

**EFFECT OF SCHOOL GARDEN FOOD PRODUCTION ON NUTRIENT
ADEQUACY AND NUTRITION STATUS OF CHILDREN IN NAMASAGALI
PRIMARY SCHOOL IN RURAL KAMULI DISTRICT, UGANDA**

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H60/12931/05**



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OF SCIENCE (FOOD, NUTRITION AND DIETETICS) IN THE SCHOOL
OF APPLIED HUMAN SCIENCES, KENYATTA UNIVERSITY**

OCTOBER 2016

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DECLARATION

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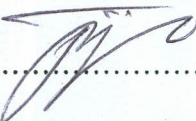
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DEDICATION

I dedicate this work to my late mum Karen Byaruhanga, my beloved daughter Carren Sayuri, my dad Prof. John Byaruhanga and Papa Gaetano Bahemuka.

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OPERATIONAL DEFINITION OF TERMS

Primary School Child: A child between ages 6-18 years attending school at Namasagali Primary School

School meal: A hot lunch (maize and beans, vegetables, oils and iodized salt) provided to pupils during school days

Nutritional Status: The current body status of a person related to their state of nourishment (consumption and utilization of nutrients). In this study it was measured in terms of BMI-for-Age and stunting.

Nutrient adequacy: nutrient composition of the meal based on macro and micronutrients with the ability to meet the individual requirement for that nutrient based on age/gender. The nutrients analyzed in this study-included energy (kcal), protein, lipids, iron, vitamin A and iodine.

Recommended Dietary Allowance(RDA): the intake levels for nutrients that meet the needs of nearly all (97+98%) of healthy individuals that make up a certain group at the given life-stage

Stunting: it indicates the attained growth in height of the child. This indicator is used to assess whether a child has normal height (>1 to <2 SD), is moderately stunted (>-3 to <-2 SD) or severely stunted (<-3 SD). It can help identify children who are stunted due to prolonged under nutrition or repeated illness (WHO, 2008).

BMI-for-Age: Is measured by dividing weight (kg) by the height (m^2) of an individual. It is age (2-20) and gender specific. BMI-for-age cut off¹: $\leq 95^{\text{th}}$ percentile-overweight 85^{th} - 95^{th} percentile-risk of overweight $\leq 5^{\text{th}}$ percentile underweight.

Cost Description: The required payments, expenditures and cash in kind necessary to provide lunch for pupils at NPS.

Index Child: The pupil attending NPS and taking part in the study

Estimated Average Requirement (EAR) - intake levels for nutrients estimated to meet the needs of half of the healthy individual in a particular group.

Offline menu planner- It is a tool used to measure the nutritional value of a meal and provides a gentle introduction to the HGSFP web application. This tool can be used without an Internet connection. The tool should run on most versions of Microsoft Excel for Windows

ABBREVIATIONS/ACRONYMS

AOAC	Analysis of the Association of Official Analytical Chemists
BCG	Boston Consulting Group
BMI	Body Mass Index
CSRL	Centre for Sustainable Rural Livelihood
FAO	Food and Agriculture Organization
HGSF	Home Grown School Feeding
ISU	Iowa State University
MDG	Millennium Development Goals
MUK	Makerere University Kampala
NEPAD	New Partnership for Africa's Development
NPS	Namasagali Primary School
PEM	Protein Energy Malnutrition
RDA	Recommended Dietary Allowance
SDG	Sustainable Development Goals
SFP	School Feeding Program
SPSS	Statistical Package for Social Sciences
UBOS	Uganda Bureau of Statistics
UNICEF	United Nations Children's Fund
UNHTF	United Nations Hunger Task Force
UPE	Universal Primary Education
UN	United Nations
UNCST	Uganda National Council of Science and Technology
VEDCO	Volunteer Efforts for Development Concerns
WHO	World Health Organization
WFP	World Food Program

ABSTRACT

Proper nutrition is critical for optimal growth, cognitive development, general well being and academic performance among school going children. Access to good nutrition either at home or at school can contribute to the elimination of malnutrition and its associated health and developmental problems among this age group. Developing countries still remain within reach of halving the proportion of hungry people. Gains of the second Millennium Development Goal (MDG) (Sustainable Development Goal-SDG 4) are being threatened by several factors that including short term hunger. A cross sectional study with an analytical design and laboratory analysis was used. Data was collected on socio economic and demographic factors of the pupils, dietary intake patterns of the pupils , anthropometric measurements were collected from 226 pupils. The meal was analysed in the laboratory for nutrients: energy, protein, fats, vitamin A, iodine and iron. Both inputs and output from the school garden were recorded and these computed in monetary terms. Data was analysed using SPSS version 17, Anthro-plus version 1.0.2 and Nutri-survey. Descriptive statistics such as mean, frequencies and percentages were used to describe the data. A higher level of cross tabulation and correlation test of the three hypothesis was done and $P < 0.05$ was used to determine statistical significance. From the study 50.4% were male pupils while 49.6% were females. About 51% of the caregivers had attained at least level of primary education with 89% of them being peasant farmers. The most grown crops were maize (97%) and sweet potatoes (87%). The school meal provided a significant amount of calories ($853\text{kcal} \pm 178$) and all other major nutrients as compared to what the pupils received from home. Stunting and BMI-for -age levels did not change much after the program introduced the school feeding program, an indication that there could be a spill over of malnutrition from childhood to school age. Regression analysis showed that there exists a positive correlation between BMI for age and education level of parent and a negative relationship between BMI for age and marital status of parent exists. Further analysis showed a weak relationship between nutrition status BMI for age and number of meals consumed per day ($r=0.120$, $p=0.021$). The study did not find any significant relationship between schools meals and nutritional status. Contribution from the stakeholders-program-28%, parents-14% and school garden-57% indicated a reduction on the cost incurred by the program to sustain the SFP. This study recommends that a longitudinal study comparing schools that employ gardens and those that do not should be conducted to examine the difference in nutritional status and the cost implications.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

The creation of the Millennium Development Goals (MDGs) in the year 2000 and Sustainable Development Goals [SDGs] in 2015 resulted from the determination of all countries in the United Nations (UN) to address challenges resulting from advancing globalization. Attention was paid to hunger and poverty which was stated in MDG one (SDG 1&2), as “eradicate extreme hunger and poverty (Murray, 2015),” specifically expressed in the sub-goal formulated “ by the year 2015 the proportion of people who suffer from hunger is halved as compared to 1990” (UN, 2005). *The State of Food Insecurity in the World 2013* presented updates showing that further progress has been made towards the 2015 MDG target (halving the proportion of hungry people), this remains within reach for the developing countries collectively (FAO, 2013).

Globally, it is estimated that every six seconds a child dies from hunger-related causes (FAO, 2007) and in developing countries one out of four children are stunted (WFP, 2009; UNICEF, 2007). Across the developing continents, 66 million primary school aged children attend classes hungry, 23 million being in Africa (Badri, 2014). Of the 72 million primary school-age children worldwide, who are not in school. 95 percent are in developing countries; 57 percent are girls; 48–56 percent are stunted and up to 62 percent are underweight. More than half of the 72 million suffer from iron deficiency anaemia. 5 percent from iodine deficiency and 7 percent from vitamin A deficiencies (WFP, 2009).

The target of the second MDG was to ensure that all boys and girls complete primary schooling through achieving Universal Primary Education (UPE). Developing countries have made great strides in reaching this goal but these gains are threatened by several factors that include short term hunger due to lack of proper meals at school, insufficient school supplies and lack of enough teachers in the schools (Muntenyo, 2010). Other reasons stem from responsibilities at home and pressure to earn additional income.

In Uganda children belonging to poor and food insecure regions/households have been forced to contribute to household chores rather than go to school (WFP, 2011). The policy on school feeding is that parents who can afford to pay are allowed to make feeding arrangements with the school management, and those parents who cannot afford the cost of a school meal, provide food for their children to carry to school (Uganda Budget, 2007/2008 in Kibwika *et al.*, 2010). In Kamuli District Eastern region poverty and lack of school feeding programs (SFPs) have severely crippled the children's ability to learn because most of the time they are hungry (Kirabo, 2011 & UBOS, 2012).

SFPs have been reported to improve children's cognitive outcomes and nutritional status depending on the design of the program (Kristjansson, 2007). School gardens have been used as a source of locally grown products for SFPs (Mwangi *et al.*, 2010). Foods from school gardens are more appropriate, cost-effective and contribute to the sustainability of the SFPs (Lawson, 2012). The New Partnership for Africa's Development (NEPAD) teamed up with World Food Program (WFP) and other partners to create the Home Grown School Feeding Program (HGSF), a program that provides nutritionally adequate

meals for learners and improving enrolment and retention in schools while addressing the needs and growth of the local small farmers (NEPAD, 2007; Mutenyo 2010; UNHTF 2003). One of the NEPAD's recommendations is that food must be produced in the locality of the school (Tomlison, 2007).

Iowa State University's-Centre for Sustainable Rural Livelihoods (CSRL) in partnership with Volunteer Efforts for Development Concerns (VEDCO), a local non-governmental organization in Uganda and Makerere University; are implementing a sustainable rural livelihood program to ensure that rural people of Kamuli District have access to sufficient food, sustainable incomes and livelihoods that result in good health and well-being. The program set up a school garden/feeding project at Namasagali Primary School (NPS) with a goal of providing a hot, solid and nutritious lunch to the children. Produce from the gardens are used in the SFP or sold to provide ingredients for the meal. The aim of linking the garden to the feeding was to make the SFP cost-effective, improve its efficiency and overall contribution and make it self-sustaining (CSRL, 2012).

1.2 Problem Statement

Malnutrition and hunger among children in developing countries contribute to poor health and low quality of life. The economic costs of malnutrition are very high in terms of higher budget outlays as well as lost gross domestic product (Lopez, 2006). School-age children are more vulnerable to under nutrition because they are not a priority for nutrition interventions, which often focuses on preventing malnutrition during fetal development and the early years of life. Evidence-based research is beginning to show

that school-age children may not, in fact, be healthier than younger children. The developing world and the development community are starting to acknowledge this problem of malnutrition and health among this age group and more importantly the need of addressing it. SFPs and other food-based strategies are among the range of nutrition interventions aimed at improving school –age children’s nutritional status (Hall, 2007 & Bennett, 2003; Allen, 2001).

Uganda’s launch of the Universal Primary Education (UPE) in 1997 was a landmark towards meeting MDG two (SDG 4). However, short-term hunger in schools has become a threat (Kibwika *et al.*, 2010) to the realization of this goal. Under the UPE program, parents are taxed with the responsibility of providing meals among other materials to their children. In most rural schools in Uganda, school administrations make arrangements with parents to provide the children with a cup of porridge for lunch. Parents contribute in kind or cash towards this lunch. The school administration in NPS, Namasagali Sub-County of Kamuli District is one of the schools that had this arrangement. However, providing one-cup (250 ml) of maize meal porridge for lunches, which is grossly inadequate (50kcal) in terms of quality and quantity, is never guaranteed due to poverty and poor agricultural productivity in the area (CSRL Report , 2011). Furthermore, the government also announced that parents should not be forced to contribute towards feeding their children in schools (ACT, 2008). Due to these pronouncements, rural Kamuli District parents are reluctant to contribute maize and money to facilitate the feeding in schools (Kirabo, 2011).

In 2006, the CSRL Program introduced a school gardening and feeding program in NPS to enhance the quality and quantity of the school lunch. Through the school gardens, grain amaranth (a protein-rich cereal) and occasionally eggs were added to the porridge. Although the additional of the macro and micro nutrients in the grain amaranth marginally improved the quality of the porridge; the quantity served (one 250 ml cup) was still inadequate in terms of kcal (from 50kcal to 80kcal) for a primary school going child. In 2010, CSRL introduced a solid meal with an intention of increasing the caloric intake and provide the much-needed macro and micronutrients. The dish consisted of whole maize, beans, vegetables, iodized salt and vegetable oil; also, eggs were added to the meal once a week to provide animal source protein.

No study has been conducted to find out the exact nutrient content in the meal, and the effect it has on the pupils at the school. This study, therefore, set out to establish the adequacy of the solid meal served and its contribution to the children's daily dietary intake based on the Recommended Dietary Allowance (RDA) for their ages and nutritional status. It further sought to establish the cost implication of linking a school garden to the feeding program at a rural primary school. The study formed part of the evaluation of the CSRL's school garden and lunch project. Also, the over-reliance of the schools on donations to run school feeding programs is an awful idea because of lack of sustainability. It is hoped that school gardening, though expensive in short run, it will prove to be a viable option over donations, thereby fostering the need for scaling up of the program to the neighbouring schools and later the entire country.

1.3 Purpose of Study

The purpose of this study was to determine the nutritional adequacy of the meal served at NPS, its contribution to the children's daily dietary intake based on the RDA for the age group. The study also assessed the contribution of the lunches on the nutritional status of the target group and outlined the cost of providing lunch to the pupils from the school gardens. The study is also supposed to carry out cost comparison of feeding programme with the school gardening programme in place and when out of the picture.

1.4 Specific Objective

1. To determine the demographic and socio-economic characteristics of the households of the index child in Namasagali Primary School
2. To determine the dietary intake of the children in Namasagali Primary School
3. To establish the nutritional content of the meals taken at school under the school-feeding program
4. To determine the nutritional status of the children in Namasagali Primary School
5. To compare the cost of school gardening with the cost incurred by the donors to run the school-feeding program.

1.5 Study Questions

1. In one month prior to the study, what are some of the illnesses the index child suffered from?
2. Does the school meal provide one-third of the nutrients required by the children?
3. Does the school garden lower the cost of providing meals for the pupils at school?

1.6 Hypotheses

H₀₁ The school meal (maize, beans, and vegetables) introduced by the program did not significantly contribute to daily dietary needs of calories, proteins and micronutrients for the primary school children (6-18years) based on their RDA.

H₀₂ Introduction of the school meal of maize, beans, and vegetables did not significantly change the nutritional status of NPS children.

H₀₃ Supporting the school feeding program with the school garden produce did not have any effect on the cost of providing lunch to the pupils.

1.7 Significance and Anticipated Outputs

Although the provision of lunch to school-aged children is important, it remains a challenge for poor rural farmers experiencing hunger and poverty. Poor rural farmers have to choose between providing meals for the whole family at home or giving the produce to children to take to school. Most of the times the families will choose to forego

giving the children lunch at school. It is widely acknowledged that an integrated approach to problem solving is more likely to produce sustainable results. Extensive research has shown that the potential for school gardens in providing a nutritious meal and sustaining a SFP is possible, but this has to be affordable. Introducing and sustaining a SFP is in the interest of CSRL, and providing this information on the school lunch linked to the school garden is expected to inform the program on the decisions to be taken when scaling up to other primary schools. The findings of the current study are critical in filling this gap. Most central to this study was to assert the importance of providing a nutritious lunch to the beneficiaries and the cost implication involved. This study also sought to add to the call for introducing such programs in rural public schools and hopes to convince the leadership to rethink the school feeding policy. For policy makers' results are important in making informed economic decisions on school lunches. This study has demonstrated that growing of high value crops for sale has been an effective way of funding the SFP but this has to be supported through contributions from the parents. The nutrient adequacy of the lunch has also improved noted in the high caloric intake on the meal consumed.

1.8 Justification of Study

The SFP is part of the nutrition component of the CSRL program, through which it is enhancing the nutritional status of school children, improving their school performance, attendance, enrolment and increasing production and sustainability of the school gardens. An extensive evaluation of the program is yet to be carried out since the inception of the school garden and feeding program in 2006. CSRL and its partners are in the process of

scaling up the feeding and nutritious lunch project to other schools in which they are operating. This study provided information on the efficiency and cost of providing this meal, which is necessary for making decisions to provide adequate nutritional meals for other schools using locally available foods. Results of this study also informed other stakeholders and policy makers in Kamuli District on the benefits and cost implication of linking school gardens to SFP with the goal of providing nutritious meals to school-going children.

In a similar study done in an Australian context, Geissman *et al.* (2005) found out that adequate vegetable and fruit intake in young children (in the school set up) has a positive effect on developing healthier food preferences later in life. Mosie (2004) suggested that the reduction of the prevalence of deficiencies should entail encouraging the growing of fresh vegetables in school gardens and educating the public on the value of including them in the diet.

1.9 Limitation and Delimitation of the Study

The CSRL program is implementing the school garden and feeding project in 5 schools, however, the study was limited to NPS because this is the school where the solid nutritious lunch has been introduced. Nutritional status of the children was a variable of interest in this study. However, the children spent 88 days in school and food consumed on school days and at home might have confounded the results of this study. The methodology applied in data collection and analysis took care of these factors. When costing the meal the study only considered the ingredients in the food assuming all other

costs remain constant whether the produce is from the school gardens or provided otherwise by the parents, school or donor (Gelli *et al.*, 2010).

1.10 Conceptual Framework

The study adopted the Home Grown School Feeding (HGSF) conceptual framework developed by NEPAD and WFP (Martens, 2007; NEPAD 2007). NEPAD has urged African governments to support SFP using as much as possible locally produced foodstuffs (NEPAD 2005). NEPAD's framework focuses on food purchased or produced by the local small-scale farmers. In the case of CSRL's SFP, the food is produced in the school garden and also by the parents who are small-scale farmers in the area. Apart from promoting local agricultural production, NEPAD's HGSF aims at promoting the children's wellbeing (Espejo, Burbano, and Galliano, 2009), which is in line with CSRL's objective of the SFP.

The goal of CSRL's SFP is to provide a nutrient dense school lunch in a cost-effective and sustainable way to ensure the well-being of the children in NPS. By consuming the meal, the children received part of their caloric, protein and micronutrient daily intake. Consuming the meal eventually reduces the short-term hunger and improves the children's nutritional status while increasing enrolment at the school, attendance and cognitive outcomes. The use of food from the school garden results in increased demand and diversity for the produce from the school garden and coupled with food contributed by parents which leads to an increase in local agricultural production (Figure 1.1).

Children participating in the SFP receive a portion size of 250g of the maize, beans, and vegetable meal (“*nyoyo*”), which directly contributes to their dietary intake. A school lunch meal usually provides from one-third to one-half of the RDA for energy and protein. According to Bennet, 2003, school feeding programs have three major impacts that are an improvement in the school-going children’s nutritional status and reduction of malnutrition rates; increasing school enrolment; attendance and cognitive performance; and finally to increase the demand for locally produced foods as shown in Figure 1.1.

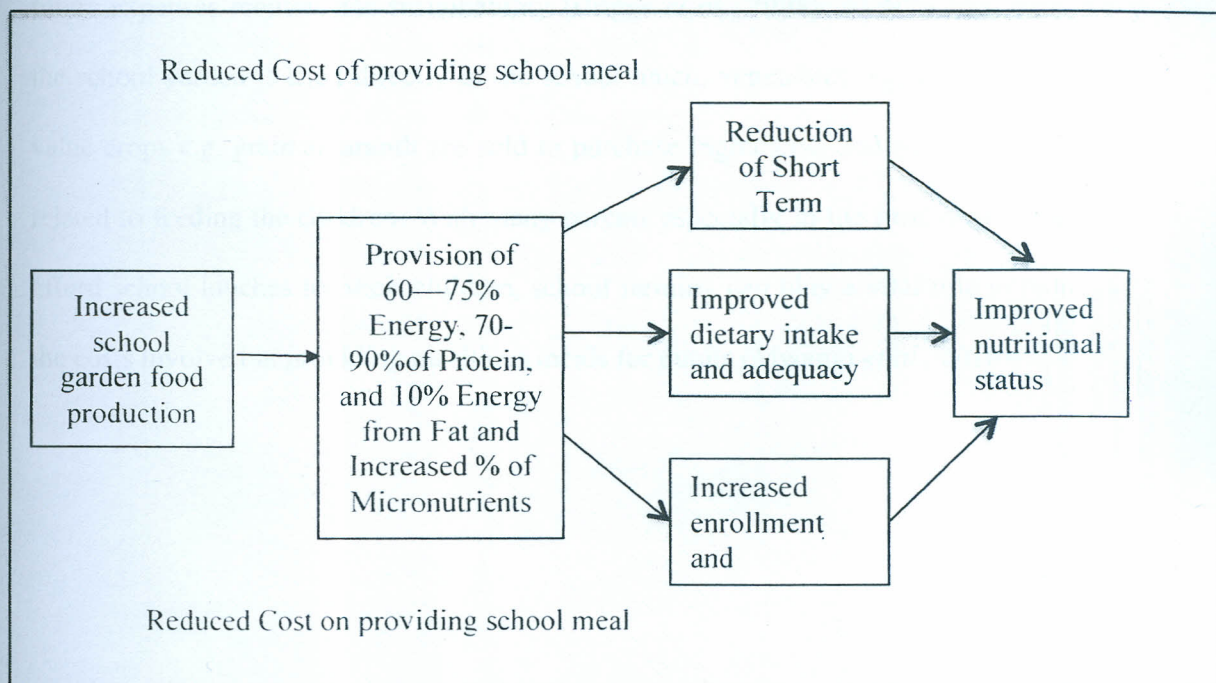


Figure 1.9: Contribution of locally grown and sourced school feeding program to improve dietary adequacy and reduce short term hunger

Source: Adapted from Tineke Martens, 2007

Iron deficiency (anaemia), vitamin A deficiency, and iodine deficiency among other deficiencies have been shown to affect school attendance and performance. Food rations

for schools should supply energy, protein and fat in the following ratios: Energy should be 1200-1500 kcal, protein 28-36 g , and fat should be 13-17 g . Food for the school lunch at NPS is obtained locally from the school garden and community.

Growing or rearing food through school gardens and raising animals has been one of the most successful ways of providing additional food for the SFP in some schools around the world (Bundy, 2009). It will, however, require adequate tools and trained staff to maintain the gardens. The food that is obtained from the garden can either be used directly in the SFP, or a portion of the harvest is sold and the funds obtained saved for future expenses required for sustainability (Briggs *et al.*, 2008). At NPS food grown in the school garden is used directly in the school lunch, vegetables, eggs and other high-value crops e.g. grain amaranth are sold to purchase ingredients and pay for other costs related to feeding the children. With many parents especially in the rural areas unable to afford school lunches for their children, school farming can play a vital role in reducing the costs involved in providing nutritious meals for pupils (Mwangi *et al.*, 2010).

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

There are over 350 million hungry children in the world. Of the over 115 million children that are out of school, 96% are from developing countries. Short-term hunger is one of the contributors of failure to attend school. A lot needs to be done to reverse the long-term effects of hunger and lack of education for children, their families and societies (WFP, 2012, WFP, 2006, FAO, 2005). Providing meals at school has the potential to mitigate this challenge. School Feeding Programs (SFP) have the potential to break the vicious cycle of hunger, poverty and poor education, which are interdependent (WFP, 2006). Studies have shown that inadequate access to nutritious food causes a significant setback in a child's learning ability and contributes a high economic cost to the nation (WFP, 2009). SFPs are interventions that alleviate hunger while supporting education, health and community development (WFP, 2009). School feeding can be broadly defined as the provision of food to children during the school days

2.2 Overview of School Feeding Programs

School feeding programs can take different forms. The common ones include in-school meals (children are fed breakfast, lunch or both at school) or take-home rations (THR) (transfer of food resources to entire families' conditional upon school enrolment and regular attendance of children). The latter targets a particular group of vulnerable children such as orphans or older girls who are provided with THR at certain times of the

school year (WFP, 2009). The success of a sustainable SFP relies on the active participation of the parents, teachers, pupils and the communities (WFP and BCG, 2011).

2.3 Benefits of School Feeding Program

Research and literature continue to demonstrate that SFP has benefits as follows:

2.3.1 Alleviate Short-term Hunger, Improve Learning and Cognitive Function

Across the developing world, 66 million primary school-age children attend classes hungry with 23 million in Africa alone (WFP, 2012). The potential of a child to concentrate and learn is reduced with hunger due to skipped meals and much activity. Many children, especially in rural areas, leave home on an empty stomach, take long walks to school and, as a result, begin school hungry and unable to concentrate (Briggs *et al.*, 2008). Much research has shown that providing school meals, especially breakfasts, can play a critical role in alleviating short-term hunger and ensuring that children learn. Other studies (Benin, Jamaica, and North America) have shown that learning achievement is higher for children receiving SFP especially to those who missed breakfast (Bennett, 2003). Introducing a small snack at the beginning of the day or mid-morning can relieve the short-term hunger, increase activity levels and learning capacity.

2.3.2 Increase Enrolment and Attendance

The enrolment and attendance of children coming to school is one of the most direct effects of SFP (Andrews *et al.*, 2011). A study done in Bangladesh by Ahmed 2004 showed a considerable impact on school participation by increasing the enrolment and attendance by 14% and 6% respectively. This is more prevalent among the girls than boys; food is a strong incentive for children to attend school on a regular basis and keeps them there. Female learners especially benefit from this, as parents may feel that there are sufficient income-transfer benefits. Research has shown that enrolment for girls increased by 247% in Pakistan and 197% in another province as a result of School Feeding Program. Similar results were echoed in the extreme Northern Province of Cameroon where the program increased girls' enrolment by 313% (Briggs *et al.*, 2008). Introducing school garden program can increase enrolment and school attendance in rural areas.

2.3.3 Improve Nutrition and Health Status

Research shows that undernourished young children do benefit from SFPs, though they cannot reverse the consequences of earlier malnutrition (Bundy *et al.*, 2009, Krisjansson, 2007, Bundy *et al.*, 2006). Studies have indicated that an increase in micronutrient and macronutrient intake leads to enhanced nutrition and child health. increased learning and decreased morbidity for the pupils. Furthermore, Bundy(2006) and Krisjansson (2007) have further demonstrated that providing meals at school can have a significant contribution to the nutritional status and educational outcomes in children (Bundy *et al.*, 2009, Krisjansson, 2007 Bundy *et al.*, 2006).

A study in Kenya by Meme *et al.*, 1998, concluded that the SFP did not improve the nutrition status and children's school attendance. One of the studies by Krisjansson (2007) showed an improvement of Body Mass Index (BMI for age) in primary school children participating in breakfast supplementation programs. Good evidence suggests that SFP, when designed with micronutrients in mind, can significantly improve the effects of 'hidden hunger'. The three top macronutrients linked to learning capacity that SFPs can impact on are iron, Vitamin A and iodine. Increased cognitive performance and development (particularly in female children) has been linked to micronutrient supplementation especially of iodine and iron (Leslie & Jamison, 1990; Tomilinson, 2007). An increase in micronutrient and macronutrient intake can lead to enhanced nutrition and child health, increased learning and decreased morbidity for the pupils.

2.4 Nutrient Adequacy of School Meals

School meal programs should be well designed, to provide adequate macro and micro nutrients content. The average school meal should offer a third of the RDA for calories, proteins, fats, vitamins and minerals given their role in ensuring good nutrition and health for the child. Lunch is one of the three primary meals that a person is required to eat in a day (Musamali, 2007).

When designing a meal for the SFP it is important to take into consideration the type of ration and if the size will vary according to the age of the child, modality or delivery format of the food (Mosie, 2004). Some of the common means include snacks, in school meals or take-home rations. The best food sources and such meat or dairy products will

be included. Some guidelines do exist, and they guide nutritional requirements and recommended daily allowance. The tables below provide guidelines derived from WFP, WHO and USAID data.

Table 2.4a: Mean Daily per Capita Energy Requirement and Safe Protein Intake for Primary and Pre-Primary Children

	Pre –Primary School Children 3-5 years	Primary School Children 6-12 years	Adolescent 11-14 years*	Adolescent / Teen 15-18 years**
Energy (Kcal)	1600-1800	2000	2200 - 2350	3000 (male) 2200 (female)
Protein (grams)	24-32	28-40	45-46	59 (male) 44 (female)

* USAID and WHO data only

** USAID data only

Source: Bundy *et al.*, 2009

World Food Programme recommends that during meal distribution, serving portions should be adapted to the consumer's ages with younger children receiving smaller portions than their older counterparts. Calories, protein and fat content are availed to children up to age 12 (Bundy *et al.*, 2009). WFP recommends that for day school, feeding programmes supply two meals: a light meal and lunch. The light meal can be served at the start of classes or mid-morning and should supply approximately between 400-600kcal. As for the lunch, it should provide 700-900kcal.

The total number of kilocalories supplied by both meals should be between 1200-1500 refer to Table 2.4b (Finan, 2010) the meal should also supply protein between 28-36g and fats between 14-17g. Adjusting portion sizes for older children (especially adolescent girls) can help meet the increasing needs within the school set.

Table 2.4b: Recommended Nutritive Values of Rations for Primary Schools (WFP Data)

School Type	Acceptable range of rations nutritive value (Children 6-12 years)		
	Energy (Kcal)	Protein (gram)	Fat (gram)
Half-Day School	600-900 (30-45%)	16-24 (40-60%)	7-11 (40-60%)
Day School	1200-1500 (60-75%)	28-36 (70-90%)	14-17 (46-56 %)
Boarding School	Up to 2000 (up to 100%)	At least 40 (up to 100%)	>23 (76%)

Key: The figures in shown the brackets show the percentages of caloric provisions of meals in different situations.

In addition to protein, calories and fat, micronutrient deficiencies such as Iodine deficiencies, iron deficiency anaemia and vitamin A deficiencies contribute significantly to poor educational outcomes (Tomlinson, 2007). The WFP, WHO and USAID provide guidelines to regulate the recommended daily intakes for Vitamin A, Iron and Iodine Table 2.4c.

Table 2.4c: Recommended Mean Daily Intakes for Vitamin A, Iron and Iodine

Age Group	Vitamin A (μg retinol)	Iron (mg)	Iodine (μg)
Pre-Primary (3-5 yrs WFP) (1-6 yr WHO) (4-6 yrs USAID)	400	9-10	90
Primary (6-12 yrs WFP) (7 -10 yrs WHO & USAID)	400 (WHO) 500 (WFP)	10-16	120
Adolescents (10-15 yrs WHO) (11- 14 yrs USAID) (14-18 yrs IOM)	500 (10-12 yrs) 600 (12-15 yrs) 630(boys 14-18 yrs) 485(girls 14-18 yrs)	12 (boys 11-14 yrs) 15 (girls 11-14 yrs)	150

*** Differences Exist Between WFP and WHO in Regards of Micronutrients**

When providing lunches to school children, care should be taken in making sure the meal is nutritious and not too “heavy”, to cause a temporal sedative effect on the children.

2.5 Sustaining School Feeding Through Agriculture (School Gardening).

One of the most probable means of ensuring sustainability of a SFP and at the same time empowering pupils to gain life skills in agriculture are through school gardens. A school garden is considered an outdoor laboratory for teaching/learning of farming by the learners and a source to produce food for the SFP (Kibwiika *et al.*, 2010). In their aim to restore agricultural growth, food security, adequate nutritional levels and rural developments, African governments in 2003 endorsed the Home Grown School Feeding Programme (HGSFP) under the Comprehensive Africa Agriculture Development Programme (CAADP) initiative. In the same year, NEPAD identified HGSFP as having an immediate influence on food insecurity in Africa with the prospective to contribute to

long-term development outcomes (NEPAD, 2007, Gelli *et al.*, 2010). HGSF is seen as a tool to reach three different target groups: school children, small-scale farmers and community groups involved in food preparation and other income generating activities involved in school feeding service provision (Gelli *et al.*, 2010). The main objective of HGSF programmes is to link a food-based programme, such as school feeding, with local agricultural production (WFP, 2009). This creates ready markets for local farm produce, supports primary education and builds community relationships leading to strong community ownership and sustainability of the SFP (Loga, 2012). To avoid shocking the already food insecure and at the neediest community, it is important that a right balance be reached. The balance can be between programs that count on community participation and ownership and those that seek to be largely funded by communities (Weru, 2011).

NEPAD through the CADDP and the Alliance for a Green Revolution in Africa, have been actively supporting the connection between School Feeding and domestic agricultural production. Food can be obtained within the boundaries of the village or areas surrounding a single school, or within the national border of the country with which the school sits (Sumberg, 2011). The in-country demand for smallholder production for local school meals has so far translated into sustainable, nationally owned, cost-effective HGSF programs in Ethiopia, Mali, Kenya, Ghana, Nigeria and Tanzania. These countries are less dependent on external sources of food by linking the program with local agricultural production, which is the main drive behind HGSF (Gelli *et al.*, 2010).

Kenya, Uganda, and Benin view this as a way to strengthen their SFP and make it more sustainable. In Ghana, HGSFP forms the basis for WFP's exit strategy (WFP, 2008). An

excellent example of a successful school farming and SFP is the Garden for life project underway in the UK, India, Kenya as well as Gambia (Loga, 2012). These countries have embraced school farming as a crucial factor for a successful SFP. In Kenya's Nakuru town, a case study on improving school feeding through school farming was conducted and African Studies Centre reported that school farming appeared to be common in both secondary and primary schools with most of the produce destined for the SFP. This will keep the cost of the feeding programme at a low, and more parents will be able to afford school meals (Turkana & River, 2011). For schools to produce part of the ingredients needed to support school feeding program some conditions must be met, including adequate land, sufficient water, technical support and leadership

2.6 Costing a School Feeding Program

The cost and effects should be considered when designing school feeding interventions, and several different factors come into play when costing. These factors include choice of modality, composition and size of the rations, source of food (obtained locally or imported), number of beneficiaries and school feeding days per year (Geli *et al.*, 2010). Resource availability is naturally linked directly to the costs of operating and designing the program and, therefore, it is important to obtain information on local produce and other food sources to assist with meal planning and program implementation. Other factors that need to be reviewed include seasonal fluctuations in food availability that may influence the working of the program, transportation, and storage. It has also been documented that preparation facilities and equipment and fuel (availing fuel in abundance) will greatly affect the nature of the SFP.

It is pertinent to note that the sources of funds or resources for the program, duration of funding and how costs will be divided amongst the school, parents, local sources, government sources, partners and implementing agencies are outlined. Food for the program can be acquired through donation, purchase of local food, growing/rearing own food, local vendors or a combination of these. Parents, community members, government, food agencies or NGO's can donate food. This food can be directly used or sold (monetization) for the purchase of needed items. Purchase of local food will require cash inputs, and this allows for greater control of the quality and quantity of items bought and will contribute to the local economy (Weru, 2011). School gardening and livestock rearing can provide many opportunities for learning and skill training for the pupils, in addition to food production for the SFP. While costing, it is important to include contributions made by the community in cash or kind such as labour or food (Rose, 2003). To maintain the garden and livestock at the school adequate tools and training need be provided along with sufficient staffing.

2.7 School Gardening and Feeding Programme at NPS

The school gardening program in NPS began in 2006 with an active partnership between ISU College of Agriculture and environmental sciences and VEDCO a local NGO in Uganda. The main intention of setting up these gardens was to provide an outdoor learning laboratory for the pupils, produce supplemental food for the SFP and generate planting materials for the pupils to take home. The gardens also serve as demonstration sites for modern agricultural practices aimed at teachers, parents and community. Some of the crops grown included fruits, collards, maize, grain amaranth, soybean, and orange-

fleshed sweet potatoes (CSRL Report, 2011). The SFP launched in 2010 was met with enthusiasm from the pupils. Prior to initiation of this program, the students at NPS were served a lunch that consisted of a cup of maize meal porridge that provided 50kcalories or equivalent to medium-sized apple. "Nyoyo", a famous Kenyan dish was introduced in 2010 with an aim of providing a more filling and high caloric meal for the children (CSRL Report, 2011).

The program has been in place for two years with funding and contributions from the donor community, but CSRL is working to make itself sustaining through the school gardens with support and donation from the teachers, parents pupils and community. The school garden produces most of the food that is used in school lunches or sells part of it to purchase other items (salt, oil) needed for the meal. A successful chicken-rearing project in the school is providing eggs for the students' meal plus additional income. The idea of a school lunch program has been accepted, and parents in the community are now willing to contribute. At the beginning of every term, they contribute 3kg of maize and 2 kg of beans (that they once refused) to ensure that their children get the benefits of a midday meal (CSRL Report, 2012). The continued success and impact of our School Lunch Program at Namasagali reflects a collective effort and support by the parents, teachers, and pupils in that community (CSRL Report, 2011). It is important that the program be informed of the contribution of this SFP on the pupils' nutrition and health status. This is because good nutrition is one of the indicators of the meals' adequacy about the needs of children of primary school age and cost implication of the program. This study was conducted with an intention of providing answers to these important

questions.

2.8 Summary

The literature reviewed shows that there is a clear indication that a lot needs to be done to address the long-term implications of hunger and lack of education for our children, their families and societies (WFP 2012, WFP 2006 & FAO, 2005). School meals are seen as a tool that will address short-term hunger, supporting education, nutrition and encourage community development (WFP, 2006). SFP is also viewed as one of the ways of encouraging families to send girls to school instead of staying home to do household chores (WFP, 2009). A well-designed school meal should provide adequate nutrients for a school going child normally a third of the RDA for both macro and micronutrients (Musamali, 2007). The modality of the meal, composition and size of the ration, age and sex of the child, number of beneficiaries, school feeding days per year and source of food should always be used as guide when planning for a design of a SFP (Weru, 2011).

Central to this study is to provide a cost description of having a school garden fit into an SFP. School farming is considered as one of the ways of keeping the cost of the program at a minimum. Also, linking the SFP to local agriculture is a sure way to reduce donor dependency while encouraging community ownership and sustainability especially through the HGSFP model that NEPAD and CAADP are actively advocating for (WFP and BCG, 2011; Gelli *et al.*, 2010). Some fundamental conditions to be met to ensure a successful gardening program include sufficient land, sufficient water, professional support and leadership. Many schools could reap more benefits from the positive

experiences of schools in the garden for life project and also the success story of a school in Nakuru Kenya (Turkana & River, 2011). NPS in Kamuli district has a school garden that is supplementing the SFP as highlighted in the literature. However, the program needs answers on how successful this project has been and this study sought to provide that information especially to the nutrition and health of the children, adequacy of the meal served and cost implications.

2.2 Study Site

This study was conducted at NPS of Kamuli District in a long 100 km road from Parali, Nakuru Sub County of Kenya. The school has a well-ventilated and secure parts of the campus with a large playground. It is a primary school for 1-5 year (KDA, 2004) and has a population of 150 pupils. The school has necessary foundation facilities in the form of classrooms, water supply, latrine

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study was cross sectional study with an analytical design and had a laboratory analysis that was done on the “new” school meal. This study was conducted at one point in time and no follow up was done. The study employed both quantitative and qualitative methodologies in data collection and analysis. Anthropometric measurements, dietary intake, and socioeconomic data were obtained from the respondents using questionnaires. Proximate and micronutrient analysis of the meal was done at Makerere University Department of Food Science and Technology using Official Methods of Analysis of Association of Official Analytical Chemists (AOAC). The researcher opted to perform an analysis of samples of food from the NPS kitchen as opposed to using offline menu planners because 1) she had the means to access the laboratory and 2) to minimize errors due a possible variation of nutrient composition of food crops from region to region. The use of laboratory results is one of the major strengths of this study.

3.2 Study Site

This study was conducted at NPS, which is located in Kabanyoro village in Namasagali Parish, Namasagali Sub County of Kamuli District. The district is one of the most food-insecure parts of the country with at least 50% of the population food insecure throughout the year (KDA, 2004) and high malnutrition rates (79%) (UBOS, 2012). NPS is a missionary founded a school of the church of Uganda that began way back in 1932.

It is located a kilometre from the river Nile. Secondary data obtained from the school indicated that in the year 2010 the average enrolment was 285 pupils (148 girls and 137 boys), while in 2011 the average enrollment was 726 pupils (358 girls and 368 boys).

3.3 Target Population

The target population was the pupils attending NPS. The class register was used to obtain the total attendance from which the study sample was drawn. It is important to note that being a rural school the attendance by the pupils was low though the enrolment rate are recorded as being high. The common anecdotal evidence from an annual Parent Teacher Association (PTA) meeting held at the school on 24th March 2011 included statements such as:

Parents in Namasagali are not interested in taking their children to school. The child has the right to decide when to go to school...

...Girls have become a major source of income for the households through early marriages while boys spend most of their time fishing to raise money to look after themselves ...

...Namasagali Sub County has the highest number of school dropout. The parents will hold their children at home especially during, planting and harvesting time. Chores such as guarding the rice fields against birds, walking cattle to greener pastures, fetching water and cooking are mostly done by children. This contributes to high rates of absenteeism ...

3.3.1 Inclusion Criteria

The study sample included pupils aged between 6-18 years of age whose parents/guardian gave consent and pupils provided assent.

3.3.2 Exclusion Criteria

Pupils who were involved in pretesting were excluded from the study sample. Children suffering from chronic conditions such as diabetes and HIV/AIDS were excluded from the study.

3.4 Sampling Technique

3.4.1 Purposive sampling

Namasagali Primary School was purposively selected because it is the school that CSRL program introduced a School Feeding Program (solid meal) that is directly benefiting from the school gardens. NPS is the piloting school; if the cost of school gardening proves to be lower than the cost incurred by the CSRL donors, scaling up of the program will be justifiable. Pupils enrolled in the school during the 2012 school year and attended on a daily basis were selected to participate in the study.

3.4.2 Sample Selection

All pupils in the school during the year 2012 from grade one to grade seven participated in this study.

3.5 Sample Determination

The total daily attendance in the whole school was 226 at the time of data collection and, therefore, the whole school population was included in the study. Total comprehensive sampling was used to examine the entire student population at NPS.

3.6 Study Variables

3.6.1. Independent Variables

The independent variables were the school meal, composed of whole maize, beans, collard kales, iodized salt and oil, and the cost of feeding the entire school with produce from the school garden. Socio-economic factors were considered as extraneous variables that were controlled during analysis.

3.6.2 Dependent Variables

The dependent variables (outcome variable) in this study were nutritional status stated in terms of anthropometric indicators like body mass index (BMI) for age and sex, stunting; dietary intake, morbidity and illness, and the cost of providing lunch to school children at NPS.

3.6.2.1. The School Meal

The meal composed of whole maize, beans, collard kales, iodized salt and oil, and was prepared and served at school. Each pupil received a portion size of 250g of the meal daily for lunch (Monday to Friday). The portion size of 250g (maize to beans ratio of 2:1) yielded 765 kilocalories (offline menu planner). According to the offline menu planner,

children aged 6-12 years will require 1850 Kcal per day. During the lunch hour, they will require one-third (616 Kcal). However, the children attending NPS came from low-socioeconomic households and the likelihood that meals served at home met the two-thirds of their caloric needs was very low. Thus, the school meal provided slightly more than the required one-third to compensate for any inadequacies at home. An analysis of the meal served at NPS was done to establish its nutrient composition and 24hour recall was used to establish what the children had eaten at home.

To determine the impact of the meal on nutritional status and dietary intake, the school meal was analysed for nutrient composition. A sample of the meal was analysed at Makerere University's Department of Food Science and Technology Laboratory using Association of Official Analytical Chemist (AOAC) methods (2005).

3.6.2.2. Collection and Preparation of the Sample

All ingredients for the meal were transported from the school to the laboratory in their raw and dry form to protect the sample from the changes in composition, possible loss of nutrients and contamination. The school meal was prepared in the Makerere University's Department of Food Science and Technology Laboratory using the same procedures as on site. Maize and beans in the ratio of 2:1 (200g and 100g respectively) were soaked separately overnight and then boiled the next day for a period 3 hours. The maize was boiled first until soft and then the beans were added. Once cooked, vegetable oil (20g), iodized salt (4g) and collard/kales (20g) were added, and the mixture cooked for a 2

minutes. The mixture was then left to cool and then grounded using a blender into a fine uniform consistency. The blended sample was then analysed for moisture, protein, energy fat, ash, vitamin A, iron and iodine. The ground paste was then used to determine the proximate analysis of the meal and the micronutrient content using the AOAC method (2005). All proximate components were analyzed in triplicate and reported as mean on % wet weight basis.

3.6.2.3. The Moisture Content

Moisture content was determined using the oven drying method. Five grams of homogenized sample were accurately weighed out in triplicate in a clean, dried crucible (W_1). The crucible was allowed in the oven at 105°C for 3 hours until a constant weight was obtained and to avoid the losses of volatile components. After 3 hours of drying the crucibles were placed in a desiccator for 30 minutes to cool. After cooling it was weighed again (W_2) the percentage moisture content was calculated using the formula:

$$\% \text{ Moisture content} = \frac{(W_1 - W_2) \times 100}{\text{Wt. Sample}}$$

Where:

W_1 = Initial weight of crucible + sample

W_2 = Final weight of crucible + sample

Note: Moisture free samples were used for further analysis of crude protein, Ash, fats/oils, iodine, vitamin A and iron.

3.6.2.4. Crude Protein

Protein in the sample was determined by Kjeldahl method. The samples were digested by heating with concentrated Sulphuric acid (H_2SO_4) in the presence of a digestion mixture. The mixture was then made alkaline. Ammonium sulphate thus formed, releasing ammonia that was collected in 2% boric acid solution and titrated against standard 0.05M Hydrochloric Acid. Methylene blue and methyl red was used as indicator. Total protein was calculated by multiplying the amount of nitrogen with appropriate conversion factor (6.25).

Percentage crude protein content of the sample was calculated using the following formula:

$$\% \text{ Crude protein} = 6.25 * x \%N \text{ (Correction factor)}$$

$$\%N = \frac{(S-B) \times N \times 0.014 \times D \times 100}{\text{Wt. of Sample} \times V}$$

Where:

S= Sample titration reading

B= Blank titration reading

N= Normality of HCL

D= Dilution of sample after digestion

V= Volume taken for distillation

0.014= Milli equivalent of weight Nitrogen

3.6.2.5. Crude Fat Content

Crude fat content was determined according to the soxhlet method (AOAC, 2005). Triplicate weights of 5g sample were accurately weighed into a thimble. 1-1.5g of sand was added to the sample and mixed using a glass rod. The glass rod was then wiped with a cotton wool and the cotton placed on the top of the thimble. The thimble was then inserted in a soxhlet liquid/solid extractor and was exhaustively extracted for 6 hours in Soxhtec systems apparatus using petroleum ether (b.p. 40-60 °C) as the extractant. The extractant in the flask was then placed in an oven at 102°C and the contents dried for 1-2 hours until a constant weight was reached. After 2 hour the contents in the flask were cooled in a desiccator and contents weighed after. The % crude fat was calculated using the formula:

$$\% \text{ Crude Fat} = \frac{(W2 - W1) \times 100}{S}$$

Where:

W1= weight of empty flask

W2= weight of flask and extracted fat (g)

S=Weight of Sample.

3.6.2.6. Ash Content

Ash content was determined by incinerating the sample for 12hours in a furnace at 550°C. 2g of dry sample was weighed in triplicates in pre-weighed crucibles. The

crucible was then placed in a muffle furnace set at 550°C for 8 hours until sample became completely free from carbon and appeared as light gray or white.

The furnace was then turned off to allow the sample to cool. The partially cooled crucible was then transferred into a desiccator and allowed to cool at room temperature. The percentage ash was then calculated using the formula below:

$$\% \text{ Ash Content} = \frac{\text{Weight of residue} \times 100}{\text{Weight of Sample}}$$

3.6.2.7. Iodine Content

The iodine content of the sample was determined using the Iodometric titration method. Ten grams of sample was weighed in triplicates into 250ml flasks with a stopper. 30 ml of water was added and flask swirled to dissolve the sample. Water was then added to make volume up to 50 ml. afterwards; 1ml of 2N Sulphuric acid (H_2SO_4) was pipetted into the solution. Five milliliters of 10% potassium iodide (KI) was then added into the solution. The solution should turn pale yellow in the presence of iodine. The flask was then stoppered and put in the dark (cupboard or drawer) for 10 minutes. After 10 minutes the solution was then titrated against 0.005M sodium thiosulphate until the solution turned pale yellow. 2ml of starch indicator solution (solution should turn dark purple) was added and titration continued until the solution becomes pink and finally colorless. The level of sodium thiosulphate in the burette was recorded and converted to parts per million (ppm) equivalents to the content of iodine at that level.

3.6.2.8. Iron Content

Iron content of the sample was determined using the atomic absorption spectrophotometer. The food sample (2.5g) was weighed and placed in a crucible. The crucible was heated for about 20 minutes with a hot burner flame until the food sample was well charred and stopped smoking. The sample was then ashed in a furnace at a temperature of 550°C until ash turned white. The crucible was then allowed to cool and the contents transferred to a small beaker. 10 ml of 2.0 M hydrochloric acid was added into the sample and stirred for one minute. Ten milliliters of distilled water was also added and stirred well to mix. The mixture was then filtered and 2.5mls of 0.1M potassium thiosulphate added to the filtrate. Using a spectrophotometer (Shimadzu AAS, AA-6300) at a wavelength of 458 nm, each standard solution and the sample was placed into a separate cuvette and the absorbance of each solution measured. A standard curve constructed by plotting concentration of standard solutions vs. absorbance was used to determine the iron (III) concentration of the samples.

3.6.2.9. Vitamin A Content

Vitamin A content was determined by a photometer using light emitting diode (LED) technology. 5g of the previously crushed sample was weighed into a 1litre flask. 20ml of 50% NaOH solution was added to the sample and the mixture warmed in a water bath at 90°C. 100ml diethyl alcohol and 2ml of hydroquinone solution was also added and the water bath maintained at 90°C for 30minutes. The contents were then poured into a decanting vial and 100mls of water added followed by 50mls of ethylic ether and content mixed uniformly by shaking. 50mls of petroleum ether was added to the mixture and

allowed to decant. Extraction was done twice with 50mls of petroleum ether. The ether phase was then washed three times with 100mls of water. The mixture was then filtered, evaporated and concentrated until 1ml was obtained. Total carotenoids content was determined using the Harvest Plus method and using the Spectrophotometer (Shimadzu AAS, Model AA-6300) to read of the absorbance of the Carotenoid at the wavelength 450nm this value was then converted to Vitamin A by dividing with 12 conversion factor.

3.6.2.10. Energy Content (Bomb Calorimeter)

The energy content was determined using the bomb calorimeter method. About 1g of dried sample was weighed in a crucible with a piece of cotton wool and then placed inside a stainless steel vessel (decomposing vessel/bomb) filled with 30atm of oxygen. The bomb was then placed in a calorimeter bucket containing 1.2litres of water. The sample was then ignited through the cotton thread connected to an ignition wire inside the bomb and was burned (combusted) at 1000°C. The heat created during the burning process was recorded using a thermometer in the calorimeter at intervals of 3minutes until a stable maximum temperature was reached. After calibrating the bomb with the sample of a known heat, then the amount of energy needed to heat up the water by 1°C was known and this unit displayed the amount of energy inside the sample in units of joules or BTU per gram. This was the physical calorific value.

3.6.3 Cost Description of Producing Crops from the School Garden

The produce from the garden consisted of collards (kales) that were added to the meal. In addition a high-value crop, grain amaranth and tomatoes were produced throughout the year and sold to purchase maize and beans from the local farmers and oil and salt from the local market. These food products were prepared at the school as part of the school meal. The cost of producing these crops was determined by taking the costs of inputs and outputs from the school garden. The cost of all inputs and outputs were determined through recording during the actual crop production process. Costs were standardized to an acre for purposes of analysis. The costs were then calculated in terms of cost of the each food crop grown and the total cost determined and separately the cost of running the SFP before the introduction of school gardening programme to make it easier to draw comparisons.

3.6.4 Socio-economic Factors

Other variables of interest including household characteristics like socio-economic factors associated with the caregiver were also included in the study and controlled for during analysis. Variables of gender, the age of the caregiver, education, household income, proxies of wealth in terms of household assets, land size, were obtained through the questionnaire.

3.6.5 Dependent Variable

The dependent variables (outcome variable) in this study were nutritional status stated in terms of anthropometric indicators like Body Mass Index (BMI) for age and sex, stunting; dietary intake, morbidity and illness, and the cost of providing lunch to school children at NPS.

3.6.5.1 Anthropometric Measurements

Indicators such as BMI-for-age and stunting ratios were used to assess the child's nutritional status. Anthropometric measurements of weight, height and age in months and sex for each child were obtained. These indices were compared to WHO (2006) reference standard for stunting, wasting and underweight for a child at that particular age. Household factors likely to influence nutritional status were obtained through interviews and controlled for in the analysis.

3.6.5.1.1 Weight Measurements

Weight measurements were obtained using the method described by Lee and Nieman (2013). A platform beam balance scale accurate to 0.1 kg was used to obtain the pupils' weights. The pupil stood in the middle of the scale, which was placed on a flat surface and their weight taken barefoot but with the school uniform. To check for accuracy and reliability, three consecutive and independent readings were taken. The school uniform was then weighed, and the weight deducted from the readings.

3.6.5.1.2 Measuring of Height

Standing height of the pupils was recorded to the nearest 0.1 centimetre (cm), with the use of a stadiometer. The individual to be measured stood bare feet or in thin socks with the body leaning against a vertical board (WHO, 1995). The individual was required to stand heels together, arms hanging freely at the sides, and head, back, buttock, heels in contact with the vertical board and the head positioned so that the eyes were looking parallel to the headboard to avoid parallax error. The horizontal headboard was then brought into contact with the uppermost point on the individual's head. To check for accuracy and reliability, three consecutive and independent readings were taken.

3.6.5.2 Dietary intake

The adequacy of nutrient and caloric intake for children between 6-18 years was expressed as the proportion of the Dietary Reference Intakes (DRIs) according to the National Academy of Sciences (2002). The dietary intake at home was determined by food frequency questionnaires and 24-hour recall. Local compositions tables were incorporated during analysis.

3.6.5.3 Cost Description of School Lunch Sustained by School Garden

Cost Description of the school lunch in terms of feeding was provided in two ways. The total cost of feeding using harvest from the garden and the total cost of feeding the entire school using food purchased from the local market by the program.

The initial price of all inputs for the school gardens was obtained. This included the seedlings, fertilizer, herbicides, organic manure and labour used for cultivation. This was compared with prices for all the ingredients if purchased and supplied to the school by the program. The cost of producing in the school and purchase of food items by the program was obtained and compared in this study.

3.7 Data Collection Technique

3.7.1 Socio-Demographic Data

A semi-structured questionnaire was used to obtain demographic and social-economic information of the pupils' ages 6-18 years old. The pupils gave directions to their homes and the research assistants administered the questionnaire (Appendix II) to their mothers/caregivers. Socioeconomic and demographic information, such as age, sex, and class of the child and parents/guardians information such as marital status, educational level, age, occupation was collected. Data on type of house, fuel used for cooking and lighting and assets at home was also collected during the home visitations by research assistants. Anthropometric data on weight, height and age in months was obtained from the study population.

3.7.2 Dietary Intake

A food frequency questionnaire was also administered to determine the consumption frequency of each type of food based on the number of times it is eaten per day in a week. Also, a 24-hour recall was used to capture the daily food consumptions of the index

children from home and out of school. In the 24-hour recall method, subjects (aided by the care givers/parents) were asked by the dietitian, trained in interviewing techniques, to recall the subject's exact food intake during the previous 24- hour period or preceding day. The respondents were given the opportunity, without suggestion, to provide detailed descriptions of all foods and beverages consumed, including cooking methods and brand names. Twenty-four-hour recalls can be obtained on single or multiple occasions. Recalls of actual food consumption during the previous 24 to 48 hours are the most reliable, with the maximum period thought to be a month. The 24-hour recall method is easy to administer, economical, and is not dependent on the literacy of the respondent. Other advantages include: the time required to administer is short, respondent burden is low so compliance is generally high: data obtained can be repeated with reasonable accuracy.

Limitations include the following: Individual diets vary daily, so a single day's intake may not be representative; an experienced interviewer is required; selective forgetting of foods such as liquids, high calorie snacks, and fat occurs; reported intake may not be actual but what the interviewer wants to hear; and the tendency to over-report intake at low levels and underreport intake at high levels of consumption, leading to "flat slope syndrome" with reports of group intakes. A single 24-hour recall was most appropriate for assessing average intakes of foods and nutrients because of the large group (226).

3.7.3 Anthropometric Data

Anthropometry information of interest in this study included weight and height for the index children. The tools used to collect the data included bathroom scale (weight) and height board/stadiometer for taking height. Height of the children was taken while standing on a horizontal ground and without shoes, then the measurement were read out and recorded by the assistant in meters to the nearest 0.1 cm. The weight of children was taken with the participant standing upright on a weighing bathroom scale. While taking the weight, the children were also asked to remove excess clothing. The weight taken was recorded to the nearest 0.1kg.

3.8 Data Quality Control Assurance

To ensure the quality of data collected, the researcher took some steps including training data enumerators and pretesting of the questionnaires.

3.8.1 Training of Enumerators

Two research assistants were trained for one day on how to conduct the face-to-face interviews at household level and also how to obtain anthropometric data. The purpose and objectives of the study were also explained to them.

3.8.2 Pretesting of Study Instruments

The instrument was pre-tested at NPS with a small sample of the children. A pilot study using 10% (n=25) of the respondents was identified and followed to their homes, where

their parents were interviewed. The results were analyzed, and the few defects that were observed in the instrument were corrected and changes implemented before the actual data collection exercise. The result of analysis of the pre-testing sample was excluded from those of the main study. The researcher did not select a subset of the pretesting study population from a different school because NPS is a piloting school into the school gardening program, and, therefore, the characteristics of its pupils are dissimilar to those of any other neighbouring schools.

3.8.3 Validity

Two nutrition specialists examined the questionnaires for the study; feedback provided and this was integrated into the final questionnaire.

3.8.4 Reliability

The test re-test method was used to check for consistency in producing the same results. Twenty pupils comprising the pretest sample were randomly selected from a neighboring school and interviewed at the household level. After a week, the same respondents were visited and interviewed again to establish whether the responses obtained each time by the same tool were similar. The responses from the first interview and the second interview were then compared and areas of the tool found to have discrepancies were adjusted accordingly.

3.9 Data Analysis

Raw data was crosschecked for completeness and correct labeling daily. Data was then entered in an excel spread sheet and exported to SPSS and Nutri survey where subsequent descriptive and statistical analyzes were done on dietary and anthropometric data. Local food composition tables were used when analysing data using Nutri Survey. Local foods with their nutrient composition were added to the list provided in Nutri Survey software. The prevalence of stunting and wasting was statistically obtained using the World Health Organization's Anthro Plus version 1.0.2 statistical software (WHO, 2012). Analyzes of the social demographic data were performed using SPSS version 17 and descriptive and inferential statistical analysis of the data was computed. Variables including distribution of pupils per class and by gender, demographic characteristics of principal caregiver, crop and animal enterprise distribution per household, housing characteristics and hygiene and sanitation were analyzed.

Laboratory analysis of the school meal was also determined and macro and micronutrients analysed included: calories, proteins, lipids, vitamin A, iron and iodine. Cost of producing and providing the meal at school was also computed and a comparison done on different levels of contributions towards the SFP: including parents, school garden and program contributions. A higher level of cross tabulations and correlation test on the three hypotheses was done for further analysis and $P < 0.05$ was used to determine statistical significance.

3.10 Ethical and Logistical Consideration

Approval to conduct this research was obtained from the Graduate school Kenyatta University, Nairobi. Ethical clearance was sought from the Ethical Board at the College of Health Sciences Makerere University, Kampala. Permission to conduct the study was also obtained from the Uganda National Council of Science and Technology (UNCST). In addition permission to conduct the study was obtained from the Resident District Commissioner of Kamuli District who is a representative of the Office of the President in the district. Local authorities that govern the community in which the school is situated gave a written consent for the study to be conducted at the school.

A written consent from the school administration was obtained after all relevant documents from the district, and the UNCST were presented to the school head teacher. The parent/ guardian signed a written consent form while the pupils gave their assent to take part following a meeting where the purpose and objectives of the study were explained to them. Participants were informed that there would be no risk if they took part in this study and that their participation is entirely voluntary, and they could withdraw from the study at any time if they wished. The participants were also made aware that all their responses were to be kept confidential and only accessible to the researcher. Any names on the interviewing tool were not made public and were not included in the data entry and analysis. The participants were also assured that refusal to take part in the study will not affect the usual services that the child receives at school. Records identifying the participants have been kept in a secure location and confidential

CHAPTER FOUR: RESULTS

4.1 Introduction

Results of the descriptive and inferential statistical analysis of the data and their interpretation as per the objectives are presented in this chapter. Results are reported and discussed in six sections: demographic and socio-economic characteristics of the respondents; dietary intake of the of the children in NPS, nutrient composition of the school meal (nyoyo), nutritional status of the children in NPS, and comparisons of the costs incurred by donors in running the school feeding before and after the implementation of school feeding program and finally multivariate analysis to show correlation between different variables of the study.

4.2 Demographic and Social Economic Characteristics of Pupils and Caregivers

A total of 226 pupils with their parents took part in this study and data analysis was done on 226 respondents. Out of all the pupils assessed, 114 (50.4%) were boys, and 112 (49.6%) were girls. The mean, mode and the median age for the pupils' were 10.7 ± 2.4 years, 12.9 years and 10.9 years respectively as shown in Table 4.1.

Table 4.1; Mean, Mode and Median Age in Years for Pupils at NPS

N=226	Age in years
Mean	10.7±2.4
Median	12.9
Mode	10.9
Maximum Age	18
Minimum Age	5.4

The frequency of distribution of the pupils by percentage per class is shown in Table 4.2. According to Table 4.2, Grade five had the highest number of pupils 20.4% (46) participating in the study while grade seven had the least number of pupils 8.4% (19) taking part in the study.

Table 4.2: Frequency Distribution of Participating Pupils by Class and by Gender

Class	Frequency (n)	Frequency distribution by Sex		Percentage (%)
		Male	Female	
Grade 1	36	21	15	15.9
Grade 2	36	16	20	15.9
Grade 3	26	13	13	11.5
Grade 4	36	24	12	15.9
Grade 5	46	25	21	20.4
Grade 6	27	8	19	11.9
Grade 7	19	7	12	8.4

4.2.1. Distribution of the Caregivers by Marital Status

The majority of the pupils came from male-headed households 187 (82.7%) with most principal caregivers being the mothers 193(85.4%) (Table 4.3)

4.2.2. Distribution of the Caregivers by Age

Most of the pupils came from homes where the parents were married (86.3%) with the majority of the caregivers being in the age group of 31-45 (54.0%) as indicated in Table 4.3.

4.2.3 Distribution of the Caregivers by Level Education

In regard to education, slightly more than half (59%) of the caregivers at NPS had attended school, of whom, the majority (58.1%) were male. Findings of study found out that of the respondents who had attended school, most (50.4%) of them had attended primary school education as indicated in Table 4.3.

Table 4.3: Demographic Characteristics of the Principal Caregiver

Variable	Frequency	Percentage
Principal care giver		
Mother	193	85.4
Grandmother	18	8.0
Aunt	5	2.2
Others (Father)	10	4.4
Occupation		
Casual Labourer	7	3.1
Housewife	15	6.6
Farmer	200	88.5
Others	7	1.8
Marital Status		
Single	18	8.0
Married	195	86.3
Separated	10	4.4
Divorced	3	1.3
Education Level		
None	18	8
Primary	115	50.8
Secondary	93	41.2
Age		
20-30 year	36	38.0
31-45 years	122	54.0
46-55 years	13	5.8
Above 55 years	5	2.2
Sex of household head		
Male	187	82.7
Female	39	17.3

4.2.4 Social Economic Characteristics of the Caregivers at NPS Participating in the Study

The study examined the socioeconomic characteristics of pupils' households such as occupation of caregiver, housing characteristics, ownership of consumer goods and the source of cooking fuel.

4.2.4.1 Type of Occupation of Caregivers of Children at NPS

Majority (88.5%) of the caregivers of children at NPS were small-scale farmers (peasants), 6.6% house wives, and 3.1% casual laborers. The peasants group mainly grew crops and reared animals. The study found that there was an emphasis on food crops, cash crops, and vegetables, though in small scale. The three predominant food crops grown by the household of the NPS pupils was mainly maize (97%), sweet potato (81%) and cassava (75%). "Posho" (maize meal stiff porridge) and sweet potatoes were the main traditional staples/food crops consumed by predominant ethnic group Basoga residents in Kamuli District as shown in Figure 4.1. These findings are in agreement with those of the Uganda Bureau of Statistics that indicated that major crops grown in rural Uganda are maize, cassava (Uganda Bureau of Statistics, 2009).

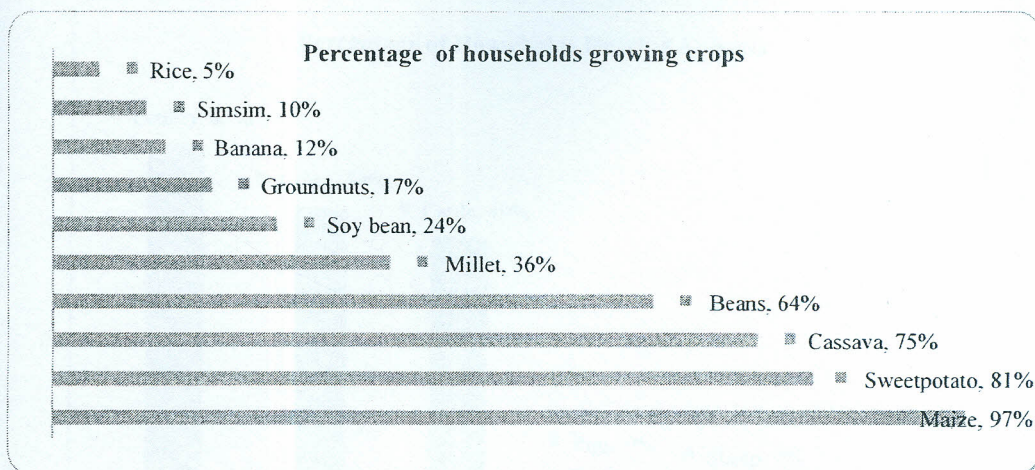


Figure 4.1: Percentage of Household Growing Crops

With respect to animal rearing, the investigator found out that most commonly reared animals by the households were poultry (65%), goats (54%) and cattle (49%). These were mostly local breeds domesticated by the household. This observation agree with Uganda Census of Agriculture 2008/2009 Volume iv which indicated that local poultry, goats and cattle breeds were mostly reared in Kamuli District and other rural areas of Uganda (Ministry of Agriculture, Animal Industry & Fisheries, 2008). Figure 4.2 shows the percentages of household, which reared animals.

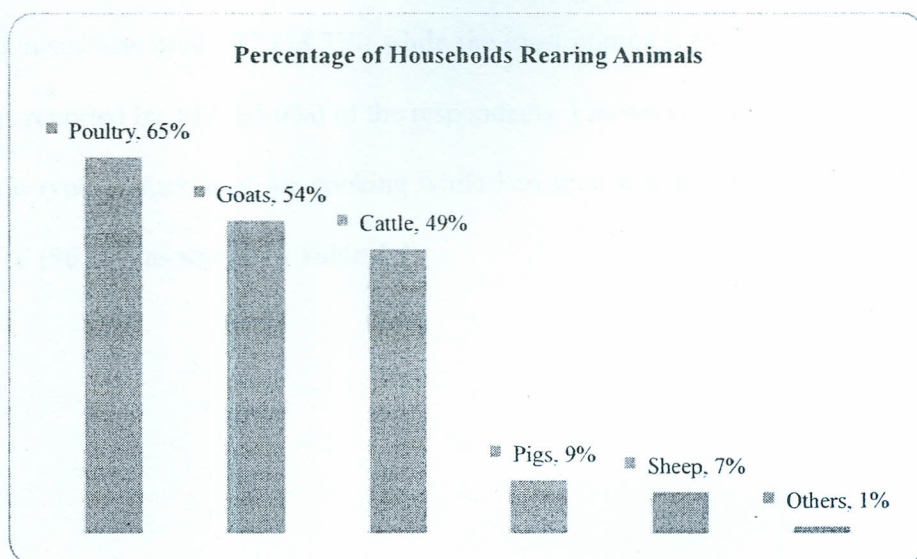


Figure 4.2: Percentage of Households Rearing Animals

4.2.4.2 Housing Characteristics and Fuel Use by Households of Children at NPS

The housing characteristics of the pupils' dwellings were established as a proxy indicator of their wealth and socio-economic status (Table 4.4). This was hoped to have implications on the capacity of the household to provide the basic needs for the pupils. Temporary structures such as mud houses are an indicator of low standards of living. Some of the indicators included in this study were: house ownership, the type of material used to build the house, number of rooms in the house, number of household members living in the house, fuel used for cooking, source of water, type and ownership of toilet and bathroom. The majority of the pupils lived in houses owned by their parents 218 (96.9%), with most of the houses having two rooms and shared by an average of 7 members. These findings are in agreement with the Uganda Bureau of Statistics (2014), which revealed that housing in the rural areas, is a problem characterized by overcrowding to an average of six or more people per room. The predominant floor type

in the houses was mud 177 (78.3%) while the most common roofing material used was grass as reported by 147 (65.0%) of the respondents. Firewood 211 (93.4%) was the most common type of fuel used for cooking while kerosene was the main source of lighting used 218 (96.4%) as shown in Table 4.4.

Category	Count	Percentage
Type of house		
Wattle and daub	14	6.2%
Disposable material	0	0%
Others	0	0%
Type of floor		
Grass	17	7.5%
Mud floor	17	7.5%
Mud floor with dung	37	16.4%
Earth	4	1.8%
Others	0	0%
Cooking fuel		
Acacia	3	1.3%
Electricity	0	0%
Charcoal	10	4.4%
Firewood	211	93.4%
Others	0	0%
Source of lighting		
Electricity	0	0%
Kerosene	218	96.4%
Solar	2	0.9%
Candle wax	3	1.3%
Others	0	0%
Number of rooms		
1 room	40	17.8%
2 rooms	104	46.4%
3 rooms	46	20.4%
4 rooms	33	14.7%
Number of household members		
1-3 members	69	30.6%
4-7 members	71	31.5%
8-10 members	62	27.5%
11-16 members	18	8.1%

Table 4.4: General Characteristics of the Study Household

Variable	Frequency (n=226)	Percentages (%)
Type of Household		
Rented	4	1.8
Owned	218	96.9
Others (staff housing)	8	1.3
Type of Roof:		
Iron sheet	79	35.0
Grass-thatched	147	65.0
Disposable material	0	0.0
Others	0	0.0
Type of Floor:		
Cement	17	7.5
Mud floor	177	78.3
Mud floor with dung	28	12.4
Earth	4	1.8
Others	0	0.0
Cooking fuel		
Kerosene	3	2.2
Electricity	0	0.0
Charcoal	10	4.4
Firewood	211	93.4
Others	0	0.0
Source of lighting		
Electric	0	0.0
Kerosene	218	96.9
Solar	4	1.8
Candle wax	3	1.3
Others	0	0.0
Number of rooms:		
1 room	40	17.7
2 rooms	104	46.0
3 rooms	44	19.4
4 rooms	35	15.5
Number of household members		
4-5 members	63	27.8
6-7 members	78	34.5
8-10 members	62	27.4
11-16 members	14	6.2

4.2.4.3 Ownership of Land and Household Durable Consumer Goods

Generally, income is not a reliable estimate for economic status in developing countries (Howe *et al.*, 2008). As such, the researcher sought to establish ownership of household goods and assets as an indicator of economic status of the households in the study. The most valued asset in this community was land because farming was the main activity practiced at the pupils' homes; land is an essential asset supporting any form of farming. The study results revealed that the majority (96.5%) of the respondents owned land. Ownership of household durable consumer goods among the caregivers in the study was as follows: bicycle (95.1%), radio (94.7%) and mobile phone (82.7%). These observations are in agreement with those by Uganda Bureau of Statistics (2014) provisional results that cited land, bicycles, radio and cell phones as the most popularly owned assets in Uganda. The bicycles are used by most of the household as a mode of transport and a means of ferrying/carrying goods. The radio is also seen as the media to receive information.

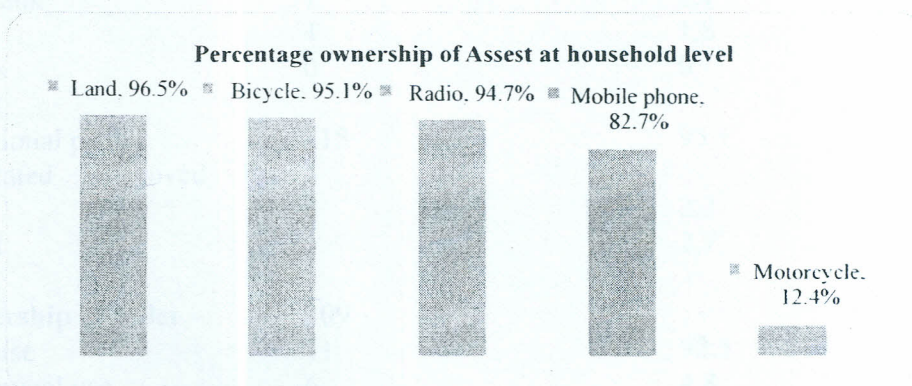


Figure 4.3: Percentage Ownership of Assets in the home

4.2.4.4 Water, Hygiene and Sanitation Characteristics of the Households of Children at NPS

Provision of safe water and sanitation is very crucial for improving the quality of life of any community. The source of water, presence of pit latrines and bathroom coverage were some of the factors taken into consideration in this study. These will have an effect on the health and nutrition status of a person. The major source of safe water supply in Namasagali was the boreholes and the majority (88.9%) of the pupils used borehole water, for home consumption. Most of the households owned pit latrines (92%) with the traditional pit latrine being the most common toilet (95.1%) used by the pupils at home. The use of bathrooms was also very high with 91.2% of the households having bathrooms as indicated in Table 4.5.

Table 4.5: Water, Hygiene and Sanitation Characteristics of the Households of Children at NPS

Variable	Frequency	Percentage
Source of water		
River/spring/swamp	14	6.2
Borehole/well	201	88.9
Rain/tank	7	3.1
Tap	4	1.8
Others	0	0
Toilet		
Traditional pit	215	95.1
Ventilated Improved Pit (VIP)	5	2.2
No pit	6	2.7
Ownership of toilet		
Own use	209	92.5
Communal use	11	4.8
Not applicable	6	2.7
Bathroom		
Yes	206	91.2
No	20	8.8

4.3 Nutritional Content of the Meals Taken at NPS under the School Feeding Program

The nutrient content of the meal consumed at the school was determined through a laboratory analysis at the Makerere University Department of Food Science. From the analysis the energy content of the school meal was 341kcal, Protein was 12g, Fat was 0.8g, Iron was 0.0195ug, Vitamin A was 16.715ug Retinol Activity Equivalent (RAE) and the Iodine content was 0.0037ug. Laboratory results after analysis on the school lunch are as presented in Table 4.6.

Table 4.6: Nutrient Content of School Lunch at NPS (Maize, Beans and Collard Kale “Sukumawiki”)

Parameter measured	Unit (100g)	measure	Results Sample Content
Energy	Kcal		341
Protein	G		12
Fat/oil	G		0.8
Vitamin A	µgRAE		16.715
Iron	µg		0.0195
Iodine	µg		0.0037

This results are similar (with the exception of Vit A and iron) when the composition of the school meal is estimated using the online menu planner: it yields 306 Kcls, 11.666 grams of protein, 3.3 grams of fat, 1.083ugRAE of Vit A. Fe 3.97 µg.

4.4 Dietary Intake of the Children in Namasagali Primary School

The type of food consumed by the respondent in the past 7 days was obtained using a food frequency questionnaire while the 24 hour recall was used to obtain information on

the quantity of all foods and drinks consumed by the respondent in the last 24 hours of the previous day.

4.4.1 Dietary Intake as Reported by the Food Frequency Questionnaire

The researcher visited the homes of each child and during the interview in the presence of the caregiver different foods from the various food groups were read to the pupil who in turn had to respond by stating the number of times he/she consumed that food in a week. Results indicated that groundnuts (42.8%), beans (35.4%), soybeans (30.2%) and silver fish (50.0%) were the main source of protein among pupils in the household. The households consumed more plant protein sources compared to protein from animals and animal products. The most common animal source protein was silver fish, which was consumed at least 3 days in a week by most households. The most common cereal consumed was 'posho' (maize flour) 62.1% and the most common root tuber among the household was white sweet potatoes (65.3%). Fruits were consumed mostly on seasonal basis and mangoes (22.5%), jackfruit (19.7%), papaya (19.1%) and oranges (13.8%) were the most common fruits eaten by the pupils. The most common vegetables (greens) eaten by the pupils at home were the eggplant (24.1%), tomatoes (27.9%), and leaf amaranth- (26.3%) Table 4.7.

Table 4.7: Frequency of Consumption (%) of Selected Foods by Households in the Preceding 7 days

Food Group	Frequency of consumption as percentage (n=226)
Cereals roots and tubers	
Sweet potato	65.3
Maize	62.1
Cassava	31.9
Millet	25.0
Rice	13.4
Animal source protein	
Meat (Beef)	7.0
Silverfish	50.0
Fish	22.4
Eggs	4.9
Milk	9.0
Plant source protein	
Soy bean	30.2
Beans	35.4
Groundnuts	42.8
Mushroom	1.3
Vegetables	
Leaf amaranth (<i>do do</i>)	26.3
Tomatoes	27.9
Eggplant	24.1
Cabbage	9.0
Fruits	
Mangoes	22.5
Oranges	13.8
Pawpaw	19.1
Jackfruit	19.7

4.4.2 Macro and Micronutrient Intake by the Pupils in the Preceding 24-hour

From the 24hour recall data the study indicated that the mean average consumption of energy, protein, fats, vitamin A, Iron and Iodine was 218 ± 133 kcal, 3.79 ± 3.77 g, 1.54 ± 1.55 g, 43.75 ± 35.33 ugRAE, 0.154 ± 0.110 ug, 0.0088 ± 0.0050 μ g respectively (Table 4.8). Table 4.8 also shows the total consumption per day for the pupils from school and home in terms of energy, protein, fats, vitamin A, iodine, and iron was 1071kcal, 33.79g, 3.54g, 85.54 μ g retinol, 0.0178ug and 0.6415 μ g respectively. This represent % of the RDA; the pupils did not meeting their Recommended Dietary Allowance (RDA) for energy and protein.

Table 4.8: Consumption of Nutrients at Home and School

Nutrient	Home consumption	School Lunch	Mean Intake/day	RDA
Energy kcal	218 \pm 133	853 \pm 178	1071	2000-2200
Protein (g)	3.79 \pm 3.77	30 \pm 14	33.79	40-46
Fats (g)	1.54 \pm 1.55	2 \pm 0.5	3.54	>23
VitaminA (ug/RAE)	43.75 \pm 35.33	41.787 \pm 25.3	85.54	400-600
Iodine (μ g)	0.008 \pm 0.005	0.0098 \pm 0.003	0.0178	120-150
Iron (μ g)	0.154 \pm 0.110	0.0488 \pm 0.07	0.6415	10-15

RDAs were adopted from WHO 2006/2007

The percentage contribution of lunch from school and at least two meals from home (breakfast and supper) for a particular nutrient according to age category are as indicated in Table 4.8. The lunch at school significantly contributed to the pupils' RDA as seen from the table 4.4.2. At home, the pupils received less of the nutrient for their age with a large percentage of nutrient consumed being obtained from the school lunch. Most pupils

came to school without taking breakfast, and this would have an impact on their RDA and overall nutritional status.

The meal served at the school contributes 853kcal for the pupils per day. The school feeding program at NPS provides one meal in the form of a solid lunch to the 226 pupils. According to WFP, for a day school, school-feeding lunch should provide between 30-45% of energy for the pupil per day (WFP, 2010).

4.5 Nutritional Status of the Children in Namasagali Primary School

The prevalence for the respective anthropometric measurements taken Body Mass Index for age and the stunting at baseline indicated that 1.5% and 13.4% of the pupils had a low Body Mass Index for Age and stunted respectively. After introducing the SFP, the prevalence for chronic malnutrition among the pupils did not change much. BMI-for-age and stunting ratios were reported as 1.8 % and 13.4 % respectively, indicating that the SFP did not have much of an impact on the pupils' nutrition status. The proportion of stunting (height-for-age) and BMI –for- age are as shown in Table 4.9:

Table 4.9: Prevalence for BMI-for-age, Height-for-age z scores in 2012. Sex disaggregates data

	Female (n=112) 95% CI	Male (n=114) 95% CI	Total (n=226) 95% CI
Stunting (Height-for-age)	13.3 (7.6-20.9)	13.5 (4.5-28.8)	13.4 (6.3-24.0)
Low BMI-for-age (thinness)	0 (0-3.2)	3.5 (1.0-8.8)	1.8 (0.5-4.5)

4.6 Morbidity and Illness among the Pupils

Forty-one percent of the pupils reported falling sick in the previous two weeks prior to data collection. The most common illness reported were malaria (48%), acute respiratory infections (23%), diarrhoea (12%), stomach ache (6%) and skin infections (12%) (Figure 4.5).

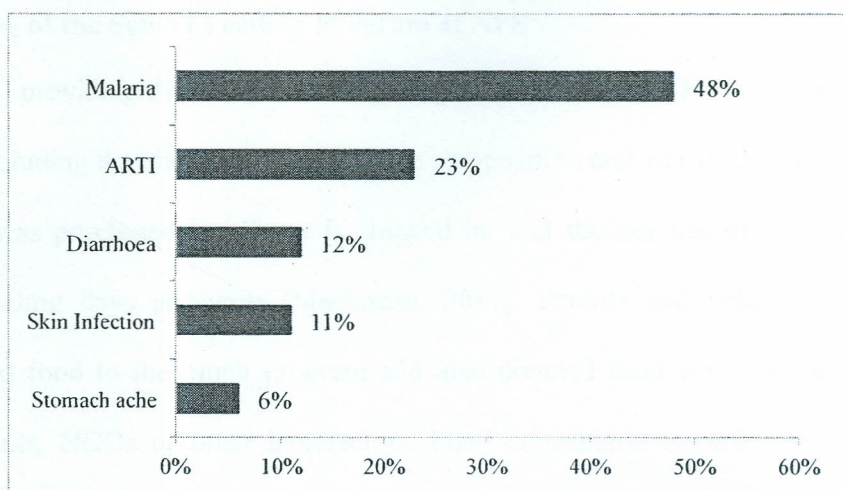


Figure 4.5: Percentage of Pupils Sick in the Last 2 Weeks

When the pupils fell sick, the majority of the caregivers 200 (88%) took them to the health Centre (average distance of 2km from the home) to seek medical attention (Table 4.10).

Table 4.10: Health Seeking Behaviour by the Caregivers when the Child falls Sick

	Frequency	Percentage
Steps taken when child falls sick		
• Rush to health Centre	200	88.5
• Self-medication	24	10.6
• Did not seek treatment	2	0.8
• Others	0	0

4.7 Costing of the School Feeding Program at NPS

The cost of providing the School Feeding Program (SFP) at the NPS depended on several factors, including the choice of modality, the composition and size of the rations, whether the food was purchased locally or is shipped in, and the number of beneficiaries and school feeding days per term (Machocho, 2011). Parents and community members contributed food to the lunch program and also donated food was considered coming from parents, NGOs or other benefactors. Food contributed towards the SFP can be directly used or sold (monetization) for the purchase of needed items. All these factors were taken into consideration when costing the SFP at NPS. The cost difference of having an SFP supported by the program verses the parents and the school gardens supporting SFP were both taken and comparison done on the two modalities.

4.7.1 Costing Meal per Term

The meal at NPS consisted of maize, bean, vegetables (mostly collard kales), oil and iodized salt. The meal was designed to feed 226 Children. Maize and beans were mixed at a ratio of 2:1, and then collard kale, oil, and iodized salt added based on the quantities cooked. Each child consumes 26g of beans and 52g of maize, approximately 20g of kale, 0.6g of oil and 2.2g of iodized salt of raw food products (dry weight) in 100 grams. This is cooked and is measured using a 250gm cup and served on a plate or any container that the child brings to school. Food products or ingredients are obtained from the parents, school garden, and the CSRL program. They are either consumed directly or monetized to purchase additional ingredients and pay other costs. Stakeholder's contributions were

monitored closely to determine how much they contributed towards the SFP. The total estimated cost of feeding 226 pupils for 89 days (1 term) was UShs.

2,288,785 (\$915.5) (Table 4.11)

Table 4.11: Total Cost of providing NPS with Lunch of Maize, Beans and Kales (Sukuma wiki) for 226 Pupils for 89 Days (One Term).

Item	child/d	226pupils/89	Unit cost	Total Cost (UShs)	Total cost (USD)
Maize	52g	1046 (kg)	600	627,600	251.04
Beans	26g	523 (kg)	2000	1,046,000	418.37
Collards	10g	201 (kg)	1000	201,140	80.46
Cooking Oil	0.6mls	12 (litres)	6500	78,445	31.38
Salt	2.21g	89 (pkts)	400	35,600	14.24
Firewood		1 truck	150,000	150,000	60
Labour	50,000/month		3	150,000	60
Total				2,288,785	915.49

4.7.2 Contribution made to the SLP by the Stakeholders

When the solid high nutrient meal (*whole maize and beans mix meal*) for SFP was introduced at the NPS in 2010, the CSRL program was providing all the ingredients for the meal. In addition, the program paid the cook who was preparing the meal. The children brought the firewood that was used to cook the meal. At that time, the program was spending about UShs. 2,288,785 (\$915.5) per school term to feed the 226 children who were eating the lunch (Table 4.11).

However, the goal of the CSRL program was to make the SFP lunch sustainable by linking it to the school gardens and also encourage the parents and the local community to contribute towards feeding the children. The plan was to have the program continue when the CSRL program exits from the community. The CSRL program worked with the parents and the school community to start including parents' contribution and produce from the garden to provide the meal. Over time, the school has faced a big challenge obtaining beans from the school garden. Producing beans in the school garden at NPS remain a challenge because of the poor soil types and climatic conditions related issues like insufficient rainfall; this is a problem that affects the whole of Namasagali Parish. Previous attempts to produce beans as an enterprise from NPS garden led to either total crop failure or very low yields, which resulted in financial losses. Hence, the program realized producing beans from the school gardens was not a viable venture. Alternative crops that could be sold to purchase beans had to be identified for cultivation.

Maize can be produced at the gardens, but the yields are still below the expected output resulting in less than the break-even point. This has been attributed to poor soils and pests mainly mobile termites that are a problem at the school. The program is working with other researchers to adopt and adapt technologies that will enhance the maize yield to make it viable for school gardens. At the moment high-value crops mainly bananas, vegetables and grain amaranth are the main enterprises being practiced at the school garden. These crops once harvested are sold, and the funds used to purchase food items for the SFP. Initially, the program purchased all the ingredients and with little support from the parents and the school community. However, this has since changed, and the

gardens are now being used to supplement the SFP, with support from the parents who are contributing part of the maize used in the school lunch. Table 4.12 and figure 4.6. show how the SFP was sustained with support from the program in 2010 and 2011 with parents, program and the school.

Table 4.12: Contribution made by the different Stakeholders towards the SFP in 2011 in NPS

Stakeholders	Contributions	Amount (Ushs)	Amount (US)	%
Program	Garden inputs, cook salary, cooking oil, beans, labour, land hire.	1,435,000	574	27.8%
Parents	Maize	766,800	306.72	14.9%
School Garden	Grain amaranth, Collards, Tomatoes	2,950,000	1180	57.3%
Total Contribution		5,152,500	2060.72	100

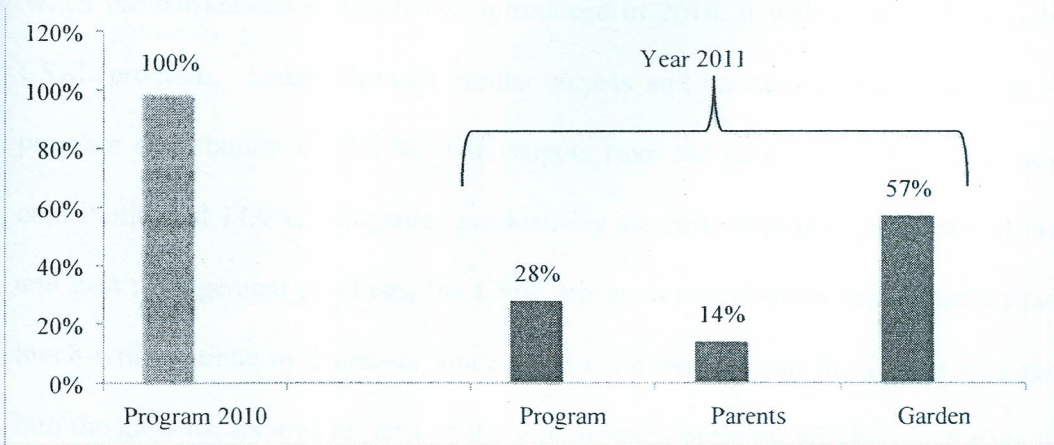


Figure 4.6: Percentage Contribution made by Program, Parents, and School Gardens in 2010 and 2011

In 2010, the program would contribute all food items towards the SFP and spend an equivalent of UShs. 2,288,785 (\$915.5). In 2011, the program started including proceeds from the school gardens as a way to supplement the SFP. Parents contributions in kind (maize) was also received and supplemented in the lunches. The program invested 1,435,000 Uganda shillings (574 US Dollars) in the school gardens in the form of seed, labor, fertilizer, herbicides and land preparation. This same year the program paid for the cooks wages and purchased a few kilograms of beans to support the lunch program. The parents contributed 1278 kg of maize equivalent to 766,800 Uganda Shillings (306.72 US Dollars). This was more than enough maize needed to feed the entire school. The school gardens in the end produced an equivalent of 2,9500.000 Uganda shillings (1180 US dollars) in the form of tomatoes, grain amaranth, and collards. Some of these was directly used in the lunches of the pupils, and part of it sold to purchase beans.

When the nutrient-dense lunch was introduced in 2010, it was supported 100% by the CSRL program. Today, through garden outputs and parents' contributions, the CSRL program contribution is 27.8 %, with outputs from the gardens at 57.3 % and parents' contributions at 14.9%. As garden productivity increases through improved horticultural and pest management practices, the CSRL program contribution toward the cost of the lunch will continue to decrease. Since part of the output from the garden is reinvested into the gardens, the overall cost of the school lunch program will be less for the CSRL program. The school gardens and the parents' contribution have greatly reduced the cost of the SLP to CSRL program. These have also improved the quality and diversity of the school children's diet.

4.7.3 Food Production in the School Gardens

One acre of school land was used to produce three crops each (tomatoes, grain amaranth and collards). The program invested UShs. 1,107,500 (\$443) and harvested produce worth UShs. 2,950,000 (\$1180), which were more than half of the initial capital (Table 4.13). Collards are the most yielding crop from the school gardens followed by grain amaranth and tomatoes, 40.7%, 33.9% and 25.4% respectively.

Table 4.13: Acreage Planted per Enterprise and the Input and Output obtained from the School Garden

Enterprise	Acreage planted	Input cost	Output
Tomatoes	1	UShs.387, 500 (\$155)	UShs.750, 000 (\$ 300)
Grain amaranth	1	UShs. 432,500 (\$173)	UShs.1, 000,000(\$400)
Collards	1	UShs. 287,500 (\$115)	UShs.1, 200,000(\$480)
Total		UShs.1, 107,500 (\$443)	UShs.2, 950,000(\$1180)

From proceeds of the school garden, UShs. 5,152,500 (\$ 2061), the school is able to pay for maize (\$251), beans (\$418), kales (\$ 80), iodized salt (\$14), firewood ,cooking oil,and labour (\$ 100) and still remain with a balance of \$ 978 which can be reinvested to ensure sustainability of the program. If the school garden must feed the entire school, then it is important that production areas is expanded to at least two acres and also improve the productivity. The yield of all the crops produced were below optimum, which was attributed to poor rainfall, poor soils (CSRL Report, 2011). The CSRL program is working with VEDCO and ISU Service Learning program to introduce technologies likes irrigation, soil fertility improvement and disease tolerant/resistant varieties to increase productivity. The gardens are therefore a cost effective way of supplementing the SFP especially if they are expanded in relations to the number of pupils at the school.

4.8 Relationship between Factors (Demographic and Socio-economic Characteristics, Dietary Intake, Nutrient Composition of School Meals) and Nutritional Status of Children attending NPS

Analysis of nutrition status nutrition status (BMI for age) was done with respect to demographic and socio-economic, dietary intake, nutrient composition of school meals.

4.8.1 Nutritional Status about Demographic and Socio-Economic Characteristic

Table 4.14. Chi square test for selected socio-economic characteristics and nutrient intake in relation to nutritional status

	X^2	df	P Value
Level of education vs. nutritional status			
BMI-for-age	27.251	20	0.128
Stunting	16.952	10	0.075
Occupation vs. nutritional status			
BMI-for-age	44.551	28	0.024
Stunting	42.86	12	0.001
Level of education of parents vs. nutritional status			
BMI-for-age	30.931	20	0.056
Stunting	38.928	6	0.001
Marital status of the parent vs. nutritional status			
BMI-for-age	9.26	8	0.321
Stunting	29.269	4	0.001
Macronutrient intake vs. nutritional status			
BMI-for-age	44.643	14	0.001
Stunting	56.902	20	0.001
No. of rooms for sleeping vs. nutritional status			
BMI-for-age	32.094	12	0.001
Stunting	13.982	4	0.007
Main fuel for cooking vs. nutritional status			
BMI-for-age	41.911	16	0.001
Stunting	33.065	8	0.001

A significant positive relationship was found in education, occupation and macronutrient intake

Regression analysis, which was performed to determine the relation between BMI for age (dependent variable) and demographic characteristics (Table 4.14), yielded the following equation.

Regression equation: $y = 11.294 + 0.121x_1 + 1.341x_2 - 0.378x_3$; here x_1 = Education Status of parents, x_2 = occupation of the parents/caregivers, x_3 = marital status of the parent.

The level of BMI age is 11.294 when all other variables are zero. From the equation, it can be deciphered there exists positive correlation between BMI for age and education level of the parents such that an increase education level by one unit results in an increase in BMI for age by 0.121. If the respondent is/has employed parents, the BMI for age is likely to increase by 1.341 unlike when the respondent has parents who are not employed. There was a negative relationship between BMI for age and marital status of the parents/caregivers of the study participants in which an increase from one category to the other led to a decrease in BMI for age by 0.378.

4.8.2 Nutritional Status in Relation to Dietary Intake

The researcher sought to determine the association between nutrition status of children at NPS and dietary intake such as food. There was weak relationship between BMI for age and number of meals consumed per day ($r = -0.120$; $p = 0.021$). A negative significant correlation was recorded for the dietary composition of the school meal and nutrition status ($r = -0.0056$, $p = 0.087$). This was translated to mean that despite the adequacy of the school meal it did not still reflect a better nutrition status because of the various other variables involved.

A chi-square analysis between macronutrient intake and nutrition status revealed a significant positive relationship between nutrition status (BMI of age and Height for age). Children who had taken average macronutrients were more likely have better nutrition status.

CHAPTER FIVE: DISCUSSION

5.1 Demographic and Social Economic Characteristics Households of Children in NPS

This study recruited nearly an equal number of male and female children attending NPS with a mean age of 10.7 ± 2.4 years. These findings are in agreement with the study by Wells (2009), which showed that Uganda is rapidly closing its gender parity gap in primary school enrollment. Age and sex are important determinants of an individual's nutrition status (Ogden, Carroll & Flegal, 2008). These parameters were instrumental in the determination of BMI for the age of the study participants.

Demographic characteristics such as age and marital status of parents and/or caregivers are known to contribute to child wellbeing because such parameters are known to influence the socio-economic profiles of households. For example, it is expected that moderately to highly educated household heads hold high paying jobs (better occupation) having better purchasing power of the basic needs such as shelter, food and medication; all which can have a positive effect on the children's nutrition and health status. Contrary to this households whose heads are poorly educated are likely to engage in subsistence farming. In this study, the majority were subsistence farmers growing food crops and rearing a few animals. These findings are in agreement to those of Uganda Bureau of Statistics in which it was revealed that rural dwellers in Uganda engage in small-scale farming (Uganda Bureau of Statistics, 2009).

Parents/caregiver's level of education influences their food choices as well as their economic status occupation. Studies by Miller *et al.*, (2009) and Bradley *et al.*, (2002) have shown that educational attainment has a strong effect on health behaviors and attitudes and thus affecting the nutrition status of the people. This socioeconomic status is associated with a wide array of health, cognitive and socioemotional outcomes in children, with effects beginning prior to birth and continuing into adulthood. Mother's education is strongly inversely associated with stunting (Bradley *et al.*, 2002 and Miller *et al.*, 2009).

A Study by Faith *et al.*, (2004) revealed that knowledge is a significant factor affecting dietary practices. This study agreed with those of Faith *et al.*, (2004) assertions because many parents and caregivers had not attended school, and of those who had only completed primary school level, a situation that can be attributed to lack of knowledge among the participants in respect to high stunting levels witnessed among the children at NPS. Lack of education and therefore knowledge of disease prevention and nutrition management in the study participants is likely to be one of the chief contributors to poor nutrition status among children attending NPS.

5.2 Dietary Intake of the Children in NPS

It was hypothesised that the school meal served at NPS consisting of whole grain cereal; legume, collards, vegetable oil and salt did not significantly contribute to the daily dietary intake of caloric and nutrient intake, for the child of between 6-18 years based on the RDA. Results from the laboratory indicated that the meal provided a significant amount

of calories (853kcal) and all the other major nutrients (proteins, fats, iron, vitamin A and iodine; 30g of proteins which is about 68% of the RDA, 2 g of fats, 0.0488ug of iron, and 0.0098ug of iodine). One of the main meals that a person eats in the day is lunch; and this should provide at least a third of the RDA given their role in ensuring good nutrition and health for the child (Musamali, 2007). According to the WFP, (2010) a primary day school feeding programs should supply two meals, a light meal at the start of the day supplying approximately 400-600kcal and lunch supplying 700-900kcal. Namasagali Primary School provides only lunch with no light meal/breakfast in the morning. From the study, the amount of calories and nutrients received by the children from the school lunch is much higher than what the children receive from home. This may be attributed to the fact that most of the families consume one meal at home (supper) as coping mechanisms of saving food for later use. The school lunch plays a significant role in its contribution to the overall diet adequacy of the pupils as it contributes more than a third of the RDA of the nutrients. It is also vital in ensuring good nutrition, which is important in mental development and consequently good academic performance.

5.3 The Nutrient Quality and Quantity of the Meal Served at NPS

Nutrients of interest in this study were energy, protein, fats, vitamin A, iron, and iodine. In the analysis, 100 grams of the food for the NPS kitchen yielded, 341 calories, 12 grams of protein, 0.8 of fat, vitamin A 16.715ug, 0.0195ug of iron and 0.0037ug of iodine. This translated to 853 calories, 30 grams of protein, 2 g of fat, vitamin A 41.787ug, 0.0488ug of iron and 0.00488ug of iodine in servings of 250 grams of the 'nyoyo'. Essentially, lunch should provide 1/3 of 1850 Kal (616 kcal). In the NPS's case,

it provided slightly more than enough. The servings were slightly elevated because these children come from poverty-stricken households, and there is a very high possibility that the breakfasts and dinners at home combined may not meet the remaining 2/3 of the daily servings.

5.4 Nutrition Status of Children at NPS

It was hypothesized that the school meal did not significantly change the nutritional status of pupils at Namasagali Primary School (NPS). From the results obtained the stunting and BMI-for-age levels in this study did not change much after intervention of a School Feeding Program; an indication that there could have been a spill-over of malnutrition from childhood to school age. The null hypothesis was therefore accepted. The majority of the pupils were stunted an indication that the pupils could have suffered long-term deprivation of food shortage. Lunch contributed significantly to the total daily caloric and nutrient intake, and this should have translated to an improvement of the nutritional and health status for the pupils. However from this study the nutritional status did not change much even after introducing a solid meal at the school that is high in caloric and nutrient intake as compared to what they initially consumed (Maize meal porridge 50kcal). This could also be explained by the fact that most of the pupils who are receiving lunches at school and also contributing a higher amount of grain towards the feeding program, were not given enough to eat at home (Personal Communication, 2012).

The parents are normally left in a dilemma of whether to contribute food for the SFP or use it at home. Normally when the child is given grain to take to school, then his portion

is at school and sometimes this child is left to go hungry at home. A higher level of analysis showed that the girls had a low BMI-for-age compared to the boys while the boys are much more likely to become stunted compared to their female counterparts. This can be explained by the fact that girls normally begin puberty at an early age (8-13 years) as compared to the boys (9-14 years), therefore the physiological changes occurring "late" in the boys could be a contributor to the possibility of them being stunted more as compared to the girls. Literature continues to demonstrate that in sub-Saharan Africa, the male children under five years of age are more likely to become stunted than females, which might suggest that boys are more vulnerable to health inequalities than their female counterparts of the same age groups (Wamani *et al.*, 2007).

The results of this study are in agreement with a similar study conducted in Kenya's Nyambene District where the SFP did not have any significant impact on the nutritional status of the pupils (Meeme *et al.*, 2010). Though there was an improvement in the nutrient quality of the meal served at lunchtime, this made little or no effect to the nutritional status of the children at NPS. According to Musamali, 2010, wasting in school children can be corrected through SFP and can also prevent severe cases among the pupils. From this study, we can conclude that the amount of calories and nutrients consumed by the pupils from the school lunches is much higher compared to what they receive at home.

5.5 Relationship between Factors (Demographic and Socio-economic Characteristics, Dietary Intake, Nutrient Composition of School Meals) and Nutritional Status of Children attending NPS

5.5.1 Correlation between Nutrition Status, Demographic and Socio-Economic Characteristics

The significant positive correlation witnessed between education level and occupation with BMI for age and height for age points out to the fact that individual demographic characteristics influence the people nutrition status in different ways. The children whose parents were educated and had better occupation had a better nutrition status. This was attributed to the fact that educated parents and employed had higher purchasing powers of the basic amenities including food, shelter and healthcare. Similar results were obtained in a study done in Kenya, which indicated that the demographic characteristics of the parents (higher employment status and higher levels of education) were positively correlated to children's nutrition status (Mwangi *et al.*, 2002).

Results from this study indicate that malaria (48%) is the most common illness that the pupils have been suffering from while attending school. From literature, malaria has been known to contribute for up to 20% of deaths among the pupils in primary schools and has remained the leading cause of absenteeism in Uganda (Acham, 2010). Diarrhea incidences among the school going children are much higher among households that have a traditional pit (95%), and this can be attributed to poor hygiene and sanitation in the household (Bosch *et al.*, 2002& Quinn, 2009). Diarrhea is one of the common illnesses that can cause malnutrition among children: because much of the food consumed is lost, and very little is absorbed. Underweight children are seen to have higher incidences of

diarrhea compared to those with normal weights. There is a weak negative correlation between BMI for age and incidences of diarrhea ($R = -0.123$), children with a high number of incidences of diarrhea have a low BMI for age. Stunting is evenly distributed among those having diarrhea and those without. Stunting being an indicator of chronic food insecurity and malnutrition over a long period may not be influenced much by diarrheal incidences, because it is an indicator of chronic malnutrition over long periods of time (Kandala *et al.*, 2011).

5.5.2 Nutrition Status in Relation to Dietary Intake

Adequacy of food for school going children is very critical in the determination of their nutritional status. However, inadequacies were revealed from the 24hr recalls and food frequency questionnaires among children attending NPS. Most of the children had little control of the food they consumed; the decisions regarding food are bestowed on the school and/or the parents. The results revealed a positive correlation between the number of food groups chosen and the nutrition status of the respondents. This study finding agrees with another study done by Mirmiran, Azadbakht and Azizi (2006) in which it was revealed that people who consumed diversified diets are likely to have a better nutritional status.

5.5.3 Correlaton between Nutrition Status and Nutrient Composition of School Meals

The study did not find any significant relationship between schools meals and nutrition status. Comparatively, the school meals provided slightly more than one-third of the caloric requirements. However, from the 24hr recalls and food frequency questionnaires done, it was revealed that most children could get the remaining two-thirds from the meals taken at home.

5.6 Cost of School Feeding at NPS Before and After the Introduction of School Gardening

The third hypothesis of this study stated that supporting the school-feeding program with school garden produce did not reduce the cost of providing lunch to the pupils. This hypothesis was rejected because from the study the cost of feeding was reduced with the introduction of a school gardening program. The initial costs for the SFP in Namasagali Primary School were entirely made by the CSRL program. The program had to absorb all the cost involved in setting up a school garden and feeding program. The program also purchased all ingredients and supplies required for the feeding of the pupils and also paid for the cook's labour. The results obtained from this study indicate that the initial cost spent by the program to sustain the feeding program in 2010 was 915.5 dollars per term. The decision by the program to produce its own food for the school lunch at NPS has been the cheaper option for the program and also as a way to sustain the program and encourage rural agricultural production and economic growth at community level.

The produce from the school was partly used in the lunch while some were sold, and the money used to purchase ingredients for the lunch. From the result presented the cost of feeding the pupils from the gardens was reduce with supplementation from the gardens and contribution from the parents. If we compared what the program spent on purchasing of ingredients from the market, which was 915.5 dollars in 2010, and how much it spent to produce the food and from parents contribute in kind it is much less (\$ 574 and \$ 306.72 respectively). According to Mwangi *et al.* (2010), school gardens play an important role in sustainability and success of a feeding program.

CHAPTER SIX: SUMMARY, CONCLUSION, AND RECOMMENDATION

6.1 Summary

This study mainly focused on the contributions of the SFP at a rural universal primary education school in Eastern Uganda. It aimed at determining the nutrient quality of the lunch served at the school and the adequacy of foods served away from school, its contribution to the nutrition and frequency of illness of the pupils as well as conducting a cost analysis pre and post introduction of the school gardening program at NPS. Most rural schools in Uganda provide inadequate meals -if at all any -and many parents are not willing to contribute to or support the feeding program. The majority of rural children come from homes that are food insecure, and most of them report to school hungry. This has a negative effect on the overall gains of UPE schools to have all children attend primary school. Short-term hunger leaves pupils hungry at school, unable to concentrate in class and constantly absent from school. School feeding programs reduce short-term hunger, increase concentration and, therefore, overall performance.

6.1.1 Purpose of study

The central focus of this study was to provide a cost description how HGSFP using school garden and parents contributions can supplement on the SFP. Nutrient analysis on the school meal was also done to provide further information on whether the caloric content and nutrient content of selected nutrients of the meal has been improved and what effect this had on the overall nutritional and health status of the pupils.

6.1.2 Results and Implication

The nutrient value of the lunches served at the school had improved with the introduction of a more nutritious meal. The school meal served at the school initially provided 50kcal (CSRL Report, 2011), and the lunch introduced provided 854 Kcal as reported by the laboratory analysis, also the protein content and other nutrients had improved. Though the meal did not improve the nutrition status of the pupils, it had a positive impact on attendance, concentration and enrollment at the school. The lunch contributed a larger percentage to the child's Recommended Daily Allowance as compared to the meals they received from home. The study also reported that it is more cost effective to have a school garden program supplement a school feeding program. The garden produce can either be used directly in the SFP or can be sold to purchase other food items needed for the feeding program. Support from the parents is also very necessary for the success of the feeding program. This could be in cash or in kind.

6.2 Conclusion

This study found that the maize and beans diet served at the school for lunch had a high caloric and protein intake as compared to the maize meal porridge (50kcal) that the pupils were initially consuming. The meal contributed a significant amount to the pupils RDA between 28%-43% depending on the age group as compared to 7%-11% of the calls from home. Though the nutrient content of the meal had improved, there was not much improvement in the nutrition status of the pupils. The BMI-for -age and stunting ratios during the baseline were 1.5% (0-8.0) and 13.4% (6.3-24.0) as compared to the nutrition status of the pupils after two years being 1.8% (0.5-4.5) and 13.4% (6.3-24.0)

respectively. The majority of the pupils in this study could have suffered long-term deprivation of food shortage, due to the high levels of stunting especially among the male pupils. The parents of the majority of these children are left in a dilemma of whether to contribute food for the SFP or use it at home. Normally when the child is given grain to take to school, then his portion is at school and sometimes this child is left to go hungry at home. A higher level of analysis showed that the girls had a low BMI-for-age compared to the boys while the boys are much more likely to become stunted compared to their female counterparts.

Children from homes where parents were divorced are more likely to be malnourished, and were also found to be more stunted than those from homes where either parent are separated or married. The age of the mother is also one of the factors that influence the nutritional status of their children moreover, we can conclude that children who have been left under the care of young mothers and the elderly are seen to have a very high prevalence of malnutrition.

Concerning illness: malaria, respiratory infections and diarrhoea are some of the most common illness that the pupils have been suffering from while attending school leading to high level of absenteeism. Underweight children are seen to have higher incidences of diarrhea compared to those with normal weights (Sepulveda *et al.*, 1988).

The study also concluded that supplementing an SFP from a school gardening program is indeed cost effective way of feeding pupils. Home Grown School Feed Program (HSFP)

concept is one perfect way to mitigate short-term hunger in the schools especially rural schools where parents may not be able to afford to pay for feeding at school. CSRL program initially provided 100% towards the school-feeding program at NPS. However, with the introduction of school gardening and parents' contribution, the program only spent/contributed 28% towards the SFP, the parents contributed 14%, and the gardens contributed 57%. The harvest from the garden can also be sold to purchase any food items needed for the school lunches. School pupils and teachers did the management of the gardens with technical assistance from the agronomist and other staff of CSRL. It is therefore very possible and cost effective to maintain a school-feeding program with support from the school garden and the parents.

With regards to the age of the mother, the findings showed mixed outcomes due to various other confounding variables. In some situations, there was better nutrition status of children belonging to younger mothers while in some cases in older mothers. We therefore conclude that confounding variables such as income and education status of the mother play a critical role in influencing nutrition status of children.

6.3 Recommendations

6.3.1 Recommendation for policy

Home Grown School Feeding Program, use school gardens and parents support in promoting School Feeding Program in the schools should be one of the practices the Education Ministry should consider as a way of ensuring sustainable SFP. One of the policies that the Ministry should revert is Parents should taking on the responsibility for

feeding their school children while at school. The idea of UPE does not come with free food and therefore they should contribute either in cash or kind towards the school-feeding program. Practical agriculture integrated into the curriculum and use of outdoor laboratory for both food production and learning could be a way of teaching pupils and encouraging production of food. This should be emphasised in the curriculum.

6.3.2 Recommendations for Practice

For the School Feeding Program to be sustainable Namasagali Primary School gardens should be expanded to make them economically productive and viable as a source of produce for the school lunch all year round. It is important to produce enough so that the school can sell and have enough to feed the children. The parents and the community should be involved and educated on the importance of SFP for their Children. Use of locally sourced foods to support the SFP and encourage production as demand increases.

6.3.3 Recommendation for research

This research did not exhaustively explore the SFPs in urban and private owned schools. Therefore further research should be done in urban and private schools and a comparison made. This research study has addressed the possibilities of maintaining a feeding program using farming at school and parents' support and contributions in a rural setting. The gap that this study has addressed is the possibility of having a rural school-feeding program that is fitting into a school gardening program. A more in-depth analysis should be conducted to establish economic analysis of using school garden to support School

Lunch Programs. Longitudinal study comparing schools who employ gardens and those who not to examine differences in nutritional status.

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APPENDICES

APPENDIX A: INTRODUCTION LETTER

Greetings. My name is, and I am a master's student at Department of Foods, Nutrition and Dietetics, Kenyatta University. I am undertaking a study on the Effect of school garden food production on nutrient adequacy and nutrition status of children in Namasagali primary school in rural Kamuli District, Uganda

This letter is a request for you to participate in the study. My research assistants and I will ask you questions about child's feedings practices and some information related to your household. The session normally takes 45 minutes to one hour. Any information you shall divulge will be kept treated with high confidentiality and will not be shared with any other persons. Your participation is voluntary, and you can choose not to respond to any individual question or all of the questions.

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APPENDIX B: INFORMED CONSENT FORM ENGLISH VERSION**TOPIC**

Effect of school garden food production on nutrient adequacy and nutrition status of children in Namasagali Primary school in Rural Kamuli District, Uganda

Principal Investigator: Laura Byaruhanga

This is a research study. Please take your time in deciding if you and your child would like to participate. Feel free to ask questions at any time.

Introduction

Iowa State University (ISU) under the Centre for Sustainable Rural Livelihood (CSRL) program introduced an SFP in Namasagali Primary School that is linked to the school gardening program; with the aim of eliminating hunger, improving nutritional and health status of the school aged, increasing enrollment, attendance and therefore academic performance. We will require the participation of your child in this research to access what effect the SFP has had on your child and the community.

Description of procedures

Upon enrollment, the index child will provide direction to his home so that a questionnaire can be filled together with the mother or caregiver. Questions asked will involve, foods the child has eaten at home throughout the day, socioeconomic data and morbidity patterns of the child during the previous months. We may also ask for permission to take a photograph of your child serving or taking her lunch. The photoaph will be used for the purpose of the study.

Participant rights

You and your child's participation in this study are completely voluntary. You and your child may refuse to participate or leave the study at any time. If you decide not to allow your child to participate in this study or decide to end your child's participation early, it will not result in any penalty or loss of benefits to which you and your child are otherwise entitled. She /he will continue to receive the same services offered by the school as the other children in the school.

Benefits for participating clients

If you allow your child to participate in this study, she/he will be entitled to lunch daily during school hours for the entire term. Information obtained will be simplified and disseminated to you, so that it may help in ensuring proper nutrition for your child. It is hoped that this study will provide valuable information that will be used as a baseline for the introducing this meal to the entire school and other primary schools in Kamuli district.

Risks for participating in the study

There are no foreseeable risks at this time from participating in this study.

Costs and compensation

You will not have any cost from allowing your child to participate in this study. You will not be compensated for participating in this study.

Confidentiality

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. Data collected

will be summarized, tailed and names withheld. Data will be kept securely either on the investigator or in a secure location.

Questions or problems

You are encouraged to ask questions at any time of the study. A Lusoga-speaking translator will be available to help answer questions and facilitate communication. For further information about the study, contact Laura Byaruhanga (CSRL Programme).

Parent/guardian signature

I have understood the above information concerning this study, which has been fully explained to me. I understand what will be required of my child if he/she takes part in this study. I had the opportunity to ask questions that were answered to my satisfaction. I understand that at any time if I may wish to withdraw my child from this study I can do so without giving any reasons and without affecting my child's access to any of the school services. I agree to this and allow my child to take part in this study.

Participant's

Name:

Parent/guardian of Participant's name: _____

Parent/guardian's signature

Date

Participant's signature

Your signature indicates that you voluntarily agreed to participate in this study, the study has been explained to you, that you have been given time to read the document and that your questions have been satisfactorily answered. You and your parent/guardian will receive a copy of the written informed consent prior to your participation in this study.

Participant's signature----- Date -----

Investigator statement

I certify that the participant's parent/guardian has been given adequate time to ready and learn about the study and all their questions have been answered. It is my opinion that the participant understands the purpose, risk, benefits and procedures that will be followed in this study and has voluntarily agreed to participate.

(Signature of the person

Date

Obtaining informed consent)

APPENDIX C: INFORMED CONSENT FORM IN LUSOGA VERSION**ENDHAGAANO EYOKWIKIRIZA****Omulamwa**

Ebyendisisa ebimala nokwinhohola kumuwendu ogwebyendiisa tibigemagana na nimiro mu isomero iriri mumasokolo age ebyaalo mu disitulikiti ye Kamuli Yuganda. Tulingiliire eisomero lya pulayimaale elya Namasagali.

Omukulu wokunoneleza kuno: Laura Agaba Byaruhanga

Guno musomo gwakunonereza. Twaala ekiselakyo okusalawo oba iwe no omwanawo mwenda okugwenhigiramu. Oliwaidembe okubuuzza ebibuuzo woba oyendere.

Enhandhula.

Eitendekero lya Iowa ne senta ye ebyenkulakulania eye ebyalo (Muluzungu centre for sustainable Livelihoods CSRL) ty (ISU) yatandika ebyo okuliisa mu isomero lya Namasagali elya pulayimaale ne byenima mwisomero lino nga baline ekyigenderelwa ekyo okulwanisa endhala. okwongerera kumutiindo ogwebyendiisa ne ebyobulamu mubaana abalimu myaka egijja kwisomero, no okwongerera omuwendo gwa basomi, endhidha yokwisomero ghalala nomutindo gwe byensoma. Twiidha kwenda omwanawo okwenhigira mu kunonereza kuno kisobozese okunamanha biki enteekateeka eyebendiisa mwisomero kyekoleire omwana ne kyaalo.

Emitendela Egibitibwamu.

Olumala okughandikibwa, omwana gwetujja okubuuzza, atulagirira engirala etutuusa ewaibwe tusobole okwidhuzaamu olupapula olwebibuuzo ghalala ni mukaire we oba oyo amulabirira. Ebibuuzo ebibuuzibwa mulimu. emere omwana galiire waka olunaku lwonalwona, ebyenhingiza, enebisa yomwana, ne ebyobulamu bwe omwezi gwebakubye amabega. Tuyinza nokusaba olukusa okukuba omwanawo ekifananyi nga alikulya emere oba nga agaaba emere yekyomusana. Ekifananyi kino kyakukozesebwa musomo guno. Omwanawo aidha kupimibwa obuzito no obuwanvo bikozezebwe mu kunonereza kuno.

Eidembe elya eyenhigiire mumusomo guno

Iwe no mwanawo okenhigira mukunonereza kuno kyakyendere. Mwembi bwemusalawo obutagwenhigiramu oba okukuvaamu amangu wazira kibonerezo kyonakyona waire okufiirwa ebyo ighe oba omwanawo byemusaniire okufuna. Era omwanawo aidhakugya mumaiso nokufuna okuwebwa byene obyo eisomero byeriwa abaana abandi kuisomero.

Emiganhulo eri abantu abanenhigiramu.

Bwoganha omwanawo okwenhigira mu kunonenkereza kuno, anaaba nga ali nokufuna ekyomusana mukiseera eisomero lyekiweramu abaana emere etaamu yonayona. ebinafunibwa biidha kugondezebwanu era bibakoberwe kibasobozese okutukiriza endiisa enkalamu eyomwanawo. Kilwozebwanti okunonereza kuno kwidha kuwa amawulile agaidha okozesebwa nga gesigamibwaku okuwa eisomero ekiwulo ekyemele era nimumasomero agandi mu kamuli disitulikiti.

Obulabe obuli mukwetaba mukunonenkereza kuno

Wazila bulabe bwonabwona obwalibuboneibwa mu kiseru kino nga wenhigiire mukunonkereza kuno.

Emiwendo no okuliyirilwa

Okwikiriza omwanawo okwenhigira mukunonenkereza kuno ezira kyonakyoona kyogya kusasula. Ezira kigya kukuliyirilwa olwo okwenhigira mukunonekereza kuno.

Okukuuma ebyama.

Ebiwandhiko byonabyona ebigema kubantu ababaire mukunonenkerza kuno biidha kukumibwa butiribiri okugiira ku mateeka nenfuga era tibiidha kwikirizibwa kumanhika mulwatu. Ebinava mukunoneleza bidha gonzebwamu babigaite aye amaina gaidha kwesigalizibwa. Eraebinaava mukunonereza kuno biidha kusigala nanoneleiza oba okukumibwa mukifo ekyekusifu.

Ebibuuzo oba ebizibu

Osabibwa okubuuzo ebibuuzo akaseera koonkoono . Waidha kubaawo akwiriramu mu Lusoga okusozesa empulizagania enkalamu. Okufuna ebisingawo ebigemagana kumusomo guno, gemagana ni Laura Byaruhanga (CSRL programe)

Omukono gwomuzaiile oba amukuma owomwana

Ntegeile ebigema kukunonenkereza kuno okusenziira bwebabinhinhongoire nategela lwaki omwana wange yandyenhigiire mu mukunonkereza kuno naaba noomukisa okubuuzo ebibuuzo byonabyona byenhenze baabindhilamu nainhohoka. Erantegeire nti bwenhendha okutolayo omwanawange mumusomoguno ngazira nsoga nambulukufu ezilabulabe buyinza kutuuka kumwana mungeli gyafunamu ebintu kwisomero ndikiliiza kino era naikiliza omwanawange okwenhigira mukunonenkereza kuno.

Amaina ageyenhigiire mukunonenkereza kuno.

.....
Amaina agomuzaiile oba amukuuma.....

Omukono ogwomukuumi oba omuzaire oba omwana.....
enaku edhomwezi.....

Omukono ogweyenhigiire mu kunonenkereza kuno

Omukonogwo gutwamba okulaga nti okiliza okwenhigira mukunonenkereza kuno kyeyendere ngawazila kusalubwa nga bwonhingoibwa, nti ofunie ebwire okusoma mubikuweleibwa erawabuuzo ebibuuzo bakwilamu. Iwe nomuzeirewo oba akukuma ogyafunaku ekiwandiko kino ekilaga nti mwenhigiire mukunononkereza kuno.

Omukono ogweyenhigiire mukunonereza kuno.....
enaku edhomwezi.....

Ebigambo eby omunonereza.

Ndhikiliza nti omuzaire oba omukumi ow omwana aweleibwa ebisera ebimala okusomamu ne okutegera ebigema kumusomo guno ne emigaso, emitendera no obulabe obuvaamu, era yaikiriza okugwenhigiramu nga wazira kusalubwa kwonakwona.

.....
Omukono ogwo omuntu aline endhagaano eno enaku edhomwezi

APPENDIX D: CHILD ASSENT FORM IN ENGLISH**Topic**

Effect of school garden food production on nutrient adequacy and nutrition status of children in Namasagali Primary school in Rural Kamuli District, Uganda

My name is [researcher name]. I am trying to learn about the benefits this school feeding program has brought to you, your school and the community; and how the program can sustain it through the school garden.

If you agree to take part in this study, I will ask you and your parents/guardian some questions about your feeding habits and about home and later on we will take your weight and height. There are no right or wrong answers because this is not a test; we want to get your views. The benefit of this study is that your participation will assist the researcher come up with answers that will assist other schools have a school lunch program with a school garden.

You can ask questions about this study at any time. If you decide at any time not to finish, you can ask us to stop. Your parents or guardian have to say it is OK for you to be in the study. After they decide, you get to choose if you want to do it too. If you do not want to be in the study, no one will be mad at you. If you want to be in the study now and change your mind later, that is OK. You can stop at any time.

Agreement

I have decided to be in the study even though I know that I don't have to do it. [Name of researcher] has answered all my questions.

Signature of Study Participant

Date

Signature of Researcher

Date

APPENDIX E: CHILD'S ASSENT FORM IN LUSOGA

Olupapula olulaga okwikiriza kyo omwana

Omulamwa

Ebwendhisa ebimala ne ebintu ebwetolerela tumulamwa ogwebendhisa enimilo mu bwalobwa Kamuli district: Uganda: tusinzira Namasagali Primary School.

Amanagange ninze(.....) Nga ndhigezaku okusomaku bilungi ebwe omulamwa ogwe bendhisa eli-ewe, esomero ene ekwalo nengeli omulamwa guno jjegusoboramu okwemerezebawo kunimiro eyesomelo.

Bwoba okiliza okwetaba mumusomo gune njakubuza ebibuzo ewe enomuzelewo oba akukuma kumbera eyebwendisa ewaka near mare nkupimeku obuzitowo ne obuwanwu bwo. Wazira kiribwemu kifu oba kitufu olokuba bino tibigezo. Twetaga bidhubobwo. Ebinava mumusomo guno bedhakuyamba ku alikunonereza okutandhika omulamwaguno mumasomelo aganhi.

Osobola okubuza ebibuzo ebigema kumosomo guno ekiselakyonakyoona era bwoyendha okukoma okulamu ebibuso osobola okukoba twakoma awo. Ne omuzerewo oba akukuma atekwaokukiriza otwetaba mu musomoguno. Nerawebaba tibasazewo musete kumpi era webabatinga tibakukiriza okwetaba mumusomo guno, tibalalu nerabaziransobi jjebakoze. Era bwobatinga osazewo otwetaba mumusomo guno mare nochusamu mubirowozo, oliwedghembe okusaba omusomo guno okukomawo.

Okwikirisanganya

Ndhikiriza okwetaba mu musomoguno nibwekyandhibele nti tisanire kukolakino.

.....

Omukono gwa obwana/omuzere
edhomwezi

enaku

.....

Omukono gwa ali kunonereza

.....

enaku edho

**APPENDIX F: RESEARCH AUTHORIZATION FROM KENYATTA
UNIVERSITY**



**KENYATTA UNIVERSITY
GRADUATE SCHOOL**

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

Our Ref: H60/12931/05
+254 725732099
+256 777253453

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

DATE: 30th July, 2012

Uganda National Council for Science and
Technology (UNCST)
Plot 6, Kimera Road, Ntinda
P. O. Box 6884
KAMPALA, UGANDA.

+256 414705500
+256 312314800
+256 414234579

Dear Sir/Madam,

**RE: RESEARCH AUTHORIZATION LAURA AGABA BYARUHANGA – REG. NO.
H60/12931/05**

I write to introduce Ms. Laura Agaba Byaruhanga who is a Postgraduate Student of this University. She is registered for M.Sc degree programme in the Department of Foods, Nutrition and Dietetics.

Ms. Byaruhanga intends to conduct research for a proposal entitled, "Nutrient Adequacy and Cost Effectiveness of Garden Linked Feeding Programme in Rural Kamuli District, Uganda: A Case of Namasagali Primary School".

Any assistance given will be highly appreciated.

Yours faithfully:
30 JUL 2012

MRS. LUCY N. MBAABU
FOR DEAN, GRADUATE SCHOOL

APPENDIX G: ETHICAL CLEARANCE



**COLLEGE OF HEALTH SCIENCES
 SCHOOL OF HEALTH SCIENCES
 OFFICE OF THE DEAN**

July 1st, 2013

Ms. Laura Agaba Byaruhanga
 Kenyatta University, Nairobi

Category of review

- Initial review
 Continuing review
 Amendment
 Termination of study
 SAEs

Dear Ms. Agaba,

**Re: Approval of Proposal #SHSREC REF: 2012-032
 "Nutrient Adequacy and Cost Description of Garden Linked Feeding Programme in
 Rural Kamuli District-Uganda: Case study of Namasagali Primary School"**

Thank you for submitting an application for approval of the above – referenced.
 The committee reviewed it and granted approval for one (1) year, effective **July 1st, 2013**.
 Approval is valid until **July 1st, 2014**.

Continuing Review

In order to continue work on this study (including data analysis) beyond the expiration date, the School of Health Sciences Research and Ethics Committee must reapprove the protocol after conducting a substantive, meaningful, continuing review.

This means that you must submit a continuing report form as a request for continuing review. To best avoid a lapse, you should submit the request six (6) to eight (8) weeks before the lapse date. Please use the forms supplied by our office.

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 School of Health Sciences Research and Ethics Committee approval before implementing it.

Please summarize the proposed change and the rationale for it in a letter to the School of Health Sciences Research and Ethics Committee. In addition, submit two (2) copies of an

updated version of your original protocol application- one showing all proposed changes in bold or 'track changes,' and the other without bold or track changes.

Reporting

Other events which must be reported promptly in writing to the School of Health Sciences Research and Ethics Committee include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to participants or others

Adverse events, including unanticipated or anticipated but severe physical harm to participants.

Do not hesitate to contact us if you have any questions. Thank you for your cooperation and commitment to the protection of human subjects in research.

Final approval is to be granted by Uganda National Council for Science and Technology.

Documents approved for use along with protocol:

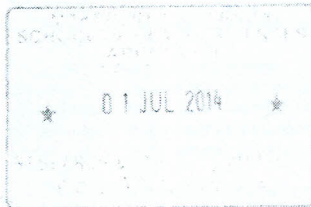
- Informed consent forms (English and Lusoga)
- Assent forms (English and Lusoga)
- Questionnaires

Yours sincerely,



Mr. Paul Kutwabami

Chairperson, School of Health Sciences Research and Ethics Committee



APPENDIX H: UGANDA NATIONAL COUNCIL OF SCIENCE AND TECHNOLOGY APPROVAL



Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

30/07/2013

Our Ref: SS 3210

Ms. Laura Agaba Byaruhanga
VEDCO
P.O. Box 1244
Kampala

Re: Research Approval:

Nutrient adequacy and cost description of garden linked feeding programmes in rural Kamuli District-Uganda: Case study of Namasagali Primary School

I am pleased to inform you that on 12/07/2013 the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of 12/07/2013 to 12/07/2015

Your research registration number with the UNCST is **SS 3210**. Please, cite this number in all your future correspondences with UNCST in respect of the above research project.

As Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the research protocol or the consent form (where applicable) must be submitted to the designated local Institutional Review Committee (IRC) or Lead Agency for re-review and approval prior to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local IRC for review with copies to the National Drug Authority.
4. Unanticipated problems involving risks to research subjects/participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST review.
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. A progress report must be submitted electronically to UNCST within four weeks after every 12 months. Failure to do so may result in termination of the research project.

Below is a list of documents approved with this application:

Document Title	Language	Version	Version Date
1. Research proposal	English	N/A	January 2013
2. Informed Consent Form	English & Lusoga	N/A	January 2013
3. Assent forms	English & Lusoga	N/A	January 2013
4. Questionnaires	English	N/A	January 2013

Jane Nabuto

for Executive Secretary

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

cc: Chair, Makerere University College of Health Sciences, School of Health Sciences, RC, Kampala

LOCATION CORRESPONDENCE

Plot 4 Akimira Road, Ntinda
P.O. Box 6884
KAMPALA, UGANDA

COMMUNICATION

TEL: (+256) 414 704500
FAX: (+256) 414 234579
EMAIL: info@uncst.go.ug
WEBSITE: http://www.uncst.go.ug

APPENDIX I: LETTER TO RESIDENT DISTRICT COMMISSIONER, KAMULI DISTRICT



THE REPUBLIC OF UGANDA

OFFICE OF THE PRESIDENT

PARLIAMENT BUILDING P.O. BOX 100, KAMPALA. TELEPHONE 5 2040570 / 343306 / 3431028 / 3431028 / 2331177 / 344026 / 230028 / FAX 235439700343
E-MAIL: secretary@proug.gov.ug Website: www.officethepresident.ug

ADM 154/212/01

August 22, 2013


The Resident District Commissioner
Kamuli District

This is to introduce to you **Byaruhanga Laura Agaba** a Researcher who will be carrying out a research entitled "**NUTRIENT ADEQUACY AND COST DESCRIPTION OF A GARDEN LINED FEEDING PROGRAM IN RURAL KAMULI DISTRICT, UGANDA: CASE OF NAMASAGALI PRIMARY SCHOOL.**" for a period of **02 (two) years** in your district.

She has undergone the necessary clearance to carry out the said project.

Please render her the necessary assistance.

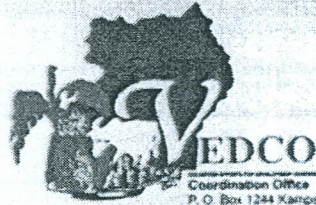
By copy of this letter **Byaruhanga Laura Agaba** is requested to report to the Resident District Commissioner of the above district before proceeding with the Research.


Alenga Ross

FOR: SECRETARY, OFFICE OF THE PRESIDENT

Copy to: Byaruhanga Laura Agaba

APPENDIX J: VEDCO ENDORSEMENT OF RESEARCH APPLICATION



Coordination Office
P. O. Box 1244 Kampala
Tel: 256 - 414 - 270598
Fax: 256 - 414 - 345441
E-mail: vedco@info.com.ug
Website: www.vedco.uganda.org

The Uganda National Council for Science and Technology
Plot 5/5/1 Nasser Road
P.O. Box 6884
Kampala, Uganda

10 July 2013

RE: Endorsement of Research Application by Laura Agaba Byaruhanga

Kenyatta University graduate student Laura Agaba Byaruhanga would like to conduct research in Kamuli district of Uganda. The proposed project title is "Nutrient Adequacy and Cost Effectiveness of a Garden Linked Feeding Program in Rural Kamuli District, Uganda: Case of Nnamagah Primary School". Her supervisor is Iowa State University Dr. Deborah Mwinzi and Kenyatta University Professor Mutitu Kinywe. Ms. Laura is also a staff of Volunteer Efforts for Development Consultants (VEDCO) NGO in Uganda.

The research has been reviewed by Kenyatta University and approval given by Makerere University's Institutional Review Board at the School of Health Sciences. The purpose of this study will be to assess the nutritional adequacy of the meal, its contribution to the nutritional status of the target group (6-16 years) and to provide a cost description of supplementing the school lunch from the school gardens. This study will focus on Nnamagah Primary School (NPS) in Kamuli, District Eastern Uganda.

At VEDCO, we appreciate the interest of researchers, such as Ms. Laura Byaruhanga. As one of Uganda's leading non-governmental organizations, advocating the needs of small and medium holder farmers through food and nutrition security, we recognize the significance of ensuring that a sustainable school lunch program is introduced in our settings. We will appreciate your efforts to approve her application in a timely manner.

[Signature]
Wanda

Program Manager, Eastern Region Kamuli

Head Office
P.O. Box 1244 Kampala
Tel: 256 - 414 - 270598
Fax: 256 - 414 - 345441

Eastern Region Office - Kamuli
Dundurwa Zone
Kamuli Town Uganda

North Western Region Office - Moyo
P.O. Box 1244 Kampala

Northern Region Office - Apia
Plot 11, Regatta Corner
Apia, South Sudan

MANDATE: Agricultural Entrepreneurship development

APPENDIX K: QUESTIONNAIRE**SECTION A: SOCIALDEMOGRAPHIC DATA****Part 1: Identification**

Name of Index Pupil: _____

Class _____

Date of Birth of Pupil (Date: Month: Year) _____
(Request for birth certificate)

How many members are in this household? _____

What is your marital status (caregiver)?

- 1= Single
- 2= Married
- 3= Separated
- 4= Divorced

What is your education level (caregiver)?

- 1= No formal education
- 2= Primary school level
- 3= Secondary school level

How old are you (caregiver)?

- 1= 20-30 years
- 2= 31-45 years
- 3= 46-55 years
- 4= above 55 years

Who is the head of the home?

- 1= Female headed home
- 2= Male headed home

Who is the principal caregiver?

- 1= Mother
- 2= Grandmother
- 3= Aunt
- 4= Others (specify) _____

Occupation of the caregiver?

1= Casual laborer

2= Housewife

3= Farmer

4= Others (specify) _____

Part 2: SOCIO-ECONOMIC FACTORS.

Do you live in a:

1=Rented house

2=Own house

How many rooms does the house have? _____

What is your main source of lighting?

1=Kerosene

2=Electricity

3=Solar

4=Candle wax

5=Others (specify) _____

What is your main source of cooking fuel?

1=Kerosene

2=Electricity

3=Charcoal

4=Firewood

5=Others (Specify) _____

Observe around the house for the following and tick

Item	Yes	No
Bicycle		
Motorcycle		
Radio		
Television		
Mobile phone		
Land		
Vehicle		
Sofa set		
Plot		

What kind of roofing materials has been used on the house?

1=Iron sheet

2=Grass thatched

3= Disposable material

4=Others (specify) _____

What kind of material has been used on the floor material?

1=Cement

2= Mud floor

3=Mud floor plastered with cow dung

4= Earth

5=Others _____

Do you keep any animals at home? 1=Yes 2= No

If yes which ones?

Do you have a garden? 1=Yes 2=No.

If yes indicate crops you cultivate?

PART 3: DIETARY INTAKE

24-HOUR DIETARY RECALL

Ask the caretaker what the child has consumed in the previous day. Use local households measures like spoons, cups, glasses and bowls to estimate amount consumed.

Interview date: Day recall: Recall Date:							Official use only	
Time /Meal	Type of dish	Ingredients in dish	HH Measure	Amt In (gm)	Vol of dish cooked	Vol taken by child	Amt taken by child(gm)	
Breakfast								
Mid mornin g snack								

Lunch							
Mid afterno on snack							
Supper							
After supper Snack							

FOOD FREQUENCY QUESTIONNAIRE

Ask and Tick the foods consumed by household and the frequency.

Foods	Daily	>3times a week	Twice a week	Once a week	Rarely/never	When in Season
PROTEINS						
Meat						
Silver fish (Mukhene)						
Fish						
Eggs						
Milk						
Soya bean						
Beans						
Groundnuts (Paste)						
Other proteins						
CARBOHYDRATES						
Posho (stiff porridge)						

Rice						
Millet/sorghum bread						
Sweet potato						
Irish potato						
Yams						
Cassava						
Green Bananas (Matooke)						
Chapatti (flat fat cake)						
Other carbohydrates						
FATS/OILS						
Margarine						
Ghee						
Cooking oil						
Other oils						
FRUITS						
Oranges						
Avocado						
Pawpaw						
Pineapple						
Ripe bananas						
Lemons						
Passion fruits						
Guavas						
Mangoes						
Other fruits						
VEGETABLES						
Kale (sukumawiki)						
Cabbage						
Pumpkins						
Pumpkin Leaves						
Spinach						
Carrots						
Tomatoes						
Egg plant						
Nakati. dodo. amaranth						
Peas						
Other vegetables						

PART 5: ILLNESS, SANITATION AND HYGIENE**Morbidity**

Have you been sick in the Past 2 weeks? 1=Yes 2=No

If yes, what you suffering from? _____

Which of the following illness have you suffered from?

Diseases	Duration
Malaria	
Tuberculosis	
Pneumonia	
Diarrhea	
Cold and Flu	
Worm infestation	
Skin infection	
Jigger infestation	
Measles	
Others (specify)	

What do you do first when the child falls sick?

1= Take the child to the health clinic

2= Buy drugs to treat the child

3= Did not consult a health care

4= Others (Specify) _____

How far is the nearest Health Center from your home?

1=Less than Km

2=1Km

3= 2Km

4=More than 2Km

Please circle the most appropriate

What is your main source of drinking water at home?

1=River/spring/swamp

2=Borehole/well

3=Rain/tank

4=Tap water

5=Others (specify)

Part 3: Parents Contribution

Class	Total Contribution (Maize) in kg	Amount in Ug shs if sold	Amount in US dollars
Grade 1			
Grade 2			
Grade 3			
Grade 4			
Grade 5			
Grade 6			
Grade 7			
Total			

APPENDIX L: LABORATORY ANALYSIS OF SCHOOL MEAL

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**COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES
SCHOOL FOOD TECHNOLOGY, NUTRITION & BIO-ENGINEERING**

DEPARTMENT OF FOOD TECHNOLOGY & NUTRITION

24/10/
2012

Laura Byaruhanga

Through: Archileo N. Kaaya (PhD)
Professor and Head,
Dept. of Food Technology & Nutrition

Re: Results for the analysis of food composite (maize, beans and Sukumawki)

Please find below the tabulated results for the analysis of food composite (Maize, Beans and Sukumawki)

No.	Parameter measured	Unit	Results sample content	
			Wet weight basis	Dry weight basis
1	Moisture content	(g/100gm)	62.18	
2	Dry matter	(g/100gm)	37.82	
3	Ash content	(g/100gm)	1.62	4.28
4	Dietary fibre	(g/100gm)	4.04	10.68
5	Crude Protein	(g/100gm)	4.44	11.74
6	Oil Content	(g/100gm)	0.3	0.78
7	Carbohydrates	(g/100gm)	6.56	17.35
8	Total Energy (DM27.2%)	(Kcal/100gm)	94.858	
9	Total Energy (DM95%)	(Kcal/100gm)	341.717	
10	Vitamin A	(mgRAE/100gm)	200.58	530.35
11	Zinc	(mg/100gm)	6.60	17.45
12	Iron	(mg/100gm)	19.48	51.51
13	Iodine	(mg/100gm)	3.67	9.70

Okalany Emmanuel
Technician DFT&N

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