IMPACT OF COMMUNITY HEALTH WORKERS ON NUTRITIONAL STATUS AND COGNITIVE DEVELOPMENT OF CHILDREN AGED LESS THAN TWO YEARS IN KISUMU AND MIGORI COUNTIES, KENYA

CAROLINE JEPKOECH SAWE

A80/96627/2014

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN APPLIED HUMAN NUTRITION

DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY

FACULTY OF AGRICULTURE

UNIVERSITY OF NAIROBI

2020

DECLARATION

This thesis is my original work and has not been submitted for the award of a degree in any other University.

Sign ……  Date …21st November, 2020

Sawe Caroline Jepkoech

Registration number: A80/96627/2014

APPROVAL;

This thesis is submitted with our approval as University supervisors

Signature ……..... Date: November 24, 2020

Prof. Wambui Kogi-Makau (Ph.D.)

Department of Food Science, Nutrition and Technology

University of Nairobi

Signature …  **… Date: 23rd November 2020**

Prof. Grace Keverenge Ettyang' (Ph.D.)

Department of Health Management, Policy and Human Nutrition

Moi University

Signature ……  **…....** **Date: 22st November 2020**

Dr. Charles Kimamo (Ph.D.)

Department of Psychology

University of Nairobi

Plagiarism Declaration Form
UNIVERSITY OF NAIROBI

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES (CAVS)

Faculty of Agriculture

DEPARTMENT OF FOOD SCIENCE NUTRITION AND TECHNOLOGY (DFSNT)

Plagiarism Declaration Form for Students

Name of Student ___CAROLINE JEPKOECH SAWE

Registration Number _____ A80/96627/2014.

College _____Agriculture and Veterinary Sciences (CAVS)

Faculty/School/Institute Agriculture.

Department _____ Food Science Nutrition and Technology (DFSNT)

Course Name ____PhD in APPLIED HUMAN NUTRITION

Title of the work____ Impact of Community Health Workers on Nutritional Status and Cognitive Development of Children Aged Less Than Two Years in Kisumu and Migori Counties, Kenya

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard

2. I declare that this **RESEARCH THESIS** is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my own work has been used, this has properly been acknowledged and referenced in accordance with the requirements of University of Nairobi.

3. I have not sought or used the services of any professional agencies to produce this work

4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work

5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature:  **Date**: 24th November, 2020

Plagiarism Turnitin report

ACKNOWLEDGEMENT

I give thanks to God for his protection and ability to do this work. I am so grateful to the Consortium for Advanced Research Training in Africa (CARTA) for funding my PhD education and University of Nairobi for making it possible for me to study here. My deep thanks goes to the College of Agriculture and Veterinary Sciences and the department of Food Science, Nutrition, and Technology for their support. My special appreciation goes to my supervisors; Professor Wambui Kogi-Makau, Professor Grace Ettyang and Dr Charles Kimamo for their consistent directions.

I am also deeply thankful to CARTA cohort 4 fellows and all facilitators whose challenges and productive criticism, especially at the Joint Annual Seminars provided rich ideas to the work.

Finally, I thank my family who encouraged and prayed for me throughout the time of my thesis work. I thank all who in one way or another contributed in the completion of this thesis.

May the Almighty God richly bless all of you.

DEDICATION

This thesis is lovingly dedicated to my loving husband (Oliver), my children (Natalie and Nathan), mother (Rael), Mother in law (Elizabeth) and all my siblings (Betty, Kossy, Chemu and Kem). Their support, encouragement, and constant love have sustained me throughout my life.

I also dedicate this work to my late dad. He always inspired me and loved education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADP	Area Development Program
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-Retroviral Therapy
ARV	Anti-Retroviral
BSID	Bayley Scales of Infant Development
CHEW	Community Health Extension Worker
ChNIS	Child Health Nutrition Impact Study
CHS	Community Health Strategy
ChTIS	Child Health Targets Impact Study
CHW	Community Health Worker
FFQ	Food Frequency Questionnaire
FGD	Focus Group Discussion
GoK	Government of Kenya
HAZ	Length for Age Z Scores
HAZ	Length-for-age
HIV	Human Immune-Deficiency Virus
IDI	In-Depth interview
IQ	Intelligence Quotient
IREC	International Research and Ethical Committee
KDHS	Kenya Demographic and Health Survey
KEPH	Kenya Essential Package of Health
KNBS	Kenya National Bureau of Statistics

LMIC	Low and Middle-Income Countries
MDG	Millennium Development Goals
MOH	Ministry of Health
NGO	Non-Governmental Organization
NHSSP	National Health Sector Strategic Plan
PEM	Protein Energy Malnutrition
PHC	Primary Health Care
RA	Research Assistant
RDA	Recommended Dietary Allowance
SD	Standard Deviation
SDG	Sustainable Development Goals
TTc	Timed and Targeted counselling
UNICEF	United Nations International Children's Emergency Fund
UoN	University of Nairobi
WAZ	Weight for Age Z Scores
WHO	World Health Organization
WHZ	Weight for Height Z Scores
WV	World Vision

OPERATIONAL DEFINITION OF TERMS

CHW - Community Health Workers are trusted, knowledgeable frontline health personnel who typically come from the communities they serve.

Cognitive - Is the ability (or lack of) of the mind to process gained information. The process involves thinking, knowing, learning, remembering, judging and problem-solving.

Dietary intake: Refers to the daily eating patterns of an individual, including specific foods and calories consumed and relative quantities

ENA for SMART: Emergency Nutrition Assessment software for analyzing anthropometric measurements and generates the Z scores for the nutritional indices.

Fine motor skills - Involve tasks that require dexterity of small muscles, such as buttoning a shirt.

Gross motor skills - Tasks such as walking or throwing a ball.

Impact - Level of contribution by CHWs on the nutritional outcomes and cognitive development on children aged below two years as they were implementing the TTc through home visits and giving key nutritional messages to caretakers.

Malnutrition - In this study malnutrition will be defined using anthropometric indicators of height-for-age, weight-for-age, and weight- for-height Z scores.

Moderate malnutrition will be defined using the cut off points of less than minus 2 Z (<-2) scores while severe malnutrition was defined using cut off points of less than minus 3 Z (<-3) srestcores.

Nutrients - Chemical substances obtained from food and used in the body to provide energy, structural materials regulating agents to support growth, maintenance and repair of body tissues.

Nutritional Care of Sick children - Nutritional care of sick children refers to quality of food and care given to children during illness.

NVivo: Qualitative data analysis (QDA) computer software package

Psychosocial Support for Children - It refers to the process of meeting children's emotional, social, mental and spiritual needs. All of these are essential elements of positive human development. Some of these include: Talking to a child, touching and playing.

Recommended Dietary Allowances: Average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%-98%) healthy people according to age group.

STATA: Statistical Data analysis software for analyzing quantitative data

Z-Score: Refers to the number of standard deviations below or above the reference median value, (WHO, 2006)

ABSTRACT

Globally, child malnutrition and poor cognition issues of public health importance. Sub Saharan Africa records the highest levels of malnutrition with 39% of children being stunted, 4% underweight and 10% wasted while in Kenya, 26% are stunted, 4% wasted and 11% underweight. Most growth faltering in children occurs after the six months of life when exclusive breastfeeding has been stopped, exposure to diseases is high and demand for nutritional needs increases due to rapid growth and development. Nutrition in the first 1,000 days of life is key in child's ability to grow but after the second year of life, malnutrition can be been linked to reduced cognitive outcomes, poverty, low human capita, reduced school and work performance. Compared to developed nations, there is limited documented data on the relationship between child nutritional status and cognitive development in developing countries. Kenyan Government integrated Community Health Workers into the health system through the Health Community Strategy program whose main aim was to ensure improved nutritional status and cognitive development among all children. But since its launch in 2007, there has been limited studies on the effectiveness of CHWs yet that finding could be key in upscaling the program. In 2013, World Vision trained the CHWs in the Health Strategy program and used them to implement the Timed and Targeted Counselling nutrition intervention in Kisumu County. The trained CHWs delivered key nutritional messages on nutritional status and cognitive development at a particular time during child's growth as they engaged and counseled caretakers on health status of their children from time of delivery until child was two years old. CHWs in Migori County which was the comparative group did not receive any specialized training from World Vision on timed and targeted counseling. Trained CHWs have the potential of improving the nutritional status and cognitive development among children. The objective of this study was to establish the impact of CHWs on the nutritional status

and cognitive development of children in Katito in Kisumu County with a comparison at Kegonga Ntimaru in Migori County. Quasi experimental study design was used with secondary baseline data obtained from World Vision database and endline data collected and analyzed. WHO Z scores computed child's underweight, overweight, stunting and wasting status while Bayleys Scale of Infant Development Kit assessed the Cognitive scores of children with categories computed using the Bayleys composite score. Food Frequency questionnaire collected data on dietary intake and nutrient inadequacies were computed based on the Recommend Daily Allowances. Qualitative data collected information on the perception of CHWs' knowledge on nutritional status and child cognition. STATA 13.1 and NVivo 7.0 analyzed quantitative qualitative data respectively. Descriptive statistics summarized data into frequencies, means and standard deviation. Chi-square and independent sample t-test assessed the relationship between two variables while Multinomial logistic regression analyzed the relationship among variables. The level of significance was set at $p<0.05$. At baseline, there was no significant difference in the levels of underweight and overweight ($chi^2=8.73$, $p=0.068$), wasting ($chi^2=0.25$, $p=0.885$) and stunting ($chi^2=2.79$, $p=0.25$) among children at Katito and Kegonga Ntimaru sites. After three years of intervention implementation at Katito, the prevalence of underweight reduced by 21.6%, overweight increased by 8.3% ($chi^2=21.55$, $p<0.001$) and wasting reduced by 26% ($chi^2=22.54$, $p<0.001$). Only 61% and 48% of children were exclusively breastfed in Katito and Kegonga Ntimaru respectively. A total of 43% of children in Katito and 50% at Kegonga had inadequate iron sources from their diets. Only 5% and 34% of the children had cognitive scores that were below average at Katito and Kegonga Ntimaru respectively ($Chi^2=15.8537$, $p<0.001$). The CHWs were perceived to be knowledgeable on child nutritional status but had little knowledge on key foods for child cognition. In Katito, it was found that exclusive breastfeeding was linked to child underweight and

overweight status (Chi^2=27.13, p=0.04) while stunting was linked to duration of breastfeeding (Chi^2=16.72, p=0.033). Children with cognitive scores that were above average had 8 times less Relative Risks of being underweight compared to those with scores that were below average [RRR: 0.194: 95% CI: 0.06-0.624; p=0.0006] while those who were exclusively breastfed had 0.02 times more Relative Risks of being severely wasted compared to those who breastfed for 3 months [RRR: 0.028: 95% CI: 0.05-2.64; p=0.03]. The presence of CHWs led to reduced prevalence of underweight but increased the overweight status of same population thus concluding that double burden of malnutrition is already existing in communities with children at early age at higher risk. This study recommends the use of CHWs to implement nutrition interventions and that interventions to focus on child overweight. Further research on nutritional outcomes and cognitive development at early age of growth is also recommended. Nutrition interventions to target this age period as is the window period of opportunity.

CHAPTER 1

INTRODUCTION

1.1 Background

Childhood malnutrition and poor cognition are public health issues among children in Low- and Middle-Income Countries (LMICs). In 2015, there were 667 million children globally of whom 156 million were stunted, 42 million underweight and 50 million wasted. Even though these rates have been declining worldwide, Africa has shown little progress (UNICEF, 2012; UNICEF and World Health Organization, 2015). An estimated 19 million children in Africa and South East Asia are malnourished and these has attributed to nearly a third of all deaths among children (World Health Organization, 2014). Sub Saharan Africa still records the highest prevalence of malnutrition with 39% of children being stunted, 4% underweight and 10% of wasted with statistics revealing that a third of all undernourished children in the world are from Sub Sahara Africa. In Kenya, a total of 26% of the children are stunted, 4% wasted and 11% underweight (R. E. Black et al., 2013; Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014; United Nations, 2015). Malnutrition can be as a result of a complex interplay of factors including household food insecurity, inaccessible health care services, poor care by the mother to the child and poor hygiene and sanitation (United Nations Children's Fund, 2009)

Over and underweight, stunting and wasting are forms of malnutrition. Overweight and underweight is a measure of how heavy or light a child is for their age and can be as a result of excess or less amount of macro and or micro nutrient in the body. It predisposes children to non-communicable diseases later in life. These non-communicable diseases can be diabetes mellitus,

coronary heart disease, kidney failures among others. Wasting is an indicator of acute or sudden malnutrition due to less calories and deficient dietary intake. A wasted child is usually thin for its height. Stunting is an indicator of chronic or recurrent malnutrition due to low quality diets and recurrent infections. Stunted children are at higher risks of infections, low cognitive development, poor school functioning and low intellectual capacity. Stunted women have a higher chance of having complicated deliveries and having low birth weight infants who later grow to be stunted adults thus contributing to the intergenerational cycle of stunting. Stunted child has too short height for his or her age (Tzioumis and Adair, 2014; World Health Organization, 2006, 2009) Malnutrition in children can lead to increased chances of death, infection and reduced human capita. The mortality risks of children with acute and serious malnutrition are nine times higher than the mortality risks of children without malnutrition.

Cognitive development is the process of growth and change in intellectual and or mental abilities among children. Nutrition in the first two years of life (1000 days) is vital in cognitive development as is the period that is characterized by rapid growth and development (Schwarzenberg and Georgieff, 2018). How well a child is nourished at this period has an influence on child's ability to grow, learn and develop (Cusick and Georgieff, 2016). In Low and Middle-Income countries (LMIC), almost 200 million children who are under two years may not meet their full development potential because of malnutrition, poverty and inadequate stimulation. These factors have contributed to increased risks of childhood morbidity, mortality and cognitive development (Grantham-McGregor et al., 1999; A. K. Yousafzai, M. A. Rasheed, A. Rizvi, R. Armstrong, and Z. A. Bhutta, 2014). Poor cognition is affected by a multitude of factors including economic poverty, poor nutrition, environment and genetics (Acosta et al., 2014). Poverty impedes cognitive

development and it has shown that children from low income families lag in cognition compared to their peers from high income families (P. J. Anderson, De Luca, Hutchinson, Roberts, and Doyle, 2010; Mani, Mullainathan, Shafir, and Zhao, 2013). Research has proved that children with poor school performance are the ones who failed to reach their full developmental potential and such children may eventually perpetuate social inequalities that can contribute to a cycle of intergenerational transmission of ill health and slow development in the communities (Alderman, 2010). A study in India revealed that malnourished children scored less in the social, language and motor behavior compared to those who and normal nutrition (Carrasco Quintero, Ortiz Hernández, Roldán Amaro, and Chávez Villasana, 2016)

Nutrition plays a crucial role in maintaining brain function. Poorly nourished children with nutrient deficiencies usually do not take full advantage of social and learning activities (Freeman, Klein, Townsend, and Lechtig, 1980). At early age, insufficient nutrition will reduce child's motivation, interests to play and exploratory undertakings thus can result to low mental and cognitive development. Malnutrition therefore in the first 1,000 days of life has negative outcome on a child's ability to grow resulting to stunting. This is a permanent condition that can be associated with reduced cognitive ability, reduced school and work performance (Children, 2012). Research has proved that growth flattering among children occurs mostly after the six months of life when children are no longer protected by exclusive breastfeeding, introduction of inferior complementary feeds have started and is the period when nutritional needs are high due to the rapid growth (Picciano et al., 2000). Other minerals and vitamins like iron, iodine, zinc copper, vitamin A and B complex are required in high amounts during this extremely rapid growth as they are key for brain health (De Jager and Ahmed, 2015; Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014)

Health professions account to only 67% of all the health care force and they face a lot of challenges (World Health Organization, 2006, 2010b). With the increase in the world population, high burden of diseases, high cost of training health professionals and low access to health care services, it has been hard for the few health professionals to handle the increased work load in the few busy public facilities (Hessel et al., 2010; South Africa Every Death Counts Writing Group, 2008). This has led to several countries including Kenya to look for other easily accessible options that can help bridge these gaps in the health sectors. Some of the strategies of addressing these gaps is integrating the Community Health Workers (CHWs) into the health systems. CHWs are frontline public health workers who are trusted members of a community and have a close understanding of the community they serve (APHA, 2013).

The concept of integrating CHWs into the health system was first adopted in China in 1920 then countries such as Bangladesh and Latin America adopted their use in implementing Community based programs in 1960s (Ahmed, 2008; H. Perry, 2013). By 1988, over 110 million citizens from Brazil and Bangladesh had benefited from Community based programs that were being implemented by CHWs. This inspired LMICs who later embraced them in the 1990s (Ahmed, 2008; Harris, 2012) In order to achieve the Millennium Development Goals (MDGs) number 4 and 5 on reducing child and maternal mortality, African countries including Uganda, Ethiopia and Kenya joined other developed nations in training CHWs (GHWA, 2014; World Health Organization, 2004). The 'Village Health Workers' or 'liberators' as they were earlier called, acted as agents of reducing poverty (Pérez and Martinez, 2008), by advocating for community rights and social change; and activists of fighting against inequities (Lewin et al., 2010; Werner,

1981) Integration of CHWs into service improved health and health outcomes for all and created a positive path in achieving Sustainable Development Goals, promoted nutrition and Primary Health Care (PHC) to all (H. B. Perry, Zulliger, and Rogers, 2014). It is therefore evident that CHWs have been adopted in implementing various community-based programs ranging from small to large interventions.

In 2007, Kenyan, through the Ministry of Heath, sought to improve the health outcomes of its citizens through the National Health Sector Strategic Plan II (NHSSP II). This plan was to support health care services by use of community-based approach called Community Health Strategy (CHS). Its main agenda was to promote the health and nutritional status of individuals and that of the community including that of the vulnerable groups. For these to be possible, accessibility to health care services were improved and the Community Health Extension Workers (CHEWs) and CHWs were integrated into the health care system. The CHWs' major role was provision of Primary Health Care services including nutrition education at the community level. This led to better linkages between the health facilities and the communities which resulted in improved referral systems within the health facilities and communities got better understanding of their rights to accessing health care services. Despite being effective in service delivery, their performance were affected by several challenges including lack of recognition from other health workers, heavy workloads, poor supervision and lack of clearly defined work schedules and formal trainings (Lewin et al., 2010; Phuka, Maleta, Thomas, and Gladstone, 2014; Singh and Sullivan, 2011). But with adequate training and support, CHWs can strengthening health structures (Vallières, McAuliffe, Palmer, Magbity, and Bangura, 2012). To improve child and maternal health in Katito in Kisumu County, Kenya, World Vision, a key partner with the Ministry of Health (MOH),

introduced a Community based nutrition intervention called Timed and Targeted Counseling (TTc) that being implemented by CHWs.

This community based TTc intervention that was under the World Vision, aimed at improving the nutritional status of children and mothers in the community through behavior change communication approach (Gilmore, Vallières, McAuliffe, Tumwesigye, and Muyambi, 2014). Existing CHWs from MOH received specialized training on TTc and implemented the intervention through home visits. The visits targeted to a period in early childhood when nutrition messages were most relevant to enable caregivers get a better understanding of nutrition issues and make best possible choice for their children who were aged below two years. Messages were delivered to the caretakers since they were the ones executing the intervention to their children.

Timing of when the message was being delivered was key in this intervention. This was to ensure that the message was relevant, not forgotten and that caretakers had enough time to act on it. These messages were also individualized according to the child's circumstances. Because of different cultural and financial barriers to promoting good health practices, CHWs had to counsel, engage and discuss with caregivers on feasible shifts of behaviors that could cultivate practices that were geared to promoting good nutrition among children (World Vision International, 2015) The program empowered the CHWs and facilitated them with trainings, provision of working resources like stationaries, weighing scales, height boards, monthly stipend and a well-structured supervision plan existed. This intervention was implemented in Katito in Kisumu County. A comparative site was set in Kegonga Ntimaru in Migori county where the MOH's CHWs were present but did not received neither the TTc training nor the working facilitation by world Vision. The two study sites

were selected and paired because of their similarities in population and community characteristics including socio cultural practices and beliefs. There was no other nutrition intervention in these study sites apart from TTc.

1.2 Statement of the Problem

Malnutrition is a major concern in Kenya. It affects both populations in the rural and urban areas and has serious health implications to the households and government. Malnutrition in the first two years of life has negative outcome on a child's ability to grow resulting to stunting. This is a permanent condition that can be associated with reduced cognitive ability, reduced school and work performance (Children, 2012). Community Health Workers have major role in improving the nutritional status and cognitive development of children. Since the launch of the TTc intervention and use of CHWs by WV in 2013, neither the Kenyan government nor key partners have established empirical evidence to prove that the strategy is effective in improving these outcomes or not. Assessing the effectiveness of such implemented programs is paramount in its expansion as even recommended by Kawakatsu et al in 2012 (Kawakatsu, Sugishita, Kioko, Ishimura, and Honda, 2012). More than 1.7 million or 6% of Kenyans are living with HIV/ AIDS with Kisumu County recording a prevalence of 14% (Kenya Bureau of Statistics (KNBS) and ICF Macro, 2010). Links between HIV/AIDS and nutrition is very strong. HIV / AIDS compromises the immune system and makes the body to be susceptible to various infections and making the nutrient requirements to be high. If these requirements are not met, then nutrition deficiency is likely to occur (Duggal, Chugh, and Duggal, 2012). In Kisumu County, data on CHWs' contribution on nutritional status and cognitive development among children who are aged below two years is limited. Stunting, a chronic form of malnutrition, has been found to be

irreversible after the second year of life and has been linked to poor cognitive outcomes, poverty, low human capita, reduced school and work performance (Children, 2012). The relationship between child nutritional status and cognitive development has not really been fully explored by researchers with the few available studies only focusing countries like Europe and America. With trained CHWs, Nutrition and cognitive development among children can be improved. This study assessed the impact of CHWs on nutritional status and cognitive development of children aged less than two of years in Katito in Kisumu County and compared with children from Kegonga Ntimaru in Migori County. The two study sites were paired because of their similarities in population size and density; ethnic and cultural beliefs and practices.

1.3 Justification

Malnutrition is a major concern in Kenya. It affects both populations in the rural and urban areas and has serious health implications to the households and government. According to KDHS 2008 /09 report, the prevalence of stunting, wasting and underweight in Kenya among children less than two years of age was 35%, 7% and 16% respectively with rural areas recording higher figure (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2008-09). Undernutrition is linked to poor cognitive outcomes (Cusick and Georgieff, 2016). Therefore, nutrition interventions should target regions with high prevalence of malnutrition (Grantham-McGregor et al., 1999). The use of the CHWs in improving health has been described as a flagship project in the Kenya's Vision 2030's whose main aim is to transform the country into a Middle-Income economy by 2030 through economic, political and social change (GOK, 2007). Flagship projects are research and development projects that are strategically and scientifically defined, are of substantial size with regard to their scientific and financial volume, number of project partners and the running time.

They form part of the national development as it is under the health sector. This study will provide data on the impact of services of CHWs on nutrition and child development among children less than two years. These will be useful in policy formulation by Kenya's Ministry of Health especially the Directorate of Nutrition and the World Vision programs. The results will also form a basis for other future studies on child nutrition and cognitive development.

The use of the CHWs in improving health has been described as a flagship project in the Kenya's Vision 2030's. The findings from this study will help in policy formulation by Kenya's Ministry of Health especially the Directorate of Nutrition and World Vision programs. The results will also form a basis for further research on child nutrition and cognition

1.4 Research objectives

1.4.1 General Research objective

To determine the impact of Community Health Workers on the nutritional status and cognitive development of Children aged less than two years in Kisumu and Migori Counties.

1.4.2 Specific Objectives

1. To describe the socio demographic characteristics of the children aged less than two years in Katito and Kegonga Ntimaru.
2. To assess the nutritional status of children aged less than two years in Katito and Kegonga Ntimaru.
3. To assess the level of cognitive development of children aged less than two years in Katito and Kegonga Ntimaru.
4. To determine the perception of CHWs on knowledge on child Nutritional status and Cognitive Development in Katito and Kegonga Ntimaru

5. To assess the impact of Community Health Workers on the nutritional status of children aged less than two years in Katito and Kegonga Ntimaru
6. To examine the impact of Community Health Workers on the Cognitive development of children aged less than two years in Katito and Kegonga Ntimaru

1.5 Hypotheses

1. There is no significant relationship between the Community Health Workers and nutritional status among children aged less than two years in Katito and Kegonga Ntimaru
2. There is no significant relationship between the Community Health Workers and cognitive development among children aged less than two years in Katito and Kegonga Ntimaru.
3. There is no relationship between Community Health Workers and their impact on nutritional status among children aged less than two years in Katito and Kegonga Ntimaru
4. There is no relationship between the Community Health Workers and their impact on cognitive development among children aged less than two years in Katito and Kegonga Ntimaru

1.6 Scope of the Study

The study focused on the impact of CHWs on the nutritional status and cognitive development of children under two years in Kisumu County. The study also was determined to find out the knowledge that CHWs had on matters related to nutrition and child cognition. The scope of the study was restricted to the intervention and comparative site to assess if CHWs had any influence on the nutritional status and cognitive development of children.

CHAPTER TWO

LITERATURE REVIEW

2.1 Community Health Workers

A community health worker is a frontline public health worker who is a trusted member of a community and has a close understanding of the community he serves (APHA, 2013). Globally, they have been referred to by so many titles including outreach workers, community health representatives, volunteer health workers, health auxiliaries, barefoot doctors, health agents, health promoters, family welfare educators, health volunteers, village health workers, community health aides, community health volunteers and community health workers (Rosenthal, 1998)

As early as 1920, Chinese were already using the CHWs to implement their community based programs then were followed by Bangladesh government in 1960s (Ahmed, 2008; H. Perry, 2013). By end of 1988, community-based programs that were being implemented by CHWs had targeted over 110 million citizens from Brazil and Bangladesh. This stimulated developing and LMICs nations to accept them in early 1990s (Ahmed, 2008; Harris, 2012). As a way of achieving Millennium Development Goal numbers four and five on reducing child and maternal mortality respectively by 2000 and improving the general health of its citizens, Kenya and Uganda joined other industrialized countries in training and up scaling the use of CHWs (GHWA, 2014; World Health Organization, 2004).

The 'Village Health Workers' or 'liberators' as they were earlier called, were employed by governments as agents of reducing, activists of fighting against inequities, advocates of community rights and social change (Pérez and Martinez, 2008; Werner, 1981). Several years later, other

countries around the world adopted their use in broadening access and coverage to health care (Haines et al., 2007). It is evident that since their integration there has been a wide access to Primary Health Care by the rural and poor communities (Wrold Health Organization, 1978). There has also been a better access to child and maternal health services like nutrition education, breastfeeding, complementary feeding, early disease screen, basic emergency care, care of simple and common infections, referrals, family planning, record keeping, collection of data on important events, among others (Goodwin and Tobler, 2008; Haines et al., 2007; Lehmann and Sanders, 2007).

World Health Organization has defined them as members of communities who are selected by the communities and are answerable to them for the activities that they do. They are supported by the health systems but are not part of these systems as they have shorter trainings and have no formal professional training (World Health Organization, 1989). From the definition, they do not receive any form of formal training and that they do not have any work planned schedule and this translates to them having less work resources. In Kenya for example, their area of coverage at the community level is usually wide with one CHW covering an area with over 50 households. They have an important responsibility of addressing the health needs of people at different stages of the life including ensuring a healthy diet for children under two years of age (Ministry of Health, 2006)

CHWs face a lot of challenges as they are serving their communities. The challenges they face include but not limited to; poor remunerations, isolation from other health staff, hefty workloads, poor supervision and lack of both clear defined work schedules and trainings (Lewin et al., 2010; Phuka et al., 2014; Singh and Sullivan, 2011). But regardless of all these and numerous titles,

they created a great impact at community level, and this could be because they share experiences, understand the culture, practices, norms and beliefs with the communities that they serve. This has also made them provide health care that is more culturally accepted hence highly effective. In Kenya, they have improved the general health of many at the community level and the government is with the plans of scaling up the community strategy to all its 47 counties (Ministry of Health, 2006)

2.2 Role of Community Health Workers on health and development

CHWs have contributed to better health outcomes of underserved populations and have been part of positive milestone in achieving Millennium Development Goals. Several researchers in the world have used CHWs in implementing various programs and interventions because they have been found to be effective and their use have been highly advocated. For example a study in Sub Saharan Africa on Antiretroviral (ARV) drugs uptake showed that with CHWs, there was a great potential in improving the health of people living with HIV/ AIDS and they also showed an impact in fighting HIV and TB in South Africa where the pandemic prevalence was very high (Hermann et al., 2009; Suri, Gan, and Carpenter, 2007). A study in a low income community in New York on child immunization and asthma management programs concluded that there was a positive impact and a wider coverage of the programs with the presence of the CHWs (Perez, Findley, Mejia, and Martinez, 2006). A study conducted in Kenya, Uasin Gishu County on management of hypertension and control of blood pressure revealed that CHWs empowered the community and the patients by providing education and social support that resulted to improved management and control of blood pressure (Brownstein et al., 2007).

In Sub Saharan Africa where access to professional health worker is hard and expensive, CHWs have come in handy to help mothers and children meet their critical health needs by supporting and promoting breastfeeding and complementary feeding; immunization and micronutrient supplementation; and nutrition education and screening children for malnutrition. For example in Brazil, when CHWs received training on counseling and practical skills on breastfeeding, there was an increase in exclusive breastfeeding status from 10% to 13% (Coutinho et al., 2014). A study on the iron –folic acid supplementation in Nepal showed a decrease in maternal mortality from 581 to 281 deaths per 1000 live births due to a decrease of anemia cases. Female Community Health Workers distributed the Iron- folate acid and its uptake increased drastically (Pokharel, Maharjan, Mathema, and Harvey, 2011). The same Female Community Health Workers had already gained fame in the community because of their valued service of distributing Vitamin A to the members of the community (Fiedler, 2000). It is evident that training is an important aspect for any intervention to be successful. Therefore, it is fundamental that CHWs be trained on some aspects of the tasks that they are going to perform at the communities and be provided with adequate tools and equipment for effective service delivery. Addressing the challenges, they face is also paramount in discharging their services to communities they serve (Lewin et al., 2010; Phuka et al., 2014)

2.3 Community Health Workers as flagship project in Kenya guiding policy

In line with the Kenya's vision 2030, training of CHWs is an agenda under the health sector. With the introduction of devolved governments, the country intends to fast track the implementation of community health strategy so that the CHWs services can be up-scaled to other counties. As at October 2015, WV was supporting a total of 4,725 CHWS in Kenya. These CHWs were involved

in various health activities at the community level including the Timed and Targeted Counseling intervention that targeted children aged less than two years (World Vision International, 2015)

2.4 Nutritional status of children

Globally, an estimated 186 million children under the age of two are stunted with another 18% of same population being underweight when compared with the WHO growth standards (Black et al., 2008; World Health Organization, 2014). Even though there has been a decrease in the underweight among the same population between 1990 and 2005, the decrease has really been uneven (World Health Organization, 2010b). Because of poor policies, Africa was left behind in fighting hunger, malnutrition and poverty by 2015 under the MDGs (Von and Joachim, 2007). More than 3.8 million children from poor countries die each year due to malnutrition (Black et al., 2003; Caulfield, de Onis, Blössner, and Black, 2004). Malnutrition is a severe medical condition that is characterized by a deficiency of calories, essential amino acids, lipids and fats, vitamins and minerals in a diet. It is a major threat to the survival of a child, and a major public health concern in most of the developing countries (De Onis and Blössner, 2003; Luo and Hu, 2002). Undernutrition could be due to diet related factors like poverty, diseases and household food insecurity (UNICEF, 1991).

In Kenya, according to the KDHS statistics of 2008-09, the prevalence of stunting, wasting and underweight among children aged less than two years was 35%, 7% and 16% respectively and only 32% of children were exclusively breastfed for six months. These figures slightly dropped according the KDHS report of 2014 from 2008-09 report to 26% for stunting, 4% wasting and 16% for underweight. The percentage of children who exclusively breastfed for six months in the 2014 report improved to 62%. These stunting levels of 25% according to WHO is an indicator of

chronic malnutrition and indicates that children are introduced early to complementary feeds which is highly discouraged as it exposes and increases risks of infections. Researchers have recommended the need of disrupting the vicious cycle of intergenerational stunting syndrome, a syndrome that has been characterized by stunted women delivering stunted babies and if this is not intervened early, they later give birth to stunted babies and the cycle continues (Bird, 2013; Prendergast and Humphrey, 2014).

Often, nutritionally inferior foods increases the chances of children to growth failure and poor cognition in later years of life (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2008-09, 2014; WHO, UNICEF., and UNAIDS, 2003). It is evident that iron mineral which contributes to anemia is essential for cognitive development in children and in KDHS statistics, only 29% of rural communities consume foods rich in iron compared to 41% in the urban areas. Iodine, an essential mineral too, showed that 98% of households got adequate supply of it from the cheap readily available iodized salt (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014)

The proportion of children who are underweight in Kenya was 16% and this was high compared to other African like Tanzania 14%, Uganda 13% Algeria 3.7% (World Health Organization, 2010a). Child's height and weight are important and widely used indicators in determining the nutritional status. Underweight (weight-for-age) usually reflects wasting (weight-for-height) which then indicates stunting (height-for-age). According to KDHS, Under-Five Mortality is 74 deaths per 1,000 live births implying that one in every 19 children born in Kenya dies before its first birthday, while one in every 14 does not survive to age five (Kenya Bureau of Statistics (KNBS) and ICF Macro, 2010). This is a major concern particularly in the move towards achieving

the Sustainable Development goals (SDG) especially on goal number three on promoting good health and wellbeing (Sachs, 2012). More than 1.7 million or 6% of Kenyans are living with HIV/ AIDs with a prevalence of 14% in Kisumu County (Kenya Bureau of Statistics (KNBS) and ICF Macro, 2010). Links between HIV/AIDS and nutrition is very strong. HIV / AIDS compromises the immune system and makes the body to be susceptible to various infections and making the nutrient requirements to be high. If these requirements are not met, then nutrition deficiency is likely to occur (Duggal, Chugh, and Duggal, 2012).

2.5 Breastfeeding and dietary intake of children

Adequate nutrition is key to child development. Adequate diet from the period a child is stopped exclusive breastfeeding till two years of age is important for ideal growth, health, and development. This is because, this age period is characterized by failure to thrive, major nutrient deficiencies and simple childhood illnesses like diarrhea which could be contributed by early initiation of complimentary feeds and poor hygiene. An incomparable way of provision of ideal food for growth and development of children is breastfeeding. Globally, World Health Organization and other NGOs recommends that children be exclusively breastfed for the first six months of life then introduce complementary feeds that are affordable, adequate, accessible and safe as breastfeeding is continued till two years of life and even beyond (WHO et al., 2003; World Health Organization, 2001). All these aims at ensuring that a child achieves optimal growth. According to KDHS 2014 report, a total of 61.4% of children benefited from exclusive breastfeeding and only 60% of the children aged between 18 and 23 months were still breastfeeding (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). Breast milk has been termed ideal and best food for children because of its complete nutritional characteristics

and benefits to the child and the mother. Breast milk has a protein content which has a relatively high ratio of whey compared to casein and is very rich in essential fatty acids. All these nutrients are important for brain development and have a role in management and resistance to infection (Dewey, 2001). Researchers have found that during the introduction to complementary feeds, children become vulnerable to illnesses and to reduce these incidences, the complementary feeds must be timely, safe and adequate (WHO et al., 2003). Therefore, appropriate and accurate information on complimentary feeding has to be passed to the caregivers by health care providers including the CHWs who work at the community levels

Malnutrition can be caused by poor dietary intake. Inappropriate feeding practices are widespread in many countries with many children not receiving adequate breast milk and unsafe complimentary feeds. Poor nutrition can lead to higher prevalence of diseases and has directly and or indirectly led to over 3 million deaths of children in the world (Tessema, Belachew, and Ersino, 2013). Nutritional deficiency in the first two years of life is linked to long-term impairment in growth and health. A study that was done in India documented that under nutrition, protein-energy malnutrition and micronutrient deficiencies retards the physical and cognitive growth of children especially in the children first two years of life. This malnutrition is mostly as a result of high levels of exposure to infections; inappropriate children and young child feeding and caring practices; and household food insecurity. Evidence has shown that adults who were malnourished at childhood have impaired intellectual abilities and reduced capacity for physical activity while women have their reproductive capacity affected hence giving birth to low birth weight children and may even have complicated deliveries (Black et al., 2008; Haas, Murdoch, Rivera, and

Martorell, 1996; World Health Organization, 2009). Therefore, adequate dietary intake in the first years of life is critical to child's growth and future development (Braun et al., 2006).

2.6 Cognitive development in children

Cognitive development is defined as the process of growth, change in intellectual and or mental abilities such as thinking, reasoning understanding and consolidation of knowledge. Children draw on social- emotional, language, motor and perceptual experiences and abilities for cognitive development. Children with nutritional deficiencies are mostly those from disadvantaged and poor environments. Many of the caregivers in these settings are ignorant of psychosocial stimulation to their young children because they may be too busy in activities to help their children survive. Scientific findings have proved that poor stimulation has negative consequences on children's social, psychological and cognitive health. It is also evident that adequate parenting or caregiver stimulation, good nutrition and good environment can reduce the loss of potential cognitive development in children (Grantham-McGregor et al., 2004). A strong maternal-children or caregiver-children bond therefore is essential for cognitive development.

A strong bond formed in the early years of life is an important step for cognitive development later in life. Child cognitive development is multifactorial. It is influenced by several factors including genetics, child personalities, biological state, wellbeing, nutritional status and the surrounding environment. The environment implies the level of stimulation and bonding that the child receives from the parents and or guardians; the level of education, culture and residence of the parents. Some of these factors are protective and while others make the child more exposed. For example, a more learned mother who stimulates her child frequently may be providing protective factors in

that these may decrease the detrimental effects on the child's nutritional status and cognitive development. Young children who are underweight, stunted, iron deficient, zinc deficient or small for gestational age have been found to show altered behavior. They have reduced activity, unhappiness, and less exploration of the environment (Grantham-McGregor et al., 2004). The caregivers may also be affected by the child's altered behavior. For example, caregivers of children with nutrient deficiencies have been described as having poorer quality vocalizations and are weak to hold and carry their own children (Black et al., 2008). Majority of the parents may be too busy and are never available to provide social and physiological stimulation to their children due to ill health. Yet poor child stimulation has a negative effect on their survival, mental and cognitive development.

Cognitive development in children under two years of age is usually assessed by use of a Bayleys Scales for Infant Development kit which was standardized in the USA (Bayley, 2006). The Bayleys gives global mental score of general cognitive, language and motor development (Michalec, 2011). In the first year of life, children's development scales have a limited predictive value although predictive value increases with age (Albert et al., 1995). It is a valuable tool of milestone achievement and can be used to diagnose and plan treatment for children who experience developmental delays and or disabilities. It was first published in 1969 by Nancy Bayley with the second edition in 1993 and has been used to assess children all over the world (Bayley, 1969, 1993). Since then it has been used extensively worldwide to measure the mental and motor development and examine the behavior of children.

The Scale is used to explain the current functioning of children and aids in diagnosing and planning for intervention and management of developmental challenges. The BSID consists of two domains; cognitive and language. Cognitive domain assesses how a child thinks, reacts, and learns about the world around him or her while language domain evaluates the receptive and expressive communication (P. J. Anderson et al., 2010). In assessing this, appealing toys and activities are used to stimulate child's interests. Children interact with appealing toys and perform various tasks to assess their thinking, language and movement (sitting, walking). The tasks usually range from basic to complex depending on child's age.

2.7 Nutrition with cognitive development

Nutrition plays a crucial role in maintaining brain function. The relationship between nutrition and cognitive development has not really been fully explored by researchers and available studies have been done in Europe and America. According to a 1980's study in Guatemala, poorly nourished children had insufficient energy and were not taking full advantage of social and learning activities and this led to poor stimulation resulting to poor development (Freeman et al., 1980). At childhood, poor nutrition reduces child's motivation, interests play and exploratory undertakings. These then results to low mental and cognitive development as it decreases the duration of interaction of the child with the environment and the care takers. Ingested food provides vitamins and minerals that act as co-factors for the synthesis of neuro-transmitter and glucose, and it influences the cognitive function (Greenwood and Craig, 1987). Poor nutrition therefore in the first 1,000 days of life has a undesirable effect on a child's ability to grow resulting to stunting, an irreversible condition that can be linked to reduced cognitive ability and reduced school and work performance (Children, 2012). Most growth faltering in children occurs after exclusive

breastfeeding has been stopped and is a time when exposure to diseases is high and also nutritional needs high due to the steady growth and development (Picciano et al., 2000). Micronutrients that are vital for cognitive development are and are not limited to iron, iodine, zinc calcium, magnesium folic acid, vitamin A and B complex (De Jager and Ahmed, 2015; Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). These key nutrients are evident to have a direct impact on cognitive function through metabolism of neurons, contribution to nutrient metabolism of neurons and synthesis of neurotransmitters (Haller, 1995). Vitamin A, and B complex are in carbohydrates, protein and fats synthesis and converting glucose into energy, folic acid helps in the functioning of the nervous system while the minerals like zinc, copper and iron are key in the functioning of the Central Nervous system (De Jager and Ahmed, 2015). Deficiency of these nutrients could result to negative functional effects on the brain hence poor cognitive function (Huskisson, Maggini, and Ruf, 2007).

As these children develop the motor skills to feed themselves, they somehow influence on their dietary intake and may choose what to and not to eat (Edmunds et al., 2006). Poorly nourished children are susceptible to infections and diseases, they become ill frequently, have decreased activity levels, reduced social activities, reduced curiosity and low cognition function (Isaacs and Oates, 2008). For example, lack or reduced iodine and iron in the bodies have been associated delay in cognitive functioning in children and zinc deficiency has been linked with deficits in child activity and motor development (Black, 1998). World Health Organization together with UNICEF recommends that children be exclusively breastfed for the first six months as breast milk provides best and ideal nutrients for growth and development. The long-term benefits of exclusive breastfeeding are better intelligence test performance in later years. WHO actively supports and

promotes breastfeeding and it advocates mother and families to initiate and maintain optimal breastfeeding practices (World Health Organization, 2001). Nutrients in breast milk are required for rapid development of immature brain and recent studies have shown that children who were exclusively breastfed and or were breastfed for a longer time have higher score on visual tests than their counter parts who were formula fed (J. W. Anderson, Johnstone, and Remley, 1999). Research findings have also shown that iron deficiency anemia has been associated with psychomotor developmental delays and lowers the cognitive development especially in childhood years. It has also been linked with reduction in IQ by almost 9 points and anemic preschoolers have been to be having a problem in maintain class concentration (Srivastava, Mahmood, Srivastava, Shrotriya, and Kumar, 2012). A study by Neumann et al in Embu amongst adolescent primary school pupils, revealed a low school achievement that was linked with iron deficiency (Neumann et al., 2003)

After Infancy, it is very difficult to reverse any cognitive deficit since malnutrition in early life creates a greater undesirable impact on cognitive development than in the later years (Benjamin T Crookston et al., 2013; Glewwe and King, 2001). Therefore in countries where the prevalence of stunting is high, programs that aim at improving children's nutritional status should be introduced and target children under two years of age (Grantham-McGregor et al., 1999). Nutritional deprivation can result to long term deficits in development, disease resistance, cognitive development and school performance. World Health Organization in its 2010 statistics report showed that poor nutrition was the underlying cause of about 33% of deaths among children under the age of two. It also reported that 18% of children under two years of age were underweight and over 86 million had stunted growth (Black et al., 2008; World Health Organization, 2010b). This

shows that poor dietary intake among young children can be a predictor of functional impairment and this calls for interventions that promote and improve child nutritional status, growth and development in the early years (Children, 2012; R. Martorell, 2010). After a nutrition intervention in Guatemala, there was a significant increase in the cognitive development as indicated by Engle and Fernandez in preschoolers who were on supplementary feeding and a decrease in the number of student dropouts (Engle and Fernández, 2010). Another study by Whaley, et al in 2003 in Embu Kenya found that animal source foods might have specific domain of cognitive function of school going children. The study recommended for extensive nutrition education to improve the quality of diets as it had proved to have had an effect on the human cognitive function.(Whaley et al., 2003). Other studies have also recommended nutritional interventions that address the growth and learning abilities of children (Belli, Bustreo, and Preker, 2005; Neumann et al., 2003). This therefore shows that poor dietary intake among young children can be a predictor of functional impairment from early childhood to adulthood (Children, 2012; R. Martorell, 2010). Undernutrition also results in physical and functional changes in the brain as demonstrated by animal researches that proved that prenatal and early postnatal malnutrition in rats led to many changes in brain structure (Gómez-Pinilla, 2008). Very few studies have been done in Kenya on linking nutrition and cognitive development in children and this research study will then aim at determining the nutritional status and cognitive development of children in Kisumu County as a function of CHWs.

2.8 Gaps in Knowledge

CHWs are increasingly recognized as an essential cadre in improving the health outcomes of communities through the Primary Health Care initiative. Researchers have conducted community-

based health interventions carried out by the CHWs but limited research on their impact on the nutritional status and cognitive development amongst children has been done. A research that was done in Rwanda on CHWs recommended that it was key to assess the effectiveness of CHWs programs so that the community needs can be harmonized and CHW capacity be up-graded (Jeanine et al., 2014). In a document on CHWs and Universal Health coverage, it was noted that there was wealth of knowledge available on key aspects of CHWs, but critical knowledge gaps existed that required attention including their services on health delivery (Frymus,Kok, and Quaian, 2013)

2.9 Study designs and methodology

Studies on impact usually assess how outcomes of interventions have benefited the targeted communities and individuals. Several studies on impact of nutrition interventions have been conducted. For example, a study on the impact of computer nutrition intervention that was done in Netherlands assigned the experimental group with certain nutrition activities while the comparative group only received nutrition information (Brug, Steenhuis, van Assema, and de Vries, 1996). The impact was assessed by measuring the outcomes in the experimental group verses the comparative group. Another study that was conducted in three countries (Brazil, China and India) that had undergone rapid economic transition assessed the impact of nutrition on their per capita income. The impact was assessed by comparing the nutrition data for the year 1961 with data for the year 2011 for each country and also compared data among the countries. (Gill, Feliciano, Macdiarmid, and Smith, 2015). A study that assessed the Impact of low energy diet on protein and clinical outcomes of patients in Intensive Care Unit compared these outcomes at baseline with end-line which was after three months (Berger et al., 2017). Another study that was

conducted to find the impact of an early life intervention on nutrition behaviors also collected nutrition data of children at baseline and after rolling the intervention on children aged less than two years old (Fangupo et al., 2015). In 2003, a study in Kenya, assessed the impact of dietary feeds on cognitive development. In this study, the impact was assessed by collecting baseline data and after the end of the feeding intervention (Guthrie et al., 2003).

2.10 Conceptual Framework

Poor child cognitive outcomes can be as a result of under nutrition, poor breastfeeding practices, poor feeding practices, diseases and infections and other factors like genetics and environment. Under nutrition can be due poor dietary intake and breastfeeding practices. This is illustrated on the figure 1.

VARIABLES

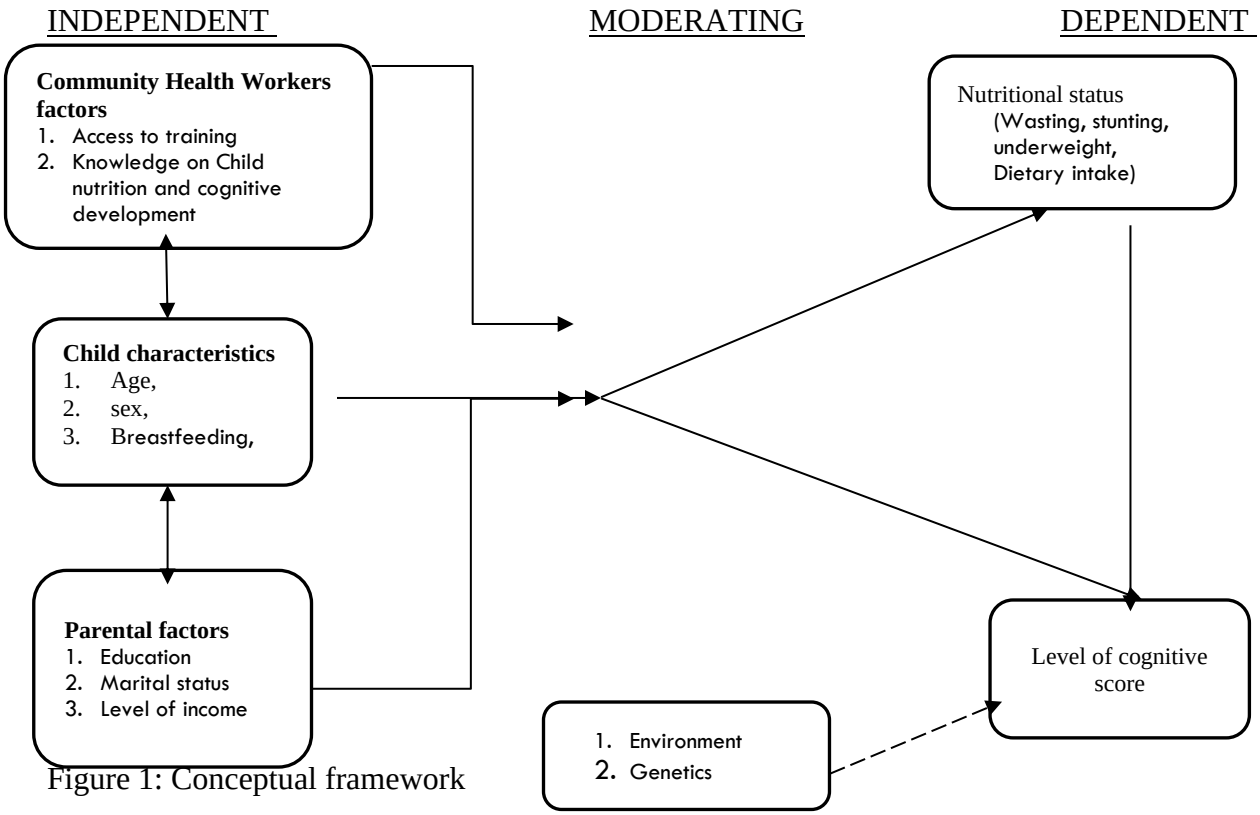


Figure 1: Conceptual framework

Source: Modified UNICEF, State of the World's Children, 1998

CHAPTER THREE

METHODOLOGY

3.1 Study Setting

Kisumu County has a total population of 968,909 people with approximately 85,083 children aged less than two years. It has six constituencies namely; Kisumu Town East, Kisumu Town West, Kisumu Rural, Nyando, Muhoroni and Nyakach. The TTc was conducted in Katito in Nyakach constituency. Migori County has an average of 917,170 people with 230,00 children aged less than two years. It has a total of eight constituencies namely; Awendo, Kuria East, Kuria West, Nyatike, Rongo, Suna East, Suna West and Uriri. The comparative site was in Kegonga Ntimaru in Kuria East Constituency (Kenya National Bureau of Statistics (KNBS), 2009). Figure 2 shows the study areas in the map of Kenya.

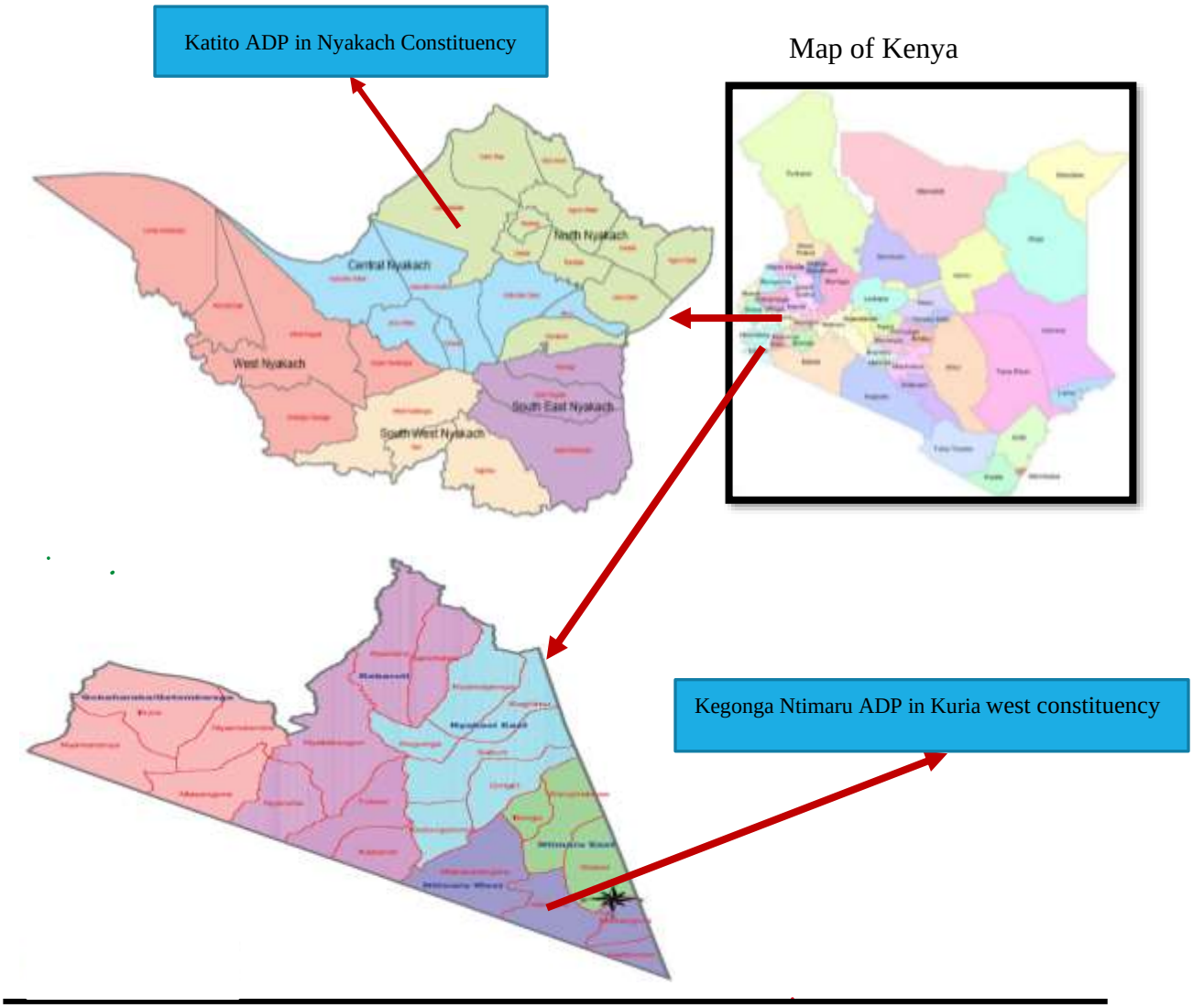


Figure 2 Map of Kenya

Source: Google maps

Timed and Targeted counseling intervention was implemented in Katito Area Development Program (ADP) in Kisumu County and Kegonga Ntimaru ADP in Migori County was the comparative site. Both study sites had CHWs employed under the Health strategy but only those based in Katito ADP received the TTc specialized training. These two ADPs were paired because of their similarities in population size and density; ethnic and cultural beliefs and practices. The population in Katito and Kegonga Ntimaru ADP were 66,114 and 58,799 respectively. The sample

size was limited to children aged less than two years from the two selected sites. The figure 3 showed how the sample size was derived.

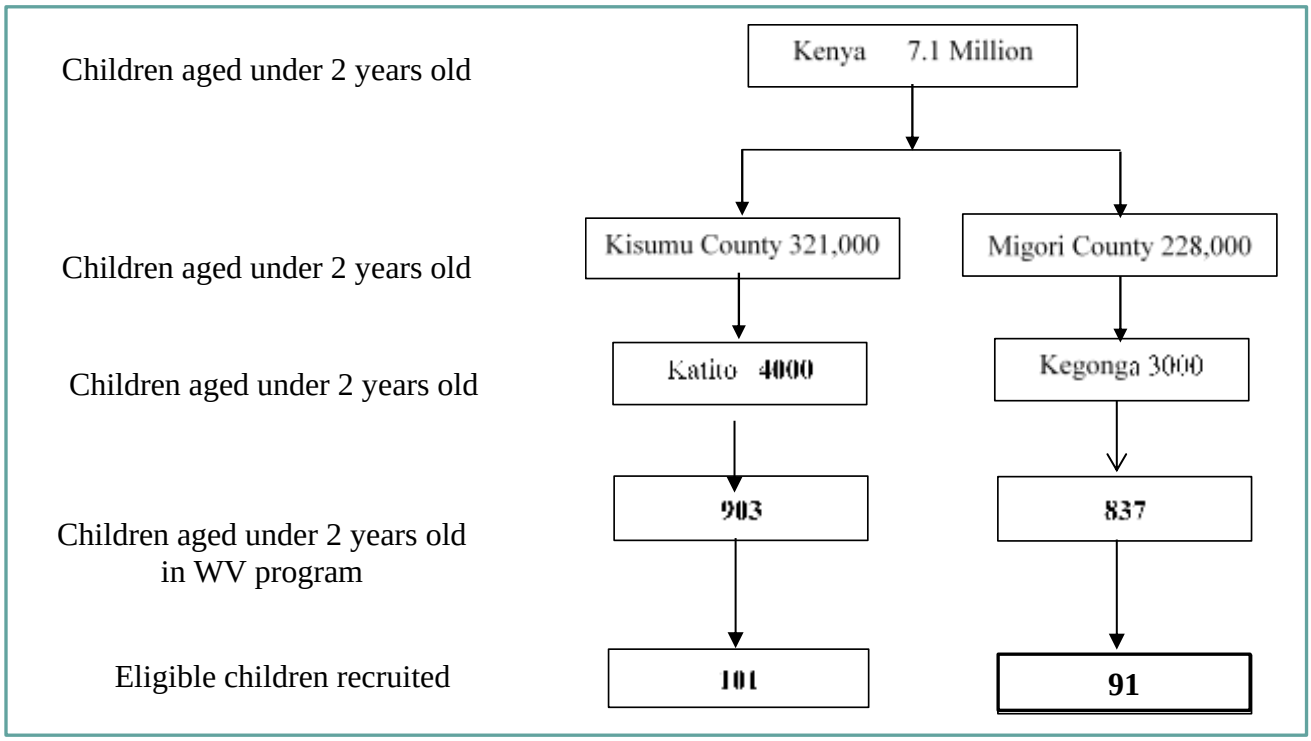


Figure 3 Sampling Schema

3.2 Research Design

This study used a quasi-experimental study design with intervention and comparative groups; and pre (baseline) and post (endline) tests. CHWs were present in both groups. Children aged less than two years in Katito in Kisumu County who were in the intervention group received key nutrition messages from CHWs through home visits under the TTc program while those from Migori County were in the comparative group did not receive any key Messages from the CHWs. Data was collected using both qualitative and quantitative methods. Quantitative data assessed nutritional status and cognitive development among children while qualitative data examined the perception of CHWs on their knowledge on the nutritional status and cognitive development of

children. The Impact of the CHWs on the nutritional status and cognitive development of children were assessed by comparing the results on the outcome variables before and after the TTc intervention in both study sites. Figure 4 shows the flow of the data in the sudy sites

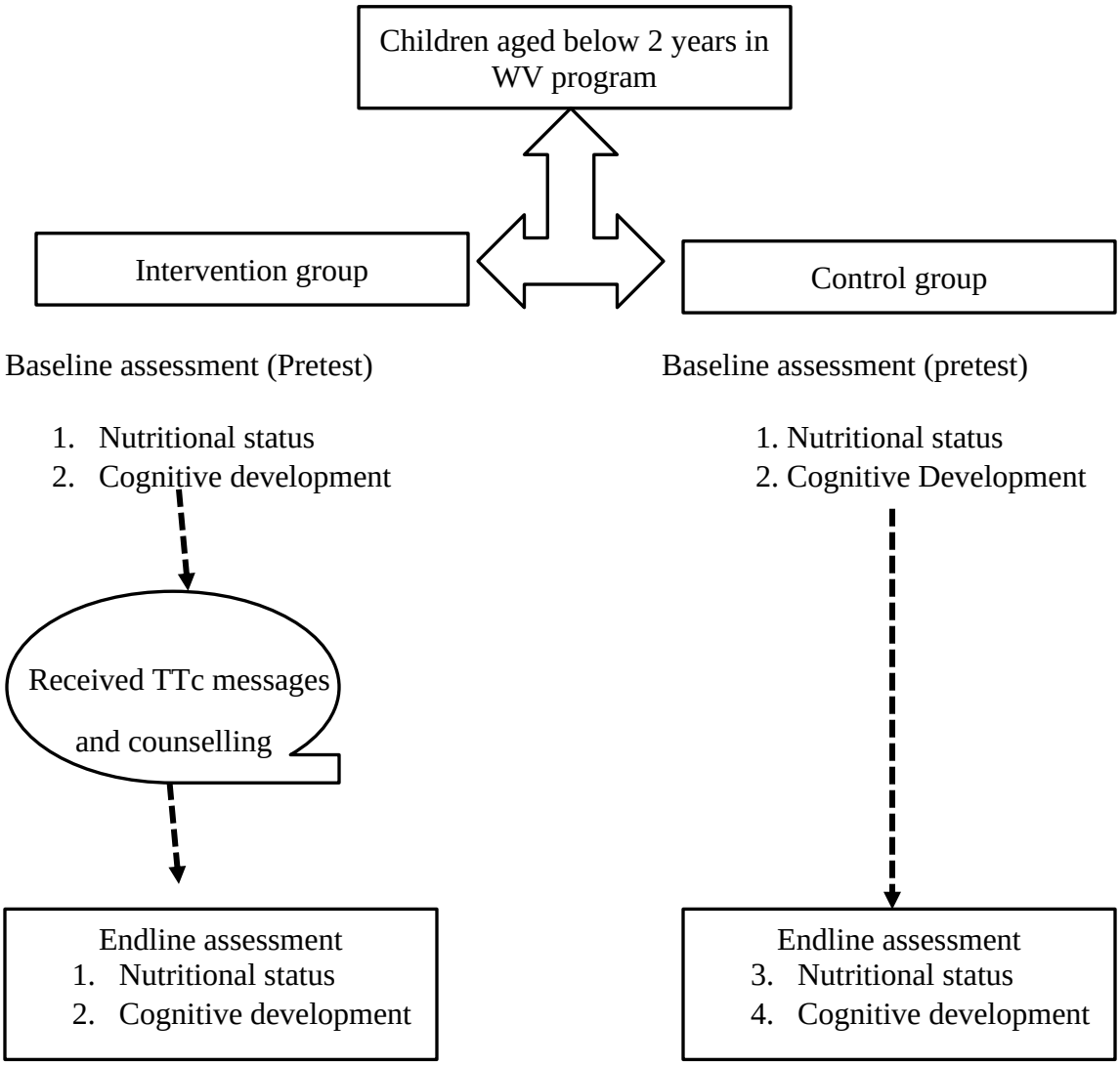


Figure 4 Flow of data in the study design

3.3 Research Population

The study targeted children aged less than two years residing in Katito and Kegonga Ntimaru with their mothers or caretakers. It also targeted the World Vision Manager, training officer and the health facility managers as they provided information on the perception of the knowledge of CHWs on nutritional status and cognitive development among children. The study populations were identified from both the intervention and comparative sites.

3.4 Inclusion criteria

Children aged less than two years and their mother/caretakers who were in TTc study, World Vision officers and health facility managers who assented and consented to participate in the study.

3.5 Exclusion criteria

Children with chronic diseases like cancer, TB, malaria and those on prescribed drugs during the time of data collection. Those who refused to consent were also excluded.

3.6 Sample Size

To measure and compare the proportion of under-nutrition in Kisumu and Migori (the intervention and the comparative arms), the sample size estimation formula was;

$$N = \frac{(Z_{\alpha/2} + Z_{1-\beta})^2 (P1 (1-P_1) + P_2 (1-P_2))}{(P_1-P_2)^2}$$

Where:

P_1 = Proportion of under-nutrition in Kisumu County study site - 60% (Children, 2012).

P_2 = Proportion of under-nutrition in another study site- 39% (Dhatrak, Pitale, Kasturwar, Nayse, and Relwani, 2013)

Z_α = the standard normal deviate for α. -1.96,

Z_β = the standard normal deviate for β. = 0.84,

n = number of subjects (sample size) = 176

n = 88 per study site

To cater for non-response, an additional 10% of children were added giving a total of 192 children.

3.7 Sampling procedures

Children aged below 2 years in the WV TTc program database were the sampling frame in this study. An approximate 20,000 children aged less than two years were in TTc programme in the two study sites with a proportion of 2: 3: 3: 2 for ages 1 to 6 months, 6 to 12 months, 12 to 18 months and 18 to 24 months respectively. In each age strata, children were randomly selected into the study until the desired sample size was achieved. This was to ensure that all children in the programme got an equal chance of being selected to participate in the study. Therefore, for each of the sites, for ages 0 to 6 months and 18 to 24 months, 18 children were selected in each set and 26 children in each of the 6 to 12 months and 12 to 18 months age sets as summarized in the table 1. By selecting a child, the caretaker was automatically selected into the study. Caretakers who participated in the FGD were randomly selected from the child-caretaker pair. The World Vision training officers and Health facility managers who were interviewed were sampled purposively. This was because they provided TTc training to the CHWs. At Baseline, secondary data from WV database sampled 132 and 128 children from Katito and Kegonga Ntimaru respectively. A stratum from for age group created. The proportion of children in each age strata were 2:3:3:2 for those

aged less than 6 months: between 6 and 12: between 13 and 18: and between 19 and 23 months respectively. In each stata, children were randomly sampled in to the study until the desired sample size was achieved. The table 1 summarizes the sample size at the Katito and Kegonga Ntimaru; at baseline and endline. Being a community-based intervention, children sampled at baseline were different from those sampled at endline. The duration of the intervention was three years.

Table 1 Population size per age strata at endline

Age in months	**Population at baseline**		**Population at endline**	
	Katito	**Kegonga Ntimaru**	**Katito**	**Kegonga Ntimaru**
< 6	26	25	20	19
6 to ≤12	40	39	30	27
12 to ≤18	40	38	31	26
18 to ≤24	26	24	20	19
Total	**132**	**128**	**101**	**91**

3.8 Data Collection instruments

Quantitative data were gotten from questionnaires that were developed by the researcher with the guidance of the study conceptual framework and those adopted from Baileys Scale for Infant Development (Bayley, 2006). The socio-economic demographic questionnaire collected information on child's parents' marital status, level of income and highest level of education, the type and size of house they lived in. It also collected information on the household house ownership(Harrell and Bradley, 2009). The anthropometric measurements form collected data on child' birth date and collected measurements for the length and weights of the children. SECA weighing scales and length boards measured the weight and length respectively. Food frequency questionnaires captured information on dietary intake and consisted a list of locally a list of locally consumed foods in the study sites. BSID assessed the cognitive development of the children. Qualitative questionnaires sought information on the knowledge of CHWs on nutrition and

cognitive development among children. In-Depth Interviews (IDIs) collected information from the Health Facility managers; and World Vision manager and training officer while Focus Group Discussions (FGDs) collected information from caretakers of the children. IDIs and FGDs collected information on what the CHWs are trained training on the nutritional status and cognitive development among children. Data were collected by the principle researcher and five trained Research Assistants (RA).

3.9 Research assistants

Research assistants who were working for TTc program were recruited into the study. They were recruited competitively through an oral interview and were required to do online Protection of Human Subjects tests and pass with at least 85% before working in the study. They were later trained on ethical issues, consenting process, data collecting procedures; anthropometric measurements, dietary intake, interviewing skills and conducting FGDs and IDIs. Three RAs were recruited from Kisumu and two from Migori Counties. Before recruiting any subject, the RAs were tasked to explain the purpose of the study, procedures of data collection, consented and assented as they assured confidentiality to the respondents.

3.10 Reliability and validity

To ensure validity, all the RAs were trained, and a pilot study conducted in Uasin Gishu County before the main study began. To improve reliability, anthropometric instruments were calibrated after every 15^{th} child with two RAs taking measurements and comparing the readings. Children who were irritable were weighed together with their caretakers then their weights gotten by

subtracting the weight of the caretaker alone. Children were measured with very light and minimal clothing and without shoes.

3.11 Data collection procedures

This summarizes the data collection procedures in the study sites. All the data collection procedures that were done in the intervention site were also done in the comparative site. Secondary data from World Vision database was collected in 2013 while primary data that was endline data was collected for a period of four months (June to September 2016).

3.11.1 Assessment of nutritional status

Anthropometric measurements were obtained from all eligible children and recorded on the anthropometric form. The form also collected information on date of data collection and the date of birth of children. The dates were then used to compute the exact ages of children in months. Length measurements were taken using the length boards and the unit of measurement was centimeters. These measurements were taken by two RAs with the length boards placed on flat surface like a table. The children were measured without a nappy so as to ensure that the child lied flat on the length board. One RA ensured that the head of the child looking straight up and resting on the base and in the midline position of the length board. He also ensures that the trunk and pelvis were properly aligned on the board. The second RA ensured that the child's shoulders, back, buttocks lied flat along the center of the board with his hands carefully and firmly pressing the knees of the child and second hand moving the foot board firmly against the soles of the child's feet as he does the reading.

The SECA and salter weighing scales were used to take the weights of the children in kilograms. They were covered with a table paper which were changed for each child. The RA ensures that the scale reading zero before a child was weighed. The caretaker was requested to undress the child and place the child on the weighing scale. The RA then read the reading and recorded on the anthropometric form. For irritable children who could sit on the weighing scale alone, their weights were gotten by subtracting their caretaker's weight alone with that of them with their caretakers. Exact ages of children were confirmed from the health cards including Child growth cards (World Health Organization, 2010a). To ensure accuracy, the measurements were taken twice, and the mean computed. Recording of weight and length were done to the nearest 0.1kg and 0.10 cm respectively. The anthropometric form is attached as Appendix D

The nutritional indices of the children in terms of Weight for Age (Underweight/overweight), Weight for Age (Wasting) and Length for Age (Stunting) were classified according to the WHO Z- Scores (WAZ). Children whose Z scores were ≤-3 were classified as severely undernourished, those between >-3 and ≤-2 were classified as moderately undernourished, those between >-2SD and ≤2SD were classified as normal and those between >2SD and ≤3SD moderately overweight and those above >3 were classified as severely overweight. These cutoffs are as summarized on the Table 2. The nutritional status for children in the study sites were summarized before and after the intervention program.

Table 2 Nutritional status Z –scores

Malnutrition classification	Z – scores cut offs
Severely	≤ -3
Moderately	>-3 to ≤-2
Not malnourished	>-2 to ≤+2
Moderately overweight	>+2 to ≤+3
Severely overweight	>+3

Source: WHO Z scores

3.11.2 Assessment of dietary intake

To determine the dietary intake of children, Food frequency questionnaire (FFQ) was used. FFQ approximated the typical dietary intake of an individual over a period of up to 1 month (Block, 1995). In this study, it was administered to caretakers of children to determine the average daily food intake based on local consumed foods in the region. The caretakers were probed, and model pictures of local foods were used to ask if children had consumed certain foods in the past one month and if so, in what estimated amount per each meal. The FFQ had a total of 26 locally consumed foods. Caretakers assented and gave this information on behalf of their children. The FFQ with food model pictures is as attached on Appendix C.

Children between ages 6 and 24 months experience fast growth and development and are usually vulnerable to poor dietary patterns. If they receive less or excess of the required key nutrients during this critical window period of growth and development, they may develop poor health in childhood and or later years in life. Some major micronutrient deficiency may also result to irreversible defects in the motor and mental development. Recommended Daily Allowances (RDA)s provide average daily consumption of foods that are adequate to meet the nutrient requirement for nearly 98% of healthy persons according to different age group. Table 3

summarizes the RDAs for energy, proteins, fat, iron and vitamin A for children who are aged less than two years old.

Table 3 RDA for infants and Toddlers

Nutrient	Age in months			
	< 6	**6 to <12**	**12 to < 18**	**18 to < 24**
Energy (Kcal/kg)	108	98	98	1240
Protein (mg/kg)	2.05	1.65	1.65	22
Fat(mg)	6	10	10	25
Iron (mg/kg)	1.0	1.0	1.0	12
Vitamin A (mcg)	1200	1200	1200	1600

Source: Dietary Reference Intakes for Energy, Carbohydrate, Fat, vitamins and minerals

3.11.3 Assessment of cognitive development

This assessment was done using the BSID kit, a valuable tool of milestone achievement and can be used to diagnose and plan treatment for children who experience developmental delays and or disabilities. It needed two RAs to administer the BSID questionnaire (Appendix G (i) to (v)). Under the cognitive domain, children were assessed on how they thought, reacted, learned about the world around them, how they explored and manipulated with the surrounding environment, related to objects, conceptualized information, judged the memory, visual acuity and preference. Also assessed was counting (with face to face conversation and cardinality), exploration of objects both visually and physically, assembling objects together, finishing a puzzle, identification of colors, matching objects, discrimination of patterns and imaginary play.

Under the language domain, children were evaluated on how they recognized sounds and understood spoken words and directions; how they communicated using sounds and gestures. Communication was assessed through babbling, use of gestures, new word development,

development of morpho-syntactic sentences like use of several words in a sentence and the use of plural and tenses and the ability of a child to identify object and pictures.

One RA instructed the child to perform specific tasks while the second RA observed, timed and scored the performance. In some tasks, children were given up to one minute and others were given up to three trials before a score was given. A successfully completed task earned one mark while incomplete or failed task earned zero mark. The researcher scored each raw score of successfully completed items or task then scores tallied, and composite scores computed and categorized. Child's performance was then compared with reference scores from children of similar ages. The RAs were trained on how to administer it and score the tasks as per the child's age. Administration of BSID lasted approximately 45-60 minutes. Caretakers took assent on behalf of their children for this task to be done.

The cognitive scores were computed based on qualitative scores from the tallied cognitive and language scales. The qualitative scores were then used to estimate child's cognitive scores and compared with children of similar age. Child's qualitative score was then used to categorize the child's cognitive score based on the qualitative evaluation categories. Children whose qualitative scores were found to be above or equal to 110.0 were classified as above average, between 90 and 109.9 as average while those below or equal to 89.9 were below average. This is summarized below on table 4.

Table 4 Qualitative Bayley Composite Score

Quantitative Score	Qualitative Evaluation
≥110.0	Above Average
90.0 – 109.9	Average
≤89.9	Below average

Source: Bailey Scale of Infant Development 3rd edition technical manual

3.11.4 Determining the perception of CHWs on knowledge on Nutritional status and Cognitive Development

Information on knowledge of CHWs was collected by use of qualitative method. Six In-Depth Interviews (IDIs) were conducted. For each study site, a Health Facility Manager, World Vision Manager and World Vision training officer was interviewed. These were the officers in charge of training of CHWs on TTc. The IDIs were conducted so as to explore the knowledge that they had equipped the CHWs on child nutrition and cognitive development of children. A question guide was used to guide the In-depth interviews. An IDI took an average of 40 minutes and was conducted in the WV offices. Attached appendix E for IDI guide.

Two FGDs were conducted with caretakers of the children in the study sites. Each FGD comprised of 9 caretakers with each discussion lasting 45 to 60 minutes. This was done to determine the kind of information that mothers and caretakers received from the CHWs on issues of child nutrition and cognitive development. A schedule guide was used to guide the discussion. One RA acted as the moderator and the other as a note taker in each of the FGD. The discussions took place in the WV training rooms. The proceedings of the FDGs were audio recorded. Each of the respondents consented voluntarily. Each study site conducted one FGD. Attached F for FGD guide

3.11.5 Assessment of the impact of CHWs on the nutritional status of children

The impact was assessed by evaluating difference in nutritional status of the children before and after three years of the TTc intervention. This difference was assessed as the impact that was contributed by the CHWs as they were implementing the TTc intervention. Impact was also assessed as the difference in the prevalence of nutritional status at the endline between the study sites.

3.11.6 Assessment of the impact of CHWs on cognitive development of children

Timed and Targeted Counseling intervention did not assess the cognitive development in children at baseline. But because nutrition has benefits to child cognition, this study assessed the impact of CHWs on child cognition by evaluating the cognitive development of the children in the two study sites after implementation of the TTc intervention.

3.12 Ethical considerations

Ethical approval and clearance were sought from Moi University Institutional Research and Ethical Committee. Permission was also sought from the WV (Child Health Nutrition Impact Study) ChNIS so as to allow the research to nest on its study and allow the use of its participants and data. Confidentiality of the participants was ensured by using anonymous. After explaining the purpose of the study, the caretakers who accepted voluntarily to participate in the study assented on behalf of their children. All research assistants had to do an online Protection of Human Subjects tests and passed before collecting data (U. D. o. Health and Services, 2014). Completed collected data from the field were sealed in envelopes, transported and kept under lock and key in the Researcher's office. Data entered in the computer were protected using password.

3.13 Timed and Targeted Counseling Intervention

The TTc intervention under WV ChNIS program aimed at improving the nutritional status of children in the community through behavior change communication approach (Gilmore et al., 2014). Existing CHWs from MOH received specialized training on TTc and implemented the intervention through home visits. The visits targeted a period in early childhood when nutrition messages were most relevant to enable caregivers get a better understanding of nutrition issues and make best possible choice for their children who were aged below two years. Messages were delivered to the caretakers since they were key implementers to their young children

The key nutrition messages were carefully timed so that caretakers had adequate time to act on the delivered message. They were not given too early or too late to the caretakers so that they could still be relevant and not forgotten. The messages targeted a time in a child's growth when nutrition was important. Because of different cultural and financial barriers to promoting good health practices, CHWs had to counsel, engage and discuss with caregivers on feasible shifts of behaviors that could cultivate practices that were geared to promoting good nutrition practices among children. The messages were individualized according to child circumstances (World Vision International, 2015)

Up to when a child was aged 24 months, it had received at least seven home visits. The first four visits targeted to a time when a child was aged less than six months and the key messages emphasized on practices that promoted exclusive breastfeeding. The next three visits highlighted on complementary feeds that were diverse and rich in iron and Vitamin A with importance of continued breastfeeding. Cross cutting key messages at all the visits included child stimulation and

play; and frequent reminder of routine services like growth monitoring and complete immunization as scheduled. The program empowered the CHWs and facilitated them with trainings, provision of working resources like stationaries, weighing scales, length boards, monthly stipends with a well-structured supervision plan. This intervention was implemented in Katito in Kisumu County. A summary of the visits with key nutrition messages given to caregivers at specific times of child's growth is on Table 5.

Kegonga Ntimaru in Migori county was a comparative site for the TTc intervention. The CHWs from the MOH were present but did not receive the specialized TTc training or the working facilitation by World Vision. The two study sites were selected and paired because of their similarities in population and community characteristics including socio cultural practices and beliefs. There was no other nutrition intervention in these study areas apart from TTc.

Table 5 Summary of Timed and Targeted Counseling key messages

Visit No.	Topic	Key messages and additional information
First visit newborn care	Essential new born care	Put baby to breast within 30-60 minutes after birth Do not discard first milk (Colostrum) Exclusive breastfeeding; give no other foods or liquids
Second visit During first week of life	Newborn Care first week of life	Exclusive breastfeeding to six months No other foods or water; no bottles or utensils Breastfeeding on demand at least 8 times in 24 hours Holistic child development: talk, play and stimulate the baby for language and emotional development
Third visit One month	Routine Services	Attend clinic to complete growth monitoring and immunization as scheduled
Fourth visit 5th month	Child feeding: 6 to 9 months Complementary feeding	Importance of dietary diversity Continued breastfeeding to 24 months in addition to giving foods Give foods rich in iron – meat, chicken, fish, green leaves, fortified foods Preparation of complementary foods for 6 to 9 months child Feed in response to child's hunger. From six months give water to drink – should be boiled or purified water Continue regular growth monitoring at the clinic and community
Fifth visit 9 months	Child Feeding 9 to 12 months Micronutrient	Give Vitamin A rich foods Micronutrients: Vitamin A supplementation from 6 months Preparation of complementary foods for 9 to 12 months child and Feed in response to child's hunger. Continued growth monitoring at clinic and community Holistic Child Development – stimulation and play
Sixth visit 12 months	One Year Old Child	Continued breastfeeding alongside complementary foods Give iron rich foods Routine Health Services: Growth Monitoring and Immunizations Vitamin A Supplement from 12 months Holistic Child Development – stimulation and play
Seventh Visit 18 months old child	18-month-old child	Preparation of complementary foods for 18-month child and feed in response to child's hunger. Vitamin A and deworming at 18 months Give iron foods rich Holistic child development – play and stimulation

3.14 Data management and analysis

This summarized how data was handled from data collection by RAs to analysis.

3.14.1 Nutritional status

Raw data were entered into ENA for SMART software and the information entered included child's unique identifier number, sex, date of data collection, date of birth, length and weight

measurement readings. The Software computed the ages in months and the three nutritional indicators (underweight, wasting and stunting) based on WHO Z scores were generated. This was then exported to STATA software for further analysis with other variables.

3.14.2 Dietary intake

Raw data from the Food frequency Questionnaires were entered into an excel spreadsheet for computation of food frequencies to daily amounts. The information entered included child's Number, date of data, date of birth and frequency of consuming a specific food. The computed information was then exported to Moi University NutriCal software for computation of average daily consumption of nutrients with nutrient inadequacies identified. The Moi University Nutrical software had a list of most of Kenyan foods with their specific nutrient composition per 100grams based on the Kenyan Food composition tables. The spreadsheet with the consumed nutrients per child was then exported into the STATA for further analysis with the other variables.

3.14.3 Cognitive development

Raw tallies were entered into excel sheet, summed up and composite scores computed. This yielded standard scores that enabled the researcher to estimate the child's cognitive scores and compared to other children of similar age. The categorized scores were them exported to the STATA for further analysis.

3.14.4 Perception of CHWs on their knowledge on Nutritional status and Cognitive Development

Raw data were transcribed, typed and exported into the NVivo 7.0 for analysis. It was then coded according to the emerging themes and report done qualitatively.

3.14.5 Qualitative and quantitative analysis

All quantitative data were exported to STATA software and then merged with the data on socio economic status using each child's unique identifier. The data were then summarized using descriptive statistics (frequencies, mean and standard deviation). Chi-square test compared the proportions of children with malnutrition and cognitive development in the study sites. Independent samples t-test compared the mean differences in cognitive assessment scores between the study sites. Multinomial logistic regression predicted the probability of the effect of nutritional status and cognitive development of children on the multiple independent variables in the two study sites. Multinomial logistics regression was used because the dependent variables had more than two distinct outcomes (Chatfield, 2018). The level of significance was set at P=0.05. The study rejected the null hypothesis if the p value was less than 0.05 and that there was no significant difference between the means of the variables of interest (Halsey, Curran-Everett, Vowler, and Drummond, 2015).

For qualitative data, raw information from IDI and FGD were transcribed, typed and exported into the NVivo 7.0 for analysis. It was then coded according to the emerging themes and report done. The research findings were presented in tables, charts, graphs and narratives. The results from this study were disseminated to the public through publications and presentation in conferences.

CHAPTER FOUR

RESULTS

4.1 Socio demographic characteristics of children

This is the descriptive analysis of the household characteristics of the children in the study sites. Table 6 summarises the household characteristics of 101 children from the intervention (Katito) and 91 from comparative site (Kegonga Ntimaru). The chi square statistics obtained showed that the p-values of the independent variables were all greater than 0.05 except for mother's income (chi^2=49.6349, p<0.001) and type of housing (chi^2=22.2179, p<0.001). Therefore, the study showed that there was significant relationship between mothers' income and the type of housing in the two study sites.

Table 6 Demographic Characteristics of households of children in study sites

Characteristic	Site		Statistics	
	Intervention(n=101) (%)	**Comparative(n=91) (%)**	**χ2-value**	**P-value**
Marital status				
Single/divorce/widow	22(21.78)	39(42.86)		
Married	79(78.22)	43(57.14)	9.8084	0.231
Mother's income (Ksh)				
<2,999	80(79.21)	26(28.57)		
>3,000	21(20.79)	65(71.43)	49.6349	<0.001
Father income (Ksh)				
<2,999	65(64.36)	54(59.34)		
>3,000	36(35.64)	37(40.66)	0.5111	0.475
Mother's education				
≤Primary	55(54.46)	14(15.38)		
Secondary	31(30.69)	45(49.45)	2.6580	0.851
Tertiary	15(14.85)	32(34.16)		
Type of housing				
Semi-permanent	39(38.61)	66(72.53)		
Permanent	62(61.39)	25(27.47)	22.2179	<0.001
Size of housing				
Single	3(1.10)	30(29.70)		
Double	37(40.66)	29(28.71)	8.9301	0.059
≥3 rooms	52(58.24)	42(41.58)		
Rent amount (Ksh)				
None	22(21.78)	41(45.05)		
<3000	51(60.40)	26(28.57)	3.2017	0.673
>3001	18(17.82)	24(26.37)		
Caretaker own phone				
Yes	93(92.08)	90(98.9)	4.9863	0.066
No	8(7.92)	1(1.1)		
Median Household size (IQR)	6(4, 7)	5(4, 6)	2.926	0.074

4.1.1 Mean Estimate for child anthropometry in the study sites

This summarizes the mean estimate for children's age in months, weight in kilograms and length in centimeters in the study sites before and after the TTc intervention.

4.1.2 Mean estimation for children anthropometry at baseline at study sites

Secondary data on child weight, length and age were obtained from the World Vision database. This was the baseline data that was collected in 2013 before the TTc intervention was implemented.

At Katito where the intervention was implemented, information from 132 children were sought and their mean age, weight and length computed. It was reported that the mean age, weight and length were 12.35 (11.15, 13.46), 9.33 (8.76, 9.89) and 72.62 (70.51, 74.72) respectively. The youngest child was aged 0.46 months while the oldest was 23.59 months.

At Kegonga Ntimaru, the comparative site, a total of 128 children were sampled from World Vision database and their data analyzed. Their mean age, weight and length was 11.67 (10.59, 12.76), 8.68 (8.29, 8.75) and 71.18 (69.75, 72.61) respectively. The youngest child was aged 0.53 months while the oldest was 23.56 months. This is summarized on table 7.

Table 7 Mean estimation for children anthropometry at baseline in study sites

Site	Child characteristics	Means statistics for children (n=132)							
		N	Mean	SD	Std Err	CI		Min	Max
Intervention	Age (Months)	132	12.35	7.00	0.61	11.15	13.56	0.46	23.59
	Weight (kg)	132	9.33	3.24	0.28	8.78	9.89	2.70	16.40
	Length (cm)	132	72.62	12.24	1.07	70.51	4.72	50.00	99.00
Comparative	Age (Months)	128	11.67	6.20	0.55	10.59	12.76	0.53	23.56
	Weight (kg)	128	8.68	2.25	0.20	8.29	8.75	3.08	14.00
	Length (cm)	128	71.18	8.17	0.72	69.75	72.61	50.00	95.90

Source: ChNIS World Vision, Kenya.

4.1.3 Mean Estimation for Children anthropometry at endline at study sites

This summarizes the mean results for the children after three years of TTc intervention at both intervention and comparative sites. The results obtained on table 8 showed that, at the intervention site, the mean age (months), weight (kilograms) and length (centimeters) for children after the TTc at the intervention site was 11.85 (10.49, 13.22), 8.60 (8.09, 9.11) and 70.86 (69.12, 72.60) respectively. Their minimum weight was 3.5 kg and maximum 13.5kg while the minimum length was 54cm and maximum 92cm. With the comparative group, which did not receive the TTc intervention, a total of 91 children were sampled and their data analyzed. Their mean age, weight and length was 12.33 (11.05, 13.60), 11.78 (11.05, 12.50) and 73.79 (71.99, 75.60) respectively. The youngest child was aged 1.58 months while the oldest was 23.89 months.

Table 8 Mean estimation for children anthropometry at endline in the study sites

Site	Child characteristics	N	Mean	SD	Std. Err	CI		Min	Max
Intervention	Age (Months)	101	11.85	6.90	0.69	10.49	13.22	0.72	23.98
	Weight (kg)	101	8.60	2.60	0.26	8.09	9.11	3.50	13.50
	Length (cm)	101	70.86	8.82	0.88	69.12	72.60	54.00	92.00
Comparative	Age (Months)	91	12.33	6.10	0.64	11.06	13.60	1.58	23.89
	Weight (kg)	91	11.78	3.47	0.36	11.05	12.50	4.80	18.00
	Length (cm)	91	73.79	8.65	0.91	71.99	75.60	49.00	88.00

4.2 Nutritional status of children at study sites

This summarizes the results obtained from the study based on the nutritional status at baseline and at endline at the intervention and comparative site. Secondary data for baseline results were obtained from WV database and were collected in 2013 while primary data was collected in 2015.

4.2.1 Nutritional status of children at baseline in the study sites

Baseline data were obtained from secondary data that were gotten from WV database. The results as shown on table 9 are from 260 children (132 from intervention and 128 comparative site). The findings showed that 17% of children were moderately underweight, 8% severely wasted and 19% severely stunted in the intervention group and from comparative group, 15% were moderately underweight, 9% moderately wasted and 18% moderately stunted. There was no significant difference in underweight and overweight status (chi^2=8.73, p=0.068), wasting status (0.25, p=0.89) and stunting status (chi^2=2.77, p=0.25) and study sites among the children at the start of the study.

Table 9 Nutritional status of children at baseline in the study sites

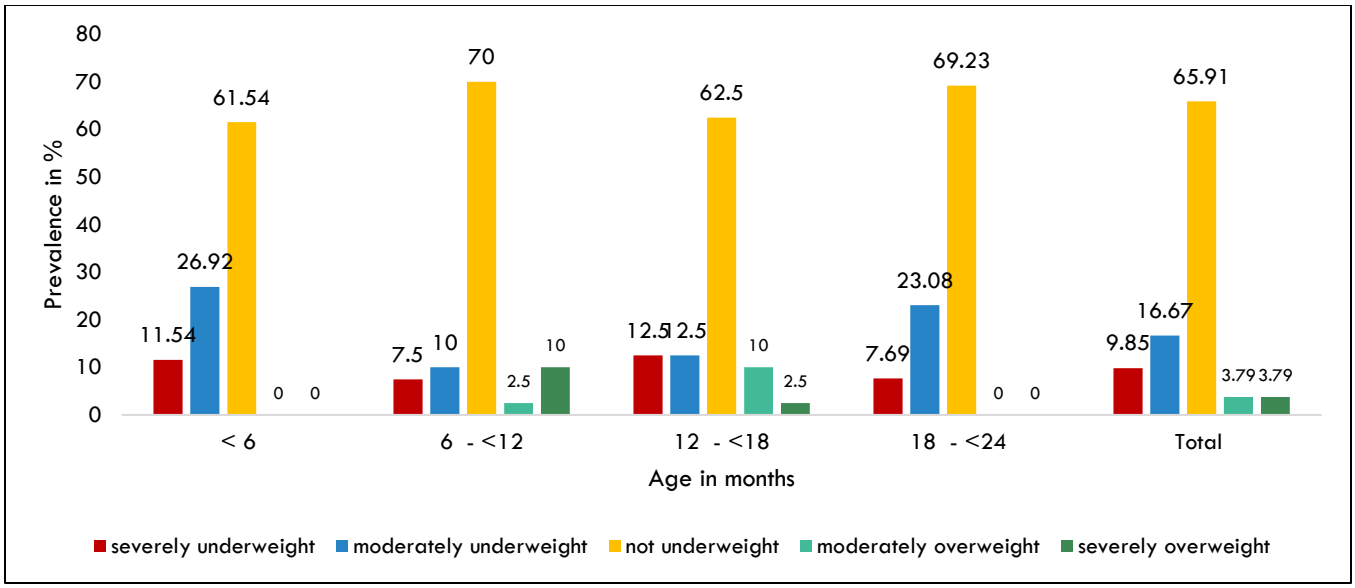
Nutritional status	**Intervention (n=132) %**	**Comparative (n=128) %**	chi^2	**p-value**
Underweight				
Severely underweight	9.85	3.13	8.7263	0.068
Moderately underweight	16.67	14.84		
Not underweight	65.91	75.00		
Overweight	3.79	6.25		
Moderately overweight	3.79	0.78		
Total	100.00	100.00		
Wasted				
Severely wasted	7.58	6.25	0.2453	0.885
Moderately wasted	8.33	9.38		
Not wasted	84.09	84.38		
Total	100.00	100.00		
Stunted				
Severely stunted	18.94	13.28	2.7696	0.250
Moderately stunted	12.12	17.97		
Not stunted	68.94	68.75		
Total	100.00	100.00		

4.2.2 Nutritional status of children per age group at baseline at the study sites

This summarized the nutritional status among children at Katito and Kegonga Ntimaru before the CHWs started giving key nutrition messages through home visits under TTc intervention. These results were for the prevalence of underweight and overweight; wasting and stunting as per different age groups of the children.

4.2.2.1 Prevalence of underweight and overweight at baseline at Katito

These results showed the prevalence of underweight and overweight among children as per different age groups at Katito before the TTc was implemented by CHWs. From baseline results as shown on figure 5, a total of 17% of children were moderately underweight, 10% severely underweight while 4% were moderately and severely overweight each. For children aged less than 6 months old and those aged between 18 and 24 months, a total of 27% and 23% of them were found to be moderately underweight respectively compared to 3% and 10% who were found to be severely and moderately overweight respectively in the ages between 12 and 18 months. There was no significant difference (chi^2=17.20, p=0.14) in the underweight and overweight status at baseline since the p-value for the nutritional indicator (Weight for Age) obtained was greater than 0.05 significant level.

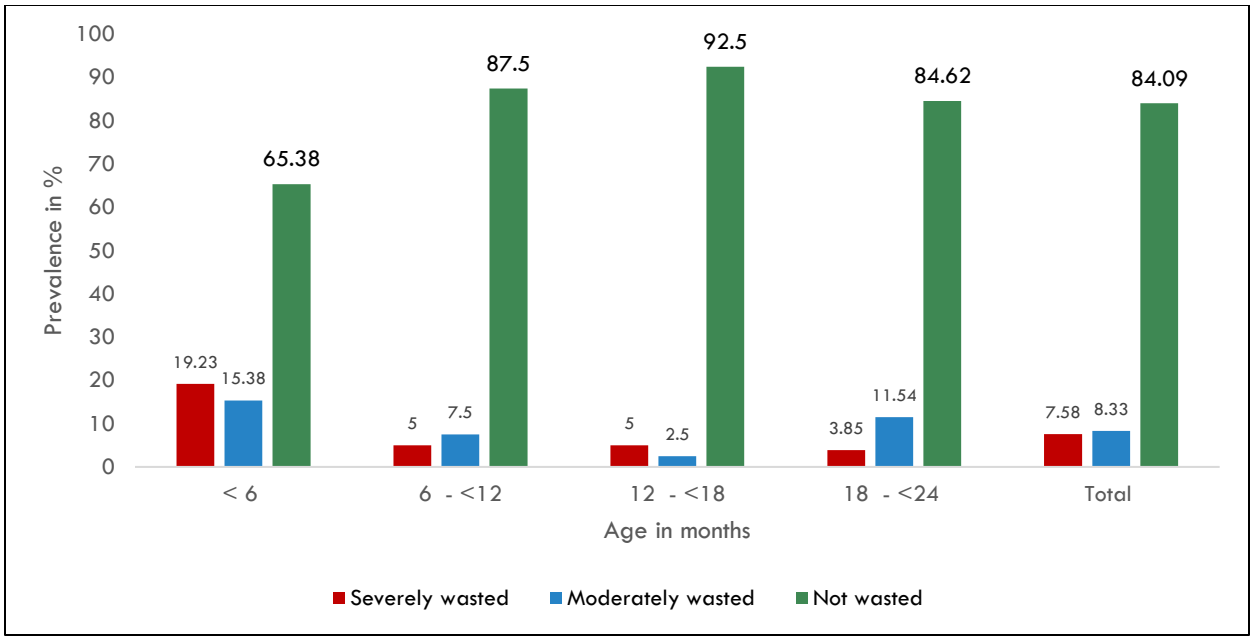


Chi^2 =17.20, p=0.14

Figure 5 Prevalence of underweight and overweight of children at baseline at Katito

4.2.2.2 Prevalence of wasting among children at baseline at Katito

These results showed the prevalence of wasting among children per different age groups at Katito before the TTc was implemented by CHWs. From the baseline results as shown on figure 6, a total of 8% of the children were moderately wasted. Of those aged less than 6 months, 19% and 15% were found to be severely and moderately wasted respectively. Only 4% of children aged between 18 and 24 months were found to be severely wasted. There was no significant difference (Chi^2=10.85, p=0.09) in the wasting status and the ages of the children before the start of the intervention.

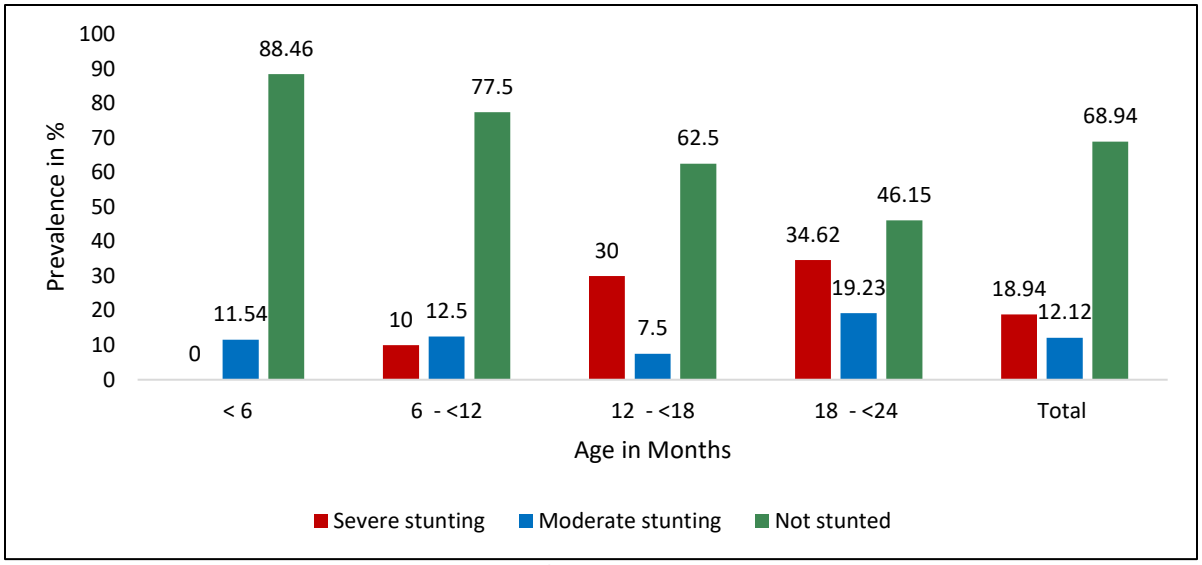


Chi^2 =10.85, p=0.09

Figure 6 Prevalence of wasting among children at baseline at Katito

4.2.2.3 Prevalence of stunting among children at baseline at Katito

These results showed the prevalence of stunting of children as per different age groups at Katito before the TTc intervention was implemented by CHWs. From the baseline results as shown on figure 7, a total of 19% and 12% of the children were severely and moderately stunted respectively. Of those aged between 18 and 24 months a total of 35% and 19% reported to be severely and moderately stunted respectively. A total of 30% of children aged between 12 and 18 months were found to be severely stunted. There was significant difference (Chi^2=18.43, p=0.005) between stunting status and the ages of the children at baseline.

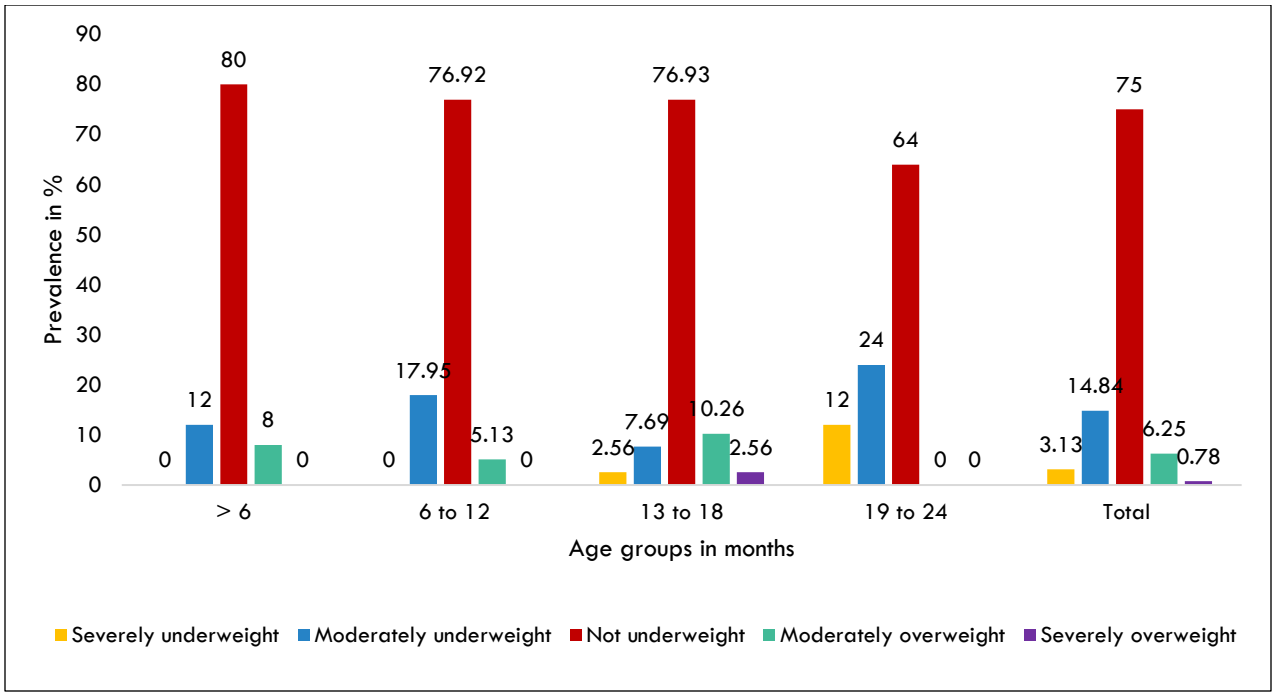


Chi^2=18.43, p=0.005

Figure 7 Prevalence of stunting among children baseline at Katito

4.2.2.4 Prevalence of underweight and overweight among baseline at Kegonga Ntimaru

These results showed the prevalence of underweight and overweight of children as per different age groups at Kegonga Ntimaru before the TTc was implemented by CHWs at the intervention site. From the baseline results as shown on figure 8, a total of 15% of the children were moderately underweight, 3% severely underweight and 6% moderately overweight. For children aged less than 6 months, a total of 18% were found to be moderately underweight while 24% of those aged between 19 and 24 months reported to be moderately overweight compared to 8% who were moderately underweight in the 13 to 18 months age category. There was no significant difference (chi^2=17.20, p=0.14) in the underweight and overweight status at baseline since the p-value for the nutritional indices (Weight for Age) obtained was greater than 0.05 significant level.

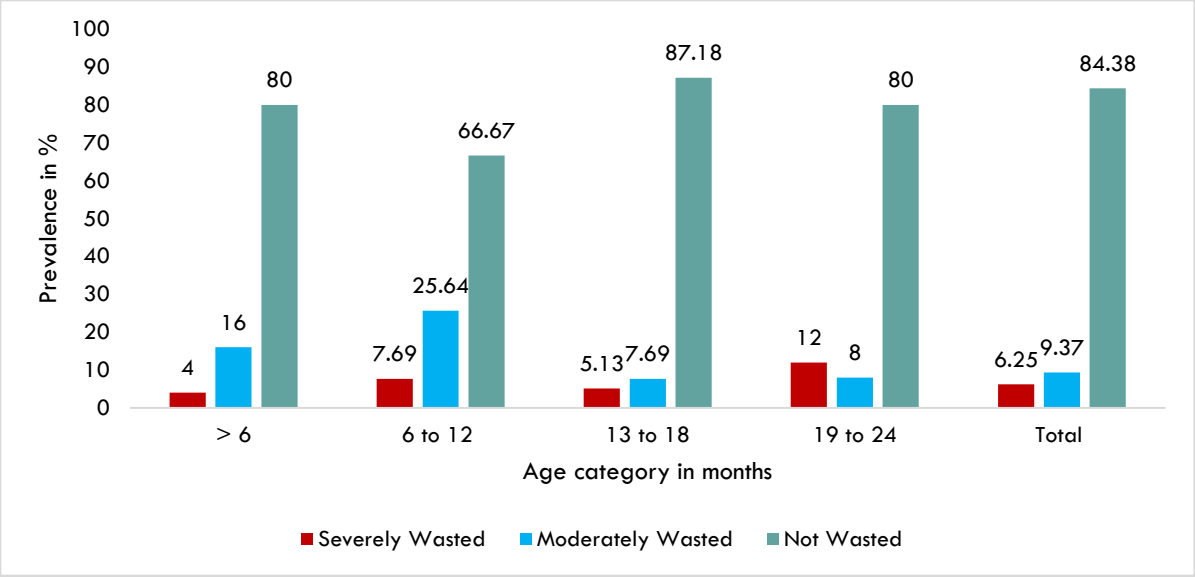


Chi^2 =17.058, p=0.147

Figure 8 Prevalence of underweight and overweight of children at baseline at Kegonga Ntimaru

4.2.2.5 Prevalence of wasting among children at baseline at Kegonga Ntimaru

These results showed the prevalence of wasting among children per different age groups at Katito before the TTc was implemented by CHWs. From the baseline results as shown on figure 9, a total of 6% and 9% of the children were severely and moderately wasted. Of those aged between 6 and 12 months, 26% and 19% were found to be moderately and severely wasted respectively. Only 12% of children aged between 19 and 24 months were severely wasted. There was no significant difference (Chi^2=3.3246, p=0.767) in the wasting status and the ages of the children before the start of the intervention at the comparative site.

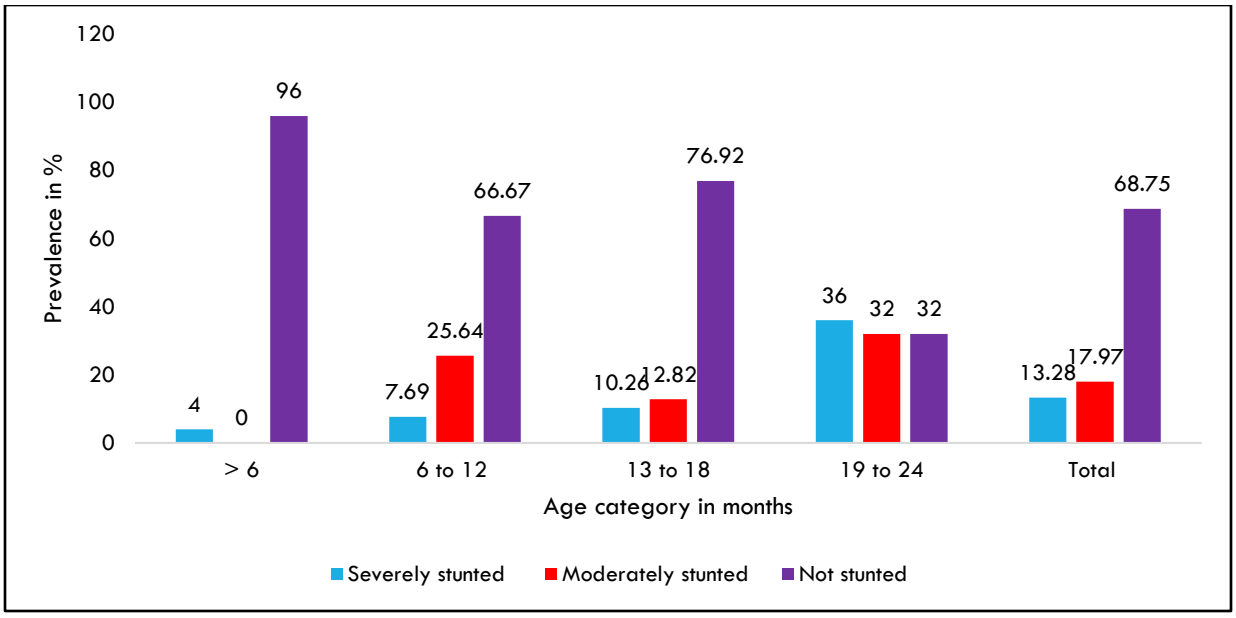


Chi^2 =3.3246, p=0.767

Figure 9 Prevalence of wasting among children at baseline at Kegonga Ntimaru

4.2.2.6 Prevalence of stunting among children at baseline at Kegonga Ntimaru

These results show the prevalence of stunting among children per different age groups at Kegonga Ntimaru in Migori County. From the baseline results as shown on figure 10, a total of 18% and 13% of the children were moderately and severely stunted respectively. Of those aged between 19 and 24 months, 32% and 36% reported to be moderately and severely stunted respectively. A total of 10% of children aged between 13 and 18 months were found to be severely stunted. There was significant difference (Chi^2 =29.6221, p<0.001) between stunting status and the ages of the children at baseline in the comparative site.



$Chi^2=29.6221$, $p<0.001$

Figure 10 Prevalence of stunting among children at baseline at Kegonga Ntimaru

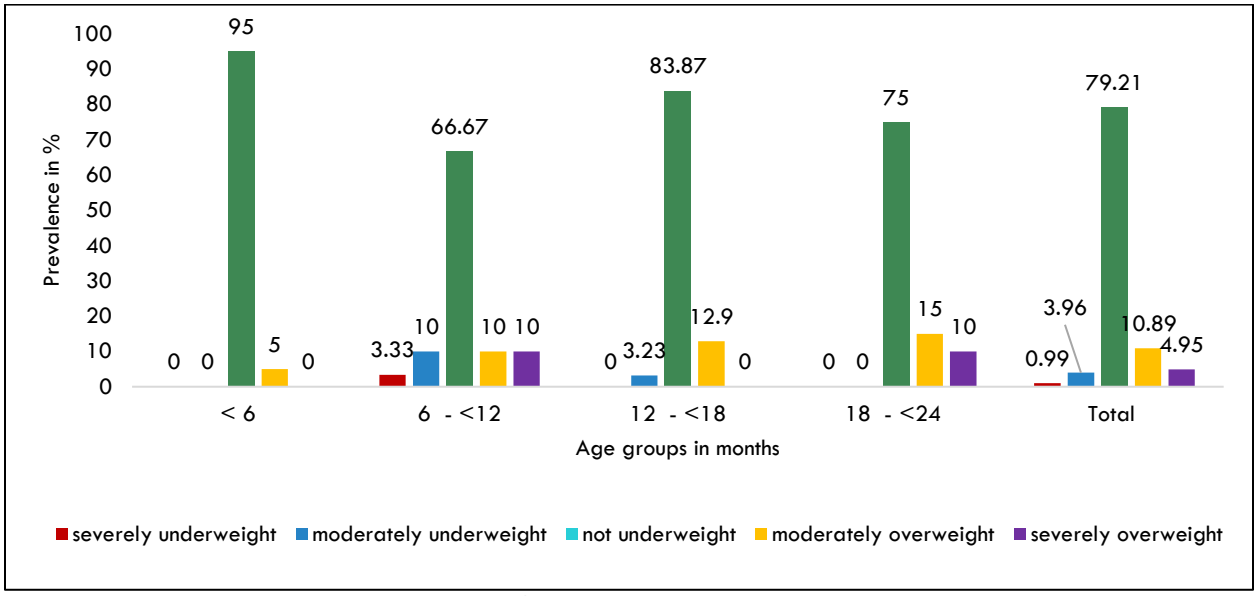
4.2.3 Nutritional status of children at endline in the study sites

This summarizes the nutritional status of children at Katito in Kisumu County and Kegonga Ntimaru in Migori County after three years of TTc nutrition intervention. Children in Katito received key nutrition messages from CHWs through home visits under TTc intervention. Those from Kegonga Ntimaru did not receive the key messages form the CHWs in the TTc intervention. These results were for the prevalence of underweight and overweight; wasting and stunting of children as per different age groups.

4.2.3.1 Prevalence of underweight and overweight at endline at Katito

This shows the prevalence of underweight and overweight for children at Katito in Kisumu County after the TTc was implemented by the CHWs. The findings from Katito as on figure 11 showed that only 1% of the children were found to be severely underweight with 10% of those aged between 6 and 12 months being moderately underweight. Of all children, only 4% were found to

be moderately underweight with 13% being from the ages between 13 and 18 months. A total of 5% of the children were severely overweight with 10% each being from the those aged between 6 and 12; and 19 and 24 months brackets. The statistics obtained (chi^2=14.29; p= 0.282) and the p value was greater than the significant level of 0.05. The null hypothesis that there was no relationship between the age of the children and their underweight and overweight status was not rejected thus showing that the variables were independent of each other.



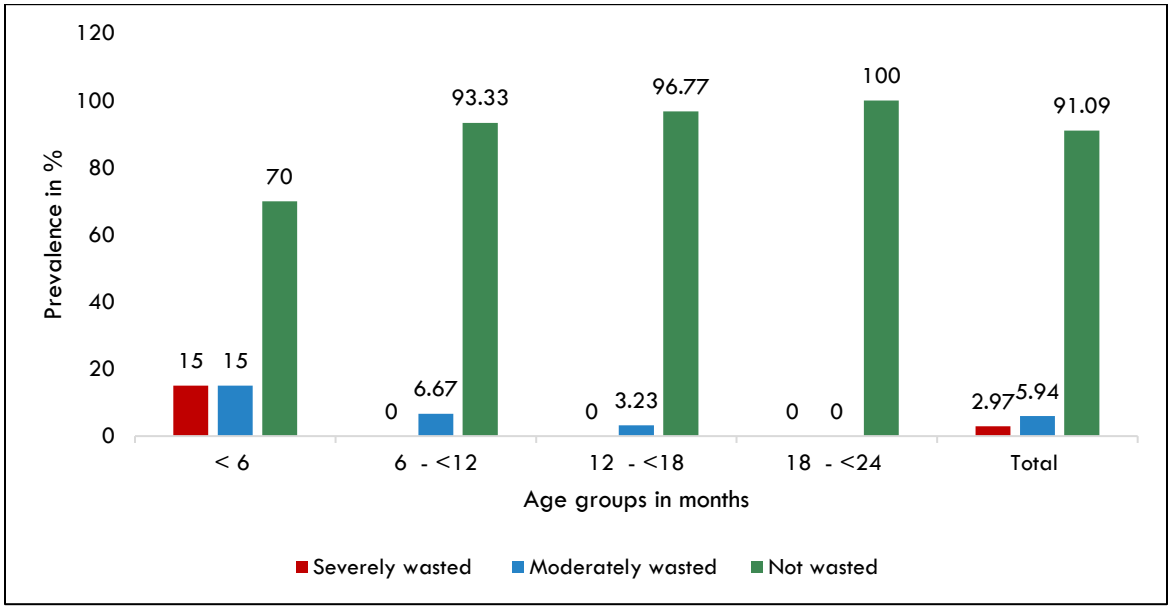
Chi^2=14.2959, p= 0.282

Figure 11 Prevalence of underweight and overweight among children endline at Katito

4.2.3.2 Prevalence of wasting among children at endline at Katito

This summarizes the prevalence of wasting among children at Katito in Kisumu County after the TTc was implemented by the CHWs. As shown in the figure 12, only 3% of the children were severely wasted. Those aged less than 6 months had 15% being severely and moderately wasted each. The chi-square test done resulted in a probability p-value of 0.007 which was greater than the 0.05 significant level. This showed that there was no significant relationship between wasting

and the age group of the children at Katito and that the two variables were independent of each other and the null hypothesis was rejected.

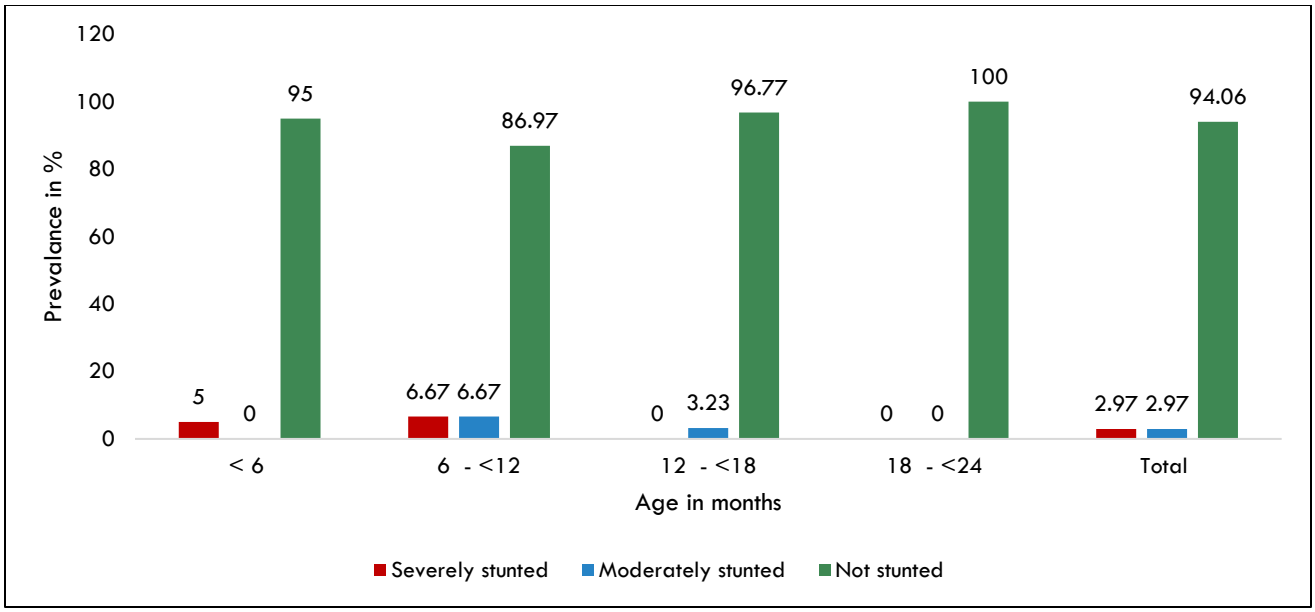


Chi^2=17.7899, p=0.007

Figure 12 Prevalence of wasting among children at endline at Katito

4.2.3.3 Prevalence of stunting among children at endline at Katito

This summarizes the prevalence of stunting among children at Katito in Kisumu County after the TTc was implemented by the CHWs. As summarized on figure 13, a total of 6% of the children were severely and moderately stunted. It was found that children aged between 6 and 12 months were highly affected as 7% of them were severely stunted. The chi–square test done resulted in a probability p-value of 0.421 which was greater than the significant level of 0.05. This showed that there was no relationship between the stunting and the age group of the children and that the two variables were independent of each other.

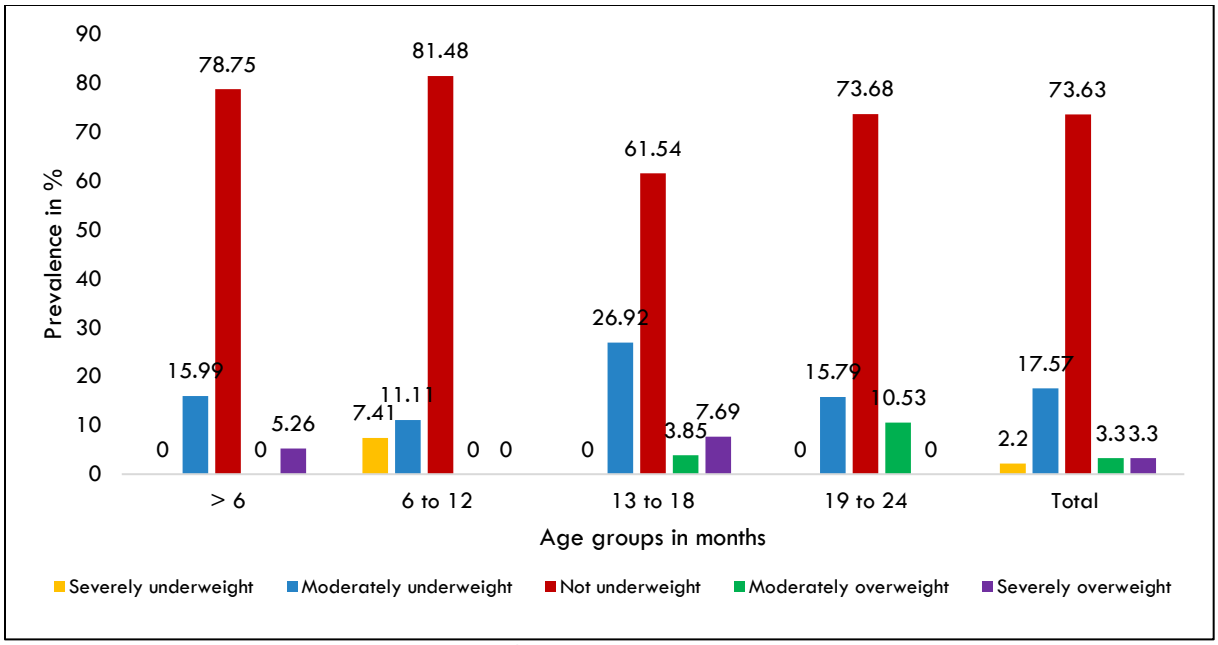


Chi^2=6.0227, p=0.421

Figure 13 Prevalence of stunting among children at endline at Katito

4.2.3.4 Prevalence of Underweight and overweight among children at endline at Kegonga Ntimaru

This shows the prevalence of underweight and overweight for children at Kegonga Ntimaru in Migori County after the TTc was implemented by the CHWs. This site was the comparison site and therefore did not receive any key nutrition message from CHWs. Findings from comparative site as on figure 14 showed that only 18% of the children were found to be moderately underweight with 7% of those aged between 6 and 12 months being severely underweight. Of all children, a total of 6% were found to be severely and moderately overweight, with 8% from the ages between ages 13 and 18 months found to be severely overweight. The statistics obtained (chi^2=15.3746, p=0.222) and the p value was greater than the significant level of 0.05. The null hypothesis that there was no relationship between the age of the children and their underweight and overweight status was not rejected thus showing that the variables were independent of each other.

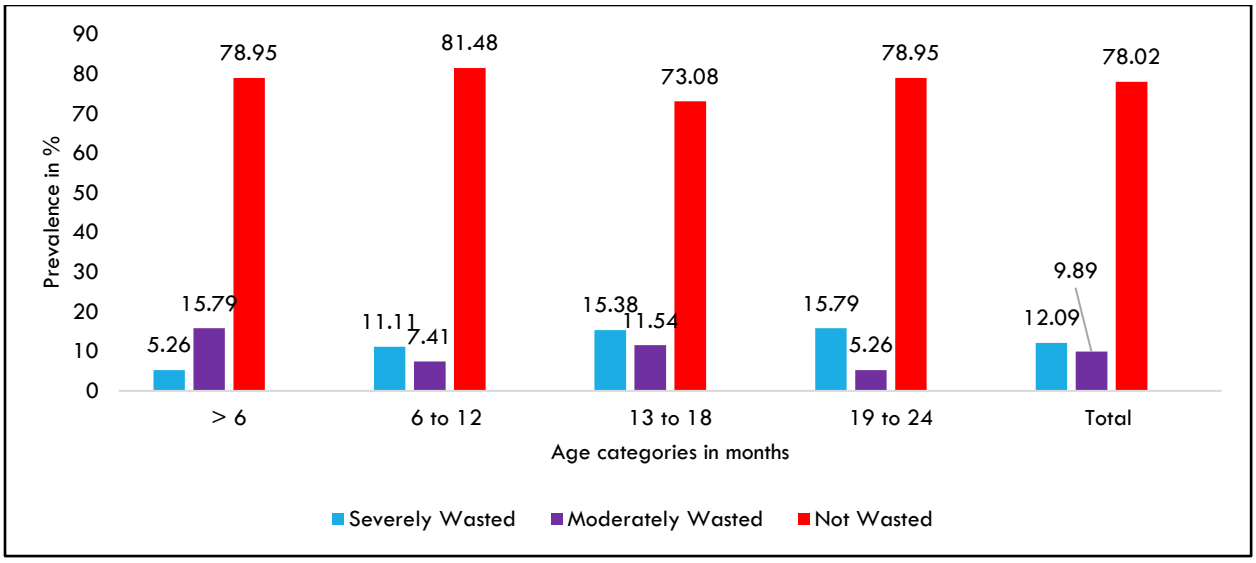


Chi^2=15.3746, p= 0.2222

Figure 14 Prevalence of underweight and overweight among children at endline at Kegonga Ntimaru

4.2.3.5 Prevalence of wasting among children at endline at Kegonga Ntimaru

This summarizes the prevalence of wasting among children at Kegonga Ntimaru in Migori County after the TTc was implemented by the CHWs. As shown in the figure 15, only 12% of the children were severely wasted. Of those aged less than 6 months, 16% of them were moderately wasted and 15% of those aged between 13 and 18 months were found to be severely wasted. The chi-square test done showed a probability p-value of 0.851 which was greater than the 0.05 significant level. This showed that there was no significant relationship between wasting and the age group of the children at Kegonga Ntimaru and that the two variables were independent on each other and the null hypothesis was not rejected.

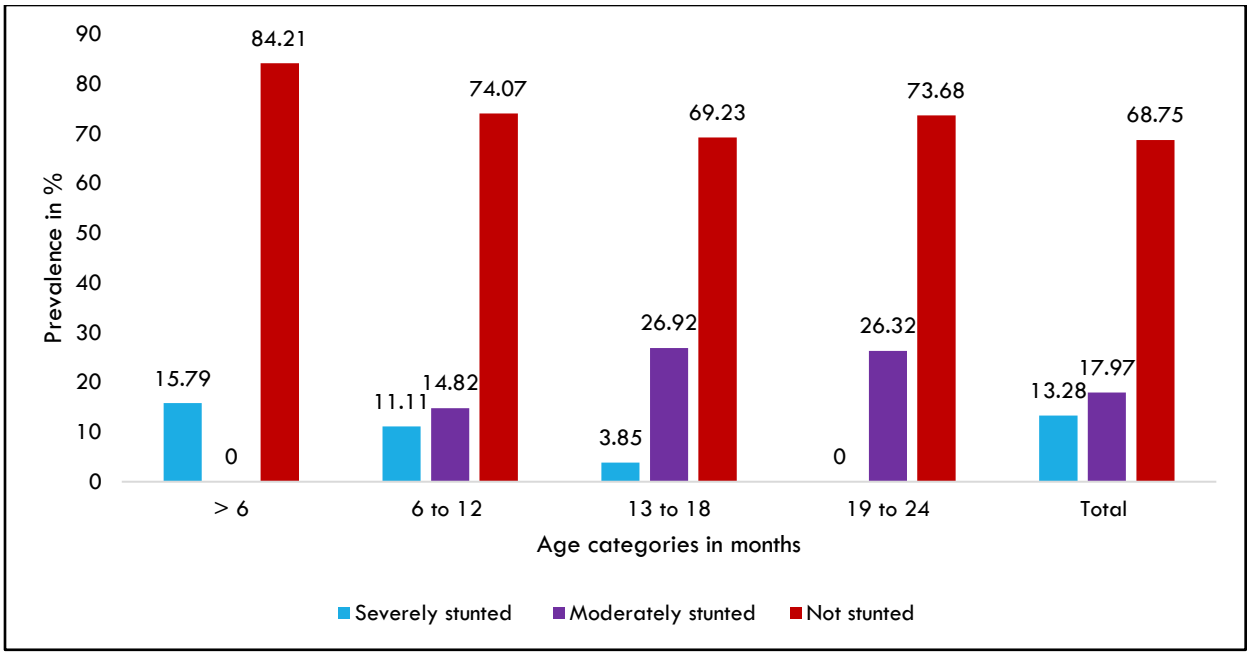


Chi^2=2.6492, p=0.851

Figure 15 Prevalence of wasting among children at endline at Kegonga Ntimaru

4.2.3.6 Prevalence of stunting among children at endline at Kegonga Ntimaru

This summarizes the prevalence of stunting among children at Kegonga Ntimaru in Migori County after the TTc implementation. As summarized on figure 16 a total of 31% of the children were severely and moderately stunted. A total of 15% and 11% of children aged between 6 and 12 months were found to be moderately and severely stunted. The chi–square test done showed a probability p-value of 0.129 which was greater than the significant level of 0.05. This showed that there was no relationship between the stunting and the age group of the children and that the two variables were independent of each other.



Chi^2=9.9020, p=0.129

Figure 16 Prevalence of stunting at endline at Kegonga Ntimaru

4.2.4 Nutrient intake among children at study sites

These presents result from the Food Frequency Questionnaire in the study sites at the end of the intervention. TTc intervention did not collect data on dietary intake before the intervention was implemented and therefore secondary data from WV was not available for analysis at baseline. Data on dietary intake was collected after the intervention then computed and then compared with Recommended Dietary Allowances. The nutrients that were analyzed in the study were energy, protein, fats, iron and Vitamin A both in the intervention and comparative sites.

4.2.4.1 Adequacy of energy intake at study at the study sites

This shows the percentage of children who consumed adequate amount of required energy according to the RDA for their ages at the study sites. A summary of adequate nutrients consumed by children is on table 10. It showed that 81% and 97% of children at Katito and Kegonga Ntimaru

respectively consumed adequate calories according to RDAs. The chi-square test done obtained a probability p value that was less than 0.0001. This showed that there was a relationship between the total dietary energy intake and the study sites thus indicating that the variables were dependent on each other.

For protein intake, at Katito and Kegonga Ntimaru sites, 61% and 4% of the children received adequate amount of protein from their diets respectively. Of those aged below 6 months, 85% and 16% from intervention and comparative site respectively had inadequate protein intake from their diets according to the RDAs. The probability p-value obtained was less than 0.0001 which showed that there was a relationship between protein intake and age group of the children. This indicated that the two variables were dependent on each other.

For fat intake, at Katito and Kegonga Ntimaru sites only 57% and 94% had consumed diets that were adequate in fat respectively according to RDAs intake. Of those aged less than 6 months, 75% from intervention site and 84% from comparative site had adequate diets. The probability p value obtained was less than 0.0001 showing that there was a relationship between the fat intake and the age of the children. This also showed that the two variables were dependent on each other.

For iron intake, at Katito only 56% of the children consumed adequate amount of iron from their diets compared to 44% who were not receiving adequate amounts. The probability p value obtained was less than 0.0001 showing that there was a relationship between iron intake and age group of children thus showing that the two variables were dependent on each other.

For Vitamin A intake, this study indicated that in Katito, a total of 85% of the children consumed adequate amount of vitamin A from their diets with 35% of those aged between 19 and 24 months consuming diets that were inadequate according to RDAs standards for their age. At Kegonga Ntimaru, a total of 18.5% of children had inadequate vitamin A from their diets. The p-value obtained was less than 0.0001 showing that there was a relationship between the vitamin A intake and age group of the children. This indicated that the two variables were dependent on each other.

Table 10 Adequacy of nutrient intake by children as per different age groups

Age group (months)	RDA Kcal/kg	Intervention site		Comparative site	
		Adequate (%)	Not adequate (%)	Adequate (%)	Not adequate (%)
Energy Intake					
< 6	108	85.00	15.00	94.74	5.26
6-12	98	76.67	23.33	96.30	3.70
13-18	98	90.32	9.68	96.15	3.85
19-24	1240	65.00	35.00	100.00	0.00
Total		81.19	18.81	96.70	3.30
Statistics			**Chi^2=36.7882, p<0.0001**		
Protein Intake					
< 6	2.05	85.00	15.00	15.79	84.21
6-12	1.65	63.33	36.67	0.00	100.00
13-18	1.65	58.07	41.94	3.85	96.15
19 to 24	22	40.00	60.00	0.00	100.00
Total		61.39	38.61	4.40	95.60
Statistics			**Chi^2=69.0697, p<0.0001**		
Fat intake					
< 6	6	75.00	25.00	84.51	15.79
6-12	10	60.00	40.00	100.00	0.00
13-18	10	54.84	45.16	92.31	7.69
19 -24	25	30.00	70.00	100.00	0.00
Total		**57.42**	**42.57**	**94.51**	**5.49**
Statistics			**Chi^2=59.9504, p<0.0001**		
Iron intake					
< 6	6	75.00	25.00	84.51	15.79
6-12	10	60.00	40.00	100.00	0.00
13-18	10	54.84	45.16	92.31	7.69
19 -24	25	30.00	70.00	100.00	0.00
Total		**57.42**	**42.57**	**94.51**	**5.49**
Statistics			**Chi^2=59.9504, p<0.0001**		
Vitamin A intake					
< 6	1200	95.00	5.00	89.47	10.53
6-12	1200	90.00	10.00	66.67	33.33
13-18	1200	87.1	12.90	84.62	15.38
19 to 24	1600	65.00	35.00	94.74	5.26
Total		**85.15**	**14.85**	**82.42**	**17.58**
Statistics			**Chi^2=13.5673, p=0.001**		

4.2.5 Breastfeeding status at the study sites

This showed the results for the status of exclusive breastfeeding and duration of breastfeeding among the children who participated in the study after the TTc intervention implementation

4.2.5.1 Status of exclusive Breastfeeding at the study sites

This indicates the prevalence of exclusive breastfeeding among children aged below two years at Katito in Kisumu County and Kegonga Ntimaru in Migori County. After key messages that emphasized on practices that promoted exclusive breastfeeding were given to the caretakers who were to implement the messages to their young children in Katito site, it was found that a total of 61.4% and 3% of the children were exclusively breastfed for six and less than 3 months respectively. In Kegonga Ntimaru which was the comparative site, a total of 47.9% and 44% had exclusively been breastfed for six month and between four and five months respectively. This is summarized on figure 17

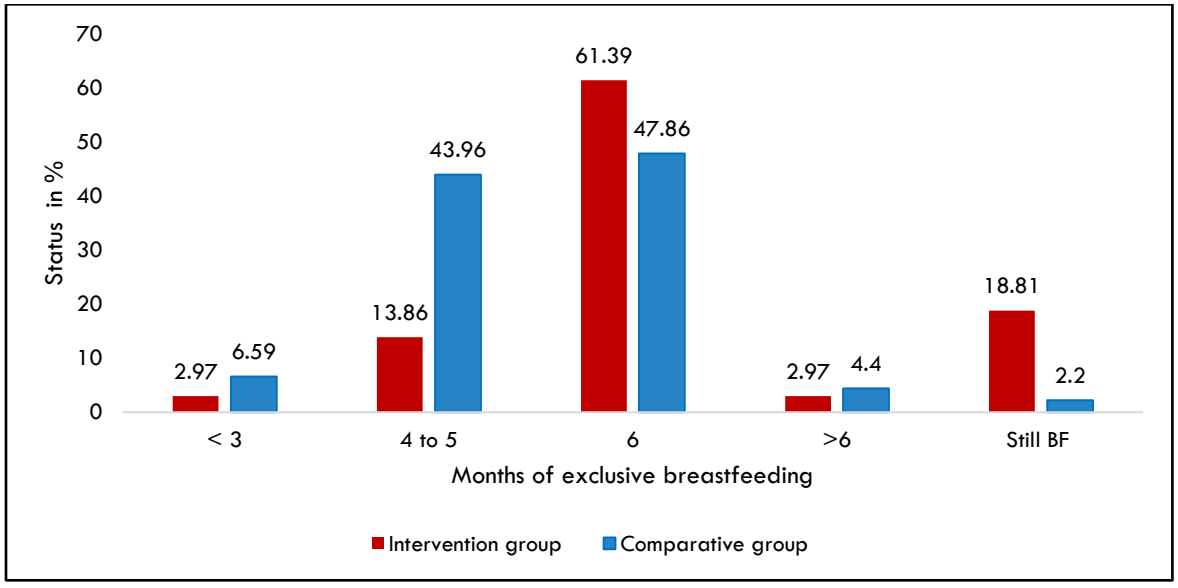


Figure 17 Status of exclusive breastfeeding at Katito and Kegonga Ntimaru

4.2.5.2 Duration of breastfeeding at the study sites

This shows the age at which children were stopped breastfeeding as they continued with complementary feeding. One of key messages contained in TTc given by CHWs to caretakers at various growth stage of child was that children should continue breastfeeding until they are two years and even beyond. This study as shown on figure 18 showed that 4% of children in the intervention group stopped breastfeeding when they were aged between 19 and 24 months while 43% of those from the comparative group stopped when they aged below six months. A total of 80% and 10% were still breastfeeding at the time the data were being collected at the intervention and comparative sites respectively.

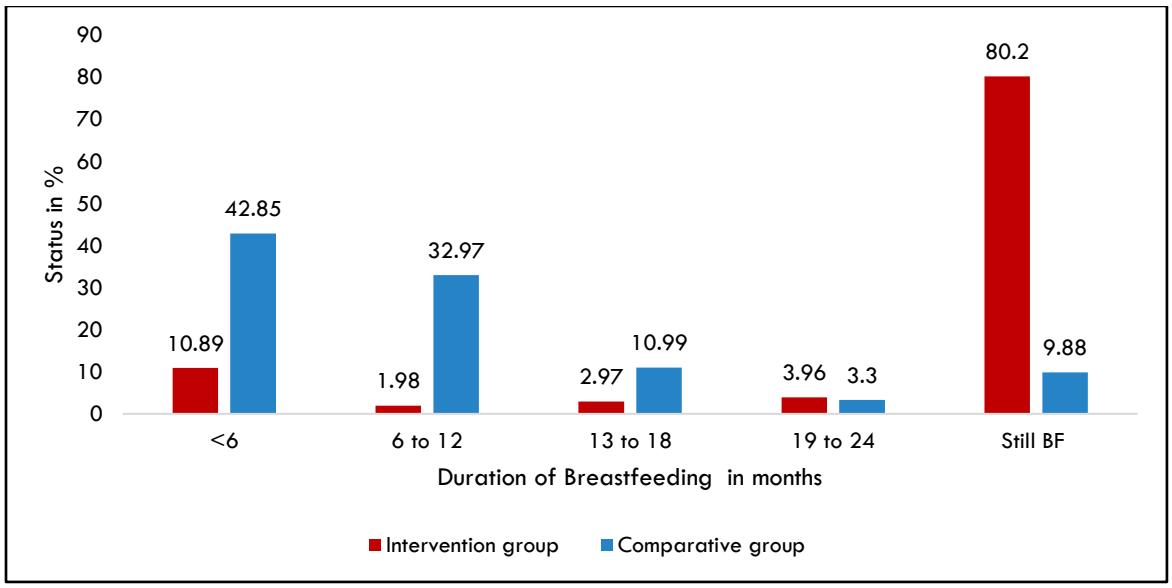


Figure 18 Duration of Breastfeeding among children at Katito and Kegonga Ntimaru

4.2.5.3 Status of duration of breastfeeding as per children age groups at study sites

This indicates when the children were stopped breastfeeding at their different age groups. The table 11 shows that a total of 30% and 42% of the children aged between 18 and 24 months stopped breastfeeding in the intervention and comparative groups respectively. Those who were stopped

breastfeeding when they were below 6 months were 10% and 26% in the intervention and comparative groups respectively. It showed that there was significant difference between the duration of breastfeeding and the age groups of children both at the intervention (Chi^2=24.0924, p= 0.020) and comparative sites Chi^2= 32.4803, p=0.001).

Table 11 Duration of breastfeeding among children as per age groups

Duration of BF (months)	Intervention site					Comparative site				
	Age groups of children in months					Age groups of children in Months				
	< 6	6 to 12	13 to 18	19 to 24	Total	< 6	6 to 12	13 to 18	19 to 24	Total
< 6	10.00	6.67	3.22	30.00	10.89	26.32	62.96	34.62	42.11	42.85
6-12	0.00	3.33	0.00	5.00	1.98	42.11	25.93	23.08	47.37	32.97
13-18	0.00	0.00	9.68	10.00	2.97	0.00	7.41	23.08	10.53	10.99
18-24	0.00	0.00	0.00	10.00	3.96	0.00	0.00	11.54	0.00	3.30
Still BF	90.00	90.00	87.1	45.00	80.2	31.58	3.70	7.69	0.00	9.89
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Statistics	Chi^2= 24.0924, p= 0.020					Chi^2= 32.4803, p= 0.001				

4.3 Cognitive development amongst children

This summarized the results for the cognitive development among the children from Katito and Kegonga Ntimaru sites after the TTc nutrition intervention. The TTc Intervention by WV did not assess cognitive development among children and therefore secondary data at baseline was not available for analysis. The cognitive scores were categorized according to the tallied scores on the BSID questionnaires. Children whose tallied scores were found to be below 89.9 was categorized as below average, between 90.0 and 109.9 as average while those above 110.0 were categorized as above average.

4.3.1 Mean estimates for cognitive scores of children

This summarizes the mean cognitive score results for the children after three years of TTc intervention at both intervention and comparative sites. The results obtained on table 12 showed that, at the intervention site the mean cognitive tallies for children was 9.58 with the minimum tally being 68 while the maximum was 123. With the comparative group, the mean tally was 94.58 with the range being from 68 to 123.

Table 12 Mean estimates for cognitive scores of children

	Mean estimates for cognitive scores of children (n=192)							
Site	**N**	**Mean**	**SD**	**Std Err**	**CI**		**Min**	**Max**
Intervention	101	98.59	11.16	1.11	96.36	100.79	68	123
Comparative	91	94.58	11.57	1.21	92.17	96.99	68	123

4.3.2 Cognitive scores

This illustrates the results for children's cognitive scores after the TTc intervention at both intervention and comparative sites. The cognition level as shown on figure 19 showed that 15% of children from Katito had scores that were below average while only 4.4 % of children from comparative site had scores above average.

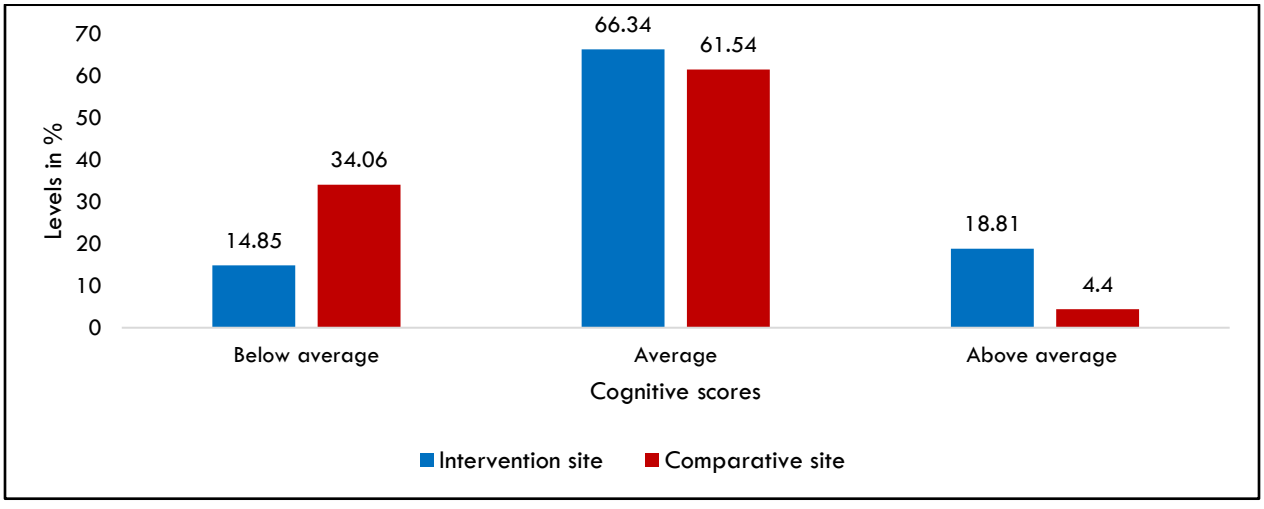


Figure 19 Cognitive Scores for children at Katito and Kegonga Ntimaru after TTc

4.4 Perception of CHWs on knowledge on Nutritional status and Cognitive Development

This evaluated the perception of the CHWs on their knowledge on nutritional status and cognitive development among children. The study used qualitative approach and FGDs and IDIs were employed to collect data. The FGDs were done with the women in the study sites while IDIs were administered to the Health facility Manager; and the World Vision Manager and Training officer. This was to find out what was being taught to CHWs concerning TTc while caretakers were to discuss what was being taught to them by the CHWs on issues concerning child nutrition and cognitive development.

From the FGDs and IDIs in the intervention site, the study found that majority of caretakers were visited atleast once in a month by the CHWs. The main purpose of their visit was to encourage caretaker and teach them on nutrition of their young children including that of their families. They agreed that the CHWs were not telling them or stressing the importance of cognitive development in the first two years of life even though they usually tell them to continuously stimulate their children through play, frequently smiles and touch. CHWs also tell them good food is good for brain development, but they don't know which foods are key for this. Even though some of the CHWs visited late hours and others stayed for long hours during the visits, the caretakers appreciated their work and what WV was doing for them, not just on nutrition but on other activities like malaria prevention and equipping the hospital for easy access by children and community. The WV officers also alluded that CHWs visit caretakers atleast once in a month and they are trained and given necessary information and resources that needed for every visit.

"...Sometimes the CHWs come every month and they really encourage me to exclusively breastfeed until the child is six months. It is hard because my child is a boy, but I am really trying. The boy is now 4 months and 21 days…."

Respondent 4, mother, Katito ADP, FGD, 01

In the comparative site, some of the caretakers said that they have never seen or heard about the CHWs or World Vision child health programs. Some said that they knew of some ladies who were CHWs and used to visit them long time, but they haven't seen them of late. Even though they were aware about nutrition issues through the health facilities, they did not have any information on nutrition form the CHWs. On cognitive development, they said that they usually just try playing and communicating with the children and giving them foods that are good for general health. The health officers and WV staff said that because they have not rolled out the WV TTc program there, they have not recruited any CHWs and therefore no training is given to the existing ones that are from the Government.

"...Its unfortunate WV did not roll out its child program here like other ADPs. We are only relying on the Government CHWs who are facing a lot of challenges thus disadvantaging our community members in terms of child nutrition…."

Health Facility Manager, Kegonga- Ntimaru, IDI

4.5 Impact of CHWs on Nutritional status and cognitive levels.

This study defined impact as the level of contribution by CHWs on the nutritional outcomes and cognitive development of children aged below two years as CHWs were implementing the TTc through home visits and giving key nutritional messages to caretakers. This was assessed by finding the change in prevalence of nutritional outcomes before and after the intervention in both

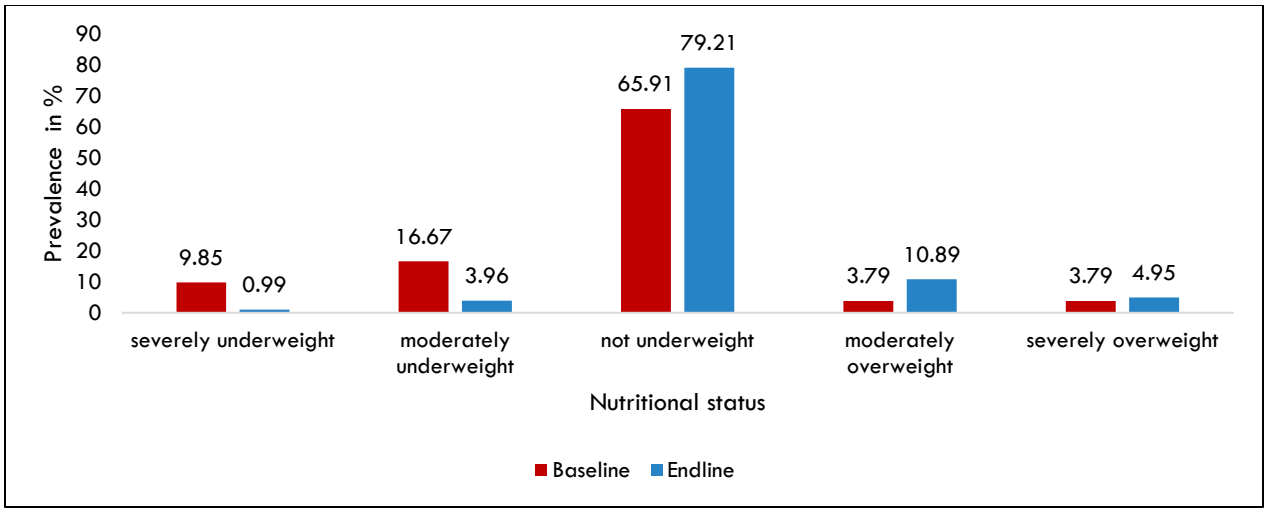
study sites and in comparing the prevalence of nutritional status and cognition levels between the intervention and comparative site at the end of the implementation of the TTc by the CHWs.

4.5.1 Comparing nutritional status at baseline and endline at study sites

This assessed the impact of the CHWs on nutritional status (underweight and overweight, wasting and stunting) among the children. It compared the prevalence of the nutritional indicators in the study sites before TTc intervention (baseline) and after the implementation period (endline) in the two study sites.

4.5.1.1 Impact on underweight and overweight status among children at Katito

Assessing the impact of CHWs on underweight and overweight status by comparing the prevalence of the underweight and overweight at baseline and endline in the intervention site. Figure 20 showed that there was a reduction in the prevalence of severely and moderately underweight from 10% and 17% at baseline to 1% and 4% at endline respectively in the intervention group. It further showed that there was an increase in the prevalence of moderately overweight from 4% at baseline to 11% endline. The p-value was less than the 0.05 significant level ($Chi^2=21.55$, $p<0.001$) thus showing that there was a significant difference in underweight and overweight status in the two study sites before and after the TTc implementation by CHWs.

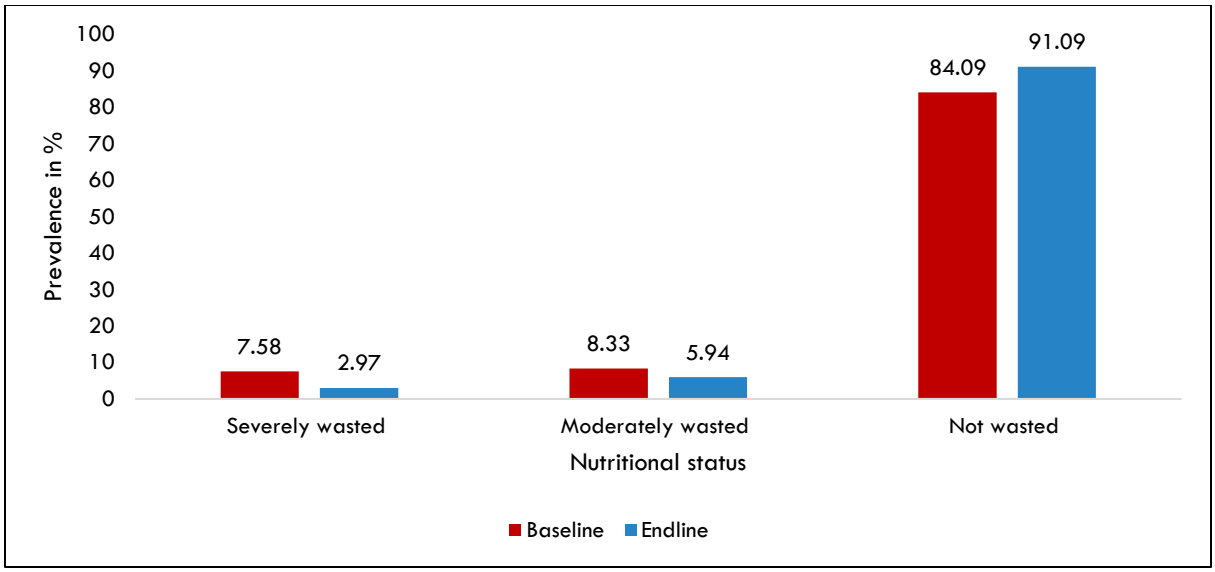


Chi^2= 21.5476, p< 0.001

Figure 20 Levels of underweight and overweight status among children at baseline and endline at Katito

4.5.1.2 Impact on wasting status among children at Katito

Assessing the impact of CHWs on wasting status by comparing the prevalence of wasting at baseline and endline in the intervention site. Figure 21 shows that there was reduction in both severely and moderately wasted from 8% at baseline to 3% endline and from 8% at baseline to 6% at endline respectively among the children in the intervention group before and after the TTc implementation. The probability p-value 0.229 was greater than 0.05 which was significant level. This meant that the study failed to reject the null hypothesis that there was no significant difference in the wasting status of the children before and after the at Katito (Chi^2=2.95, p= 0.229)

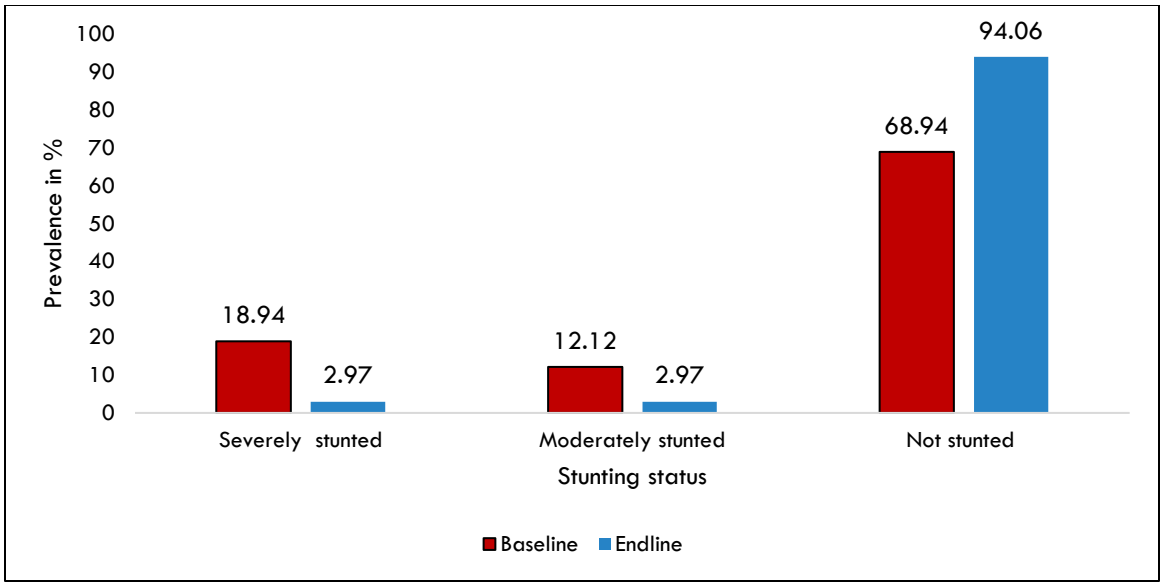


Chi^2=2.9458, p= 0.229

Figure 21 Levels of wasting status among children at baseline and endline at Katito

4.5.1.3 Impact on stunting status among children at Katito

Assessing the impact of CHWs on stunting status among children by comparing the prevalence of stunting indicator at baseline and endline in the intervention site. Figure 22 shows that there was reduction in both severely and moderately stunted from 19% to 3% and from 12% to 3% respectively among the children in the intervention group before and after the CHWs implemented the TTc intervention. The probability p-value < 0.0001 was smaller than 0.05 which was significant level. Therefore, study rejected the null hypothesis and there was a significant difference in stunting status of children and the intervention period (Chi^2=22.54, p< 0.001)

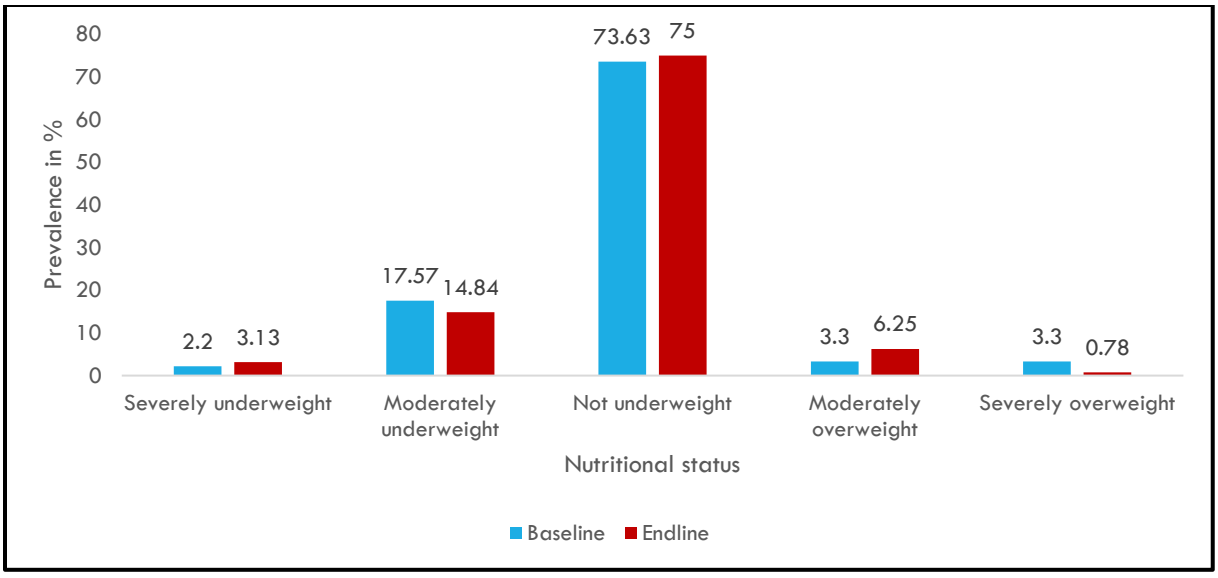


Chi^2=22.5410, p<0.001

Figure 22 Level of stunting status among children at baseline and end-line at Katito

4.5.1.4 Impact on underweight and overweight status among children at Kegonga Ntimaru

Assessing the impact of CHWs on underweight and overweight status among children by comparing the prevalence of underweight and overweight indicator at baseline and endline in the comparative site. Figure 23 shows that even thought there was a reduction in the prevalence moderate underweight from baseline to endline by 2%, it also revealed that there was an increase in the prevalence of both severe underweight from 2% at baseline to 3% at endline and moderate overweight from 3% at baseline to 6% at endline among children at the comparative site. The probability p value<0.0001 was smaller than 0.05 which was significant level. Therefore, there was no relationship between underweight and overweight status before and after the intervention at the comparative site (Chi^2=3.196, p<0.526).

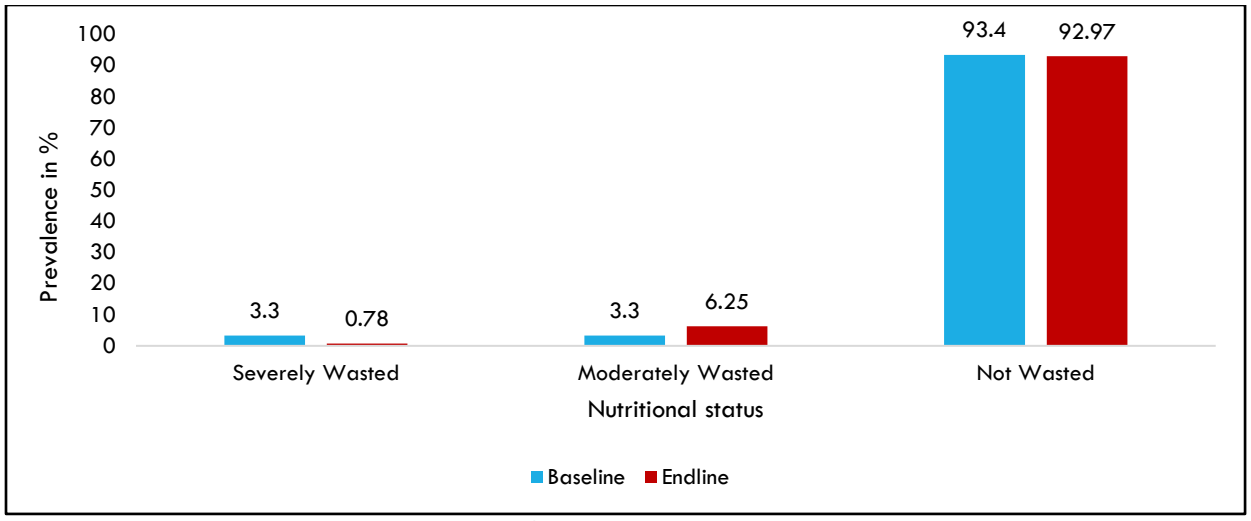


Chi^2=3.196, p<0.526

Figure 23 Level of underweight and overweight at baseline and end-line at Kegonga Ntimaru

4.5.1.5 Impact on Wasting status among children at Kegonga Ntimaru

Assessing the impact of CHWs on wasting status by comparing the prevalence of wasting at baseline and endline in the comparative site. Figure 24 shows that there was reduction in severely wasted children from 3% at baseline to 1% at endline while prevalence of moderate wasting increased from 3% at baseline 6% at endline among the children at the comparative site. The probability p-value 0.252 was greater than 0.05 which was significant level. This meant that there was no relationship between wasting status before and after the intervention period at the comparative site (Chi^2=2.7672, p= 0.252)

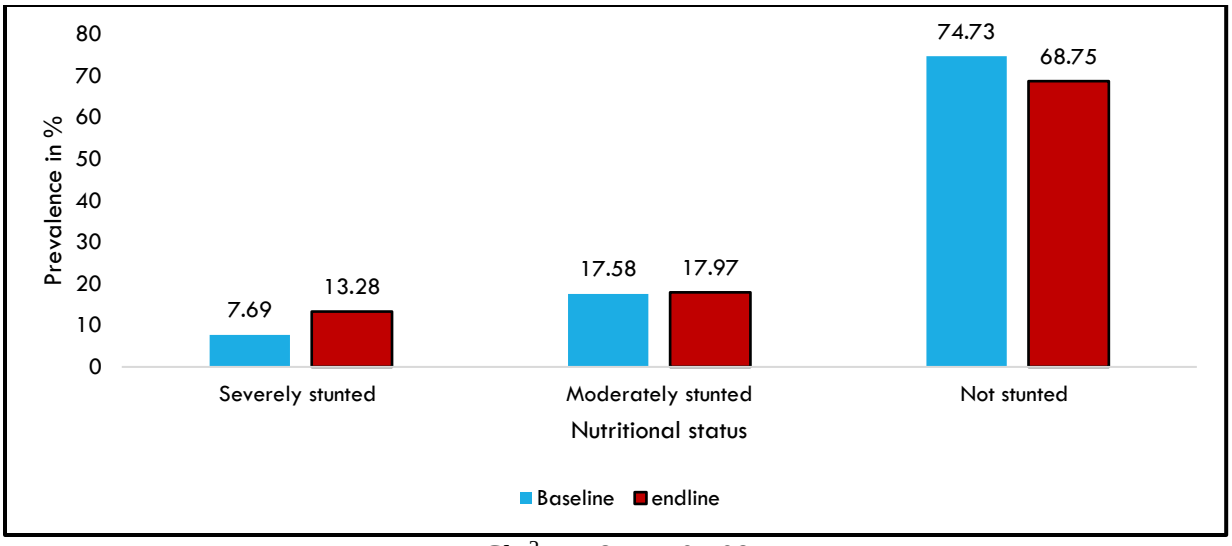


Chi^2=2.7672, p<0.252

Figure 24 Level of wasting status among children at baseline and end-line at Kegonga Ntimaru

4.5.1.6 Impact on stunting status among children at Katito

Assessing the impact of CHWs on stunting status among children by comparing the prevalence of stunting indicator at baseline and endline in the comparative site. Figure 25 shows that there was an increase in severely stunted children from 8% at baseline to 13% at endline at the comparative site. The probability p-value < 0.409 was smaller than 0.05 which was significant level. Therefore, it showed that there was no relationship between stunting status among children before and after the intervention at the comparative site (chi^2=1.787, p< 0.409)



Chi^2=1.787, p<0.409

Figure 25 Level of stunting status among children at baseline and end-line at Kegonga Ntimaru

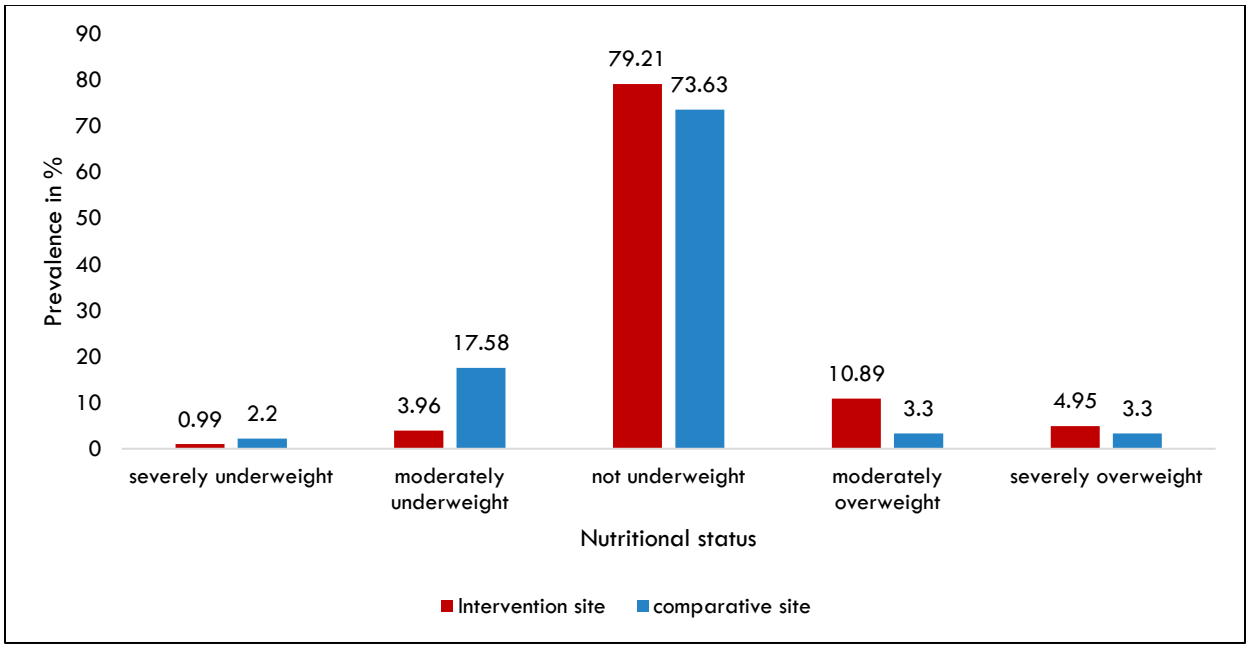
4.5.2 Comparing nutritional status of children at endline at the study sites

To assess the impact of the CHWs by comparing the underweight and overweight, wasting and stunting status among the children at end of the intervention between the study sites.

4.5.2.1 Impact on underweight and overweight status

Assessing the impact of CHWs on underweight and overweight status by comparing the prevalence of the underweight and overweight between the two sites at the end of the TTc intervention. Figure 26 shows that, after the TTc intervention, the prevalence of moderate and severe underweight was at 4% and 1% respectively at the intervention group while at the comparative site, a prevalence of 18% and 2% for moderately and severely underweight respectively was recorded. For overweight status, the group that received TTc key messages recorded a higher prevalence of overweight of 11% and 5% for moderately and severely overweight respectively compared to the comparative group who did not receive any key message from CHWs that recorded a prevalence of 3% for both severely and moderately overweight. This showed that CHWs intervention had a positive impact

on the underweight status since the prevalence was lower in the intervention groups but there was a negative impact on the overweight status since the prevalence was higher in the intervention group compared to the comparative group. The p value obtained showed that there was a significant difference in underweight and overweight status among the children at the end of the intervention in the two study sites (chi^2 =13.27, p= 0.010).



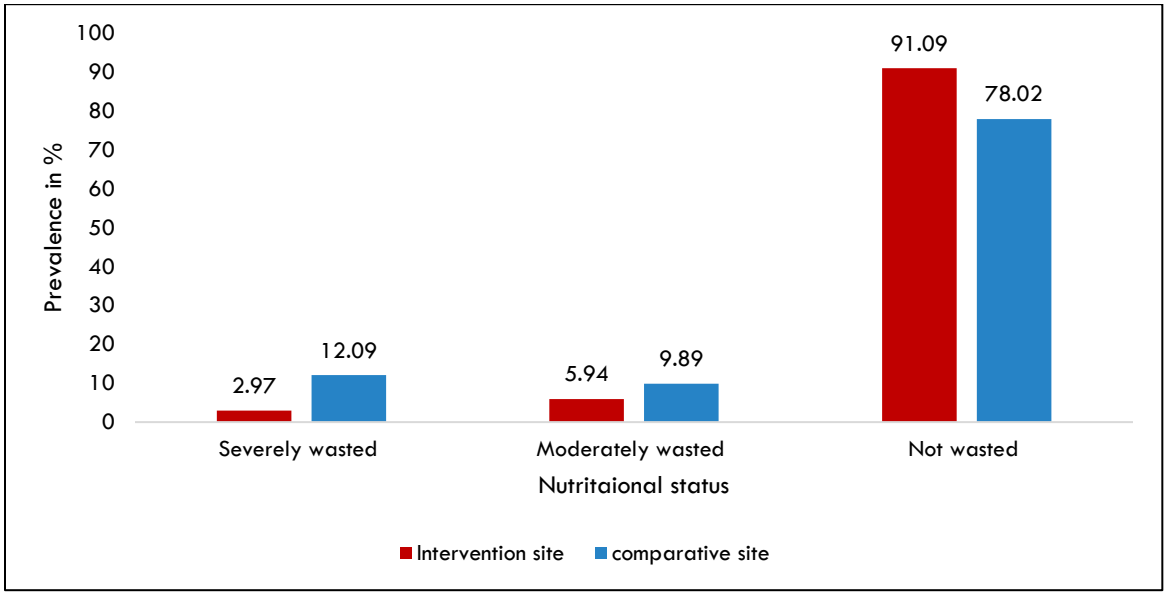
Chi^2 =13.2696, p= 0.010

Figure 26 levels of underweight and overweight among children at endline in the study sites

4.5.2.2 Impact on wasting status

Assessing the impact of CHWs on wasting status by comparing the prevalence of wasting at the end of intervention in the two study sites. Figure 27 shows that the prevalence of severely and moderately wasted children in intervention group were lower at 3% and 6% respectively compared to 12% and 10% respectively from the comparative group at the end of TTc intervention implementation. The p-value obtained was less than the 0.05 significant level (Chi^2=7.3761, p=0.025) thus showing that there was significant difference in the wasting status in the two study

sites at the end of the intervention. The null hypothesis that there was no relationship between wasting status between the study groups was rejected.

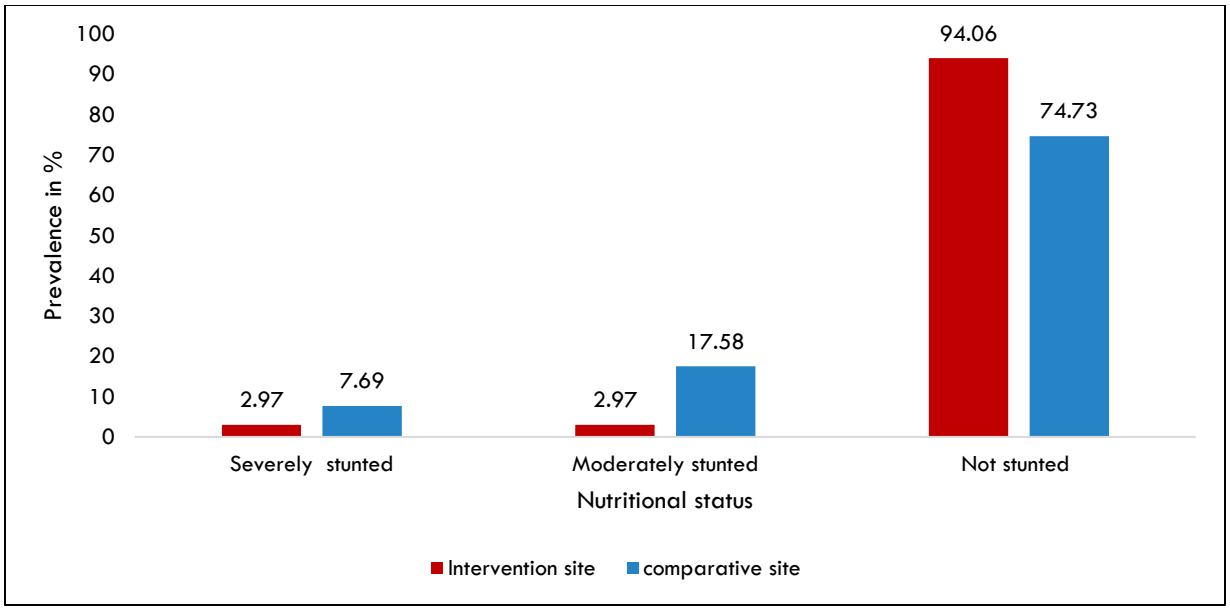


Chi^2=7.3761, p=0.025

Figure 27 Levels of wasting between the study sites after the intervention period

4.5.2.3 Impact on Stunting status

Assessing the impact of CHWs on stunting status by comparing the prevalence of the indice at the end of intervention in the two study sites. Figure 28 shows that the prevalence of severely and moderately stunted in children in intervention group were lower at 3% each respectively compared to 8% and 18% respectively for comparison group at the end of TTc intervention implementation. The p-value obtained was less than the 0.05 significant level (Chi^2=14.49, p<0.001). Thus, the difference in stunting status in the two study sites at the end of the intervention was significant. The null hypothesis that there was no difference in stunting between the study sites after intervention was rejected.

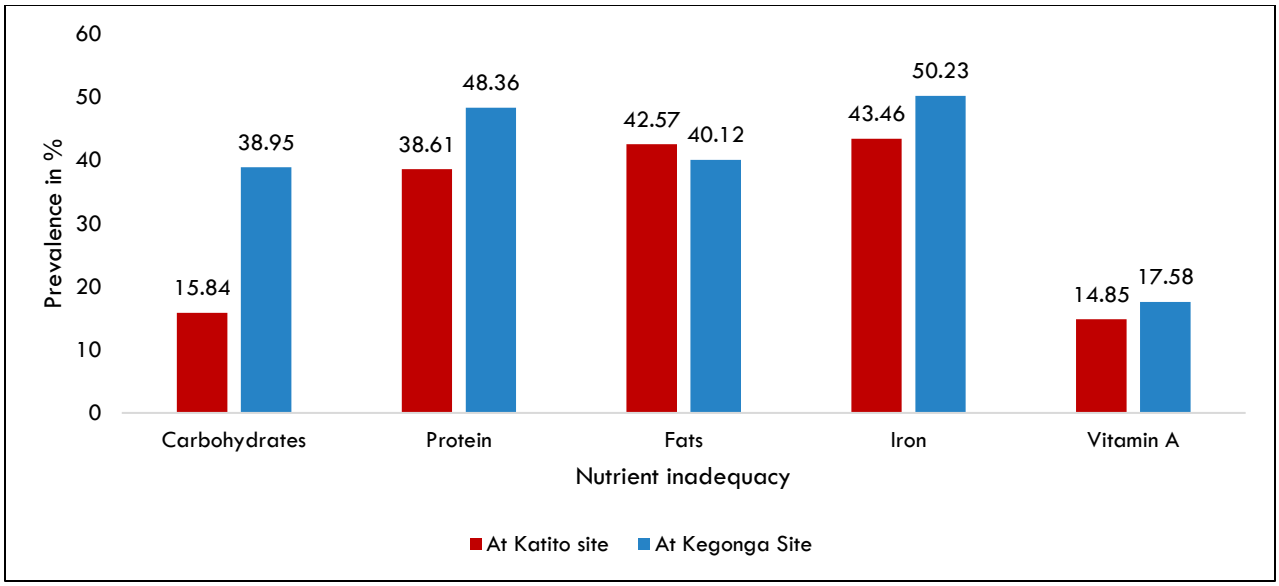


Chi^2=14.4856, p = 0.001

Figure 28 Levels of stunting between the study sites at endline

4.5.3 Impact of CHWs on dietary intake

Assessing the impact of CHWs on dietary intake inadequacy by comparing the prevalence at the end of intervention in the two study sites. Dietary inadequacy refers to when there is poor intake of foods that can lead to nutrient deficiency. Figure 29 shows that 50% of children from comparative group had consumed diets that were inadequate of Iron compared to those from intervention group that had were 43%. Only 16% from intervention group had inadequate calories from their diets compared to 38% of children from comparative group. The probability of p value obtained showed that there was no relationship between dietary intake and the two study sites at the end of the intervention (Chi^2=9.3761, p=0.825)



Chi^2=9.3761, p=0.825

Figure 29 Levels of nutrient inadequacy after the intervention

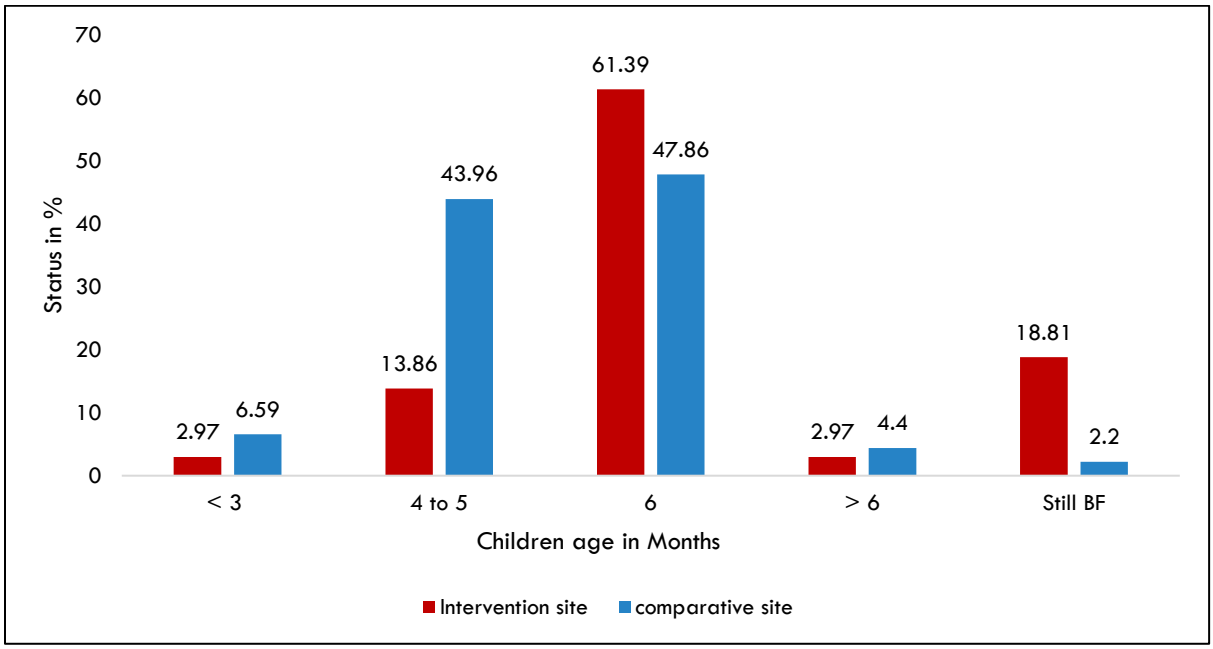
4.5.4 Impact of CHWs on breastfeeding status

To assess the impact of the CHWs services on status of exclusive breastfeeding and duration of breastfeeding among children in intervention and comparative groups at the end of TTc intervention. Secondary data for baseline analysis from WV on exclusive and duration of breastfeeding was not available

4.5.4.1 Comparing status of exclusive breastfeeding at endline in study sites

Assessing the impact of CHWs on status of exclusive breastfeeding by comparing the prevalence of exclusive breastfeeding at the end of intervention between the two study sites. Figure 30 illustrates that of all the children, 61% of them from intervention group and 48% from comparative group were exclusively breastfed in their first six months of life. Only 3% and 7 % from intervention and comparative group respectively were exclusive breastfed for only three months or less. Of those still breastfeeding, 19% were from intervention group while 2% were from the

comparative group. The probability of p value obtained showed that there was a relationship between status exclusive breastfeeding and the two study sites at the end of the intervention (Chi^2=32.2275, p<0.001)

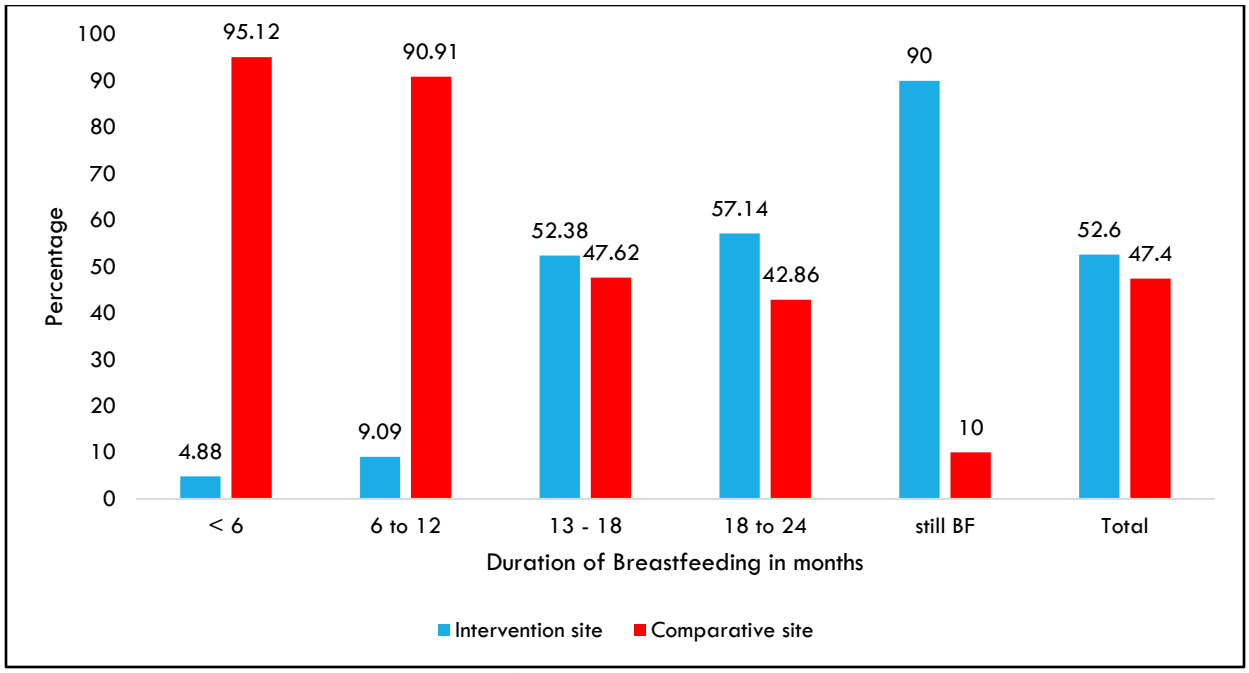


Chi^2=32.2275, p<0.001

Figure 30 Levels of exclusive breastfeeding in the study sites at endline

4.5.4.2 Comparing duration of breastfeeding

Assessing the impact of CHWs on duration of breastfeeding by comparing the prevalence of duration of breastfeeding at the end of intervention between the two study sites. Figure 31 illustrates of the children, 57% and 43% from intervention group and comparative group respective stopped breastfeeding when they were aged between 19 and 24 months while at the time of study 90% of children from intervention group were still breastfeeding. The probability of p value obtained showed that there was a significant difference between duration of breastfeeding among the children and the two study sites at the end of the intervention. (Chi^2=113.0575, p<0.001)

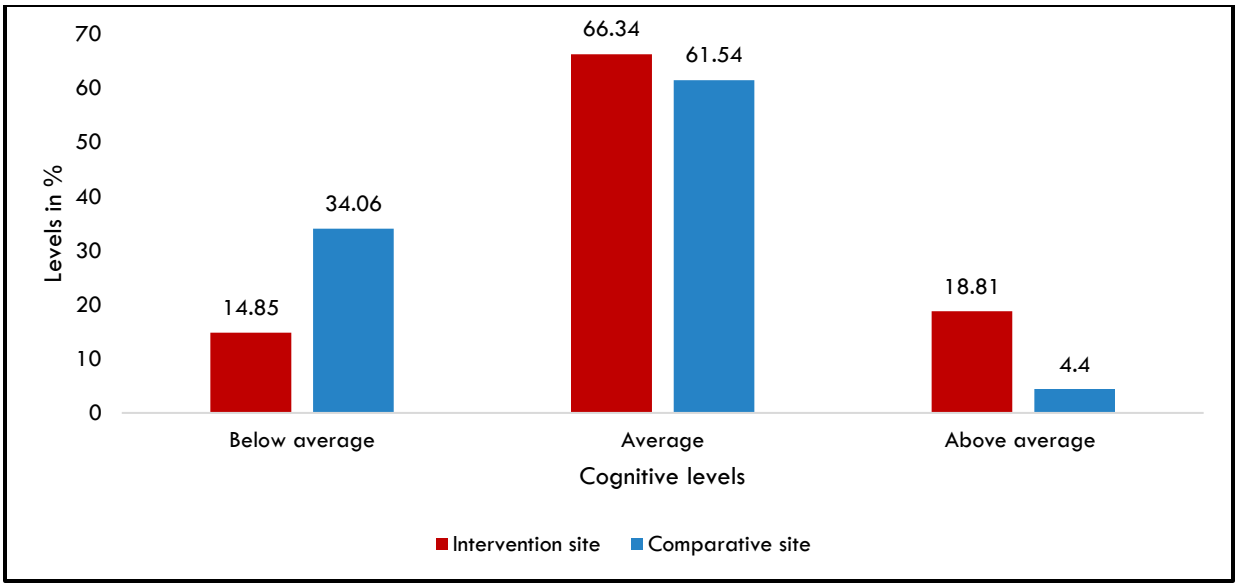


Chi^2=113.0575, p<0.001

Figure 31 Comparing levels of duration of breastfeeding in the study sites after intervention

4.6 Impact of CHWS on cognitive development

Assessing the impact of CHWs on cognitive development among children by comparing the cognitive scores in the study sites after the nutrition intervention. Figure 32 shows that children who were categorized as above average were more at 18.81% in the intervention site compared to 4.4% at the comparative site while those below average were lower at the intervention site at 14.85% compared to 34.06% at the comparative. The probability of p-value 0.001 obtained was less than the 0.05 significant level showing that there was a relationship between cognitive levels and the study sites at the end of the intervention thus rejecting the null hypothesis.



Chi^2=15.8537, p<0.001

Figure 32 Levels of cognitive scores at the study sites after the intervention

4.7 Determinants of nutritional status and cognitive development among children

The bivariate analysis was used to determine the relationship between the dependent and independent variables in the intervention and comparative sites. The dependent variables included the nutritional status and cognitive scores of the children while independent variables included the socio-economic characteristics of the children in the study.

4.7.1 Association between the nutritional status and the variables

This analyzed the relation between nutritional status of children with independent variables and the other dependent variables at the study sites

4.7.1.1 Underweight and overweight; with independent and dependent variables at Katito

This analyzed the relationship between weight for age indice with independent and dependent variables. The independent variables included; child's sex and age, duration of exclusive

breastfeeding and when child stopped breastfeeding, caretaker' and father's level of income and highest education level; and type of housing child lives if house owned by family or paying for house rent while dependent variables included; cognitive scores and dietary intake

From table 13, the p-values obtained for child's sex were (p=0.830), age group (months) (p=0.282); when child stopped breastfeeding (p=0.265), caretaker's marital status (p=0.465), caretaker's education (p=0.580), caretaker's income level (p=0.145), father's income level (p=0.754), house type (p=0.928), rent amount (p=0.341) and caretaker own phone (0.832) were all greater than 0.05 which was the significant level. Therefore, the null hypothesis was not rejected, and it was drawn that there was no relationship between weight on age and the variables of interest. This meant that each variable and weight for age indice in the intervention site were independent of each other. More information is in Appendix I. However, the result obtained from duration of exclusive breastfeeding variable showed that the p-value of 0.040 was less than the 0.05 significant level. Therefore, rejecting the null hypothesis thus indicating that there was a relationship between the weight for age and exclusive breastfeeding.

For dependent variables, p-values obtained for the cognitive scores (p=0.156), energy intake (p=0.14), protein intake (p=0.213), fat intake (p=0.416), iron intake (p=0.053) and vitamin A intake (p=0.190) were all greater than 0.05 which was the significant level. Therefore, the null hypothesis was not rejected and that there was no relationship between weight for age and these dependent variables. This meant that each of variables and weight for age indice in the intervention site were independent of each other. More data are in Appendix J

Table 13 Relationship between weight for age and independent and dependent variables at Katito

Variable	Nutritional status at Intervention site (n=101)					Statistics	
	Severely Underweight	Moderately Underweight	Not underweight	Moderately Overweight	Severely Overweight	chi^2	P-value
Sex							
Female	0.00	3.92	82.35	9.80	3.92	1.4812	0.83
male	2.00	4.00	76.00	12.00	6.00		
Total	0.99	3.96	79.21	10.89	4.95		
Exclusive breastfeeding (Months)							
< 3	0.00	0.00	100.00	0.00	0.00	27.1309	0.04
4-5	4.55	4.55	63.64	22.73	4.55		
6	0.00	6.25	81.25	6.25	6.25		
> 6	0.00	0.00	33.33	50.00	16.67		
Still BF	0.00	0.00	100.00	0.00	0.00		
Total	0.99	3.96	9.21	10.89	4.95		
Caretaker's marital status							
Single	0.00	0.00	86.36	4.55	9.09	3.5881	0.465
Married	1.27	5.06	77.22	12.66	3.80		
Total	0.99	3.96	79.21	10.89	4.95		
Caretaker's education							
≤ Primary	1.82	3.64	78.18	10.91	5.45	6.5998	0.58
Secondary	0.00	0.00	83.87	9.68	6.45		
Tertiary	0.00	13.33	73.33	3.33	0.00		
Total	0.99	3.96	79.21	10.89	4.95		
Caretaker's Income level (Ksh)							
<3000	0.00	2.50	80.00	12.50	5.00	6.8284	0.145
>3001	4.76	9.52	76.19	4.76	4.76		
Total	0.99	3.96	79.21	10.89	4.95		
Father's Income level							
<3000	1.54	3.08	76.92	12.31	6.15	1.9029	0.754
>3001	0.00	5.56	83.33	8.33	2.78		
Total	0.99	3.96	79.21	10.89	4.95		
Caretaker Own phone							
Yes	1.08	4.30	79.57	10.75	4.30	1.4704	0.832
No	0.00	0.00	75.00	12.50	12.5		
Total	0.99	3.96	79.21	10.89	4.95		
Cognitive scores							
Below average	5.88	11.76	82.35	0.00	0.00	11.8875	0.156
Average	0.00	3.08	78.46	12.31	6.15		
Above average	0.00	0.00	78.95	15.79	5.26		
Total	0.99	3.96	79.21	10.89	4.95		

Protein intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	10.8039	0.213
Adequate	0.00	9.09	11.36	11.36	4.55		
Inadequate	2.38	0.00	76.19	14.29	7.14		
Total	0.99	3.96	79.21	10.89	4.95		
Fat intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	8.1836	0.416
Adequate	0.00	6.98	76.74	9.30	6.98		
Inadequate	2.33	2.33	74.42	16.28	4.65		
Total	0.99	3.96	79.21	10.89	4.95		

4.7.1.2 Underweight and overweight; and independent and dependent variables at Kegonga Ntimaru

This analyzed the relationship between weight for age indice with dependent and independent variables. From table 14, the study showed that that the p-values for the independent variables in the comparative site were all greater than the 0.05 significant level. This meant that the null hypotheses were rejected and that there were no relationships between the weight for age indice with the independent variables. More information in Appendix K

The table also showed that that the p-values for the dependent variables in the comparative site were all greater than the 0.05 significant level. This meant that the null hypotheses were not rejected and that there was no relationship between the weight for age and the dependent variables listed on the table. More information on Appendix L

Table 14 Relationship between weight for age indice with independent and dependent variables at Kegonga Ntimaru

Variable	Nutritional status at Comparative site (n=91)					Statistics	
	Severely Underweight	Moderately Underweight	Not underweight	Overweight	Severely Overweight	chi^2	P-value
Sex							
Female	0.00	17.39	71.74	6.52	4.35	5.3379	0.254
Male	4.44	17.78	75.56	0.00	2.22		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Single	0.00	10.26	87.18	0.00	2.56	7.6472	0.105
Married	3.85	23.08	63.46	5.77	3.85		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Caretaker's education							
≤ Primary	0.00	21.43	78.57	0.00	0.00	10.386	0.239
Secondary	4.44	22.22	68.89	0.00	4.44		
Tertiary	0.00	9.38	78.13	9.38	3.13		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Caretaker's Income level (Ksh)							
<3000	3.85	7.69	84.62	0.00	3.85	4.3053	0.366
>3001	1.54	21.54	69.23	4.62	3.08		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Father's Income level							
<3000	3.70	2.96	79.63	0.00	3.70	8.0775	0.089
>3001	0.00	24.32	64.86	8.11	2.70		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Cognitive scores							
Below average	0.00	32.26	61.29	0.00	6.45	11.78	0.161
Average	3.57	10.71	78.57	5.36	1.79		
Above average	0.00	0.00	100.00	0.00	0.00		
Total	2.22	17.58	73.63	3.33	3.33		
Fat Intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	6.1040	0.636
Adequate	2.35	18.82	72.94	3.53	2.35		
Inadequate	0.00	0.00	80.00	0.00	20.00		
Total	2.22	17.58	73.63	3.33	3.33		
Iron intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	0.7325	0.999
Adequate	0.00	0.00	100.00	0.00	0.00		
Inadequate	2.25	17.98	73.03	3.37	3.37		
Total	2.22	17.58	73.63	3.33	3.33		

Vitamin A intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	3.2722	0.916
Adequate	1.35	18.92	72.97	2.70	4.05		
Inadequate	6.25	2.50	75.00	6.25	0.00		
Total	2.22	17.58	73.63	3.33	3.33		

4.7.1.3 Stunting with independent and dependent variables in the study sites

This analyzed the relationship between stunting with dependent variables. Table 15 and Appendix M summarized the bivariate analysis between stunting and independent variables from both study sites. From the intervention site the study noted that the p-values child's age group (p=0.421), duration of exclusive breastfeeding (p=0.528), caretaker's marital status (p=0.779), caretaker's education (p=0.888), caretaker's income level (p=0.583), father's income level (0.998), type of housing (p=0.368), rent pay (p=0.590), caretaker own phone (p=0.228) were all greater than the 0.05 significant level. None of the variable in the comparative site was also found to be less than 0.05 significant level. Therefore, the study did not reject the null hypothesis that there was no relationship between the variables listed above with stunting. This meant that the variables were independent of each other.

However, from the intervention group, duration of Breastfeeding obtained a p-value of 0.033 which was less than the 0.05 significant level. Therefore, the study rejected the null hypothesis that there was no relationship between the breastfeeding duration and stunting. Therefore, there was a relationship between the two variables and that they are dependent on each other.

This analyzed the relationship between stunting with dependent variables. From the intervention site the study noted that the p-values for the cognitive scores (p=0.17), sex (p=0.189), age group (p=0.421), energy intake (p=0.519), protein intake (p=0.291), fat intake (p=0.086), iron intake

(p=0.227), vitamin A intake (p=0.610), exclusive breastfeeding (p=0.528), caretaker's marital status (p=0.779), caretaker's education (p=0.888), caretaker's income level (p=0.583), father's income level (0.998), type of housing (p=0.368), rent pay (p=0.590), caretaker own phone (p=0.228) had all p values that were greater than the 0.05 significant level. Therefore, the study did not reject the null hypothesis that there was no relationship between the variables listed above from the comparative site and the length for age variable. This meant that the variables were independent of each other.

However, for duration of Breastfeeding duration, p-value obtained was 0.033 which was less than the 0.05 significant level. Therefore, the study rejected the null hypothesis that there was no relationship between the breastfeeding duration and the length for age variable and thus indicating that there was relationship between the two variables and that the variables were dependent on each other.

From the comparative site, the study also noted that the p-values obtained from all the listed variables were greater than the 0.05 significant level. This meant that the null hypothesis was rejected that there was no relationship between the individual variables mentioned on the table above and the length for age variable was not rejected. Therefore, there was no relationships and the variables were independent of each other. More information on Appendix N

Table 15 Relationship between stunting with independent and dependent variables in study sites

Nutritional status at Intervention site (n=101)				Nutritional status at Comparative site (n=91)		
Variable	**Severely Stunted**	**Moderately stunted**	**Not stunted**	**Severely Stunted**	**Moderately stunted**	**Not stunted**
Exclusive breastfeeding						
< 3 months	0.00	0.00	100.00	16.67	16.67	66.67
4-5 months	4.55	4.55	90.91)	7.50	15.00	77.5
6 months	4.17	0.00	95.83	6.98	20.93	72.09
> 6 months	0.00	0.00	100.00	0.00	0.00	0.00
Still BF	0.00	10.53	89.47	0.00	0.00	100.00
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics		Chi^2=7.0807, p= 0.528			Chi^2=1.8971, p= 0.929	
Breastfeeding duration						
< 6 months	0.00	50.00	50.00	2.56	20.51	76.92
6-12months	0.00	0.00	100.00	10.00	13.33	76.67
13-18months	0.00	0.00	100.00	10.00	30.00	60.00
18-24 months	0.00	0.00	100.00)	0.00	33.33	66.67
Still BF	3.70	2.47	93.83	22.22	0.00	77.78
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics		Chi^2=16.7174, p=0.033			$Chi^{2=}$8.0602, p = 0.428	
Rent pay (Ksh)						
None	4.55	0.00	95.45	4(9.76)	5(12.2)	78.05
<3000	3.28	4.92	91.80	2(7.69)	7(26.92)	65.38
>3001	0.00	0.00	100.00	1(4.17)	4(16.67)	79.17
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics		Chi^2=2.8103, p=0.590			Chi^2=3.0208, p=0.554	
Cognitive scores						
Below average	11.76	0.00	88.24	9.68	2.90	77.42
Average	1.54	3.08	95.38	7.14	21.43	71.43
Above average	0.00	5.26	94.74	0.00	0.00	100.00
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics		Chi^2=6.3576, p = 0.17			Chi^2=2.5025, P= 0.644	
Protein intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	6.82	2.27	90.91	50.00	0.00	50.00
Inadequate	0.00	4.76	95.24	6.82	18.18	75.00
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics		Chi^2= 4.9668, p= 0.291			Chi^2= 5.6136, p= 0.230	
Fat intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00

Adequate	0.00	6.98	93.02	8.24	18.82	72.94
Inadequate	6.98	0.00	93.02	0.00	0.00	100.00
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics	Chi^2= 8.1591, p= 0.086			Chi^2= 2.1727, p= 0.704		
Iron intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	7.69	2.56	89.74	0.00	0.00	100.00
Inadequate	0.00	4.26	95.74	7.87	17.98	74.16
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics	Chi^2= 5.6454, p= 0.227			Chi^2= 0.6917, p= 0.952		
Vitamin A intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	4.23	4.23	91.65	5.41	18.92	75.68
Inadequate	0.00	0.00	100.00	18.75	12.50	68.75
Total	2.97	2.97	94.06	7.69	17.58	74.73
Statistics	Chi^2= 2.6953, p= 0.610			Chi^2= 3.7803, p= 0.437		

4.7.1.4 Wasting with independent and dependent variables in the study sites

This shows the results obtained from the bivariate analysis between wasting; and independent and dependent variables in the study sites. From the intervention site the study observed a p value that was less than 0.05 significant level from child's age (p=0.007), father's level of income (p=0.041) and there was none from the comparative group. The study therefore rejected the null hypothesis that there was no relationship between these two variables in the intervention site with wasting variable, thus indicating that the variables were dependent of each. This is further explained in Appendix P.

From the intervention group the study observed a p-value that was less than 0.05 significant level from the following variables; cognitive scores (p=0.012), energy intake (p=0.009), protein intake(p=0.007), fat intake(p= 0.007), iron intake (p=0.007) and Vitamin A intake (p=0.008) while in cognitive scores (p=0.014) was observed in the comparative group. The study therefore rejected the null hypothesis that there was no relationship between these dependent variables in the study

sites with wasting, thus indicating that the variables were dependent of each. This is further explained on table 16 with more information on Appendix Q.

Table 16 Relationship between wasting with independent and dependent variables in the study sites

	Nutritional status at study sites					
	Intervention site (n=101)			Comparative site (n=91)		
Variable	**Severely wasted**	**Moderately wasted**	**Not wasted**	**Severely wasted**	**Moderately wasted**	**Not wasted**
Child's Age group						
< 6 months	15.00	15.00	70.00	5.26	15.79	78.95
6-12 months	0.00	6.67	93.33	11.11	7.41	81.48
13-18 months	0.00	0.00	0.00	15.00	70.00	73.08
19-24 months	15.00	15.00	70.00	5.26	15.79	78.95
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=17.7899, p=0.007			Chi^2=2.6492, p=0.851		
Caretaker's education						
≤ Primary	3.64	7.27	89.09	1.14	14.29	78.57
Secondary	3.23	3.23	93.55	17.78	8.89	73.33
Tertiary	0.00	6.67	93.33	6.25	9.38	84.38
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=1.1497, p=.886			Chi^2=3.0112, p=0.556		
Type of Housing						
Semi-permanent	7.69	5.13	87.18	10.61	10.61	78.79
Permanent	0.00	6.45	93.55	16.00	8.00	76.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=4.9464, p=0.084			Chi^2=0.5790, p= 0.749		
Cognitive scores						
Below average	5.88	23.53	70.59	19.35	22.58	58.06
Average	3.08	3.08	93.85	8.93	3.57	87.50
Above average	0.00	0.00	100.00	0.00	0.00	100.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=12.9355, p= 0.012			Chi^2=12.4795, p=0.014		
Energy intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	0.00
Adequate	1.49	2.99	95.52	12.22	10.00	77.78

Inadequate	0.00	5.26	94.74	0.00	0.00	0.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics		Chi^2= 13.6257, p= 0.009			Chi^2=2.6492, p=0.851	
Protein intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	2.27	4.55	95.35	0.00	50.00	50.00
Inadequate	0.00	2.38	95.35	12.50	9.09	78.41
Total	2.97	5.94	91.09	2.09	9.89	78.02
Statistics		Chi^2= 13.9740, p= 0.007			Chi^2=4.0490, p=0.399	
Iron intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	2.56	5.13	92.31	0.00	0.00	100.00
Inadequate	0.00	2.13	97.87	12.36	10.11	77.53
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics		Chi^2= 14.2517, p= 0.007			Chi^2= 0.5760, p= 0.966	
Vitamin A intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	1.41	2.82	95.77	13.51	10.81	75.68
Inadequate	0.00	6.67	93.33	6.25	6.25	87.50
Total	2.97	5.94	91.09	2.09	9.89	78.02
Statistics		Chi^2= 13.7842, p= 0.008			Chi^2=1.3713, p=0.849	

4.7.1.5 Relationship between cognitive scores with dependent and independent variables

This analysis was used to find the relationship between the cognitive development scores and both the independent and dependent variables in the study sites after the TTc nutrition intervention that was being implemented by the CHWs.

4.7.1.6 Relationship between cognitive scores with independent and independent variables in study sites

These were results obtained from the bivariate analysis that were analyzed between the cognitive levels and independent and dependent variables in the study sites. The table 17 indicated that from intervention group, p-values obtained for child's age group (p=0.033) and father's income level

(p=0.036) were less than 0.05 significant level. The study therefore, rejected the null hypothesis that there was no relationship between the cognitive levels and these variables. This meant that cognitive level and each of these two variables were dependent on each other. From the comparative group, none of the independent variables were found to have a relationship with cognitive levels thus were independent of each other. More information on Appendix R

These were results obtained from the bivariate analysis that were analyzed between the cognitive levels and the dependent variables. It showed that wasting status among children at intervention (p=0.012) and comparative group (p=0.014) had p values less than 0.05 and that the null hypothesis was rejected thus indicating that wasting status in both sites had a relationship with cognitive levels thus were dependent on each other. More information on Appendix S

Table 17 Relationship between cognitive scores with independent and dependent variables in study sites

	Cognitive scores in study sites					
	Intervention site (n=101)			Comparative site (n=91)		
Variable	**Below average**	**Average**	**Above average**	**Below average**	**Average**	**Above average**
Child's Sex						
Female	13.73	66.67	19.61	34.78	60.87	4.35
Male	20.00	62.00	18.00	33.33	62.22	4.44
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi^2=0.7107, p=0.701			Chi^2=0.0213, p=0.989		
Breastfeeding duration						
< 6 months	0.00	100.00	0.00	33.33	64.1	2.56
6-12months	0.00	100.00	0.00	36.67	56.67	6.67
13-18months	0.00	54.55	45.45	50.00	50.00	0.00
18-24 months	0.00	75.00	25.00	0.00	66.67	33.33
Still BF	20.99	62.96	16.05	22.22	77.78	0.00
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi^2=10.9452, p=0.205			Chi^2=10.1758, p=0.253		
Mother's marital status						
Single	22.73	54.55	22.73	35.9	61.54	2.56
Married	15.19	67.09	17.72	32.69	61.54	5.77
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi^2=1.2307, p=0.540			Chi^2=0.5880, p=0.745		
Father's Income level (Ksh)						
<3000	20.00	55.38	24.62	33.33	62.96	3.70
>3001	11.11	80.56	8.33	35.14	59.46	5.41
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi^2=6.6334, p=0.036			Chi^2=0.2094, p=0.901		
Type of Housing						
Semi-permanent	17.95	61.54	20.51	34.85	62.12	3.03
Permanent	16.13	66.13	17.74	32.00	60.00	8.00
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi^2=0.2232, p=0.894			Chi^2=1.0752, p=0.584		
Wasting						
Severely wasted	33.33	66.67	0.00	54.55	45.45	0.00
Moderately stunted	66.67	33.33	0.00	77.78	22.22	0.00
Not stunted	13.04	66.30	20.65	25.35	68.01	5.63
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi2=12.9355, p=0.012			Chi2=12.479, p=0.014		
Energy intake						

Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	11.43	67.14	21.43	34.48	60.92	4.60
Inadequate	25.00	56.25	18.75	33.33	66.67	0.00
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi2=5.9981, p=0.199			Chi2=0.7881, p=0.940		
Fat intake						
Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	6.98	72.09	20.93	34.12	61.18	4.71
Inadequate	20.83	58.14	20.33	40.00	60.00	0.00
Total	16.83	64.36	18.81	34.07	61.54	4.40
Statistics	Chi2=7.4207, p=0.115			Chi2=0.9189, p=0.922		

4.7.2 Relationship between variables -Multinomial Regression Analysis

These analyzed the relationship between all the variables in intervention site after the TTc nutrition intervention. Multinomial logistics regression was used because the dependent variables had more than two distinct outcomes. The multinomial logistic regressions results were expressed in form of Relative Risk Ratio (RRR).

4.7.2.1 Underweight and Overweight

This analyzed the relationship between weight for Age indice (underweight and overweight) with all the variables in the study sites after the implementation of the TTc by the CHWs. Table 18 indicated the children who were found to be of average cognitive scores had 8 times less Relative Risk of being underweight compared to those whose cognitive scores were found to below average [RRR: 0.194: 95% CI: 0.06-0.624; p=0.0006]. It also found that those whose caretakers were earning more than Ksh 3,000 on monthly basis had 7 times more risks of being underweight compared to those earning less than Ksh 3,000 Ksh [RRR: 7.365: 95% CI: 1.676-32.355; p=0.008]. More information on Appendix T

Table 18 Multinomial Regression Analysis for underweight and overweight

Weight-for-Age Z scores	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
UNDERWEIGHT						
Cognitive scores						
Below average	1 (base)					
Average	0.194	0.115	-2.75	0.006	0.06	0.624
Above average	8.03	0.000	-0.01	0.992	0	.
Mother's level of income (Ksh)						
<3000	1 (base)					
>3001	7.3650	5.562	2.64	0.008	1.676	32.355
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.5513	0.938	0.73	0.468	0.474	5.073
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.9059	0.654	-0.14	0.891	0.22	3.732
Site						
Intervention	1 (base)					
Comparative	1.1449	1.296	0.12	0.905	0.125	10.521
Constant	0.0487	0.088	-1.67	0.096	0.001	1.705
Not underweight	**(BASE OUTCOME)**					
OVERWEIGHT						
Cognitive scores						
Below average	1 (base)					
Average	3.0343	2.549	1.32	0.186	0.585	15.742
Above average	2.7630	2.955	0.95	0.342	0.34	22.479
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.1235	0.653	0.2	0.841	0.36	3.509
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.7471	0.487	-0.45	0.655	0.208	2.683
Site						
Intervention	1 (base)					
Comparative	0.4608	0.521	-0.69	0.493	0.05	4.221
_Constant	**0.0000**	**0.000**	**-0.01**	**0.993**	**0**	**.**

4.7.2.2 Stunting

This analyzed the relationship between Length for Age indice (stunting) with all the variables in the study sites after the implementation of the TTc by the CHWs. Table 19 indicated the children whose parents were paying less than ksh 3,000.00 for house rent per month had 9 times more Relative Risk of being stunted compared to those whose parents were owning there owned their houses and were not paying any rent. [RRR: 9.205: 95% CI: 1.448-58.506; p=0.019]. More information on Appendix U

Table 19 Multinomial Regression Analysis for stunting

Length-for-Age Z	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
SEVERELY STUNTED						
Mother's Highest education						
≤ Primary	1 (base)					
Secondary	0.324	0.327	-1.12	0.264	0.045	2.345
Tertiary	0.074	0.112	-1.72	0.086	0.004	1.445
Type of housing						
Semi-permanent	1 (base)					
Permanent	2.335	2.558	0.77	0.439	0.273	19.989
_Constant	0.208	0.453	-0.72	0.471	0.003	14.793
MODERATELY STUNTED						
Mother's Highest education						
≤ Primary	1 (base)					
Secondary	1.459	1.275	0.43	0.665	0.263	8.091
Tertiary	1.014	1.041	0.01	0.989	0.136	7.581
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.570	1.160	0.61	0.542	0.369	6.685
Type of housing						
Semi-permanent	1 (base)					
Permanent	2.624	2.125	1.19	0.234	0.537	12.831
Site						
Intervention	1 (base)					
Comparative	0.159	0.196	-1.49	0.136	0.014	1.787
_cons	0.023	0.047	-1.82	0.069	0.000	1.347
Not stunted			**(BASE OUTCOME)**			

4.7.2.3 Wasting

This analyzed the relationship between Weight for Length indice (wasting) with all the variables in the study sites after the implementation of the TTc by the CHWs. Table 20 indicated the children who were found to be of average cognitive scores had 8 times less Relative Risk of being severely wasted compared to those whose cognitive scores were found to be below average [RRR: 0.192: 95% CI: 0.04-1.01; p=0.05]. It also found that those who breastfed six months had 0.02 times more Relative Risk of being severely wasted compared to those who breastfed for 3 months [RRR: 0.028: 95% CI: 0.05-2.64; p=0.03], Those whose caretakers were earning more than Ksh. 3000 per month had 7 times more relative risk of being severely wasted compared to those whose caretakers were earning less than Ksh 3000 per month [RRR: 7.515: 95% CI: 1.08-52.18; p=0.04]. those whose fathers were earning less than ksh 3000 had 8 times more Relative Risk of being severely wasted compared to those whose fathers were earning more than ksh 3000 per months [RRR: 8.135: 95% CI: 1.25-53.04; p=0.35]. Children who lived in permanent houses had 9 times less relative Risks of being severely wasted compared to those living in permanent house [RRR: 0.103: 95% CI: 0.01-0.91; p=0.04].

Also, those whose caretakers were earning more than Ksh. 3000 per month had 5 times less Relative Risk of being moderately wasted compared to those for whose caretakers were earning less than Ksh 3000 per month [RRR: 0.552: 95% CI: 2.46-52.13.318; p=0.01]. Also, those whose fathers were earning more than Ksh. 3000 per month had 0.092 times Relative Risk of being moderately wasted compared to those for whose fathers were earning less than Ksh 3000 per month [RRR: 0.092: 95% CI: 0.01-0.93; p=0.04]. More information on Appendix V

Table 20 Multinomial Regression Analysis for wasting

Weight -for-Age Z scores	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
SEVERELY WASTED						
Mother's level of income (Ksh)						
<3000	1 (base)					
>3001	7.515	7.430	2.04	0.04	1.08	52.18
Mother's Highest education						
≤ Primary	1 (base)					
Secondary	3.314	3.784	1.05	0.29	0.35	31.06
Tertiary	0.146	0.229	-1.23	0.22	0.01	3.17
Father's level of income (Ksh)						
>3001	1 (base)					
<3000	8.135	7.782	2.19	0.03	1.25	53.04
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.103	0.114	-2.05	0.04	0.01	0.91
Site						
Intervention	1 (base)					
Comparative	0.648	0.976	-0.29	0.77	0.03	12.4
_Constant	1.207	2.703	0.08	0.93	0.01	97.2
MODERATELY WASTED						
Mother’s level of income (Ksh)						
<3000	1 (base)					
>3001	0.552	92.195	2.52	0.01	2.46	13.318
mother's Highest education						
≤ Primary	1 (base)					
Secondary	2.336	2.456	0.81	0.42	0.3	18.34
Tertiary	2.930	3.766	0.84	0.4	0.24	36.39
Father's Level of Income						
<3000	1 (base)					
>3001	0.092	0.108	-2.03	0.04	0.01	0.93
Site						
Intervention	1 (base)					
Comparative	1.127	2.693	0.05	0.96	0.01	121.73
_Constant	0.000	0.000	-0.01	0.99	0	.
NOT WASTED	**(base outcome**					

4.7.2.4 Cognitive development level

This analyzed the relationship between cognitive level with all the variables in the study sites after the implementation of the TTc by the CHWs. Table 21 indicated the children whose parents were paying house rent amounting to more than Ksh 3,000 per month had 3 times higher Relative Risk of having cognitive scores that are below average compared to those who were living in their own houses and not pay any rent [RRR: 3.367: 95% CI: 1.055-10.753; p=0.04]. Also, children whose fathers were earning less than Ksh 3,000 per month had 8 times less relative risks of having cognitive scores above average compared to those earning more than Ksh 3000 per months that were less [RRR: 0.253: 95% CI: 0.067-0.955; p=0.043]. More information on Appendix W

Table 21 Multinomial Regression Analysis for cognitive development

Cognitive level	RRR	Std. Err.	Z	p-value	[95% Conf. Interval]	
BELOW AVERAGE						
Underweight and Overweight						
Severely underweight	1 (base)					
Moderately underweight	2.639	4.117	0.62	0.534	0.124	56.151
Not underweight	1.763	2.754	0.36	0.717	0.082	37.677
Moderately overweight	0.000	0.000	-0.01	0.996	0	.
Severely overweight	4.124	7.530	0.78	0.438	0.115	147.758
Wasting						
Severely wasted	1 (base)					
Moderately wasted	3.201	3.057	1.22	0.223	0.493	20.804
Not wasted	0.318	0.292	-1.25	0.213	0.053	1.926
Stunting						
Severely Stunted	1 (base)					
Moderately Stunted	0.302	0.320	-1.13	0.259	0.038	2.418
Not stunted	0.456	0.371	-0.97	0.334	0.093	2.242
Mother's level of income (Ksh)						
<3000	1 (base)					
>3001	0.605	0.328	-0.93	0.354	0.209	1.75
Site						
Intervention	1 (base)					
Comparative	0.390	0.299	-1.23	0.219	0.087	1.752
_Constant	0.721	1.478	-0.16	0.873	0.013	40.034
AVERAGE	**(base outcome)**					
ABOVE AVERAGE						
Mother's Highest education						
≤ Primary	1 (base)					
Secondary	0.906	0.600	-0.15	0.881	0.247	3.32
Tertiary	1.620	1.372	0.57	0.569	0.308	8.524
Father's level of income (Ksh)						
>3001	1 (base)					
<3000	0.253	0.172	-2.03	0.043	0.067	0.955
Site						
Intervention	1 (base)					
Comparative	5.399	6.431	1.42	0.157	0.523	55.733
Constant	0.000	0.000	-0.01	0.996	0	.

CHAPTER FIVE

DISCUSSION

5.1 Socio demographic characteristics

The study findings revealed that there were more married women in the intervention site at 78% compared to 57.1% at the comparative site. This showed that majority of the children had their mothers married and it agreed with a study that had been done in Greek Municipality (Abuya, Ciera, and Kimani-Murage, 2012; Koukouli, Vlachonikolis, and Philalithis, 2002; Oliveira, Sheiham, and Bönecker, 2008).

The study also showed that 31% and 49% of mother at the intervention and comparative site had secondary educations as their highest level of education. This percentage was low due to the fact that majority of the people could not afford secondary education and that the 100% secondary from primary school transition by government of Kenya directive had not been implemented. This agrees with study that had been done in Nairobi slums that had found that less than 50% of women participants had not schooled beyond secondary (Abuya et al., 2012; Oliveira et al., 2008)

From the intervention site, a total of 60% of the children lived in semi-permanent houses while 22% lived in their own homes compared to the comparative site where 50% lived in their own houses and 45% in semi-permanent houses. These showed that children in both sites were not living in good conditions. This could be due to the hard economic conditions coupled with increase in populations and lack of employment for to afford them live in permanent and self-owned luxurious homes (Oliveira et al., 2008). This is also evident when the findings confirmed that majority of the participants' parents were earning less than Ksh 3000.00 per month. This study

further revealed that 79% of mothers and 64% of fathers earned less than ksh 3000.00 per month. This again supports the poor living conditions of the children in the study sites.

There was a significance difference between the mothers' level of income and type of housing; and the site of study. These differences could be due to the economic activities in the study sites. For example, in the intervention site, there was the Sondu Miriu hydro power project. With the project, some of the mothers of the children might have been employees there thus creating a difference in their income and the eventual type of houses that they lived in. This agrees with a study that had been done among communities that lived near Sondu Miriu hydro power project that found revealed that the presence of the project improved the livelihoods (Moreri, 2010).

5.2 Nutritional status

These CHWs play a major role in meeting the critical needs of a community by providing support and promoting health services including nutrition and cognitive development of young children (Rahman, Malik, Sikander, Roberts, and Creed, 2008). After the implementation of the TTc intervention, the prevalence of severely and moderately underweight amongst children in intervention site had dropped by 8.9% and 12.7% respectively but the prevalence of moderately and severely overweight had increased by 7.1% and 1.2% with a significant difference of $p< 0.001$. At the comparative site, there was no significant difference between the underweight and overweight status of children at baseline and endline. There was a slight drop in the prevalence of underweight from 20% at baseline to 18% at endline with overweight status among children also recording a slight increase in prevalence from 6.6% at baseline to 7.0% at endline. This indicated that at the intervention site, the key nutrition messages by the CHWs might have contributed to

the reduction in underweight status of children and increased the prevalence of overweight. These key nutrition messages that were delivered to the caretakers resulted to positive impacts on the underweight status of children compared to the children who did not receive the intervention. This is evident that intervention by CHWs appeared to have put the children at a higher risk of overweight, indication that well intended interventions can generate unexpected risks. It is also evident that double burden malnutrition is existing in the region including in rural settings and low and middle income countries (Dietz et al., 2015). This study results agreed with the findings from a study that was done in Pakistan on child stimulation and nutrition that had found that, children who were exposed to the intervention recorded better weight for age z scores compared to those who were not exposed. The stimulation and nutrition intervention was being implemented by CHWs (Aisha K. Yousafzai, Muneera A. Rasheed, Arjumand Rizvi, Robert Armstrong, and Zulfiqar A. Bhutta, 2014). The findings of severely and moderately underweight which were 0.99% and 3.96% respectively were lower than the findings from KDHS 2014 report for Kisumu county that were at 0.4% and 6.6% respectively and far much lower than the national prevalence that were 2.3% and 11% respectively (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014).

Further analysis revealed that children whose cognitive scores were average had 8 times less risks of being underweight compared to those whose cognitive scores were below average. Children whose cognitive development scores were above average tended to interact well and could confidently request for feeds whenever they needed. This concurred with a Peruvian study that showed association between poor cognitive scores children underweight (Benjamin T. Crookston et al., 2011)

In the comparative site, a total of 2.2% and 17.6% children were severely and moderately underweight. These prevalence were higher than those at the intervention group and higher than the KDHS 2014 report for Kisumu County and the national figures (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). This revealed that children who were in the intervention site were doing better compared to those in the comparative site. This could be due to the TTc intervention that they received from the CHWs. Neighboring counties, Siaya and Homabay, also have shown high prevalence of underweight at 30% each (Bloss, Wainaina, and Bailey, 2004). These are counties with similar characteristics with Kisumu County with no nutrition intervention.

Childhood overweight has been on the rise in the last three decades in developed countries but recent studies are showing a rapid increase in the developing countries (Glanz, Rimer, and Viswanath, 2008; Lobstein et al., 2015). Results revealed that there was an increase in the prevalence of overweight among children in the intervention site from 7.6% at baseline to 14.8% at endline and 6.6% to 7.0% at the comparative site. This is evidence that, overweight is existing among children population in Kenya. A study that was done in England established an increase from 8% to 18% in childhood obesity especially in households of low social economic status even after implementation of nutrition interventions (Lobstein et al., 2015). Most interventions in developing countries have not been targeting obesity and overweight and lack of proper training of health workers and caregivers in behavior change has contributed to this rapid increase (Dietz et al., 2015).

A study that was done in Vietnam association between both caretaker's education status and level of income with child nutritional status. Caretakers with primary education and less had 1.7 times higher chance of having underweight children while those without formal source of income had

4.9 times higher chance of being underweight (Hien and Kam, 2008). This contradicts the results of this study which found that exclusive breastfeeding was the only factor that was associated with underweight (chi^2 =27.1309, p=0.004 (Hien and Kam, 2008). This is because exclusive breastfeeding has protective effect on the child as it contains antibodies and growth factors. It reduces the risks of childhood diseases, including obesity and underweight since chances of a breastfeeding taking too much or less is low. Most communities have women as household heads. Therefore, income earned is diverted to other basic needs leaving little money to buy food for the children thus predisposing them to malnutrition including underweight. The results of this study differed with a study in Malawi that revealed children whose caretakers were economically empowered had less chances of being underweight (Chirwa and Ngalawa, 2008)

From the baseline results, this study found that 12% and 19% of children in Kisumu County were moderately and severely stunted respectively. After the TTc implementation by CHWs, the prevalence dropped to 2.9% each for both moderately and severely stunted. In the comparative site, there was a slight drop in the prevalence from 17.9% and 13.3% to 17.5% and 7.7% in the moderately and severely stunted respectively. These concludes that the high reduction in prevalence in the intervention site was likely due to the interaction of the intervention with caretakers of children in the study site. Similar findings have been found in studies that had indicated reduction in child stunting in sites where interventions that aim at improving nutritional status existed (Zulfiqar A. Bhutta et al., 2008; Haddad, Nisbett, Barnett, and Valli, 2014; Lechtig, Cornale, Ugaz, and Arias, 2009). The 2014 KDHS survey found that a total of 35% of children under two years of age were stunted and that 18% of them were from Kisumu county (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). The prevalence of stunting from

KDHs report were higher compared to the prevalence in this study and this could be due to the presence of the TTc intervention in Kisumu County.

After the bivariate analysis, this study found that duration of breastfeeding was associated with child stunting in the intervention site. Association with other factors such as child's sex and age, parent's education and income; and state of housing were not evident after this analysis in both sites. The study results concurred those of Nepal and Filipino studies that associated duration of breastfeeding with child stunting (Adair and Guilkey, 1997; Reynaldo Martorell, Leslie, and Moock, 1984) but contradicted studies that found determinants of stunting to be child' sex and age ; and parent's education (Espo et al., 2002; Fenske, Burns, Hothorn, and Rehfuess, 2013; Ikeda, Irie, and Shibuya, 2013). World Health Organization endorses breastfeeding up to when a child is two years and beyond due to the health and nutritional benefits including prevention of stunting among children (World Health Organization, 2010a). According to this study, 80% of the children were still being breastfed with 45% of them being aged between 18 and 24 months. One of the key nutrition messages to caretakers by the CHWs was "Continued *breastfeeding to 24 months, in addition to giving foods*". This was to encourage caretakers to breastfeed their children up to the age of two years and beyond as recommend by WHO report and this almost achieved as revealed in this study where 45% of children aged between 18 and 24 months were still being breastfed (World Health Organization, 2001).

After implementation of TTc by the CHWs, the prevalence of wasting dropped by half from 16% to 8.9% in the intervention site while at the comparative site, the prevalence increased from 15.6% to 21.9%. KDHS 2014 results had reported that only 4% of the children of this age were wasted

and this were below this research findings (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). A study that was done in Philippines among early childhood had found that father's education was a predictor of child wasting and did not agree with this study that had found child's age, father's level of income, cognitive scores, energy intake, protein intake ,fat intake and Vitamin A intake to be associated with child stunting (Ricci and Becker, 1996).

Studies have shown that nutritional deficiencies during the early years of life have long term effects on the cognitive development skills and physical growth of individuals in the later years of life and therefore is important to focus on the dietary intake of children at this period of growth (Prado and Dewey, 2014). Correct feeding practices and dietary intakes among children can be enhanced by knowledgeable CHWs (Pelto et al., 2004). In this study, CHWs encouraged caretakers to feed their children with diverse balanced diets were rich in iron and vitamin A sources. This study found that even though most of the children were receiving adequate daily dietary intake, there were still those whose diets were still inadequate.

Only 19% of the children received less calories from their diets compared to their Recommended Daily Allowance required for their age with those aged 19 to 24 months and 6 to 12 months highly affected with 36.8% of each receiving inadequate calories. This could be because, after 6 months of age, dependence on breast milk reduces yet the growth spurt is rapid and there is an increase in energy requirements. It is also a period where children begin to explore life independently; learning eating behaviors, trying new foods and tastes. After the 18 months, children acquire greater autonomy and can feed themselves with spoons and cups. With this new behavior, food consumption is reduced due to lots of food spillages, little attention span and easy destruction that cannot make them sit down for normal meal times (N. Health and Council, 2003). All these

behaviors have a role in inadequate dietary intake leading to reduced energy and key nutrients. It is therefore important that guardians and parents are keen on what children consume especially in these critical years of growth (Dalmau et al., 2015).

A total of 43.5%, 42.6%, 38.6%, 18.8%, 15.4% and 14.8% of children had inadequate intake of iron, fats, proteins, energy, carbohydrates and vitamin A. Some of the key message in the TTc included feeding children with diverse complementary diets. This is because diverse diet is benefit for growth and development of children. Other research findings have concurred with this study that nutrition counseling by CHWs have improved the intake of proteins, carbohydrates , fats and diets that are diverse (Palwala et al., 2009). There is evidence that malnutrition including deficiencies of micronutrients like iron and Vitamin A have a negative impact on the brain development and cognitive functions. This contradicted with this research findings that did not show any association between cognitive developments in children with their dietary intake. (Bryan et al., 2004). From the knowledge of CHWs on cognitive development, the caretakers in this study revealed that CHWs were not knowledgeable on the foods that were key for cognitive development and it could be the reason why children were consuming diets that were deficient of certain nutrients including proteins, fat, iron and vitamin A.

A total of 61.4% of children in intervention site were exclusively breastfed for the first six months of life compared to 47.9% from the comparative site. Current 2014 KDHS reported that a total of 61% of children were exclusively breastfed and it totally agrees with this study (Kenya National Bureau of Statistics (KNBS) and ICF Macro, 2014). The key messages that included exclusive among the children by CHWs to better status of exclusive breastfeeding among those in the

intervention group compared to those in the comparative site. A Brazilian study and a systematic reviewed article established that frequent counseling on exclusive breastfeeding at homes by CHW was linked to high rates of exclusive breastfeeding (Coutinho et al., 2014; Lewin et al., 2010).

5.3 Cognitive development

Caretakers' play sessions with their children are key in promoting child's cognitive development that are likely to be sustainable. With home visits by CHWs, caretakers' practices and play sessions with their children to increase thus creating more benefits to developmental level of children that are likely to be sustainable (S. Grantham-McGregor and Smith, 2016; Aisha K. Yousafzai et al., 2014). This study revealed that a total of 14.8% of children in the intervention site were below average in cognitive development compared to 34.1% from the comparative site and there was a significant difference between the two study sites ($p<0.001$). Studies have found that cognitive development and malnutrition are confounded by poor socio-economic background, poor maternal education, unstimulated environment and family genetics and therefore hard to isolate the effects of these factors to malnutrition and cognitive development (Prado and Dewey, 2014). This study found after the bivariate analysis child' age ($chi=13.71$, $p<0.033$) and father's level of income ($chi=6.66$, $p<0.36$) were associated with the cognitive development in children. This agrees with findings of a study that was done in Guatemala and Jamaica that; as children grow their cognitive abilities improve (Powell, Walker, Himes, Fletcher, and Grantham-McGregor, 1995). This study findings contradicted with a Pakistan study that found child stunting and underweight status to be linked with cognitive development (Avan, Raza, and Kirkwood, 2014). Studies on child cognitive development in LMICs are limited but an intervention study where CHWs encouraged caretakers

play and stimulation their children resulted to more cognitive benefits to the children (S. Grantham-McGregor and Smith, 2016)

5.4 Perception of CHWs knowledge on Nutritional status and Cognitive Development

After the CHWs had received training on nutrition and cognitive development, they delivered the acquired knowledge to the caretakers who were then expected to comprehend on the knowledge gain and implement on their children. This study therefore assessed the perception of the CHWs knowledge on nutritional status and cognitive development from the caretakers of the children. It was revealed by caretakers that CHWs at the intervention site were knowledge on nutritional issues of children. This is because caretakers admitted that they got a lot of information of the importance of exclusive breastfeeding and complementary feeds for young children. They were also aware of the importance of diverse feeds, rich iron and vitamin A with the sources of these ley nutrients. They alluded that the CHWs also reminded them to stimulate and play with their children frequently, but they did not inform them of the foods that were key in promoting cognitive development among children.

5.5 Impact of the Community Health Workers on the nutritional status of the children

The study showed that there was a significant difference in the underweight and overweight status of the children. Most (79%) of the children had normal weights after the TTc intervention by compared to 65.9% before the intervention. Even though the presence of TTc intervention reduced the prevalence of underweight, there was a proof of an increased the prevalence of overweight status among the children from 7.6% to 15.8%. This increase in overweight is in agreement with a policy report WHO that had been projected that the number of overweight children in the world could increase from 32 million in 2000 to 42 million by 2013 with Africa recording the highest

increase from 1% to 19% (World Health Organization, 2015). The decrease in the prevalence could be due to the interventions in Africa that majorly focus undernutrition and neglects overnutrition among children (Doak, Visscher, Renders, and Seidell, 2006). The increase in the prevalence of underweight could be due to the lifestyle that is characterized by lots of sugary foods with decreased physical activities. Other studies have found that poor dietary practices among young children but with the presence of Nutrition interventions that are being implemented by community volunteers and aim at change in nutrition behaviors can lead to improved nutritional status (Goudet, Faiz, Bogin, and Griffiths, 2011)

There was also a significant difference in the wasting status of the children at the end of the intervention period. In the intervention site, 91.1% children were not stunted after the intervention compared to 84.1% before the implementation of the intervention. The percentage of children who were not stunted also improved from 68.9% to 94.1% after the implementation of the TTc by CHWs.

The percentage of children who were not found to stunted increased from 68.9% to 94.1%. This was a great impact by the community health workers and is in agreement with previous studies that documented that continual investment on nutrition precise interventions through community engagement could go a long way in addressing child undernutrition (Zulfiqar A Bhutta et al., 2013).

5.6 Impact of the Community Health Workers on Cognitive development of the children

After the TTc, it was found that only 15% of the children had cognitive scores that were below average at the intervention site compared to 34% at the comparative site. Key nutrition messages

that emphasized on child stimulation, play and good nutrition practices that were being delivered by the CHWs might have created this positive impact in the intervention site (World Vision International, 2015). Previous studies have shown that stunting in children especially in the first 1000 days of life have negative consequences on cognitive ability and development (Schwarzenberg and Georgieff, 2018). This study further found that more (19%) of the children in the intervention site compared to 4% at the comparative site had cognitive scores that were above average. This might again have been attributed to the presence of the CHWs in the intervention site. This might eventually improve the general development of the place and even reduce the incidence of poor nutrition in the communities.

5.7 Determinants of nutritional status and cognitive development among children

This study established that children whose parents were paying rent had more than 9 times chances of being stunted compared to those living in their own homes. House rent is an expense that is usually given priority in most households because of fear of eviction by landlords. This might deny household members, including children, the ability to buy enough high-quality foods thus predisposing members, especially, children to stunting. This research contradicted a critical review that had concluded that house possession is not related to nutritional outcome (Leventhal and Newman, 2010)

It also revealed that children who had higher chances of wasting were those who's both parents were earning less income while those with lower chances of wasting were those with average cognitive scores, exclusively breastfed and those who lived in permanent houses. Because of many financial priorities, most parents would allocate little money on nutrition of their children.

Likewise, the benefits of exclusive breastfeeding with good child cognition and comfort in personal homes are directly linked to better nutrition including low rates of child wasting (Jones et al., 2014). Studies have proved that wasted children perform poorly in cognitive tests (Kar, Rao, and Chandramouli, 2008; Upadhyay, Agarwal, and Agarwal, 1989)

Some of the limitations to this study were; lack of finance since the resources needed to conduct this study were costly and that recruitment of participants and data collection process took longer than anticipated because the researchers at times visited a home and did not find either the caretaker or child or both.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Community Health Workers are key in addressing child nutrition and cognition. In this study, through the TTc intervention, they CHWs were able to reduce the prevalence of underweight; stunting and wasting amongst children aged below two years but increased the prevalence of overweight in the same population. It concluded that double burden of malnutrition that already existed in the region, was worsened by CHWs and therefore, risk of overweight at this early age is high. The rate of exclusive breastfeeding was at 61% in Katito and 48% at Kegonga Ntimaru and these were below the slightly low in Kegonga Ntimaru at 48% below the WHO recommendations that expects all children to be breastfed exclusively in the first 6 months of their lives. The average daily diets of these children were insufficient in iron, fat and proteins. It also concluded that poor diets and lack of emphasize on importance of cognitive development by CHWs led to cognitive levels that were below average among children. Exclusive breastfeeding and duration of breastfeeding were associated with child underweight and stunting respectively.

6.2 Recommendations

Based on the conclusions, this study recommends the use of CHWs in implementing nutrition interventions and the up scaling the TTc intervention in other counties in the country. Nutrition interventions should focus on malnutrition with emphasize on child overweight, cognitive development, diverse complementary feeds that are rich in iron, fats and proteins sources. Researchers to investigate on the determinants of poor nutritional status, low cognitive scores and low rates of exclusive breastfeeding. Studies to elucidate on the relationship between nutrition and

cognitive development with nutrition interventions to target children aged less than two years as is the window period of opportunity.

REFERENCES

Abuya, B. A., Ciera, J., and Kimani-Murage, E. (2012). Effect of mother's education on child's nutritional status in the slums of Nairobi. *BMC pediatrics, 12*(1), 80.

Acosta, A. M., Chavez, C. B., Flores, J. T., Olotegui, M. P., Pinedo, S. R., Trigoso, D. R., . . . Ali, A. (2014). The MAL-ED study: a multinational and multidisciplinary approach to understand the relationship between enteric pathogens, malnutrition, gut physiology, physical growth, cognitive development, and immune responses in infants and children up to 2 years of age in resource-poor environments. *Clinical Infectious Diseases, 59*(suppl 4), S193-S206.

Adair, L. S., and Guilkey, D. K. (1997). Age-Specific Determinants of Stunting in Filipino Children. *The Journal of Nutrition, 127*(2), 314-320. doi:10.1093/jn/127.2.314

Ahmed, S. M. (2008). Taking Healthcare Where the Community is: The Story Of The Shasthya Sebikas of Brac in Bangladesh. *BRAC University Journal, 5*(1), 39-45.

Albert, M. S., Jones, K., Savage, C. R., Berkman, L., Seeman, T., Blazer, D., and Rowe, J. W. (1995). Predictors of cognitive change in older persons: MacArthur studies of successful aging. *Psychology and aging, 10*(4), 578.

Alderman, H. (2010). The economic cost of a poor start to life. *J Dev Orig Health Dis, 1*(1), 19-25. doi:10.1017/s2040174409990158

Anderson, J. W., Johnstone, B. M., and Remley, D. T. (1999). Breast-feeding and cognitive development: a meta-analysis. *The American journal of clinical nutrition, 70*(4), 525-535.

Anderson, P. J., De Luca, C. R., Hutchinson, E., Roberts, G., and Doyle, L. W. (2010). Underestimation of developmental delay by the new Bayley-III Scale. *Archives of pediatrics and adolescent medicine, 164*(4), 352-356.

Avan, B. I., Raza, S. A., and Kirkwood, B. R. (2014). A community-based study of early childhood sensory stimulation in home environment associated with growth and psychomotor development in Pakistan. *International journal of public health, 59*(5), 779-788.

Bayley, N. (1969). Manual for the Bayley scales of infant development. Retrieved from https://www.worldcat.org/title/manual-for-the-bayley-scales-of-infant-development/oclc/845252563

Bayley, N. (1993). Bayley scales of infant development: Manual. Retrieved from https://journals.sagepub.com/doi/10.1177/073428290001800208

Bayley, N. (2006). Bayley scales of infant and toddler development. Retrieved from https://www.researchgate.net/publication/303251400_Bayley-III_Scales_of_Infant_and_Toddler_Development_Transcultural_Adaptation_and_Psychometric_Properties

Belli, P. C., Bustreo, F., and Preker, A. (2005). Investing in children's health: what are the economic benefits? *Bulletin of the World Health Organization, 83*(10), 777-784.

Berger, M. M., Soguel, L., Charrière, M., Thériault, B., Pralong, F., and Schaller, M. D. (2017). Impact of the reduction of the recommended energy target in the ICU on protein delivery and clinical outcomes. *Clinical Nutrition, 36*(1), 281-287. doi:https://doi.org/10.1016/j.clnu.2015.12.002

Bhutta, Z. A., Ahmed, T., Black, R. E., Cousens, S., Dewey, K., Giugliani, E., . . . Shekar, M. (2008). What works? Interventions for maternal and child undernutrition and survival. *The Lancet, 371*(9610), 417-440. doi:https://doi.org/10.1016/S0140-6736(07)61693-6

Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., . . . Group, T. L. N. I. R. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *The Lancet, 382*(9890), 452-477.

Bird, K. (2013). The intergenerational transmission of poverty: An overview *Chronic Poverty* (pp. 60-84): Springer.

Black. (1998). Zinc deficiency and child development. *The American journal of clinical nutrition, 68*(2), 464S-469S.

Black, Robert, E., Allen, L., Bhutta, Z., Caulfield, L., De Onis, M., . . . Group, C. U. S. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet, 371*(9608), 243-260.

Black, Robert, E., Morris, S., S., Bryce, and Jennifer. (2003). Where and why are 10 million children dying every year? *The Lancet, 361*(9376), 2226-2234.

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., . . . Martorell, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet, 382*(9890), 427-451.

Block, G. (1995). Semiquantitative Food Frequency Questionnaire. *Unpublished copyrighted questionnaire. Berkeley, CA: Block Dietary Data Systems*.

Bloss, E., Wainaina, F., and Bailey, R. C. (2004). Prevalence and Predictors of Underweight, Stunting, and Wasting among Children Aged 5 and Under in Western Kenya. *Journal of tropical pediatrics, 50*(5), 260-270. doi:10.1093/tropej/50.5.260

Braun, J. v., Swaminathan, M., Rosegrant, M., Montes Santiago, M., Stone, L., Church, J., . . . Piaget, J. (2006). Repositioning nutrition as central to development: a strategy for large-scale action. *Directions in Development (EUA).*

Brownstein, J. N., Chowdhury, F. M., Norris, S. L., Horsley, T., Jack Jr, L., Zhang, X., and Satterfield, D. (2007). Effectiveness of Community Health Workers in the Care of People with Hypertension. *American Journal of Preventive Medicine, 32*(5), 435-447. doi:http://dx.doi.org/10.1016/j.amepre.2007.01.011

Brug, J., Steenhuis, I., van Assema, P., and de Vries, H. (1996). The Impact of a Computer-Tailored Nutrition Intervention. *Preventive Medicine, 25*(3), 236-242. doi:https://doi.org/10.1006/pmed.1996.0052

Bryan, J., Osendarp, S., Hughes, D., Calvaresi, E., Baghurst, K., and van Klinken, J.-W. (2004). Nutrients for Cognitive Development in School-aged Children. *Nutrition Reviews, 62*(8), 295-306. doi:10.1111/j.1753-4887.2004.tb00055.x

Carrasco Quintero, M. D. R., Ortiz Hernández, L., Roldán Amaro, J. A., and Chávez Villasana, A. (2016). [Malnutrition and cognitive development if infants in rural marginalized areas in Mexico]. *Gaceta sanitaria, 30*(4), 304-307. doi:10.1016/j.gaceta.2016.01.009

Caulfield, L. E., de Onis, M., Blössner, M., and Black, R. E. (2004). Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *The American journal of clinical nutrition, 80*(1), 193-198.

Chatfield, C. (2018). *Introduction to multivariate analysis*: Routledge.

Children, S. t. (2012). *Nutrition in the first 1,000 Days* Brookstone.: Johnson and Johnson, Mattel, Inc.

Chirwa, E. W., and Ngalawa, H. P. (2008). Determinants of Child Nutrition in Malawi. *South African Journal of Economics, 76*(4), 628-640. doi:doi:10.1111/j.1813-6982.2008.00212.x

Coutinho, S. B., Lira, P. I., Lima, M. C., Frias, P. G., Eickmann, S. H., and Ashworth, A. (2014). Promotion of exclusive breast-feeding at scale within routine health services: impact of

breast-feeding counselling training for community health workers in Recife, Brazil. *Public health nutrition, 17*(4), 948-955.

Crookston, B. T., Dearden, K. A., Alder, S. C., Porucznik, C. A., Stanford, J. B., Merrill, R. M., . . . Penny, M. E. (2011). Impact of early and concurrent stunting on cognition. *Maternal and Child Nutrition, 7*(4), 397-409. doi:doi:10.1111/j.1740-8709.2010.00255.x

Crookston, B. T., Schott, W., Cueto, S., Dearden, K. A., Engle, P., Georgiadis, A., . . . Behrman, J. R. (2013). Postinfancy growth, schooling, and cognitive achievement: Young Lives. *The American journal of clinical nutrition, 98*(6), 1555-1563. doi:10.3945/ajcn.113.067561

Cusick, S. E., and Georgieff, M. K. (2016). The role of nutrition in brain development: the golden opportunity of the "first 1000 days". *The Journal of pediatrics, 175*, 16-21.

Dalmau, J., Peña-Quintana, L., Moráis, A., Martínez, V., Varea, V., Martínez, M., and Soler, B. (2015). Quantitative analysis of nutrient intake in children under 3 years old. ALSALMA study. *Anales de Pediatría (English Edition), 82*(4), 255-266.

De Jager, C. A., and Ahmed, S. (2015). Research on the Effects of Vitamins and Minerals on Cognitive Function in Older Adults *Nutrition for Brain Health and Cognitive Performance* (pp. 204-235): CRC Press.

De Onis, M., and Blössner, M. (2003). The World Health Organization global database on child growth and malnutrition: methodology and applications. *International Journal of Epidemiology, 32*(4), 518-526.

Dewey, K. G. (2001). Nutrition, growth, and complementary feeding of the brestfed infant. *Pediatric Clinics of North America, 48*(1), 87-104.

Dhatrak, P., Pitale, S., Kasturwar, N., Nayse, J., and Relwani, N. (2013). Prevalence and epidemiological determinants of malnutrition among under-fives in an urban Slum, Nagpur. *National J Community Med, 4*(1), 91.

Dietz, W. H., Baur, L. A., Hall, K., Puhl, R. M., Taveras, E. M., Uauy, R., and Kopelman, P. (2015). Management of obesity: improvement of health-care training and systems for prevention and care. *Lancet, 385*(9986), 2521-2533. doi:10.1016/s0140-6736(14)61748-7

Doak, C. M., Visscher, T. L. S., Renders, C. M., and Seidell, J. C. (2006). The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. *Obesity Reviews, 7*(1), 111-136. doi:10.1111/j.1467-789X.2006.00234.x

Duggal, S., Chugh, T. D., and Duggal, A. K. (2012). HIV and malnutrition: effects on immune system. *Journal of Immunology Research, 2012*.

Edmunds, L. S., Woelfel, M. L., Dennison, B. A., Stratton, H., Pruzek, R. M., and Abusabha, R. (2006). Overweight trends among children enrolled in the New York State special supplemental nutrition program for women, infants, and children. *Journal of the American Dietetic Association, 106*(1), 113-117.

Engle, P. L., and Fernández, P. D. (2010). INCAP studies of malnutrition and cognitive behavior. *Food and Nutrition Bulletin, 31*(1), 83-94.

Espo, M., Kulmala, T., Maleta, K., Cullinan, T., Salin, M.-L., and Ashorn, P. (2002). Determinants of linear growth and predictors of severe stunting during infancy in rural Malawi. *Acta Paediatrica, 91*(12), 1364-1370. doi:doi:10.1111/j.1651-2227.2002.tb02835.x

Fangupo, L. J., Heath, A.-L. M., Williams, S. M., Somerville, M. R., Lawrence, J. A., Gray, A. R., . . . Galland, B. C. (2015). Impact of an early-life intervention on the nutrition behaviors of

2-y-old children: a randomized controlled trial. *The American journal of clinical nutrition, 102*(3), 704-712.

Fenske, N., Burns, J., Hothorn, T., and Rehfuess, E. A. (2013). Understanding Child Stunting in India: A Comprehensive Analysis of Socio-Economic, Nutritional and Environmental Determinants Using Additive Quantile Regression. *PLOS ONE, 8*(11), e78692. doi:10.1371/journal.pone.0078692

Fiedler, J. L. (2000). The Nepal National Vitamin A Program: prototype to emulate or donor enclave? *Health Policy Plan, 15*(2), 145-156.

Freeman, H. E., Klein, R. E., Townsend, J. W., and Lechtig, A. (1980). Nutrition and cognitive development among rural Guatemalan children. *American Journal of Public Health, 70*(12), 1277-1285.

GHWA, W. (2014). Global experience of community health workers for delivery of health related millennium development goals: a systematic review, country case studies, and recommendations for scaling up. 2010. Geneva WHO.

Gill, M., Feliciano, D., Macdiarmid, J., and Smith, P. (2015). The environmental impact of nutrition transition in three case study countries. *Food security, 7*(3), 493-504.

Gilmore, B., Vallières, F., McAuliffe, E., Tumwesigye, N. M., and Muyambi, G. (2014). The last one heard: the importance of an early-stage participatory evaluation for programme implementation. *Implementation Science, 9*(1), 137.

Glanz, K., Rimer, B. K., and Viswanath, K. (2008). *Health behavior and health education: theory, research, and practice*: John Wiley and Sons.

Glewwe, P., and King, E. M. (2001). The Impact of Early Childhood Nutritional Status on Cognitive Development: Does the Timing of Malnutrition Matter? *The World Bank Economic Review, 15*(1), 81-113. doi:10.1093/wber/15.1.81

GOK. (2007). Kenya Vision 2030: Popular Version. Retrieved from tp://www.vision2030.go.ke/cms/vds/Popular_Version.pdf.

Gómez-Pinilla, F. (2008). Brain foods: the effects of nutrients on brain function. *Nature Reviews Neuroscience, 9*(7), 568-578.

Goodwin, K., and Tobler, L. (2008). Community health workers. *communities, 1*(2).

Goudet, S. M., Faiz, S., Bogin, B. A., and Griffiths, P. L. (2011). Pregnant Women's and Community Health Workers' Perceptions of Root Causes of Malnutrition Among Infants and Young Children in the Slums of Dhaka, Bangladesh. *American Journal of Public Health, 101*(7), 1225-1233. doi:10.2105/AJPH.2010.300090

Grantham-McGregor, Sally, M., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., and Strupp, B. (2004). Developmental potential in the first 5 years for children in developing countries. *The Lancet, 369*(9555), 60-70. doi:http://dx.doi.org/10.1016/S0140-6736(07)60032-4

Grantham-McGregor, Sally, M., Fernald, Lia, C., Sethuraman, and Kavita. (1999). Effects of health and nutrition on cognitive and behavioural development in children in the first three years of life. Part 1: Low birthweight, breastfeeding, and protein-energy malnutrition. *Food and Nutrition Bulletin, 20*(1), 53-75.

Grantham-McGregor, S., and Smith, J. A. (2016). Extending the Jamaican early childhood development intervention. *Journal of Applied Research on Children: Informing Policy for Children at Risk, 7*(2), 4.

Greenwood, C., and Craig, R. (1987). Dietary influences on brain function: implications during periods ofneuronal maturation. *Current topics in nutrition and disease*.

Guthrie, D., Sigman, M., Whaley, S. E., Neumann, C., Bwibo, N., Murphy, S. P., . . . Alber, S. (2003). The Impact of Dietary Intervention on the Cognitive Development of Kenyan School Children. *The Journal of Nutrition, 133*(11), 3965S-3971S. doi:10.1093/jn/133.11.3965S

Haas, J. D., Murdoch, S., Rivera, J., and Martorell, R. (1996). Early nutrition and later physical work capacity. *Nutrition Reviews, 54*(s1), S41-S48.

Haddad, L., Nisbett, N., Barnett, I., and Valli, E. (2014). Maharashtra's child stunting declines: what is driving them? Findings of a multidisciplinary analysis.

Haines, A., Sanders, D., Lehmann, U., Rowe, A. K., Lawn, J. E., Jan, S., . . . Bhutta, Z. (2007). Achieving child survival goals: potential contribution of community health workers. *The Lancet, 369*(9579), 2121-2131.

Haller, J. (1995). The actions of vitamins and other nutrients on psychological parameters. *Human psychopharmacology, 5*, 229-261.

Halsey, L. G., Curran-Everett, D., Vowler, S. L., and Drummond, G. B. (2015). The fickle P value generates irreproducible results. *Nature methods, 12*(3), 179.

Harrell, M. C., and Bradley, M. A. (2009). *Data collection methods. Semi-structured interviews and focus groups*. Retrieved from

Harris, M. (2012). Integrating primary care and public health: learning from the Brazilian way. *London journal of primary care, 4*(2), 126-132.

Health, N., and Council, M. R. (2003). Dietary Guidelines for Children and Adolescents in Australia Incorporating the Infant Feeding Guidelines for Health Workers: Commonwealth of Australia Canberra.

Health, U. D. o., and Services, H. (2014). Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects. Revised 15 Jan 2009.

Hermann, K., Van Damme, W., Pariyo, G. W., Schouten, E., Assefa, Y., Cirera, A., and Massavon, W. (2009). Community health workers for ART in sub-Saharan Africa: learning from experience–capitalizing on new opportunities. *Human resources for health, 7*(1), 31.

Hessel, A. C., Moreno, M. A., Hanna, E. Y., Roberts, D. B., Lewin, J. S., El-Naggar, A. K., . . . Weber, R. S. (2010). Compliance with quality assurance measures in patients treated for early oral tongue cancer. *Cancer, 116*(14), 3408-3416.

Hien, N. N., and Kam, S. (2008). Nutritional status and the characteristics related to malnutrition in children under five years of age in Nghean, Vietnam. *J Prev Med Public Health, 41*(4), 232-240.

Huskisson, E., Maggini, S., and Ruf, M. (2007). The influence of micronutrients on cognitive function and performance. *Journal of international medical research, 35*(1), 1-19.

Ikeda, N., Irie, Y., and Shibuya, K. (2013). Determinants of reduced child stunting in Cambodia: analysis of pooled data from three Demographic and Health Surveys. *Bulletin of the World health Organization, 91*, 341-349.

Isaacs, E., and Oates, J. (2008). Nutrition and cognition: assessing cognitive abilities in children and young people. *European Journal of Nutrition, 47*(3), 4-24. doi:10.1007/s00394-008-3002-y

Jones, A. D., Ickes, S. B., Smith, L. E., Mbuya, M. N., Chasekwa, B., Heidkamp, R. A., . . . Stoltzfus, R. J. (2014). W orld H ealth O rganization infant and young child feeding indicators and their associations with child anthropometry: a synthesis of recent findings. *Maternal and Child Nutrition, 10*(1), 1-17.

Kar, B. R., Rao, S. L., and Chandramouli, B. (2008). Cognitive development in children with chronic protein energy malnutrition. *Behavioral and Brain Functions, 4*(1), 31.

Kawakatsu, Y., Sugishita, T., Kioko, J., Ishimura, A., and Honda, S. (2012). Factors influencing the performance of community health workers in Kisumu West, Kenya. *Primary Health Care Research and amp; Development, 13*(4), 294-300. doi:10.1017/S1463423612000138

Kenya Bureau of Statistics (KNBS), and ICF Macro. (2010). *Kenya Demographic and Health and Health Survey 2008-09*. Calverton, Maryland KNSB and Macro

Kenya National Bureau of Statistics (KNBS). (2009). *Kenya Population and Housing Census: Population distribution by administrative units. 1A*. Nairobi, Kenya: Nairobi, Kenya: Republic of Kenya.

Kenya National Bureau of Statistics (KNBS) and ICF Macro. (2008-09). *Kenya demographic and health survey, 2008-09*. KNBS and ICF Macro, Calverton, Maryland.

Kenya National Bureau of Statistics (KNBS) and ICF Macro. (2014). *Kenya demographic and health survey, 2014*. KNBS and ICF Macro, Calverton, Maryland

Koukouli, S., Vlachonikolis, I. G., and Philalithis, A. (2002). Socio-demographic factors and self-reported functional status: the significance of social support. *BMC Health Serv Res, 2*(1), 20. doi:10.1186/1472-6963-2-20

Lechtig, A., Cornale, G., Ugaz, M. E., and Arias, L. (2009). Decreasing stunting, anemia, and vitamin A deficiency in Peru: results of the Good Start in Life Program. *Food and nutrition bulletin, 30*(1), 37-48.

Lehmann, U., and Sanders, D. (2007). Community health workers: what do we know about them. *The state of the evidence on programmes, activities, costs and impact on health outcomes of using community health workers. Geneva: World Health Organization*, 1-42.

Leventhal, T., and Newman, S. (2010). Housing and child development. *Children and Youth Services Review, 32*(9), 1165-1174. doi:https://doi.org/10.1016/j.childyouth.2010.03.008

Lewin, S., Munabi-Babigumira, S., Glenton, C., Daniels, K., Bosch-Capblanch, X., van Wyk, B. E., . . . Zwarenstein, M. (2010). Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database of Systematic Reviews*(3).

Lobstein, T., Jackson-Leach, R., Moodie, M. L., Hall, K. D., Gortmaker, S. L., Swinburn, B. A., . . . McPherson, K. (2015). Child and adolescent obesity: part of a bigger picture. *Lancet (London, England), 385*(9986), 2510-2520. doi:10.1016/S0140-6736(14)61746-3

Luo, J., and Hu, F. B. (2002). Time trends of obesity in pre-school children in China from 1989 to 1997. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity, 26*(4), 553.

Mani, A., Mullainathan, S., Shafir, E., and Zhao, J. (2013). Poverty impedes cognitive function. *science, 341*(6149), 976-980.

Martorell, R. (2010). Physical growth and development of the malnourished child: contributions from 50 years of research at INCAP. *Food Nutr Bull, 31*(1), 68-82.

Martorell, R., Leslie, J., and Moock, P. R. (1984). Characteristics and determinants of child nutritional status in Nepal. *The American journal of clinical nutrition, 39*(1), 74-86.

Michalec, D. (2011). Bayley scales of infant development. *Encyclopedia of child behavior and development*, 215-215.

Ministry of Health. (2006). Taking the Kenya Essential Package for Health to the Community: A Strategy for the Delivery of Level One Services (pp. i-50): Health Sector Reform Secretariat of the Republic of Kenya Nairobi, Kenya.

Moreri, K. (2010). *Sustainable development? dam construction and the marginalization of civil society. Case of Sondu Miriu.*

Neumann, C. G., Bwibo, N. O., Murphy, S. P., Sigman, M., Whaley, S., Allen, L. H., . . . Demment, M. W. (2003). Animal Source Foods Improve Dietary Quality, Micronutrient Status, Growth and Cognitive Function in Kenyan School Children: Background, Study Design and Baseline Findings. *The Journal of Nutrition, 133*(11), 3941S-3949S.

Oliveira, L. B., Sheiham, A., and Bönecker, M. (2008). Exploring the association of dental caries with social factors and nutritional status in Brazilian preschool children. *European journal of oral sciences, 116*(1), 37-43.

Palwala, M., Sharma, S., Udipi, S. A., Ghugre, P. S., Kothari, G., and Sawardekar, P. (2009). Nutritional quality of diets fed to young children in urban slums can be improved by intensive nutrition education. *Food and nutrition bulletin, 30*(4), 317-326.

Pelto, G. H., Santos, I., Goncalves, H., Victora, C., Martines, J., and Habicht, J.-P. (2004). Nutrition counseling training changes physician behavior and improves caregiver knowledge acquisition. *The Journal of Nutrition, 134*(2), 357-362.

Pérez, L. M., and Martinez, J. (2008). Community health workers: social justice and policy advocates for community health and well-being. *American Journal of Public Health, 98*(1), 11-14.

Perez, M., Findley, S. E., Mejia, M., and Martinez, J. (2006). The impact of community health worker training and programs in NYC. *J Health Care Poor Underserved, 17*(1 Suppl), 26-43. doi:10.1353/hpu.2006.0011

Perry, H. (2013). A brief history of community health worker programs. *Encyclopedia of Public Health. Berlim: Springer*, 1-12.

Perry, H. B., Zulliger, R., and Rogers, M. M. (2014). Community Health Workers in Low-, Middle-, and High-Income Countries: An Overview of Their History, Recent Evolution, and Current Effectiveness. *Annual review of public health*(0).

Phuka, J., Maleta, K., Thomas, M., and Gladstone, M. (2014). A job analysis of community health workers in the context of integrated nutrition and early child development. *Annals of the New York Academy of Sciences, 1308*(1), 183-191.

Picciano, M. F., Smiciklas-Wright, H., Birch, L. L., Mitchell, D. C., Murray-Kolb, L., and McConahy, K. L. (2000). Nutritional guidance is needed during dietary transition in early childhood. *Pediatrics, 106*(1), 109-114.

Pokharel, R., Maharjan, M., Mathema, P., and Harvey, P. (2011). Success in delivering interventions to reduce maternal anemia in Nepal: a case study of the intensification of maternal and neonatal Micronutrient Program. *Washington, DC, 20009*.

Powell, C., Walker, S., Himes, J., Fletcher, P., and Grantham-McGregor, S. (1995). Relationships between physical growth, mental development and nutritional supplementation in stunted children: the Jamaican study. *Acta paediatrica, 84*(1), 22-29.

Prado, E. L., and Dewey, K. G. (2014). Nutrition and brain development in early life. *Nutrition Reviews, 72*(4), 267-284. doi:10.1111/nure.12102

Prendergast, A. J., and Humphrey, J. H. (2014). The stunting syndrome in developing countries. *Paediatrics and International Child Health, 34*(4), 250-265. doi:10.1179/2046905514Y.0000000158

Rahman, A., Malik, A., Sikander, S., Roberts, C., and Creed, F. (2008). Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *The Lancet, 372*(9642), 902-909. doi:https://doi.org/10.1016/S0140-6736(08)61400-2

Ricci, J. A., and Becker, S. (1996). Risk factors for wasting and stunting among children in Metro Cebu, Philippines. *The American journal of clinical nutrition, 63*(6), 966-975. doi:10.1093/ajcn/63.6.966

Rosenthal, E. L. (1998). A summary of the national community health advisor study. *Baltimore, MD: Annie E. Casey Foundation.* Retrieved from https://crh.arizona.edu/sites/default/files/pdf/publications/CAHsummaryALL.pdf

Sachs, J. D. (2012). From millennium development goals to sustainable development goals. *The Lancet, 379*(9832), 2206-2211.

Schwarzenberg, S. J., and Georgieff, M. K. (2018). Advocacy for improving nutrition in the first 1000 days to support childhood development and adult health. *Pediatrics, 141*(2), e20173716.

Singh, P., and Sullivan, S. (2011). One million community health workers: technical task force report. *New York: Earth Institute at Columbia University*, 304-310.

South Africa Every Death Counts Writing Group. (2008). Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. *The Lancet, 371*(9620), 1294-1304.

Srivastava, A., Mahmood, S. E., Srivastava, P. M., Shrotriya, V. P., and Kumar, B. (2012). Nutritional status of school-age children - A scenario of urban slums in India. *Arch Public Health, 70*(1), 8. doi:10.1186/0778-7367-70-8

Suri, A., Gan, K., and Carpenter, S. (2007). Voices from the Field: Perspectives from Community Health Workers on Health Care Delivery in Rural KwaZulu-Natal, South Africa. *Journal of Infectious Diseases, 196*(Supplement 3), S505-S511. doi:10.1086/521122

Tessema, M., Belachew, T., and Ersino, G. (2013). Feeding patterns and stunting during early childhood in rural communities of Sidama, South Ethiopia. *The Pan African Medical Journal, 14*.

Tzioumis, E., and Adair, L. S. (2014). Childhood dual burden of under- and over-nutrition in low- and middle-income countries: a critical review. *Food and nutrition bulletin, 35*(2), 230-243.

UNICEF. (1991). Conceptual framework of the causes of malnutrition. *New York: UNICEF*.

UNICEF. (2012). Levels and trends in child malnutrition: joint child malnutrition estimates. Retrieved from https://www.who.int/nutgrowthdb/estimates/en/

UNICEF, and World Health Organization. (2015). A decade of tracking progress for maternal, newborn and child survival: the 2015 report. *Geneva: World Health Organization.* Retrieved from http://countdown2030.org/documents/2015Report/CDReport_2015_ex-profiles_final.pdf

United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. *General Assembley 70 session.* Retrieved from https://www.unfpa.org/resources/transforming-our-world-2030-agenda-sustainable-development

United Nations Children's Fund. (2009). Tracking progress on child and maternal nutrition: a survival and development priority. Retrieved from https://www.unicef.org/publications/index_51656.html

Upadhyay, S., Agarwal, K., and Agarwal, D. (1989). Influence of malnutrition on social maturity, visual motor coordination and memory in rural school children. *The Indian Journal of Medical Research, 90,* 320-327.

Vallières, F., McAuliffe, E., Palmer, I., Magbity, E., and Bangura, A. S. (2012). Supporting and Strengthening maternal, neonatal, and child health services using mobile phones in Sierra Leone: A Research Protocol. *Africa Policy Journal, 8*, 46.

Von, B., and Joachim. (2007). *The world food situation: new driving forces and required actions*: Intl Food Policy Res Inst.

Werner, D. (1981). *The village health worker: lackey or liberator?* : Hesperian Foundation Palo Alto, California, USA.

Whaley, S. E., Sigman, M., Neumann, C., Bwibo, N., Guthrie, D., Weiss, R. E., . . . Murphy, S. P. (2003). The Impact of Dietary Intervention on the Cognitive Development of Kenyan School Children. *The Journal of Nutrition, 133*(11), 3965S-3971S.

WHO, UNICEF., and UNAIDS. (2003). Global strategy for infant and young child feeding. Retrieved from https://www.who.int/nutrition/publications/gs_infant_feeding_text_eng.pdf

World Health Organization. (1989). Strengthening the performance of community health workers in primary health care: report of a WHO Study Group [meeting held in Geneva from 2 to 9 December 1987]. Retrieved from http://www.who.int/workforcealliance/knowledge/resources/who_2015_h4_chws_srmncah.pdf?ua=1

World Health Organization. (2001). *The optimal duration of exclusive breastfeeding: a systematic review*. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/67208/WHO_NHD_01.08.pdf

World Health Organization. (2004). Millennium development goals. Retrieved from https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf

World Health Organization. (2006). The world health report 2006: working together for health. Retrieved from http://www.who.int/whr/2006/whr06_en.pdf

World Health Organization. (2009). Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/44306/9789241599290_eng.pdf

World Health Organization. (2010a). Indicators for assessing infant and young child feeding practices: part 2: measurement. Retrieved from http://whqlibdoc.who.int/publications/2008/9789241596664_eng.pdf?ua=1

World Health Organization. (2010b). World health statistics 2010. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/43895/9789241596664_eng.pdf

World Health Organization. (2014). Vitamin A supplementation in children 6–59 months of age with severe acute malnutrition. *e-Library of Evidence for Nutrition Actions (eLENA)*.

Retrieved from http://www.who.int/ website: http://www.who.int/elena/titles/vitamina_sam/en/

World Health Organization. (2015). Global nutrition targets 2025: childhood overweight policy brief. Retrieved from http://apps.who.int/iris/bitstream/10665/259904/1/9789241513609-eng.pdf

World Vision International. (2015). Kenya's Community Health Workers. Retrieved from https://www.wvi.org/sites/default/files/CHW%20Profile%20Kenya_0.pdf

Wrold Health Organization. (1978). Alma Ata Declaration. Retrieved from https://www.who.int/publications/almaata_declaration_en.pdf

Yousafzai, A. K., Rasheed, M. A., Rizvi, A., Armstrong, R., and Bhutta, Z. A. (2014). Effect of integrated responsive stimulation and nutrition interventions in the Lady Health Worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet, 384*(9950), 1282-1293. doi:10.1016/s0140-6736(14)60455-4

Yousafzai, A. K., Rasheed, M. A., Rizvi, A., Armstrong, R., and Bhutta, Z. A. (2014). Effect of integrated responsive stimulation and nutrition interventions in the Lady Health Worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *The Lancet, 384*(9950), 1282-1293. doi:https://doi.org/10.1016/S0140-6736(14)60455-4

APPENDICES

Appendix A: Informed Consent Forms

Appendix A (i): Parent/Guardian Consent on behalf of child

Child No : _____

Date of Data collection _____

Research Assistant name: _____

TITLE: **Impact of Community Health Workers Services on Nutritional Status and Cognitive Development of Children Aged Less than Two Years in Kisumu County, Kenya**

Researcher:

Caroline Jepkoech Sawe
University of Nairobi
College of Agriculture and Veterinary Sciences
Department of Food Science, Nutrition and Technology
P.O.BOX 29053-00625

NAIROBI
TEL: 254-721-540248
Email: csawe@cartafrica.org

PURPOSE

I kindly request you to allow your child to be part of a study that will help us know the Impact of Community Health Workers and other factors on the nutritional status and the cognitive

development of children in your county. We are interested in finding out how you child grows and eats, how much she/he weighs, how tall she/he is and how she/he is developing.

NUMBER OF CHILDREN TAKING PART IN THE STUDY:

If you agree to have your child take part, she/or he will be one of those who will participate in the study and the following things shall be carried out;

1. Your child will be weighed on a weighing scale with very light clothing, without shoes to see how much they weigh. They will also stand against height or lie against a length board and with my assistance, will gently place a small piece of wood on the top of their head or feet to see how tall they are.
2. With my assistance, I will ask you how frequent your child has eaten certain foods for the previous 30 days.
3. Your child will also be asked to perform some tasks with certain playing dolls, maybe asked to write some few things and requested to do some activities.

All this will not take more than 1 hour of your time.

RISKS / BENEFIS

There are no known dangers from the measurements and questions listed above and there are no direct benefits to the participants in the research, but you will have contributed significantly to knowledge in Public Health and Nutrition.

CONFIDENTIALITY

All information collected by the Investigator or research assistant will be confidential.

QUESTIONS

In case of further questions, comments or complains relating to the research, you can contact the researcher called Caroline Sawe on telephone number 0721-540248

CONSENT

I agree my child to participate in this study and thereby avail myself to be part of the study. I have read through this form and acknowledge receipt of a copy of this informed consent form.

Signature of parent: ……. Date:……

Interviewer signature……Date: ……..

THANK YOU.

Appendix A (ii): mother's Consent for Focus Group Discussion

TITLE: Impact of Community Health Workers and other factors on the Nutritional Status and Cognitive Development of Children in Kisumu County, Kenya

Researcher:

Caroline Jepkoech Sawe
University of Nairobi
College of Agriculture and Veterinary Sciences
Department of Food Science, Nutrition and Technology
P.O.BOX 29053-00625

NAIROBI
TEL: 254-721-540248
Email: csawe@cartafrica.org

PURPOSE

I kindly request you to be part of a study that will help us know the Impact of Community Health Workers and other factors on the nutritional status and the cognitive development of childrens in your county. We are interested in finding the knowledge that you have been taught by the CHWs on issues of nutrition of your children and their development.

This shall be done through a discussion with other seven women from your county.

This will not take more than 1 hour of your time.

RISKS / BENEFIS

There are no known dangers and no direct benefits by participating in this group discussion and the research, but you will have contributed significantly to knowledge in Public Health and Nutrition.

CONFIDENTIALITY

All information collected and recorded by the Investigator or research assistant will be confidential and no one will be victimized by participating in this discussion.

QUESTIONS

In case of further questions, comments or complains relating to the research, you can contact the researcher called Caroline Sawe on telephone number 0721-540248

CONSENT

I agree to participate in this study and thereby avail myself to be part of the discussion. I have read through this form and acknowledge receipt of a copy of this informed consent form.

Signature of parent: ……. Date:……

Interviewer signature……Date: ……..

THANK YOU.

Appendix A (iii): World Vision officers Consent for In Depth Interview

TITLE: Impact of Community Health Workers and other factors on the Nutritional Status and Cognitive Development of Children in Kisumu County, Kenya

Researcher:

Caroline Jepkoech Sawe
University of Nairobi
College of Agriculture and Veterinary Sciences
Department of Food Science, Nutrition and Technology
P.O.BOX 29053-00625

NAIROBI
TEL: 254-721-540248
Email: csawe@cartafrica.org

PURPOSE

I kindly request you to be part of a study that will help us know the Impact of Community Health Workers and other factors on the nutritional status and the cognitive development of children in your county. We are interested in finding the type of training and knowledge on child nutrition and development that you have equipped the CHWs with.

This will not take more than 40 minutes of your time.

RISKS / BENEFIS

There are no known dangers and no direct benefits by participating in this interview but you will have contributed significantly to knowledge in Public Health and Nutrition.

CONFIDENTIALITY

All information collected by the Investigator or research assistant will be confidential.

QUESTIONS

In case of further questions, comments or complains relating to the research, you can contact the researcher called Caroline Sawe on telephone number 0721-540248

CONSENT

I agree to participate in this study and thereby avail myself to be part of it. I have read through this form and acknowledge receipt of a copy of this informed consent form.

Signature of parent: ……. Date:……

Interviewer signature……Date: ……..

THANK YOU.

Appendix B: Social Economic Status Data

Child No : _____ Date of Data collection _____

Research Assistant name: _____ Date of child birth: __ __/ __ __/ __ __

Informant caretaker

1. Marital status of caretaker

   ☐ Single ☐ Married ☐ Divorced/separated ☐ Widowed

2. Occupation Self_____Spouse_____

3. Level of income self-none ☐ 1-999 ☐ 10000-2999 ☐ 3000-3999 ☐ Above 5000 ☐

4. Level of income spouse none ☐ 1-999 ☐ 10000-2999 ☐ 3000-3999 ☐ Above 5000 ☐

5. Level of education Primary ☐ Secondary ☐ Tertiary ☐ None ☐

6. Type of housing Temporary ☐ Semi permanent ☐ Permanent ☐

7. Size of housing Single ☐ Double ☐ 3 rooms and above ☐

8. Rent amount 0 ☐ 1-999 ☐ 10000-2999 ☐ 3000-3999 ☐ Above 5000 ☐

9. Mode of communication Mobile ☐ Airmail ☐ None ☐

10. Number of household members : Adults _____Children_____

11. When did you start complimentary feeds to your child?

    Below 2 months ◯ 3 months ◯ 4 months ◯ 5 months ◯ 6 months ◯ after 6 months ◯

12. When did your child stop breastfeeding

    Below 3 months ◯ 4 to 7 months ◯ 7 to 11 months ◯

    1 and 11/2 years ◯ 11/2 to 2 years ◯ Not yet ◯

Appendix C: Food Frequency Questionnaire

Child No : _____ Date of Data collection _____

Research Assistant name: _____ Date of child birth: __ __/ __ __/ __ _

The following are a list of foods commonly consumed in your community. Think about all the foods that your child has consumed in the past one month and help us fill in the table to the best of your knowledge.

	Food item	**How often food is consumed**							**Key** **A= ¼ plate** **B=1/2 plate** **C=3/4 plate** **D= full plate**	**How much each time**			
		Never	**1/ month**	**2-3 / month**	**1-2 / week**	**3-4 / week**	**5-6 / week**	**Daily**		**A**	**B**	**C**	**D**
1	Beef												
2	Fish												
3	Chicken												
4	Eggs												
5	Milk fresh												
6	Milk fermented												
7	Beans												
8	Kales/ Sukuma wiki												
9	Spinach												
10	Cabbage												
11	Bananas												
12	Avocado												

	Food item	How often food is consumed							Key A= ¼ plate B=1/2 plate C=3/4 plate D= full plate	How much each time			
		Never	1/ month	2-3 / month	1-2 / week	3-4 / week	5-6 / week	Daily		A	B	C	D
13	Mango												
14	Pineapples												
15	Ugali (Maize)												
16	Rice												
17	Sweet potatoes												
18	Irish potatoes												
19	Sorghum porridge												
20	Millet porridge												
21	Chapatti												
22	Bread												
23	Sugar												
24	Salt												
25	Oil												
26	Fat												
	Others												

Food frequency dammies

D C B A

D=800gms C= 400 gms B-400gms A= 200gms

Foods like: Githeri, beans, ndengu, peas, mokimo

D=800gms C= 400 gms B-400gms A= 200gms

Foods like: rice, spagegetti, ugali

D=500gms C= 400 gms B-300gms A= 100gms

Foods like: omena

D=400ml C= 300 ml B-200ml A= 100ml

Beverages and foods like :milk, tea, porridge, soups

Appendix D: Anthropometry Data

CHILD ANTHROPOMETRY FORM

Child No: _____ Child Sex: F__ M ___ Date of Data collection __ __/ __ __/ __ __

Research Assistant name: _____ Date of child birth: __ __/ __ __/ __ __

READING		AVERAGE READING	
length (cm)	_____	_____	_____
Weight (kg)	_____	_____	_____

Appendix E: In-Depth Interview Guide

Research question: **To explore the impact of Community Health Workers on the Nutritional status and Cognitive development of children in Kisumu County.**

Qualitative interview Guide

A. **(Establish Rapport)** [shake hands] My name is _____and am a researcher / Research assistant on the study on the impact of Community Health Workers on nutritional status and cognitive development of children in this County. The interview should take about 45 minutes of your time.

B. **Guide**

Objective	**Question for interview guide**	**Probes**
To explore the type of training being given to CHWs on nutrition and of Children	What kind of nutrition information do you give the CHWs working with the caretakers of children in this program	How frequent is this nutrition information given to the CHWs
To explore the type of training being given to CHWs on cognitive development of Children	What kind of information do you give the CHWs who are working with the caretakers of children in this program on cognitive development	How frequent is this nutrition information given to the CHWs

C. **Closing (Summarize).** I see you teach CHWs the following_____ (Maintain Rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know?

Appendix F: Focus Group Discussion Schedule

A. (Establish Rapport) My name is _____ and am a researcher / Research assistant on the study on the impact of Community Health Workers on nutritional status and cognitive development of children in this County. The interview should take about 45 minutes- 1 hour of your time.

B. Purpose:

1. I could like to know if you work closely with the CHWs in this region

2. What kind of nutrition information they usually teach you?

3. What particular nutrition information do they teach you about children who are under two years?

4. When do you start introducing complementary feeds to children?

5. What knowledge have the CHWs taught you on the cognitive development of your children who are under two years?

6. Do you think there is a relationship between nutrition and cognitive development in children?

C. Closing (Summarize). I understand that the CHWs have taught you on the following_____ (Maintain Rapport) I appreciate the time you took for this discussion. Is there anything else you think would be helpful for me to know?

Appendix G: Bayley Score Children Development Kit

Appendices G (i): 6 Months Worksheet

R.A Name **6 MONTHS WORKSHEET** CHILDREN ID. NO

Child's status: ☐ Language ☐ Language codes 1. Kiswahili 2. English 3.Luhya 4.Luo 6.Migori

Status codes: 1. Child present; 2. Away (child after 3 visits, was unable to be tested because the child was faraway from home); 3. Withdrawn from the study; 4. Child died; 5. Child was unable to do the tests due to reasons other than given above for e.g. child was ill after three visits; 6. Child was uncooperative

Study site ◯ Kisumu ◯ Migori

6 MONTHS: **COGNITIVE ASSESSMENT**

NO.	ACTIVITY		TRIAL	TIME	P/F
C16	Explores object		1	-	
C17	Carries Object to Mouth		1	-	
C18	Inspects Own Hand		1	-	
C20	Responds to Surroundings Series		1	-	
C19	Mirror Image Series Approaches		1	-	
C22	Mirror Image Series Responds positively		1	-	
C26	Bell Series: Manipulates		1	-	
C31	Bell Series: Rings purposely		1	-	
C25	Searches for fallen object		1	-	
C30	Retains Both Blocks		1	3 secs	
C33	Picks Up Block Series: Retains 2 of 3 blocks		1	3 secs	
C37	Picks Up Block Series: 3 Blocks		1	-	
C27	Picks Up Block Series: Reaches for Second Block		1	-	

C28	Pulls cloth to obtain object		1	-	
C21	Persistent reach		1	-	
C24	Bangs in play		1	-	
C23	Plays with string		1	-	

6 MONTHS: **COGNITIVE ASSESSMENT**

NO.	ACTIVITY		TRIAL	TIME	P/F
C29	Pulls string adaptively		1	-	
C32	Looks at pictures	Pic.book	1	-	
C34	Searches for missing objects		1	-	
C35	Takes blocks out of cup		2	-	
C36	Block series: One block		1	2 mins	
FINE MOTOR					
FM12	Grasps suspended ring		2	2 secs	
FM13	Block series: Reaches for block		2	-	
FM14	Block series: Touches block		2	-	
FM15	Block series: Whole hand grasp		2	-	
FM18	Block series: Partial Thumb Opposition		2	-	
FM21	Transfers block		1	-	
FM19	Transfers ring		1	-	
FM22	Block series: Thumb fingertip grasp		2	-	
FM17	Food pellet series: Raking grasp		1	-	
FM20	Food pellet series: Whole hand grasp		1	-	
FM24	Food pellet series: Partial thumb opposition		1	-	
FM26	Food pellet series: Thumb- fingertip grasp		1	-	
FM11	Rotates wrist		1	-	
FM16	Reaches unilaterally		1	-	
FM23	Brings spoons or blocks to midline		1	-	
FM25	Lifts cup by handle		1	-	

6 MONTHS: **COGNITIVE ASSESSMENT**

GROSS MOTOR					
NO.	**ACTIVITY**		**TRIAL**	**TIME**	**P/F**
GM11	Holds head upright when carried		1	-	
GM13	Rights head		1	-	
GM12	Controls head when prone series:45		1	-	
GM15	Elevates trunk when prone series: Elbows and forearms		1	-	
GM17	Controls head while prone 90		1	-	
GM18	Elevates trunk while prone series: Shifts weight		1	-	
GM21	Elevates trunk while prone series: Extended arms		1	-	
GM14	Rolls from side to back		1	-	
GM20	Rolls from back to side		1	-	
GM23	Pulls up to sit		1	-	
GM25	Rolls from back to stomach		1	-	
GM16	Sits with support series :Briefly		1	-	
GM19	Sits with support series: 30 seconds		1	30 sec	
GM22	Sits without support series: 5 seconds		1	5 sec	
GM26	Sits without support series: 30 seconds		1	30 sec	
GM27	Sits without support and holds objects		1	-	
GM28	Rotates trunk while seated		1	-	

6 MONTHS: **COGNITIVE ASSESSMENT**

NO.	ACTIVITY		TRIAL	TIME	P/F
GM32	Moves from sitting to hands and knees		1	-	
GM29	Makes stepping movements		1	-	
GM30	Crawls series: On stomach		1	-	
GM31	Crawls series: Crawl position		1	-	
GM33	Supports weight		1	-	
GM34	Crawls series: Crawl movements		1	-	
GM37	Walk series: with support		1	-	
GM39	Sits down with control		1	-	
GM40	Stands alone		1	-	

Appendix G (ii) 12 months' worksheet

R.A Name **12 MONTHS WORKSHEET**

CHILDREN ID. NO

Child's status: ☐ ☐

Language

Language codes 1. Kiswahili 2. English 3.Luhya 4.Luo 6.Migori

Status codes: 1. Child present; 2. Away (child after 3 visits, was unable to be tested because the child was faraway from home); 3. Withdrawn from the study; 4. Child died; 5. Child was unable to do the tests due to reasons other than given above for e.g. child was ill after three visits; 6. Child was uncooperative

Study site ◯ Kisumu ◯ Migori

Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C25	Searches for fallen object		1	-	
C28	Pulls cloth to obtain object		1	-	
C29	Pulls string adaptively		1	-	
C34	Searches for missing objects		2	-	
C40	Finds hidden object	-- -- L R / -- -- L R	2	-	
C43	Clear Box (Front)		1	20 secs	
C26	Bell Series; Manipulates		1	-	
C31	Bell Series; Rings purposely		1		
C27	Picks up blocks series: Reaches for second block		1	-	
C30	Retains both blocks		1	3 sec	
C33	Picks up blocks: Retains 2 of 3 blocks		1	-	
C37	Picks up blocks series: 3 blocks		1		
C35	Takes blocks out of cup		1	2 mins	
C36	Block Series: One block		1	-	

C38	Explores holes in pegboard		1	-	
C42	Removes pellet		3	-	
C39	Pushes car		1	-	

12 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C44	Squeezes object		1	-	
C32	Looks at pictures	Picture bk	1	-	
C41	Suspends ring		1	-	
RECEPTIVE LANGUAGE					
RL9	Responds to name			-	
RL10	Interrupts activity			-	
RL12	Responds to No- No			-	
RL8	Sustained play with object			60 secs	
RL13	Attends to other's play routine	Tickling		60 secs	
RL14	Responds to request for social routines	Bye;bye		-	
RL11	Recognizes 2 familiar words	Ball, baby		-	
EXPRESSIVE LANGUAGE					
EL3	Vocalizes mood	Crying smiling	1	-	
EL4	Undifferentiated nasal sound	Mm,nn		-	
EL5	Social vocalizing or laughing			-	
EL6	2 Vowel sounds	Aa, ee		-	
EL10	Consonant – Vowel combination series: 1 combination	Baba, gaga		-	
EL13	Consonant – Vowel combination series: 4 combination	Baba,fafa,ga ga		-	

EL12	Jabbers expressively			-	
EL7	Gets attention			-	
EL15	Directs attention to others			-	

12 months: Cognitive Assessment Worksheet

NO.	ACTIVITY		TRIAL	TIME	P/F
EL9	Uses gestures	Pointing, reaching		-	
EL11	Participates in play routine	Rolling ball		-	
EL16	Imitates word				
EL14	Uses one-word approximations			-	
FINE MOTOR					
FM19	Transfers ring			-	
FM23	Brings spoons or blocks to midline			-	
FM25	Lifts cup by handle			-	
FM20	Food pellet series: Whole hand grasp			-	
FM24	Food pellet series: Partial thumb opposition			-	
FM26	Food pellet series: Thumb finger tip grasp			-	
FM28	Grasp series: Palmer grasp	Cube		-	
FM30	Scribbles spontaneously			-	
FM21	Transfers block			-	
FM22	Block series: Thumb fingertip grasp		2	-	
FM27	Turns pages of book	Pic.bk		-	
FM29	Isolates extended index finger			-	

Appendix G (iii) 18 months' worksheet

R.A Name **12 MONTHS WORKSHEET**

CHILDREN ID. NO

Child's status: ☐ ☐
Language
Language codes 1. Kiswahili 2. English 3.Luhya 4.Luo 6.Migori

Status codes: 1. Child present; 2. Away (child after 3 visits, was unable to be tested because the child was faraway from home); 3. Withdrawn from the study; 4. Child died; 5. Child was unable to do the tests due to reasons other than given above for e.g. child was ill after three visits; 6. Child was uncooperative

Study site ◯ Kisumu ◯ Migori

Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C25	Searches for fallen object		1	-	
C28	Pulls cloth to obtain object		1	-	
C29	Pulls string adaptively		1	-	
C34	Searches for missing objects		2	-	
C40	Finds hidden object	-- -- L R | -- -- L R	2	-	
C43	Clear Box (Front)		1	20 secs	
C26	Bell Series; Manipulates		1	-	
C31	Bell Series; Rings purposely		1		
C27	Picks up blocks series: Reaches for second block		1	-	
C30	Retains both blocks		1	3 sec	
C33	Picks up blocks: Retains 2 of 3 blocks		1	-	
C37	Picks up blocks series: 3 blocks		1		
C35	Takes blocks out of cup		1	2 mins	
C36	Block Series: One block		1	-	
C38	Explores holes in pegboard		1	-	
C42	Removes pellet		3	-	

18 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C44	Squeezes object		1	-	
C32	Looks at pictures	Picture bk	1	-	
C41	Suspends ring		1	-	
RECEPTIVE LANGUAGE					
RL9	Responds to name			-	
RL10	Interrupts activity			-	
RL12	Responds to No- No			-	
RL8	Sustained play with object			60 secs	
RL13	Attends to other's play routine	Tickling		60 secs	
RL14	Responds to request for social routines	Bye;bye		-	
RL11	Recognizes 2 familiar words	Ball, baby		-	
EXPRESSIVE LANGUAGE					
EL3	Vocalizes mood	Crying smiling	1	-	
EL4	Undifferentiated nasal sound	Mm,nn		-	
EL5	Social vocalizing or laughing			-	
EL6	2 Vowel sounds	Aa, ee		-	
EL10	Consonant – Vowel combination series: 1 combination	Baba, gaga		-	
EL13	Consonant – Vowel combination series: 4 combination	Baba,fafa,ga ga		-	
EL12	Jabbers expressively			-	
EL7	Gets attention			-	
EL15	Directs attention to others			-	

18 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
EL9	Uses gestures	Pointing, reaching		-	
EL11	Participates in play routine	Rolling ball		-	
EL16	Imitates word				
EL14	Uses one-word approximations			-	
FINE MOTOR					
FM19	Transfers ring			-	
FM23	Brings spoons or blocks to midline			-	
FM25	Lifts cup by handle			-	
FM20	Food pellet series: Whole hand grasp			-	
FM24	Food pellet series: Partial thumb opposition			-	
FM26	Food pellet series: Thumb finger tip grasp			-	
FM28	Grasp series: Palmer grasp	Cube		-	
FM30	Scribbles spontaneously			-	
FM21	Transfers block			-	
FM22	Block series: Thumb fingertip grasp		2	-	
FM27	Turns pages of book	Pic.bk		-	
FM29	Isolates extended index finger			-	

Appendix G (iv) 24 months' worksheet

R.A Name **24 MONTHS WORKSHEET**

CHILDREN ID. NO

Child's status: ☐ ☐

Language

Language codes 1. Kiswahili 2. English 3.Luhya 4.Luo 6.Migori

Status codes: 1. Child present; 2. Away (child after 3 visits, was unable to be tested because the child was far away from home); 3. Withdrawn from the study; 4. Child died; 5. Child was unable to do the tests due to reasons other than given above for e.g. child was ill after three visits; 6. Child was uncooperative

Study site ◯ Kisumu ◯ Migori

Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C40	Finds hidden object -- -- -- -- L R L R	Bracelet +2 wash cloths	2	-	
C45	Finds hidden object (Reversed) -- -- -- -- L R L R	Bracelet+2 Washcloths	2	-	
C50	Finds hidden object (Visible displacement) -- -- -- -- L R L R		2	-	
C48	Relational play series: Self (doll, plastic cups, spoons, ball, washcloth and blocks)		1	-	
C53	Relational play series: Others (doll, plastic cups, spoons, ball, washcloth and blocks)		1	-	
C65	Representational Play (doll, plastic cups, spoons, ball, washcloth and blocks)		1	-	
C67	Imitates a two step Action (duck and spoon)		3	-	
C69	Imaginary Play (doll, plastic cups, spoons, ball, washcloth and blocks)		1	-	
C71	Multi scheme Combination Play (doll, plastic cups, spoons, ball, washcloth and blocks)				
C70	Understands the concept of one (3 blocks)		1	5 secs.	
C47	Pegboard Series: 2 holes		3	70 sec. Per trial	
C55	Pegboard series : 6 pegs		3	70 secs. Per trial	
C62	Completes pegboard : 25 seconds		1	25 secs.	
C51	Blue Board series : 1 piece		1	150 sec	
C58	Blue Board series : 3 pieces		1	180 sec	
C66	Blue Board Series: completes (75 seconds)		1	75 sec	
FM31	Block stacking Series : 2 blocks		3	-	

FM38	Block Stacking series:6 Blocks		3	-	

24 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
FM44	Builds a train of blocks (10 blocks)		1	-	
FM50	Builds wall (8 blocks)		1	-	
FM52	Builds bridge (6 blocks)		1	-	
FM56	Builds T (10 blocks)		1	-	
FM58	Builds steps (12 blocks)		1	-	
C49	Pink Board:1 piece		1	180 “	
C56	Pink Board completes		1	180”	
C60	Rotated Pink Board		1	-	
FM32	Imitates stroke series: Random		1	-	
FM40	Imitates stroke series: horizontal		1	-	
FM41	Imitates stroke series: vertical		1	-	
FM43	Imitates stroke series: circular		1	-	
FM33	Places 10 pellets in bottle		1	60”	
FM63	Places 20 pellets in bottle			15”	
FM36	Connecting Blocks apart		1	-	
FM42	Connecting Blocks together		1	-	
FM34	Grasp Series: Transitional Grasp		1	-	
FM37	Grasp Series: Intermediate (Tripod grasp)		1	-	
FM48	Grasp Series: Dynamic grasp		1	-	
FM60	Imitates square		1	-	

FM53	Imitates plus sign		1	-	
FM45	Strings 3 blocks		1	-	
FM57	Buttons 1 button		1	-	
FM35	Coins in slot		1	-	

24 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
C46	Removes lid from box		1	-	
C52	Clear Box sides		1	20”	
C57	Uses pencil to get object (pencil and small duck)		2	-	
C59	Attends to story (story book)		1	-	
C68	Matches 3 colors (stimulus book Pg.25)		1	-	
C76	Discriminates pictures (stimulus book pg27-37)		1	-	
C80	Discriminates sizes (stimulus book Pg39-43)		1	-	
C88	Classifies objects(stimulus bookPg69-73)		1	-	
C72	Concept grouping color		1	-	
C77	Simple pattern (big and little ducks)		1	-	
C78	Sort pegs by color 4 red pegs, 4 blue pegs, 4 yellow pegs and 3 plastic cups		1	-	
C79	Counts one to one correspondence (5 Blocks)		1	-	
C85	Counts (cardinality) (10 blocks) How many blocks are there? Are there 11 blocks?		1	-	
C86	Number Constancy – How many blocks are there? How many blocks are there now?	Correct if both are correct	1	-	
C73	Concept grouping: Size (big and little ducks)		1	-	
C75	Matches size (big red duck, big blue duck and little yellow duck)		1	-	
C74	Compares masses (2 big blue ducks)		1	-	
C89	Understands the concept of more (9 blocks, 1 red disc, and 2 red pegs				
C87	Laces card				
RL10	Interrupts activity (while child is playing call him)		1	-	
RL12	Responds to No-No (when he reaches an object say no –no		1	-	
RL18	Understands inhibitory words (duck swimming, turns –Wait)		1	-	

RL13	Attends to other's play routine (tickling)		1	-	
RL14	Responds to request for social routine (bye bye)		1	-	

24 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
RL15	Identifies object series: 1 correct Story book, plastic cup, spoon, small ball +doll		1	-	
RL19	Identifies object series: 3 correct		1	-	
EL20	Names object series :1 object		1	-	
EL27	Names object series :3 objects		1	-	
RL16	Identifies object in the environment (bottle, shoe)		1	-	
RL17	Identifies picture series: 1 correct	Pic.bk 1-5	1	-	
RL21	Identifies picture series: 3 correct	Pic.bk 1-5	1	-	
EL22	Names Picture Series:1 correct	Pic.Bk.10-15	1	-	
EL28	Names Picture Series:5 pictures	Pic.bk 10-15	1	-	
RL20	Follows one part directions-Feed doll, wipe doll's nose, comb hair	2 correct	1	-	
RL25	Follows Two part directions Get the doll and give it to me, Get the car and push it.	Follows one part	1	-	
RL22	Identifies 3 clothing items-Shoes, socks, shirt, pants, hat	3	1	-	
RL24	Identifies 5 parts of the body –doll, hair, eyes, nose, mouth, ears, head, hands, feet	5	1	-	
RL23	Identifies Action Picture series: 1correct	Pic.bk 6-9	1	-	
RL26	Identifies Action Picture Series: 3 correct	Pic.bk.6-9	1	-	
RL29	Identifies Action Picture Series: 5 correct	Pic.bk.6-9	1	-	
EL31	Names Action Picture Series: 1 picture	Pic.bk 16-21	1	-	
EL35	Names Action Picture Series: 3 pictures	Pic.bk 16-21	1	-	
EL37	Names Action Picture Series: 5 pictures	Pic.bk 16-21	1	-	

RL27	Understands the use of objects 3 Correct 3 correct	St.Bk.pg.79	1	-	
RL28	Understands Part/Whole Relationships 3 correct	St.bk. pg.81	1	-	
RL31	Understands labels for sizes: 2 correct	St.bk. pg.83	1	-	

24 months: Cognitive Assessment Worksheets

NO.	ACTIVITY		TRIAL	TIME	P/F
RL35	Identifies colors : 4 correct	St.bk. pg.95	1	-	
EL41	Names 4 colors:	St.bk. pg.159	1	-	
RL36	Understands the label of one	St.bk pg.97	1	-	
RL40	Understands more	St.Bk pg109-111	1	-	
RL41	Understands most	St.bk. pg.113-115			
RL32	Understands prepositions series: 2 correct On, through, around, against (cup with handle, shoelace and block with hole)		1	-	
RL42	Understands prepositions series: 4 correct On, through, around, against (cup with handle, shoelace and block with hole)		1	-	
EL18	Uses words appropriately:2 words				
EL23	Uses words appropriately: 8 words				
EL19	Uses words to make wants known				
EL24	Answers yes or no verbally to questions Do you like uji? Do you want the car? Do you have a toy?	2 correct	1	-	
EL29	Uses Multiple word utterances	2	1	-	

Appendix H Institutional Research and Ethical Committee Approval

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/5/9

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2015/226
Approval Number: 0001567

3rd February, 2016

Ms. Caroline J. Sawe,
University of Nairobi,
College of Agriculture & Veterinary Sciences,
Department of Food Science, Nutrition & Technology,
P.O. Box 29053-00625,
NAIROBI-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
APPROVED
P.O. Box 4606 ELDORET

Dear Ms. Sawe,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Impact of Community Health Workers and Other Influencing Factors on Nutritional Status and Cognitive Development of Infants in Kisumu County, Kenya."

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1567*** on 3rd February, 2016. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 2nd February, 2017. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc Director - MTRH Dean - SOP Dean - SOM
Principal - CHS Dean - SON Dean - SOD

Appendix I Relationship between weight for age and independent variables in Intervention site

Variable	Nutritional status at Intervention site (n=101)					Statistics	
	Severely Underweight	Moderately Underweight	Not underweight	Overweight	Severely Overweight	chi^2	P-value
Sex							
Female	0.00	3.92	82.35	9.80	3.92		
male	2.00	4.00	76.00	12.00	6.00	1.4812	0.83
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Age group (months)							
< 6	0.00	0.00	95.00	5.00	0.00		
6-12	3.33	10.00	66.67	10.00	10.00		
13-18	0.00	3.23	83.87	12.9	0.00	14.2959	0.282
19-24	0.00	0.00	75.00	15.00	10.00		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Exclusive breastfeeding (Months)							
< 3	0.00	0.00	100.00	0.00	0.00		
4-5	4.55	4.55	63.64	22.73	4.55		
6	0.00	6.25	81.25	6.25	6.25	27.1309	0.04
> 6	0.00	0.00	33.33	50.00	16.67		
Still BF	0.00	0.00	100.00	0.00	0.00		
Total	**0.99**	**3.96**	**9.21**	**10.89**	**4.95**		
When Stopped BF (Months)							
< 6	0.00	50.00	0.00	50.00	0.00		
6-12	0.00	0.00	100.00	0.00	0.00		
13-18	0.00	0.00	81.82	18.18	0.00	19.0726	0.265
18-24	0.00	0.00	100.00	0.00	0.00		
Still BF	1.23	3.70	79.01	9.88	6.17		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Caretaker's marital status							
Single	0.00	0.00	86.36	4.55	9.09		
Married	1.27	5.06	77.22	12.66	3.80	3.5881	0.465
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Caretaker's education							
≤ Primary	1.82	3.64	78.18	10.91	5.45		
Secondary	0.00	0.00	83.87	9.68	6.45	6.5998	0.58
Tertiary	0.00	13.33	73.33	3.33	0.00		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Caretaker's Income level (Ksh)							
<3000	0.00	2.50	80.00	12.50	5.00	6.8284	0.145

>3001	4.76	9.52	76.19	4.76	4.76		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Father's Income level							
<3000	1.54	3.08	76.92	12.31	6.15		
>3001	0.00	5.56	83.33	8.33	2.78	1.9029	0.754
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
House type							
Semi-permanent	0.00	5.13	79.49	10.26	5.13	0.876	0.928
Permanent	1.61	3.23	79.03	11.29	4.84		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Rent amount (Ksh)							
None	0.00	0.00	95.45	4.55	0.00		
<3000	1.64	4.92	75.41	9.84	8.20	9.0155	0.341
>3001	0.00	5.56	72.22	22.22	0.00		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Mother own phone							
Yes	1.08	4.30	79.57	10.75	4.30		
No	0.00	0.00	75.00	12.50	12.5	1.4704	0.832
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		

Appendix J Relationship between Weight for Age indice with dependent variables in Intervention site

Variable	Nutritional status at Intervention site (n=101)					Statistics	
	Severely Underweight	Moderately Underweight	Normal	Overweight	Severely Overweight	chi^2	P-value
Cognitive scores							
Below average	5.88	11.76	82.35	0.00	0.00	11.8875	0.156
Average	0.00	3.08	78.46	12.31	6.15		
Above average	0.00	0.00	78.95	15.79	5.26		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		
Energy intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	12.2595	0.14
Adequate	0.00	5.71	7.29	12.86	7.14		
Inadequate	6.25	0.00	81.25	12.50	0.00		
Total	0.99	3.96	79.21	10.89	4.95		
Protein intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	10.8039	0.213
Adequate	0.00	9.09	11.36	11.36	4.55		
Inadequate	2.38	0.00	76.19	14.29	7.14		
Total	0.99	3.96	79.21	10.89	4.95		
Fat intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	8.1836	0.416
Adequate	0.00	6.98	76.74	9.30	6.98		
Inadequate	2.33	2.33	74.42	16.28	4.65		
Total	0.99	3.96	79.21	10.89	4.95		
Iron intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	15.3124	0.053
Adequate	0.00	10.26	79.49	5.13	5.13		
Inadequate	2.13	0.00	72.34	19.15	6.38		
Total	0.99	3.96	79.21	10.89	4.95		
Vitamin A intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	11.2188	0.190
Adequate	0.00	5.63	76.06	12.68	5.63		
Inadequate	6.67	0.00	73.33	13.33	6.67		
Total	**0.99**	**3.96**	**79.21**	**10.89**	**4.95**		

Appendix K Relationship between weight for age indice with independent variables in comparative site

Variable	Nutritional status at Comparative site (n=91)					Statistics	
	Severely Underweight	Moderately Underweight	Not underweight	Overweight	Severely Overweight	chi^2	P-value
Sex							
Female	0.00	17.39	71.74	6.52	4.35	5.3379	0.254
male	4.44	17.78	75.56	0.00	2.22		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Age group (months)							
< 6	0.00	15.79	78.95	0.00	5.26	15.374	0.222
6-12	7.41	11.11	81.48	0.00	0.00		
13-18	0.00	26.92	61.54	3.85	7.69		
19-24	0.00	15.79	73.68	10.53	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Exclusive breastfeeding							
< 3 months	16.67	0.00	83.33	0.00	0.00	13.998	0.301
4-5 months	2.50	15.00	80.00	0.00	2.50		
6 months	0.00	20.93	67.44	6.98	4.65		
> 6 months	0.00	0.00	0.00	0.00	0.00		
Still BF	0.00	50.00	50.00	0.00	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Stopped BF							
< 6 months	5.13	15.38	74.36	0.00	5.13	18.755	0.282
6-12months	0.00	23.33	70.00	6.67	0.00		
13-18months	0.00	10.00	80.00	10.00	0.00		
18-24 months	0.00	0.00	66.67	0.00	33.33		
Still BF	0.00	22.22	77.78	0.00	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Mother's marital status							
Single	0.00	10.26	87.18	0.00	2.56	7.6472	0.105
Married	3.85	23.08	63.46	5.77	3.85		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Mother's education							
≤ Primary	0.00	21.43	78.57	0.00	0.00	10.386	0.239
Secondary	4.44	22.22	68.89	0.00	4.44		
Tertiary	0.00	9.38	78.13	9.38	3.13		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Caretaker's Income level (Ksh)							

<3000	3.85	7.69	84.62	0.00	3.85	4.3053	0.366
>3001	1.54	21.54	69.23	4.62	3.08		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Father's Income level							
<3000	3.70	2.96	79.63	0.00	3.70	8.0775	0.089
>3001	0.00	24.32	64.86	8.11	2.70		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Rent amount (Ksh)							
None	0.00	17.07	78.05	4.88	0.00	10.718	0.218
<3000	7.69	11.54	73.08	0.00	7.69		
>3001	0.00	25.00	66.67	4.17	4.17		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
House Type							
S-permanent	3.03	16.67	74.24	1.52	4.55	4.3338	0.363
Permanent	0.00	20.00	72.00	8.00	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Caretaker Own phone							
Yes	2.22	17.78	73.33	3.33	3.33	0.3622	0.985
No	0.00	0.00	100.00	0.00	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		

Appendix L Relationship between weight for Age indice and dependent variables on comparative site

Variable	Nutritional status at Comparative site (n=91)					Statistics	
	Severely Underweight	Moderately Underweight	Not underweight	Overweight	Severely Overweight	chi^2	P-value
Cognitive scores							
Below average	0.00	32.26	61.29	0.00	6.45	11.788	0.161
Average	3.57	10.71	78.57	5.36	1.79		
Above average	0.00	0.00	100.00	0.00	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Energy intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	9.5855	0.295
Adequate	2.30	18.39	73.56	2.30	3.45		
Inadequate	0.00	0.00	66.67	33.33	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Protein intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	1.1113	0.997
Adequate	0.00	0.00	100.00	0.00	0.00		
Inadequate	2.20	18.39	72.73	3.41	3.41		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Fat intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	6.1040	0.636
Adequate	2.35	18.82	72.94	3.53	2.35		
Inadequate	0.00	0.00	80.00	0.00	20.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Iron intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	0.7325	0.999
Adequate	0.00	0.00	100.00	0.00	0.00		
Inadequate	2.25	17.98	73.03	3.37	3.37		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		
Vitamin A intake							
Still B/F	0.00	0.00	100.00	0.00	0.00	3.2722	0.916
Adequate	1.35	18.92	72.97	2.70	4.05		
Inadequate	6.25	2.50	75.00	6.25	0.00		
Total	**2.22**	**17.58**	**73.63**	**3.33**	**3.33**		

Appendix M Relationship between stunting and independent variables in study sites

Nutritional status at Intervention site (n=101)				Nutritional status at Comparative site (n=91)		
Variable	**Severely Stunted**	**Moderately stunted**	**Not stunted**	**Severely Stunted**	**Moderately stunted**	**Not stunted**
Child's Sex						
Female	1.96	5.88	92.16	13.04	15.22	71.74
male	4.00	0.00	96.00	2.22	20.00	77.78
Total	**2.97**	**2.97**	**94.0)**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=3.3343, p=0.189			Chi^2=3.8697, p = 0.144		
Child's Age group						
< 6 months	5.00	0.00	95.00	15.79	0.00)	84.21
6-12 months	6.67	6.67	86.67	11.11	14.81	74.07
13-18 months	0.00	3.23	96.77	3.85	26.92	69.23
19-24 months	0.00	0.00	100.00	0.00	26.32	73.68
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=6.0227, p=0.421			Chi^2= 9.9020, p = 0.129		
Exclusive breastfeeding						
< 3 months	0.00	0.00	100.00	16.67	16.67	66.67
4-5 months	4.55	4.55	90.91)	7.50	15.00	77.5
6 months	4.17	0.00	95.83	6.98	20.93	72.09
> 6 months	0.00	0.00	100.00	0.00	0.00	0.00
Still BF	0.00	10.53	89.47	0.00	0.00	100.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=7.0807, p= 0.528			Chi^2=1.8971, p= 0.929		
Breastfeeding duration						
< 6 months	0.00	50.00	50.00	2.56	20.51	76.92
6-12months	0.00	0.00	100.00	10.00	13.33	76.67
13-18months	0.00	0.00	100.00	10.00	30.00	60.00
18-24 months	0.00	0.00	100.00)	0.00	33.33	66.67
Still BF	3.70	2.47	93.83	22.22	0.00	77.78
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=16.7174, p=0.033			$Chi^{2=}$8.0602, p = 0.428		
Caretaker's marital status						
Single	4.55	4.55	90.91	7.69	12.82	79.49
Married	2.53	2.53	94.94	7.69	21.15	71.15
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=0.4996, p=0.779			Chi^2=1.0873, p=0.581		
mother's education						

≤ Primary	3.64	3.64	92.73	21.43	14.29	64.29
Secondary	3.23	3.23	93.55	4.44	20.00	75.56
Tertiary	0.00	0.00	100.00	6.25	15.63	78.13
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=1.1365, p= 0.888			Chi^2=7014, p=0.319		
mother's income level (Ksh)						
<3000	3.75	2.50	93.75	3.85	15.38	80.77
>3001	0.00	4.76	95.24	9.23	18.46	72.31
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=1.0779, p= 0.583			Chi^2=0.9779, p=0.613		
Father's Income level (Ksh)						
<3000	3.08	3.08	93.85	5.56	14.81	79.63
>3001	2.78	2.78	94.44	10.81	21.62	67.57
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=0.0148, p = 0.993			Chi^2=1.7944, p=0.408		
Type of Housing						
Semi-permanent	2.56	0.00	97.44	7.58	16.67	75.76
Permanent	3.23	**4.84**	91.94	8.00	20.00	72.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=1.9994, p=0.368			Chi^2=0.1531, p = 0.926		
Rent pay (Ksh)						
None	4.55	0.00	95.45	4(9.76)	5(12.2)	78.05
<3000	3.28	4.92	91.80	2(7.69)	7(26.92)	65.38
>3001	0.00	0.00	100.00	1(4.17)	4(16.67)	79.17
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=2.8103, p=0.590			Chi^2=3.0208, p=0.554		
mother own Phone						
Yes	2.15	3.230	94.62	7.78	17.78	74.44
No	12.5	0.00	87.5	0.00	0.00)	100.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=2.9542, p=0.228			Chi^2=0.3420, p=0.843		

Appendix N Relationship between stunting and dependent variables in study sites.

	Prevalence of stunting at study sites					
	Intervention site (n=101)			Comparative site (n=91)		
Variable	**Severely Stunted**	**Moderately stunted**	**Not stunted**	**Severely Stunted**	**Moderately stunted**	**Not stunted**
Cognitive scores						
Below average	11.76	0.00	88.24	9.68	2.90	77.42
Average	1.54	3.08	95.38	7.14	21.43	71.43
Above average	0.00	5.26	94.74	0.00	0.00	100.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2=6.3576, p = 0.17			Chi^2=2.5025, P= 0.644		
Energy intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	4.48	4.48	91.04	7.78	17.78	74.44
Inadequate	0.00	0.00	100.00	0.00	0.00	0.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2= 3.2371, p= 0.519			Chi^2= 0.3420, p= 0.843		
Protein intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	6.82	2.27	90.91	50.00	0.00	50.00
Inadequate	0.00	4.76	95.24	6.82	18.18	75.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2= 4.9668, p= 0.291			Chi^2= 5.6136, p= 0.230		
Fat intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	0.00	6.98	93.02	8.24	18.82	72.94
Inadequate	6.98	0.00	93.02	0.00	0.00	100.00
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2= 8.1591, p= 0.086			Chi^2= 2.1727, p= 0.704		
Iron intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	7.69	2.56	89.74	0.00	0.00	100.00
Inadequate	0.00	4.26	95.74	7.87	17.98	74.16
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2= 5.6454, p= 0.227			Chi^2= 0.6917, p= 0.952		
Vitamin A intake						
Still B/F	0.00	0.00	100.00	0.00	0.00	100.00
Adequate	4.23	4.23	91.65	5.41	18.92	75.68
Inadequate	0.00	0.00	100.00	18.75	12.50	68.75
Total	**2.97**	**2.97**	**94.06**	**7.69**	**17.58**	**74.73**
Statistics	Chi^2= 2.6953, p= 0.610			Chi^2= 3.7803, p= 0.437		

Appendix P Relationship between wasting and independent variables

Variable	Nutritional status at Intervention site (n=101)			Nutritional status at Comparative site (n=91)		
	Severely wasted	**Moderately wasted**	**Not wasted**	**Severely wasted**	**Moderately wasted**	**Not wasted**
Child's sex						
Female	1.96	3.92	94.12	13.04	8.70	78.26
Male	4.00	8.00	88.00	11.11	11.11	77.78
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=1.164, p= 0.559			Chi^2=0.2051, p=0.903		
Child's Age group						
< 6 months	15.00	15.00	70.00	5.26	15.79	78.95
6-12 months	0.00	6.67	93.33	11.11	7.41	81.48
13-18 months	0.00	0.00	0.00	15.00	70.00	73.08
19-24 months	15.00	15.00	70.00	5.26	15.79	78.95
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=17.7899, p=0.007			Chi^2=2.6492, p=0.851		
Exclusive breastfeeding						
< 3 months	0.00	0.00	100.00	33.33	0.00	66.67
4-5 months	0.00	4.55	95.45	7.50	10.00	82.5
6 months	2.08	4.17	93.75	11.63	11.63	76.74
> 6 months	0.00	0.00	100.00	0.00	0.00	0.00
Still BF	10.53	15.79	73.68	50.00	0.00	50.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=9.7505, p= 0.283			Chi^2=6.6578, p= 0.354		
Breastfeeding duration						
< 6 months	0.00	0.00	100.00	12.82	5.13	82.05
6-12months	0.00	0.00	100.00	10.00	16.67	73.33
13-18months	0.00	0.00	100.00	20.00	10.00	70.00
18-24 months	0.00	0.00	100.00	0.00	0.00	100.00
Still BF	3.70	7.41	88.89	11.11	11.11	77.78
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=2.4396, p=0.964			Chi^2=4.0446, p=0.853		
Caretaker's marital status						
Single	4.55	9.09	86.36	5.13	10.26	84.62
Married	2.53	5.06	92.41	17.31	9.62	73.08
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=0.7738, p= 0.679			Chi^2=3.1244, p=0.210		
Caretaker's education						
≤ Primary	3.64	7.27	89.09	1.14	14.29	78.57
Secondary	3.23	3.23	93.55	17.78	8.89	73.33

Tertiary	0.00	6.67	93.33	6.25	9.38	84.38
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=1.1497, p=0.886			Chi^2=3.0112, p=0.556		
mother's income level (Ksh)						
<3000	2.50	3.75	93.75	3.85	3.85	92.31
>3001	4.76	14.29	80.95	15.38	12.31	72.31
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=3.6936, p= 0.158			Chi^2=4.3420, p= 0.114		
Father's Income level (Ksh)						
<3000	0.00	7.69	92.31	7.41	12.96	79.63
>3001	8.33	2.78	88.89	18.92	5.41	75.68
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=6.3883, p= 0.041			Chi^2=3.7189, p=0.156		
Type of Housing						
Semi-permanent	7.69	5.13	87.18	10.61	10.61	78.79
Permanent	0.00	6.45	93.55	16.00	8.00	76.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=4.9464, p=0.084			Chi^2=0.5790, p= 0.749		
Rent pay (Ksh)						
None	4.55	0.00	95.45	9.76	14.63	75.61
<3000	3.28	9.84	86.89	3.85	11.54	84.62
>3001	0.00	0.00	100.00	25.00	0.00	75.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=4.9937, p=0.288			Chi^2=8.5372, p = 0.074		
mother own Phone						
Yes	3.23	6.45	90.32	12.22	10.00	77.78
No	0.00	0.00	100.00	0.00	0.00	100.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	chi=0.8499, p= 0.654			Chi^2=0.2848, p= 0.867		

Appendix Q Relationship between wasting and other dependent variables in study sites

Variable	Nutritional status at Intervention site (n=101)			Nutritional status at Comparative site (n=91)		
	Severely wasted	**Moderately wasted**	**Not wasted**	**Severely wasted**	**Moderately wasted**	**Not wasted**
Cognitive scores						
Below average	5.88	23.53	70.59	19.35	22.58	58.06
Average	3.08	3.08	93.85	8.93	3.57	87.50
Above average	0.00	0.00	100.00	0.00	0.00	100.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2=12.9355, p= 0.012			Chi^2=12.4795, p=0.014		
Energy intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	0.00
Adequate	1.49	2.99	95.52	12.22	10.00	77.78
Inadequate	0.00	5.26	94.74	0.00	0.00	0.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2= 13.6257, p= 0.009			Chi^2=2.6492, p=0.851		
Protein intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	2.27	4.55	95.35	0.00	50.00	50.00
Inadequate	0.00	2.38	95.35	12.50	9.09	78.41
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2= 13.9740, p= 0.007			Chi^2=4.0490, p=0.399		
Fat intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	2.33	2.33	95.35	12.94	10.59	76.47
Inadequate	0.00	4.65	95.35	0.00	0.00	100.00
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2= 13.9716, p= 0.007			Chi^2=1.8094, p=0.771		
Iron intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	2.56	5.13	92.31	0.00	0.00	100.00
Inadequate	0.00	2.13	97.87	12.36	10.11	77.53
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2= 14.2517, p= 0.007			Chi^2= 0.5760, p= 0.966		
Vitamin A intake						
Still B/F	13.33	20.00	66.67	0.00	0.00	100.00
Adequate	1.41	2.82	95.77	13.51	10.81	75.68
Inadequate	0.00	6.67	93.33	6.25	6.25	87.50
Total	**2.97**	**5.94**	**91.09**	**2.09**	**9.89**	**78.02**
Statistics	Chi^2= 13.7842, p= 0.008			Chi^2=1.3713, p=0.849		

Appendix R Relationship between cognitive scores and independent variables in study sites

	Cognitive scores in study sites					
	Intervention site (n=101)			Comparative site (n=91)		
Variable	**Below average**	**Average**	**Above average**	**Below average**	**Average**	**Above average**
Child's Sex						
Female	13.73	66.67	19.61	34.78	60.87	4.35
Male	20.00	62.00	18.00	33.33	62.22	4.44
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=0.7107, p=0.701			Chi^2=0.0213, p=0.989		
Child's Age group						
< 6 months	25.00	65.00	10.00	42.11	57.89	0.00
6-12 months	26.67	66.67	6.67	33.33	62.96	3.70
13-18 months	9.68	54.84	35.48	38.46	53.85	7.69
19-24 months	5.00	75.00	20.00	21.05	73.68	5.26
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=13.7108, p=0.033			Chi^2=3.7520, p=0.710		
Exclusive breastfeeding						
< 3 months	16.67	50.00	33.33	16.67	83.33	0.00
4-5 months	18.18	59.09	22.73	42.5	55.00	2.50
6 months	14.58	66.67	18.75	27.91	65.12	6.98
> 6 months	0.00	83.33	16.67	50.00	50.00	0.00
Still BF	26.32	63.16	10.53	16.67	83.33	0.00
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=4.4201, p=0.817			Chi^2=4.2004, p=0.650		
Breastfeeding duration in months						
< 6	0.00	100.00	0.00	33.33	64.1	2.56
6-12	0.00	100.00	0.00	36.67	56.67	6.67
13-18	0.00	54.55	45.45	50.00	50.00	0.00
18-24	0.00	75.00	25.00	0.00	66.67	33.33
Still BF	20.99	62.96	16.05	22.22	77.78	0.00
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=10.9452, p=0.205			Chi^2=10.1758, p=0.253		
Caretaker's marital status						
Single	22.73	54.55	22.73	35.9	61.54	2.56
Married	15.19	67.09	17.72	32.69	61.54	5.77
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=1.2307, p=0.540			Chi^2=0.5880, p=0.745		
Caretaker's education						

≤ Primary	20.00	61.82	18.18	35.71	57.14	7.14
Secondary	12.90	67.74	19.35	37.78	60.00	2.22
Tertiary	13.33	66.67	20.00	28.13	65.63	6.25
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=0.8717, p=0.92			Chi^2=1.6471, p=0.800		
mother's income level (Ksh)						
<3000	17.50	65.00	17.5	34.62)	61.54	3.85
>3001	14.29	61.90	23.81	33.85)	61.54	4.62
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=0.4789, p= 0.787			Chi^2=0.0282, p=0.986		
Father's Income level (Ksh)						
<3000	20.00	55.38	24.62	33.33	62.96	3.70
>3001	11.11	80.56	8.33	35.14	59.46	5.41
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=6.6334, p=0.036			Chi^2=0.2094, p=0.901		
Type of Housing						
Semi-permanent	17.95	61.54	20.51	34.85	62.12	3.03
Permanent	16.13	66.13	17.74	32.00	60.00	8.00
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=0.2232, p=0.894			Chi^2=1.0752, p=0.584		
Rent pay (Ksh)						
None	9.09	72.73	18.18	29.27	60.98	9.76
<3000	19.67	62.30	18.03	38.46	61.54	0.00
>3001	16.67	61.11	22.22	37.5	62.50	0.00)
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=1.5208, p=0.823			Chi^2=5.3913, p=0.249		
Caretaker own Phone						
Yes	16.13	63.44	20.43	34.44	61.11	4.44
No	25.00	75.00	0.00	0.00	100.00	0.00
Total	**16.83**	**64.36**	**18.81**	**34.07**	**61.54**	**4.40**
Statistics	Chi^2=2.1317, p=0.344			Chi^2=0.6319, p=0.729		

Appendix S Relationship between cognitive scores and dependent variables in study sites

	Intervention site (n=101)			Comparative site (n=91)		
Variable	**Below average**	**Average**	**Above average**	**Below average**	**Average**	**Above average**
Wasting						
Severely wasted	33.33	66.67	0.00	54.55	45.45	0.00
Moderately stunted	66.67	33.33	0.00	77.78	22.22	0.00
Not stunted	13.04	66.30	20.65	25.35	68.01	5.63
Statistics	Chi^2=12.9355, p=0.012			Chi^2=12.479, p=0.014		
Energy intake						
Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	11.43	67.14	21.43	34.48	60.92	4.60
Inadequate	25.00	56.25	18.75	33.33	66.67	0.00
Statistics	Chi^2=5.9981, p=0.199			Chi^2=0.7881, p=0.940		
Protein intake						
Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	15.91	68.18	15.91	100.00	0.00	0.00
Inadequate	5(11.90)	26(61.90)	26.19	32.95	62.50	4.55
Statistics	Chi^2=5.8270, p=0.212			Chi^2=4.5456, p=0.337		
Fat intake						
Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	6.98	72.09	20.93	34.12	61.18	4.71
Inadequate	20.83	58.14	20.33	40.00	60.00	0.00
Statistics	Chi^2=7.4207, p=0.115			Chi^2=0.9189, p=0.922		
Iron intake						
Still B/F	33.33	60.00	6.67	0.00)	100.00	0.00
Adequate	20.51	64.10	15.38	100.00	0.00	0.00
Inadequate	8.51	65.96	25.53	33.71	61.80	4.49
Statistics	Chi^2=7.2854, p=0.122			Chi^2=2.5668, p=0.633		
Vitamin A intake						
Still B/F	33.33	60.00	6.67	0.00	100.00	0.00
Adequate	15.49	63.38	21.13	35.14	60.81	4.04
Inadequate	6.67	73.33	20.00	31.25)	62.50	6.25
Statistics	Chi^2=5.0554, p=0.282			Chi^2=0.8407, p=0.933		

Appendix T Multinomial Regression Analysis for underweight and overweight

Weight-for-Age Z scores	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
UNDERWEIGHT						
Cognitive scores						
Below average	1 (base)					
Average	0.194	0.115	-2.75	0.006	0.06	0.624
Above average	8.03	0.000	-0.01	0.992	0	.
Duration of exclusive breastfeeding						
< 3 months	1 (base)					
4-5 months	1.1384	1.470	0.1	0.92	0.091	14.304
6 months	2.2176	2.870	0.62	0.538	0.175	28.026
> 6 months	1.5479	0.002	0	0.999	0	.
Still BF	0.3521	0.628	-0.59	0.558	0.011	11.588
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	0.7394	0.611	-0.37	0.715	0.147	3.731
13-18months	0.1097	0.162	-1.5	0.134	0.006	1.973
18-24 months	0.0000	0.000	-0.01	0.995	0	.
Still BF	0.9233	0.941	-0.08	0.938	0.125	6.804
Caretaker's level of income (Ksh)						
<3000	1 (base)					
>3001	7.3650	5.562	2.64	0.008	1.676	32.355
Caretaker's Highest education						
≤ Primary	1 (base)					
Secondary	1.6399	1.173	0.69	0.489	0.404	6.661
Tertiary	0.4226	0.375	-0.97	0.332	0.074	2.405
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.5513	0.938	0.73	0.468	0.474	5.073
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.9059	0.654	-0.14	0.891	0.22	3.732
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	1.3016	0.957	0.36	0.72	0.308	5.498
>3001	1.3729	1.054	0.41	0.68	0.305	6.18
Caretaker owns phone						
Yes	1 (base)					
No	0.0000	0.001	-0.01	0.995	0	.
Size of housing						
Single	1 (base)					
Double	1.5574	1.147	0.6	0.548	0.368	6.598

≥3 rooms	3.6101	2.806	1.65	0.099	0.787	16.561
Site						
Intervention	1 (base)					
Comparative	1.1449	1.296	0.12	0.905	0.125	10.521
_Constant	**0.0487**	**0.088**	**-1.67**	**0.096**	**0.001**	**1.705**
Not underweight	**(BASE OUTCOME)**					
OVERWEIGHT						
Cognitive scores						
Below average	1 (base)					
Average	3.0343	2.549	1.32	0.186	0.585	15.742
Above average	2.7630	2.955	0.95	0.342	0.34	22.479
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	1.4280	1.615	0.31	0.753	0.156	13.112
13-18months	2.7566	3.485	0.8	0.423	0.231	32.855
18-24 months	0.2125	0.403	-0.82	0.414	0.005	8.725
Still BF	4.2101	4.722	1.28	0.2	0.467	37.925
Caretaker's level of income (Ksh)						
<3000	1 (base)					
>3001	0.4663	0.402	-0.88	0.377	0.086	2.531
Caretaker's Highest education						
≤ Primary	1 (base)					
Secondary	0.4131	0.302	-1.21	0.227	0.098	1.734
Tertiary	1.926538 1.541822		0.82	0.413	0.401	9.247
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.1235	0.653	0.2	0.841	0.36	3.509
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.7471	0.487	-0.45	0.655	0.208	2.683
Amount of rent parents pay						
None	1 (base)					
<3000	4.0800	3.335	1.72	0.085	0.822	20.254
>3001	2.8813	2.417	1.26	0.207	0.557	14.918
Caretaker owns phone						
Yes	1 (base)					
No	1.8451	1.837	0.62	0.538	0.262	12.991
Size of housing						
Single	1 (base)					

Double	0.4046	0.276	-1.33	0.185	0.106	1.541
≥3 rooms	1.3792	1.031	0.43	0.667	0.319	5.968
Site						
Intervention	1 (base)					
Comparative	0.4608	0.521	-0.69	0.493	0.05	4.221
_Constant	**0.0000**	**0.000**	**-0.01**	**0.993**	**0**	**.**

Appendix U Multinomial Regression Analysis for stunting

Height-for-Age Z	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
SEVERELY STUNTED						
Cognitive scores						
Below average	1 (base)					
Average	0.290	0.247	-1.45	0.146	0.055	1.537
Above average	0.000	0.000	-0.01	0.996	0.000	.
Duration of exclusive breastfeeding						
< 3 months	1 (base)					
4-5 months	0.595	0.898	-0.34	0.731	0.031	11.476
6 months	0.648	0.984	-0.29	0.775	0.033	12.706
> 6 months	0.000	0.014	0	0.999	0.000	.
Still BF	0.000	0.000	0	0.997	0.000	.
mother's level of income (Ksh)						
<3000	1 (base)					
>3001	0.678	0.777	-0.34	0.734	0.072	6.415
mother's Highest education						
≤ Primary	1 (base)					
Secondary	0.324	0.327	-1.12	0.264	0.045	2.345
Tertiary	0.074	0.112	-1.72	0.086	0.004	1.445
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	3.247	3.013	1.27	0.204	0.527	20.015
Type of housing						
Semi-permanent	1 (base)					
Permanent	2.335	2.558	0.77	0.439	0.273	19.989
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	1.225	1.258	0.2	0.844	0.163	9.177
>3001	0.142	0.204	-1.36	0.175	0.008	2.382
Caretaker owns phone						
Yes	1 (base)					
No	3.931	5.681	0.95	0.344	0.231	66.779
Size of housing						
Single	1 (base)					
Double	0.636	0.641	-0.45	0.654	0.088	4.587
≥3 rooms	2.483	2.617	0.86	0.388	0.315	19.588
Site						
Intervention	1 (base)					
Comparative	0.022	0.041	-2.01	0.044	0.001	0.902
_Constant	0.208	0.453	-0.72	0.471	0.003	14.793

MODERATELY STUNTED

Cognitive scores						
Below average	1 (base)					
Average	1.864	1.303	0.89	0.373	0.474	7.339
Above average	0.630	0.930	-0.31	0.754	0.035	11.367
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	0.652	0.538	-0.52	0.605	0.130	3.285
13-18months	1.317	1.386	0.26	0.793	0.168	10.356
18-24 months	5.593	9.107	1.06	0.29	0.230	136.015
Still BF	0.000	0.000	-0.01	0.992	0.000	.
Caretaker's level of income (Ksh)						
<3000	1 (base)					
>3001	3.034	2.335	1.44	0.149	0.671	13.709
Caretaker's Highest education						
≤ Primary	1 (base)					
Secondary	1.459	1.275	0.43	0.665	0.263	8.091
Tertiary	1.014	1.041	0.01	0.989	0.136	7.581
Father's level of income (Ksh)						
<3000	1 (base)					
>3001	1.570	1.160	0.61	0.542	0.369	6.685
Type of housing						
Semi-permanent	1 (base)					
Permanent	2.624	2.125	1.19	0.234	0.537	12.831
Amount of rent parents pay						
None	1 (base)					
<3000	9.205	8.685	2.35	0.019	1.448	58.506
>3001	0.858	0.750	-0.18	0.861	0.155	4.763
Caretaker owns phone						
Yes	1 (base)					
No	0.000	0.001	0	0.997	0.000	.
Size of housing						
Single	1 (base)					
Double	2.608	2.011	1.24	0.214	0.575	11.824
≥3 rooms	0.604	0.496	-0.61	0.539	0.121	3.019
Site						
Intervention	1 (base)					
Comparative	0.159	0.196	-1.49	0.136	0.014	1.787
_cons	**0.023**	**0.047**	**-1.82**	**0.069**	**0.000**	**1.347**
Not stunted	**(BASE OUTCOME)**					

Appendix V Multinomial Regression Analysis for wasting

Weight -for-Age Z scores	RRR	Std. Err	Z	p value	[95% Conf. Interval]	
SEVERELY WASTED						
Cognitive scores						
Below average	1 (base)					
Average	0.192	0.163	-1.95	0.05	0.04	1.01
Above average	0.000	0.000	-0.01	0.99	0	.
Duration of Exclusive breastfeeding						
< 3 months	1 (base)					
4-5 months	0.008	0.014	-2.69	0.01	0	0.27
6 months	0.028	0.045	-2.24	0.03	0.05	2.64
> 6 months	0.000	0.000	0	1	0	.
Still BF	0.428	0.784	-0.46	0.64	0.01	15.49
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	0.300	0.372	-0.97	0.33	0.03	3.4
13-18months	2.491	4.122	0.55	0.58	0.1	63.82
18-24 months	0.000	0.000	0	1	0	.
Still BF	0.431	0.771	-0.47	0.64	0.01	14.41
Caretaker's level of income (Ksh)						
<3000	1 (base)					
>3001	7.515	7.430	2.04	0.04	1.08	52.18
Caretaker's Highest education						
≤ Primary	1 (base)					
Secondary	3.314	3.784	1.05	0.29	0.35	31.06
Tertiary	0.146	0.229	-1.23	0.22	0.01	3.17
Father's level of income (Ksh)						
>3001	1 (base)					
<3000	8.135	7.782	2.19	0.03	1.25	53.04
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.103	0.114	-2.05	0.04	0.01	0.91
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	0.736	0.839	-0.27	0.79	0.08	6.86
>3001	2.920	2.940	1.06	0.29	0.41	21
Caretaker owns phone						
Yes	1 (base)					

No	0.000	0.001	0	1	0	.
Size of housing						
Single	1 (base)					
Double	1.247	1.302	0.21	0.83	0.16	9.66
≥3 rooms	1.712	1.852	0.5	0.62	0.21	14.27
Site						
Intervention	1 (base)					
Comparative	0.648	0.976	-0.29	0.77	0.03	12.4
_Constant	**1.207**	**2.703**	**0.08**	**0.93**	**0.01**	**97.2**
MODERATELY LY WASTED						
Cognitive scores						
Below average	1 (base)					
Average	0.008	0.011	-3.47	0	0	0.12
Above average	0.000	0.000	-0.01	0.99	0	.
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	4.123	6.369	0.92	0.36	0.2	85.15
13-18months	2.992	6.225	0.53	0.6	0.05	176.56
18-24 months	1.836	15360.720	0	1	0	.
Still BF	6.680	14.710	0.86	0.39	0.09	500.16
Caretaker's level of income (Ksh)						
<3000	1 (base)					
>3001	0.552	92.195	2.52	0.01	2.46	13.318
Caretaker's Highest education						
≤ Primary	1 (base)					
Secondary	2.336	2.456	0.81	0.42	0.3	18.34
Tertiary	2.930	3.766	0.84	0.4	0.24	36.39
Father's Level of Income						
<3000	1 (base)					
>3001	0.092	0.108	-2.03	0.04	0.01	0.93
Type of housing						
Semi-permanent	1 (base)					
Permanent	2.246	2.595	0.7	0.48	0.23	21.62
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	0.790	0.876	-0.21	0.83	0.09	6.95
>3001	0.000	0.000	-0.01	0.99	0	.
Size of housing						

Single	1 (base)					
Double	0.860	1.024	-0.13	0.9	0.08	8.87
≥3 rooms	3.757	4.585	1.08	0.28	0.34	41.07
Site						
Intervention	1 (base)					
Comparative	1.127	2.693	0.05	0.96	0.01	121.73
_Constant	**0.000**	**0.000**	**-0.01**	**0.99**	**0**	**.**
Not wasted	(base outcome					

Appendix W Multinomial Regression Analysis for cognitive development

Cognitive level	RRR	Std. Err.	Z	p-value	[95% Conf. Interval]	
BELOW AVERAGE						
Under/over weight						
Severely underweight	1 (base)					
Moderately underweight	2.639	4.117	0.62	0.534	0.124	56.151
Not underweight	1.763	2.754	0.36	0.717	0.082	37.677
Moderately overweight	0.000	0.000	-0.01	0.996	0	.
Severely overweight	4.124	7.530	0.78	0.438	0.115	147.758
Wasting						
Severely wasted	1 (base)					
Moderately wasted	3.201	3.057	1.22	0.223	0.493	20.804
Normal	0.318	0.292	-1.25	0.213	0.053	1.926
Stunting						
Severely Stunted	1 (base)					
Moderately Stunted	0.302	0.320	-1.13	0.259	0.038	2.418
Not stunted	0.456	0.371	-0.97	0.334	0.093	2.242
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	1.683	1.112	0.79	0.431	0.461	6.147
13-18months	2.598	2.343	1.06	0.29	0.444	15.213
18-24 months	5.791	0.000	0	0.997	0	.
Still BF	1.381	1.100	0.4	0.686	0.289	6.585
Duration of Exclusive breastfeeding						
< 3 months	1 (base)					
4-5 months	2.261	2.214	0.83	0.405	0.332	15.413
6 months	0.938	0.929	-0.07	0.948	0.135	6.532
> 6 months	0.000	0.001	0	0.997	0	.
Still BF	1.639	1.840	0.44	0.66	0.182	14.795
mother's level of income (Ksh)						
<3000	1 (base)					
>3001	0.605	0.328	-0.93	0.354	0.209	1.75
mother's Highest education						
≤ Primary	1 (base)					
Secondary	0.864	0.467	-0.27	0.786	0.299	2.492
Tertiary	0.865	0.565	-0.22	0.825	0.241	3.111
Father's level of income (Ksh)						
>3001	1 (base)					
<3000	0.850	0.402	-0.34	0.731	0.336	2.148
Type of housing						
Semi-permanent	1 (base)					

Permanent	0.808	0.387	-0.45	0.655	0.316	2.065
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	2.067	1.142	1.32	0.188	0.701	6.101
>3001	3.367	1.995	2.05	0.04	1.055	10.753
Size of housing						
Single	1 (base)					
Double	1.277	0.624	0.5	0.617	0.49	3.325
≥3 rooms	0.732	0.430	-0.53	0.596	0.232	2.315
Caretaker owns a phone						
Yes	1 (base)					
No	1.685	1.595	0.55	0.581	0.264	10.776
Site						
Intervention	1 (base)					
Comparative	0.390	0.299	-1.23	0.219	0.087	1.752
_Constant	**0.721**	**1.478**	**-0.16**	**0.873**	**0.013**	**40.034**
AVERAGE	**(base outcome)**					
ABOVE AVERAGE						
Under/over weight						
Severely underweight	1 (base)					
Moderately underweight	0.095	718.012	0	1	0	.
Not underweight	442942.800	3.091	0	0.999	0	.
Moderately overweight	764109.100	5.331	0	0.998	0	.
Severely overweight	616404.400	4.301	0	0.998	0	.
Wasting						
Severely wasted	1 (base)					
Moderately wasted	0.739	4110.076	0	1	0	.
Normal	7622292.000	2.771	0	0.997	0	.
Stunting						
Severely Stunted	1 (base)					
Moderately Stunted	6818474.000	2.961	0	0.997	0	.
Not stunted	9779567.000	4.251	0	0.997	0	.
When stopped breastfeeding						
< 6 months	1 (base)					
6-12months	2.559	3.476	0.69	0.489	0.179	36.664
13-18months	6.277	9.664	1.19	0.233	0.307	128.309
18-24 months	11.832	19.357	1.51	0.131	0.479	292.169
Still BF	1.717	2.613	0.36	0.722	0.087	33.891
Duration of Exclusive breastfeeding						
< 3 months	1 (base)					
4-5 months	0.584	0.631	-0.5	0.619	0.07	4.858
6 months	0.790	0.774	-0.24	0.81	0.116	5.39

> 6 months	0.133	0.233	-1.15	0.25	0.004	4.147
Still BF	0.584	0.737	-0.43	0.67	0.049	6.924
mother's level of income (Ksh)						
<3000	1 (base)					
>3001	1.706	1.201	0.76	0.448	0.429	6.778
Mother's Highest education						
≤ Primary	1 (base)					
Secondary	0.906	0.600	-0.15	0.881	0.247	3.32
Tertiary	1.620	1.372	0.57	0.569	0.308	8.524
Father's level of income (Ksh)						
>3001	1 (base)					
<3000	0.253	0.172	-2.03	0.043	0.067	0.955
Type of housing						
Semi-permanent	1 (base)					
Permanent	0.802	0.505	-0.35	0.726	0.233	2.755
Amount of rent parents pay (Ksh)						
None	1 (base)					
<3000	0.910	0.607	-0.14	0.887	0.246	3.361
>3001	0.544	0.432	-0.77	0.443	0.115	2.575
Size of housing						
Single	1 (base)					
Double	1.112	0.673	0.18	0.861	0.34	3.639
≥3 rooms	0.417	0.359	-1.02	0.309	0.077	2.251
Site						
Intervention	1 (base)					
Comparative	5.399	6.431	1.42	0.157	0.523	55.733
Constant	**0.000**	**0.000**	**-0.01**	**0.996**	**0**	**.**