JB, Tanumihardjo SA (2018). Serum Carotenoids Reveal Poor Fruit and Vegetable Intake among Schoolchildren in Burkina Faso. **Nutrients**; 10, 1422. doi:10.3390/nu10101422

Coates J, Swindale A, Blinsky P (2007). Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide. Version 3. Food and Nutrition Technical Assistance. http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf (Assessed 19 April 2017).

FAO (2013). **Linking Nutrition to Agriculture through School Feeding: CAADP Nutrition Workshop, SADC.** http://www.fao.org/fileadmin/user_upload/wa_workshop/PPT_SA/DAY2_Ps1_HGSF2.pdf. (Accessed 9 January 2014).

Kaurk J, Lamb M, Ogden CL (2015). The Association between Food Insecurity and Obesity in Children—The National Health and Nutrition Examination Survey. **Journal of the American Academy of Nutrition and Dietetics**; 115(5). doi: 10.1016/j.jand.2015.01.003.

Kral TVE, Chittams J, Moore RH (2017). Relationship between Food Insecurity, Child Weight Status, and Parent-Reported Child Eating and Snacking Behaviors. **Journal for Specialist in Pediatric Nursing**; 22(2): doi:10.1111/jspn.12177.

Nutrition Information Centre University of Stellenbosch (NICUS) (2003). Dietary Reference Intakes (DRIs).

Franklin B, Jones A, Love D, Puckett S, Macklin J, & White-Means S (2012). Exploring mediators of food insecurity and obesity: a review of recent literature. **Journal of Community Health**; 37(1): 253–264. doi:10.1007/s10900-011-9420-4.

Neervoort F, Rosenstiel I, Bongers K, Demetriades M, Shacola M, Wolffers I (2013) Effect of a School Feeding Programme on Nutritional Status and Anaemia in an Urban Slum: A Preliminary Evaluation in Kenya. **Journal of Tropical Pediatrics** 59: 3. :165-174. doi: 10.1093/tropej/fms070. Epub 2012 Dec 12.

Swindale A, Bilinsky P (2006). **Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide**. Version 2. Food and Nutrition Technical Assistance. https://www.fantaproject.org/sites/default/files/resources/HDDS_v2_Sep06_0.pdf (Accessed 19 April 2017).

WHO (2009). **WHO AnthroPlus for personal computers: Software for assessing growth of the world's children and adolescents**. Geneva. www.who.int/growthref/tools/en (Accessed 5 January 2019).

Zenebe M, Gebremedhin S, Henry CJ, Regassa N (2018) School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children. **Italian Journal of Pediatrics** 44(1):16. doi: 10.1186/s13052-018-0449-1.

World Bank (2016). **Improving Africa's school feeding programs: analysis sheds light on strengths, challenges**. <http://www.worldbank.org/en/news/feature/2016/06/09/improving-africas-school-feeding-programs-analysis-sheds-light-on-strengths-challenges> (Accessed 17 March 2019)

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

The nutritional and educational outcomes of the SFP is a well-documented area (Nikiema, 2019; Agbozo, Atitto, Abubakari, 2017; Abotsi, 2013). Although the purpose of the SFP is to improve nutritional outcomes by reducing malnutrition, it has also been shown to help address the emerging public health problem of childhood obesity (American Heart Association, 2019). However, it has also been shown that the provision of school lunch contributes to an increase in learner weight and an increased risk of developing overweight and obesity (Schanzenbach, 2009). This is especially applicable to children who are food insecure and reside in urban areas (Mohammad, Ajami, Abdollahi, Ahari, 2016).

In the current study, the prevalence of learners who participated in the SFP and were found to be at risk of becoming overweight or were overweight at the time of the study, is consistent with that of a study conducted in the eastern region of Ghana, where a higher prevalence of overweight was documented among learners who were overweight as well as being recipients of the SFP (Kwabla, Gyan, Zotor, 2018). Factors such as a sedentary lifestyle are consistent with a study conducted in Tanzania where both public and private schools identified a number of lifestyle and dietary factors among learners that are related to overweight and obesity among primary school learners in western countries (Mwaikambo, Leyna, Killewo, Simba, Puoane, 2015). As the current study was conducted in the South-east District of Botswana, it is important to note that the country is going through a nutrition transition, characterised by a dietary shift from the consumption of traditional foods, to foods that are high in energy but lack essential nutrients. This too could contribute the nutritional status of children (Nnyepi, Gwisai, Lekgoa, Seru, 2015; Wrotniak, Malete, Maruapula, Jackson, Shaibu, Ratcliffe, Stettler, Compher, 2012).

8.2 Study aim

The aim of this study was to determine the impact of SFPs on the nutritional status of primary school learners (attending government schools) in the South-east District of Botswana when compared to non-recipients of SFPs (learners from private schools).

8.3 Study overview

The study objectives were:

- To determine the socio-demographic characteristics, household dietary diversity, household food security status and level of physical activity of primary school beneficiaries of school feeding (intervention) versus non-school feeding beneficiaries (control). This objective was addressed in **Chapter 4** by assessing the dietary diversity, food security status and physical activity levels of the primary school learners from government and private schools in urban and peri-urban areas.
- To determine the anthropometric status of primary school feeding beneficiaries (intervention) versus non-school feeding beneficiaries (control) at baseline with a follow up period after the school holiday (period of no school feeding) referred to as end line. Anthropometric parameters used to determine if the SFP (intervention) had an impact on learner nutritional status included weight-for-age z-scores and body mass index-for-age z-scores reported in **Chapter 5**.
- To determine the contribution of the SFP ration scales to the DRI for energy, RDA for protein and EAR for selected micronutrients. The purpose of this objective was to determine if the SFP ration scales provided at least 33% of the Dietary Reference Intakes as per the learner age and sex reported in **Chapter 6**.
- Based on the results documented in chapters four to six, a research report was compiled for the Botswana Ministry of Local Government and Rural Development to guide future SFP policy in the South-east District of Botswana. This report was presented in **Chapter 7**.

8.4 Thesis hypotheses statement

The following null hypotheses were formulated at the outset as per **Chapter 1:**

- There will not be a difference in the socio-demographic characteristics, household dietary diversity, household food security status and physical activity levels of primary school learners, irrespective of whether they formed part of the intervention (SFP recipients) or control (SFP non-recipients) group or whether the school was located in an urban or peri-urban area;
- There will not be a difference in the anthropometric status of primary school learners, irrespective of whether they formed part of the intervention (SFP recipients) or control (SFP non-recipients) group or whether the school was located in an urban or peri-urban area; and
- There will not be a difference in the anthropometric status of primary school learners, irrespective of whether they formed part of the intervention (SFP recipients) or control (SFP non-recipients) group or whether the school was located in an urban or peri-urban area when comparing baseline (during the school term) anthropometric status to that of their anthropometric status after the school holiday (period of no school feeding for SFP recipients) referred to as end line.

Based on the study outcomes, the null hypotheses were rejected for the following variables due to significant differences being documented. Hence the alternative hypotheses were accepted:

- For beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control):
 - There was a highly significant difference in mode of transport to school, as the majority of SFP beneficiaries walked to school (69.7%), followed by using public transport (23.0%), whereas the majority of non-participants used public transport (48.4%), followed by being dropped off at school in a private vehicle (43.6%) ($p < 0.000$).
 - There was a highly significant difference in food security status, as the majority of SFP beneficiaries were at risk of food insecurity (41.8%), whereas the majority of non-beneficiaries were food secure (98.4%) ($p < 0.000$).

- There was a highly significant difference in the DDS, as the majority of SFP beneficiaries had a medium DDS (58.5%), followed by a low DDS (41.5%), while the majority of non-recipients had a medium DDS (62.9%), followed by a high DDS (35.5%) ($p < 0.000$).
- For urban versus peri-urban learners:
 - There was a highly significant difference in mode of transport to school, as the majority of urban learners walked to school (42.0%), followed by using public transport (39.6%), while the majority of peri-urban learners walked to school (80.0%) ($p < 0.000$).
 - There was a highly significant difference in household food security status, as the majority of urban learners were food secure (75.6%), while the majority of peri-urban learners were at risk of food insecurity (52.4%) ($p < 0.000$).
 - There was a highly significant difference in DDS, as the majority of urban learners had a medium DDS (80.7%), while the majority of peri-urban learners had a low DDS (64.9%) ($p < 0.000$).
 - There was a highly significant difference in PAL, as the majority of urban learners had a moderate PAL (95.6%), while the majority of peri-urban learners had a moderate PAL (86.5%), followed by a high PAL (13.0%) PAL ($p < 0.001$).
- For beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) at baseline:
 - There was a highly significant difference in WAZ at baseline, as the majority of SFP beneficiaries were of a normal weight (66.1%), followed by being at risk of becoming overweight (16.7%), while the majority of non-beneficiaries were of a normal weight (62.9%), followed by being overweight (30.6%) ($p < 0.005$).
- For urban versus peri-urban learners at baseline:
 - There was a highly significant difference in WAZ at baseline, as the majority of urban learners were of a normal weight (58.91%), followed by being at risk of becoming overweight (30.4%), while the majority of peri-urban learners were of a normal weight (73.0%), followed by being underweight (19.5%) ($p < 0.000$).

- There was a highly significant difference in BAZ at baseline, as the majority of urban learners had a normal BAZ (59.4%), followed by being at risk of becoming overweight (27.1%), while the majority of peri-urban learners had a normal BAZ (82.7%), followed by being at risk for becoming overweight (13.0%) ($p < 0.000$).

Based on the study outcomes, the null hypothesis was accepted for the following variables due to an inability to document a significant difference:

- PAL for beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) ($p = 0.680$).

The testing of the null hypotheses formulated for the comparison of anthropometric status of recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding) with non-recipients of the SFP serving as control, as well as the comparison of anthropometric status of urban and peri-urban recipients of school feeding at baseline (during the school term) versus after the school holiday at end line (period of no school feeding) was not possible due to the 90.3% drop-out of recipients of the SFP based on reasons discussed in **Chapter 5**.

8.5 Study Limitations

A limitation of the study was related to the fact that only one private school (serving as control due to the fact that private schools are not eligible for the government funded SFP) could be recruited for participation in the current study. Gatekeepers of other eligible private primary schools in the South-East District of Botswana that did not consent to participation were of the opinion that the findings of the current study would not benefit the schools in any way. Hence, the findings could not be extrapolated to other private schools in the South-east District.

To determine whether the school holiday (period of no school feeding) had an impact on the nutritional status of recipients of school feeding, baseline values of anthropometric status (during the school term), had to be compared to end line values (immediately after the school holiday). However, a major contributor to the 90.3% drop-out of SFP beneficiaries at this time point was

related to the fact that learners were involved in rehearsals to mark the 50 year anniversary of Botswana's independence. As schools were sampled at random for participation in this event, the primary researcher had no control over the lack of availability of learners. However, schools that participated in baseline screening were willing to participate, albeit at a time point which would have negated the purpose of end line screening for comparative purposes.

A comparison between government schools based on SFP participation versus non-participation was not possible, as all government primary schools in Botswana are SFP recipients. However, it is acknowledged that the comparison between SFP recipients (government schools) versus non-recipients of the SFP (private schools) adds an additional variable, namely a difference in socio-economic status, to the study design. Hence the latter should be considered when interpreting the disparity (or lack thereof) between recipients of the SFP versus non-recipients.

As the study was conducted in a single district due to cost constraints, it limited the extrapolation of baseline study findings to the other districts in Botswana. However, it should be noted that district in which the study was conducted, included the country's capital city Gaborone.

8.6 Main findings

The study established that there were significant differences ($p < 0.000$) between beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) in terms of food security status and dietary diversity. As the presence (or absence) of the SFP was an assumed proxy for socio-economic status (the SFP is not offered in private schools), could have been a main contributor to the limited dietary diversity and food insecurity experienced by SFP beneficiaries. It can therefore be concluded that these significant differences between beneficiaries of the SFP (intervention) versus non-SFP beneficiaries (control) documented for food security status and dietary diversity, indicates that the SFP is not able to adequately address the household food insecurity and lack of dietary diversity experienced by beneficiaries of the SFP among learners that participated in the study. These findings may further be explained by the results reported in Chapter 6, where it was documented that the energy, protein, vitamin A and Calcium provided by the SFP ration scale in Botswana, when compared to age appropriate reference intakes, was inadequate.

The majority of learners from both the intervention and control schools had normal WAZ and BAZ scores. In addition, learners from both groups were at risk of becoming overweight or were overweight at the time of the study, with the risk being higher among learners from the private school (control) as was illustrated by WAZ at baseline. Despite the difference between the two groups for BAZ at baseline not showing a significant difference, significant differences for WAZ and BAZ between urban and peri-urban learners at baseline were documented.

8.7 Contribution of the study

This comparative study consisting of a cross-sectional design for household food security status and dietary diversity at baseline and a longitudinal design for anthropometric status to facilitate comparison between baseline and end line (following a period of no SFP during the school holiday), attempted to generate data regarding the anthropometric status, dietary diversity and food security status of primary school learners in the South-east district of Botswana due to a paucity of data. In addition, a comparison was drawn between SFP beneficiaries and non-SFP beneficiaries in an attempt to investigate the ability of the SFP to address malnutrition, improve dietary diversity and curb hunger by having an impact on learner food security status. In addition, the significantly higher level of PAL documented for peri-urban versus urban learners, sheds light on the significant difference in WAZ and BAZ documented for the two geographic areas. In both the intervention and control groups, the low dietary diversity scores show that primary school learners in the South-east District, regardless of socio-economic status, are consuming diets that could be lacking in essential nutrients. However, cognisance should be taken of the fact that dietary diversity scores were based on a single 24-hour recall, despite the fact that this is not a methodological flaw when determining the dietary diversity of groups of individuals. As the majority of learners that benefit from the SFP had a normal WAZ and BAZ, it is indicative of the fact that the Botswana SFP is making a contribution to the nutritional outcome of learners, despite the fact that it does not have a significant impact on dietary diversity.

8.8 Conclusions

Primary school learners require adequate nutrition to facilitate the attainment of optimal health, as well as positive educational outcomes. School nutrition intervention programmes are important in minimising the prevalence of malnutrition, especially for children from resource limited households. However, due to the double burden resulting from the nutrition transition in

developing countries such as Botswana, there is need for nutrition education of learners and caregivers regarding the importance of quality nutrition to reduce the impact of both undernutrition and overnutrition. Results from the current study indicate that the SFP has not been able to adequately address a lack of dietary diversity, food insecurity and malnutrition, as the SFP ration scales did not meet the dietary requirements for energy, protein and certain micronutrients of the study sample.

8.9 Recommendations for future further research

This research was the first study conducted among primary school learners in the South-east District of Botswana. With the introduction of the breakfast meals (Appendix P) in April 2019, after the current study was conducted, it is recommended that a similar study should be conducted in both urban and rural areas, but on a national scale to determine the impact of the SFP on dietary intake and nutritional status of primary school learners.

It will be beneficial to expand the scope of the study to include education authorities such as school heads and teachers as key informants to determine their opinion regarding the tangible benefits of the SFP on variables such as learner school attendance and academic performance. Qualitative research techniques would therefore serve the recommendation well.

Suggestions for future studies include:

- Evaluation of school meal uptake by beneficiaries;
- Evaluation of the nutritional quality of school packed lunches and other dietary sources such as street vendors and tuck shops;
- Educational impact of the Botswana SFP; and
- Learner attitude towards and perception of the Botswana SFP.

8.10 Policy implications

The Ministry of Local Government and Rural Development in Botswana should formulate the necessary policy regarding the SFP by taking into consideration emerging public health problems such as the double burden of malnutrition brought about by nutrition transition and nutrition-

related disparities as a result of differences in geographical areas. Currently Botswana has no policy on SFP as it is directed by guidelines only. Although the aim of the Botswana SFP is to address malnutrition among learners, there is a need to expand this objective to address the risk of childhood obesity among primary school learners and to improve learner nutritional status.

References

Abotsi AK (2013). Expectations of School Feeding Programme: Impact on School Enrolment, Attendance and Academic Performance in Elementary Ghanaian Schools. **British Journal of Education, Society & Behavioural Science**; 3(1): 76 – 92.

Agbozo F, Atitto P, Abubakari A (2017). Nutritional Status of Pupils Attending Public Schools with and without School Feeding Programme in Hohoe Municipality, Ghana. **Journal of Food and Nutrition Research**; 5(7), 467 – 474. doi: 10.12691/jfnr-5-7-3.

American Heart Association (2019). Stepping Up to the Plate: Nutrition Standards and School Meals. <https://www.heart.org/-/media/files/about-us/policy-research/fact-sheets/healthy-schools-and-childhood-obesity/nutrition-standards-and-school-meals-fact-sheet-2019.pdf?la=en&hash=65A283F35E8B24CF601EB759BB5F84BB87CE77E8> (Accessed 1 May 2019).

Kwabla MP, Gyan C, Zotor F (2018) Nutritional status of in-school children and its associated factors in Denkyemba District, eastern region, Ghana: comparing schools with feeding and non-school feeding policies. **Nutrition Journal**; 17:8: doi 10.1186/s12937-018-0321-6

Mohammad A, Ajami M, Abdollahi M, Ahari GK (2016). A Review of the Relationship between Obesity and Food Insecurity. **International Journal of Medical Reviews**; 3 (1): 381 – 388.

Mwaikambo SA, Leyna GH, Killewo J, Simba A, Puoane T (2015). Why are primary school children overweight and obese? A cross sectional study undertaken in Kinondoni district, Dar-es-salaam. **BioMedical Central Public Health**; 15: 1269. doi: 10.1186/s12889-015-2598-0

Nikiema PR (2019). The Impact of School Feeding Programmes on Educational Outcomes: Evidence from Burkina Faso. **Journal of African Economies**; <https://doi.org/10.1093/jae/ejy026>.

Nnyepi MS, Gwisai N, Lekgoa M, Seru T (2015). Evidence of nutrition transition in Southern Africa. **Proceedings of the Nutrition Society**; 74(4):478 - 86. doi: 10.1017/S0029665115000051. Epub 2015 Feb 17.

Schanzenbach DW (2009). Do School Lunches Contribute to Childhood Obesity? **The Journal of Human Resources**; 44 (3): 684 – 709.

Wrotniak BH, Maletse L, Maruapula SD, Jackson J, Shaibu S, Ratcliffe S, Stettler S, Compher C (2012) Association between socioeconomic status indicators and obesity in adolescent students in Botswana, an African country in rapid nutrition transition. **Pediatric Obesity**; 7: e9 – e13.

**APPENDIX A: LETTER REQUESTING TO CONDUCT STUDY (SCHOOL):
ENGLISH AND SETSWANA VERSION**



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Date: _____

Dear School Head,

RE: REQUEST FOR YOUR SCHOOL TO PARTICIPATE IN THIS STUDY

I am a staff member of the Department of Nutrition and Dietetics at Boitekanelo College, Gaborone. I am studying toward my PhD and my research topic is entitled "*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.*"

I am hereby requesting permission to use your school in my study. I would like to visit your school and interview a sample of your teachers and learners from standard 5 to 7 in your school. The students will also be taken weights and heights a process which is non-invasive and not anticipated to cause them distress or harm.

Should you agree to participate, I will formally request consent from the parents/guardians of your learners, as well as assent from the learners themselves. The information obtained from your school and learners will be collected on an anonymous, strictly confidential and voluntary basis. You may withdraw the participation of your school at any stage of the study. There will not be negative or undesirable consequences should you choose to do so. Attached is copies of research permit from Ministry of Education and Ministry of Health.

Yours Sincerely,

Malebogo Eluya

Supervisors:
Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

SCHOOL AUTHORITY RESPONSE FORM:

I hereby confirm that I have been informed by UKZN PhD student **Ms. Malebogo Eluya** and/or her team of research assistants **Ms. Tapologo Itaoleng** and **Mr. Moses Ketlholegile** about the nature of her study *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.”*

Instructions: *Kindly tick appropriate boxes*

I have also received, read and understood the written information in the letter requesting permission to use my School in this study.

I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431

kassiers@ukzn.ac.za at any time if I have questions about the research.

I understand that my School’s involvement in the study is on a strictly anonymous, confidential and voluntary basis and that both assent and consent for any learner participation will be requested from the learner and their parent / guardian.

I understand that I may withdraw my School’s participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

I **DO** consent for my School to participate.

I **DO NOT** consent for my School to participate

Name: _____

Signature: _____

School Name: _____

Date:

Official Stamp:

Letsatsi: _____

Moeteledipele wa sekolo,

RE: KOPA YA GORE SEKOLO SE TSEYE KAROLO MO DITSHEKATSHEKONG

Ke morutintshi mo lephateng la Nutrition and Dietetics at Boitekanelo College, mo Gaborone. Ke dira dithuto tsame tse ko mmadikolo mo setlhopeng sa PhD ke dira ditshekatsheko ka setlhogo sa *“Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana”*, kgotsa ka seeng *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana”*.

Ketla jaana ke kopa tseletso ya go dirisa sekolo sa lona mo ditsheka tshekong tse. Ke eletsa go etela sekolo sa lona ke bua le bana ba batlaa ithaipang ba setlhopa sa botlhano goya kogo sa bosupa. Ke eletsa le go kana bana mme ke solofetsa gore kamano e ga ekake ya utlwisa bana kgotsa ya ba tsuolola ditshwanelo ka mokgwa ope
Ga le ka dumela go tsaya karolo mo ditshekatshekong tse, ke tlamega go kopa tseletso gotswa mo botsading ba bana, le mo ngwaneng yoo eletsang go tsaya rarolo.

Sepe se setlaabong se dirisiwa mo ditshakatshekong tse, se tlaabo se rurefatsa gore sekolo le bana ba babalesegile. Le ka itlhopela go emisa go tsaya karolo mo ditshekatshekong tse go sa fiwe mabaka. Mo lekwalong le, ela tlhoko tseletso ya Lephala la ba botsogo le ba Thuto.

Kele weno,

Malebogo Eluya

Baeteledipele:
Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

PHETOLO YA MOETELEDIPELE YA SEKOLO:

Ke kaya fa ke kaetswe ke moithuti wa leina la **Malebogo Eluva** le baa berekeng le bone Tapologo **Itaoleng** le **Moses Ketlholegile** ka maikaelelo a ditshekatsheko tsa *Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana*” kgotsa “*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.*”

Kaedi: Tsweetswee, tshwaela ka letswao

- Ke amogetse, e bile kea tlhaloganya se se kwadilweng mo lekwalong le le kopang tseletso ya go tsaya karolo ga sekolo sa rona mo ditshekatshekong tse.
- Ke tlhaloganya gore ga kenale dipotso nka botsa Mme M. Eluya ko (74516360), kgotsa meluya@boitekanelo.ac.bw kgotsa baeledi-pele ba gagwe, Professor F Veldman (033-2605453) kgotsa Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za nako nngwe le nngwe fela.
- Ke tlhaloganya gore go tsaya seabe sa sekolo mo ditshekatshekong tse, gotla abo go sireletsegile ebile maina a sekolo a sa dirisiwe.
- Ke tlhaloganya gore go tsaya karolo ga sekolo go ka ema nako ngwe le ngwe fela, gaa itlhopelwa go sena ditlamorago dipe fela.

Fetola ka go tshwaela momo mokwalong o o fa tlase:

- Ke dumelana le sekolo go tsaya karolo.
- Ga ke dumelane le sekolo go tsaya karolo

Maina a moeteledipele: _____

Monwana: _____

Leina la sekolo: _____

Letsatsi:

Stempe sa molao:

APPENDIX B: LETTER OF REQUESTING CONSENT (PARENT): ENGLISH AND SETSWANA VERSION



4th Floor Kopanyo House Tel: (00267) 3911-009
5131 Nelson Mandela Rd Fax: (00267) 3911-014
P O Box 203156 info@boitekanelo.ac.bw
Gaborone, Botswana www.boitekanelo.ac.bw

Date: _____

Dear Parent/Guardian

RE: REQUEST FOR PERMISSION TO INTERVIEW YOUR CHILD

I am a staff member of the Department of Nutrition and Dietetics at Boitekanelo College, Gaborone. I am studying toward my PhD and my research topic is entitled "*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana*".

I am hereby requesting permission to obtain information through interviews and checking of weight and height from your child named..... attending..... Primary School for use in my study. This information will be collected on an anonymous, strictly confidential and voluntary basis. Your child may withdraw from participating in my study at any point should they wish. They will not face any negative or undesirable consequences should they choose to withdraw.

Should you have any queries regarding my research, please feel free to contact me on 74516360 or meluya@boitekanelo.ac.bw.

I would be most grateful if you could sign the attached form and return it to your child's school as soon as possible.

Yours Sincerely,

Malebogo Eluya

Supervisors:
Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

PARENTAL/ GUARDIAN RESPONSE FORM:

I hereby confirm that I have been informed by UKZN PhD student **Malebogo Eluya** and her research assistants **Tapologo Itaoleng** and **Moses Ketlholegile** about the nature of her study *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.”*

- I have also received, read and understood the written information in the letter requesting permission for your child to participate in this study.
- I understand that I may contact Ms. M. Eluya (74516360), mcluya@boitckanclo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
- I understand that my child’s involvement in the study is on an anonymous, strictly confidential and voluntary basis.
- I also understand that my child may withdraw from participating in this study at any point should they wish, without fear of any negative or undesirable consequences.

PARENT/GUARDIAN RESPONSE: indicate with a (√)

- I **DO** hereby consent for my child to participate in this study.
- I **DO NOT** wish my child to participate in this study

Name of parent/guardian: _____

Signature: _____

Child’s Name: _____

Child’s Class: _____

School Name: _____

Date: _____

Date: _____

Dear Motsadi/ Motlhokamedi wa ngwana

RE: KOPO YA GO BUISANYA KGOTSA GO BOTSISISA NGWANA WA GAGO

Ke morutintshi mo lephateng la Nutrition and Dietetics at Boitekanelo College, mo Gaborone. Ke dira dithuto tsame tse ko mmadikolo mo setlhopeng sa PhD ke dira ditshekatsheko ka setlhogo sa *“Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana”*, kgotsa ka seeng *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana”*.

Ke tla jaana ke kopa tetla ya go botsisisa ngwana wa gago le go mo kala, yoo bidiwang _____ yoo tsenang sekolo sa _____ Primary School. Sepe se se tlaabong se dirisiwa mo tshekatshekong ee, se tlaabo se siretsegile, se sa kae ngwana ka leina kana sepe hela. Ngwana o kgona goi kgogela morago ga tshekatsheko entse e tswेतse. Ngwana o tlaabo a babalesegile.

Ole motshadi, ga o ka nna le dipotso kgotsa ditshwaelo, o ka nteletsa kgotsa wa romela mokwalo ka tsa maranyane ko 74516360 or meluya@boitekanelo.ac.bw.

Go ka lebosega fa o ka baya mokwalo o o latelang wa o busetsa ngwana mo lobakeng le le sa fediseng pelo.

Kele weno

Malebogo Eluya

Maina a baeteledipele bame ke a a latelang:

Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

MOKWALO PIETOLO WA MOTSADI KGOTSA MOTLIHOKOMEDI WA NGWANA:

MOKWALO PHETOLO WA MOTSADI KGOTSA MOTLHOKOMEDI WA NGWANA:

Ke kaya fa ke kaetswe ke moithuti wa leina la **Malebogo Eluya** le baa berekeng le bone Tapologo **Itaoleng** le **Moses Ketlholegile** ka maikaelelo a ditshekatsheko tsa *Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana*” kgotsa “*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.*”

- Ke amogetse, e bile kea tlhaloganya se se kwadilweng mo lekwalong le le kopang tseletso ya go botsisisa ngwana mo ditshekatshekong tse.
- Ke tlhaloganya gore ga kenale dipotso nka botsa Mmc M. Eluya ko (74516360), kgotsa meluya@boitekanelo.ac.bw kgotsa baeledipele ba gagwe, Professor F Veldman (033-2605453) kgotsa Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za nako nngwe le nngwe fela.
- Ke tlhaloganya gore ngwanake go tsaya seabe mo ditshekatshekong tse, otlala abo a sireletsegile ebile maina a gagwe a sa dirisiwe, mme ebile a ithaopa.
- Ke tlhaloganya gore ngwanake o ka emisa go tsaya karolo nako nngwe le nngwe fela, gaa itlhopehla go sena ditlamorago dipe fela.

PHETOLO KA GO TSAYA KAROLO *Tshwaela ka letshwao la (√)*

- Kea dumela gore ngwanake o ka tsaya karolo mo ditshekatshekong tse.
- Ga ke dumele fore ngwanake oka tsaya karolo mo ditshekatshekong tse.

Leina la motsadi kgotsa motlhokomedi wa ngwana:

Monwana:

Leina la ngwana:

Setlhopa sa ngwana: _____

Leina la sekolo sa ngwana:

Letsatsi:

APPENDIX C: LETTER REQUESTING ASSENT (LEARNER): ENGLISH AND SETSWANA VERSION



4th Floor Kopanyo House Tel: (00267) 3911-009
5131 Nelson Mandela Rd Fax: (00267) 3911-014
P O Box 203156 info@boitekanelo.ac.bw
Gaborone, Botswana www.boitekanelo.ac.bw

Date: _____

Dear Learner,

RE: REQUEST FOR YOUR ASSENT

I am a staff member of the Department of Nutrition and Dietetics at Boitekanelo College, Gaborone. I am studying toward my PhD and my research topic is entitled "*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana*".

I am hereby requesting assent to interview, check your weight and height during my study. Should you agree to participate, I will also formally request consent from your parents/guardians. The information obtained from you will be collected on an anonymous, strictly confidential and voluntary basis. You may withdraw your participation at any stage of the study. There will not be any negative or undesirable consequences should you choose to do so.

Should you have any queries regarding my research, please feel free to contact me on 74516360 or meluya@boitekanelo.ac.bw

Yours Sincerely,

Malebogo Eluya

Supervisors:

Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

RESPONSE LETTER: PRIMARY SCHOOL LEARNER:

I hereby confirm that I have been informed by UKZN PhD student **Malebogo Eluya** and research assistants **Tapologo Itaoleng** and **Moses Ketlholegile** about the nature of her study *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana”*.

I have also received, read and understood the written information in the letter requesting assent to interview me in her study.

I understand that I may contact Ms. M. Eluya (74516360, mcluya@boitckanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.

I understand that my involvement in the study is on a strictly anonymous, confidential and voluntary basis and that consent to participate will be requested from my parents / guardians.

I understand that I may withdraw my participation in the study without any fear of negative or undesirable consequences should I choose to do so.

I have also received, read and understood the written information in the letter requesting assent to interview me in her study.

LEARNER’S RESPONSE: indicate with a tick (✓) an appropriate box.

I hereby agree freely to participate in this study (*attach proof of parental consent*).

I do not wish to participate in this study

Name:

Signature:

School Name:

Date:

Letsatsi: _____

Moithuti,

RE: KOPO YA TESELETSO YA GO TSAYA KAROLO GA GAGO MO DITSHEKA TSHEKONG

Ke morutintshi mo lephateng la Nutrition and Dietetics at Boitekanelo College, mo Gaborone. Ke dira dithuto tsame tse ko mmadikolo mo setlhopeng sa PhD ke dira ditshekatsheko ka setlhogo sa *“Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana”*, kgotsa ka seeng *“Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana”*.

Ke kopa go re ontetlelele go re ketle go buisana le wena le go go kala. Ga o dumetse go tsaya karolo go tlhokana le tseletso gotsa kwa botsading ba gago.

Tsotlhe dintlha di tlaa dirwa ka sephiri go go sireletsa. Go tsaya karolo mo ditshekatshekong tse ke boithaopo mme o letlelesega go emisa nako nngwe le nngwe fela. Ga onale dipotso kgotsa dikakgelo o ka leletsa 74516360 kgotsa maranyane a meluya@boitekanelo.ac.bw

Kele weno,

Malebogo Eluya

Baetelebedi:

Professor F. Veldman
Supervisor PhD
veldmanf@ukzn.ac.za

Dr. S. Kassier
Supervisor PhD
Kassiers@ukzn.ac.za

LEKWALO LA PHETOLO LA MOITHUTI WA SEKOLO SESENNYE

Ke kaya fa ke kaetswe ke moithuti wa leina la **Malebogo Eluya** le baa berekeng le bone Tapologo **Itaoleng** le **Moses Ketlholegile** ka maikaelelo a ditshekatsheko tsa *Go kanoka boitekanelo ja tsa kanamo ya dijo mo baneng ba ba dirisang lenaneo la go jesa bana mo dikolong, ke lebagane le kgaolo ya South-east district, mo Botswana*” kgotsa “*Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana.*”

- Ke amogetse, e bile kea tlhaloganya se se kwadilweng mo lekwalong le le kopang tseletso ya go tsaya karolo mo ditshekatshekong tse.
- Ke tlhaloganya gore ga kenale dipotso nka botsa Mmc M. Eluya ko (74516360), kgotsa mcluya@boitekanelo.ac.bw kgotsa baecedipele ba gagwe, Professor F Veldman (033-2605453) kgotsa Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za nako nngwe le nngwe fela.
- Ke tlhaloganya gore go tsaya seabe mo ditshekatshekong tse, gotlaabo go sireletsegile ebile maina a me a sa dirisiwe, mme ebile ke ithaopa.
- Ke tlhaloganya gore nka emisa go tsaya karolo nako ngwe le ngwe fela, gake itlhopehla go sena ditlamorago dipe fela.

PHETOLO KA GO TSAYA KAROLO *Tshwaela ka letshwao la (√)*

- Kea dumela go tsaya karolo mo ditshekatshekong tse.
- Ga ke dumele go tsaya karolo mo ditshekatshekong tse.

Leina: _____

Monwana:

Setlhopa sa sekolo: _____

Leina la sekolo: _____

Letsatsi: _____

APPENDIX D: ETHICAL CLEARANCE (MINISTRY OF HEALTH, BOTSWANA)

TELEPHONE: 363 2766
FAX: 391 0647
TELEGRAMS: RABONGAKA
TELEX: 2818 CARE BD



Republic of Botswana

MINISTRY OF HEALTH
PRIVATE BAG 0038
GABORONE

REFERENCE NO: HPDME 13/18/1 X (534)

31 May 2016

Health Research and Development Division

Notification of IRB Review: **New application**

Ms Malchogo Eluya
P O Box 40483
Gaborone
Botswana

Protocol Title:

**DIETARY INTAKE AND NUTRITIONAL STATUS OF
PRIMARY SCHOOL CHILDREN PARTICIPATING IN
THE BOTSWANA SCHOOL FEEDING PROGRAMME
IN SOUT-EAST DISTRICT, BOTSWANA**

HRU Approval Date:	31 May 2016
HRU Expiration Date:	30 May 2017
HRU Review Type:	HRU reviewed
HRU Review Determination:	Approved
Risk Determination:	Minimal risk

Dear Madam,

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health within 3 months of completion of the study. Approval is for academic fulfillment only. Copies should also be submitted to all other relevant authorities.

Continuing Review

In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the protocol's expiration date. The Continuing Review Form can be obtained from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of Health website: www.moh.gov.bw or can be requested via

e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw As a courtesy, the HRDD will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form

Amendments

During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment form available from the Health Research Division Office (HRDD), Office No. 7A 7 or Ministry of Health website: www.moh.gov.bw or can be requested via e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw . In addition submit three copies of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

Reporting

Other events which must be reported promptly in writing to the HRDC include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subjects or others
- Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

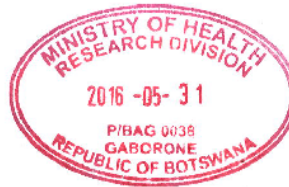
If you have any questions please do not hesitate to contact Mr. P. Khulumani at pkhulumani@gov.bw, Tel +267-3914467 or Lemphi Moremi at lamoremi@gov.bw or Tel: +267-3632754. Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours faithfully



P. Khulumani

For /Permanent Secretary



MINISTRY OF HEALTH

Vision: *A Model of Excellence in Quality Health Services.*

Values: *Botho, Equity, Timeliness, Customer Focus, Teamwork.*



APPENDIX E: ETHICAL CLEARANCE EXTENSION (MINISTRY OF HEALTH AND WELLNESS)

PRIVATE BAG 0030
GABORONE
BOTSWANA
REFERENCE:



TEL: (267) 363 2500
FAX: (267) 991 0047
TELEGRAMS: RADONGAKA
TELEX: 2218 GARE BW

REPUBLIC OF BOTSWANA
MINISTRY OF HEALTH AND WELLNESS

REFERENCE NO: IIPDME 13/18/1

19th April 2018

Health Research Development Committee

Principal Investigator: Malebogo Eluya
Notification of IRB Review: **Continuing Review**

Protocol Title: **DIETARY INTAKE AND NUTRITIONAL STATUS OF PRIMARY SCHOOL CHILDREN PARTICIPATING IN THE BOTSWANA SCHOOL FEEDING PROGRAMME IN SOUTH-EAST DISTRICT, BOTSWANA**

Review Type: Health Research Unit/Expedited
Review Date: 18 April 2018
Effective Date: 19 April 2018
Approved Date: 18 April 2018
Expiration Date: 18 April 2019

This certifies that the continuing review request for the protocol above was reviewed under review procedures. Approval is valid for a period of 1 year.

- Open to Enrolment
- Accrual complete with treatment intervention and/or participant interviews/surveys continuing
- Subject interventions/data collection ended on: **September 2017**
- Open for analysis only. Expected end date:
- Complete (including all analysis). Date completed: **January 2018**
- Cooperative Review
- Other, Please describe: _____
- Study never activated, closure requested.

If you have any questions please do not hesitate to contact Ms Sceletso Mosweunyane at smosweunyane@gov.bw, Tel +267-3632018 and Mr. K. Motlhanka at kgmmotlhanka@gov.bw, Tel +267-3632751. Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours sincerely


Ms S. Mosweunyane
for **PERMANENT SECRETARY**



Vision: *A Healthy Nation by 2036*
Values: *Botho, Equity, Intellness, Customer Focus, Teamwork, Accountability*



APPENDIX F: ETHICAL CLEARANCE (MINISTRY OF EDUCATION AND SKILLS DEVELOPMENT)

TELEPHONE (027) 3655469
TELEX: 2944 THUTO BD
FAX: 3185167



REPUBLIC OF BOTSWANA

MINISTRY OF EDUCATION
AND SKILLS DEVELOPMENT
PRIVATE BAG 005
GABORONE

REF: DPRS 7/1/5 XXVI (47)

20th June 2016
Malebogo Eluya
P O Box 40483
Gaborone

Dear Madam

RE: PERMIT TO CONDUCT A RESEARCH STUDY

This serves to grant you permission to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

Dietary intake and Nutritional status of primary school children participating in the Botswana school feeding programme in South East Region.

It is of paramount importance to seek **Assent** and **Consent** from the Director of South East region, School Heads, teachers and students of sampled Schools that you are going to collect data from. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from **20th June 2016 to 20th June 2017**.

You are requested to submit a copy of your final report of the study as stated in the **Research Guidelines (para 4.5 - 4.6, 2007)** to the **Ministry of Education and Skills Development, in the Department of Educational Planning and Research Services, Botswana.**

Thank you.

Yours faithfully

Sir Wonder Masebola
For/Permanent Secretary



APPENDIX G: ETHICAL CLEARANCE EXTENSION (MINISTRY OF EDUCATION AND SKILLS DEVELOPMENT)

TELEPHONE: 3655400/3655483
TELEX: 2944 THUTO BD
FAX: 3914271



MINISTRY OF BASIC EDUCATION
PRIVATE BAG 005
GABORONE, BOTSWANA

REF: DPRS 7/1/6 I (53) PEO II-Research

11th April 2018

Malebogo Eluya
P O Box 40483
Gaborone

Dear Madam

RE: REQUEST FOR EXTENTION OF PERMIT

This serves to extend your permit to conduct your study in the sampled areas in Botswana to address the following research objectives/questions /topic:

Dietary intake and nutritional status of primary school children participating in the Botswana school feeding programme in South East Region.

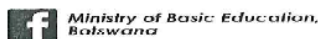
It is of paramount importance to seek Assent and Consent from the Director of South East Region, School Heads, Participants and their Parents/Guardians where appropriate, of the sampled Primary Schools from which you are going to collect data. We hope that you will conduct your study as stated in your proposal and that you will adhere to research ethics. Failure to comply with the above stated, will result in immediate termination of the research permit. The validity of the permit is from **11th April 2018 to 11th April 2019.**

You are requested to submit a copy of your final report of the study as stated in the Research Guidelines (para 4.5 - 4.6, 2007) to the Ministry of Basic Education, Department of Educational Planning and Research Services, Botswana.

Thank you.

Yours faithfully

Sir Wonder Masebola
For/Permanent Secretary



"delivering 21st century learner"

APPENDIX H: ETHICAL CLEARANCE (SOUTH-EAST DISTRICT)

MINISTRY OF EDUCATION
AND SKILLS DEVELOPMENT

TELEPHONE: (267) 3901263
FAX: (267) 3975899



Director, Regional Operations
South East
Private Bag 00343
GABORONE
BOTSWANA

REF: SER 1/15/2 VIII (233)

26 July 2016

Malebogo Eluya
P O Box 40483
GABORONE

Dear Sir/ Madam,

PERMISSION TO CONDUCT A RESEARCH STUDY

Reference is made to your letter dated 08 July 2016 requesting to carry out a research study in the Ministry of Education and Skills Development- South East Region. The research is on "Dietary Intake and Nutritional Status of Primary School Children Participation in the Botswana School Feeding Programme in south East District, Botswana" from 20 June 2016 to 20 June 2017. The research will be carried out in Tsogang, Tshwaragano, Segoditshane, Mafithakgosi, Ledumang, Kgosi-Kgosi, Ikageng, Galaletsang, Bophirima, Bontleng, Boitumelo, baratani and mogobane Primary Schools.

Permission is hereby granted for you to conduct your research as per your request. The schools have been notified of your intent and you are advised to contact them directly.

Thank you.

Yours faithfully,

A handwritten signature in blue ink, appearing to be 'A.Z. Ernest', written over a dotted line.

A.Z. Ernest

For/ Director, Regional Operations, South East Region



SAVINGRAM

FROM: Director, Regional Operations
South East Region


A. Z. Ernest
for/Director

TEL: 3972454

FAX: 3972915 / 3975899

TO: School Heads

- Tsogang Primary School
- Tshwaragano Primary School
- Segoditshane Primary School
- Mafitlhakgosi Primary School
- Ledumang Primary School
- Kgosi-Kgosi Primary School
- Ikageng Primary School
- Galaletsang Primary School
- Bophirima Primary School
- Bontleng Primary School
- Boitumelo Primary School
- Baratani Primary School
- Mogobane Primary School

REF: SER1/15/2 VIII (234)

26 July 2016

PERMISSION TO CONDUCT RESEARCH STUDY

Mrs. **Malebogo Eluya** from University of Kwazulu-Natal has been granted permission to conduct research study in your schools from the 20 June 2016 to 20 June 2017. The research is on "**Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South East District, Botswana**".

The researcher has been advised to contact you directly

Thank you.



This Ministry supports the Vision 2016 in terms of creating "an educated and informed nation", "a prosperous, productive and innovative nation" and "an open, democratic and accountable nation"



APPENDIX I: SCHOOL HEADS CONSENT LETTERS

RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluva and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

I have also received, read and understood the written information in the letter requesting permission to use my School in this study.

I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.

I understand that my School's involvement in the study is on a strictly anonymous, confidential and voluntary basis and that both assent and consent for any learner participation will be requested from the learner and their parent / guardian.

I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

I DO consent for my School to participate.

I DO NOT consent for my School to participate

Name: KHUTSAFALO KEITYMETSE

Signature: *Khutse*

School Name: KGOSIKGOSI

Date:

Official Stamp:

**SOUTH EAST DISTRICT COUNCIL
SCHOOL-HEAD**

26 AUG 2016

**KGOSIKGOSI PRIMARY SCHOOL
PRIVATE BAG T031 TLOKWENG BOTSWANA
TEL: 3132155**

RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Keflhologile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: VIOLET M. MASIFI

Signature: 

School Name: MOGEBANE PRIMARY SCHOOL

Date: 29.08.16

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleang and Mr. Moses Ketlholepile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitckanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: LYDIA PANSIRI

Signature: L Pansiri

School Name: BOPHIRIMA P.S

Date:

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluva and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

I **DO** consent for my School to participate.

I **DO NOT** consent for my School to participate

Name: L.M. Kaplana

Signature: [Handwritten Signature]

School Name: Galaletsang P.S.

Date:

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketholepile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

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- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

I **DO** consent for my School to participate.

I **DO NOT** consent for my School to participate

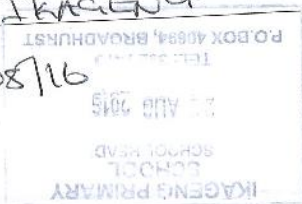
Name: Bourumelo Hule

Signature: [Signature]

School Name: IKAGENI

Date: 22/08/16

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Kertholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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- I **DO NOT** consent for my School to participate

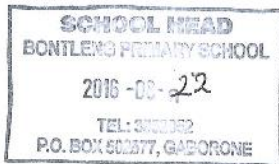
Name: KEDIAONYE MARTHA BOGAS

Signature: [Signature] for sch head

School Name: BONTLENG

Date: 23.08.2016

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketlholoile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (7451 6360, meluya@boitsekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: SPASET KELOPANG

Signature: 

School Name: TSHWARAGANO PRIMARY

Date:

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluva and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketlholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

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Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: Reboamogotse Senabye

Signature: R.E. Senabye

School Name: Beredani P. School

Date: 22/08/2016

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketlholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

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- I understand that I may contact Ms. M. Eluya (74516360, mcluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
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Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: Tlhwana Kasu

Signature: Tlhwana Kasu

School Name: Tsogang Primary

Date: 28

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

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Kindly tick the appropriate box below:

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- I **DO NOT** consent for my School to participate

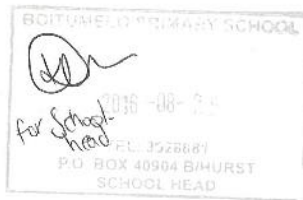
Name: KAMOGELO CATHERINE OBATENG

Signature: 

School Name: BOITUMELO PRIMARY SCHOOL

Date:

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Kethholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
- I understand that my School's involvement in the study is on a strictly anonymous, confidential and voluntary basis and that both assent and consent for any learner participation will be requested from the learner and their parent / guardian.
- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

Name: Dimakatso Seelo

Signature: 

School Name: Segoditshane Primary School

Date: 24/8/16
Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Kethholcile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

- I have also received, read and understood the written information in the letter requesting permission to use my School in this study.
- I understand that I may contact Ms. M. Eluya (74516360, meluya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.
- I understand that my School's involvement in the study is on a strictly anonymous, confidential and voluntary basis and that both assent and consent for any learner participation will be requested from the learner and their parent / guardian.
- I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

- I **DO** consent for my School to participate.
- I **DO NOT** consent for my School to participate

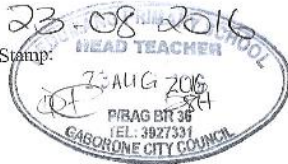
Name: Mrs D HABAHIGA MPA

Signature: [Handwritten Signature]

School Name: LEDUMANG P. SCHOOL

Date: 23-08-2016

Official Stamp:



RESPONSE FORM

I hereby confirm that I have been informed by UKZN PhD student Ms. Malebogo Eluya and/or her team of research assistants Ms. Tapologo Itaoleng and Mr. Moses Ketholegile about the nature of her study "Dietary Intake and Nutritional Status of Primary School Children Participating in the Botswana School Feeding Programme in South-east District, Botswana."

Instructions:

Kindly tick appropriate boxes

I have also received, read and understood the written information in the letter requesting permission to use my School in this study.

I understand that I may contact Ms. M. Eluya (74516360, mchuya@boitekanelo.ac.bw) or her supervisors Professor F Veldman (033-2605453) or Dr. S. Kassier (033) 260 5431 kassiers@ukzn.ac.za at any time if I have questions about the research.

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I understand that I may withdraw my School's participation in the study without any fear of negative or undesirable consequences should I choose to do so.

Kindly tick the appropriate box below:

I **DO** consent for my School to participate.

I **DO NOT** consent for my School to participate

Name: M. RAMATLAPENG

Signature: *nrh*

School Name: MAFITIHAKGOSI

Date: 23/08/16

Official Stamp:



APPENDIX J: SOCIO-DEMOGRAPHIC QUESTIONNAIRE (ENGLISH AND SETSWANA VERSION)

SOCIO-DEMOGRAPHIC QUESTIONNAIRE
ID Code: _____

INSTRUCTIONS: *This questionnaire covers certain aspects of your life at home and at school. The answers to these questions will be kept strictly confidential and the information will not be identifiable from any reports or publications. Tick (✓) or cross (X) appropriate answer on the box. Ignore abbreviations in brackets []. ID code will be given to you by the researcher.*

Learner's information

A. Gender [GEN]

1. Male	2. Female
---------	-----------

B. Age group [AG]

1. 7 – 8 years	2. 9 – 10 years	3. 11 – 12 years	4. 13 years and over
----------------	-----------------	------------------	----------------------

C. Race [RACE]

1. Black	2. White	3. Mixed Ancestry	4. Asian	5. Other
----------	----------	-------------------	----------	----------

If other please specify:

D. In which area is your school situated [SCLAR]

1. Gaborone	2. Tlokweng	3. Oodi	4. Mogobane
-------------	-------------	---------	-------------

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

E. What is the name of your school? [SCNAME]

1. Boitumelo	2. Galaletsang	3. Ledumang	4. Tshwaragano
5. Ikageng	6. Segoditshane	7. Tsogang	8. Bontleng
9. Mafitlhakgosi	10. Baratani	11. Kgosikgosi	12. Mogobane
13. Rainbow			

F. What type of school is this? [SCTYP]

1. Government / Tswana Medium	2. Private/ English Medium
-------------------------------	----------------------------

G. Class Grade [CGRADE]

1. Standard five	2. Standard Six	3. Standard Seven
------------------	-----------------	-------------------

H. How would you rate your school performance? [SCHP]

1. Excellent	2. Good	3. Fair	4. Poor
--------------	---------	---------	---------

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

I. How do you get to school? [GSCII]

1. Walk	2. Vehicle From Home	3. Public Transport	4. Other
---------	----------------------	---------------------	----------

If other, please specify: _____

J. How many days of school have you missed the past school term? [MISDSCII]

1. None	2. One to two days	3. Three to four days	4. More than five days
---------	--------------------	-----------------------	------------------------

K. How many people live in your household including yourself? [NIII]

1. One to two people	2. Three to four people	3. Five to six people	4. More than seven people
----------------------	-------------------------	-----------------------	---------------------------

L. How many people in your household go to school including yourself? [NHHS]

1. One to two people	2. Three to four people	3. Five to six people	4. More than seven people
----------------------	-------------------------	-----------------------	---------------------------

M. How many people in your household are employed (including self-employed)? [NEMP]

1. One To Two People	2. Three To Four People	3. Five To Six People	4. None
----------------------	-------------------------	-----------------------	---------

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

N. Household Water supply: [HHWS]

1. Running water in the house/yard	2. Stand-pipe/communal tap	3. River /stream	4. Purchased water from water bowsers
------------------------------------	----------------------------	------------------	---------------------------------------

O. Household Head: [HHH]

1. Father	2. Mother	3. Sibling	4. Other Relative
-----------	-----------	------------	-------------------

If Other, please specify: _____

P. How many meals do you usually have each day during school term (do not include snacks)? [NMSI]

1. One	2. Two	3. Three	4. Four and More
--------	--------	----------	------------------

Q. Does it include meals prepared at school? [INCLSCH]

1. Yes	2. No	3. Not applicable
--------	-------	-------------------

R. How many meals do you usually eat each day during school holidays (do not include snacks) [NMSII]

1. One	2. Two	3. Three	4. Four and more
--------	--------	----------	------------------

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

S. Do you usually eat before you go to school? [BRF]

1. Yes	2. No	3. Sometimes
--------	-------	--------------

T. Do you usually carry a lunch box or snack money to school? [HFS]

1. Lunchbox	2. Snack money	3. Both	4. None
-------------	----------------	---------	---------

U. If you do take snack money to school, what do you usually buy? [LSM]

1. Cooked lunch	2. Snacks	3. Both
-----------------	-----------	---------

V. How often do you eat free food prepared at school? [ESF]

1. Always	2. Sometimes	3. Never	4. Not applicable
-----------	--------------	----------	-------------------

W. Is there a time school meals are available? [NFD]

1. Yes	2. No	3. Sometimes	4. Not applicable
--------	-------	--------------	-------------------

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

Tlhaloso: *Dipotso tse di akaretsa botshelo bag ago tse di tsamayanag le le tsa sele gae. Dikarabo tse di mo pampitshaneng e, di babelesegile ebile di sephiri. Fa o araba tshwaya ka mokwalo wa (✓) kgosa (X). Itlhokomolose matshwao aa mo*

[]. *Nomore ya omang otlala e neelwa.*

A. Bong [GEN]

1. Mosimane	2. Mosetsana
-------------	--------------

B. Dingwaga tsa gago [AG]

1. Bosupa – Borobabobedi (dingwaga)	2. Borobabogwe – Lesome (dingwaga)	3. Lesome le bongwe – Lesome le bobedi (dingwaga)	4. Lesome le boraro le go feta (dingwaga)
-------------------------------------	------------------------------------	---	---

C. Letso [RACE]

1. Montsho	2. Mosweu	3. Letso le le Kopaneng	4. Letso la se Asia	5. Letso le lengwe
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Letso le lengwe, tlhalosa:

D. Sekolo sag ago se mo lefeleng lefe? [SCHAR]

1. Gaborone	2. Tlokweneng	3. Oodi	4. Mogobane
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SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

E. Leina la sekolo sag ago ke mang? [SCNAME]

1. Boitumelo	2. Galaletsang	3. Ledumang	4. Tshwaragano
5. Ikageng	6. Segoditshane	7. Tsogang	8. Bontleng
9. Mafitlhakgosi	10. Baratani	11. Kgosikgosi	12. Mogobane
13. Rainbow			

F. Sekolo sa gago ke mofuta ofe? [SCTYP]

1. Government / Tswana Medium	2. Private/ English Medium
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G. O bala lekwalo lefe ko sekolong? [CGRADE]

1. Lekwalo la botlhano	2. Lekwalo la borataro	3. Lekwalo la bosupa
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II. O ka lekanyetsa jang go dira ga gago ko sekolong? [SCIIP]

1. Mogo siameng go fetisa	2. Mogo siameng	3. Mogo fagare	4. Mogo fatlase
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I. O tsamaya ka eng ko sekolong? [GSCH]

1. Dinao	2. Koloi yako lapeng	3. Dipalamo tsa sechaba	4. Tse dingwe
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Fa ele tse dingwe, tlhalosa: _____

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

J. O tlodile malatsi a le kae a sekolo mo pakeng e e fetileng? [MISDSCII]

1. Gagona	2. Letsatsi – malatsi a mabedi	3. Malatsi a le mararo malatsi a le mane	4. Malatsi ale matlhano le go feta
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K. O nna le batho bale kae mo lelwapeng, o ipalela mo palong? [NHH]

1. Bongwe - bobedi	2. Boraro – bone	3. Botlhano borataro	4. Bosupa le go fetsa
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L. Ba le kae mo lelwapeng la ko galona baba tsenang sekolo? [NHHS]

5. Bongwe - bobedi	6. Boraro – bone	7. Botlhano – borataro	8. Bosupa le go fetsa
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M. Ba le kae mo lelwapeng baba berekang kgotsa ba ipereka? [NEMP]

9. Bongwe - bobedi	10. Boraro – bone	11. Botlhano – borataro	12. Bosupa le go fetsa
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N. Motswedi wa metsi wa ko lapeng: [HHWS]

1. Metsi a thepe a mo lapeng	2. Metsi a thepe ya sechaba kgotsa yamo motseng	3. Noka/molapo	4. Metsi a rekisiwang a dikupu
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O. Tlhogo ya lelwapa la ga lona: [HHH]

1. Rre	2. Mme	3. Moloo	4. Lesika le lengwe
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Yo mongwe, tlhalosa: _____

SOCIO-DEMOGRAPHIC QUESTIONNAIRE

ID Code: _____

P. O ja ga kae mo letsatsing ka paka ya sekolo? [NMST]

1. Gangwe	2. Gabedi	3. Gararo	4. Gane le go feta
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Q. Dijo tse o di jang di kopane le tse di apeiwang ko sekolong? [INCLSCII]

1. He	2. Nnyaya	3. Ga go a lebagana
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R. O ja ga kae mo letsatsi ka nako ya malatsi a sekolo a boikhutso: [NMSII]

1. Gangwe	2. Gabedi	3. Gararo	4. Gane le go feta
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S. Pele o ya sekolong, a watle o fitlhole? [BRF]

1. Ec	2. Nnyaya	3. Fa gongwe
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T. Watle o pake dijo kgotsa madi a dijo ga o ya sekolong? [IIFS]

1. Dijo	2. Madi	3. Tsotlhe	4. Sepe
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U. Fa o tsamaya ka madi go ya sekolong, o rekang ka one? [LSM]

1. Dijo tse di apciweng	2. Dijo tse di sa apciweng/kgotsa tse di motlhofo	3. Tsotlhe
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V. O ja dijo tse sekolo ga kae? [ESF]

1. Nako tsotlhe	2. Malatsi a mangwe	3. Nako tse dingwe	4. Ga go a lebagana
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W. A go nale nako e dijo tsa sekolo di sa nnung teng? [NFD]

1. Ec	2. Nnyaya	3. Nako tse dingwe	4. Ga go a lebagana
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APPENDIX K: ANTHROPOMETRIC ASSESSMENT DATA COLLECTION TOOL

Code:.....

ANTHROPOMETRIC ASSESSMENTS

Initial Weight Measurements	Weight (kilograms to two decimal places) [BW1]	Height [HT]	Body Mass Index [BMI1]
Measurement 1			
Measurement 2			
Average			
Subsequent Measurements after school holidays	Weight [BW2]	Height	Body Mass Index [BMI2]
Measurement 1			
Measurement 2			
Average			

APPENDIX L: HOUSEHOLD FOOD INSECURITY SCALE (HFIS): ENGLISH AND SETSWANA VERSION

HFIAS – Household Food Insecurity Access Scale (Tool for measuring household food insecurity).

ID CODE:

QUESTIONNAIRE FORMAT

Question Number	Question	Response options	Code
Q1	In the past four weeks, did you worry that your household would not have enough food? [FQ1]	0 No (skip to Q2) 1=Yes	
Q1a	How often did this happen? [FQ1A]	1 Rarely (once or twice in the past four weeks) 2 Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
Q2	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? [FQ2]	0 No (skip to Q3) 1 Yes	
Q2a	How often did this happen? [FQ2A]	1 Rarely (once or twice in the past four weeks) 2 Sometimes (three to ten times in the past four weeks)	

		3 – Often (more than ten times in the past four weeks)	
Q3	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? [FQ3]	0 – No (skip to Q4) 1 = Yes	
Q3a	How often did this happen? [FQ3A]	1 = Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 – Often (more than ten times in the past four weeks)	
Q4	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? [FQ4]	0 – No (skip to Q5) 1 – Yes	
Q4a	How often did this happen? [FQ4A]	1 – Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)	
Q5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there	0 = No (skip to Q6) 1 – Yes	

	was not enough food? [FQ5]	
Q5a	How often did this happen? [FQ5A]	1 – Rarely (once or twice in the past four weeks) 2 = Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)
Q6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food? [FQ6]	0 = No (skip to Q7) 1 – Yes
Q6a	How often did this happen? [FQ6A]	1 – Rarely (once or twice in the past four weeks) 2 – Sometimes (three to ten times in the past four weeks) 3 – Often (more than ten times in the past four weeks)
Q7	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? [FQ7]	0 – No (skip to Q8) 1 – Yes
Q7a	How often did this happen? [FQ7A]	1 = Rarely (once or twice in the past four weeks) 2 – Sometimes (three to ten times in the past four weeks) 3 = Often (more than ten times in the past four weeks)

Q8	<p>In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food? [FQ8]</p>	<p>0 – No (skip to Q9) 1 – Yes</p>	
Q8a	<p>How often did this happen? [FQ8A]</p>	<p>1 – Rarely (once or twice in the past four weeks) 2 – Sometimes (three to ten times in the past four weeks) 3 – Often (more than ten times in the past four weeks)</p>	
Q9	<p>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? [FQ9]</p>	<p>0 – No (questionnaire is finished) 1 – Yes</p>	
Q9a	<p>How often did this happen? [FQ9A]</p>	<p>1 – Rarely (once or twice in the past four weeks) 2 – Sometimes (three to ten times in the past four weeks) 3 – Often (more than ten times in the past four weeks)</p>	

Nomoro e e supang gore o mang: _____

DIPOTSISITSO

Nomoro ya potso	Potso	Phetolo ya dikarabo	Code
Q1	Mo bekeng tse nne tse di fitileng, a oikile wa tshwenyega ka go tlhokahala ga dijo ko lwapeng?[FQ1]	0 = Nnyaa (tlola go ya Q2) 1=Ee	
Q1a	Se, se diragetse ga kae? [FQ1A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)	
Q2	Mo bekeng tse nne tse di fitileng, a o kile le ba lelwapa la gago la tlhoka go ja dijo tse le di eletsang ka ntata ya go tlhoka di dirisiwa? [FQ2]	0 = Nnyaa (tlola go ya Q3) 1=Ee	
Q2a	Se, se diragetse ga kae? [FQ2A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)	
Q3	Mo bekeng tse nne tse di fitileng, wena le ba lelwapa la gago le kile la tlhoka dijo tse dilekaneng ka ntata ya go tlhoka didirisiwa? [FQ3]	0 = Nnyaa (tlola go ya Q4) 1=Ee	
Q3a	Se, se diragetse ga kae? [FQ3A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)	

HFIAS – Household Food Insecurity Access Scale (Tool for measuring household food insecurity):
 SETSWANA TRANSLATION.

Q4	Mo bekeng tse nne tse di fitile, wena le ba lelwapa la gago le kile la ja dijo tse le sa di batleng ntateng ya go tlhoka di dirisiwa? [FQ4]	0 = Nnyaa (tlola go ya Q5) 1=Ee
Q4a	Se, se diragetse ga kae? [FQ4A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)
Q5	Mo bekeng tse nne tse di fitileng, wena le ba lelwapa la gago le kile la ja dijo tse dinnye le baka ele gore dijo di ne disa lekana? [FQ5]	0 = Nnyaa (tlola go ya Q6) 1=Ee
Q5a	Se, se diragetse ga kae? [FQ5A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)
Q6	Mo bekeng tse nne tse di fitileng, wena le ba lelwapa lagago le kile la tlhoka go ja dijo tse di lekaneng mo letsatsing ntateng ya dijo tse di sa lekaneng? [FQ6]	0 = Nnyaa (tlola go ya Q7) 1=Ee
Q6a	Se, se diragetse ga kae? [FQ6A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)
Q7	Mo bekeng tse nne tse di fitileng, dijo dine di tlhokahala tsa go jewa mo lelwapeng ntateng ya go tlhokahala ga didirisiwa? [FQ7]	0 = Nnyaa (tlola go ya Q8) 1=Ee
Q7a	Se, se diragetse ga kae? [FQ7A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di

HFIAS – Household Food Insecurity Access Scale (Tool for measuring household food insecurity):
SETSWANA TRANSLATION.

		fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)
Q8	Mo bekeng tse nne tse di fitileng, wena le ba lelwapa la gago le kile la robala ka tlala ntateng ya go tlhoka dijo mo lwapeng? [FQ8]	0 = Nnyaa (tlola go ya Q9) 1=Ee
Q8a	Se, se diragetse ga kae? [FQ8A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)
Q9	Mo bekeng tse nne tse di fitileng, wena le ba lelwapa la gago le kile la tlhola letsatsi lotlhe le sa ja sepe ntateng ya go tlhoka dijo tse di lekaneng? [FQ9]	0 = Nnyaa (dipotsô tse di kwadilweng tsa potsolotsô di fidile) 1=Ee
Q9a	Se, se diragetse ga kae? [FQ9A]	1 = Ka sewelo (gangwe go fitletlha ko bo beding mo bekeng tse nne tse di fitileng) 2 = Nako nngwe (ga raro go fitlha kobo supeng mo bekeng tse nne tse di fitileng) 3 = Gantsi (bo supa le go feta mo bekeng tse some tse di fitileng)

APPENDIX M: PHYSICAL ACTIVITY QUESTIONNAIRE FOR CHILDREN: ENGLISH AND SETSWANA VERSION

Physical Activity Questionnaire (Elementary School)

ID CODE:

Sex: M _____ F _____

Age: _____ Standard: _____

*We are trying to find out about your level of physical activity from **the last 7 days** (in the last week) and during holiday time. This includes any activity that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others.*

Remember:

1. There are no right and wrong answers — this is not a test.
2. Please answer all the questions as honestly and accurately as you can — this is very important.

A. Physical activity in your spare time: have you done any of the following activities in the past 7 days (last week)? If yes, how many times? Mark only one circle per row.

	1. NO	2. One to two times	3. Three to four times	4. Five to six times	5. Seven times or more
Skipping [ASP]					
Rowing /cannoning [ARC]					
In-line skating [AIS] Tag [ATG]					
Walking for exercise					

Physical Activity Questionnaire (Elementary School)

[AWE]		
Bicycling [ABI] Jogging or running [AJR]		
Aerobics [AAE] Swimming [ASW]		
Baseball, softball [ABS] Dance [ADA]		
Football ¹ [AFO] Badminton [ABA] Skateboarding [ASK] Soccer [ASO] Street hockey [ASH] Volleyball [AVO] Floor hockey [AFH]		
Basketball [ABA]		

¹ American Football

Physical Activity Questionnaire (Elementary School)

Ice skating [AIS]	
Cross-country skiing [ACK]	
Ice hockey/ringette [ATH] Other: [AOT]	

B. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

[BPE]

1. I don't do PE	2. Hardly ever	3. Sometimes	4. Quite often	5. Always
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C. In the last 7 days, what did you do most of the time at recess²? (Check one only.)

[CBK]

1. Sat down (talking, reading)	2. Stood around or walked around	3. Ran or played a little bit	4. Ran around and played quite a bit	5. Ran and played hard most of the time
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² Break time

Physical Activity Questionnaire (Elementary School)

D. In the last 7 days, what did you normally do at lunch (besides eating lunch)? (Check one only.)

[DLII]

1. Sat down (talking, reading)	2. Stood around or walked around	3. Ran or played a little bit	4. Ran and played hard most of the time
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E. In the last 7 days, on how many days right after school, did you do sports, dance, or play games in which you were very active? (Check one only.)

[ESD]

1. None	2. 1 time last week	3. Two or three times last week	4. Four times last week	5. Five times last week
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F. In the last 7 days, on how many evenings did you do sports, dance, or play games in which you were very active? (check one only)

[FSD]

1. None	2. 1 time last week	3. Two or three times last week	4. Four or five times last week	5. Six or seven times last week
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G. On the last weekend, how many times did you do sport, dance, or play games in which you were very active (Check one only)

[GSD]

1. None	2. One time last week	3. Two to three last week	4. Four to five times last week	5. Six or more times
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Physical Activity Questionnaire (Elementary School)

11. Which one of the following describes you best for the last 7 days? Read all FIVE statements before deciding on the one answer that describes you.

[IIPL]

1.	All or most of my free time was spent doing things that involve little effort
2.	I sometimes (1 – 2 times) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)
3.	I often (3 – 4 times last week) did physical things in my free time
4.	I quite often (5 – 6 times last week) did physical things in my free time
5.	I very often (7 or more times last week) did physical things in my free time

1. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week:

Day	1. None	2. Little bit	3. Medium	4. Often	5. Very often
Monday [IMD]					
Tuesday [ITD]					
Wednesday [IWD]					
Thursday [ITH]					
Friday [IFD]					
Saturday [ISD]					
Sunday [ISU]					

Physical Activity Questionnaire (Elementary School)

J. Were you sick last week, or did anything prevent you from doing your normal physical activity? (check one)

[JPP]

1. Yes	2. No
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If yes, what prevented you?

Physical Activity Questionnaire (Elementary School): SETSWANA VERSION

Nomoro e e supang gore o mang: _____

Bong: Mosimane

Mosetsana

Dingwaga:

Setlhopha sa sekolo:

Re leka go batlisisa gore oitshila mmele ka selekanyo se se kae mo malatsing a a supa a a fitileng (beke e e fitileng) le ka malatsi a boitapoloso. Go akaretsa go nna matlhagatlhaga kgosa itshidilo mmele e e dirang gore o fufule kgotsa o lape maoto, kgosa metshameko e e dirang gore o hemele ko go dimo, jaaka motshameko wa tag, koi, go taboga, go palama le tse dingwe.

Gakologelwa:

1. Ga gona dikarabo tse di siameng kgotsa tse di sa siamang — mo ka se teko.
2. Araba dipotso tsotlhe ka boammaruri le mo go tshwanetseng ka bokgoni ba gago — go botlhokwa.

A. Selekanyo sa go dira mmele mo nakong eo sa direng sepe: ao kile wa dira mgwe ya metshameko e mo malatsing a a supa a a fitileng (beke e e fitileng)? Ga karabo ele ee, selekanyo se kae? Tshwaya ka letshwao la (N).

	Nnyaa	Gangwe go yak o bobeding	Ga raro goya ko boneng	Ga tlhano go yak o borataro	Go supa le go feta
Koi [ASP] Motshameko wa mokoro [ARC] Motshameko wa ditlhako tsa maotwana [AIS] Motshameko wa tag [ATG]					
Go itshidila mmele ka go tsamaya ka maoto [AWE] Go tsamaya ka baesekele [ABI]					
Go taboga [AJR]					
Motshameko wa di aerobics [AAE] Go thuma [ASW]					
Motshameko wa softball kgotsa baseball [ABS]					
Go bina [ADA]					
Kgwele ya dinao wa America [AFO]					

Physical Activity Questionnaire (Elementary School): SETSWANA VERSION

Motshameko wa Badminton [ABA]	
Motshameko wa Skateboarding [ASK]	
Kgwele ya dinao [ASO] Motshameko wa Street hockey [ASH]	
Motshameko wa bolibolo [AVO]	
Motshameko wa Floor hockey [AFH]	
Bolo ya letloa [ABA]	
Motshameko wa Ice skating [AIS]	
Motshameko wa Cross-country skiing [ACK]	
Motshameko wa Ice hockey/ringette [AIH] Tse dingwe: [AOT]	

B. Mo malatsing a a supa a a fitileng, mo claseng ya metshameko (PE) one wa nna malhagatlhaga ga kae (go tshameka thata, go taboga, go lolatlola, go tika)? (Tshwaela gangwe fela.)

[BPE]

1. Ga ke dire motshameko wa sekolong	2. Nako e mngwe	3. Ka sewelo	4. Gantsi	5. Nako tsotlhe
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C. Mo malatsing a a supa a a fetileng, one o dira eng ka nako ya go ikhutsa ya letsatsi la sekolo? (Tshwaela gangwe fela.)

[CBK]

1. Ke ntse faatse (ke bua, bala)	2. Ke eme, ke tsamaya	3. Ke tshamekanyana	4. Ke tshameka thata	5. Ke tshameka thata ga mmalwa
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Physical Activity Questionnaire (Elementary School): SETSWANA VERSION

D. Mo malatsing a a supa a a fetileng, one o dirang eng ka nako tsa dijo tsa motshegare (konleng ga go ja dijo)? (Tshwaela gangwe fela.)

[DLII]

1. Ke ntse faatse (ke bua, bala)	2. Ke eme, ke tsamaya tsamaya	3. Ke tshamekanyana	4. Ke tshameka thata	5. Ke tshameka thata ga mmalwa
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E. Mo malatsing a a supa a a fetileng, o tshamekile metshameko e e kae ya go bina, kana motshameko yo o matlhagatlhaga? (Tshwaela gagwe fela)

[ESD]

1. Gangwe	2. Gangwe mo bekeng	3. Ga bedi kgotsa ga raro mo bekeng e ee fetileng	4. Gane mo bekeng e e fetileng	5. Ga tlhano mo bekeng e e fetileng
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F. Mo malatsing a a supa a a fetileng, mo nakong ya maitseboa, one wa tshameka metshameko efe e e matlhagatlhaga? (Tshwaela gangwe fela)

[FSD]

1. Gangwe	2. Gangwe mo bekeng	3. Ga bedi kgotsa ga raro mo bekeng e ee fetileng	4. Gane mo bekeng e e fetileng	5. Ga tlhano mo bekeng e e fetileng
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G. Mo malatsing a bohela ba beke, one wa tshameka metshameko efo ya matlhagatlhaga (Check one only)

[GSD]

1. Gakeise	2. Gangwe mo bekeng	3. Ga bedi kgotsa ga raro mo bekeng e ee fetileng	4. Gane kgotsa ga tlhano mo bekeng e e fetileng	5. Ga rataro le go feta
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H. Kaela gore mo malatsing a a supa a a fetileng o dirileng gantsi? Bala dikarabo tsoitlhe tse tlhano pelo o fetola.

[IPL]

1.	Ganke ke dira sepe mo nakong yame.
2.	Ga gongwe (gangwe goya ko bobeding) ke tshameka metshameko ya (sekai, metshameko, go taboga, go thuma, go tshameka ka baesckele, go bina)

Physical Activity Questionnaire (Elementary School): SETSWANA VERSION

3.	Ka se welo (gararo kgotsa gane mo bekeng) ke dira metshako e e matlhagatlhaga
4.	Nako e nngwe (ga tlhano go yako boratarong mo bekeng) ke dira metshameko e e matlhagatlhaga
5.	Gantsi (ga supa le go feta mo bekeng) ke dira metshameko e e matlhagatlhaga

I. Tshwaela gore o dira metshameko e e matlhagatlhaga eo e dirang ga kae mo malatsing otlhe a beke (jaaka go tshameka, go bina, kana tse dingwe):

Letsatsi	1. Ganke	2. Ga gongwe	3. Ka sewelo	4. Nako e nngwe	5. Gantsi
Mosupologo [IMD]					
Labobedi [ITD]					
Laboraro [IWD] Labone [ITII] Labotlhano [IFD] Matlhatso [ISD] Tshipi [ISU]					

J. Ao kile wa hwala kgotsa wa tlhoka go tshameka mo bekeng e e fetileng? (Tshwaela gangwe)

[JPP]	1. Fe	2. Nnyaya
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Ga ele ee, keeng se se go kgoreleditseng?

APPENDIX N: HOUSEHOLD DIETARY DIVERSITY SCORE (HDDS): ENGLISH AND SETSWANA VERSION

HOUSEHOLD DIETARY DIVERSITY SCORE

Food group	Examples of foods
A Cereals	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products), porridge
B Roots and tubers	White potatoes, white yam, white cassava, or other foods made from roots
C Vegetables	Pumpkin, carrot, squash, sweet potato, red sweet pepper, dark green leafy vegetables, including wild forms and locally available leaves such as amaranth, cassava leaves, kale, spinach, tomato, onion, eggplant.
D Fruits	Apples, oranges, bananas, pears, peaches, mango, cantaloupe, apricot (fresh or dried), papaya, dried peach, and 100% fruit juice made from these, wild fruits and 100% fruit juice made from these
E Meat, poultry, offal	Liver, kidney, heart or other organ meats, beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects
F Eggs	Eggs from chicken, duck, guinea fowl or any other egg
G Fish and seafood	Fresh or dried fish or shellfish
H Pulses/legumes/nuts	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)
I Milk and milk products	Milk, cheese, yogurt or other milk products
J Oils/fats	Oil, fats or butter added to food or used for cooking
K Sugar/honey	Sugar, honey, sweetened soda or sweetened juice, sugary foods such as chocolates, candies, cookies and cakes
L Miscellaneous	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages

HOUSEHOLD DIETARY DIVERSITY SCORE

Ditlhopha tsa dijo	Dikai tsa dijo
A Cereals (masika a bogobe, marotho le tse dingwe)	Mmedi, reise, Korong, mabele, mosutlwane, le tse dingwe tse di dirilweng ka (borotho, bogobe, le masika a bogobe)
B Digwere	Mapotata, white yam, white cassava, kgotsa digwere tse dingwe
C Merogo	Lephutse, kherote, dipotata, pepere e khibidu, merogo e metala ya naga, tamati, anyanse, eggplant.
D Maungo	Apole, namume, panana, pere, perekisi, mangu, cantaloupe, apricot (e e sa tlhabololwaang le e e omositsweng), papaya, dried peach, le drinki ya maungo
E Nama ya kgomo, nama ya koko, mateng	Sebete, diphilo, pelo, kgotsa mateng a mangwe, nama ya kgomo, kolobe, pudi, nku, mmutle, koko, pedipedi, nama ya dinonyane tse dingwe, nama ya naga, dikhukwane
F Mae	Mae a koko, kgaka kgotsa a mangwe
G Tlhapi	Tlhapi e e metsi kgotsa e e mo thining
H dinawa, letlhodi, manoko	Dinawa, letlhodi, manoko, kgotso dijo tse di dirilweng ka tse, jaaka, botoro ya dinawa, hummus
I Mashi le dijo tsa mashi	Mashi, chisi, yogate, kgotsa tse dingwe tse di dirilweng ka mashi
J Mafura	Mafuka, botoro
K Sukiri	Sukiri, seno tsididi se se tsentsweng sukiri, dimonamona, dikuku
L Le tse dingwe	Spices (black pepper, letswai), condiments (soy sauce, hot sauce), kofi, tee, bojalwa

APPENDIX O: PRIMARY SCHOOL RATION SCALE

Day	Food items	Ration
Monday	Porridge/sorghum stewed beef	100g/child/day 100g/child/day
Tuesday	samp beans	100g/child/day 100g/child/day
Wednesday	Porridge Beans	100g/child/day 100g/child/day
Thursday	Bread Milk UHT Jam Peanut butter	2 slices at 25g/slice 340ml 45g on three slices of bread 45g
Friday	Porridge Beans	100g/child/day 100g/child/day

APPENDIX P: INTRODUCTION OF SCHOOL BREAKFAST CORRESPONDENCE

Private Bag 006
Gaborone
BOTSWANA
REFERENCE NO: MLGRD/1/6/7 I (194)



TEL: (+267) 3658400
FAX: (+267) 3952382

REPUBLIC OF BOTSWANA

MINISTRY OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT

18 March 2019

FOR IMMEDIATE RELEASE

PRESS RELEASE

PROVISION OF BREAKFAST AT PRIMARY SCHOOLS

Government, through the Ministry of Local Government and Rural Development, has resolved to provide breakfast meals at pre- schools and primary schools beginning 1st April, 2019 for the financial year 2019/2020.

This follows recommendations of the Task Team set up in 2013 by Government to come up with a menu that provides nutrients to promote optimal health, growth and development as well as prevent nutritional deficiencies (and equally align the primary school menu to that of secondary schools).

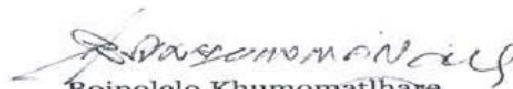
The school menu for primary schools is geared towards supporting poverty eradication and home-grown feeding initiatives to economically empower and capacitate Batswana to promote micro and small scale entrepreneurship.

The food commodities to be provided include rooibos tea with bread, peanut butter or jam, boiled eggs, mabele or maize meal soft porridge, milk and an orange or an apple.

These meals, based on sufficient nutrients required by pupils, are to be taken by learners daily before commencement of lessons in the morning.

For more information, please contact the Ministry's Communications Office on 3658467/69 or mramakgati@gov.bw

Ends


Boipolele Khumothare
PERMANENT SECRETARY