UNDERNUTRITION AND ITS ASSOCIATED FACTORS IN PRE-SCHOOL CHILDREN IN ASEMBO, SIAYA COUNTY, KENYA

TERRY WATIRI KOMO

MASTER OF SCIENCE

(Epidemiology)

JOMO KENYATTA UNIVERSITY OF

AGRICULTURE AND TECHNOLOGY

2021

Undernutrition and its associated factors in pre-school children in Asembo, Siaya County, Kenya

Terry Watiri Komo

A thesis submitted in partial fulfilment of the Requirements for the degree of Master of Science in Epidemiology of the Jomo Kenyatta University of Agriculture and Technology

2021

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature…….....Date …….

Terry Watiri Komo

This thesis has been submitted for examination with our approval as university supervisors

Signature…….....Date …….

Dr. Daniel Mokaya, PhD

JKUAT, Kenya

Signature…….....Date …….

Ms. Caroline Patricia Musita

JKUAT, Kenya

DEDICATION

I dedicate this thesis to my son Kyle, my friend Kevin Mark Muchemi and my parents Peter Komo and Grace Wanjiku.

ACKNOWLEDGEMENT

I would like to acknowledge the following people who have been instrumental to the finalizing of my thesis and towards the completion of my graduate degree.

My sincere gratitude goes to my supervisors; Dr. Daniel Mokaya and Ms. Caroline Musita who have been nothing but supportive in my work. I know that I would not have gotten this far, were it not for their push and input. Given another chance, I would still choose them as my supervisors.

I am also very grateful to the entire public health department and faculty. All the lecturers were very dedicated in their work, hence enabling us to learn well and complete our master's program.

My work would not be possible to complete without the assistance and guidance of one Mr. Jack Asillah, who is the Siaya County ECD coordinator. It was through him that I got the go ahead to do my study in the nursery schools in Asembo. He also gave me an easy entry into the schools.

I really do acknowledge the support, assistance and motivation accorded to me by my friends and colleagues. All the input and suggestions towards my thesis have gone a long way to ensure that I complete this thesis.

Last but not least, I sincerely thank our good God for his mercies all through; for giving me the grace to live through the completion of this thesis and for good health and strength to allow me to study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS

ARI	Acute Respiratory Infection
FAO	Food and Agricultural Organization
HAZ	Height-for-Age Z-score
IQ	Intellectual Quotient
KDHS	Kenya Demographic Health Survey
MDGs	Millennium Development Goals
MOH	Ministry of Health
SD	Standard Deviation
SSA	Sub-Saharan Africa
STATA	Statistics and Data
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
WASH	Water and Sanitation Health
WAZ	Weight-for-Age Z score
WHZ	Weight-for-Height Z score
WHO	World Health Organization

DEFINITION OF TERMS

Academic performance	Refers to how good or bad a child rates in arithmetic skills, language skills and school attendance.
Malnutrition	Refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. It includes undernutrition; stunting (low height for age), wasting (low weight for height), underweight (low weight for age), micronutrient deficiencies and over nutrition; overweight and obesity.
Undernutrition	Nutritional deficiency resulting from insufficient food intake, lack of food or the inability of the body to convert or absorb it. The key indicators of undernutrition and those which will be used in this study are stunting, wasting and underweight. (WHO, 2016)
Stunting	Low height-for-age; It represents past or chronic malnutrition or illness, but is less sensitive to temporary food shortages.
Wasting	Low weight-for-height; Wasting is sensitive to temporary food shortages and episodes of illness and commonly used as an indicator of current nutritional status.
Under weight	Low weight-for-age; It reflects the cumulative and acute exposures and body mass relative to chronological age. It is influenced by both the height of the child (height-for-age) and his or her weight (weight-for-height)

WHO Z-scores	These indicate the magnitude of malnutrition categorized as below -3 severely undernourished, -3 to -2 moderately undernourished, -2 to -1 mildly undernourished, more than -1 Normal nutritional status

ABSTRACT

Approximately half of all demises in children below 5 years of age in low-to-middle-income countries (LMICs) are attributed to undernutrition. Despite efforts to curb undernutrition, it's still a major public health problem in Kenya. The study aimed to determine the prevalence of undernutrition in 3-5-year-old children in public nursery schools in Asembo and to establish factors associated with undernutrition. The study adopted a school-based cross-sectional design. A sample size of 160 children was estimated but only 152 consented to participate. The dependent variables were Wasting, stunting and underweight, while the independent variables were demographic characteristics, socio-economic characteristics, child morbidity and immunization status and WASH practices. Univariate and multivariate logistic regressions were used to determine factors associated with undernutrition. Children aged 36-47 months were 56(36.8%) while those aged 48-60 months were 96 (63.2%). The mean age of caregivers was 29.9 years with a range of 20-62 years. Majority of the caregivers 117 (77.0%) had reached primary level in education. The prevalence of undernutrition was 15.1%. The prevalence of wasting, stunting and underweight was 2.6%, 9.2% and 3.3% respectively. Children who had had diarrhoea 2 weeks preceding the interview, had 8.7 more odds of being wasted and 7.4 more odds of being underweight than those who did not have diarrhoea. Children from the richest quintile had 0.7 less odds of being stunted than children from the poorest wealth quintile. The study found that the prevalence of undernutrition in Asembo was relatively low based on the WHO prevalence threshold classification, although the prevalence of wasting in Asembo was notably higher than the prevalence of the whole of Siaya County as reported in KDHS 2014.Diarrhoeal episode as a risk factor for wasting and underweight concurs with several studies conducted in low-to-middle-income countries such as Nigeria, Somalia, Uganda and Ethiopia. The finding that children from poorer quintiles were more likely to be stunted as compared to those from richer quintile concurs with studies conducted in several LMICs. In conclusion, the prevalence of undernutrition in pre-school children in Asembo was lower than the Kenya national prevalence levels, diarrhoea and belonging to poorer quintiles are factors associated with undernutrition in nursery school children in Asembo. The study recommends that routine anthropometric screening be introduced in nursery schools to identify otherwise healthy children who may be suffering from undernutrition to allow for prompt corrective actions. The study further recommends for regular health education to parents and teachers on ways of preventing diarrhoea which was positively associated with wasting and underweight.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Malnutrition denotes to shortages, excesses or imbalances in a person's consumption of energy or nutrients. The term covers two expansive groups of conditions which are undernutrition and overnutrition. Overnutrition is a form of malnutrition arising from excessive intake of food leading to accumulation of body fat that impairs health, while undernutrition is a lack of adequate energy, protein and micronutrients to meet basic requirements for body maintenance, growth and development (Luchuo *et al.*, 2013).

According to the WHO classification of child undernutrition, children with a Z-score below -2 SD of the Weight for Height (WHZ), Height for Age (HAZ) and Weight for Age (WAZ) are classified as wasted, stunted and underweight correspondingly (World Health Organization, 2016).

Stunting refers to low height for age; when a child is short for his age. This signifies past or chronic malnutrition or illness, but is less sensitive to momentary food scarcities. Wasting refers to low weight for height; when a child is thin for his height. Wasting is sensitive to temporary food scarcities and episodes of sickness and frequently used as a pointer of present nutritional status. Underweight refers to low weight for age; when a child can be either thin or short for his age. This reflects a combination of chronic and acute undernutrition (Leilei *et al*., 2014).

Undernutrition is one of the main public health problems all over the world. An estimated 41 million children under the age of 5 years are overweight or obese, while some 159 million are stunted and 50 million are wasted. (WHO, 2016). In developing countries currently, undernutrition is attributed to more than 41% of the annual mortalities in children between the ages between 6 to 24 months accounting to

approximately 2.3 million deaths. In overall children of 5 years and below, undernutrition is linked with an estimate of 60% of the 10.9 million annual deaths. (Ibid)

Globally it is estimated that one in every three kindergarten children is undernourished. Among the general populations, the most frequently observed to have undernutrition are women, children and the elderly, whereas among the children, preschool age is an important stage of life where nutrition plays an important role and has long lasting effects in the later years of life (Khattak, 2015).

By 2014, worldwide undernutrition estimation rates indicated that 35.7% of kindergarten children in developing countries were underweight, 42.9% were stunted, and 9.2% were wasted (Pius, 2014).

Undernutrition among children in third world countries is a major public health concern since it places a hefty problem on already underprivileged communities (Luchuo *et al*., 2013).

Diseases and undernutrition are closely related; occasionally infection is the result of malnutrition, sometimes it is an underwriting factor. Undernutrition stops children from attaining their full physical and mental potential. Health and physical effects of protracted conditions of undernutrition among children are: delay in their physical development and mental development, lower intellectual quotient (IQ), greater behavioral challenges, wanting social skills and amplified vulnerability to contracting diseases (Yasser *et al.*, 2016).

Undernutrition reduces immunological capacity to defend against diseases and recurrent infections in children and this in turn deprive the body from essential nutrients. this leads to the dismal growth of children which adversely affect the child's mental and physical development and, learning capacity (Partha *et al.,* 2019).

Adequate nutrition is indispensable during childhood to guarantee healthy growth, proper organ development and function, a versatile immune system and neurological and

cognitive development. Nutritional status has a major consequence on children's survival mainly due to the synergistic association between malnutrition and diseases. Linear growth retardation (stunting) is often connected with frequent exposure to unfavorable economic conditions, improper hygiene, and the interactive effects of poor nutrient intake and infection (WHO, 2016).

Nutrition is an endogenous factor that affects the learning ability and skills of children at school. The relationship between nutrition and school performance has been an interest to many researchers due to the frequent observation of poor school performance among malnourished students. Cognitive development and brain physiology among children requires access to sufficient and nutrient rich foods. Undernutrition adversely affects school attendance, academic performance and social skills among children (Abebe *et al.,* 2016).

A study conducted in Nigeria established that an underweight child is thrice more likely to have delay in language skill compared to a well-nourished counterpart and is five times as likely to have delay in interactive social skills (Adenike *et al*., 2017). Compared with normal-weight children, undernutritioned children are more apathetic and they tend to explore their environment less. The mechanism by which this happens has been associated with overall negative influence of malnutrition on the central nervous system, resulting either directly to the child being unable to properly receive and interact with information from the environment or indirectly by showing behaviours not consistent with stimulation from the environment (Laus *et al*., 2011). Some interactive social skills children adopt as they grow include empathy, participation in group activities, generosity, helpfulness, communicating with others, negotiating, and problem-solving. An underweight child who is regularly irritable, depressed or aggressive is not likely to develop these social skills effectively. This has negative influence on later academic success as the development of social skills builds the foundation for academic achievement as well as work-related skills later in life (McClelland *et al*., 2013).

The causative agents of childhood malnutrition are varied, multidimensional and interrelated. An analytical framework recommended by the United Nations Children's Fund (UNICEF) categorizes the causes into a) immediate causes: nadequate dietary consumption and illness b) underlying causes: insufficient access to food in a household; inadequate health care services and unhygienic environment; and inadequate household level care for children and women and c) basic causes: inadequate current and potential social level resources. In sub-Saharan Africa, numerous pointers of social economic status have been associated with children's nutritional status such as maternal and paternal educational level, parental revenue, and family assets (Zaida *et al*, 2014).

Enhancing the educational level of parents particularly mothers on nutrition, hygiene and common disease prevention practices should logically reduce the malnutrition related morbidity and deaths. It is said that the path to the child's stomach is through the mind of the mother. Quality of food taken, choices and quantity are all depend on the mother or caregiver. Musgrove et al points to 3 important ways that lack of knowledge and inadequate education contribute to malnutrition. First people may have very little knowledge about vitamins or nutrients and they don't eat even the cheap and available ones and Secondly, ignorance about disease causes and its side effects. Cure and prevention options may be most of the time very accessible and affordable. Poor hygienic conditions and the inability to control some intestinal parasites have serious consequences in competing for nutrients with the host, causing anemia and suppressing appetite. Thirdly, some people might not know how to care for their infant children as they might underrate healthy practices like breastfeeding, providing vitamins and other micronutrient rich foods to their children. Women's education improvements have influenced by far the most, accounting for 43% between 1970 and 1995 while improvement in per capita food accessibility contributed about 26% (Mahaama, 2014).

Increasing variable rainfall patterns are likely to affect the supply of fresh water. A lack of safe water can compromise hygiene and increase the risk of diarrheal disease. In extreme cases, water scarcity leads to drought and famine. According to the World Health Organization, various major killers such as diarrheal diseases,malnutrition,

malaria and dengue fever are highly climate associated and are anticipated to rise as the climate changes increase (Luchuo *et al*., 2013).

Tackling undernutrition is directly related to the achievement of MDG1 (eliminating hunger), MDG4 (reducing child mortality). The achievement of many of these goals in human development hinges upon elimination of undernutrition, as it impacts on health, productivity and educational achievement (Awah *et al*., 2013). Educational level of women, maternal ages, marital status, availability of tap water and latrines have been reported to be influence malnutrition. Childhood undernutrition is represented by contextual impacts over and above likely compositional impacts that urban rural differentials are mainly explained by the socioeconomic standards of communities and households, that childhood undernutrition occurs more often among children from poorer households and/ or poorer communities and that living in deprived communities has an independent effect in some instances. Socioeconomic inequalities in childhood undernutrition are more pronounced in urban centers than in rural areas. (Ibid)

The Ministry of Health (MoH) in Kenya is keen to ensure there is appropriate legislation to raise the profile of nutrition coordination. However, legislation and commitment alone are not enough. The Health Cabinet Secretary in 2016 noted a need for the government to transform the political commitments for action into on-the-ground actions; which would entail sustained support for strategies that promote good maternal nutrition, optimal breastfeeding, complementary feeding, early detection and management of illness and acute malnutrition and improved water, sanitation and hygiene (Mailu, 2016).

1.2 Statement of the Problem

Undernutrition in pre-school children is a substantial problem and has been acknowledged by the WHO as the most lethal form of malnutrition; indirectly or directly causes an annual death of at least 5 million children worldwide (Abolfazl *et al.*, 2013). Inadequate nutrition during childhood leads to unhealthy growth, improper organ formation and functioning, a weak immune system and poor neurological and cognitive

development. Undernutrition inhibits children from reaching their full physical and mental potential (WHO, 2016).

One of the challenges faced in the fight against undernutrition in Kenya is the low understanding of linkage between national food security, basic education, water and hygiene strategies on one hand and nutrition on the other. It is therefore, of high importance to alert policy makers and programmers on the causal factors of malnutrition and influence them to address malnutrition in an all-inclusive approach and broad manner (National Nutrition Action Plan 2012-2017).

The factors leading to undernutrition are varied and change in space and time. Interventions to curb undernutrition need to be innovative and versatile to achieve this goal. One of the proposed strategies in Kenya is to institutionalize the fight against undernutrition. In lieu of this, there are a considerable number of studies on prevalence and risk factors for undernutrition in pre-school children in Kenya that are community based but very few are school based and therefore important to have data on the nutrition status of children and the predictors, that is school-based to allow for comparability with similar studies from other countries.

1.3 Justification

Undernutrition among Kenya's children is a serious problem and occurs throughout the country. Yearly, more than 70,000 Kenyan children perish before their 5^{th} birthday; malnutrition contributes to nearly half of these deaths. According to KDHS 2014, about a quarter (25%) of children under five years of age are stunted in Siaya County, a prevalence that is higher than the average of the entire Nyanza region whose prevalence was 23%. Similarly, the prevalence of underweight children in Siaya (7.8%) was reportedly higher than the average of the entire region (7.4%). Mortality rate of children under 5 years in Nyanza stands at 82 deaths per 1,000 live births; the highest among all regions in Kenya and higher than the national average of 56 deaths per 1000 live births and malnutrition is one of the most contributing factors (Reilly *et al.*, 2014). To curb the

child mortality rate, undernutrition in Siaya county needs to be arrested and it is therefore important to establish the prevalence of undernutrition and factors associated with it among children in the county.

Community based nutritional studies among children in Kenya have been conducted. In line with the National Nutrition Action Plan of Kenya (2012-2017), the study appreciates that the school set up provides an ideal setting to promote good nutritional practices early in life and in lieu of this, there is need for school-based studies on nutrition of children to be conducted to complement community-based studies. These studies would be useful in informing intervention policies such as introduction of anthropometry screening in schools. This study will therefore fill a gap of the limited data available on school based nutritional studies in Kenya and also shed light on factors associated with undernutrition in nursery school children in Asembo.

1.4 Objectives

1.4.1 Broad Objective

To determine the prevalence of undernutrition and the factors associated with undernutrition among children attending nursery schools within Asembo in Siaya County, Kenya.

1.4.2 Specific Objectives

1. To establish the prevalence of undernutrition among nursery school children within Asembo in Siaya County, Kenya.
2. To establish the factors associated with undernutrition among nursery school children within Asembo in Siaya County, Kenya.

1.5 Research questions

1. What is the prevalence of undernutrition in nursery school children within Asembo in Siaya County, Kenya?
2. What are the factors associated with undernutrition in nursery school children within Asembo in Siaya County, Kenya?

1.6 Scope of the Study

The study focused on 3-5-year-old children in public nursery schools in Asembo, Siaya County, Kenya. The researcher limited the study to public nursery schools to ensure homogeneity of participants since the study did not include a comparative arm to seek differences between public and private school children, with the assumption that children from private schools come from higher socio-economic groups. Anthropometric measurements were limited to weight and height as a factor of age of children. For factors associated with undernutrition, the study was limited to demographic characteristics of the children and their care givers, socio-economic status of the households from where the children hailed, immunization status of children and their morbidity history in the two weeks prior to the interview day and water and sanitation characteristics both at home and in school.

1.7 The Study Limitations

The study being of cross-sectional design was well suited for determining the prevalence of undernutrition and also for generation of hypotheses, longitudinal studies are however generally the best for determining predictors of an outcome. Nevertheless, the study findings generate very important hypotheses that can be used as basis for further studies.

Children morbidity and immunization status were reported based on the care givers' account since the health documents were not availed to verify. Recall bias may have been introduced.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

According to the World Food Programme malnutrition refers to a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain sufficient bodily performance process such as development, pregnancy, lactation, physical work and resisting and healing from disease (Luchuo *et al*., 2013).

According to the WHO classification of child malnutrition, children with a Z-score below -2SD of the median for height, height for age and weight for age are classified as wasted, stunted and underweight respectively. Children with a Z-score below -3SD of the median are categorized as harshly undernourished while those with a Z-score between -2SD and -3SD are classified as being moderately undernourished (WHO, 2016).

Stunting characterizes past or chronic malnutrition or illness, but is less sensitive to temporary food shortages. Wasting is sensitive to temporary food shortages and episodes of illness and frequently used as a pointer of current nutritional status. In addition, underweight reflects the cumulative chronic and acute exposures (Leilei *et al*., 2014).

The impact of undernutrition usually falls mainly on children under five years of age. Inspite of the millennium development goals target to reduce hunger by half by 2015, major failures have been reported mainly in Africa; Out of the 800 million people still suffering from starvation globally, Sub-Saharan Africa accounts for over 204 million. The situation is currently worsening in this region as it rose from 170.4 million hungry people in 1990 to 204 million in 2002 (Luchuo *et al*., 2013).

Determinants of undernutrition are varied and dynamic; specific to cohorts and regions. The United Nations International Children Emergency Fund (UNICEF)' conceptual

framework for causes of malnutrition categorizes these determinants into immediate (dietary intake and disease), underlying (household food security, care and feeding practices, unhealthy household environment and inadequate healthcare services) and basic causes (geographical location, lack of capital and resources) (Monsurul *et al*., 2019).

2.1 Theoretical Review

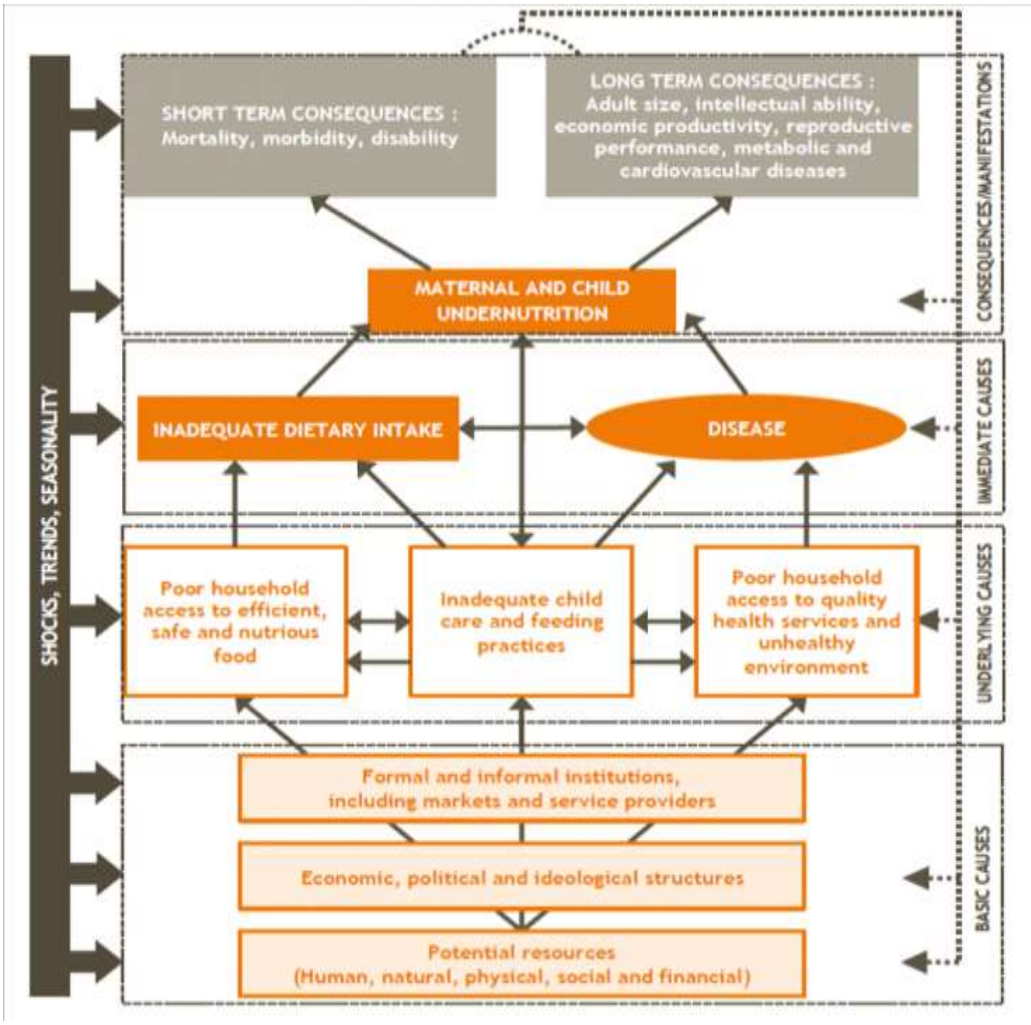

Figure 2.1: Theoretical Framework of Undernutrition

Source: Theoretical framework of undernutrition; ACF (2012) "The Essential: Nutrition and Health**"**

adapted from UNICEF 1990

The malnutrition framework created by UNICEF in the 1990's as depicted in the above diagram explains the causes of undernutrition and highlights the causes to be multisectoral in nature. It highlights the complexity of the elements that affect undernutrition at the three major levels; basic, underlying and immediate levels and shows that its barely just about lack of food.

An individual's nutritional status is as a result of an inadequate diet and disease; these are referred as the immediate causes of undernutrition. Diseases such as diarrhoea, acute respiratory illnesses, measles and malaria are known to have a synergistic relationship with undernutrition where one leads to the other in a cyclic manner. These diseases affect food absorption in the gut and also lead to decreased appetite hence undernutrition.

These immediate causes in turn, are influenced by adequate household food security, adequate care, adequate health care services and a hygienic household environment such as availability of safe water and adequate sanitation services and are known to as underlying causes.

Underlying causes are reliant on the wider social, political and economic context as well as the natural physical environment; these are known as basic causes of undernutrition. Government policies and political goodwill in the fight against undernutrition would fall into this category.

2.2 Study Conceptual Framework

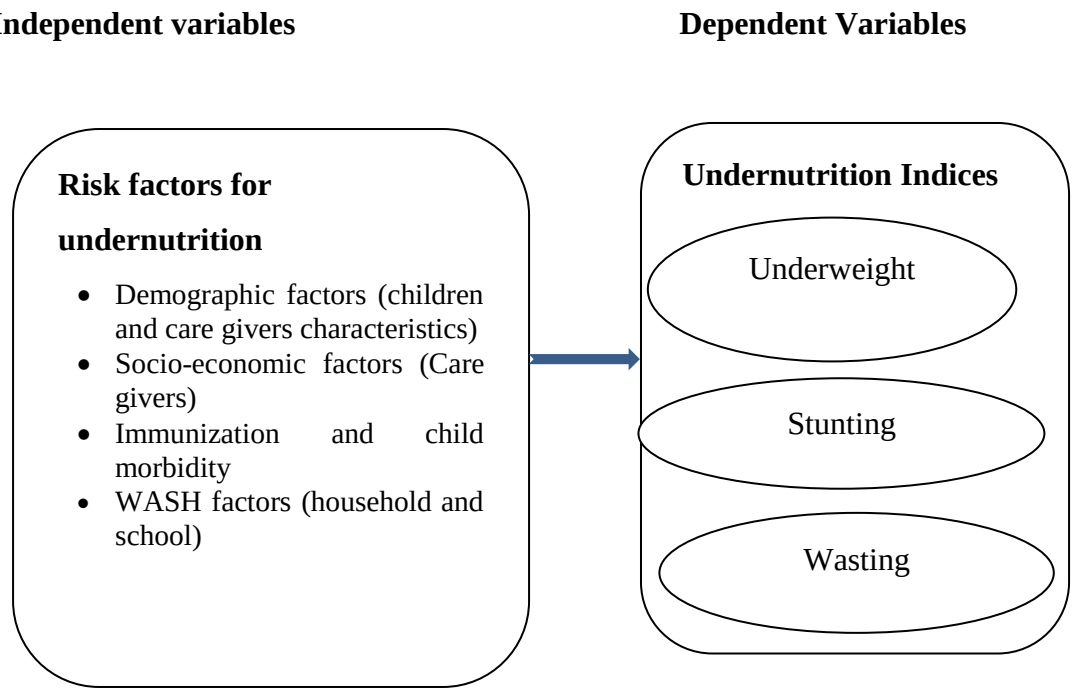

Figure 2.2: Conceptual Framework (Adopted from Undernutrition Conceptual Framework by UNICEF)

Independent variables

Factors associated with undernutrition:

Demographic characteristics: Age of household members, Gender, marital status of caregiver

Socio-economic characteristics: Main source of income, education level of care giver, Wealth index: (livestock ownership, housing, cooking fuel, type of sanitary facilities)

Child morbidity and immunization status: Diarrhoea incidence in the past 2 weeks, other morbidities in the past 2 weeks and child immunization status

WASH: drinking water treatment practices, presence of a toilet and availability of hand washing facilities

Dependent variables

Stunting: low height for age (HAZ)

Wasting: low weight for height (WHZ)

Underweight: low weight for age (WAZ)

2.3 Prevalence of Undernutrition

The 2018 joint malnutrition estimates, reveal insufficient progress by countries to reach the World Health Assembly targets set for 2025 and the Sustainable Development goals set for 2030 towards the fight against malnutrition. Globally in 2017, 151 million (22.2%) children less than five years of age were stunted and 51 million (7.4%) were wasted. More than one third of all stunted children lived in Africa while more than one quarter of all wasted children lived in Africa (UNICEF, WHO, World Bank, 2018).

In Africa alone, 58.7 million (30.3%) children less than 5 years of age were stunted and 13.8 million (4.0%) were wasted. Prevalence of stunting showed an upward trend when compared between 2000 and 2017. Whereas stunting was found in 50.6 million children in 2000, 58.7 million children were found to be stunted in 2017.Africa was rated as medium prevalence area; rates ranging between 5 - 9%. 13.8 million (7.1%) children under five years of age were wasted. In Eastern Africa, children under five years of age with stunting were 23.9 million (35.6%) and those who were wasted were 4.0 million (4.4%). (Ibid)

Undernutrition among children in Kenya is a serious problem and exists throughout the country. Each year more than 70,000 Kenyan children die before their 5^{th} birthday and malnutrition contributes to about half of the deaths. According to KDHS 2014, 26% of

children with five years and below in Kenya were stunted, 4% were wasted and 11% were underweight. Among the 26% who were stunted, 18% were moderately stunted while 6% were severely stunted. Of the 4% who were wasted, 3% were moderately wasted while 1% was severely wasted and of the 11% who were underweight, 9% were moderately underweight while 2% were severely underweight.

In a survey assessment carried out in eight counties in Kenya in June and July 2017, 420,674 children aged 6-59 months required urgent treatment for acute malnutrition. More than 3.4 million children and pregnant mothers needed urgent aid, up from 2.7 million in January, 2017 (Save the Children, 2017).

In the multiple indicator cluster survey conducted by the Kenya National Bureau of Statistics, Nyanza region was found to have a prevalence of: stunting 27.1%, wasting 3.9% and underweight 14.9% (KNBS, 2013).

The findings of the latest national demographic health survey of 2014 report that about 25% of the children under the age of five are still stunted in Siaya, a rate that is higher than the average of the entire region which stands at 23%. 7.8% of the children are still underweight which again is slightly higher than the average of the entire region standing at 7.4%.

2.4 Factors Associated with Undernutrition

The causal path of undernutrition is very complex, whereby biological, cultural and socioeconomic factors are interrelated. As described by the UNICEF causal framework, the causes of undernutrition are divided into immediate, underlying and basic causes; inadequate dietary intake and disease are the immediate causes; household food insecurity, inadequate care and poor sanitation and hygiene practices are underlying causes; other socio-economic characteristics are classified as basic causes of undernutrition (Monsurul *et al*., 2019).

Undernutrition is usually characterized by impairment in growth in weight and height. There is global agreement that children have almost similar potential for growth before they get to their seventh year; hence socioeconomic and demographic features seem to be more appropriate than hereditary features, in growth variations among children. There is considerable indication in the health economic literature that confirming that child nutritional status is dependent on a number of socioeconomic factors such as household wealth, rural/urban residence, mother's education, demographic factors and access to health care services (Dickson *et al.*, 2013).

Most studies done have showed that demographic factors such as the child's age, sex and birth size are linked to children's nutritional status. Moreover, a good number of studies have found consistent disparities in the prevalence of undernutrition along based on age, sex and birth size of children. There are also consistent results in child malnutrition studies that show that households' wealth \is a determinant of childhood nutritional status. It is argued that children from the poorest households are stunted or underweight compared to children from richest households. (Ibid)

The importance of a mother's education on child health and nutrition has been well demonstrated in several studies. Mother's education is associated with better children's health and nutritional status. A well-educated mother is at most times in a good socioeconomic status. In turn, the higher socioeconomic status mitigates a set of proximate determinants of health that directly influence health and nutritional outcomes of the child (Makoka *et al.*, 2015).

In neonatal medicine and infant health communities, excess male morbidity and mortality is almost universally reported and is widely recognized. Boys are known to be more vulnerable than girls from as early as the point of conception. Conditions common in childhood such as lower respiratory infections, diarrheal diseases, malaria and preterm birth are all more common in boys than girls. All of these are not only causes of death but also of weight loss, growth faltering or severe undernutrition among young children. Several studies show that boys aged 0-59 months are much more likely to be wasted,

stunted and underweight using anthropometric case definitions than girls. This indicates sex differences in susceptibility to undernutrition (Thurstans *et al.*, 2020).

A study conducted in Ethiopia found that parental education status was independently associated with children's underweight. Children of uneducated fathers were more likely to be underweight when compared with children of educated fathers. It is argued that fathers with higher educational status in the society have the ability to make decisions that improve the nutritional status of children while those with low educational status do not (Mandefo *et al.*, 2015).

Children born to a mother who gave birth to more than four children were more likely to be underweight when compared to children from a mother who gave birth to less than four children. This could be because families with more children experience more economic strain for food consumption and hence, they are more likely to suffer from poor nutritional status. (Ibid)

Diarrhoea can be considered as both the cause and the consequence of malnutrition: diarrhoea prevents children from catching up for stunting and malnutrition increases the frequency and the length of diarrheic episodes, constituting a vicious circle. Undernutrition causes immune-deficiency and increased susceptibility to infections such as diarrhoea. In turn, diarrhoea causes malnutrition through reduced food appetite, energy intake, nutrient loss and malabsorption (Wasihun *et al*., 2018).

2.5 Research Gaps

Several community-based studies have been conducted to establish the prevalence and correlates of undernutrition in children. However, there are limited studies that have been conducted in nursery schools in Kenya of the kind. It is important that nursery school-based studies are conducted to allow for comparability with studies conducted in other parts of the word and secondly, preschool children are an important cohort in the

fight against undernutrition and therefore, conducting such studies in the setting where they spend most of their time is prudent.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Site

The study was carried out in Asembo within Siaya County. Asembo covers an area of 100km^2 with a population of 325 persons per km^2. The area lies at an altitude of 1100 metres above sea level and with an annual rainfall of 1358mm. The area is culturally homogenous (95% Luo tribe); subsistence farming and fishing constitute the principal economy. There are two rainy seasons in the region; long rains fall between March and May, while the short rains fall between October and November. The average monthly temperature is 24.5^{0}C. The area has one of the highest rates of malaria in Africa; it is holoendemic, occurring all through the year. The area also has a high HIV prevalence of 18.5% and other infectious diseases are common. Consequently, the area has mortality figures that reflect this burden of infectious diseases; infant mortality rate (82 per, 1,000 live births) (KDHS, 2014) and a life expectancy at birth of 38 years. The area is one of the most impoverished in Kenya; 60-70% of people live below the poverty line in Siaya. (Kenya Central Bureau of Statistics, 1997; Feikin et al, 2011)

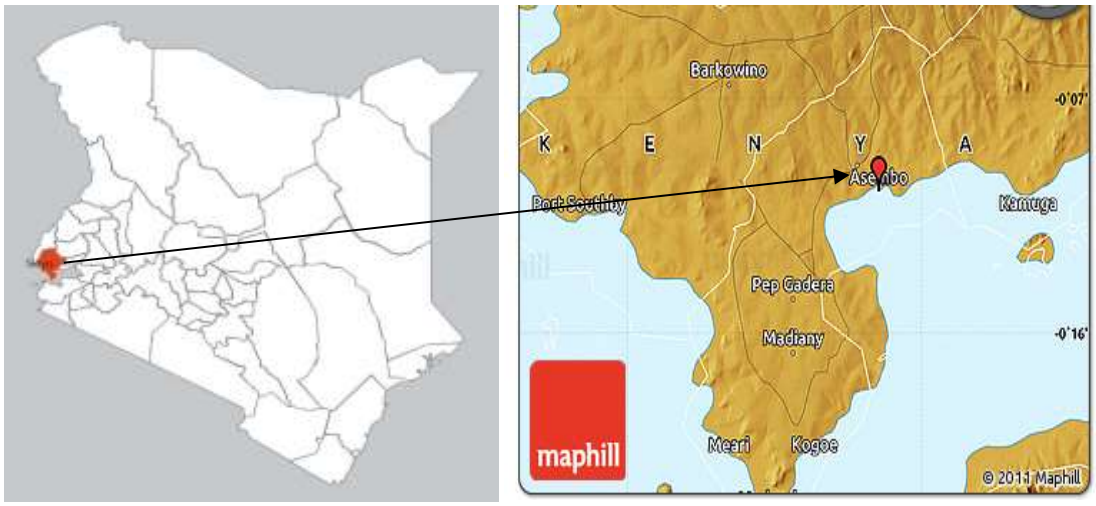

Figure 3.1: Map of Kenya showing the Study Area

3.2 Study Design

This was a descriptive cross-sectional school-based study, which sought to explore the prevalence of undernutrition in children 3-5 years attending public nursery schools in Asembo, Siaya County, Kenya. The number of children between ages of 3-5 years enrolled in public nursery schools within Asembo were approximately 4000 children. The study also sought to determine the factors associated with undernutrition. The cross-sectional study design was adopted as it is best suited in establishing prevalence of health outcomes and can also be used to show association; especially most useful in generating hypothesis. (Xiaofeng et al, 2020)

3.3 Study variables

Independent variables: Factors associated with undernutrition:

i. Demographic characteristics: Age of child, Age of caregiver, Gender, Matrimonial status of caregiver.
ii. Socio-economic characteristics: Education level, Key source of income, Wealth index: Livestock possession, house possession, types of walls, types of roofs,

types of floors, types of toilets, main source of energy and main source of drinking water.

iii. Child morbidity and Immunization Status: Diarrhea occurrence in the past 2 weeks, diseases other than diarrhea in the past 2 weeks and child vaccination status.

iv. WASH: Drinking water treatment practices, existence of a latrine/WC, accessibility of hand washing amenities.

Dependent variables: Anthropometric measures

Wasted

Stunted

Underweight

3.4 Study Population

The study population encompassed of 3-5-year-old children enrolled in public nursery schools within Asembo in Siaya County, Kenya, whose population was estimated at approximately 4500 children in the year 2018. Care givers of the children sampled and consented were also invited to participate in the study to give household and child information of interest. Head teachers of the schools selected participated in giving information on school WASH characteristics of interest.

3.4.1 Inclusion Criteria

- Children 3-5 years of age enrolled in public nursery schools within Asembo, Siaya County, Kenya.
- Children whose care givers consented to participate in the study.

3.4.2 Exclusion Criteria

- Children with physical disabilities and those who were clinically ill, on the day of taking anthropometric measurements.
- Children whose care givers declined to consent for them to participate in the study.
- Children who on the day of anthropometric measurement taking refused to participate in the study.

3.5 Sample Size Determination

Sample size was determined using Cochran's sampling formula. (Israel, 1992)

$n = t^2 * p\,(q)/\,d^2$

Where;

n = sample size

t = critical value for a 95% confidence level 1.96

p = Proportion with malnutrition= 10.9%. (Average of wasted, stunted and underweight children in Siaya County according to KDHS, 2014)

q = 1-p

d = Allowable difference = 0.05

$$n = \frac{(1.96)^2 * 0.109 * (1 - 0.109)}{0.05 * 0.05}$$

n=149

The minimum sample size determined was 149. An additional 11 was added to cover for non-response. Average non-response rate of similar studies conducted in Asembo was approximately 7%

Non-response plus sample size calculated= 149/ (1-0.07)

Total targeted number of participants =160

3.6 Sampling Techniques

A mixed sampling technique method was adopted in a multistage fashion; with different methods used for selecting the schools, children and caregivers.

3.6.1. Stratification of Asembo

Asembo is divided into two administrative units namely, Asembo East and Asembo West locations. The two locations made the two strata for the study.

3.6.2. Sampling of Schools

There was a total of 42 public nursery schools in Asembo. Asembo East had 22 schools, while 20 were in Asembo west. The study purposively selected 20% of the schools from every stratum. The aggregate number of schools picked was 9; 5 schools from Asembo East and 4 schools from Asembo West. A list from the Rarieda Early Children Education office functioned as the sample frame. A sample interval of 5 was used for both Asembo East and Asembo West.

3.6.3 Sampling of Children

The number of (3-5) year old children in the schools selected ranged between 80 and 100 children, and in total were 825. Proportionate sampling was used to determine the exact number of children to pick per school. The distribution of children in the schools was 98, 93, 93, 92, 92, 92, 88, 87, 87. Therefore, 5 schools had a target of 18 children

each, 3 schools had a target of 17 children each and 1 school had a target of 19 children. The sample frame was a list prepared by the class teachers, of all the children who met the study's conditions. Random sampling was used to pick children from each school; figures were written up to the maximum figure of children required per school on well-folded pieces of paper and mixed in a box together with blank pieces of paper. The children were asked to pick a piece each and those who picked papers with figures written on them were selected. Informed consent forms were then sent to the principal care givers of the children selected to take part in the study.

3.6.4 Response Rate and Distribution of Children per School

A positive response was obtained from 95% of the care givers which is a total of 152 care givers. The distribution of children per school who took part in the study was 16 children each in 5 schools, 17 children in 1 school, 18 children each in 2 schools and 19 children in 1 school.

Invitation letters were sent to all the principal care providers who gave consent to take part in the study and all the 152 principal care providers participated in the study.

3.7 Data Collection Tools

A researcher administered questionnaire was used to gather data from the care givers and head teachers.

A calibrated digital weighing scales and vertical height boards were used to measure weight and height respectively.

3.8 Pretesting of Data Collection Tools

Pretesting of the questionnaires was done in a nursery school in Asembo among 8 respondents. Due to time constraints, the study was not able to pretest on more respondents. Nevertheless, by the time the 8th respondent was reached, it was evident

that the questions were flowing, well understood and interpreted by the respondents, the questionnaire was not leading and was devoid of errors.

Pretesting of the weighing scale and height board was also done.

3.9. Data Collection

Data was gathered with the aid of trained research assistants. Care givers were invited to the schools where interviews were conducted through a structured questionnaire. Data collected from care providers included: Demographic and socio-economic characteristics, water and hygiene characteristic and child morbidity and vaccination data.

Data about the school characteristics of interest was obtained from the head teachers and also used observation skills for the same. This encompassed availability of toilets and hand washing facilities and water treatment practices.

Anthropometric measurements were taken following WHO standard anthropometry guidelines. Height was measured to the nearest 0.1 cm by use of calibrated vertical boards, while weight was measured to the nearest 0.1kg by use of calibrated digital weighing machines.

3.10 Data Management and Analysis

Descriptive and inferential statistics were used to analyze and report findings of the study. Data entry was done using excel and analysis was done using STATA.

Weight and height measurement were converted to weight for age z-scores (WAZ), height for age z-scores (HAZ) and weight for height z-scores (WHZ) using the WHO Anthro software. The resulting indices were used to determine the levels of malnutrition. Underweight was defined as WAZ less than -2SD, stunting as HAZ less than -2SD and wasting as WHZ less than -2SD.

Wealth index was calculated using principal component analysis using main variables that included; possession of own house, possession of livestock, types of walls, types of roofs, types of floors, main source of cooking fuel, types of toilets and main source of drinking water. The resulting wealth index variable was categorized into five quintiles; very poor, poor, medium, rich and very rich.

The relationship between the indicators of undernutrition and the associated factors was determined using univariate and multivariate logistic regression. In the univariate model, all variables with a p-value of < 0.25 were selected to proceed to the multivariate model. The variables were then tested by use of stepwise, backward and forward multivariate models independently. The model which retained most of the variables with p-value of <0.05 significance was used in the final multivariate model.

Prevalence of undernutrition and odds ratios were reported.

3.11. Ethical consideration

The study protocol was reviewed and approved by a NACOSTI approved Ethical Review Board in Kenya; this was preceded by an approval from the Jomo Kenyatta University of Agriculture and Technology Board of Post Graduate Studies. Consent was sought from the Siaya County Early Childhood Education office to permit the study to be conducted. The protocol and objectives were discussed with the school heads and nursery school teachers for clarification and acceptance. Written and signed informed consent forms were sought from the parents of the sampled children before start of the study. The class teachers of the selected children were instrumental in explaining the study to the children and what was expected from them, and those that were unwilling to participate were to be excluded from the study.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the study findings conducted to establish the prevalence of undernutrition and its associated factors in pre-school children in Asembo Siaya County, Kenya. The study was conducted in March, 2018.

4.2 Demographic and Socio-economic Characteristics of Children and Care givers

4.2.1 Age and Gender of Children

Children aged 48-60 months old were 96 (63.2%) and males in the age group were 52 (54.2%). Children who were 36-47 months old were 56 (36.8%) and males and females in the group were 28 (50%) each.

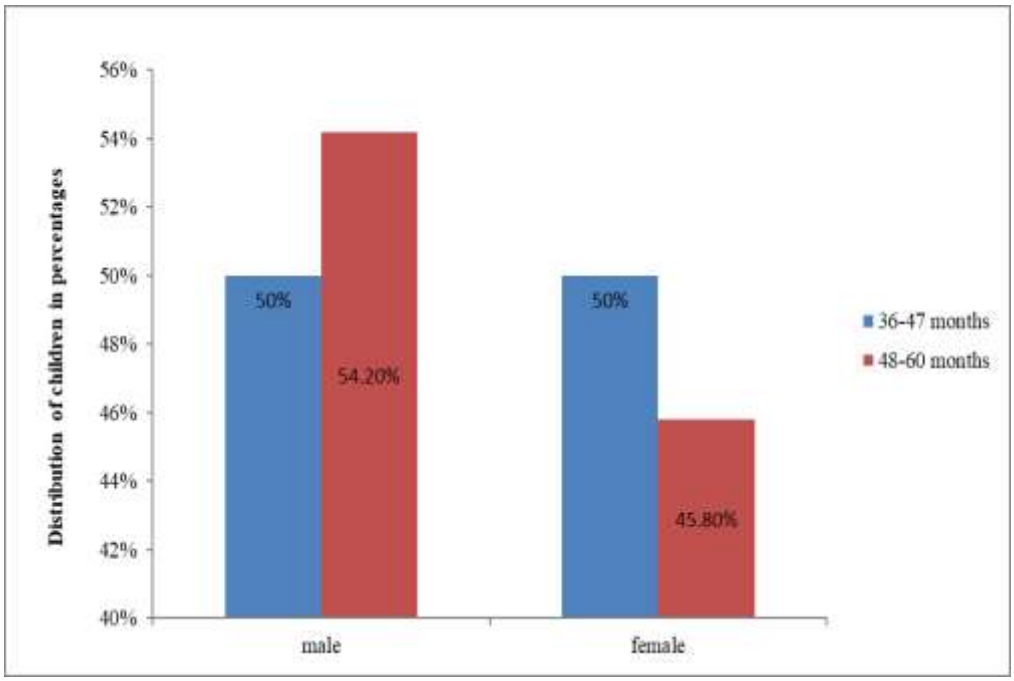

Figure 4.1: Age Distribution by Gender of Children

4.2.2 Demographic and Socio-economic Characteristics of Care givers

Care providers between 20-25 years of age were the majority (38.8%); those aged between 36-40years and over 40 years were at 9.2% and 9.9% respectively. The mean age of the care givers was 29.9 ±8.49 with a range of 20-62 years. The bulk of care givers (82.2%) were married; 7.9% were single, 7.9% widowed and 2.0% were separated. Most of the care providers (77.0%) had primary school education only, with 2.0% only, having reached the tertiary level of education. Unemployed care givers made up 38.8%. In occupation, farmers were at 32.9% while fishers were at 1.3%.

Table 4.1: Demographic and Socio-economic Characteristics of Care givers

Variables [N=152]	n	%
Age in years		
20-25	59	38.8
26-30	37	24.3
31-35	27	17.8
36-40	14	9.2
over 40	15	9.9
Marital status		
Married	125	82.2
Single	12	7.9
Separated	3	2.0
Widowed	12	7.9
Education level		
Primary	117	77.0
Secondary	32	21.1
Tertiary	3	2.0
Occupation		
Unemployed	59	38.8
Farmer	50	32.9
Small business	30	19.7
Formal employment	7	4.6
Casual worker	4	2.6
Fishing	2	1.3

4.3 Prevalence of Undernutrition

The prevalence of wasting among the study participants was 2.6%, stunting was 9.2% and underweight was 3.3%. Among children of 48-60 months, the prevalence of wasting was 4.2% and there was no wasting observed among children aged between 36-47months. In male children, prevalence of wasting was 1.3% and in females, was at 4.2%. The prevalence of stunting in children of 36-47 months was 8.9%, while in children of 48-60 months, was 9.4%. Prevalence of stunting in males was 7.5% while in females was 11.1%. Prevalence of underweight in 36-47 and 48-60 months was 3.6%

and 3.1% respectively. The prevalence of underweight in male participants was 3.8% and in females was 4.2%.

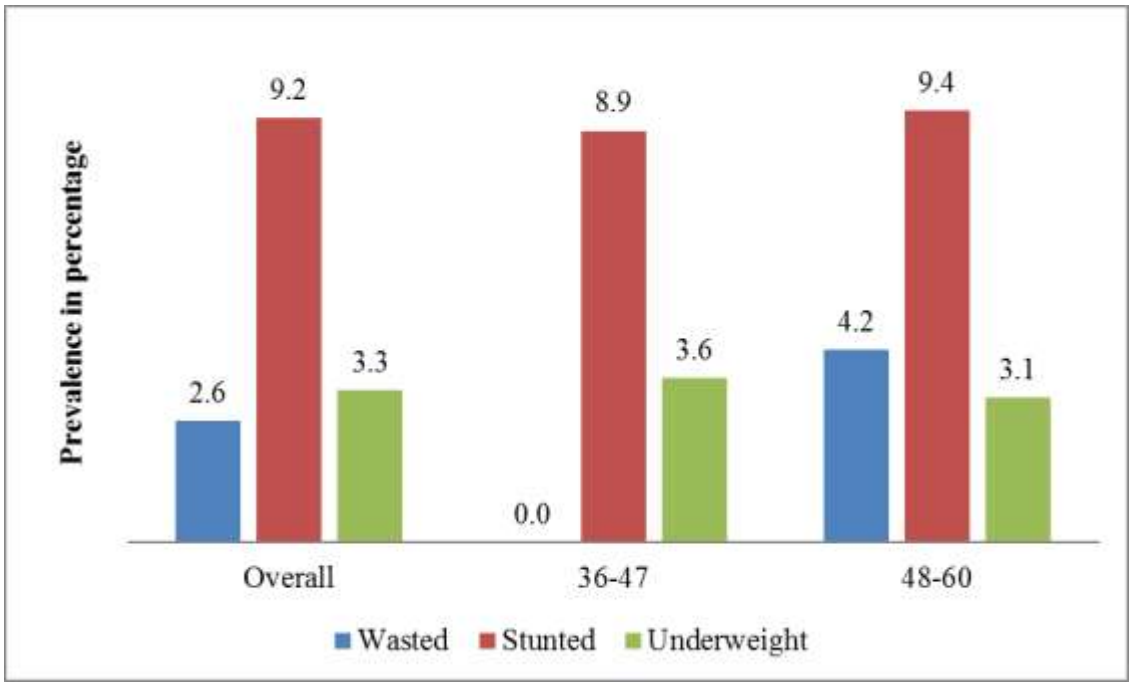

Figure 4.2: Prevalence of Undernutrition in Children

4.4 Factors Associated with Undernutrition

4.4.1 Distribution of Key Predictors of Undernutrition

Most participants (95.4%) had toilets in their homes and 71.1% of the participants treated their drinking water. Children who had completed vaccination as conveyed by their care givers made up 95.4%. Only 10.5% of the children were stated to have had diarrhoea in a fortnight prior to the interview.

Many of the children (77.6%) were stated to have had at least a sickness in a fortnight prior to the interview.

Schools that had treated water for the children were 5, with a total of 83(54.6%) children. Only 3(33.3%) of the schools had hand washing facilities for the children, making a total of 54 (35.5%) children.

Table 4.2: Distribution of Factors Associated with Undernutrition

	N=152	
	(n)	(%)
Household socio-economic status (Wealth index)*		
First quintile	31	20.4
Second quintile	30	19.7
Third quintile	31	20.4
Fourth quintile	30	19.7
Fifth quintile	30	19.7
Household WASH		
Availability of toilet	145	95.4
Treatment of drinking water	108	71.1
Child morbidity and immunization status		
Completed immunization	142	93.4
Had diarrhoea in the last 2 weeks prior to interview	16	10.5
Had an illness in the last 2 weeks prior to interview	111	73.0
School WASH		
Treatment of drinking water	83	54.6
Availability of hand washing facilities	54	35.5

* First quintile is lowest and fifth is richest

4.4.2 Univariate Analysis of Factors Associated with Wasting, Stunting and Underweight

For wasting; profession of care providers (casual worker against farmer), complete vaccination of children and diarrhoea in the 2 weeks prior to interview, had a p-value of less than 0.25 in the univariate analysis

For stunting; age of caregiver, profession of care giver and the wealth quintiles had a p-value of less than 0.25 in the univariate analysis.

For underweight; financial independence of the principal care giver, diarrhoea in the last two weeks prior to interview and any other morbidity in the last two weeks prior to interview had a p-value of less than 0.25 in the univariate analysis.

Table 4.3: Univariate Analysis of Factors Associated with Wasting, Stunting and Underweight

	variables **[n=152]**	**COR**	**P-value**
Wasting	**Occupation**		
	Farmer	**ref**	
	Casual worker	16.33	0.07
	Completed immunization		
	No	**ref**	
	Yes	0.19	0.17
	Diarrhoea in last 2 weeks prior to interview		
	No	**ref**	
	Yes	9.57	0.03
Stunting	**Age of caregiver**		
	20-25	**ref**	
	over 40 years	2.7	0.21
	Occupation of care giver		
	Farmer	**ref**	
	Small business owner	2.88	0.13
	Wealth quintiles		
	First	**ref**	
	Second	0.12	0.05
	Third	0.24	0.09
	Fourth	0.38	0.2
	Fifth	0.12	0.05
Underweight	**Care giver is financially independent**		
	No	**ref**	
	Yes	0.25	0.22
	Diarrhoea in last 2 weeks prior to interview		
	No	**ref**	
	Yes	6.33	0.05
	Other morbidities in last 2 weeks prior to interview		
	No	**ref**	
	Yes	4.52	0.12

* First quintile is poorest and fifth is richest

4.4.3 Multivariate Analysis of Factors Associated with Wasting, Stunting and Underweight

Diarrhoea in the last two weeks prior to interview was found to be independently and statistically associated with wasting in multivariate analysis. Wasted children had 9.57 more odds of having had diarrhoea in the last two weeks prior to the interview than those who were not wasted.

The wealth index was found to be significantly associated with stunting in the multivariate analysis. Stunted children were more likely to belong to the lower quintiles. Children in the 5^{th} quintile had 33% less odds of being stunted than children in the first quintile.

Diarrhoea in the last two weeks prior to interview was independently and statistically associated with being underweight in the multivariate analysis. Children who were underweight had 6.34 more odds of having had diarrhoea in the last two weeks prior to the interview than those who were not underweight.

Table 4.4: Multivariate analysis of Factors Associated with Undernutrition

	Variables **[n=152]**	**COR [95% CI]**	**AOR [95% CI]**
Wasted	**Diarrhoea in last 2 weeks prior to interview**		
	No	ref	ref
	Yes	9.57 [1.25-17.30]	8.72 [1.08-17.59]
Stunted	**Wealth quintiles**		
	First quintile	ref	ref
	Second quintile	0.12 [0.01-0.29]	_
	Third quintile	0.24 [0.04-0.26]	_
	Fourth quintile	0.38 [0.08-0.64]	_
	Fifth quintile	0.11 [0.01-0.29]	0.67 [0.44-0.89]
Underweight	**Diarrhoea in last 2 weeks prior to interview**		
	No	ref	ref
	Yes	6.34 [5.74-21.76]	7.38 [6.15-24.32]

* First quintile is poorest and fifth is richest

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Prevalence of Undernutrition

According to the prevalence range classification by World Health Organization, the prevalence of wasted (2.6%) and underweight (3.3%) stated are low while that of stunting (9.2%) is in the medium category (WHO, 1995). This however should not prompt complacency to action, since the outcomes do not generalize the status of the entire region.

The prevalence of undernutrition for wasting (2.6%), stunting (9.2%) and underweight (3.3%) in the area was lower in comparison to the Kenya national prevalence cited in the most recent nationwide demographic health study of 2014; 4% wasting, 26% stunting and 11% underweight.

In contrast to the larger Siaya County, the proportions for stunting and underweight in Asembo, found by the study, were much lower than those reported in KDHS 2014 for Siaya County in 2014 at 25% and 7.8% respectively.

The results of this study illustrates that the levels of undernutrition may have reduced in Asembo over the years, working by proportions of stunting (33%) and wasting (7%) reported in 2011 in a paper looking at the burden of common infectious disease syndromes in Asembo (Feikin *et al*., 2011). The difference however, may be because Feikin's paper encompassed children from 6 months, while this study looked at children from 36-60 months only. Possibly another reason for the dip in prevalence of undernutrition could be because Asembo is an area covered by the Household Demographics surveillance and survey project and the Population Based Infectious Diseases Project, led by Kenya Medical Research Institute in partnership with Centers

for Disease Control of the United States of America, whereby, the projects closely monitor communicable diseases and promptly refer children and adults for treatment. The projects also offer free medical care for the participants in one of the health facilities in the area. It is evident that infections in children are a risk factor for undernutrition, and the longer an infection remains untreated, the more the toll it takes on children. Therefore, the prompt and free treatment offered by the KEMRI projects helps in ensuring that infections are treated and on time and subsequently reduces the level of undernutrition in the area.

Asembo was also the location where the first clinical trial on Rotavirus vaccine was conducted in Kenya. Emphasis on uptake of the vaccine and catch-up efforts on children due for the vaccine was done and this has led to decreased incidence and mortality due to diarrheal diseases in Asembo and subsequently helped in the reduction of undernutrition in the area (Amek *et al.*, 2014).

A comparison between the levels of undernutrition stated by the study and those stated by a study conducted in a neighboring county in Western Province, demonstrates that the prevalence of undernutrition in the study area is low, given proportions for the study in Western province were 28.9% stunting, 1.7% wasting and 6.6% underweight (Dennis *et al*., 2014).The two studies however agree, in that the levels of wasting in these two close regions were lower than the other undernutrition pointers.

In a study carried out in Machakos County in Kenya, the prevalence of undernutrition reported was higher than that found in Asembo. The Machakos study stated wasting at 6%, stunting at 38% and underweight at 21% (Ruth, 2017). The resemblance between these two studies is that both were school based but the Machakos study targeted children from the age of 2 to 5 years.

The study did not observe wasting among children of 36-47 months, while the proportion of children with wasting of 48-60 months was 4.2%. The proportion observed among the older children is higher when compared to the general prevalence of wasting

in Kenya according to KDHS, 2014 which was 4%. Wasting in children is reflective of failure to receive adequate nutrition during immediate crisis such as food shortage (Amengor *et al*., 2016). It is more natural that during times when there is food shortage, mothers tend to be keener on the feeding of younger children, with the assumption that the older children are more independent. This could be a contributing factor for this observation and especially being a rural area where children are made to mature faster as compared to children in urban areas (Faghambibe *et al*., 2020).

In stunting, it was also observed that children of between 48-60 months had a higher proportion than those of 36-47 months. This is in agreement with a study that showed a continued increase in stunting between ages 24 and 60 months (Leroy *et al*., 2014). The observation brings out a critical concern on the lack of possibility for these children to catch up and attain the optimum height for age since beyond 48 months, studies show that catch up is nearly impossible (Victora *et al*., 2010).

The proportion of female children who were undernourished was consistently higher in all the three undernutrition indices This finding contradicts findings from several studies conducted across the globe which show that boys are likely to be more undernourished while compared to boys (Thurstan et al., 2020). This observation could however be explained by the observed African cultural beliefs and practices whereby boys are given priority over girls in terms of the food amount, timing of feeding and types of food given (Luchuo *et al.*, 2013). Such practices may be detrimental to the nutritional well-being of the female child, leading to higher levels of wasting, underweight and stunting observed.

5.1.2 Factors Associated with Undernutrition

Diarrheal incidence in the 2 weeks prior to interview was found to be positively associated with wasting. This finding is similar with the findings of a systematic review paper, looking at stunting, wasting and underweight in Sub-Saharan Africa, whereby different papers from Nigeria, Somalia, Ethiopia, Uganda and Kenya, stated diarrheal episode as a risk factor for wasting (Akombi *et al*., 2017). Poor appetite, vomiting,

deliberate withholding of food resulting in poor consumption, malabsorption of macro and micronutrients; hastening of intestinal transit time; disturbance of metabolic and endocrine function; and direct loss of proteins and other nutrients in digestive tract are some of the known mechanisms which have an impact on nutrition during an episode of diarrhoea (Sigdel *et al*., 2020).

A study conducted in Ethiopia also reported that children with history of diarrheal illness in the previous 2 weeks preceding the survey date had higher odds of being wasted. Late treatment and poor health seeking behavior and unsuitable home founded management of diarrhea may upsurge the vulnerability of child developing wasting (Derso *et al*., 2017).

This study established that children with stunting were more likely to come from poorer households than those who came from richer households. Studies in Nepal, Bangladesh and Kenya show that children in higher wealth indices are less likely to be stunted than those in lower wealth indices (Dorsey *et al*., 2018)(Ahsan *et al*., 2017)(Shinsugi *et al*., 2015). This study endorses that poverty is related with undernutrition in most developing nations.

Poverty and food insecurity are deeply related, as poverty may adversely affect the social determinants of health and may create unfavorable conditions in which people might experience unreliable food supply. Food is a major household expenditure for the poor households but despite spending a large proportion of their household income on food, many poor households continue to remain food insecure because of their insufficient, irregular and fluctuating incomes (Faareha *et al*., 2020).

The findings that poverty is associated with stunting aligns with findings of a study conducted in Rwanda, looking at factors associated with stunting in children. The study in Rwanda reported that children from poorer households were more likely to be stunted than children from rich households; it also reported that the level of poverty in Rwanda was on the decline which was reflective of the declining prevalence of stunting in

Rwanda. The study went further to allude that fighting poverty in Rwanda and the larger Sub- Saharan Africa would go a long way in reducing the levels of stunting in children of this region; since the wealth of households is a proxy for the purchasing power of food and other nutritional goods needed for the health of the children (Nshimiyrio *et al*., 2019).

This study showed that diarrhoea was associated with being underweight. Children who were underweight were more likely to have had diarrhoea in the last two weeks prior to interview than those who were not underweight. In a similar study investigating maternal risk factors for underweight children under five years of age, in a resource limited setting in Nepal, children who had one or more diarrhoea episodes within a one-month period were 2.09 times more likely to be underweight than those children who did not experience episodes of diarrhoea (955 CI 1.02-4.31) (Sigdel *et al*., 2020). Similarly, in a study carried out in Ethiopia, diarrhea in the last 2 weeks prior to the interview was established to be related with being underweight, whereby children who had had diarrhea were more likely to be underweight than those who had not (Tosheno *et al*., 2017).

The above association is clear because there is a reciprocal relationship with diarrhoea leading to malnutrition while malnutrition predisposes to diarrhoea. Infections play a major role in the etiology of undernutrition because they result in increased needs and high energy expenditure, lower appetite, nutrient losses due to vomiting, diarrhoea, poor digestion, malabsorption of nutrients and disruption of metabolic equilibrium. (Ibid)

However, this finding disputes a study conducted in Rwanda, which did not find diarrhea illness in the last two weeks as an associated factor for being underweight (Mukabutera *et al*., 2016).

5.2 Conclusions

The prevalence of wasting (2.6%), stunting (9.2%) and underweight (.3%) in pre-school children in Asembo area was relatively low as compared to the national levels reported in the 2014 KDHS; the prevalence of stunting was highest among the three nutritional indicators. Among children with undernutrition, child morbidity and precisely diarrhoea was significantly associated with underweight and wasting, whereas children from the poorest households were more likely to be stunted.

5.3 Recommendations

i. There is need for regular monitoring of undernutrition in pre-school children in Kenya. Despite the prevalence of undernutrition being low, children who were otherwise healthy were found to have different forms of undernutrition. The screening should be done in schools by the teachers who should undergo training through efforts by the Ministry of Health.

ii. There is need for provison of health education to parents and schools on importance of maintaining hygiene, availing handwashing facilities and treatment of drinking water should be done regularly in a bid to eradicate diarrhoea which was positively associated with wasting and underweight.

iii. There is need for more efforts and strategies aiming at improving socioeconomic status of poorer households in Asembo be invented by the non-governmental organizations operating in Asembo, as the study found out that children from the poorest households were more likely to be stunted.

5.4 Recommendation for further Research Work

i. There is need to conduct more school-based studies to establish the prevalence of undernutrition in other sub-counties of Siaya to allow for generalization of the findings that prevalence of undernutrition in the county is low.

ii. There is need to conduct studies in Kenya, to investigate whether undernutrition has an impact on academic or psychosocial performance of nursey school children.

REFERENCES

Adenike Oluwayemisi Jimoh , Jane Oowo Anyiam & Alhassan Mela Yakubu. (2017). Relationship between child development and nutritional status of under-five Nigerian children. *South African Journal of Clinical Nutrition, 3*(3).

Abby C. Sauer, Carolyn J. Alish, Kelly Strausbaugh, Katherine West, Beth Quatrara. (2016). Nurses needed: Identifying malnutrition in hospitalized older adults. *Nursing plus open*. *2,* 21–25.

Agedew, E., & Chane, T. (2015). Prevalence of Stunting among Children Aged 6–23 Months in Kemba Woreda, Southern Ethiopia: A Community Based Cross-Sectional Study. *Advances in Public Health, 2015,* 1–6.

Agedew, E., & Chane, T. (2015). Prevalence of Stunting among Children Aged 6–23 Months in Kemba Woreda, Southern Ethiopia: A Community Based Cross-Sectional Study. *Advances in Public Health, 2015,* 1–6.

Ahsan, K. Z., Arifeen, S. El, Al-Mamun, M. A., Khan, S. H., & Chakraborty, N. (2017). Effects of individual, household and community characteristics on child nutritional status in the slums of urban Bangladesh. *Archives of Public Health*, *75*(1), 9.

Akombi, B. J., Agho, K. E., Hall, J. J., Wali, N., Renzaho, A. M. N., & Merom, D. (2017). Stunting, Wasting and Underweight in Sub-Saharan Africa: A Systematic Review. *International Journal of Environmental Research and Public Health*, *14*(8).

Amek, N. O., Odhiambo, F. O., Khagayi, S., Moige, H., Orwa, G., Hamel, M. J., Laserson, K. F. (2014). Childhood cause-specific mortality in rural Western Kenya: application of the InterVA-4 model. *Global Health Action*, *7*(1), 25581.

Anil Sigdel, Hardik Sapkota, Subash Thapa, Anu Bista, Anil Rana. (2020). Maternal risk factors for underweight among children under-five in a resource limited setting: A community based case control study. *PLOS ONE, 10, 1371.*

Asiki, G., Newton, R., Marions, L., Kamali, A., & Smedman, L. (2019). The effect of childhood stunting and wasting on adolescent cardiovascular diseases risk and educational achievement in rural Uganda: a retrospective cohort study.*Global health action*, *12*(1), 1626184.

Bain, L. E., Awah, P. K., Geraldine, N., Kindong, N. P., Sigal, Y., Bernard, N., & Tanjeko, A. T. (2013). Malnutrition in Sub-Saharan Africa: burden, causes and prospects.*The Pan African Medical Journal 15*, 120.

Bigogo G, Audi A, Aura B, Aol G, Breiman RF, &Feikin DR. (2010). Health-seeking patterns among participants of population-based morbidity surveillance in rural western Kenya: implications for calculating disease rates. *International Journal of Infectious Diseases.* 14: e967–e973.

Bilal, S. M., Moser, A., Blanco, R., Spigt, M., & Dinant, G. J. (2014). Practices and Challenges of Growth Monitoring and Promotion in Ethiopia: A Qualitative Study. *Journal of Health, Population, and Nutrition*, *32*(3), 441–451.

Bukania, Z. N., Mwangi, M., Karanja, R. M., Mutisya, R., Kombe, Y., Kaduka, L. U., & Johns, T. (2014). Food Insecurity and Not Dietary Diversity Is a Predictor of Nutrition Status in Children within Semiarid Agro-Ecological Zones in Eastern Kenya. *Journal of Nutrition and Metabolism*, *2014*, 907153.

Chinyoka Kudzai. (2014). Impact of Poor Nutrition on the Academic Performance of Grade Seven Learners: A Case of Zimbambwe. *International Journal of Learning and Development*, *4*(3)

Cleopa Mailu. (2016). The malnutrition epidemic. The Star Newspaper.http://www.the-star.co.ke/news/2016/06/24/the-malnutrition-epidemic

Dickson A Amugsi, Maurice B Mittelmark and Anna Lartey. (2013). An analysis of socio-demographic patterns in child malnutrition trends using Ghana demographic and health survey data in the period 1993–2008. *BMC Public Health 13*, 960.

Desalegne Amare, Ayenew Negesse, Baye Tsegaye, Birtukan Assefa, and Birehanu Ayenie. (2016). Prevalence of Undernutrition and Its Associated Factors among Children below Five Years of Age in Bure Town, West Gojjam Zone, Amhara National Regional State, Northwest Ethiopia. *Advances in Public Health*.

Dennis, M., Anzelimo, M., Isaac, K., Charles, M., Isaac, K., Charles, M., … Dennis, M. (2014). Prevalence of malnutrition among preschool children (6-59 months) in Western Province, Kenya. *Journal of Public Health and Epidemiology*, *6*(11), 398–406.

Dorsey, J. L., Manohar, S., Neupane, S., Shrestha, B., Klemm, R. D. W., & West, K. P. (2018). Individual, household, and community level risk factors of stunting in children younger than 5 years: Findings from a national surveillance system in Nepal. *Maternal & Child Nutrition*, *14*(1).

Dumas, S. E., Kassa, L., Young, S. L., & Travis, A. J. (2018). Examining the association between livestock ownership typologies and child nutrition in the Luangwa Valley, Zambia. *PloS One*, *13*(2).

Eze, U., Olowu, A. A., Bamidele, T. O., and Adeyanju, F. D. (2008). Prevalence of Malnutrition and Effects of Maternal Age, Education and Occupation Amongst Preschool Children Attending Health Centres in a Semi Urban Area of South Western Nigeria. *Nigerian Quarterly Journal of Hospital Medicine*, *15*(4), 179–183.

Faareha Siddiqui, Rehana A. Salam, Zohra S. Lassi and Jai K. Das. (2020). The Intertwined Relationship Between Malnutrition and Poverty. *Front Public Health*, 28th August 2020.

Fagbamigbe, A.F., Kandala, N.B. & Uthman, A.O. Demystifying the factors associated with rural–urban gaps in severe acute malnutrition among under-five children in low- and middle-income countries: a decomposition analysis. *Sci Rep , 10,* 11172

Feikin DR, Audi A, Olack B, Bigogo GM, Polyak C, Burke H, et al. (2010). Evaluation of the optimal recall period for disease symptoms in home-based morbidity surveillance in rural and urban Kenya. *Int J Epidemiol*, *39*(2), 450-458.

Gamecha, R., Demissie, T., & Admasie, A. (2017). The Magnitude of Nutritional Underweight and Associated Factors Among Children Aged 6-59 Months in Wonsho Woreda, Sidama Zone Southern Ethiopia. *The Open Public Health Journal*, *10*(1), 7–16.

Glover-Amengor, M., Agbemafle, I., Hagan, L. L., Mboom, F. P., Gamor, G., Larbi, A., & Hoeschle-Zeledon, I. (2016). Nutritional status of children 0-59 months in selected intervention communities in northern Ghana from the africa RISING project in 2012. *Archives of public health = Archives belges de sante publique*, *74*, 12.

Gwenaelle. (2015). Link NCA, Nutrition Causal Analysis, Agro-pastoral and Mixed Farming Livelihood Zones, West Pokot County, Kenya, 2015. Retrieved from http://old.actioncontrelafaim.org/en/content/link-nca-nutrition-causal-analysis-agro-pastoral-and-mixed-farming-livelihood-zones-west

Habaasa, G. (2015). An investigation on factors associated with malnutrition among under five children in Nakaseke and Nakasongola districts, Uganda. *BMC Pediatrics*, *15*, 134.

Jimoh, A. O., Anyiam, J. O., & Yakubu, A. M. (2018). Relationship between child development and nutritional status of under-five Nigerian children. *South African Journal of Clinical Nutrition*, *31*(3), 50–54.

Kelly A. Tappenden, Beth Quatrara, Melissa L. Parkhurst Ainsley M. Malone, Gary Fanjiang, Thomas R. Ziegler. (2013). Critical Role of Nutrition in Improving Quality of Care: An Interdisciplinary Call to Action to Address Adult Hospital Malnutrition. *The Journal of the Academy of Nutrition and Dietetics*. *113*(9): 1219–1237.

Kenya National Bureau of Statistics. 2013. Nyanza Province Multiple Indicator Cluster Survey 2011, Final Report.

Kenya National Bureau of Statistics, Ministry of Health/Kenya, National AIDS Control Council/Kenya, Kenya Medical Research Institute, and National Council for Population and Development/Kenya. 2015. Kenya Demographic and Health Survey 2014. http://dhsprogram.com/pubs/pdf/FR308/FR308.pdf.

Kesari, Kavindra & Handa, Ruchika & Prasad, Ranu. (2010). Effectct of undernutrition on cognitive development of children. *International Journal of Food Safety Nutrition and Public Health*. *3*.

Leonor Rodríguez, Elsa Cervantes, and Rocío Ortiz. (2011). Malnutrition and Gastrointestinal and Respiratory Infections in Children: A Public Health Problem. *Int J Environ Res Public Health*. *8*(4): 1174–1205.

Laus MF, Duarte Manhas Ferreira Vales L, Braga Costa. (2011). Early postnatal protein-calorie malnutrition and cognition: a review of human and animal studies. *Int. J. Environ*. Res Public Health, *8,* 590–612

Leilei Pei, Lin Ren and Hong Yan (2014) A survey of undernutrition in children under three years of age in rural Western China. *BMC Public Health*. *14*, 121

Leroy JL, Ruel M, Habicht JP, Frongillo EA. Linear growth deficit continues to accumulate beyond the first 1000 days in low- and middle-income countries: global evidence from 51 national surveys. J Nutr. 2014 Sep; *144*(9), 1460-6.

Luchuo Engelbert Bain, Paschal Kum Awah, Ngia Geraldine, Njem Peter Kindong, Yelena Sigal, Nsah Bernard, and Ajime Tom Tanjeko.(2013).Malnutrition in Sub – Saharan Africa: burden, causes and prospects. *Pan African Medical Journal*.*15*, 120.

Lisa A. Barker, Belinda S. Gout, and Timothy C. Crowe. (2011). Hospital Malnutrition: Prevalence, Identification and Impact on Patients and the Healthcare System. *International Journal Environmental Res Public Health*. 8(2): 514–527.

Mahama Saaka. (2014). Relationship between Mothers' Nutritional Knowledge in Childcare Practices and the Growth of Children Living in Impoverished Rural Communities. *J Health Popul Nutr*. 2014 Jun; *32*(2), 237–248.

Makoka, D., Masibo, P.K. (2015) Is there a threshold level of maternal education sufficient to reduce child undernutrition? Evidence from Malawi, Tanzania and Zimbabwe. *BMC Pediatr 15*, **(**96)

Margaret Chan. (2016) The UN Decade of Action on Nutrition: Working together to implement the outcomes of the Second International Conference on Nutrition. Retrieved from http://www.who.int/nutrition/events/2016_UNGA71_side-event_20Sept_NY/en/

Maimuna M. Ahmed, Adolfine Hokororo, Benson R. Kidenya, Rogatus Kabyemera and Erasmus Kamugisha. (2016). Prevalence of undernutrition and risk factors of severe undernutrition among children admitted to Bugando Medical Centre in Mwanza, Tanzania. *BMC Nutrition*. *2*, 49

Mandefro Asfaw, Mekitie Wondaferash, Mohammed Taha and LamessaDube. (2015). Prevalence of undernutrition and associated factors among children aged between six to fifty-nine months in Bule Hora district, South Ethiopia. *BMC Public Health* 15, 41

Matee MI, Msengi AE, Simon E, Lyamuya EF, Mwinula JH, Mbena EC, Mbena EC, Mbena Samaranayake LP, Scheutz F. (1997). Nutritional status of under-fives attending maternal and child health clinics in Dar es Salaam, Tanzania. *East African Medical Journal*. *74*(6), 368-371

Matu M, Kikuvi G, Wanzala P, Karama M, Symekher S. (2014). Risk factors for acute respiratory infections in children under five years in Nakuru. *Afr J Health Sci*.27(4), 376-387

McClelland M. M, Morrison F. J. (2013). The emergence of learning-related social skills in preschool children. *Early Child Research Quarterly*. 18:206.

Mosites, E. M., Rabinowitz, P. M., Thumbi, S. M., Montgomery, J. M., Palmer, G. H., May, S., Walson, J. L. (2015). The Relationship between Livestock Ownership and Child Stunting in Three Countries in Eastern Africa Using National Survey Data. *PloS One, 10*(9).

Niyibituronsa M; Kyallo F; Mugo C; Gaidashova S. (2015). Intrahousehold allocation, household headship and nutrition of under-fives: A study of Western Kenya. *African Journal of Food, Agriculture, Nutrition and Development*. *15*(1), 9744-9761.

Nshimyiryo, A., Hedt-Gauthier, B., Mutaganzwa, (2019). Risk factors for stunting among children under five years: a cross-sectional population-based study in Rwanda using the 2015 Demographic and Health Survey. *BMC Public Health 19*, 175

O'Reilly CE, Jaron P, Ochieng B, Nyaguara A, Tate JE, et al. (2012) Risk Factors for Death among Children Less than 5 Years Old Hospitalized with Diarrhea in Rural Western Kenya, 2005–2007: A Cohort Study. PLoS Med, *9*(7), e1001256.

Partha De and Nandita Chattopadhyay. (2019). Effects of malnutrition on child development: Evidence from a backward district of India. *Clinical Epidemiology and Global Health*,*7*(3), 439-445

Pauline Scherdel, leodunkel, Paulavan Dommelen, Olivier Goulet, Jean francois, Raja Brauner, Barbara Heude, Martin Chalumeau.Growth monitoring as an early detection tool: a systematic review. The Lancet. *4*(5), 447-456

Rhianna Charchuk, Stan Houston, and Michael T. Hawkes. (2015). Elevated prevalence of malnutrition and malaria among school-aged children and adolescents in war-ravaged South Sudan. *Pathog Glob Health*. *109*(8), 395–400.

Shinsugi, C., Matsumura, M., Karama, M., Tanaka, J., Changoma, M., & Kaneko, S. (2015). Factors associated with stunting among children according to the level of food insecurity in the household: a cross-sectional study in a rural community of Southeastern Kenya. *BMC Public Health*, *15*(1), 441.

Sunanda Das and JahidaGulshan. (2017). Different forms of malnutrition among under five children in Bangladesh: a cross sectional study on prevalence and determinants. *BMC Nutrition, 3*, 1

Save The Children Organization. (2017) http://www.save the children.org.uk/2017-08

Tebeje, N. B., Bikes, G. A., Abebe, S. M., & Yesuf, M. E. (2017). Prevalence and Major Contributors of Child Malnutrition in Developing Countries: Systematic Review and Meta-Analysis. *J Child Obes*, *2*(4), 16.

Terefe Derso, Amare Tariku, Gashaw Andargie Biks, and Molla Mesele Wassie. (2017). Stunting, wasting and associated factors among children aged 6–24 months in Dabat health and demographic surveillance system site: A community based cross-sectional study in Ethiopia. *BMC Pediatr*. *17*, 96.

The UN Decade of Action on Nutrition: Working together to implement the outcomes of the Second International Conference on Nutrition-WHO, 2017

Thurstans S, Opondo C, Seal A. (2020). Boys are more likely to be undernourished than girls: a systematic review and meta-analysis of sex differences in undernutrition *BMJ Global Health* 2020; *5***,** e004030

United Nations Children's Funds (UNICEF). Strategy for Improved Nutrition of Children and Women in Developing Countries. UNICEF; New York, NY, USA: 1990

Victora CG, de Onis M, Hallal PC, Blössner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. Pediatrics. 2010 Mar; *125*(3), e473-80.

Wasihun AG, Dejene TA, Teferi M, Marugán J, Negash L, Yemane D, et al. (2018) Risk factors for diarrhoea and malnutrition among children under the age of 5 years in the Tigray Region of Northern Ethiopia. *PLoS ONE* , *13*(11), e0207743.

World Health Organization. (2015) World Hunger and Poverty Facts and Statistics. Retrieved from http://www.worldhunger.org/2015-world-hunger-and-poverty-facts-and-statistics/http://www.worldhunger.org/world-child-hunger-facts/

Xiaofeng Wang and Zhenshun Cheng. (2020). An Overview of Study Design and Statistical Considerations. *Chest Journal*. *158*(1)

Yasser Hussein Issa Mohammed, Noor FathimaKhanum, S. V. Mamatha, Mahima J yothi, {Bibliography}Zabiulla, Fares Hezam,Al-Ostoot and Shaukath Ara Khanum. (2016). The prevalence of malnutrition in developing countries: a review. *J. Bio.Innov, 5*(6), 810-815.

Zaida Herrador, Luis Sordo, Endalama.w.Gadisa, Javier Moreno, Javier Nieto, Agustín Benito, Abraham Aseffa, Carmen Cañavate, Estefania Custodio . (2014). Cross-Sectional Study of Malnutrition and Associated Factors among School Aged Children in Rural and Urban Settings of Fogera and Libo Kemkem Districts, Ethiopia. *Plos One*.*10*, 137.

Zelalem Tafese and Anteneh Shele. (2015). Knowledge, attitude and practice towards malnutrition among health care workers in Hawassa City, Southern Ethiopia. *Global Academic Research Journals.*

APPENDICES

Appendix I: Informed Consent (Care givers)

UNDERNUTRITION AND ITS ASSOCIATED FACTORS IN PRE-SCHOOL CHILDREN IN ASEMBO, SIAYA COUNTY

Hallo. My name is Terry Komo and I am a student at Jomo Kenyatta University of Agriculture and Technology. The reason I am seeking this consent is because I want to conduct the research as entitled above and would like you and your child to participate. The research aims to find out whether your child has good nutrition status, or whether he or she has lower or higher nutritional status than the normal. We would also want to find out some of the factors associated with undernutrition in nursery school children.

From your child, we shall need information on their age, weight, height, academic performance and a few details about their health.

For the weight and height, we shall visit the nursery school where your child learns and my trained team and I shall take the measurements by use of a digital weighing scale and a height board respectively.

We would also like to invite you to the school on the day when we visit your child's school so that you can see what we are doing and we would also like you to give us some information on the child's health details and a few household characteristics which may affect the nutrition status of your child. This information we shall obtain from you by use of a structured questionnaire.

We assure you that the information which we shall obtain from you is confidential. None of the teachers or any other parent shall be able to see the information you give us. Your child's and your participation in this study is also voluntary; you have the right to decline.

There will be no adverse effects of the research to you or your child. The benefit of this study will be that once factors which may lead to undernutrition are identified, actions can be taken to address them. The government can use the results of the study to make policies to help prevent malnutrition. Besides this, in case your child is found to have malnutrition, we shall inform you and refer you to a hospital for management.

In case of any questions concerning the study, please contact me on 0710261810.

NAME……SIGNATURE……

DATE……

Appendix II: Informed Consent (Head teachers)

UNDERNUTRITION AND ITS ASSOCIATED FACTORS IN PRESCHOOL CHILDREN IN ASEMBO, SIAYA COUNTY

Hallo. My name is Terry Komo and I am a student at Jomo Kenyatta University of Agriculture and Technology. The reason I am seeking your consent is because I intend to carry out a study entitled above, in your school. The study seeks to find the proportion of nursery school children (3-5 years) who have malnutrition and the factors which may lead to undernutrition.

We intend to sample a few children from your school, from whom we shall obtain their weight, height and age information. The weights and heights of the children shall be measured by use of digital weighing machine and height board respectively. With me will be a team of trained assistants to conduct the exercise.

Apart from that, I would wish to ask you a few questions on the water and sanitation details of the school. I assure you that the information obtained is confidential and only asked for the purpose of the research and the school identity shall not be revealed to any other party.

I seek your consent to also allow us to invite the parents of the chosen children to your school, so that they see exactly what we are doing and also give us some information on their homes' water and sanitation characteristics.

The benefits of this study include identification of factors which cause undernutrition in preschool children and hence help in formulation of policies as per the recommendations which will be made from the findings of the study. There are no adverse reactions anticipated from any activity that will be conducted on the children during the study.

In case of any questions concerning the study, please feel free to contact me on 0710261810.

NAME……SIGNATURE……

Appendix III: Questionnaire

Administrative Details

Questionnaire ID No……School name……

Name of interviewer……Date of interview……

SECTION A: CHILD'S DETAILS

A1. Child's ID no……A2. Name of Child……

A3. Sex 1) Male ☐ 2) Female ☐

A4. Date of birth……A5. Age in months……

A6. Height in cm……..A7. Weight in kg…….

1: HOUSEHOLD DEMOGRAPHIC CHARACTERISTICS

1.1 What is the maternal age? _____

1.2 What is the mother's marital status? 1) Married ☐ 2) Divorced ☐ 3) single ☐

4) Separated ☐ 5) Widowed ☐

1.3 What is the mother's highest education level? 1) Primary ☐ 2) secondary ☐

3) Tertiary ☐ 4) never went to school ☐ 5) adult education ☐

1.4 What is the mother's occupation? 1) Farmer ☐ 2 Fishing ☐ 3) Casual worker ☐

4) Formal employment 5) self-employed 6) ☐ 7) unemployed ☐

2: HOUSEHOLD SOCIO-ECONOMIC CHARACTERISTICS

2.1 Who is the main household provider? 1) Self ☐ 2) Other ☐

2.2 Do you live in your own house? 1) Yes ☐ 2) No ☐

2.3 Do you own any livestock? 1) Yes ☐ 2) No ☐

2.4 If yes above, which livestock? 1) Cattle ☐ 2) sheep ☐ 3) goats ☐

4) Poultry ☐ 5) donkey ☐ 6) pigs ☐ 7) other (specify)

3: HOUSEHOLD CHARACTERISTICS

3.1 What type of wall is your house made of? 1) Iron sheets ☐ 2) mud ☐ 3) cement ☐

4) Brick ☐ 5) timber ☐

3.2 What is the roof of your house made of? 1) Iron sheets ☐ 2) bricks ☐ 3) grass ☐

4) Other (specify) _____

3.3 What is the floor of your house made of? 1) Earther ☐ 2) cow dung ☐ 3) cement ☐

4) Tiles ☐ 5) other ☐

3.4 What is your main source of cooking fuel? 1) Firewood ☐ 2) charcoal ☐ 3) gas ☐

4) Kerosene ☐ 5) electricity ☐ 6) other (specify) _____

4: HOME WATER AND SANITATION CHARACTERISTICS

4.1 What type of toilet do you use? 1) Pit latrine ☐ 2) VIP latrine ☐

3) WC ☐ 4) Open field ☐

4.2 What is the source of your drinking water? 1) Tap ☐ 2) river ☐ 3) lake ☐

4) Rain ☐ 5) spring ☐ 6) other (specify) _____

4.3 Is your drinking water treated?

1) Yes ☐ 2) No ☐

4.4 If yes to above, what do you use for water treatment? 1) Boil ☐ 2) chlorine ☐

3) Water guard ☐ 4) filtration ☐ 5) other (specify)_____

5: CHILD HEALTH CHARACTERISTICS

5.1 did you complete the routine KEPI immunization schedule for your child?

1) Yes ☐ 2) No ☐

5.2 is there documented evidence? (Must see)

1) Yes ☐ 2) No ☐

_____

5.3 has your child had diarrhoea diagnosed and treated in hospital in the last 2 weeks?

1) Yes ☐ 2) No ☐

5.4 Has your child been ill of any disease that was diagnosed and treated in hospital in the last 2 weeks?

1) Yes ☐ 2) No ☐

5.5 Which disease was that? (Specify) _____

6: SCHOOL WATER AND SANITATION CHARACTERISTICS

6.1 What type of toilet do the children use? 1) Traditional pit latrin ☐ 2) Vip pit latrine ☐

3) Water closet ☐ 4) open field ☐

6.2 What is the source of drinking water for the children? 1) Rai ☐ 2) ta ☐ 3) lake ☐

4) River ☐ 5) stream ☐ 6) carry from home ☐

6.3 Is the drinking water treated?

1) Yes ☐ 2) No ☐

6.4 if yes to above, what is used for treatment? 1) Boil ☐ 2) chlorine ☐

3) Water guard ☐ 4) filtration ☐ 5) other (specify)_____

6.5 is there a functional hand washing facility in the school? (Must see)

1) Yes ☐ 2) No ☐

Appendix IV: Ethical Approval

OFFICE OF THE DIRECTOR OF GRADUATE STUDIES AND RESEARCH

UNIVERSITY OF EASTERN AFRICA, BARATON

P. O. Box 2500-30100, Eldoret, Kenya, East Africa

February 27, 2018

Terry Watiri Komo
Health Sciences
Jomo Kenyatta University of Agriculture and Technology

Dear Terry,

Re: ETHICS CLEARANCE FOR THESIS PROPOSAL (REC: UEAB/14/02/2018)

Your thesis proposal entitled ***"Undernutrition and its Association with Psychosocial and Academic Performance in Pre-school Children in Asembo,Siaya County"*** was discussed by the Research Ethics Committee (REC) of the University and your request for ethics clearance was granted approval.

This approval is for one year effective February27, 2018 until February26, 2019. For any extension beyond this time period, you will need to apply to this committee one month prior to expiry date.

Note that you will need a research permit from the National Commission for Science, Technology, and Innovation(NACOSTI) and clearance from the study site before you start gathering your data.

We wish you success in your research.

Sincerely yours.

Prof Jackie K. Obey, PhD
Chairperson, Research Ethics Committee

University of Eastern Africa, Baraton
27 FEB 2018
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

A SEVENTH-DAY ADVENTIST INSTITUTION OF HIGHER LEARNING
CHARTERED 1991