IMPLEMENTATION OF NUTRITION-SENSITIVE AGRICULTURE IN THE CENTRAL PROVINCE OF ZAMBIA

GIVEN CHIPILI

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN HUMAN NUTRITION OF THE SOKOINE UNIVERSITY OF AGRICULTURE, MOROGORO, TANZANIA

2015

ABSTRACT

The Central Province of Zambia contains the majority of the nation's malnourished children, despite being the most productive province in terms of Agriculture. Most studies focused on household food consumption rather than the linkages between agriculture performance and nutrition outcomes of the population. In light of this knowledge gap, this study focused on the linkage between nutrition and agriculture.

The study assessed the extent to which the Ministry of Agriculture in Zambia is implementing the best practices of nutrition-sensitive agriculture in the Central Province.

Data was collected from 356 randomly selected farming households using structured questionnaire. The data contained information on socio-demographic characteristics, crop diversity, women empowerment and anthropometric (height/length, weight) measurements for the children aged 6-59months. Three transect walks and nine focus group discussions were also conducted in the sampled district. The study also reviewed five project and policy documents. Two were project documents of the agricultural development programmes in central Zambia, while 3 were national policies. The prevalence rates of stunting, underweight, and wasting among children were 21.2%, 9%, and 2%, respectively. There was a significant relationship between household crops grown in households and Z-scores for HAZ and WAZ ($p< 0.05$). One variable of women empowerment, namely access to credit or income opportunities, was also significantly related with Z-scores for WHZ ($p < 0.05$).

The Ministry of Agriculture in Central province has a lot to do in order to implement Nutrition-Sensitive Agriculture and reduce stunting in Central Province.

DECLARATION

I, Given Chipili, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Given Chipili Date

(Candidate: MSc. Human Nutrition)

The declaration is hereby confirmed:

_____ _____

Prof JohnMsuya Date

(Supervisor)

COPYRIGHT

AKNOWLEDGEMENTS

I am grateful to the almighty Omnipotent, Omniscient and Omnipresent God for giving me strength and courage throughout the period of my studies and for his guidance and for helping me to complete this dissertation.

I extend my heartfelt gratitude to my supervisors Professor J. Msuya and Mrs. Pacific. R of Sokoine University of Agriculture (SUA) for their invaluable guidance rendered to me and for taking their time to read through my work. I am extremely grateful for their tireless criticisms and suggestions made from development of research proposal up to final report writing.

I also express my sincere gratitude to Ministry of Education in Zambia for giving me the opportunity to do amasser's degree outside my home country. I would like to thank the Ministry of Agriculture in Zambia for all the written documents and information provided that was of help to me in my study.

I am grateful to all those persons whose writings and works have helped me in the preparation of this dissertation.

Finally, I am highly indebted to all the members of staff in the department of Food Science and Technology (SUA) for their support and knowledge they shared. To you I say thank you so much.

DEDICATION

This work is dedicated to my late parents, Mr. Zebron Chipili and Mrs. Florence Chipili for the role they played in my early life which made me a potential academician and my two brothers Dadly and Muma for their love, encouragement, support and every sacrifice they made during my studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
CSO	Central Statistics Office
DHMT	District Health Management Team
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Research Institute
IISAM	Inter-governmental Institution for the use of Micro-algae Spirulina Against Malnutrition
MCDP	1000 Most Critical Days Programme
MDGs	Millennium Developing Goals
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOH	Ministry of Health
MUAC	Mid-Upper Arm Circumference
MUACZ	Mid-Upper Arm Circumference Z score
NFNC	National Food and Nutrition Commission
PAM	Programme Against Malnutrition

SADC	Southern African Development Community
SNDP	Zambia Sixth National Development Plan
SUA	Sokoine University of Agriculture
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
ZNAP	Zambia National Agriculture Policy
ZDHS	Zambia Demographic Health Survey
ZNNP	Zambia National Nutrition Policy

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Nutrition-sensitive agriculture is the undertaking of agriculture that effectively and explicitly incorporates nutrition objectives, concerns, and considerations to achieve food and nutrition security (FAO, 2011). This concept seems to be picking popularity from organisations such as FAO, IFAD and IFPRI. However, given the high extent of malnutrition in developing countries, it is likely that the implementation of this concept has not been taken seriously in most developing countries, including Zambia.

The agricultural sector continues to be the backbone of the Zambian economy as it contributes to the growth of the economy and also to exports. Primary agriculture contributes about 35% to the country's total non-traditional exports (i.e. all the country's exports other than copper and cobalt) and about 10% of the total export earnings for the country (CSO, 2012).

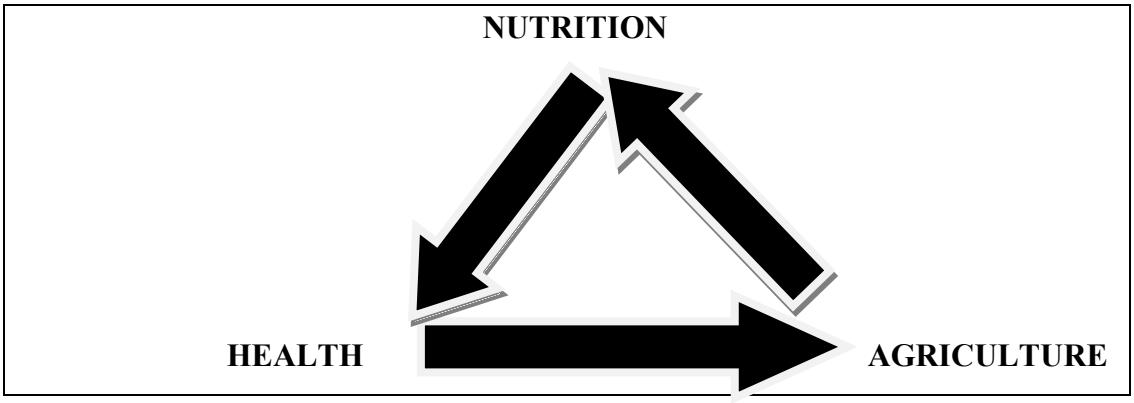
In Zambia, malnutrition prevalence for under-five children currently is still high appearing as stunting 40%, underweight 15% and wasting 6% (CSO, 2014). The high prevalence of malnutrition in early life means that childhood growth and development are compromised for many Zambians. Severely malnourished children have a much higher risk of dying (5 to 20 times) than their well-nourished counterparts. Such children also have a 50% likelihood of dying if admitted into hospital (WHO, 2003).

Malnutrition in Central Province of Zambia has remained a great challenge despite the success achieved in the production of pulses, nuts and the staple food (maize). On overage, stunting levels in children below five years of age is unacceptably high at 43% (higher than the national average of 40%). The United Nations Development Program (2011) indicated that many deaths in the Central Province could be prevented if there was effective nutritional strategy by the Ministry of Agriculture.

The Zambia Sixth National Development Plan (SNDP) 2011-2015 acknowledges nutrition as an important factor that underpins progress towards achieving the Millennium Development Goals (MDGs) and improving productivity and national development. The SNDP outlined several key areas of focus as important entry points for improving nutritional status. These include agriculture, livestock and fisheries, health, education and skills and commerce, trade and industry.

1.2 Problem Statement and Justification

Changes in nutrition or health status are expected to affect agricultural production as shown in Figure 1. Conversely, changes in the agricultural sector can have profound effects on individual's nutritional and health status (Sahn, 2010).



Source; (Sahn, 2010)

Figure 1: Nutrition-health-agriculture linkage

For agriculture to be nutrition-sensitive, FAO recommends that, a number of best practices should be observed. These include incorporating nutrition objectives and indicators into agriculture programme designs, targeting the vulnerable, empowering women and incorporating nutrition education. Others include collaboration with other sectors, maintaining improved natural resources base and facilitating production diversification (FAO, 2012).

Much of the focus in agricultural development in Central Province of Zambia has been on higher staple production and not on incorporating micro-nutrient dense crops in their cropping systems. There is also less focus on empowering women (labour, income control and time use), while nutritionists, agriculturists and health workers do not normally work together.

Since nutrition, health, and agriculture are recognized as mutually reinforcing, there is heightened interest in addressing these problems jointly (Von Braun *et al.,* 2010). Agriculture is the primary source of nutrients that sustains human life. Therefore it is worthwhile to conduct this research for three reasons. The first is to provide sufficient explanation on the factors which have hindered effective reduction of malnutrition in Central Province Zambia. Secondly, to provide policy makers in the Ministry of Agriculture with evidence based information on constraints faced by farmers in the Central Province. This will enable them to design viable interventions which will reduce malnutrition levels in the Central Province of Zambia. Lastly, to identify gaps between nutrition, agriculture and health, in order to find how they can be worked on to reduce under-nutrition levels in the Central Province of Zambia.

1.3 Objectives

1.3. 1 Overall objective

The overall objective of the study was to assess the extent to which the Ministry of Agriculture in Zambia is implementing the best practices of nutrition-sensitive agriculture in the Central Province.

1.3.2 Specific objectives

The overall objective was attained by undertaking the following specific objectives:

i. To identify the nutrition considerations that have been incorporated into the agricultural programmes and projects in the study area.
ii. To determine the extent of diversification of nutrition-dense crops in the study area.
iii. To assess women empowerment in agricultural activities.
iv. To assess and characterize nutritional status of children between 6 and 59 months.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Nutrition-Sensitive Agriculture

Agriculture, health and nutrition have long occupied and operated within separate realms. Analysers of agricultural production seldom recognize that, agriculture affects nutrition, nutrition affects health and the health status can affect agriculture production. This separation is strange given that agriculture, health, and nutrition are tightly wedded. For agriculture to be nutrition-sensitive, one should first understand the linkages (IFPRI and ILRI, 2010).

Nutrition-sensitive agriculture is agriculture that effectively and explicitly incorporates nutrition objectives, concerns, and considerations to achieve food and nutrition security (FAO, 2011). FAO recommends the following practices to be incorporated into programmes and projects meant to serve as interventions to improve nutrition

Incorporate explicit nutrition objectives and indicators into the design, and track and mitigate potential harms, to assess the context and causes of malnutrition at the local level, to maximize effectiveness and reduce negative side effects, to target the vulnerable and improve equity (through participation, access to resources and decent employment). Others are to collaborate and coordinate with other sectors (health, environment, social protection, labour, water and sanitation), to maintain improved natural resource base (water, soil, air, climate, biodiversity), to empower women (through income opportunities, extension services, labour and time-serving technologies. Facilitate production diversification and increase production of nutrient-dense crops and small livestock. Lastly to improve processing, storage and

preservation (to retain nutrition value, shelf-life, and food safety, to expand markets and market access for vulnerable groups, particularly for marketing nutritious foods and to incorporate nutrition promotion and education (FAO, 2012).

2.2 Improving Nutrition through Agriculture

The International Food Policy Research Institute (IFPRI, 2012) conducted a study and found that the cost of delivering nutrients through crops was lower than the cost of nutrition-specific interventions such as food supplementation and fortification. It was also found that educational components such as behaviour change communications need to focus on key messages related to nutrition-sensitive agriculture, not on other messaging such as general nutrition or improving farming practices.

2.2.1 Incorporation of Nutrition education

The study conducted by Bezner Kers, *et al*., 2010 found that nutrition education was an important complement to agricultural production to ensure that increased and diversified crop production benefits the community in terms of nutrition security and health. However nutritional education that was not inclusive to encompass influential groups did a little to bring real change in rural communities. Transformational education approach facilitates participation of influential groups like men and grandmothers in creating a supportive environment for adoption of good child care practices for good nutrition and health (Bezner Kerr, *et al.*, 2008). There was also a suggestion that communities need to actively participate in setting behavioural change goals that work to enhance child health and proper care for mothers to ensure

ownership of both the process and celebration of goal attainment (Cullen, *et al*., 2001).

2.2.2 Agro-ecological approach

The agro-ecological approach to agriculture, which includes increased crop diversity, intercropping, rotation, incorporation of organic materials into the soil and reduced fertilizer applications, provides long-term solutions to smallholder farmers for improving food security (Bezner Kerr, *et al.*, 2010). During in-depth interviews, a study in Malawi reviewed that participating households spoke about having a wider range of foods to draw on during the dry season. They also observed that improved soil quality, which they felt led to better crop response during times of reduced rainfall (Bezner Kerr, *et al.*, 2010). Rather than relying on external inputs such as fertilizer and seeds for their livelihoods, rural communities are able to produce and sustain the food production methods by utilizing local resources and building farmer knowledge and capacity. This approach has been recommended by the United Nations (UN) Special Report to the Right to Food, as the way forward for agricultural production (Masset, *et al., 2011*).

2.2.3 The farmer-led approach

The farmer-led approach to research and development activities, including innovative transformational educational strategies, is one reason for the high level of adoption of new crops and the successes of growing them. A study conducted by Masset, *et al*., (2012) reviewed that at the community level, farmers spoke about their increased organization and visible improvements in food security and livelihoods and their leadership in the project as a crucial feature which motivated

greater involvement of new households. Some spoke of the transformation from a feeling of hopelessness at overcoming severe poverty to address food insecurity, to one in which families were cooperating together, experimenting with new methods and took pride in their accomplishments, drawing on the notion of food sovereignty to describe their achievements (Massat *et al*., 2012).

The studies by Massat, *et al*., (2012) on agricultural research have pointed to the importance of involving farmers in meaningful ways in identifying research problems, designing and conducting experiments and assessing impacts. In addition they should recognizing the challenge of sustaining meaningful participation in the long term (Johnson, *et al*., 2003; Dalton, *et al*., 2012; Ramisch, 2012). Despite an increased interest in linking agricultural interventions to nutrition outcomes, there is limited attention paid to the educational approach used in various interventions. During in-depth interviews with participants in Malawi, farmers spoke of the importance of their increased knowledge of how to maintain food security and community resources to support them during times of food shortages (Bezner Kerr, *et al.*, 2010).

2.3 Crop Diversity and the Nutrition Status of Under-five Children

During the Green Revolution, availability of cereals per capital in Asia increased dramatically, with associated price reductions. Non-staple production, however, increased at a much slower pace and in many cases did not keep pace with population growth (Welch and Graham, 2005). The resulting shift in relative prices of staples to non-staples reduced the ability of the poor to access diverse diets. The additional purchasing power released by the lower-priced staples can be used to acquire more nutritious foods only if they are available in sufficient quantities.

Investments in non-staple crop productivity and marketing channels is needed to correct the dietary imbalances that have arisen from a strong focus on staple crop production (Welch and Graham, 2005).

A study conducted in Kenya in households where maize is highly produced reported the highest percentages in stunting, underweight and wasting. Those reporting cassava as second carbohydrate choice had higher percentages in stunting, underweight and wasting as well (Badeke *et al.*, 2014).

Projects to increase productivity of a single crop may also reduce crop diversity which is likely to result in reduced dietary diversity and an increasing risk of micronutrient deficiency (Remans, *et al*., 2011; Herforth, 2010a). Similarly, reduced crop diversity may reduce the diversity of the foods available in the local market and thus reduce dietary diversity for the net food buyers.

Farmers may be unwilling to start or continue growing perishable foods if no viable market exists, due to distance or impassability to physical markets (Mirle, 2006). Acceptance and use of certain micronutrient-rich crops, such as orange-fleshed sweet potato or indigenous leafy green vegetables, has required demand creation or educational activities, focused on the value to health and nutrition outcome of consuming those (Low, *et al*., 2007).

While research to improve productivity of non-staple crops is important, the agriculture community need not to wait for research breakthroughs. Immediately, it is possible to broaden the diversity of foods included in agricultural training, extension, seed provision programs, and exports (Kuhnlein, *et al*., 2009). Beyond

increasing attention to production diversity in general, increased vegetable production could include well-adapted crops native to specific regions, such as regionally specific green leafy vegetables and semi-wild fruits. Such crops have been shown to contribute to nutrient adequacy where they are consumed (Kuhnlein, *et al*., 2009; Gupta and Bains, 2006; Gockowski, *et al*., 2003; Grivetti and Ogle, 2000), and provide examples of how agricultural diversification can be tailored to specific contexts.

2.4 Women Empowerment and Nutritional Status of Children Under-five years of age

The health and survival of children is influenced by patterns of family interaction. The realm of influence is especially pronounced amongst children under-five years of age, as they have not yet enrolled in school and typically spends the majority of their time at home (Badake, *el at*., 2014). Given this weight of exposure, women's empowerment is frequently identified as a possible pathway to improve a child's nutritional status (Bose, 2011; Narayan, 2002).

While the promotion of women's empowerment is widespread, much debate exists on how this is actually accomplished. Conceptualized most frequently in terms of economic power and access to, and control of resources (Bose, 2011; Narayan, 2002), sone understand the provision and increased ownership of goods to be a means to empowering and enabling a woman. Along this vein, others perceive educational attainment to be the best indicator of a woman being empowered (Bose, 2011). The discourse is also dominated by the term 'autonomy' and arguments that women with higher autonomy are more able to make better decisions for themselves and children (Moursand and Kravdal, 2003).

A study conducted in Mbeere South District of Kenya revealed that lack of relationships between the nutritional status and women empowerment of the household as well as their education level could be attributed to the fact that the overwhelming majority of the household heads were males who knew less about meal preparation (Badake, *el at*., 2014). Evidence suggests that a gendered approach to ensuring that women are supported and empowered in decision making regarding good child care practices is essential for successful nutrition education (Richards, *et al*., 2012).

A combination of qualitative and quantitative research revealed that paternal grandmothers played a crucial role in early child feeding, and that particular foods introduced to infants had significant impacts on child growth (Bezner Kerr *et al*., 2007b; Bezner Kerr *et al*., 2008). Research findings from the team also suggested that women's workloads often prevented them from implementing healthy child care practices (e.g. exclusive breastfeeding and frequent feeding of children below 2 years (Bezner Kerr *et al*., 2008). For instance, female participation in household decisions regarding their own health and the health of their children is essential for improving child nutrition (Allendorf, 2007; Doan and Bisharat, 1990; Ross-Suits, 2010).

2.4.1 Women's involvement in decision-making

Women's involvement in decision-making, alone or with someone else, can help solidify their value within the family (Shroff *et al*., 2009). A woman's degree of autonomy in making decisions in a household can effectively determine provision of a proper diet to a child and medical care. Desai and Johnson (2005) reported that a woman's participation in decision-making affects child nutrition through daily and emergency care and a child-oriented allocation of resources. The ability to respond to

a child's needs without consulting the husband or family could result in greater confidence, which then translates into improved care of self and ability to respond to the child's needs.

A woman's control over financial resources could effectively change the composition of household purchases. Evidence suggests that women's control over assets is particularly important for household food security and for child outcomes because women invest substantially in nutrition, education, and healthcare (Roushdy, 2004; Shroff *et al*., 2009).

2.4.2 Freedom of mobility

Freedom of mobility outside the home could affect the care available to both the mother and the child (Shroff, *et al*., 2009). Greater mobility indicates not only the degree to which a woman can move about but also her capability to be mobile independently or without permission. This can affect the nutritional status of children in several ways. Access to markets to purchase food, medicines, and other essentials and access to schools can improve knowledge about nutrition and health. Limited mobility can also prevent women from making visits to a health centre, ultimately this affect their own and their children's nutrition. Women with limited mobility are likely to have fewer social exchanges and thus limited knowledge about feeding practices, both breastfeeding and complementary feeding (Smith, *et al*., 2003).

2.4.3 Attitude towards domestic violence

Attitude toward domestic violence is an important indicator of women's empowerment within the household. Exposure to intimate partner violence directly

influences the physical and mental well-being of women and is associated with such health outcomes as depression, anxiety, and low self-esteem and self-efficacy (Smith,*et al*., 2000; Ackerson and Subramanian, 2008). A woman's lower status implies a greater dependence on her husband and a higher probability of experiencing domestic violence. Physical abuse hinders a woman's ability to provide adequate care through diminished physical capacity, increased psychological stress, and possibly nutritional deprivation (Ackerson and Subramanian, 2008).

2.4.4 Maternal endowments

Maternal endowments such as education and health are equally important influences over child nutrition. Aslam and Kingdon (2010) found that a mother's education is critically associated with longer-term health outcomes for her children. Even small levels of education can lead to large improvements in child health and nutrition (Aslam and Kingdon, 2010). A woman's short maternal stature, which reflects lack of long-term investment in her health, is associated with a higher rate of death for her children and a greater likelihood of her children being underweight and having a reduced rate of growth (Christian, 2010).

2.5 Overall Nutrition and Agriculture in Zambia

Zambia is a low-income country where the majority of people are rural smallholder farmers, and over the last few years the government has removed an agricultural input subsidy program, with conflicting results (CSO, 2012). Persistent food insecurity and heavy reliance on maize as a food source in Zambia has multidimensional impacts on families, including low dietary diversity and child under-nutrition. Women's agency and access to agricultural resources is very limited in Zambia, with early marriage associated with low dietary diversity, early pregnancy and high spousal violence for women

(ZHDS, 2014). Rural Zambian women have less access to education, lower access to land, credit, seeds and other agricultural resources compared to men. In addition they are constrained by highly unequal workloads, including agricultural labour, household tasks and child care responsibilities (CSO, 2012).

Maize and cassava are the main staple foods although maize is consumed by over 90% of the population. *Nshima (*stiff maize porridge) prepared from maize or cassava is eaten with different types of relish such as vegetables, meat, fish, eggs and legumes. However, the Zambian nutrition profile shows that 60% of households do not afford 3 meals per day (FAO, 2009) which leads to inadequate nutrient intake and malnutrition.

The dietary energy supply was 1 905 kcal per capita/day in 2000-2002. Households did not meet the estimated energy requirement of 2056kcal per capita/day. Carbohydrates such as cereals and starchy roots are the main source of energy which account for 80%of the total energy intake. The level of intake suggests a general insufficient intake of other essential nutrients as well such as protein and lipids (ZHDS, 2014).

2.5.1 Zambia National Agriculture Policy (2004-2015)

The overall Agriculture Policy was to facilitate and support the development of sustainable and competitive agricultural sector that assures food security at national and household levels and maximizes the sector's contribution to Gross Domestic Product (GDP).

The policy was realized through the following specific priority objectives:

To ensure national and household food security through an all-year round production and post-harvest management of adequate supplies of basic food stuffs at competitive costs, to contribute to sustainable industrial development by providing locally produced agro-based raw materials. Others are to increase agricultural exports thereby enhancing the sector's contribution to the National Balance of Payments, to generate income and employment through increased agriculture production and productivity and to ensure that the existing agricultural resource base is maintained and improved upon (NAP, 2004).

2.5.2 Malnutrition in Zambia

Sub-Saharan Africa has one of the most serious rates of chronic malnutrition in the world. In Zambia, chronic malnutrition or stunting affects 40% of under-five children and remains the most common nutritional disorder in the Sub-Saharan Africa and the world at large. In addition 5% of the children are wasted while 15% are under weight (ZDHS, 2014).

Moreover, micronutrient deficiencies have enormous consequences on individuals and society through reduced productivity, 54% and 53% of the children in Zambia suffer from vitamin A deficiency and iron deficiency respectively (CSO, 2009). Under-five Mortality Rate (U5MR) is at 45 per 1000 live births (ZDHS, 2014).

Malnutrition is a manifestation of multiple causes such as inadequate food intake, inadequate child feeding practices, poverty, and poor access to education, health and social services. Due to inequalities in access to socio-economic services, 68% of the Zambian population lives below the national poverty line. Under-nutrition is

intricately linked to poverty and is more pronounced in rural than urban communities. While it is estimated that 51% of people nation-wide live in extreme poverty, the situation is worse in remote rural areas (78%), where people have poor access to social services, markets and infrastructure (CSO, 2010).

Childhood malnutrition results in short stature in adulthood and undermines individual economic potential. Evidence suggests that 1% loss in height due to malnutrition in childhood corresponds to 1.4% reduction in productivity (World Bank, 2006). As malnutrition leads to poor cognitive development and poor school performance (World Bank, 2006), a vicious cycle of poverty and ill health originates in early childhood.

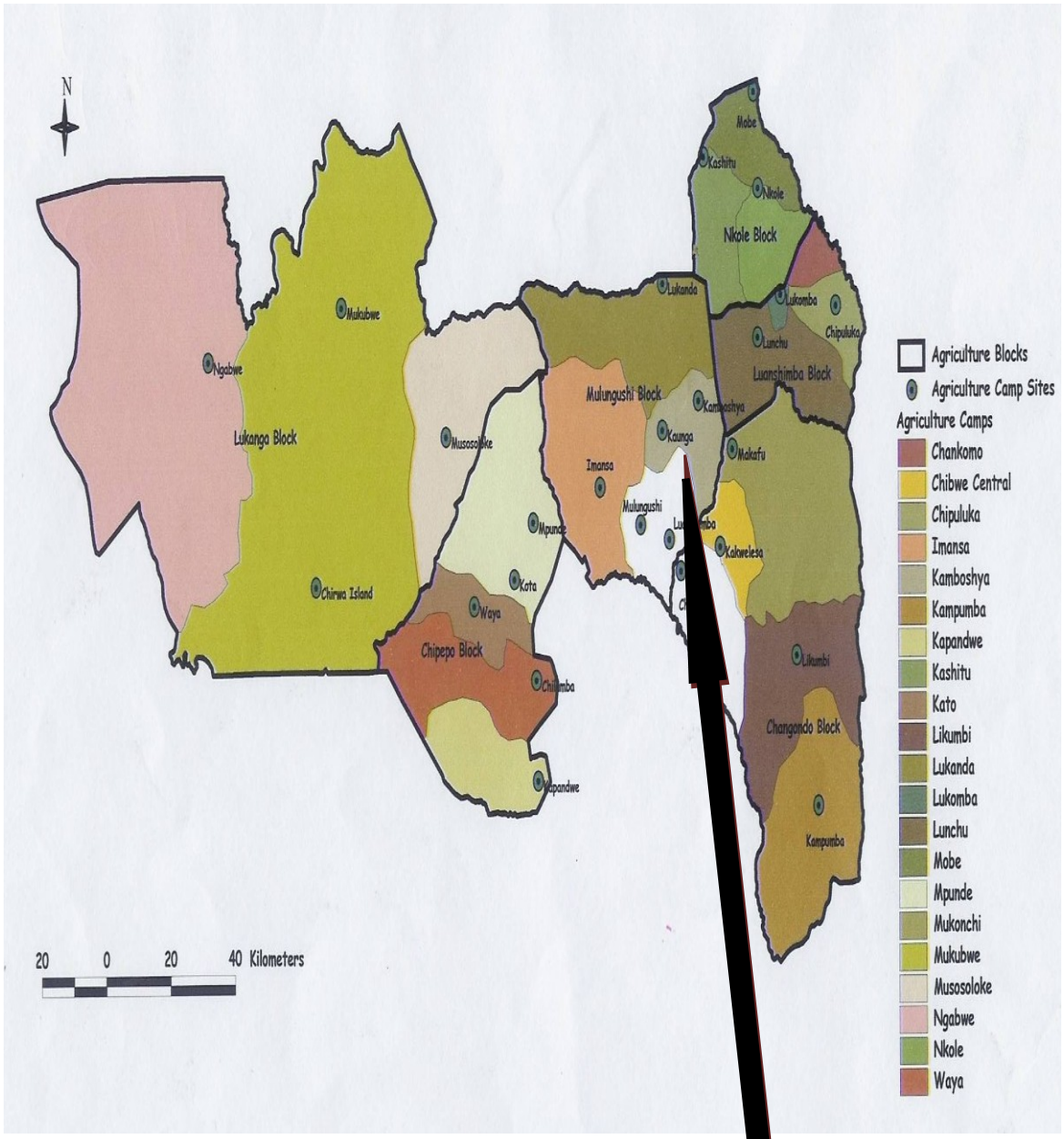
Nutrition profiles conducted in Zambia indicate that the elimination of iodine deficiency, reduction in stunting by 1% per year and reduction of maternal anaemia by one-third (all very achievable), would increase Zambia's productivity by £955,000,000 ($1.5 billion) over the next 10 years (NFNC, 2011). Despite a law specifying that only iodized salt is to be sold in Zambia for human consumption, monitoring consumption levels of iodized salt is a challenge. It is also unclear if remote communities producing their own salt are iodizing it (ZDHS, 2014).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

The study was conducted in Kapiri-Mposhi district which is located in the Central Province of Zambia. The economic base of the district is mainly the agricultural sector. About 90% of the inhabitants depend on agriculture for their livelihood and most of them are peasant farmers. Kapiri-Mposhi district is located 13°97´S; 28°66´E and is 1286m above sea level, covering 15 000 Km² and with a population of about 194 752 inhabitants (CSO, 2010). According to the Zambian Agro-Ecological Zoning the district is situated in Agro-Ecological Region II with average annual rainfall of 1000 mm. Daily temperatures range from 23 to 25 ºC during the rainy season, but can reach 32ºC during the hot season and minimum temperature of below 10 º C during the cold season with intermittent frost occurrence. The main crops grown in the district include maize, groundnuts, sweet-potatoes, cotton, water melons, tomatoes and several other vegetables. Farmers in the area are grouped in three categories namely small, medium and large (commercial) scale farmers. It is estimated that the district has 2 108 small-scale farm households, 1 517 medium-scale farmers and 76 large scale farmers. According to the Zambia administrative division Kapiri-Mposhi district is divided into six Agricultural Blocks, namely Changondo, Chipepo, Lukanga, Lunchu, Mulungushi and Nkole (Fig: 2). Agricultural Blocks are further subdivided into 32 Agricultural Camps (Figure 3). Small-scale farmers families cultivating land with oxen or hand hoes. They make up over 57% of the farming population owning not more than 2.5 hectors of cultivated land per household. On the other hand, medium scale farmers own not more than 5 hectors of cultivated land, and they make up about 41% of all farmers.



Mulungushi Block

Figure 2: Map of Kapiri-Mposhi District, Central Province of Zambia, showing the different Agricultural Blocks.

(Source: CSO, 2012).

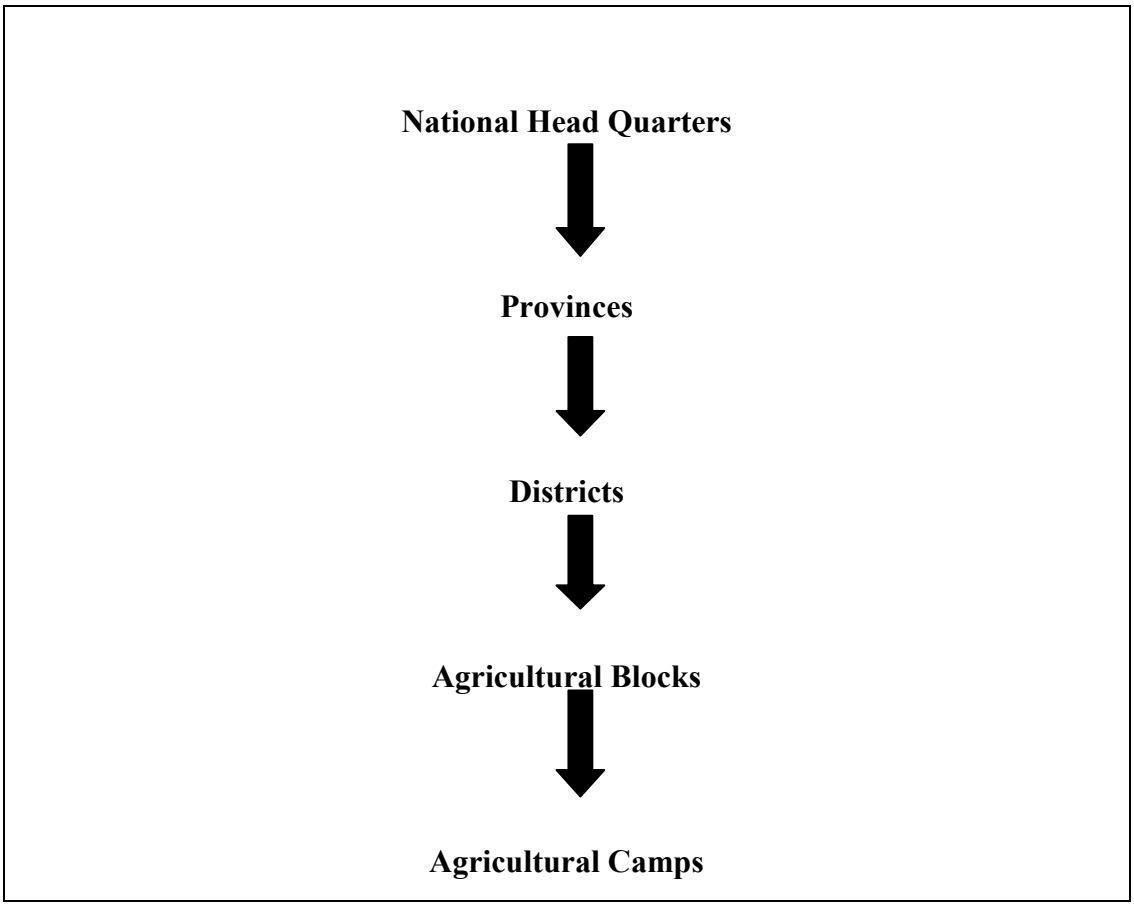


Figure 3: Administrative division of the Ministry of Agriculture in Zambia

3.2 Study Design

A cross-sectional study design was employed to collect both qualitative and quantitative data in Kapiri-Mposhi district. Quantitative data was collected in order for the researcher to undertake statistical analysis and testing on the best practices of nutrition-sensitive agriculture. The use of both quantitative and qualitative methods was necessitated by the fact that the study required varied information to achieve the desired results.

3.2.1 Study population

The study population included medium and small scale farmers in Kapiri-Mposhi district of Central Province. According to the survey conducted in 2012, all malnourished children came from either small or medium scale farmer's households (CSO, 2012). In addition, the nutrition programmes being implemented in the province have targeted the small and medium scale farmers.

3.2.2 Sampling procedure

Kapiri-Mposhi district was purposively selected due to agriculture programmes and projects that are running in the district. Multi-stage sampling was used. In the first stage Mulungushi Block was purposively selected (Fig 4). The reason for purposively selecting Mulungushi Block is that most agricultural projects are being conducted in this Block. In the second stage, three Agricultural Camps (Lukanda, Kaunga and Imansa) were selected purposively from the six Camps in Mulungushi Block. The three Camps were selected because that is where the nutrition pilot projects were being conducted. There were approximately 2000 registered farmers in Mulungushi block (88% small scale and 12% medium scale farmers). Since the distribution of medium scale and small scale farmers was not homogeneous, two strata were used, one for medium scale farmers (12%) and the other one for small scale farmers (88%). Systematic random sampling was applied to select households in the final stage. This was done by picking every 5^{th} farmer on the list of farmers from the 2000 registered farmers in Mulungushi Block. A total of 382 households were sampled in the entire survey, which is about 19% of the total number of registered farmers. However, only 356 respondents were able to be reached during the actual data collection because some respondents were not at home during the time of survey. In addition children between the ages of 6- 59 months were sampled

from each household. In case a household had more than one child only the youngest was included in the study bringing the number of children to 100.

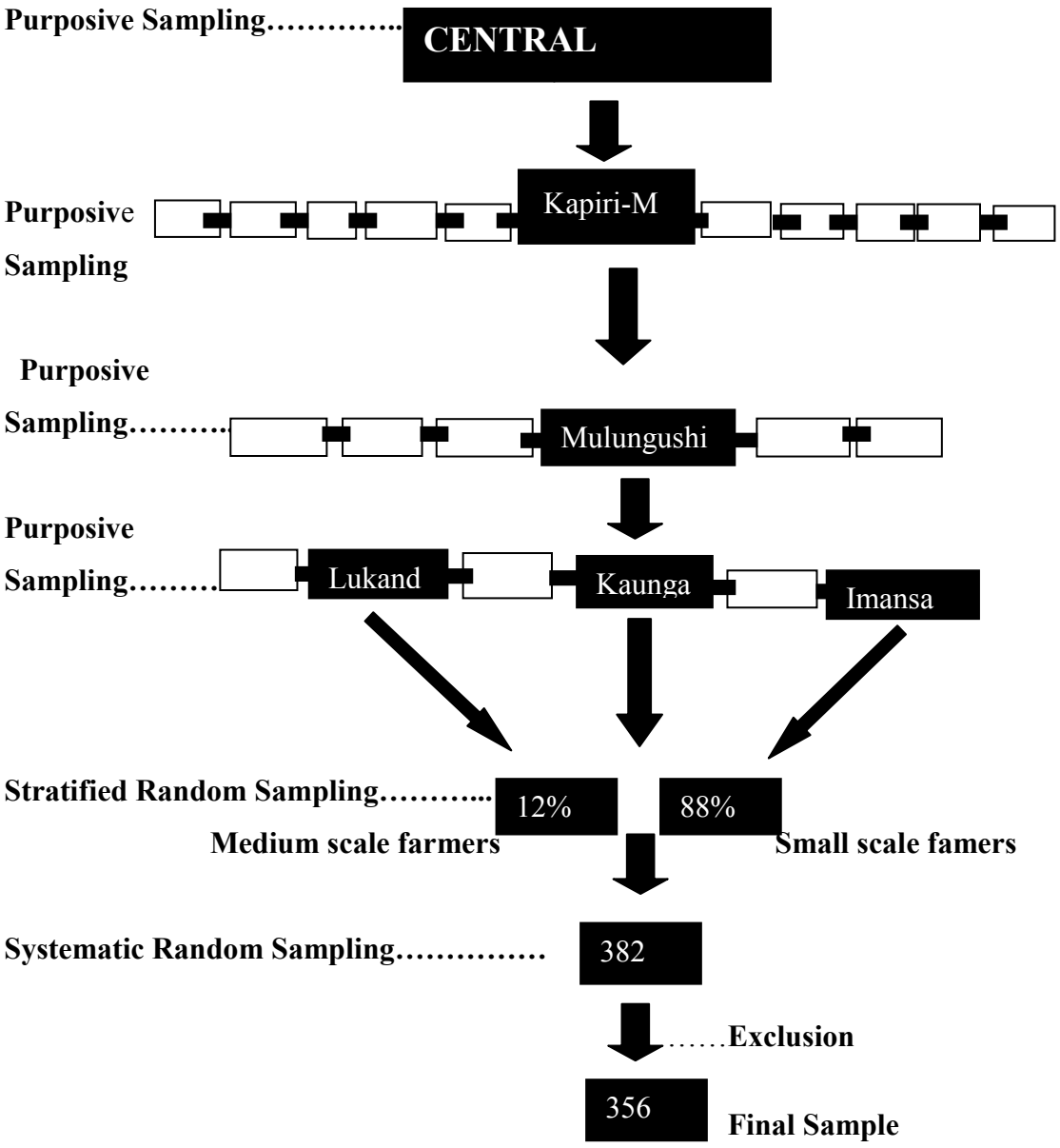


Figure 4: **Flow chart showing the sampling procedure**

3.2.3 Sample size

The sample size was computed using the equation and procedure shown in Appendix 1 (Pg.61). The computed sample size of 382 was based on the prevalence of stunting of children below five years of age in the Central Province (based on CSO, 2012) at the time of data collection. However 24 households had missing data leaving 356 households to be included in the study.

3.3 Method of Data Collection

Data were collected using a combination of quantitative and qualitative methods. Instruments used to collect data were household survey structured questionnaire, key informants interview check-list and anthropometric measurements equipment. Both primary data (from households, agricultural officers, community leaders and program co-ordinators) and secondary data (written documents) were collected. The research tools were pre-tested before using them. A total number of 25 farmers in Lukanda camp who were not included in the survey were used in the pre-test. Some adjustments were made in the questionnaire for the final survey. For example, in section B respondents were required to answer on how much extra income they earned per month apart from farming. However most of them only recalled what they earned per week; thus, there was an adjustment from month to week.

3.3.1. Document review of the projects/programs

Secondary data were collected through documents review in order to identify nutrition considerations that were incorporated into the design of programmes and projects in the Central Province. Five documents were reviewed which included two programme documents, namely; RAIN project and Vitamin A Orange Maize project.

The other three documents were policy documents which included the National Food and Nutrition Strategic Plan (NFSP), National Agriculture Policy (NAP) and National Health Strategic Plan (NHSP). The five documents were the only documents that were considered relevant by the government officials consulted. We reviewed issues related to the best practices of nutrition-sensitive agriculture which included, women empowerment, land ownership, micro-nutrient nutrition (reduction of stunting), and crop diversity.

3.3.2 Household survey

Face to face interviews were conducted on sampled households using a structured questionnaire. Medium and small scale farmers were the target population in the survey as explained earlier in section 3.2.1. The questionnaire was divided into sections (Appendix 2, Pg. 62). The sections covered questions on demographic information, social economic information, types of crop grown by farmers at household level, women empowerment and nutrition status of the under-five children between 6-59 months.

3.3.3 Focus Group Discussions (FGDs)

A total of nine Focus Group Discussions were conducted, three in each sampled Agriculture Camp. There were three types of FGDs. One had males only, the second one had females only and the third one had both males and females. Each group had six community members, one moderator and one note-taker. The moderator and community members sat in a circle while the note-taker sat in the background. The arrangement was done in order to establish some of the gender roles in the community and help both men and women to speak freely of their roles. The discussion focused on women empowerment and crop diversity.

3.3.4 Transect walk

Three transect walks were conducted, one in each of the study Camps (Lukanda, Kaunga and Imansa) for the purpose of assess crop diversity and women empowerment. A group of five enumerators walked across the camps with a community member, observing, asking questions and listening. The information and observation were captured on the transect sketch (Appendix 3, Pg. 67).

3.3.5 Anthropometric measurements for under-five children

Standard techniques and equipment (weighing scales for weight, height/length (stadiometers) boards for height/length) were used to assess the nutrition status of children between 6-59 months. The variables used in the study were height/length, weight, age and sex. The children and their mothers were weighed by using electronic scale. The weight of children was obtained by subtracting the weight of the mother from the total weight of mother and baby. The height/length of children was measured with a portable locally made height board. All anthropometric assessments were performed according to WHO procedures. The weights and height/length of the children were used to compute specific indices as z-scores for weight-for-age (WAZ), weight-for-height (WHZ), and Height-for-age (HAZ) using WHO-ENA software (2006). Underweight, wasting and stunting among children were defined as WAZ, WHZ, and HAZ of less than -2SD below the WHO 1995 growth standards respectively (Appendix 4, Pg. 68).

3.4 Data Management and Analysis

Aspects related to the best practices of nutrition-sensitive agriculture that is, reduction of micronutrient deficiencies, women empowerment, crop diversity and

collaboration with different sectors were examined in the documents. The degree to which these aspects were stipulated was expressed in terms of being mentioned. For example; if a document mentions women empowerment four times it was considered to be a good document as compared to a document which mentions women empowerment once. Crop diversity was assessed according the positive responses to the list of crops included in the questionnaire while women empowerment was also assessed according to the number of positive responses to the five questions included in the questionnaire

The collected data were processed by editing, coding and analysed statistically at 5% level of significance using statistical software SPSS version 20.0 Anthropometric measurements were entered into ENA (WHO, 2006) software to generate anthropometric indices (Z-scores). T-test was performed to compare means between variables. A p-value of less than 0.05 was considered statistically significant for any test variable or parameter.

3.5 Ethical Consideration

Permission for data collection was obtained from the local leaders in the respective province, and verbal informed consent was obtained from each respondent before interviews were conducted. The study's purpose and objectives were explained to each participant prior to interview. Study participants were free to refuse or withdraw from the study at any time.

CHAPTERFOUR

4.0 RESULTS

4.1Characteristics of the Sampled Respondents (farmers)

4.1.1 Location

The sampled respondents came from three Agriculture Camps in Mulungushi Block (Table 1). Almost half of the respondents came from Lukanda Camp, and the other half was shared between Kaunga and Imansa Camps. This was proportional to the total number of farmers in the sampling frame.

Table 1: Distribution of respondents by Agriculture Camps

Camp	n	Percentage
Lukanda	172	48.3
Kaunga	78	21.9
Imansa	106	29.8
Total	356	100.0

4.1.2 Demographic characteristics

According to the categorization used in this study as described in chapter three, about three quarters of the respondents were small-scale and a quarter was medium-scale farmers (Table 2). The majority came from families with not more than 10 members (86%) while a few had more than 10 individuals. On the other hand, about 23% were having under-five children of less than 6 months of age, 48% had none while the rest had under-fives of between 6 and 59 months old.

Table 2: Distribution of respondents according to farmer category, household size and type of under-five children

Characteristic	Frequency *(n=356)*	Percentage
Farmer category		
Small scale Farmers	227	78.8%
Medium Scale Farmers	79	22.2%
Household size		
Below 5	153	43
Between 6 and 10	156	43.8
Between 11 and 15	42	11.8
Between 16 and 20	4	1.1
21 and above	1	0.3
Under-five Children		
Between 6 and 59 months	104	29.2
Less than 6months	80	22.5
None	172	48.3

More than 60% of the interviewed respondents were between 20-39 years of age, and one third was 40 years and above while very few were below 20 years of age (Table 3). The table also shows that more females were interviewed than men, and the majority of respondents were married and headed by men (84%). Those aged between 6 and 59 months were the ones targeted for anthropometric assessment of nutrition status in this study.

Table 3: Distribution of respondents according to age, sex, marital status and household head

Characteristic	Frequency *(n=356)*	Percentage
Age		
Below 20 years	15	4.2
Between 20 and 29	112	31.5
Between 30 and 39	108	30.3
Between 40 and 49	55	15.4
50 and above	66	18.5
Sex		
Male	134	37.6
Female	222	62.4
Marital status		
Married	292	82
Single	64	18
Household head		
Male	301	84.6
Female	55	15.4

4.1.3 Socio-economic characteristics

The majority of the respondents (70%) had attained upper primary, junior or senior secondary school education (Table 4). About 9% had no formal education, while very few had post-secondary school education. More than half of the famers had small businesses as an extra income apart from farming while a quarter had salaried jobs and another quarter had none.

Table 4: Distribution of respondents according to their level of education and source of income

Characteristic	Frequency *(n=356)*	Percentage
Education level		
No Formal Education	31	8.7
Lower Primary	29	8.1
Upper Primary	75	21.1
Junior Secondary	90	25.3
Senior secondary	84	23.6
Certificate (post-secondary)	11	3.1
Diploma (post-secondary)	22	6.2
Degree (post-secondary)	14	3.9
Source of Income apart from Farming		
Salaried Job	72	22.2
Small Business	190	53.4
None	94	24.4

Nearly half of the households earned below K 300 per week while very few earned more than K 1200 (Table 5). With respect to wealth categories, the majority of respondents were classified as fair, while one third was classified as poor and only a few were classified as rich.

Table 5: Distribution of respondents according to income levels and category of wealth

Characteristic	Frequency *(n=356)*	Percentage
Income per week in Zambian Kwacha(ZK)		
Below 300	176	49.4
Between 301 and 600	67	18.8
Between 601 and 900	38	10.7
Between 901 and 1200	40	11.2
More than 1200	35	9.8
Assets/Wealth score points (wealth categories)		
Poor	119	33.4
Fair	228	64.0
Rich	9	2.5

Note K6 = One US. Dollar ($1)

4.2 Implementation of the Best Practices of Nutrition-Sensitive Agriculture

In assessing the implementation of nutrition-sensitive agriculture, we looked at the key best practices as recommended by FAO (2011), IFAD (2012), and WHO (2012). Several issues were considered in the assessment. These included the extent to which: Nutrition objectives were incorporated into the agricultural development project/programmes designed to serve as interventions as well as in the relevant national related policies, Crop diversity is practised by farmers in the area, Women empowerment practices are undertaken in the study area.

4.2.1 Incorporation of Nutrition objectives into agricultural projects or programmes and related national policies

As described in chapter 3, two programmes and three policy documents were reviewed for this assessment. Table 6 summarises the type of nutrition objectives that were identified in the documents. Two of the documents included five objectives while three documents had four objectives. Collaboration with other sectors (Health, Agriculture and Nutrition) was one of the objectives that came out in almost all the documents reviewed. An emphasis was also seen on crop diversity and reduction of stunting.

Table 6: Type of nutrition objectives included in the reviewed programmes/policies

Reviewed paper	Best Practices of Nutrition-Sensitive Agriculture included
National Agriculture Policy (2004-2015)	▪ Improve household food security ▪ Provide credit to small scale farmers ▪ Improve crop diversity ▪ Improve women empowerment ▪ Collaboration with other sectors
National Food and Nutrition Strategic Plan (2011-2015)	▪ Increase production, fortified and bio-fortified foods ▪ Improve crop diversity (home gardens) ▪ Prevent childhood stunting ▪ Collaborate with other sectors
National Health Strategic Plan (2011-2015)	▪ Provide maternal and child care ▪ Provision of vitamin A and iron-folate supplements ▪ Management of malnutrition by improving Infant and young child feeding
Vitamin A orange Maize Project (2011-2015)	▪ Prevent childhood stunting ▪ Improve women empowerment ▪ Provision of nutrition education ▪ Collaboration with other sectors
RAIN Project (2011-2015)	▪ Preventing childhood stunting ▪ Improve women empowerment ▪ Crop diversity ▪ Collaboration with other sectors ▪ Nutrition education

4.2.2 Extent to which crop diversity is practiced

From the data obtained in the survey, different types of crops were grown with almost all respondents growing cereals, especially white maize (Table 7 and Appendix 4-7). A good proportion (60%-78%) grew roots and tubers (which included Orange/white sweet potatoes and cassava), green leafy vegetables (like rape, Chinese cabbage, pumpkin leaves and sweet potato leaves), legumes and nuts

which included bean, groundnuts and soya beans among others. Fruits like mangoes, bananas, oranges, melons and lemons, among others, were grown by relatively few respondents.

Table 7: Percentage of respondents growing the various crops in their households

Crops	Frequency ***(n=356)***	Percentage
Cereals	353	99.2
Roots and Tubers	216	60.7
Vitamin A rich Vegetables	194	54.5
Dark leafy green Vegetables	281	78.9
Other Vegetables	183	51.4
Vitamin A rich Fruits	140	39.3
Other Fruits	147	41.3
Legumes and Nuts	234	65.7

4.2.3 Extent to which women empowerment is practiced

According to the assessment criteria for women empowerment described in chapter 3, results are summarised in Table 8. Leadership in agricultural programmes and access to income opportunities or credit appeared to be the least (only 43% each). Others are women's voices in farming decision making and access to extension services and information.

Table 8: Reported extent to which women empowerment practices are undertaken in the study area

Empowerment practice	**Frequency (n=356)**	**Percentage**
Access to productive resources	180	50.6
Access to income opportunities or credit	155	43.5
Women voice in farming decision making	173	48.6
Female holding leadership in agricultural programmes	161	45.2
Access to extension services and information	154	43.3

4.3 Nutrition Status of Children Under-five Years

4.3.1 Overview

The mean height-for-age-Z-scores (HAZ) and weight-for-height (WAZ) were negative suggesting a generally moderate nutritional status of children in the study area (Table 9).However, there were no cases of severely underweight, stunted or wasted children, (Tables 10-12)

Table 9: Mean z-scores, design effects

Indicator	n	Mean z-scores ± SD	Design Effect (z-score < -2)	z-scores out of range	Prevalence rate in %
Weight-for-Age (WAZ)	100	-0.5±0.86	1.00	0	9
Height-for-Age (HAZ)	100	-1.23±1.12	1.00	0	21
Weight-for-Height(WHZ)	100	0.14±1.05	1.00	0	2

4.3.2. Underweight (WAZ)

Results for the underweight situation in Table 10 reveal that underweight was mainly a problem for children of 42 months and above. For example, about two thirds of children between 42-59 months old were underweight compared to only 8.1% of 18-29 months. However none of the children were severely underweight.

Table 10: Distribution of underweight according to age in months

		Moderate underweight (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	Total no	**No.**	**%**	**No.**	**%**
6-17	35	0	0.0	35	100.0
18-29	37	3	8.1	34	91.9
30-41	16	0	0.0	16	100.0
42-53	9	4	44.4	5	55.6
54-59	3	2	66.7	1	33.3
Total	100	9	9.0	91	91.0

4.3.3 Stunting (HAZ)

Results for the stunting situation in Table 11 reveal that stunting was mainly a problem for older children among the under-fives. For example, about two thirds of children (54-59) months old were stunted compared to only 11% of 6-17months. However none of the children were severely stunted.

Table 11: Distribution of stunting according to age in months

		Moderate stunting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	Total no	**No.**	**%**	**No.**	**%**
6-17	35	4	11.4	31	88.6
18-29	37	9	24.3	28	75.7
30-41	16	4	25.0	12	75.0
42-53	9	2	22.2	7	77.8
54-59	3	2	66.7	1	33.3
Total	100	21	21.0	79	79.0

4.3.4. Wasting (WHZ)

Results for the wasting situation in Table 12 reveal that wasting was a problem for children of 42-53 months old. For example, both children who were wasted came from that age group. However none of the children were severely wasted.

Table 12: Distribution of wasting according to age in months

		Moderate wasting (>= -3 and <-2 z-score)		Normal (> = -2 z score)	
Age (mo)	Total no	**No.**	**%**	**No.**	**%**
6-17	35	0	0.0	35	100.0
18-29	37	0	0.0	37	100.0
30-41	16	0	0.0	16	100.0
42-53	9	2	22.2	7	77.8
54-59	3	0	0.0	3	100.0
Total	100	2	2.0	98	98.0

4.4 Relationship between Nutrition Outcomes with Key Variables

T-test was performed to compare means values of various indicators of nutrition status (Z-scores) for different categories of test variables. The test variables considered here were crops grown by households and women empowerment practices.

4.4.1 Relationship between crops grown and the nutrition status of under-five (6-59 months) children

T-test was performed to compare means values of various indicators of nutrition status for various crops grown by respondents. Mean values of the test variables are presented in Table 13. Out of the 25 crops that were tested, only 3 (12%) showed a significant relationship with the nutrition status of under-five children in the households. Details of the finding are presented in Appendices 4-7. It appears that growing of groundnuts in the household was positively affecting the weight and height outcomes of under-five children. Similarly, the growing of orange-fleshed sweet potatoes showed the same pattern. Growing of mangoes had effects on only HAZ and not on the other two indices. There was no effect on WHZ and therefore it was not included in the table below.

Table 13: Relationship between crops grown and under-five nutrition status

Crop diversity indicators	N = 100	WAZ		HAZ	
		Means ± SD	P-value	Means ± SD	P-value
Other fruits					
Do not grow groundnuts	82	-0.84 ± 0.91	0.004	-1.64 ± 1.03	0.001
Grow groundnuts	18	-0.31 ± 0.77		-0.83 ± 1.16	
Do not grow mangoes	32	-0.68 ± 0.95	0.58	-1.39 ± 1.2	0.040
Grow mangoes	62	-0.35 ± 0.76		-0.89 ± 1.12	
Do no grow orange Sweet potatoes	35	-0.75 ± 0.83	0.015	-1.55 ± 1.09	0.003
Grow orange sweet potatoes	65	-0.32 ± 0.83		-0.82 ± 1.15	

For result presentation purposes, only crops whose means were significant have been selected for inclusion (full results Appendix 5-8)

4.4.2. Women empowerment and the nutrition status of under-five children (6-59 months)

T-test was performed to compare mean values of various indicators of nutrition status for various practices of women empowerment. Mean values of the t-test variables are presented in Table 14. Out of the 5 practices that were tested, only 1(20%) showed a significant relationship with the nutrition status of the children below five years of age in the households. It is showing that access to income/credit was positively affecting the WHZ outcome.

Table 14: Relationship between women empowerments and under-five (6-59) nutritional status

Women Empowerment Indicator	**N = 100**	**WAZ**		**HAZ**		**WHZ**	
		Mean ± SD	P-value	Mean ±SD	P-value	Mean ± SD	P-value
No access to productive resourses	32	-0.54 ± 0.84	0.624	-1.35 ± 1.17	0.120	0.16 ± 1.03	0.779
Access to productive resourses	68	-0.45± 0.86		-0.95 ± 1.16		0.10 ± 1.06	
No access to income/credit	32	-0.66 ±0.86	0.64	-1.08 ± 1.15	0.989	-0.17 ± 1.14	0.018
Access to income/credit	68	-0.34 ±0.82		-1.08 ± 1.19		0.32 ± 0.93	
No access to extension servises	32	-0.46 ± 0.87	0.913	-0.10 ± 1.16	0.527	0.63 ± 1.10	0.446
Access to extension servises	68	0.48 ± 0.85		-1,14 ± 1.19		0.19 ± 1.01	
No voices in household decisions	32	-0.47 ± 0.86	0.986	-1.19 ± 1.12	0.646	0.14 ± 1.2	0.920
voices in household decisions	68	-0.48 ± 0.85		-1.05 ± 1.19		0.12 ± 1.0	
No female leaders in agriculture	32	-0.70 ± 0.89	0.050	-1.31 ± 1.12	0.152	-0.07 ± 1.05	0.173
There are female leaders in agriculture.	68	-0.35 ± 0.80		-0.96 ± 1.19		-0.23 ± 1.03	

N: number of households with under-five aged between 6-59 months.

CHAPTER FIVE

5.0 DISCUSSION

This study investigated the extent to which the Ministry of Agriculture is implementing the "best practices" of nutrition-sensitive agriculture in the Central Province of Zambia. The investigation has essentially focused on assessing the following aspects: Incorporation of nutrition considerations into agriculture programmes and project, the extent to which farmers diversify the nutrient-dense crops, the extent to which women are empowered in the society and Nutrition status of under-five children in the study area.

5.1 Incorporation of Nutrition Considerations that were incorporated into the Agriculture Programmes and Projects

It has been argued that inclusion of nutritional objectives in the design of programs and policies at the outset is a crucially important first step to ensuring that agricultural investments have a strong potential to benefit nutrition (FAO, 2012; Herforth *et al.*, 2012; WHO, 2012). A total of 3 policy documents and 2 project documents were reviewed to assess the extent to which nutrition considerations have been incorporated in development planning in Zambia. The three policy documents were the National Agriculture Policy (NAP) formulated in 2004, the National Food and Nutrition Strategic Plan (NFNSP) and National Health Strategic Plans (NHSP) of 2011. On the other hand, the project documents were Vitamin A Orange Maize Project and Rain Project which were both established in 2011.Nutrition considerations most commonly addressed were those related to reduction of stunting, improving women empowerment, improving crop diversity and need for

collaboration with other sectors (Table 6).This is in line with recommendations by other studies (WHO, 2012; World Bank, 2012 and UNSCN, 2014).

Promotion of healthy behaviours and nutrition education strategies have been shown to be effective in contributing to improved child feeding practices, health outcomes, and child nutritional status in the context of nutrition interventions (Dewey and Adu-Afarwuah,2008; Ruel *et al.*, 2008). Nutrition education was only found in two of the reviewed documents. This could imply that there is likelihood of having poor feeding practices in the context of nutrition interventions in this study.

The study also revealed that the presence of high focus on the nutrition of children and women (pregnant and childbearing age), but leaving out most of men, youth and the elderly. However, literature suggests that agriculture and nutrition-related capacity-building activities should involve the entire family in revaluing the importance of women's time, resources, nutrition, and the care of children (Bezner Kerr *et al*., 2008).

The identified gaps in this study included lack of inclusion of current global concerns such as climate change issues. However, since the National Agriculture policy was formulated about 11 years ago, this deficiency is not surprising. Other issues which have become critical in today's life include obesity and other non-communicable diet-related health problems.

5.2 Diversification of Nutrient-dense Crops

Crop diversity has been shown to increase intake of energy as well as micronutrients in developing countries (Gina *et al,* 2007). Maize is Zambia's staple food, something

that has been reflected by results of this study where by 99.2% of the respondent households were growing Cereals (Table 7). The study also observed low crop diversity in terms of fruits and vegetables especially Vitamin A rich fruits, therefore an indication of how most farmers have concentrated on the staple (maize). Concentration of a single crop may lead to higher productivity, that is likely to result in reduced crop diversity (Remans *et al*., 2011), which in return may result into increasing risk of micronutrient deficiency (Remans *et al.*, 2011; Herforth, 2010). Similarly, low crop diversity may reduce the diversity of the foods available in the local market and thus reduce dietary diversity for the net food buyers (Welch and Graham, 2005). A study done in Kenya (Nungo *et al.,* 2012) found that in areas where cassava was a major food that was grown, it was noted that it was very difficult for household to practice diversification of crops. The high percentages of farmers who grow cereals and tubers may mean high consumption of these foods, therefore an indication that the surveyed households are not meeting their micronutrient needs. This is in line with what Gina *et al.*, (2007) reported that it was possible that such foods were not adequate to meet the macronutrient needs of the under-five children and adults. Another contributing factor for a high cereal percentage is that maize has a very good market in Kapiri-Mposhi because the government of Zambia through the Food Reserve Agency (FRA) buys maize from small and medium scale farmers thus affecting the growing of other crops that have low market demand (CSO, 2014). Literature shows that even if a crop is useful for home consumption, farmer's ability to sell the excess produced is an important motivating factor for continued production (World Bank, 2012).

5.3 The Extent of Women Empowerment

A report by the World Bank identified women's empowerment as a key pathway through which agriculture can affect nutrition in developing countries (World Bank, 2007). Several studies from different regions of the world have documented that income controlled by women has a significantly greater positive effect on child nutrition and household food security than income controlled by men (Quisumbing *et al.,* 2003; Katz, 1994; Hoddinott and Haddad, 1994). Women typically spend a higher proportion of their income on food and health care for children than men (Hallman, 2003; Thomas, 1994). On the other hand, when women have power on decision-making in household it significantly reduces child malnutrition rates (Smith *et al.*, 2003; Helen Keller International, 2010; Bushamuka, 2005). Such power allows women to own small livestock animals and home gardens with high micronutrient content (Bezner Kerr and Chirwa, 2004). This study used five indicators to assess women empowerment which included access to productive resources, access to income or credit opportunities, women voices in farming decision making, female leadership in agriculture programmes and access to extension services. The low percentages observed in the five indicators on Table 8 imply that there is very little empowerment of women in the study area.

This is in line with what was observed by Quisumbing (2003) and Naved (2003) that women who are not empowered may lack property rights and control over agricultural production decisions, and may not have equal access to credit institutions, agricultural inputs, extension services, or membership in user groups. It has also been observed that agricultural plots controlled or owned by women may not receive the same intensity of labour or production inputs as plots controlled by men,

thus further contributing to the low productivity of women's agricultural labour (Alderman, *et al.*, 2003). The consequences of low women empowerment is poor nutrition outcome for women, children and the household at large. In South Asia, for example, evidence suggests that as women's status improves, so do prenatal and birthing care for women, appropriate complementary feeding practices for children as well as treatment of illness and nutritional status improves (Smith *et al*., 2003).

5.4 Nutrition Status of Children between 6 and 59 Months

The overall prevalence of stunting, underweight and wasting were 21%, 9% and 2% respectively, in the sampled district as shown in Table 9. As can be observed from the graph on Appendix 8, there is significant displacement of the sample curve to the left of the reference, indicating a general poor nutritional situation in the study population.

The prevalence of stunting observed in Kapiri-Mposhi district was 21% (Table 11). The majority of stunted children were aged between18-59 months in this study. This could be due to the fact that younger children were still receiving special care including breast feeding while the older children depended on meals from the family pot. A similar case was found in Kenya where stunting was lowest in the first year of life and highest in second to fifth year of life (Badeke *et al.*, 2014).

The prevalence of moderate underweight was found to be 9% in Kapiri-Mposhi with most affected children coming from 42-59 months age group. The same pattern was observed in Burkina-Faso (Badeke *et al.,* 2014) and Nigeria (Akorede and Abiola, 2013**),** where most of the underweight children were of 40 months and above.

Overall prevalence of underweight in children of less than 5 years of age in this study would be classified as low because it is less than 10% according WHO classification (WHO, 2012).

The wasting prevalence of 2% was observed in this study and it only affected children in the fourth year of life. A similar case was also found in Kenya where wasting did not affect the first years of life (Badeke *et at.*, 2014). The age of children who were found to be wasted were between 42-53 months old. The results agree with reports from other studies where wasting was analysed with the use of WFP Food Aid as the primary source of food and 40-53 months old children had a borderline significant decreased risk of being wasted (Hoffman, 2005).

5.4.1 Relationship between crops grown and nutrition status of under-five children

The main finding of the study was that household growing of specific crops was associated with stunting and underweight but not wasting among children aged 6 to 59 months in Kapiri-Mposhi. Growing of orange fleshed sweet potatoes was positively associated with weight-for age Z-scores (WAZ) and height-for-age (HAZ). Growing of mangoes was associated with WAZ while growing of groundnuts was associated with WAZ and HAZ. This evidence suggests that growing, and most likely consumption of vitamin A rich crops (orange fleshed sweet potatoes and mangoes) improves the nutrition status and growth of under-five children. A similar case was found in Mozambique where orange fleshed sweet potato (OFSP) dissemination and promotion resulted in increased consumption of OFSP and increased serum retinol of children under-five years of age in a population where

Vitamin A deficiency was prevalent (Low *et al*., 2007). Growing of groundnuts, which is a good source of protein, also improved the growth of children if consumed in recommended amounts. A similar case was found in Malawi which is also a maize dominating country where groundnuts improved the nutrition status of under-fives (Bezner kerrr *et al*., 2007a).

Substantial evidence shows that crop diversity is among the key determinants of the nutritional status of children (Burchi *et al.,* 2011; Frison *et al.,* 2006). Crop diversity is among the best practices of nutrition-sensitive agriculture (IFPRI, 2012; WHO, 2012; FAO, 2013). However, there was no association between WAZ, HAZ or WHZ with growing of some of the crops in this study (Appendices 4-7).

Whereas crop diversity may be a necessary prerequisite for good nutrition outcomes, it is insufficient on its own. Many studies (Kaiser *et al.,* 2002; Bhattacharya *et al.*, 2004; Cook *et al.*, 2004) suggest that the influence of crop diversity and access on the nutritional status of children can be confounded by other key determinants of child nutrition such as food availability, maternal nutrition knowledge and healthcare practices, maternal nutritional status, intra-household food allocation and utilization, access to health services, and healthful environmental conditions such as good hygiene and sanitation. While this can explain to some extent the lack of relationship between growing of some crops and nutrition status of under-five children, it may also be true that crops possess some nutrients which are crucial in improving nutrition status.

5.4.2 Relationship between women empowerment and nutrition status of under-five children

A number of studies have demonstrated that women's empowerment is associated with better health outcomes (Sethuraman, *et al*., 2006; Heaton &Forste, 2007; Mashal *et al.,* 2008; Brunson, *et al*., 2009; Shroff *et al.,*2009; Shroff*et al.,*2011; Rahman*et al.,* 2012;). This study found that households that reported to have higher access to income/credit by women were having better scores in weight-for-height (WHZ) of their children. Evidence suggests that women's control over assets is particularly important for household food security and for child outcomes because women tend to invest substantially in nutrition, education, and healthcare (Roushdy, 2004; Shroff *et al*., 2009). However, other indicators of women empowerment included in this study had no association with the nutrition status of children aged 6-59 months. The other indicators included access to productive resources, access to extension services, women voices in household decisions and female leaders in agriculture programmes. There is evidence that women decision making was negatively associated with nutrition status in Bolivia, Colombia and Haiti (Heaton & Forste, 2007; Shroff *et al.,* 2011).The authors of this study conjectured that this relationship was reflective of inadequate indicators that only looked at women's involvement in decisions about themselves, not of the child.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Given the worldwide emphasis on the use of best practices of nutrition-sensitive agriculture, the documents reviewed showed a good inclusion of mothers and under-five children leaving out the old, teenagers and men. The low crop diversity observed suggested that farmers concentrate more on staple crops which has a higher market demand. Women empowerment was also on the lower side, even though access to income or credit showed a relationship with under-five nutrition status. This suggest that the Ministry of Agriculture in the Central Province still has a long way to go in fully implementing the best practices of nutrition-sensitive agriculture

6.2 Recommendation

The results of this study suggest that the following recommendations be made in order to improve the nutritional status in Zambia.

- The Agriculture National Policy should be reviewed at least every five years. The current one was designed to run for more than ten (10) years. This will enable incorporation of new issues that are emerging, for example climate change.
- Engagement of a nutritional-focal person at the Ministry of Agriculture to input “nutrition-lens” into agricultural development plans and policies.
- A higher percentage of government or NGO credit to the agriculture sector should be given to women so that they contribute to agricultural production which will probably be more effective in improving the nutritional status of children aged 6 to 59 months in Central province.

- Further studies should be under taken in other provinces so that the government may have knowledge on the nutritional status of those it governs and how to plan for improvement.

REFERENCES

Alderman, H., Hoddinott, J.,Haddad,L. J.,Udry, C. R.(2003). Gender Differentials in Farm Productivity: Implications for Household Efficiency and Agricultural Policy. In *Household Decisions, Gender, and Development,* ed. A. Quisumbing, 61–66. Washington, DC: International Food Policy Research Institute.

Agulana T. F (2011). A synergetic linkage between Agriculture, Nutrition and Health. University of Ibadan Nigeria

Ackerson, L., and Subramanian, S. V. (2008). Domestic Violence and Chronic Malnutrition among Women and Children in India. *American Journal of Epidemiology* 167(10): 1188–-1196

Akorede .1 and Abiola .M. (2013) Assessment of Nutritional status of Under five children in Akure South local government, Ondo State, Nigeria **IJRRAS** 14 (3)March2013 [www.arpapress.com/Volumes 14Issue3/IJRRAS_14_3_24.pdf **671**] site visited on 12/06/2014

Aslam, M., and Kingdon, G. (2010). Parental Education and Child Health—Understanding the Pathways of Impact in Pakistan. CSAE Working Paper Series 2010-16. Oxford, UK: Centre for the Study of African Economies, University of Oxford

BadekeQ. D, Maina.I., Mboganie. M.A, Muchemi. G,Kihoro E. M, Chelimo E, and Mutea K.(2014). Nutritional Status of Children Under five years and Associated Factors in Mbeere South District, Kenya. Kenya Agricultural Researh Institute (KARI), P. O. Box 147-60500, Marsabit, Kenya

Bezner Kerr, R., and Chirwa, M. (2004). Participatory research approaches and social dynamics that influence agricultural practices to improve child nutrition in Malawi. *EcoHealth*1 (Suppl 2): 109–19.

Bezner Kerr, R., Berti, P.R. &Shumba, L. (2010). Effects of participatory agriculture and nutrition project on child growth in Northern Malawi. *Public Health Nutr,*14(8):1466-1472. doi:10.1017/S1368980010002545.

Bezner Kerr, R., Dakishoni, L., &Shumba, L. (2008). We grandmothers know plenty: breastfeeding, complementary feeding and the multifaceted role of grandmothers in Malawi. *SocSci Med.,* 66 (5): 1095-1105.

Bezner Kerr, R., Snapp, S., Chirwa, M., Shumba, L., &Msachi, R. (2007a). Participatory research on legume diversification with Malawian smallholder farmers for improved human nutrition and soil fertility. ExpAgr.,43 (4): 1-17.

Bezner Kerr, R., Berti, P., &Chirwa, M. (2007b). Breastfeeding and mixed feeding practices in Malawi: timing, reasons, decision makers, and child health consequences. *Food Nutr Bull.,* 28 (1): 90-99.

Bose, S. (2011). The effect of women's status and community on the gender differential in children's nutrition in India. *Journal of biosocial science*. 43(5): 513-533.

Bushamuka, V. N., de Pee, A. Talukder, L. Kiess, D. Panagides, A. Taher, and . Bloem , M. (2005). Impact of a Homestead Gardening Program on Household Food Security and Empowerment of Women in Bangladesh. *Food and Nutrition Bulletin* 26: 1725.

Cullen, K. W., Baranowski, T., & Smith, S. P. (2001). Using goal setting as a strategy for dietary behavior change. *J AM Diet Ass*.,Vol. 101:562–566.

Christian, P. (2010). Maternal Height and Risk of Child Mortality and Undernutrition. *Journal of the American Medical AssociationVol*303 (15): 1539–1540. DOI: 10.1001/jama.2010.469.

CDC and World Food Program (2005). Measuring and Interpreting Malnutrition and Mortality. Manual for WFP staff, pp 91-110.

Central Statistics Office (CSO), (2009). Zambia Health Demographic Survey 2006-2007. Calverton, Maryland

Central Statistical Office (CSO), (2012), 2010 Census of Population and Housing Report. Lusaka: Government of the Republic of Zambia

Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, Meyers AF, Zaldivar N, Skalicky A, Levenson S, Heeren T, Nord M. (2004). Food insecurity is associated with adverse health outcomes among human infants and toddlers. J Nutr 2004;134:14328.

Cunningham, K., Ruel, M., Ferguson, E., &Uauy, R. (2014). Women's empowerment and child nutritional status in South Asia: a synthesis of the literature. *Maternal & Child Nutrition*, n/a–n/a. doi:10.1111/mcn.12125

Cogil, B. (2001). Anthropometric Indicators Measurement guide. Food and Nutrition Technical Assistance Project Academy for Education, Development Washington DC 92pp.

Dalton, T., Lilja, N. K., Johnson, N., &Howeler, R.(2011). Farmer participatory research and soil conservation in Southeast Asian cassava systems. *World Dev., Vol.* 39 (12): 2176–2186

Desai, S., and Johnson, K. (2005). Women's Decision Making and Child Health: Familial and Social Heirarchies. In *A Focus on Gender: Collected Papers on Gender Using DHS Data*, edited by SuntiaKishor, pp. 55-67. Calverton, MD, USA: Macro International

Dewey, K. G., and Adu-Afarwuah, S. (2008). Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Maternal and Child Nutrition* 4: 24–85.

Food and Nutrition Techinical Assistance (FANTA) (2004). Increased number of different foods or food groups consumed. Measuring household food consumption; A technical guide. FANTA, AED, 2004

Food and Agricultural Organization (FAO).(2009). Investing in food security: linking agriculture to nutrition security. Rome. [http://www.fao.org/ fileadmin/templates/ag_portal/docs/i1230e00.pdf.] site visited on 02/04/2014

Food and Agriculture Organisation (FAO).(2011). Assisting the Food and Agriculture sector in addressing Malnutrition. Rome [www.fao.org/ fileadmin/templates/ag_portal/docs/i1230e00.pdf.] site visited on 02/04/2041

Food and Agriculture Organisation (FAO). (2012). Making Agriculture Work for Nutrition synthesis of guiding principles. [http://www.fao.org/fileadmin/ templates/ag_portal/ docs/i1230e00.pdf.] site visited 09/02/2014

Food and Agriculture Organisation (FAO.(2013). Synthesis of guiding principles on agriculture programming for nutrition. [http://www.fao.org/fileadmin/ templates/ag_portal/ docs/i1230e00.pdf.] site visited on 09/02/2014

Gibson, R.S. (1990). *Principles of Nutrition Assessment*. Oxford University Press New York 3-10pp.

Gina LK, Maria RP, Chiara S, Guy N and Inge, B. (2007). "Dietary diversity score Is a useful indicator of micronutrient intake in non-breast-feeding filipino children."*The Journal of Nutrition.*2007; **137**:472-477.

Government of the Republic of Zambia (2006)."2006-2011 National Health Strategic", Lusaka*:* Ministry of Health

Government of the Republic of Zambia (1995). Review of National Health Policies and Strategies. Lusaka: Ministry of Health

Government of the Republic of Zambia (2001). National Health Strategic Plan 2001 – 2005. Lusaka: Ministry of Health

Graham, R., R. M. Welch, D. A. Saunders, I. Ortiz-Monasterio, H. E. Bouis, M. Bonierbale, S. De Haan, G. Burgos, G. Thiele, R. Liria, C. A. Meisner, S. E. Beebe, M. J. Potts, M. Kadian, P. R. Hobbs, R. K. Gupta, S. Twomlow. (2007). Nutritious subsistence food systems. *Advances in Agronomy* 92: 1–74.

Hattacharya J, Currie J, Haider S.(2004). Poverty, food insecurity, and nutritional outcomes in children and adults. *J Health Econ* ;23:839–62.

Helen Keller International.(2010). Homestead Food Production Model Contributes to Improved Household Food Security, Nutrition and Female Empowerment Experience from Scaling-up Programs in Asia (Bangladesh, Cambodia, Nepal and Philippines).

Herforth, A. (2010b). Nutrition and the Environment: Fundamental to Food Security in Africa. In *The African Food System and Its Interaction with Human Health andNutrition,* ed. P. Pinstrup-Andersen, chapter 7. Ithaca, NY: Cornell University Press.

Hoddinott, J., and L. J. Haddad.(1994). Women's income and boy-girl anthropometric status in the Côte d'Ivoire. *World Development* 22 (4): 543–53.

Hoffman J.D. (2005). Prevalence of Wasting, but not Stunting, has Improved in the Democratic People's Republic of Korea. *The Journal of Nutrition* 2005; 452-456.

International Food Policy Research Institute (IFPRI). (2012). "Agriculture-Nutrition Linkages and Policies in India", Discussion Paper 01184, New Delhi, India.

International Food Policy Research Institute (IFPRI). (2011a) Leveraging Agriculture for Improving Health and Nutrition. : Highlights from anInternational Conference, Washington DC

International Food Policy Research Institute (IFPRI). (2011b). Agriculture, Nutrition, Health: Exploiting the Links. Washington, DC.

Kapiri-Mposhi District Council (2012). 2010 District Situational Analysis Kapiri-Mposhi District Medical Office. 2011 – 2012 District Health Strategic Plan

Lancet (2008). Nutrition Sensitive interventions and programs, how can they help to accelerate progress in improving Maternal and Child Under-nutrition *Series 2008*, London

Low, J. W., M. Arimond, N. Osman, B. Cunguara, F. Zano, and D. A. Tschirley.(2007). Food-Based Approach Introducing Orange-Fleshed Sweet Potatoes Increased Vitamin A Intke and Serum Retinol Concentrations in Young Children in Rural Mozambique. *Journal of Nutrition* 137: 1320–27.

Masset, E., L. J. Haddad, A. Cornelius, and J. Isaza-Castro.(2012). Effectiveness of Agricultural Interventions that Aim to Improve Nutritional Status of Children: Systematic Review. *British Medical Journal* 344:d8222

Masset, E., A. Cornelius, L. J. Haddad, and J. Isaza-Castro.(2011). What Is the Impact of Interventions to Increase Agricultural Production on Children's Nutritional Status? A Systematic Review of Interventions Aiming at Increasing Income and Improving the Diet of the Rural Poor. London: Department for International Development (DFID). .

Meerman .j. Mucha .N.Wustefeld.(UNSCN Secretariat, 2014). Country Level Programming in Nutrition-Sensitive Agriculture. Department of foreign affairs trade and development (dfatd)

Moursund A &Kravdal Ø (2003). Individual and community effects of women's education and autonomy on contraceptive use in India. *Population Studies* 57:285-302.

Mucha N. (2012), Implementing Nutrition-Sensitive Development: Reaching a consensus, Bread for the World Institute.

National Agriculture Policy (NAP). (2003). Government of the Republic of Zambia, Lusaka: Ministry of Agriculture

National Food and Nutrition Council (NFNC) (2003). Zambiafindings from a review of document. Lusaka, Zambia

National Food and Nutrition Strategic plan (NFNSP) (2011). Government of the Republic of Zambia, Lusaka: National Food and Nutrition Commission of Zambia

National Health Strategic Plan (NHSP) (2011). Government of the Republic of Zambia, Lusaka: Ministry of Health

Naved, R. T. (2003). Intrahousehold Impact of the Transfer of Modern Agricultural Technology: A Gender Perspective. In *Household Decisions, Gender, and Development*, ed. A. Quisumbing, 85–88. Washington, DC: International Food Policy Research Institute.

Quisumbing, A. R. (2003). Social Capital, Legal Institutions, and Property Rights: Overview. In *Household Decisions, Gender, and Development,* ed. A. R. Quisumbing 139–44. Washington, DC: International Food Policy Research Institute.

Quisumbing A. and B. Mac Clafferty (2006). Using Gender Research in Development. WashingtonDC: The International Food Policy Research Institute.

Quisumbing A andPandolfelli, L. (2009). Promising Approaches to Address the Needs of Poor Female Farmers Resources Constraints and Interventions. *Discussion Paper 00882,* Washington DC: International Food Policy Research Institute.

RAIN project (2011). Government of the Republic of Zambia, Central province, Mumbwa. Ministry of Agriculture

Ramisch, J. (2012). This field is our church." The social and agronomic challenges of knowledge generation in a participatory soil fertility management project. *In*J.Sumberg and J. Thompson, eds. *Contested Agronomy: Agricultural Research in a Changing World.* New York and London: Earthscan, Routledge.

Remans, R., D. F. B. Flynn, F. DeClerck, W. Diru, J. Fanzo, K. Gaynor, I. Lambrecht, J. Mudiope, P. K. Mutuo, P. Nkhoma, D. Siriri, C. Sullivan,

and C. A. Palm.(2011). Assessing nutritional diversity of cropping systems in African villages. *PLOS One* 6 (6): e21235. doi:10.1371/ journal. pone.0021235.

Richards E., Theobald, S., George, A., Kim, J.C., Rudert, C., Jehan, K., &Tolhurst, R. (2012). Going beyond the surface: gendered intra-household bargaining as a social determinants of child health and nutrition in low and middle income countries. Oxyford University Press.

Roushdy, R. (2004). Intra-household Resource Allocation in Egypt: Does Women's Empowerment Lead to Greater Investments in Children? Working Paper No. 0410. Cairo: Economic Research Forum

Ruel, M. T., P. Menon, J. P. Habicht, C. Loechl, G. Bergeron, G. Pelto, M. Arimond, J. Maluccio, L. Michaud, and B. Hankebo. (2008). Age-based preventive targeting of food assistance and behaviour change and communication for reduction of childhood under-nutrition in Haiti: *Lancet* 371: 588 95.

Sahn, D. (2010). The Impact of Poor Health and Nutrition on Labour Productivity, Poverty, and Economic Growth in Sub-Sahara Africa. In P. Pinstrup-Andersen, ed., *The African Food System and Its Interaction with Human Health and Nutrition.* Ithaca, NY: Cornell University Press in cooperation with the United Nations University.

Shroff, M., Griffiths, P., Adair, L., Suchindran, C., & Bentley, M. (2009).“Maternal autonomy is inversely related to child stunting in Andhra Pradesh, India.

Maternal & Child Nutrition, *5*(1), 64–74. doi:10.1111/j.1740-8709.2008.00161.x

Smith, L., and L. J. Haddad.(2000). Explaining Malnutrition in Developing Countries: A Cross Country Analysis. Washington, DC: International Food Policy Research Institute

Smith, L. C., U. Ramakrishnan, A. Ndiaye, L. J. Haddad, and R. Martorell.(2003). The Importance of Women's Status for Child Nutrition in Developing Countries. In *Household Decisions, Gender, and Development,* ed. A. R. Quisumbing, 41–50. Washington, DC: International Food Policy Research Institute.

Shumba, L. (2011). Food Security & Dietary Diversity Survey Report 2011. Unpublished report, Soils, Food and Healthy Communities Project.

United Nation Standing Committee on Nutrition (UN SCN) .(2010). Sustainable Food and Nutrition Security. In *Progress in Nutrition: Sixth Report on the World Nutrition Situation,*chapter 4. New York.

Vitamin A Orange Maize Project (2012). Government of the Republic of Zambia, Central Province, Kabwe: Ministry of Agriculture

World Health Organisation (WHO). (1995). Physical status: Use and Interpretation of Anthropometry. WHO Technical report series no854.

World Health Organisation (WHO). (2012). Improving human nutrition through agricultural research: overview and objectives. Geneva Switzerland *Food and Nutrition Bulletin* 21(4): 352-355.

World Bank. (2007a). From Agriculture to Nutrition: Pathways, Synergies, and Outcomes. Washington, DC: World Bank.

World Bank (2007b). World Development Report 2008: Agriculture for Development. Washington, DC.

Zambia Demographic Health Survey (ZDHS). (2014). Review of the National Health 2013-2014. Lusaka, Zambia

APPENDICES

Appendix 1: Sample size determination

The following formula will be used to select a sample.

$$n = \frac{z^2 \times p \times q}{m^2}$$

Whereby:

n = desired minimum sample size

z = the standard normal deviate corresponding to 95% Confidence Interval (1.96)

p = the proportion of an indicator measured

q = 1- p

m = degree of accuracy or desired precision

-Taking the prevalence of stunting in Central province as 53% or 0.53 for, z statistic corresponding to 95% confidence interval for a two-tailed test as 1.96, and degree of accuracy at 0.05, the sample size will be:

$$n = \frac{(1.96)^2 \times 0.53 \times 0.47}{(0.05)^2} = 382$$

Appendix 2: Questionnaire for medium and small scale farmers households in Kapiri-Mposhi

SOKOINE UNIVERSITY OF AGRICULTURE (SUA)

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

STUDY QUESTIONNARE

Given Chipili (Master of Science in Human Nurition)

Research Title "Implementation of Nutrition-Sensitive Agriculture in the Central Province of Zambia the case of Ministry of Agriculture "

Phone: +260 977837626 Email; givenchipili@yahoo.com

Date…… Researcher/Enumerator…….

Country……. Name of Reseach Site……

Camp…… Questionnaire number……..

Section A: Household Information

A1: Household head and interviewee:

		Age in Years	Sex 1-Male 2-Female	Highest education attained	Main economic occupation 1- small scale farmer 2-Mediam scale farmer
1	Interviewee				
2	Household head (if different from 1).				

A2: Household size

How many people live together with you in this household?.....

How many are;

Males;……

Females……

Under-five years ……..

Section B: Sociol-economic characteristics

1. What other income generating activities do you do apart from farming?

   [ ]Salaried job; [ ] small business; [ ]none

2. What is your income per week?.....
3. How many of the following does your house own?

   [ ]car; [ ]motorbike; [ ]tractor; [ ]; bicycle; [ ]fridge; [ ]TV; [ ]cattle/goats;

   [ ]chickens; [ ] cell phone; [ ]radio; [ ] own house.

4. Does your house use solar or electricity [ ]
5. What type of roof does your house have?

   [ ]Thached roof; [ ] Steel Roofing sheet

Section C: Crop Diversity information

1. What type of crops do you grow?

Cereals	1- yellow maize 2- white maize 3- sorghurm 4- millet	(Put the right code)
Roots and Tubers	1- orange sweet potatoes 2- white sweet potatoes, 3- cassava, 4- irish potatoes, 5- other (specify)	
Vitmin A rich Vegetables	1- pumpkins, 2- carrot, 3- red pepper 4- red cabbage 5- purple egg plants	
Dark Green Leafy Vegetables	1- rape 2- spinnach 3- pumpkin leaves 4- amaranth 5- cabbage 6- chinese cabbage 7- sweet potato leaves 8- cassava leaves 9- onion leaves 10- cowpea leaves	
Other Vegetables	1- Tomatoes 2- Onion 3- Okra 4- green beans 5- tradition egg plan	
Vitamin A rich Fruits	1- ripe mangoes 2- water melons 3- apricots 4- ripe papaya 5- peaches	
Other Fruits	1- pineapple 2- apple 3- blackberry 4- cashew fruits 5- avacado 6- oranges 7- lemons 8- bananas 9- Other fruits	

Legumes, nuts and seeds.	1- Beans 2- Peas 3- Lentils 4- Nuts 5- Seeds 6- Groundnuts 7- Cowpeas 8- Soya bean 9- Pigeon peas 10- Cashew nuts 11- Sesami seeds 12- Pumpkin seed 13- Other local seeds	

2 .Estimate the proportion of your household production that you normally sell to other consumers or in town.

	None	1/4	1/2	3/4	All of it
Cereals					
Tubers					
Vitamin A rich vegetables					
Dark green leafy vegetables					
Other vegetables					
Vitamin A rich vegetables					
Other fuits					
Legumes , seedsand nuts					

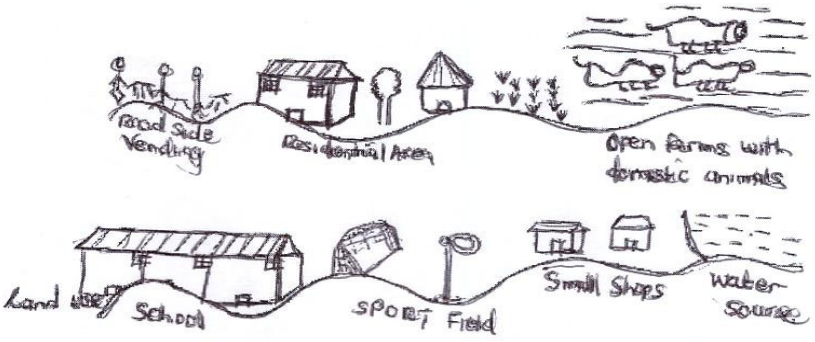
Section D: Women Empowerment

1. Do women have access to productive resourses? [ ]
2. Do women have access to income opportunitie/credit? [ ]
3. Do women have access to extension servises and imformation? [ ]
4. Are womens voices supported in the household and farming decisions? [ ]
5. Do you have female leaders in agriculture programs? [ ]

Section E: Nutrition assesment for under-five children.

1. Child's age in months……..
2. Sex 1. Male 2. Female [ ]
3. Date of birth…….
4. Birthweight (Kg)……
5. Is the child still breast feeding? [ ]
6. Childs Nutritional Status, Weight (Kg)……. Length in (cm)…….

Appendix 3 Transect sketch



Observations

- Most women vending at the road side
- Enough water for home gardens
- Most men drinking during the day
- Children left home unattended to

Appendix 4: Classification of malnutrition

Level of malnutrition	***Weight-for height (wasting)***	***Height-for-age (Stunting)***	***Weight-for –age (underweight)***
Moderate Mulnutrition	Between-2SD and-3SD Z-scores	Between-2SD and -3SD Z-scores	Between-2SD and -3SD Z-scores
Severte Mulnutrition	Less than -3SD Z-scores	Less than -3 Z-scores	Less than -3SD Z-scores
Global Malnutrition	Less than -2SD Z-scores	Less than -2SD Z-scores	Less than -2SD Z-scores

Source (WHO, 1995)

Appendix 5: Relationship between crops grown and nutrition status of under-five (6-59 months) children.

Crop diversity indicators	**N = 100**	**WAZ**		**HAZ**		**WHZ**	
		Means ± SD	t-test	Means SD	t-test	Means	t-test
Cereals			(sig)		(sig)	SD	(sig)
Does not grow yellow maize	59	-0.58 ± 0.83	0.125	0.16 ± 0.16	0.419	0.05 ± 1.01	0.384
Grows yellow maize	41	-0.32 ± 0.08		-0.97 ± 1.21		0.23 ± 1.0	
Roots and Tubers							
Does not grow orange sweet potatoes	35	-0.75 ± 0.83	0.015*	-1.55 ± 1.09	0.003**	0.10 ± 0.81	0.856
Grows orange sweet potatoes	65	-0.32 ± 0.83		-0.82 ± 1.15		0.14 ± 1.16	
Does not grow white sweet potatoes	43	-0.41 ± 0.84	0.537	-1.17± 1.15	0.523	0.25 ± 1.05	0.293
Grows white sweet potatoes	57	-0.52 ± 0.85		-1.02 ± 1.20		0.27 ± 1.05	
Does not grow cassava	79	-0.51 ± 0.88	0.462	-1.08 ± 1.21	0.953	0.05 ± 1.04	0.197
Grows cassava	21	-0.35 ± 0.74		-1.10 ± 1.05		0.38 ± 1.05	
Vitamin A rich Vegetables							
Does not grow pumpkins	35	-0.48 ± 0.90	0.952	-1.19 ± 1.13	0.498	0.18 ± 1.11	0.698
Grows pumpkins	65	-0.47 ± 0.83		-1.02 ± 1.02		0.93 ± 0.02	

Appendix 6: Relationship between crops grown and nutrition status of under-five (6-59 months) children.

Crop diversity indicators	**Responses**	**N = 100**	**WAZ**		**HAZ**		**WHZ**	
Dark green leafy vegetables			Means ± SD	P-value	Means ± SD	P-value	Means ± SD	P-value
Does not grow amaranth		31	-0.43 ± 0.85	0.221	-1.01 ± 1.17	0.133	0.13 ± 1.08	0.0843
Grows amaranth		69	-0.74 ± 0.76		-1.54 ± 1.15		0.07 ± 0.80	
Does not grow cabbage		70	-0.53 ± 0.86	0.355	-1.10 ± 1.20	0.760	0.08 ± 1.02	0.620
Grows cabbage		30	-0.35 ± 0.80		-1.03 ± 1.15		0.20 ± 1.11	
Does not grow cassava leaves		75	-0.49 ± 0.87	0.806	-1.04 ± 1.21	0.521	0.07 ± 1.10	0.366
Grows cassava leaves		25	-0.44 ± 0.78		-1.21 ± 1.09		0.29 ± 0.87	
Does not grow onion leaves		68	-0.47 ± 0.81	0.990	-1.09 ± 1.15	0.965	0.14 ± 1.02	0.806
Grows onion leaves		32	-0.48 ± 0.91		-1.07 ± 1.24		0.08 ± 1.11	
Does not grow sweet potato leaves		70	-0.49 ± 0.83	0.792	-1.12 ± 1.14	0.755	0.10 ± 1.08	0.808
Grows sweet potato leaves		30	0.44 ± 0.88		-1.03 ± 1.24		0.16 ± 1.00	
Does not grow pumpkin leaves		31	-0.42 ± 0.97	0.691	-1.21 ± 1.14	0.462	0.29 ± 1.14	0.302
Grows pumpkin leaves		69	-0.50 ± 0.79		-1.02 ± 1.19		0.05 ± 1.01	
Does not grow rape		47	-0.48 ± 0.87	0.951	-0.97 ± 1.16	0.370	0.79 ± 1.03	0.693
Grows rape		53	-0.47 ± 0.84		-1.18 ± 1.20		0.16 ± 1.07	

Appendix 7: Relationship between crops grown and nutrition status of under-five (6-59 months) children.

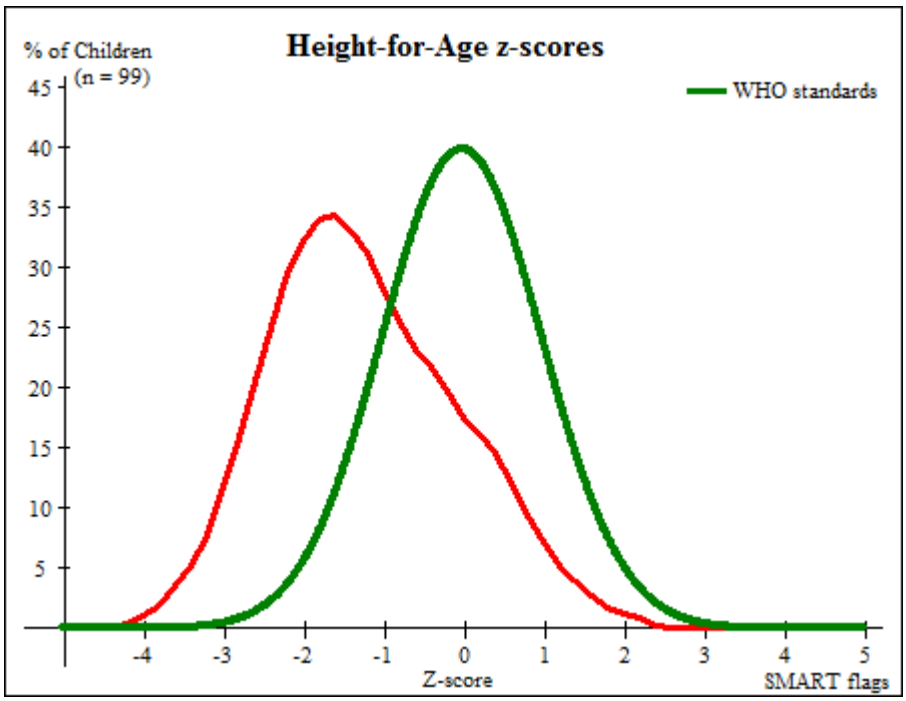
Crop diversity indicators	**Responses**	**N = 100**	**WAZ**		**HAZ**		**WHZ**	
Other vegetable			Means ± SD	t-test (sig)	Means ± SD	t-test (sig)	Mean ± SD	t-test (sig)
Does not grow green beans		81	-0.52 ± 0.80	0.256	-1.13 ± 1.12	0.256	0.08 ± 0.04	0.427
Grows green beans		19	-0.46 ± 091		-0.83 ± 1.39		0.30 ± 1.06	
Does not grow okra		75	-0.44 ± 0.84	0.452	-0.94 ± 1.20	0.052	0.07 ± 1.02	0.397
Grows okra		25	-0.59 ± 0.88		-1.48 ± 1.02		0.28 ± 1.14	
Does not grow onion		68	-0.44 ± 1.18	0.640	-1.09 ± 1.18	0.931	0.19 ± 1.00	0.398
Grows onion		32	-0.53 ± 1.20		-1.07 ± 1.20		0.01 ± 1.12	
Does not grow tomatoes		56	-0.49 ± 0.80	0.885	-1.12 ± 1.16	0.684	0.14 ± 0.10	0.820
Grows tomatoes		44	-0.46± 0.91		-1.02 ± 1.20		0.96 ± 1.12	
Vitamin A rich fruits								
Does not grow mangoes		32	-0.68 ± 0.95	0.580	-1.39 ± 1.2	0.040*	0.09 ± 1.15	0.804
Grows mangoes		62	-0.35 ± 0.76		-0.89 ± 1.12		0.14 ± 0.99	
Does not grow water melon		77	-0.51 ± 0.85	0.421	-1.04 ± 1.17	0.592	0.05 ± 1.07	0.203
Grows water melons		23	-0.35 ± 0.84		-1.20 ± 1.20		0.37 ± 0.95	

.

Appendix 8: Relationship between crops grown and nutrition status of under-five (6-59 months) children.

Crop diversity indicators	Responses	N = 100	WAZ		HAZ		WHZ	
			Means ± SD	t-test (sig)	Means ± SD	t-test (sig)	Mean ± SD	t-test (sig)
Other fruits								
Does not grow bananas		70	-0.46 ± 0.87	0.860	-01.05 ± 1.19	0.730	0.11 ± 1.08	0.800
Grows bananas		30	-0.50 ± 0.82		-1.14 ± 1.16		0.16 ± 0.99	
Does not grow Lemons		73	-0.46 ± 0.87	0.820	-1.16 ± 1.17	0.278	0.19 ± 1.03	0.281
Grows lemons		23	-0.51 ± 0.81		-0.87 ± 1.20		-0.06 ± 1.08	
Does not grow oranges		80	-0.49 ± 0.85	0.673	-1.13 ± 1.13	0.443	0.11 ± 1.06	0.806
Grows oranges		20	-0.40 ± 0.86		-0.90 ± 1.37		0.17 ± 1.01	
Legumes and nuts								
Does not grow beans		30	-0.43 ± 0.90	0.471	-1.06 ± 1.24	0.841	0.15 ± 1.10	0.721
Grows beans		70	-0.56 ± 0.74		-1.11 ± 1.04		0.07 ± 0.94	
Does not grow ground nuts		82	-0.84 ± 0.91	0.004**	-1.64 ± 1.03	0.001**	0.05 ± 1.17	0.673
Grows ground nuts		18	-0.31 ± 0.77		-0.83 ± 1.16		0.15 ± 1.00	
Does not grow pumpkin seed		47	-0.51 ± 0.87	0.671	-1.23 ± 1.07	0.671	0.16 ± 1.09	0.730
Grows pumpkins		53	-0.44 ± 0.83		0.94 ± 1.25		0.09 ± 1.02	
Does not grow Soya beans		82	-0.53 ± 0.87	0.161	-1.15 ± 1.15	0.184	0.11 ± 1.08	0.715
Grows soya beans		18	-0.22 ± 0.70		-0.75 ± 1.23		0.21 ± 0.90	

Appendix9: Graph showing stunting levels in Kapiri-Mposhi



There is significant displacement of the sample curve to the left of the reference, indicating a poor nutritional situation in the sampled population. The mean Z score of the sample is -1.23(SD 1.12) indicating a poorly nourished population.