PREDICTORS OF DOUBLE BURDEN OF MALNUTRITION AMONG MOTHER-CHILD IN KERICHO COUNTY, KENYA

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A Research Thesis Submitted to the Institute of Postgraduate Studies of Kabarak University in Partial Fulfillment of the Requirements for the Award of Master of Science in Human Nutrition and Dietetics

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DECLARATION

1. I do declare that:

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Faith J. Kimutai

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RECOMMENDATION

To the Institute of Postgraduate Studies:

The research thesis entitled "**The Predictors of Double Burden of Malnutrition Among Mother-Child Pair in Kericho County"** and written by **Faith J. Kimutai** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed the research thesis and recommend it be accepted in partial fulfilment of the requirement for the award of the degree of Master of Science in Human Nutrition and Dietetics.

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DEDICATION

This thesis is dedicated to my parents Mr. and Mrs. Kimutai Belio who endeavored to educate me and supported me throughout my academic pursuits, my loving partner George Kipng'eno K. and to my young son, Nathaniel Asher Kiptoo, who lovingly endured my absence and supported my commitments during this pursuit.

ABSTRACT

Double burden of malnutrition (DBM) is a global emerging problem in the low and middle-income countries. The coexistence of an underweight child with an overweight mother within the same household is a new occurrence as both shares a common environment, resources and has access to the same feeding habits and patterns. Several factors are responsible for this. Studies have been conducted on individual nutrition status of mothers and children. However, there is minimal information on dual burden of malnutrition. The main objective of this study was to investigate the predictors associated with double burden of malnutrition among the mother-child pairs living in Kericho County. The study design was cross-sectional analytical study design with a population of 346 participants comprising of a mother-child pairs living within the six sub-counties in Kericho County. A multi-stage stratified cluster sampling method was utilized to get the target households. A pre-tested questionnaire was used for collecting data such as: socioeconomic demographic characteristics, nutrition status for mother and child, food intake. Data entry, coding, cleaning and analysis were done using Ms Excel, SPSS version 26.0 and Nutri survey 2005 software. Chi square was used to analyze for categorical variables. P value for significance was set at $p<0.05$. The results showed that majority of the respondents 57.6% were aged between 36 and 49 years.Majority of mothers are married (68.8%), had attained secondary level of education (38.8%) and were in business (28.1%). A proportion (25.6%) the households did not access adequate food. Total mean maternal daily energy consumption was 1,441.3±343.2 kcal while for children it was 1,564.9 ±253.7 kcal. The numbers of meals taken per day were 3.2 ± 0.73 for mothers and 4.1 ± 0.91 for children. Slightly above half (56.4%) of the children were reported to have suffered from one or more of illnesses. Common illnesses include; common cold, diarrhea, malaria, and skin conditions. About 28.1% of mothers were overweight while 7.7% were obese. The children who were wasted was 34.6%, while 18.9% were stunted. The total prevalence of DBM with respect to wasting was at 8.5% of the pairs while 5.0% for stunting. The mother's age and energy intake were significantly ($P<0.05$) associated with occurrence of DBM. Similarly, the child's age and gender influenced the occurrence of DBM. This study revealed the double burden of malnutrition exists between child and maternal pair in Kericho. With age, dietary intake and morbidity status being the major determinants. The study recommends that health actors educate the mothers on maternal, infant and young child nutrition policy to fill in the existing gaps. The study also recommends that policy makers to review the Maternal, Infant and Young Child Nutrition policy to take into consideration of double burden of malnutrition.

Keywords: *Double Burden of Malnutrition, Nutrition Status and Morbidity Status*

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ABBREVIATIONS AND ACRONYMS

BMI	Body Mass Index
COVID-19	Corona virus disease 19
DBM	Double Burden
DBM	Double burden of malnutrition
EPI	Extended program on Immunization
FAO	Food and Agricultural Organization
FGR	Fetal growth restriction
KDHS	Kenya Demographic and Health Survey
LMIC	Low- and Middle-income countries
MCDBM	Maternal and child double burden
MENA	Middle East North Africa.
NCD's	Non-communicable Disease
SC	Stunted Children
SCOWT	Stunted Child and Overweight/Obese Mother
SES	Socio-Economic Status
TBM	Triple Burden of Malnutrition
UNICEF	United Nation Children Fund
WBG	World Bank Group
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

A household - People represented by one caretaker and eating from the same' cooking

pot.

Double Burden of Malnutrition - Co-existence of under nutrition and over nutrition

between a mother and child in the same population or household.

Mother-Child Pair -A woman of reproductive age (15-49) with a child aged between

24 -59months

Over Nutrition - Body Mass Index of 25.0 kg/m^2

Under Five -Children between ages of 24 to 59 months

Under Nutrition - Body Mass Index of ≤18.5kg/m^2 or wasting (-4SD, -3SD and -

2SD Z scores)

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter provides the background, problem statement, study justification, purpose of the study, objectives of the study, research questions, significance and scope of the study and limitation of the study.

1.2 Background of the Study

Globally, it is estimated that up to 41 million children under the age of 59 months were overweight or obese, while 144 million were stunted and 47 million were wasted in 2020(WHO, 2020). On the other hand, 1.9 billion adults are overweight and obese, with 246 million women of reproductive age being overweight and obese around the world. Nutrition-related factors contribute to approximately 45% of deaths in children under 59 months, mainly due to under nutrition, whereas, over nutrition is often linked to most diet related non-communicable diseases and mortality in the world. While low- and middle-income (LMIC's) countries are now witnessing transition with a simultaneous rise in overweight and obesity and an increase in under nutrition (World Health Organization, 2018).

This complex shifts produces a new triad reffered to asthe Double Burden of Malnutrition (DBM) whichimplies the presence of both undernutrition and over-nutrition (overweight or obesity) either at the individual, household or population level. DBM may appear at different levels: At individual level, as over- weight along with nutritional deficiencies; at household level, with underweight or stunted children and overweight adults; or at population level, with the coexistence of undernutrition and overweight.

Double burden of malnutrition is an emerging problem in LMICs, including Asian countries (Bann *et al.,* 2018). In an attempt to investigate the socioeconomic inequalities in the burden of underweight and overweight among children in South Asia, Hossain*et al.* (2020) found that factors like maternal nutritional status were strongly associated with nutritional outcomes in children. In addition, the study provides evidence on socioeconomic disparities for the coexistence of under-nutrition and over-nutrition among children aged 24 to 59 months in South Asian countries.

The DBM was initially documented in adults, but it has also been seen in children from Brazil, China, Russia and South Africa (Tzioumis & Adair, 2014). In China, it is estimated that 42% of adults and about one-fifth of all children are overweight or obese with the most common cause cited as inadequate food intake, such as unhealthy dietary habits (e.g., fats or drinks that are high in sugar or salt) consuming food high in salt and sugars (National Health & Family Planning Commission, 2014). Furthermore, according to Zhou *et al. (*2020)a substantial dual burden of malnutrition among children and adolescents in Henan Province exist. The urban-rural differences in nutritional status exist with higher prevalence in rural areas than in urban.

A couple of studies analyze double burden within households by looking at pairs of overweight mothers and undernourished children. In Sub-Saharan Africa Ihab *et al*. (2013) reported prevalence rates of double burden problem within households to range from less than 5% in Sub-Saharan Africa to30%. In Malaysia, Boakye-Agyemang(2018), asserts that under nutrition, obesity and diet-related non-communicable diseases are leading to catastrophic costs to individuals, communities and national healthcare systems. The study further maintains that the impact of under nutrition is being felt alongside overweight, obesity and diet-related non-communicable diseases in many poor households.

The coexistence of over-nutrition and under-nutrition is emerging as a public health problem in Nigeria. A study carried by Idowu *et al.*(2020) aimed at determining prevalence of coexisting maternal overweight and obesity with childhood stunting (MOCS) and the associated socio-demographic factors in rural and urban communities of Lagos State, Nigeria. The findings showed that the prevalence of overweight and obesity among mothers was significantly higher (p=0.022) in urban (50.7%)than rural areas (41.3%). while the prevalence of childhood stunting was significantly higher in rural than urban areas (43.3% 12.6%; p<0.001). Coexisting maternal overweight and obesity with childhood stunting was observed in 31 (10.3%) mother child pair with a significantly higher prevalence in rural than urban areas (14.7% vs. 6.0%, p=0.014). This finding indicated that coexistence of double-burden malnutrition is a problem at the community level. A study conducted in Benin reported that DBM is a rising problem in urban areas and a more lack of knowledge on this challenge that there in the rural areas (Alaofè & Asaolu, 2019).

In South Africa, the occurrence of the double burden of malnutrition is on the rise at a household level predisposing child and their mothers to negative health outcomes. However, few studies have been conducted at a household level as reported by Modjadji and Madiba (2019) who conducted a research in a rural Dikgale health and demographic site in Limpopo Province, South Africa. In Rwanda, double burden of malnutrition is a public health concern. Nyiraneza*et al*. (2018) revealed that the prevalence of stunting among children under five years decreased overtime from 51% in 2005 to 44% in 2010 and to 38% in 2015 while on the hand, the rates of overweight and obesity on children less than 5 years and women of reproductive age is also on the rise thus creating a dual burden.

The findings from this Rwandese study are in agreement with Kenya Integrated Household BudgetSurvey (2015)that also indicated that 9% of women age 15-49 are thin or undernourished (BMI <18.5kg/m2); 33 percent of women are either overweight (BMI ≥25kg/m2), with 10 percent being obese (BMI ≥30 kg/m2).The Kenya Demographic Health Survey (2014) reported that there has been a notable decrease in the country's stunting rates but are higher than the World Health Organization cut offs of <20% while an increase in women's overweight and obesity to 38% in 2014.The report also noted that double burden malnutrition is an important issue that affect mothers' health as well as the health of their children.

The double burden of malnutrition of children under 5 years is equally prevalent in Kenya. Kimani-Murage*et al*. (2015)found a DBM rate of 43% among poor households in Nairobi, Kenya. Kimani-Murage*et al*. (2015) studied on poor urban setting focusing on poor households. The study, however, analyzed respondents' socio-economic characteristics from all social classes cutting across rural and urban setting who were food secure and those that were food insecure. These findings by Kimani-Murage *et al*. (2015) confirmed an existing double burden of malnutrition characterized by a high prevalence of under nutrition particularly stunting early in life, and overweight/obesity in adulthood, particularly among women.

In another study, Fongar *et al*.(2019)on double burden problems in rural Kenya. The findings revealed that double burden is 1% in children and 1 − 3% at household level. The relatively lower prevalence was attributed to use of wasting or underweight as indicators of child under nutrition. The proportion was much higher when using stunting or micronutrient deficiency as indicators (13−17%).The study concluded that various forms of DBM problems exist in rural Kenya at household and individual levels. The

double burden of malnutrition in the country presents a novel public health problem that complicates nutrition policy planning and interventions(kinya P. Masibo et al., 2020).

A study by UNICEF(2016)documented that Kericho County is among the 28 counties in Kenya with high prevalence of stunting and wasting ranging between 20 – 28%. Kericho County Government report of 2013 also showed county underweight prevalence of 12.4% compared to the national rate of 11.0% and stunting prevalence of 28.7% against the national figure of 26.0%(Kericho County Health at Glance, 2013). There is no current data on overweight or obese women in Kericho County while the national figure for overweight and obese is reported at 33% whereas underweight stands at 9%.

There are limited studies exploring the coexistence of under nutrition and over-weight/obesity among children and mothers in the same households especially in the rural areas of most developing counties in Kenya. According to the national statistics KNBS (2015), it is evident that there is a coexistence of both under and over nutrition at the national level but no exact studies showing data of its coexistence in households in rural areas. This study therefore aimed at determining predictors associated with double burden of malnutrition among child-mother pairs in Kericho county Kenya.

1.3 Problem Statement

The coexistence of various forms of malnutrition among mothers and children has continued to rise worldwide. It is reported that an estimate of up to 41 million children under the age of 5 years were overweight or obese, while 155 million were chronically undernourished: stunting had a higher rate of 151 million and wasting rates of nearly 50million (World Health Organization, 2019).Adult obesity is also sharply rising and more than 672 million is either overweight or obese. While in Africa, 28% of children

under 5 years of age are moderately or severely underweight (UNICEF, 2007) with 38% of children under five stunted (United Nations, 2012).

The prevalence of under nutrition in Sub Saharan Africa rose from 181million in 2010 to 222 million in 2016(Summary, 2018). Although stunting in the under 5's has reduced, the number affected still continues to soar while those wasted are at 13.8 million children, those overweight and obesity rose from 6.6 million to 9.7 million respectively (World Health Organization, 2018). The statistics of adult with diabetes have also nearly doubled from 28% in 2000 to 42% in 2016 (World Health Organization, 2018), this therefore showed that under nutrition is not the only problem in Sub Saharan Africa but a serious public concern of over nutrition is rising as well in the region.

Kenya is a sub-Saharan country where under nutrition is still persisting in high numbers in spite of the progress made in poverty elimination and empowerment (El Kishawi *et al*., 2016). As under nutrition increases, it is accompanied by increase in overweight and obesity. The unknown concept the how big is this problem of dual burden of malnutrition in Kenya. Kenya has been experiencing a notable decline in under nutrition in children, but the stunting rates are still high than the WHO cut off of 20% while over-nutrition among Kenyan females is still rising since 2003-2014 with 23%,25% and 38% respectively (KDHS, 2014).

The consequences of the DBM are enormous; early life under nutrition is an underlying cause associated with about a third of young child deaths. Among the survivors who become stunted during the first two years of life, their capacity to resist disease, to carry out physical work, to study and progress in school, are all impaired across the life course (Shrimpton & Rokx, 2012).

According to Dadhich and Faridi (2013)high prevalence of maternal overweight or obesity was common with high burden of stunting and infant mortality. Malnutrition in childhood has been shown to have longer health repercussions while in adulthood while increasing ones susceptibility to both acute and chronic diseases (Popkin *et al.,* 2020).Another study conducted in Ghana showed that both chronic malnutrition (stunting and obesity) risk being transmitted from mother to its offspring- also known as maternal-child intergenerational cycles Christian. In Ethiopia, a study by Berhane *et al.* (2020) maintain that preschoolers in Addis Ababa have limited quality diets and suffer from both under- and over-nutrition. In this study, maternal education was an important explanatory factor for stunting and being overweight. Still, double burden malnutrition remains to be the problem affecting mother and under five-year-old children's pair.

In Kenya, the DBM stands at 43% Kimani-Murage *et al.*(2016) this study however was specific to the urban poor populations. In Kericho County, stunting and wasting is established to be 28.7% while stunting burden is above 20% of children UNICEF (2016), however, this survey only focused on the tea plantation estates which is not a true reflection of the wider Kericho county that has the rural and urban areas with different populations.

As a result of the transition nutrition from the chronic under nutrition to both under and over nutrition among mothers and their children, there is still limited data on the burden of malnutrition among child-mother pair especially in the rural Kenya. According to the national statistics(KNBS, 2015), there is a coexistence of both under- and over-nutrition nationally, but the magnitude of the problem at a household level is not documented. This situation therefore necessitated the study to determine the predictors associated with double burden of malnutrition among child-mother pairs in Kericho County.

1.4 Study Justification

Nutritional status, which is a critical component of a person's health and wellbeing, must be recognized as a necessary building block towards achieving Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs) in Kenya (WHO, 2017).The SDGs envisage eliminating poverty and hunger. This will be achieved by promoting good health and quality education by 2030. The broader focus on nutrition in SDGs targets on reducing malnutrition in all forms with a target of 2.2) and reducing Non-communicable Disease (NCD's) by a target of 3.4 (Sabbahi *et al.,* 2018).

The DBM affects all countries, including all socio-economic cadres, and is a major concern in countries with high stunting rates like Kenya. The consequences of the DBM are enormous more so in the early life, which has long lasting effects on physical and cognitive development. Furthermore, malnutrition affects productivity of child which is carried into the adolescence and thereafter into adulthood causing intergenerational cycle of malnutrition(IFPRI, 2000).Among the survivors of malnutrition with history of stunting during the first two years of life, evidence shows that there is reduced capacity to resist disease, to carry out physical work and impaired academic performance (Shrimpton & Rokx, 2012).

1.5 Purpose of the Study

The purpose of the study was to determine the predictors of double burden of malnutrition among mother-child pairs in Kericho County.

1.5.1 Objectives of the Study

i.   To describe demographic and socio-economic characteristics associated with double burden of malnutrition among child-mother pair in Kericho County.

ii. To assess the prevalence of double burden malnutrition in mother-child-pairs in Kericho County.

iii. To establish the dietary intake among mother-child-pairs in Kericho County

iv. To determine the morbidity status among child-mother's pairs in Kericho county

v.   To determine the association between demographic and socio-economic characteristics, dietary intake, morbidity status and nutritional status of mother-child pairs in Kericho County

1.6 Research Questions

i.   What is the demographic and socio-economic characteristic of child-mother pairs in Kericho County?

ii. What is the prevalence of double burden malnutrition among mother-child-pairs in Kericho County?

iii. What is the dietary intake among mother-child-pairs in Kericho County?

iv. What is the morbidity status among child-mother pairs in Kericho County?

v.   What is the association between, demographic and socio-economic characteristic dietary intake, morbidity status and nutritional status of child-mother pairs in Kericho County?

1.7 Significance of the Study

The study findings, conclusions and recommendations would be significance to the community on how to utilize the available foods to ensure good dietary practices and address malnutrition in mother-child pairs in Kericho County. The study finding will also

be beneficial to families on how to follow recommended dietary intake among mother-child-pairs in order to avoid malnutrition. The study findings would be beneficial to health policy implementers to scale up nutrition program to the large communities in remote areas and in schools to target the female population about malnutrition in mother-child pairs in Kericho County.

The study findings will be significant to policy makers to develop an appropriate nutrition and health action plan. It will further show ways of further implementing the plan from the top to the communities and therefore add more opening to curbing both ends of malnutrition. The study findings also will be helpful in filling the existing research gap and providing base for knowledge for future researchers and scholars.

1.8 Scope of the Study

This study focused on double burden of malnutrition among child-mother pairs in Kericho County. The study was carried out in Belgut, Bureti, Kericho East, Kipkelion, Londiani and Soin-Sigowet sub counties. Specifically, the study concentrated on demographic and socio-economic, nutritional status, and dietary intake among children under 5 years and their mothers in Kericho County. Finally, an association between nutritional status, dietary intake, and socio-demographic characteristics of children and the mothers in Kericho County was analyzed.

1.9 Limitation of the Study

The study was limited by the research design which is cross-sectional analytical study design. The design may only establish the current situation as applicable to the study subjects.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section presents literature as reviewed from existing empirical research and other related literature. This study therefore reviewed the prevalence of DBM among mother-child-pairs, socio-demographic characteristics associated with double burden malnutrition and the dietary intake among mother-child pairs to examine the plausible linkage with DBM. This section reviewed literature related to study objectives and highlighting the knowledge gaps.

2.2 Prevalence of Double Burden Malnutrition (DBM) Among Mother-Child-Pairs

Malnutrition in mothers and children is a significant public health challenge in developing countries. Although under nutrition in children has been gradually decreasing, the coexistence of various forms of malnutrition in mothers and children has continued to rise globally. It is imperative to emphasize that DBM can exist at the individual, household and population levels (Shrimpton & Rokx, 2012).According to the existing literature, at the individual level, obesity can occur with deficiency of one or various vitamins and minerals, or overweight in an adult who was stunted during childhood(Gillespie & Flores, 2000).Furthermore, at the household level, a mother may be overweight or anemic and a child or grandparent is underweight. Consequently, the DBM at the population level occurs when there is a prevalence of both under nutrition and over-nutrition in the same community, nation, or region (Shrimpton & Rokx, 2012).

One study in a LMIC sought to determine prevalence and predictors associated with double and triple burden of malnutrition among mothers and children in Nepal Sunuwar *et al*. (2020).The findings from this study indicated that the prevalence of DBM and

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TBM was 6.6% and 7.0%,respectively in the same households. The study concluded that there was prevalence of double and triple burden of malnutrition among mother-child pairs in Nepal. These findings pointed that in global scene, double burden malnutrition remains a problem that if it is not solved, could negatively affect health to children and their mothers.

The increasing number of overweight mothers is becoming a new health concern for Bangladesh. Mamun and Mascie-Taylor (2019) sought to investigate a Bangladesh Perspective of DBM and anemia. The results of their study showed that double burden exists in Bangladesh and in the same household. The study also noted that the co-existence of overweight mother and undernourished children in the same household portrays the complex dynamics of possible causes.

Further, a research by Islam *et al.*(2016) confirms that the prevalence of underweight among early chilDBMearing mothers in Bangladesh is very high (32.1 %), associated with the still common practice of teenage marriage. Education level, wealth index, occupation, place of residence, age at first, marriage and parity were important predictors for their nutritional status.

Developing countries are undergoing various types of transitions. The epidemiological transition makes them face a double burden of communicable and non-communicable diseases. Similarly, demographic and socioeconomic transitions are also occurring in these countries (Kapoor & Anand, 2002).This situation was confirmed by El Kishawi *et al*. (2016) who aimed at determining the prevalence of the dual form of malnutrition in the same household and its associated factors in the Gaza Strip. The results from their study showed the dual form of malnutrition in the same household was prevalent. The study concluded that this was a public health issue that must be understood and

addressed and policy makers must implement an appropriate nutrition action plan to control dual form of malnutrition based on the underlying specific risk factors in the study population.

In the Middle East and North Africa region, the nutrition transition has resulted in drastic increases in adiposity, particularly among women, while some types of under nutrition remain prevalent, especially among pre-school children (Sassi*et al.,* 2018). In a nutrition transition context in the MENA region where excess adiposity is highly prevalent among women, there was a high prevalence of intra-household anemic child-overweight or obese mother(Sassi*et al.,* 2018).

The nutritional situation in West Africa showed that DBM exist. Using data from the Demographic and Health Surveys and the Multiple Indicator Cluster Surveys, Transform Nutrition West Africa reported on prevalence of low birth weight, under5's stunting, under5's and WRA anemia, under five and WRA overweight/obesity, under5 and WRA wasting. The analyses showed that 14 West African countries face multiple forms of malnutrition among children simultaneously (Verstraeten, 2020). This research demonstrates that DBM is an important problem that requires urgent attention.

Brewis(2009), carried out a study to explore paradoxical malnutrition in mother-child pairs. They concluded that several factors were significantly associated with an increased relative odd of discordant mother-child pairs, including working in subsistence agriculture, low levels of maternal education, more siblings in the household and relative household poverty. However, many of these factors also predicted other combinations of poor nutritional status in mother-child pairs.

In sub-Saharan Africa, 28% of children under 5 years of age are moderately or severely underweight(UNICEF, 2007)with 38% of children under five stunted (United Nations,

2012).In sub-Saharan Africa, there is prevalence of double burden households in recent data from sub-Saharan Africa. Countries that have a high prevalence of child under nutrition correspondingly have a high prevalence of adult underweight and low prevalence of adult overweight and obesity (Wojcicki, 2014). However, the results of Keino*et al*. (2014)indicated that the prevalence rates of stunting and overweight were dependent on socioeconomic, demographic, and environmental factors. They noted further that although socioeconomic, demographic and environmental factors were significant in determining stunting and overweight, other factors, such as nutrition and lifestyle, were important risk factors.

The dual burden of nutrition transition in evident in Nigeria. This view was advanced by Kandala and Emina(2016) findings that discovered that 12.0% of the population were underweight, while 20.9% were either overweight or obese, based on BMI. The northern states of Sokoto and Yobe/Borno and the southern state of Delta had the highest prevalence of underweight, while states in the Centre had the lowest underweight prevalence. Underweight women were more likely to be from poorer households compared with their counterparts from the richest wealth index, which were consistently associated with lower odds of being underweight (posterior odds ratio (POR) and 95% credible region (CR): 0.56 [0.46, 0.70]). The coexistence of child malnutrition and maternal overweight in the same households epitomizes rapid nutrition transition in developing countries.

Bouzitou *et al.* (2005), studied the magnitude of child malnutrition and maternal overweight in same households in poor urban areas of Benin. They found that 35.5% of children were malnourished, and school-age children had a worse nutritional status than under-5 children: 41% and 30% PEM (chronic or acute or both), respectively. The rate of maternal overweight was 39.1% including 15.5% of obesity.

In South Africa, the occurrence of the double burden of malnutrition is on the rise at a household level predisposing child and their mothers to negative health outcomes. Modjadji and Madiba (2019) conducted a study on double burden of malnutrition using mother-child pairs in a rural setting in South Africa. The results indicated that Twenty five percent (25%) of the children were thin, 4% were overweight and 1% obese, while (27.4%) mothers were overweight and 42.3% obese. It was concluded based on the finding that a double burden of malnutrition was observed on a household level with thinness among children and overweight/obesity among mothers. It can be noted that a need to address the dual problems of under nutrition and rapidly rising trends of overweight/obesity cannot be over-emphasized.

Various forms of DBM problems exist in rural Kenya at household and individual levels. Prevalence rates depend on how DBM is defined and measured. Kimani-Murage*et al*. (2015) estimated that in Kenya, DBM rate of 43% was found among poor urban households in Nairobi. In contrast, Fongar *et al. (*2019) in their research endeavored to analyze DBM problems in rural Kenya, using and comparing different DBM definitions and measurement approaches. In the study, DBM at the individual level was found in 19% of the adults, but only in 1% of the children. DBM at the household level was relatively low (1–3%) when using wasting or underweight as indicators of child under nutrition, but much higher (13–17%) when using stunting or micronutrient deficiency as indicators.

Moreover, Kimani-Murage *et al.* (2015b) explored the coexistence of over and under-nutrition at the neighborhood and household level, in an urban poor setting in Nairobi, Kenya. The findings confirmed an existing double burden of malnutrition in this setting, characterized by a high prevalence of under nutrition particularly stunting early in life, with high levels of overweight/obesity in adulthood, particularly among women.

Specifically, it was evident that a large proportion (43% and 37%) of overweight and obese mothers respectively had stunted children.

2.3 Demographic and Socio-Economic Characteristics Related to Double Burden Malnutrition

Based on previous studies, the following socio-demographic characteristics have been associated with double burden malnutrition. A couple of studies have shown that maternal age, marital status and household income, education level are the main demographic characteristics that influence children's nutrition status (Dessie *et al.,* 2019). Maternal education was associated with nutrition status in the sense that mothers who were educated were less likely to have wasted and stunted children than mothers who were not educated.

2.3.1 Age of the Child and the Mother

Low- and middle-income countries (LMICs) continue to face a significant stunting burden; it was reported that 148 million children were stunted, between 30-40% of all children in 2011. Fetal growth restriction (FGR) is normal in many of these countries, as growth subsequently falters in the first 24months(Christian *et al*., 2013).

The relationship between under nutrition, overweight and obesity is more than its coexistence. Reflected in the epidemiology and supported by evidence, under nutrition early in life and even in utero may predispose to overweight and non-communicable diseases such as diabetes and heart disease later in life. Overweight in mothers is also associated with overweight and obesity in their offspring. Rapid weight gain early in life may predispose to long-term weight excess (World Health Organization, 2019).

Kimani-Murage(2013) explored the double burden of malnutrition in rural South Africa. The findings revealed that at the household level, maternal age and age of household head were associated with young child under nutrition, while maternal age, household head's education level, food security, and socio-economic status were all associated with overweight/obesity and risk for metabolic disease among adolescents. Moreover (Anik *et al.,* 2019) identified risk factors for double burden malnutrition included not only breastfeeding, respondent's older age, child's older age, but also middle and rich groups of wealth-index.

Similarly, Sunuwar *et al. (*2020) carried a study to explore the coexistence of various forms of malnutrition and associated factors among mother-child pairs residing in the same household. The results revealed that mothers with aged over 35 years (AOR = 3.08, 95% CI: 1.20–7.86), and those who had achieved at least secondary level education (AOR = 2.05, 95% CI: 1.03–4.07) were more likely to suffer from the DBM. This indicated that maternal age as well as the education level could be used to estimate the Double-burden malnutrition at the household level.

Amugsi *et al. (*2019) sought to investigate the correlates of the DBM among women in five sub-Saharan African countries (Ghana, Nigeria, Kenya, Mozambique and Democratic Republic of Congo). It was found that the risk of being underweight, overweight, and obese in all countries was correlated with older age. This means that age appears to be correlated with a greater probability of DBM among women.

2.3.2 Household Income

Children from low-income households were more likely to be underweight than those from stable income households (Mukabutera *et al.,* 2016). Children from households with insufficient finances were more likely to be wasted and underweight than those

from households with sufficient finances. Low socioeconomic status decreases an individual's ability to afford nutrient-rich foods, predisposing to under nutrition, and also to overweight and obesity (WHO, 2020). Piernas *et al.* (2015) conducted research to explore the burden of under- and over-nutrition and nutrient adequacy among 2-12-year-old Chinese children. The results showed that overweight and obesity were more prevalent among children from urban areas and higher income households. In particular, 2-6-year-old children from urban areas and higher income households experienced the highest increase in obesity from 2009 to 2011 (P<0.05). Children from urban areas and higher income households had overall higher intakes of total daily energy and most macro- and micronutrients (P<0.05). However, a significant proportion of children did not meet the recommendations for important micronutrients.

Socio-economic status (SES) and caste in rural India are intricately linked, and several researchers concur that elevated socio economic status and high caste are positively associated with higher risk of obesity and non-communicable diseases (Kinra *et al.,* 2010).Furthermore, Batal *et al. (*2019) reports that households with wealthier and less educated mothers, and children born with a healthy weight, seem less vulnerable to the dual burden of malnutrition. Also significant are household expenditure (suggesting that the phenomenon is associated with affluence) and lifestyle choices, calling for better and nuanced behavior change communication strategies.

According to Hauqe *et al. (*2019) there is little research on the association between socioeconomic status and the familial coexistence of maternal over and child under-nutrition. This study established that maternal overweight and MOCU prevalence is higher among the wealthier segment whereas prevalence of child under-nutrition is higher among the poorest segment of the households. The current study will seek to

establish whether socioeconomic status will replicate the same findings in Kenya, especially in Kericho County.

Zhang *et al. (*2016) concluded that household economic status is an important predictor that affects the distributions of childhood malnutrition; children from the highest income families were more likely to suffer from over-nutrition and less likely to suffer from under-nutrition and stunted overweight. Children from the least urbanized villages had the highest prevalence of being stunted overweight as well as under-nutrition.

2.3.3 Maternal Education Level

Specifically, Hossain *et al.* (2020)established in their research that household's education level was also positively associated with the prevalence of overweight in children. When compared with households with no formal education, households with higher education had higher odds of having overweight children in Bangladesh (OR 2.1 (95% CI: 1.3 to 3.5), India (OR 1.2 (95% CI: 1.2 to 1.3) and Pakistan (OR 1.8 (95% CI: 1.1 to 2.9).

According to Sunuwar *et al. (*2020), mothers who attended at least a secondary level of education had a higher risk of experiencing a double burden of malnutrition. The explanation for this conflicting finding could be that mothers having a higher level of education may not necessarily be sufficient to adopt behavior change in a healthy lifestyle. In addition, various studies have also indicated that the double burden of malnutrition is associated with older mothers, mothers having short stature and a higher level of maternal education and wealth (Jehn & Brewis, 2009; Sekiyama *et al.,* 2015).

Amugsi *et al*. (2019) examined the correlates of the double burden of malnutrition (DBM) among women in five sub-Saharan African countries. This study revealed that the number of years of formal education was associated with the likelihood of being overweight and obese in Ghana, Mozambique, and Nigeria, while associated with the

likelihood of being underweight in Kenya and Nigeria. Older age was associated with the likelihood of being underweight, overweight, and obese in all countries. Positive associations were also observed between living in better-off households and overweight and obesity, while a negative association was observed for underweight.

There is a consensus among the studies (de Souza Bittencourt *et al.*, 2013; Hegewisch & Liepmann, 2013; Klasen *et al.,* 2019) that women with lower educational levels have lower participation in the labor market and have lower and unstable incomes. In addition, lower educational levels are associated with both greater inefficiency in allocating financial resources and lack of knowledge on buying healthy foods.

2.3.4 Maternal and Child Stature

Mothers with short stature were three times more likely to have a child with short stature. This is because they are likely to provide a nutritionally restricted uterine environment; therefore, the fetus will have an inadequate supply of nutrients and restricted growth, which will result in low birth weight and short stature(Dewey & Begum, 2011).

Many developing countries now face the double burden of malnutrition. A research by Oddo *et al.* (2012) who sought to estimate the prevalence of DBM in rural Indonesia and Bangladesh established that maternal short stature as well as and older age were strong predictors of Maternal and child double burden (MCDBM). Child characteristics such as older age and being female were associated with an increased odd of MCDBM, whereas currently being breastfed was protective against MCDBM. Moreover, a large family size and higher weekly per capita household expenditure predicted MCDBM.

In Guatemala households with a stunted child and an overweight mother, is a growing problem. Jounghee *et al. (*2012)explored this concept and the identification of socio-economic predictors associated with this malnutrition duality. The findings indicated that

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living in rural areas, having an indigenous mother, and lower economic level were associated with a higher prevalence of child stunting; urban residency, non-indigenous mother, and higher economic status were associated with a higher prevalence of maternal overweight. It was also revealed that socioeconomic and geographic disparities in child stunting were higher than in maternal overweight. The prevalence of this concept was significantly associated with rural residency, indigenous mothers, and relatively low economic status.

In another study, Géa-Horta *et al*. (2016) found that mother's short stature, child's vegetable intake on less than or equal to 4 d/week and inadequate household were associated with child's short stature. Finally, the lack of breast-feeding was associated with maternal overweight. Besides, lower maternal educational level and inadequate household (non-masonry house) correspondingly were seen to associate with the double burden of malnutrition.

2.4 The Dietary Intake Among Mothers and Children Under 59 months

Diet is the fundamental element affecting the health status. Personal diet is influenced by various factors such as age, occupation, education and economic level, family status and residence(Caswell *et al.,* 2013). The quantity and quality of diet at the household level therefore determines the nutritional status outcomes of the household members. Habitual consumption of energy dense foods that are poor in nutrients contribute to adult overweight/obesity whilst they deprive young children of essential nutrients that they need for satisfactory growth(kinya P. Masibo et al., 2020).

Multiple factors influence food choice and thus diet quality on a number of levels; for example, budget, resources, household structure and food availability (at a socio-economic level); taste preferences, food attitudes and identity, health motivations,

nutritional knowledge and habitual behavior at an individual level(Wansink, 2003).In addition, McGowan *et al. (*2016)states that cooking and food skills abilities may not lead directly to healthier dietary choices given the myriad of other factors implicated; however, cooking skills appear to have differential influences on aspects of the diet, most notably in relation to lowering saturated fat intake.

Over the past 3 centuries, the pace of dietary change appears to have accelerated to varying degrees in different regions of the world. The concept of the nutrition transition focuses on large shifts in diet and activity patterns, especially their structure and overall composition. These changes are reflected in nutritional outcomes, such as changes in average stature and body composition(Popkin, 2006).The causes of the double burden of malnutrition relate to a sequence of epidemiological changes known as the nutrition transition, the epidemiological transition, and the demographic transition. The nutrition transition describes the shift in dietary patterns, consumption and energy expenditure associated with economic development over time, often in the context of globalization and urbanization. This change is associated with a shift from a predominance of under nutrition in populations to higher rates of overweight, obesity(WHO, 2017).

The coexistence of stunting and overweight in a child or adolescent reflects the poor quality of diet and morbidity in the first two years of life, followed by excess energy consumption at a later life stage (Piernas *et al.,* 2015).Adequate diet, which includes recommended servings from all food groups, is essential for optimal growth as well as prevention of chronic disease in the future. An imbalance in the nutrient intake may result in serious health problems later in life(Mahan, 2008).

El-Kassas and Ziade(2017) carried out research to examine the dual burden of malnutrition and associated dietary and lifestyle habits among Lebanese School Age

Children Living in Orphanages in North Lebanon. The dietary intake evaluation showed that about half of the participants had inadequate dietary intakes of proteins, fruits, and vegetables and 92% had inadequate milk and dairy intakes recommended for their age specific needs. Despite the fact that majority of participants confirmed that meals satisfy their appetite, the dietary intake of proteins, fruits, and vegetables of more than half the children was inadequate suggesting that the dietary quantity may be sufficient but the quality is not.

Different cultures may encourage or frown upon consumption of different foods by individuals who belong to their groups. Also, the consumption of different foods at different stages of life may be actively encouraged or discouraged. This is due to the benefits and dangers of consuming these foods at certain times of life and in certain conditions. For example, most cultures will not approve of the consumption of alcohol during pregnancy or lactation. This is due to the adverse effects produced by this drink. Foods and nutrition may also be affected by culture, with respect to different beliefs within the culture (Dindyal & Dindyal, 2003).

The majorities of the global hungry lives in the rural areas and are smallholder farmers who produce most of the food they eat. Improving nutrition for this sector requires an understanding of the factors that currently constrain their access to sufficient healthy, nutritious food. Increasingly, these rural smallholders are purchasing unhealthy, cheap processed foods (Winichagoon & Margetts, 2017).Sub-Saharan Africa is experiencing the double burden of malnutrition with high levels of under nutrition and a growing burden of overweight/obesity. Largely unregulated marketing of cheap processed foods and nonalcoholic beverages as well as lifestyle changes are driving consumption of unhealthy diets in the African region (Onyango *et al.,* 2019).

It has been noted that the overweight/obesity of mothers is associated with the nutrition transition condition that contributes to a positive energy balance which means higher intake of energy dense food and less energy expenditure (Kimani-Murage *et al.,* 2015). Tendency to consume calorie-dense food with more saturated fat, trans fat and a sedentary lifestyle results in reproductive aged women gaining weight (Kosaka & Umezaki, 2017).This implies that preference to consume high energy food as well as lack of adequate physical activities predisposes women to obesity. Moreover, such mothers are at risk of feeding their children with this imbalanced diet thus exposing their children to under nutrition.

The nutrition transition is associated with the emergence of a malnutrition double burden (Jehn & Brewis, 2009). There is evidence of a nutrition transition in Kenya and Tanzania which is characterized by a shift in dietary patterns from traditional foods to the consumption of energy-dense and nutrient-poor foods (Keding, 2016). With economic development, there is a shift away from diets based largely on minimally processed staple foods to diets high in meat, vegetable oils, and processed foods. This unhealthy transition has been accompanied by large numbers of people consuming excess calories, thereby contributing to overweight and obesity (Moubarac *et al.,* 2013).

Bassete *et al.* (2014) carried research to identify prevalence and determinants of the dual burden of malnutrition at the household level in Puna and Quebrada of Humahuaca, Jujuy, Argentina. The results indicated that the prevalence of dual burden household was 12%. Compared with other households, dual burden households tended to have more people living in the house, and the educational level of the head of household was lower. Individuals living in dual burden households showed overall lower energy intakes and were more likely to have inadequate intakes of calcium and iron. The increasingly large-scale global export and imports of food and the industrialization of the food chain over

the last twenty years are changing what we eat, the way we eat, and where we eat, which is accelerating the DBM and rapid rising of NCDs (Popkin, 2006).

Tydeman-Edwards *et al.* (2018) in their study found that sugar was highest and frequently consumed food item, eaten at least twice per day by all groups. Cooked porridge was the most frequently consumed starchy food (range 47.3–53.2 times a month), followed by bread, consumed at a mean frequency of 20 or more times per month in all groups. Tea was the most frequently consumed fluid (used at least once a day by all). Generally, it was established that daily consumption of sugar, salt and fats and inadequate frequency of consumption of vegetables, fruits and milk was confirmed in both rural and urban participants. This could predispose participants to double burden malnutrition.

As babies turn into toddlers and further develop tastes and preferences, weaning them with healthy choices is key. However, as industrialization happens to countries, mothers and caretakers have less and less time to spend cooking and buying healthy choices. In addition, young children spend more and more time watching commercials including for many processed foods and snacks, which contribute to changes in their food preferences enhancing DBM (Shrimpton & Rokx, 2012).

In Egypt, the double burden of malnutrition, with static stunting rates and rising levels of overweight and obesity in children, has emerged as an escalating public health concern (Kavle *et al.*, 2015). Furthermore, Kavle *et al.* (2015) reports that a diet high in energy that provides excess calories may contribute to overweight, while at the same time lacking the micronutrients needed to prevent stunting. The association we detected between higher energy intake and higher WAZ is consistent with Egypt's stage in the nutrition transition and with dietary patterns in this age group. As expected, dietary

intakes from complementary foods were low at 4 months of age and increased to the end of the study.

Usually, poor dietary intake has been linked to a number of diseases and chronic conditions (WHO, 2014). Lack of sufficient diet intake adversely affects the functional capacity of the body (Khan *et al*., 2018). Under nutrition- the insufficient intake of energy and nutrients to meet an individual's needs to maintain good health makes children more vulnerable to disease and death (Maleta, 2006).According to Bosu (2015)the nutrition landscape in West Africa have surpassed initial stages of nutrition transition which have caused childhood and adult overweight, and obesity are becoming more prevalent. This has been enhanced by an increasing urbanization, technological developments and associated change in dietary patterns and physical activity. Moreover, in these countries, there is an indication of increasing intake of dietary energy, fat, sugars, and protein while there is low consumption of fruit and vegetables universally.

In Benin, Alaofè and Asaolu(2019)acknowledges that double burden of malnutrition (DBM) is an emerging public health concern in urban Benin. However, an understanding of the phenomena in rural areas of the country is lacking. The study by Alaofè and Asaolu(2019)identified a significant link between dietary scores and nutritional outcomes, which mean that improved food variety may indeed reflect a greater likelihood of meeting daily energy and nutrient requirements that can result in improved nutritional status.

Essentially, unregulated marketing of cheap processed foods and nonalcoholic beverages as well as lifestyle changes are driving consumption of unhealthy diets in the African region. Whereas the consumption of processed foods is increasing at the expense of fresh and minimally processed foods. The commercialization of food production, is correlated

with decreasing smallholder farming, dietary diversity, and increasing household dependence on purchased foods, resulting in diets that are of low nutritional quality (Onyango *et al*., 2019).

Keding (2016) assessed nutrition transition in rural Tanzania and Kenya. The research established that vegetable and especially fruit consumption was low in both countries. In addition, in Kenya, study participants exceeded the suggested maximum level of sugar consumption per day, which will most likely contribute to increasing levels in overweight, and obesity prevalence and other non-communicable diseases in general.

2.5 Complementary Feeding Practices and Nutrition Status

Various factors such as poor complementary feeding practices, poor breastfeeding practices as well as poor childcare and healthcare practices among children may yield poor anthropometric results (Lamichhane *et al*., 2016). Feeding practices significantly influence nutrition status of under five children. Several studies have shown that complementary feeding practices affect nutrition status. In addition, a study conducted by Paramashanti *et al*. (2019) found an association between complementary feeding practice (dietary diversity) and stunting. The study further pointed out that children with low dietary diversity were more likely to be stunted than their counterparts with high dietary diversity.

2.5.1 Morbidity Status Among Mothers and Children under 59 Months Morbidity Status

The immediate repercussions of insufficient nutrition in the formative years of a child are morbidity and mortality among others (Ntenda,2019). Young children were found to be vulnerable to infections since their immune systems were not yet fully developed in Sri Lanka. Malnutrition exacerbates this situation and often leads to high rates of morbidity

and mortality among this group (Osendarp *et al*., 2021). Good nutrition during infancy and early childhood is fundamental to the development of each child's full human potential.

2.5.2 Morbidity Prevalence and Nutrition Status

Melese *et al*. (2019) showed that high prevalence rates of diarrheal diseases affected the nutrition status of children. Other studies have been conducted and established significant associations between morbidity and nutrition status of under-five year's children (Rahman *et al*., 2016). There were minimal studies that investigated the interplay between morbidity and nutrition status among children aged 6-23 months old in Kericho County that would help in appropriate design required for interventions.

2.6 Conceptual Framework

The interrelationship between the study variables is presented in Figure 1

Figure 1

Conceptual Framework on determinants of double burden of Malnutrition

Independent Variables   Dependent Variables

```
┌─────────────────────────────┐              ┌─────────────────────────────┐
│ Demographic & Socio-        │              │ Nutritional status (mother) │
│ economic characteristics    │              │    • Overweight             │
│   • Age                     │              │    • Obesity                │
│   • Education level         │──┐           └─────────────────────────────┘
│   • Income                  │  │                         │
└─────────────────────────────┘  │                         ▼
                                 │           ┌──────────┐
┌─────────────────────────────┐  │           │   DBM    │
│ Dietary intake              │  ├──────────▶│          │
│   • 24hr recall             │──┤           └──────────┘
│   • Food frequency          │  │                         ▲
│     questionnaire           │  │           ┌─────────────────────────────┐
└─────────────────────────────┘  │           │ Nutritional status (child)  │
                                 │           │    • Stunting               │
┌─────────────────────────────┐  │           │    • Wasting                │
│ Morbidity status            │  │           │    • Underweight            │
│   • Type of illness         │──┘           └─────────────────────────────┘
│   • Frequency of illness    │
└─────────────────────────────┘
```
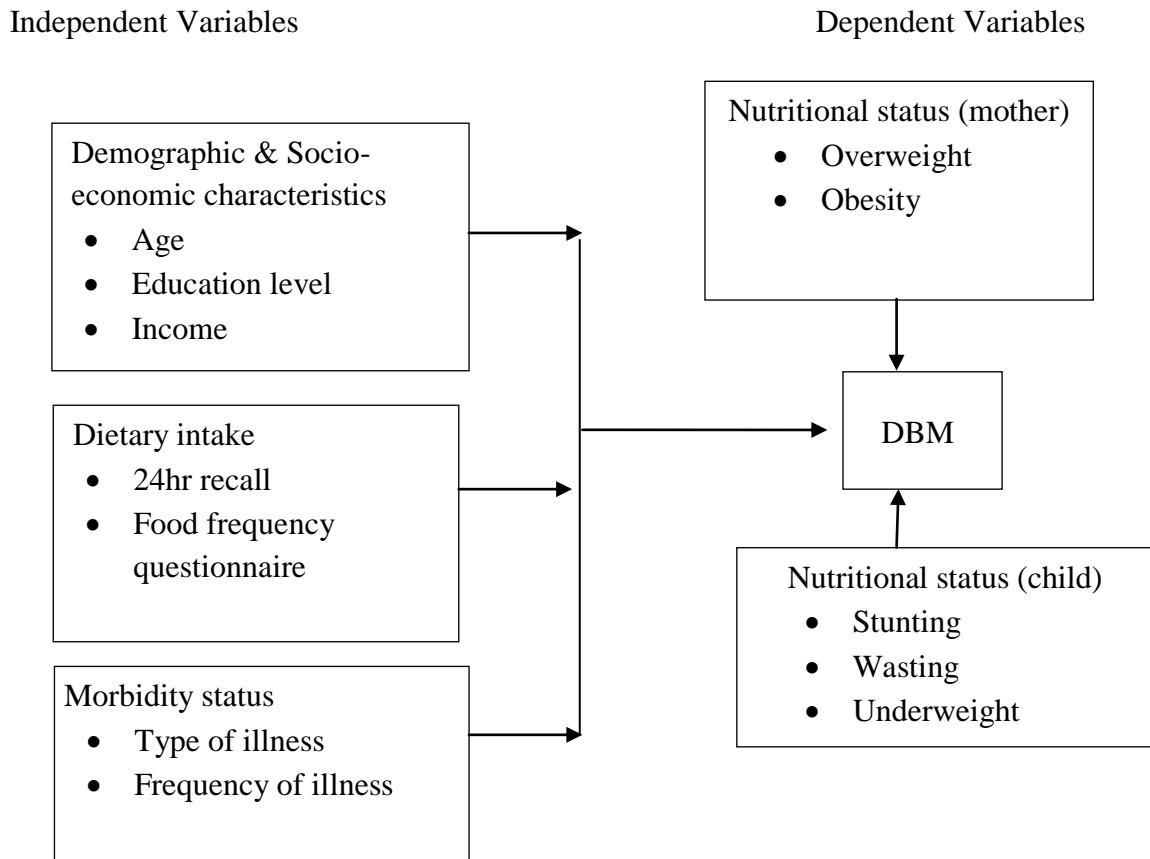
Note: Adopted from FAO(2004). DBM (Double Burden of Malnutrition)

The conceptual framework presupposes that the double burden of malnutrition could be affected by demographic and socio-economic characteristics such as age, marital status, educational level, occupation and household income. In addition, dietary intake factors such as number of meals per day, amount of food consumed and frequency of consumption of various foods. Some aspects of morbidity status like type of illness and frequency of illness also affects the occurrence of the DBM.

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2.7 Summary of Literature Review

In the global scene, the double burden of malnutrition remains the issue that could adversely affect children and their mothers' health if it is not resolved. This means that the coexistence in the same household of overweight mothers and undernourished children reflects the complicated dynamics of potential causes. Research that has been reviewed has shown that close to 28% of children under 5 years of age in Sub-Saharan Africa are moderately or critically underweight, researchers further noted that while socioeconomic, demographic, and environmental factors were important in determining stunting and overweight, other factors, such as diet and lifestyle, were major risk factors. In Kericho County, no study has been carried out to determine the prevalence of double burden malnutrition among mother-child-pairs residing in mixed settings such as Rural and urban areas.

Various forms of dual burden of malnutrition problems may exist in rural Kenya at household and individual levels. This can be characterized by a high prevalence of under nutrition particularly stunting early in life, with high levels of overweight/obesity in adulthood, particularly among women. Numerous studies reviewed have tried to examine the plausible connection between socio-economic status and Double Burden of malnutrition. For example, Socio-economic status (SES) and caste in rural India are intricately linked, and several researchers concur that elevated SES and high caste are positively associated with higher risk of obesity and non-communicable diseases. In other studies, it is believed that that childhood illness, maternal short stature as well as and older age were strong predictors of Maternal and child double burden (MCDBM). However, since researches use different measurement to define DBM, it was necessary

to conduct the present study to verify the extent to which socioeconomic characteristics associates with DBM among mother-child-pairs in Kericho County.

Proper nutrition is important in controlling DBM in populace. It has been shown that the overweight/obesity of mothers is associated with the nutrition transition condition that contributes to a positive energy balance which means higher intake of energy dense food and less energy expenditure. Adequate diet, which includes recommended servings from all food classes, is important for optimal growth and for chronic disease prevention in the future. Consequently, the quality of the household diet influences the nutritional outcomes of the household members which has an influence in controlling DBM.

It can be argued that a variety of different approaches, including an emphasis on food-based interventions that encourage the consumption of a wide range of foods across nutritionally distinct food groups, would be required to counter the double burden of malnutrition. No study has been conducted in Kericho County to determine the connection between dietary intake and double burden malnutrition among mother-child-pairs in Kericho County.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This section concentrates on research design and methodology. It explains, research design, location of the study, population of the study, sample size and sampling procedure and case definition. Furthermore, data collection instrumentation, data collection procedures, data management and analysis as well as ethical considerations will be discoursed.

3.2 Research Design

This study employed cross-sectional analytical study design. Through this design, the outcome and the exposures in the study participants at the same time was measured. Collection of data was carried from the month of April to July 2021.

3.3 Location of the Study

The study was conducted in in Kericho County which was purposively selected. The researcher incorporated all the sub-counties in Kericho given that various geographical locations affect socio-economic activities of the residents, which might affect the nutrition status of individuals at household and population level.

Kericho County lies between longitude 35º 02' and 35º 40' East and between the equator and latitude 0 23' South with an altitude of about 2002m above the sea level. The county occupies a total area of 2,479 sq.Km and is divided into six sub-counties, 30 wards, 85 locations and 209 sub locations. The county is well positioned to benefit from various markets provided by the neighboring counties as it has robust national and county roads connecting to the rest of the counties(County Government of Kericho, 2016).Kericho is one of the counties with high rates of under nutrition among children.

3.4 Population of the Study

The target population for the survey was the mothers (15-49 years) this age group has been defined as the reproductive age in women (World Health Organization, 2018) who have children aged 24-59 months and also children (24-59 months) with their mothers. The target population involved 206,036 households as presented in Table 1.

Table 1

Population of the Study

Sub-County	Number of Households
Belgut	35,012
Bureti	43,117
Kericho East (Ainamoi)	44,246
Kipkelion (West)	24,688
Londiani (Kipkelion East)	31,778
Soin Sigowet	27,195
Total	206,036

Source: (Kenya National Bureau of Statistics (KNBS, 2019)

Households were the source of primary data. This is because, at the household level, a mother-child pair can be located.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

Those who were included were child-mother pair aged 24-59 months and mother aged 15-49 years who agreed to participate in the study. Children with missing mother pairs but with caregivers were included in the study.

3.5.2 Exclusion Criteria

Those excluded were child-mother pairs who refused to consent to participate in the study. Similarly, mothers and children who cannot provide data due to critical health condition or ill were excluded from the study. Also any child-mother pair with mental challenge who may not have competency to consent was excluded from participating.

3.6 Sample Size

Sample size was based on the formula to estimate a proportion in a sample with a known level of confidence and precision to reflect the proportion in the population. For example, we could consider the adoption of new feeding practices done in the different sub-counties. We assume a large population but don't know the variability among households with regard to practices being used; we therefore assume $p < 0.05$ (maximum variability). If we want a 95% confidence level and a 5% precision, then using the Fischer's formula below:

$n = (Z^2pq/(e^2)$

Where:

n = the desired sample size (if target population is more than 10,000).

z = the standard normal deviation at the required confidence level of 1.96.

e = the level of statistical significance set.

p = the proportion in the characteristics being measured.

$q = 1 - p$

$n = (Z^2pq/(e^2) = 1.96^2 * 0.5 * 0.5 / (0.05^2) = 349$

To cater for non-response, 10% (35) was added to make a population of 384.

3.7 Sampling Procedure

The survey utilized a three-stage cluster sampling methodology. The first stage sampling was the selection of clusters at the sub county level from CBS, which was done using the probability proportional to population size (PPS). The second stage sampling involved the selection of the villages within the selected sub counties and finally the third stage was conducted to determine the actual household to be included in the survey which was done using the modified EPI method in each cluster, the researcher from the center of the cluster randomly determined a direction for surveying by spinning a pen. Researchers then walked in the direction shown by the tip of the pen until they reached the end of the village. Once again, the team used the pen this time spinning until the pen points to a direction within the boundaries of the village. The researcher and assistant then walked along this second line counting each house on the way. The first house was selected using simple random sampling and subsequent household was selected until the desired sample size was achieved.

In order to achieve the set objectives, this study used data on village population. Data was collected from a given number of households with the consultation with community health volunteers (CHV's). Only mothers with a child aged between24-59 months in every household visited were included in the survey. The design allowed for tabulation of mother-child and household level indicators that are representative of the entire assessment area.

Table 2

Sample Distribution by Division

Sub-County	Target Population (Nh)	Sample size for Stratum $n_h = (\frac{Nh}{N} * 384)$
Belgut	35,012	65
Bureti	43,117	81
Kericho East	44,246	82
Kipkelion	24,688	46
Londiani	31,778	59
Soin Sigowet	27,195	51
Total	206,036 (N)	384(*n*)

3.8 Data Collection Instrumentation

The research utilized a pre-tested questionnaire administered to collect data from respondents' demographic and socio-economic characteristics. For dietary intake, dietary diversity data was collected with reference to the mother-child using guidelines for measuring household and individual dietary diversity(FAO, 2013).

3.9 Validity of the Instrument

The researcher adopted questionnaires validated by World Health Organization. In addition, the research tools were validated by a team of experts led by Kabarak University supervisors. The study utilized a content validation method to assess the validity of the instruments.

3.9.1 Reliability

The split-half technique was used to calculate reliability coefficients. The split-half technique was used to calculate reliability coefficients. The results were r = 0.8.The

finding is considered generally good internal consistency. The researcher therefore accepted the (Chiang *et al.*, 2015).

3.10 Data Collection Procedures

Data collection began as soon as the proposal was approved for fieldwork. The researcher recruited 8 assistants to help in data collection. A two-day training session was held with the research assistants who hold Diploma and bachelor's degree to enhance familiarity with the instrument; refresh on research ethics; and share essential data sourcing skills, including how to approach participants, build a rapport, consent them, issue and collect questionnaires and take anthropometrics. After, data was collected directly from the mother-child pairs in the identified sampled households.

3.10.1 Anthropometric Measurement

Child weight was taken with electronic SECA 354 digital scales and SECA 876 flat scale to the nearest 100 g, while child height measured using SECA 417 height boards. Child nutritional status was determined using the WHO 2006 reference standard to calculate standard deviation z-scores. Childhood under nutrition was defined as height-for-age, weight-for-age and weight-for-height z-scores below −2 standard deviations from the WHO reference standard *(Croft et al.,* 2018), being stunting, underweight and wasting, respectively. Childhood overweight was defined as weight-for-height >+2 standard deviation z-score.

On the other hand, mothers' nutritional status was determined by taking the mothers' weight and height. Weight was taken by using SECA 762- a mechanical personal scale with 500g graduation and SECA 876 flat scale. Height was taken using SECA 213 standiometer. Anthropometric equipment was calibrated every morning before weighing and a height measurement of the study participants was done as per the standard

procedures. The results will be defined as: BMI <18·5kg/m^2, underweight; BMI 18·5–24·9kg/m^2, normal; BMI≥25– 29·9kg/m^2, overweight; BMI≥30kg/m2, obese. Child-mother pairs of double burden of over- and under nutrition was defined as an overweight or obese and under nutrition mother with a stunted, underweight, or wasted child.

3.11 Data Management and Analysis

All filled questionnaires were kept in a safe and secure storage. The data was only accessible to the primary researchers. Participant identifiers such as National Identification number and names were not used instead participants were assigned a particular code number. Maternal nutrition status results were categorized using BMI into three groups based on (WHO,2006) as: <18·5kg/m^2 as underweight; 18·5–24·9kg/m^2 as normal; ≥25– 29·9kg/m^2 overweight: and ≥30kg/m^2 as obese. Child nutritional status was determined using the WHO 2006 reference standard to calculate standard deviation z-scores. Childhood under nutrition will be defined as height-for-age and weight-for-height z-scores below −2 standard deviations from the WHO reference standard being stunting and wasting, respectively.

Data entry, coding and cleaning was done using excel spreadsheet prior to analysis. Subsequently, data was imported and analyzed using SPSS version 26 (IBM corporation, 2019).Descriptive and inferential analyses were computed. Mean and standard deviation, as well as frequency and proportion, was used to describe data. The dietary intake and the demographic characteristics and socio-economic and were analyzed using frequencies, while dietary intake data entry, processing and analysis were carried out using Nutri Survey software 2005 (Brined & Erhard, 2017). Furthermore, means and standard deviation was used to analyze the nutritional status. Finally, using multiple regression models, the association between nutritional status, dietary intake,

demographic and socio-economic and characteristics of mother-child pairs in Kericho County was examined. During analysis, statistical significance was considered at $p<0.05$.The findings were presented using tables and graphs.

3.12 Ethical Considerations

The researcher sought approval of the proposal by the institute of post graduate studies. An Ethical clearance for the study was obtained from the Kabarak University Ethics and Research Committee KABU01/KUREC/001/01/05/21. The study received a research authorization from the National Commission for Science and Technology (NACOSTI/P/21/11175). An approval was received to conduct research from the Kericho county review committee. An informed consent was given to each research participant before data collection. In this regard, respondents were briefed on the research process and its purpose. Respondents were notified that participation would be purely on voluntary terms. Again, their withdrawal of consent should not affect their subsequent relationship with higher authorities within the institutions or in the wider employment sector. Respondents who declined to participate in the research were substituted for appropriately. In addition, participants were assured that information on their personal life and opinions would be handled and processed in privacy and high confidentiality. Research Assistants did not collect participants' names or other personal identifiers to assure confidentiality and instead coded numbers was used.

CHAPTER FOUR

RESULTS, DATA ANALYSIS AND PRESENTATION

4.1 Introduction

The main objective of this study was to determine predictors associated with double burden of malnutrition among mother-child pairs in Kericho County, Kenya. The chapter presents the results of the data analysis and findings for the specific objectives of the study.

4.2 Response Rate

Evaluation of response rate plays a critical role in research based on study by Mugenda and Mugenda (2003) which established that 50% response rate was adequate, 60% was good and above 70% was excellent. This study had an overall response rate of 90.1%, (346)(Table 4.1) hence indicating an excellent response rate for this study according to Mugenda and Mugenda (2003).The study considered to incorporate all the sub-counties in Kericho due to the fact various geographical locations affect socio-economic activities of the residents, which might affect the nutrition status of individuals and at household level.

Table 3

Response Rate by Sub- County

	Sample Size for Stratum	Frequency	Response Rate (%)
Ainamoi (Kericho East)	82	79	96.3
Belgut	65	55	84.6
Bureti	81	76	93.8
Kipkelion West (Kipkelion)	46	38	82.6
Kipkelion East (Londiani)	59	55	93.2
Soin/Sigowet	51	46	90.2
Total	384	346	-

4.3 Socio-Demographic Characteristics

The study evaluated the demographic characteristics such as age of mother, relationship to household head, marital status, child's age and gender (Table 3).Majority of the respondents comprised of the aging population of mothers aged between 36 and 49 years. This was represented by 57.6 % of the total sampled population of interest. The age group of 15-35 years consisting of the youthful population constituted 42.4%. This gave an implication that older population are giving birth.

The male children constituted 51.9 % while the females were 48.1%. About 46.1% of the respondents were spouses to the household head while (36.5%) were the household heads themselves. Twenty-eight (15.4%) were daughters to the household heads.Other relatives and guardians constituted 1.2% and 0.8%, respectively.

Table 4

Socio-Demographic Characteristics

Socio-Demographics	Frequency	Percent (%)
Maternal age group in years		
15-34	147	42.4
35-49	199	57.6
Relationship to household head		
Head of household	126	36.5
Spouse	144	41.6
Daughter	53	15.4
Guardian	5	1.2
Other relatives	18	5.3
Gender of the child		
Male	180	51.9
Female	166	48.1

Figure 2

Marital Status of the Mothers
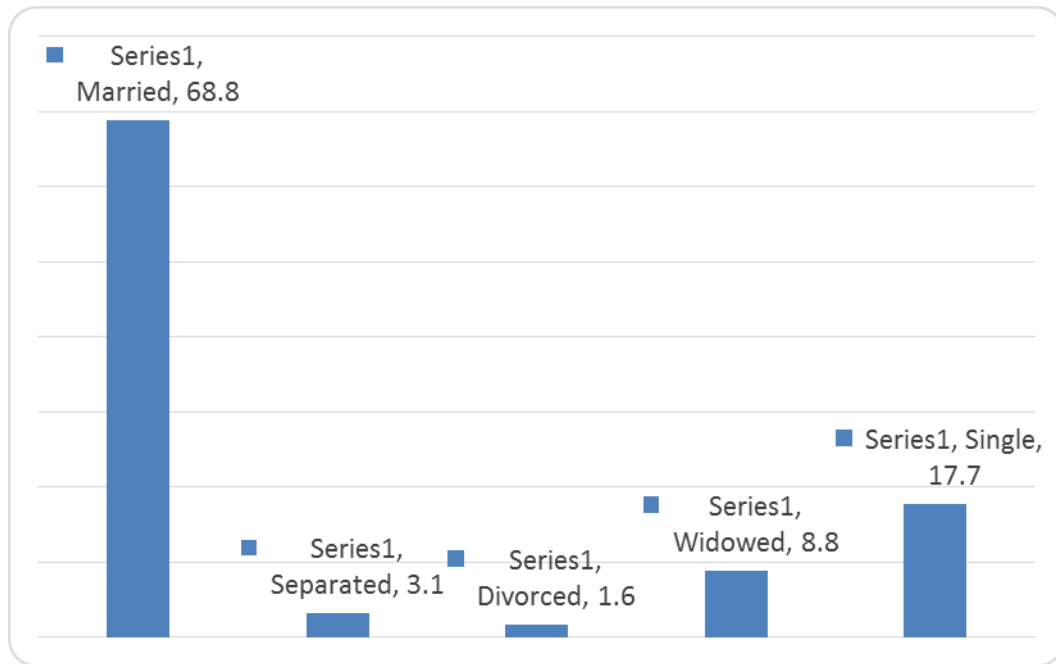
From Figure 2,two-thirds (68.8%) of the respondents were married. The singles constituted (17.7%) of the total representation.

4.4 Socio-Economic Characteristics

The socio-economic characteristics are presented in Table 5.The results indicated that the majority of the respondents had secondary level of education with (38.8%), followed closely by post-secondary level of education with (32.7%). These findings could imply that majority of the respondents had basic knowledge to make sound decisions on nutritional matters affecting their families.

Majority (28.1%) of the respondents engaged in business activities with. A significant number of respondents were housewives, constituting (24.1%) (20.8%) and (19.2%) comprised of casual laborers and salaried employees. Seventeen (5%), of the respondents were students, reported as cases of early teenage pregnancy among school going children who consented as mature minors.

Table 5

Socio-Economic Characteristics

Socio-demographics	Frequency	Percent (%)
Education level		
Pre-primary	5	1.5
Primary	93	26.9
Secondary	135	38.8
Post-secondary	113	32.6
Occupation		
Salaried	66	19.2
Business	97	28.1
Housewife	84	24.2
Casual	72	20.8
Student	17	5.0
Others	10	2.7

4.5 Household Characteristics

The study evaluated the household characteristics as shown in table 6. Majority of the respondents (75.4%) had adequate food supply in their households. However, 24.6% did not have adequate food in their households, while 57.8%, indicated that they purchased food in order to overcome shortages. A considerable number of the cases (34.4%) borrowed food. This could be a major contributor to double burden of malnutrition as the food given could possibly be less in amounts and less nutrient sufficient.

About two-thirds 66.9% of the respondents had their own land, while 33.1% do not own land. These outcomes showed that majority of the residents in various sub-counties own land which could be utilized for various purposes such as crop farming, livestock rearing, residential purposes among other uses. About 56.1% owned livestock while 43.9% did not own livestock. The higher value of 56.1% of those who owned livestock could be

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attributed to the corresponding higher number of respondents who owned land. Based on the economic activities, most (29.8%) had a household income KES 20,001- 50,000.

Table 6

Household Characteristics

Socio-Demographics	Frequency	Percent (%)
Household food adequacy		
Household with adequate food	261	75.4
Household strategy for food shortage		
Purchase food	200	57.8
Receive food aid	16	4.7
Borrow food	119	34.4
Other ways	11	3.1
Land ownership		
Household that own land	232	66.9
Livestock ownership		
Household that own livestock	194	56.1
Household income		
<5,000	23	6.6
5,001- 10,000	67	19.2
10,001- 20,000	98	28.1
20,001- 50,000	104	29.8
50,0001- 100,000	42	12.0
>100,001	12	3.4

4.5.1 Dietary Intake Among Mother-Child Pairs

The third objective of this study was to establish the dietary intake among mother-child-pairs in Kericho County. This section provides a descriptive analysis of dietary intake and nutrient intake analysis.

4.5.2 Nutrient Intake Analysis

Dietary intake for this study was obtained from the in-person 24-hour dietary recall interview together with a food frequency consumption questionnaire. A single 24-hour recall administered in a large population can provide data to adequately estimate population mean (average) intakes. Survey participants (mothers) of 15-49 years completed their own dietary interview. For this study a total of 346 respondents were selected. Data was analyzed using Nutri-survey for Windows 2007, which determined means of energy and nutrient intakes from the total diet and from each food group (Table 7).

Table 7

Analysis of Maternal Diet Intake

Nutrient	Average Analyzed	Recommended Dietary Allowance	Percentage consumption against the RDA
Macronutrients	Status	Value/day (RDA)	
Energy	1441.3 kcal	1900.0 kcal	75.8%
Water	2512.5 g	2700.0g	93.1%
Carbohydrates	68.6 g (19.1%)	48.0 g (12 %)	142.9%
Fat	23.1 g (14.2%)	77.0 g (< 30 %)	30%
Protein.	234.5 g (66.7%)	351.0 g (> 55 %)	66.8%
Dietary fiber	47.6 g	30.0g	158.7%
Micronutrients			
PUFA	5.1g	10.0g	51%
Vit. B1	1.7 mg	1.0 mg	170%
Vit. B2	1.3 mg	1.2 mg	108.3%
Vit. B6	2.0 mg	1.2 mg	236%
Vit. C	166.3 mg	100.0 mg	166.3%
Sodium	314.1 mg	2000.0 mg	15.7%
Potassium	2693.2 mg	3500.0 mg	76.9%
Calcium	447.4 mg	1000.0 mg	44.7%
Magnesium	474.8 mg	310.0 mg	153.1%
Phosphorus	1293.3 mg	700.0 mg	184.7%
Iron	14.8 mg	15.0 mg	98.7%
Zinc	13.6 mg	7.0 mg	194.3%

Total mean daily energy consumption was 1,441.3 kcal. Total mean daily intakes for water, carbohydrates, fats, and proteins were 2,512.5 g,68.6 g,23.1 g, and 234.5g, respectively. The corresponding percentage against the RDA was high in the intake of carbohydrates 142.9%, and protein 66.8%. Total mean daily dietary fiber intake was 47.6

g, Calcium intake was 447.4 mg, Potassium intake was 2,693.2 mg and Iron intake was 14.8 mg.

The total mean daily energy consumption was 1,564.9 kcal. A total mean daily intake for water was 2143g, carbohydrates 60.6g,fats 9.0g and proteins 304g. The corresponding percentage against the RDA was high in the intake of carbohydrates 449%, protein 196% in the macronutrients (Table 4.6). Total mean daily dietary fiber intake was 48.4g and Calcium intake was 316.9 mg and vitamin E was low. Potassium intake was 2425.1 mg, Vit A intake was 2209.4mcg while Iron and zinc intake was 18.2 mg and 13.2 mg, respectively.

Table 8

Analysis of Child Diet Intake

Macronutrients		Status	Recommended Value/day (RDA)	Percentage consumption
	Energy	1564.9 kcal	1050.0 kcal	149 %
	Water	2143.1 g	1300.0 g	165 %
	Carbohydrates	60.6 g (16%)	13.5 g (12 %)	449 %
	Fat	9.0 g (5%)	41.0 g (< 30 %)	22 %
	Protein	304.0 g (79%)	155.0 g (> 55 %)	196 %
	Dietary fiber	48.4 g	-	-
Micronutrients				
	PUFA	3.4 g	9.0 g	37 %
	Vit. A	2209.4 µg	600.0 µg	368 %
	Vit. E	6.1 mg	-	-
	Vit. B1	1.9 mg	0.6 mg	309 %
	Vit. B2	0.9 mg	0.7 mg	124 %
	Vit. B6	1.7 mg	0.4 mg	416 %
	Vit. C	147.3 mg	60.0 mg	245 %
	Sodium	126.1 mg	-	-
	Potassium	2425.1 mg	1500.0 mg	162 %
	Calcium	316.9 mg	600.0 mg	53 %
	Magnesium	412.3 mg	80.0 mg	515 %
	Phosphorus	1165.4 mg	500.0 mg	233 %
	Iron	18.2 mg	8.0 mg	227 %
	Zinc	13mg	3.0 mg	441 %

4.5.3 Common Types of Diets Consumed

The researcher identified a list of seven common types of foods consumed by the respondents, namely; ugali, rice, potatoes, beans, milk, meat and vegetables. Multiple response frequencies were generated (Table 8). There were 346 respondents who responded to the question, i.e., selected at least one of the seven listed types of foods (Table 9). The vast majority of respondents selected *Ugali* as common staple diet (94.6%). Likewise, the vast majority of respondents selected vegetables as common staple diet (91.1%). More than half of the respondents selected milk (61.2%). Less than half of the respondents selected beans, rice, potatoes and meat which accounted for 36%, 30.2%, 15.9% and 15.5%, respectively.

Table 9

Commonly Consumed Staple Diets

Staple Diet	Responses		Percent of Cases
	N	Percent	
Ugali	327	27.4%	94.6%
Rice	104	8.8%	30.2%
Potatoes	55	4.6%	15.9%
Beans	125	10.5%	36.0%
Milk	212	17.8%	61.2%
Meat	53	4.5%	15.5%
Vegetables	315	26.4%	91.1%

Their protein source was majorly dairy milk at 61.2% and fewer uptakes of plant-based proteins or other protein of high biological value. Also, the main sources of carbohydrates was from maize at 96% and rice at30.2% this means other cereals and pulses were not utilized hence may not benefit from most of B vitamins majorly found in them.

4.5.4 Food Consumption Frequencies

The results are summarized in Table 9. Only 38.1% of the respondents ate or consumed the vegetables 5-6 times in a week withm25% of the respondents consuming vegetables 3-4 times in a week. An equivalent number of respondents (15%) consumed the vegetables once a day and 1-2 times a week, respectively. Less than 10% of the respondents consumed the vegetables 2-3 times a week. A majority of the respondents, 40.7% consumed a cereal which was *ugali* 5-6 times in a week. 26.2% of the respondents consumed the cereals 1-2 times in a week. 21.2% and 11.9% consumed the cereals 2-3 times a day and once a day respectively. Less than 10% of the respondents consumed the vegetables 2-3 times a week (Table 10).

Table 10

Food Consumption Frequencies for Food Groups

Food categories/frequencies	Once a day		2-3 times a day		1-2 times per week		3-4 times per week		5-6 times per week	
	n	%	N	%	n	%	n	%	n	%
Vegetables	52	15	25	6.9	52	15	86	38.1	131	25
Cereals(Ugali)	41	11.9	74	21.2	90	26.2	0	0.0	141	40.7
Proteins	28	8.2	38	11.4	262	75.7	0	0.0	18	5.2
Legumes	41	11.9	15	4.2	181	52.4	94	27.3	15	4.2
Fat/sauce/dressing	52	15.1	32	9.2	188	54.2	46	13.5	13	3.8
Margarine/butter/oils	49	14.2	71	20.8	178	51.6	24	6.9	24	6.5
Bread and rolls	66	19.2	28	8.1	213	61.5	0	0.0	39	11.2
Fresh milk/mala/yoghurt	65	18.8	35	10	73	21.2	73	21.2	100	28.8

A vast majority of respondents, 76.5% consumed proteins 1-2 times in a week. 11.4% of the respondents consumed the proteins 2-3 times in a day. 8.2% and 3.1% consumed proteins once a day and 5-6 times a week, respectively.

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Further, a about half of the respondents, 52.4% consumed the legumes 1-2 times in a week. 27.3% of the respondents consumed the legumes 3-4 times in a week, while 11.9%. An equivalent number of respondents 15% consumed the legumes once a day. A high number of the respondents, 54.2% added fat, sauce or dressing 1-2 times in a week. 15.1% of the respondent's added fat, sauce or dressing once in a day, while 13.5% added fat, sauce or dressing 3-4 times in a week after cooking or at the table over the past 7 days.

More than half of the respondents, 51.6% added Oil, margarine, butter or other fats to proteins 1-2 times in a week. 20.8% of the respondents added oil, margarine, butter or other fats to proteins 2-3 times in a day, while 14.2% added oil, margarine, butter or other fats to proteins once a day. More of the respondents, 61.5% ate breads or rolls 1-2 times in a week. 19.2% of the respondents ate breads or rolls once in a day, while 11.2% and 8.1% consumed breads or rolls 5-6 times in a week and 2-3 times a day, respectively. A majority of the respondents, 28.8% drank fresh milk, mala or yoghurt 5-6 times in a week. Frequencies of consumption, 1-2 times a week and 3-4 times a week reported an equal rate of 21.2%. 18.8% consumed fresh milk, mala or yoghurt once a day.

4.5.5 Food Consumption Amounts

The results are summarized in Table4.9. Show that majority of the respondents (48%) ate between ¾ and 1 ¾ of 250 mls cup of vegetables over the past seven days. 31.2% and 23.8% of the respondents were reported to consume less than ¾ of 250 mls cup and more than 1 ¼ of 250 mls cup, respectively.

 show that more than half of the respondents (55.8%) ate between ¾ and 1 ¾ of 250 mls cup of cereals over the past seven days. 26.1% and 18.1% of the respondents were

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reported to consume less than ¾ of 250 mls cup and more than 1 ¼ of 250 mls cup of cereals, correspondingly.

More than half of the respondents (58.9%) ate less than ¾ of 250 mls cup of proteins over the past seven days. 29.3% and 11.8% of the respondents were reported to consume ¾ -1 ¼ of 250 mls cup and more than 1 ¼ of 250 mls cup of proteins, correspondingly. Therefore, the intake of proteins was lower than the recommended amounts. A majority of the respondents (46.2%) ate between ¾ and 1 ¾ of 250 mls cup of legumes over the past seven days. Further, 28.1% and 25.7% of the respondents were reported to consume less than ¾ of 250 mls cup and more than 1 ¼ of 250 mls cup of legumes, respectively

Table 11

Food Consumption Amounts Among The Study Respondents

Food type & Daily amount intake	Frequency	Percent (%)	WHO/FAO Recommended daily
Vegetables (n=346)			
Less than ¾cup (250 mls)	108	31.2	½ cup cooked
¾ - 1 ¼ 1 ¼ cup (250 mls)	166	48	vegetables (standard serve: 100-350 kJ)
> 1 ¼ cup Cereals	72	23.8	
Less than 3/4 cup (250 mls)	63	18.1	½ cup (120g); one
¾- 1¼ cup (250 mls)	193	55.8	standard serves
>1¼cup	90	26.1	(500kJ)
Proteins			
Less than ¾cup (250 mls)	204	58.9	100g cooked (one
3¾- 1¼ cup (250 mls)	101	29.3	standard serve 500-
>1 ¼cup	41	11.8	600kJ)
Legumes			
Less than 1 ¼cup (250 mls)	97	28.1	
¾- 1¼ cup (250 mls)	160	46.2	1 cup (150g) (one
>1¼cup	89	25.7	standard serve:500- 600kJ)
Margarine/butter			
Less than one tea spoon	154	44.6	
1-3 tea spoons	67	19.6	
>3 tea spoons	116	33.5	
Did not usually add	9	2.3	
Bread and rolls			
One slice/half roll	19	5.5	1 slice or ½ roll
Two slices/one roll	148	42.8	(standard serve: 500
More than two slices	179	51.7	kJ)
Fresh milk/mala/yoghurt			
Less than half a cup	50	14.6	1 cup (250 ml) fresh,
Half a cup to one cup	245	70.8	½ cup (120 ml) mala
More than one cup	51	14.6	& ¾ cup yoghurt (one

Nearly half of the respondents (44.6%) did not usually add margarine, butter, or bacon fat to vegetables. 33.5% added 1-3 teaspoon full of margarine, butter, or bacon fat to vegetables. 19.6% of the respondents added less than one tea spoonful of margarine, butter, or bacon fat to vegetables. Less than 5% of the respondents added more than three

tea spoonfuls of margarine, butter, or bacon fat to vegetables. Results show that, half of the respondents (51.7%) consumed more than two slices of bread/rolls. A majority of the respondents, 70.8% took between half a cup and one cup of fresh milk, mala or yoghurt over the past seven days.

4.5.6 Eating Patterns

Table 12 displays the description of mother-child pair eating patterns in the last three months. As shown by Table 10,91.6% of the respondents always took their breakfast. Only 8.4% sometimes took their breakfast. The highest value of 91.6% indicated that majority of the respondents always took breakfast. However, the study did not further note if the breakfast was sufficient nutritionally and quantity. Majority of the respondents, 72.7% always took lunch. A considerable number of respondents, 26.5% sometimes had their lunch meaning they sometimes missed their lunch. Vast majority of the respondents, 97.7% always took supper. Only less than 10% of the respondents sometimes took supper. On snacks consumption, most of the respondents indicated that they sometimes eat snacks. 58.8% attested to this. 17.7% indicated that they always eat snacks, while 15% never ate snacks.

Table 12

Eating patterns for mothers in the last 3 months

Eating patterns	Always		Sometimes		Only on weekends		Never	
	n	%	n	%	N	%	N	%
Breakfast	316	91.6	30	8.4	0	0.0	0	0.0
Lunch	251	72.7	93	26.5	0	0.0	2	0.8
Supper	338	97.7	8	2.3	0	0.0	0	0.0
Snacks	61	17.7	203	58.8	29	8.5	5	15.0

4.6 Morbidity Status Among Mother –Child Pair

4.6.1 Morbidity Status Among Children Aged 24-59 Months

The child's illness in the previous two weeks was also evaluated and the findings are detailed in Table 13. The health of the children in the study population was assessed by asking whether the child had been sick for the two weeks preceding the survey date. Slightly above half (56.4%) of the children were reported to have suffered from one or more of illnesses. The rest 43.6% did not show any signs in the previous four weeks preceding the survey date.

Common illnesses include; common cold, diarrhea, malaria, and skin conditions representing 13.1%, 9.3%, 7.3% and 6.9% of the total reported cases, respectively. The top illness by prevalence are as follows; respiratory infections (13.1%), gastro-enteritis (9.3%), malaria (7.3%) and Covid-19 (6.9%).

Table 13

Child Morbidity Status

Morbidity Status	Frequency	Percent (%)
Proportion of mothers who were sick	195	56.4
Type of Illness		
Respiratory tract infections	74	13.1
G.E infections	30	9.3
Malaria	19	7.3
Covid-19	18	6.9
Meningitis	5	1.9
Burns	4	1.5
Measles	4	1.5
Anemia	2	0.8
Arthritis	2	0.8
Diabetes Type 1	1	0.4

Findings showed mothers suffered from a number of illnesses at 39.6% while rest of the mothers reported of not being sick (60.4%). The most prevalent disease among the mother was respiratory tract infections (44.5%), Covid-19 and hypertension both at 10.9 and lastly diabetes type 1&2 at10.2%. The findings also noted that there were more anemic mothers than children at 3.6% and 0.8%, respectively.

Table 14

Maternal Morbidity Status

Morbidity Status	Frequency	Percent (%)
Proportion of mothers who were sick	209	60.4
Type of Illness		
Respiratory tract infections	61	44.5
G.E infections	3	2.2
Malaria	11	8.0
Covid-19	15	10.9
Meningitis	5	3.6
Typhoid	4	2.9
Arthritis	4	2.9
Anemia	5	3.6
Diabetes Type 1&2	14	10.2
Hypertension	15	10.9

4.6.2 Nutrition Status of Maternal-Child Pair

The nutrition status was analyzed to establish the prevalence of double burden malnutrition of mother-child-pairs in Kericho County. This section provides a descriptive and inferential analysis of anthropometric measurements of mother-child pairs.

4.7 Maternal Nutrition Status

The outcomes in Table 4.12 showed that 16.9% of the total sampled mothers were underweight. One hundred and sixty-four representing 47.3% had normal nutritional

status. The study findings further revealed that 28.1% of mothers were overweight while the remaining twenty representing 7.7% were obese. These findings imply that majority of mothers across different sub-counties in Kericho county are normal in terms nutritional status.

Figure 3

Maternal Nutrition Status
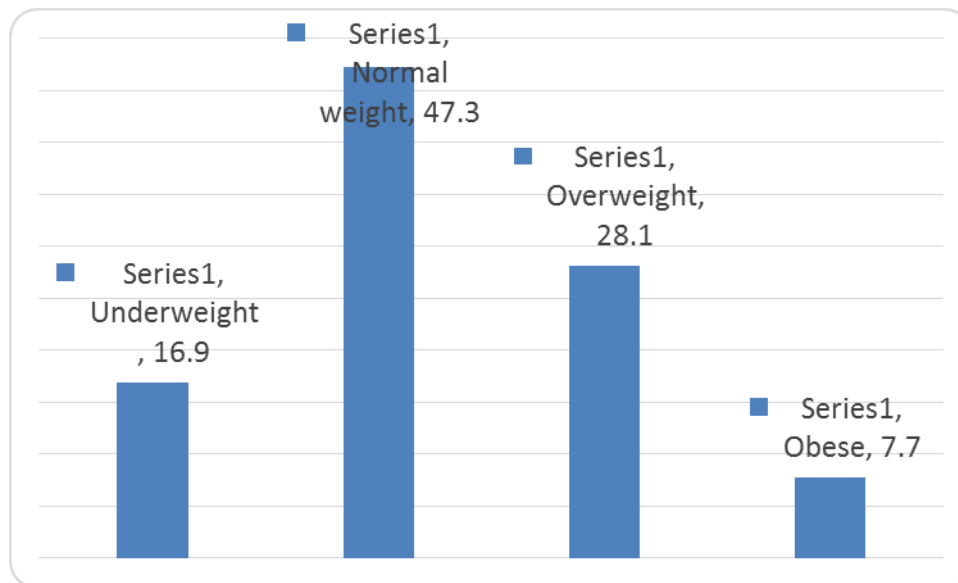
4.8 Child Nutrition Status

The findings in table 15 showed that 11.5% of the total sampled children were severely malnourished. Seventy-nine, representing 23.1% were moderately malnourished. The study results also revealed that 51.5% of children had normal nutrition status. The study results further revealed that 8.1% and 5.8% comprised of overweight and obese children respectively. The findings denote that majority of children across different sub-counties in Kericho county are normal in terms nutritional status.

The results also indicated that a total of 18.9% of the total sampled population of interest was found to be stunted a figure below the national stunting rate which stands at 26%.

Out of these, 2.4% were severely stunted while 16.5% were moderately stunted. Two hundred and eleven (281), representing 81.1 % of the total number of children had normal height. According to the Kenya Demographic Health Survey 2014, 26% of children aged 59 months are stunted while 4% are wasted. Despite the high levels of child under nutrition, this study also found a substantial prevalence of childhood obesity at 8.1% and 5.8% overweight, respectively among children aged 24-59 months.

Table 15

Child Nutrition Status

Nutrition status	Frequency	Percent (%)	Corresponding National level statistics
Child Nutrition Status			
Wasting (W/H)			
SAM (-3SD)	40	11.5	
MAM (-2SD)	79	23.1	6.7%
Normal	178	51.5	
Overweight (+2SD)	28	8.1	
Obesity (+3SD)	21	5.8	
Stunting (H/A)			
Severely Stunted	8	2.4	26%
Moderately stunted	57	16.5	
Normal	281	81.1	

Table 16

Child Nutritional Status by Gender

Gender	Wasted		Overweight (+2 SD)	Obese (+3 SD)	Severely Stunted (-3 SD)	Moderately Stunted (-3 SD)
	SAM (-3 SD)	MAM (-2 SD)				
Male	9.1%	27.1%	9.0%	6.0%	0.7%	20.1%
Female	14.4%	19.2%	7.2%	4.0%	3.2%	12.8%

Table 16 shows child nutrition status by gender, in the study there were more male children (51.9%) than the females (48.1%). More males were overweight (9.0%), obese (6.0%) and stunting (20.8%) as compared to female who were more affected by wasting (14.4%). However, there were more moderately malnourished male children than the females.

4.9 Double Burden Malnutrition

Child-mother pair of double burden of over- and under nutrition was defined as an overweight or obese and under nutrition mother with a stunted, underweight, or wasted child. Thus, the DBM for this study has been defined by the coexistence of maternal underweight, overweight and obesity along with child under nutrition and over nutrition within the same household or community level as ashown in Table 17.

Table 17

Distribution Of Study by Double Burden of Malnutrition

Maternal BMI		Wasting (W/H)				Stunting (H/A)	
		Wasted SAM (-3 SD)	MAM (-2 SD)	Overweight (+2 SD)	Obese (+3 SD)	Severely Stunted (-3 SD)	Moderately Stunted (-3 SD)
<18.5kg/m2	% within BMI of mother	29.5%	29.5%	4.5%	6.8%	0.0%	20.5%
	% of Total	5.0%	5.0%	0.8%	1.2%	0.0%	3.5%
25-29.9kg/m2	% within BMI of mother	1.4%	23.9%	11.3%	7.0%	1.4%	9.7%
	% of Total	0.4%	6.6%	3.1%	1.9%	0.4%	2.7%
	% within BMI of mother	5.0%	25.0%	25.0%	5.0%	5.0%	20.0%
	% of Total	0.4%	1.9%	1.9%	0.4%	0.4%	1.5%

Table 17 shows that, the prevalence of child underweight (6.6%) as compared to wasted children (0.4%), coexisting with overweight mothers. In terms of obese mothers, a prevalence (1.9%) cases of child underweight as compared to wasted children at 0.4%. Total prevalence of DBM with respect to wasting was at 8.5%. The total prevalence of DBM with respect to overweight and obese children was 5% and 2.3%, respectively. Stunting was (3.1%), in overweight mothers as compared to those coexisting with obese mothers at 1.9%. The total prevalence of DBM with respect to stunting stood at 5.0%.The rates are relatively low (5%) when child under nutrition is measured in terms of stunting. Household DBM rates are much higher (8.5%) when child under nutrition is measured in terms of wasting (SAM and MAM). This could be due to the fact that relatively few children in the study area suffer from stunting.

4.10 Association between Socio-demographic and Socio-economic Characteristics, Dietary Intake, and Maternal Nutritional Status

The association between socio-demographic characteristics, dietary intake, and nutritional status of mother-child pairs in Kericho County was determined. Chi-square was used to test the relationship. The findings are presented in Table 18 and 19 the mother's age and energy intake were significantly ($p<0.05$). Marital status, education level, occupation, household income and, dietary intake shows no significance ($p>0.05$).

Table 18

Association mother's Characteristics with occurrence of double burden of malnutrition

Occurrence of DBM	P-value
Mother's Age	0.019 *
Relationship to household head	0.647
Marital status	0.186
Education Level	0.515
Occupation	0.202
Household income per month	0.149
Dietary intake	0.026 *

*Statistically Significant

The child's age and gender are significant an energy intake indicates a significant relationship with occurrence of DBM (p<0.05).

Table 19

Association child's Characteristics with occurrence of double burden of malnutrition

Occurrence of DBM	P-Value
Child's Age	0.000*
Gender	0.009*
Sickness status	0.014*
Household income per month	0.078
Energy intake	0.024*

*Statistically Significant

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The main aim of this study was to determine predictors associated with double burden of malnutrition among mother-child pairs in Kericho County, Kenya. Here, the major findings of the study, discussion and conclusions are emphasized. It further highlights the recommendations of the study and outlines proposed areas for future study.

5.2 Socio-Demographic and Socio-Economic Characteristics

Malnutrition in a population can be determined in part by demographic factors. This study revealed the double burden of malnutrition exists between child and maternal pair. It was discovered that most households comprised of mothers with an advanced age. Growing evidence suggests that age-related physiological changes may make older adults more susceptible to malnutrition. This result agrees with on DBM that revealed those women over the age of 35 were found to be at an increased risk of a twofold burden of malnutrition. According to the study, older age groups had a higher prevalence of overweight and obesity than younger ones(Hauqe *et al*., 2019). In a two-parent household, children and or other siblings, chances of food scarcity might occur which could lead to cases of under nutrition. These findings supports the assertion that children raised in complicated families are often more exposed to food insecurity than children raised in two biological married-parent households.

The education level of the mother can be linked to the nutritional status of the child. The results of the study indicated that majority of the respondents had secondary level of education bestowing a basic knowledge to make sound decisions on nutritional matters affecting their families. Numerous research revealed that stunting and wasting were more

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common in children of parents without a formal education than in children of parents with a greater level of education(Wong *et al*., 2015; Mushtaq *et al*., 2011). Similarly, Wibowo *et al*. (2015)explains that education is one of the most significant indicators of social class and that the more educated a person is, the more able they are to navigate the healthcare system and receive correct and superior nutritional and medical care. Additionally, mothers with higher levels of education might have access to greater funding for additional nutritional care and information on interventions.

The findings also reported that the majority (28.1%) of the respondents engaged in business activities, a significant number of respondents were housewives and other salaried employees. Seventeen, of the respondents were students, reported as cases of pregnancy among school going children who consented as mature minors. This was in agreement with findings that showed employed women and those in businesses are occupations often attributed to less physical activities which might contribute to double burden of malnutrition.(Popkin *et al*., 2020).Teenage pregnancies are at a higher risk of giving birth to low birth weight babies, at risk of under nutrition in young life (Zhang *et al*., 2016).

5.2.1 Dietary Intake among Mother-Child Pairs

The lack of healthy meals could result in macro and micro nutrient deficiencies which is detrimental to both mother and child. A healthy diet is made up of foods from the seven main food groups: starchy carbohydrates, pulses and cereals, fruits and vegetables, meat and meat substitutes, root and tubers, dairy and its substitutes and healthy fats. It's unlikely that every meal will include all five, but the aim is to achieve balance across the day, or across the week.

Majority of the child-mother pairs exceeded the daily allowance requirement of food consumption. The WHO guidelines advocate for three balanced meals composed of 350-600 calories and one to three snacks each day that provide between 150 and 200 calories. The rate of weight loss was not greater when respondents ate three meals and three snacks versus three meals per day, despite consuming the same amount of calories (Kinra *et al.*, 2010).

Iron is a nutrient of public health concern for infants, particularly those receiving mostly human milk and women of child bearing age (Bassete *et al.*, 2014a). Basset (2014a) showed that families at risk of dual burden of malnutrition had low intake of calcium and iron a finding that is replicated in this current study. Additionally, products from animals such as meat are not the only source of protein but are considered to be the most available sources of iron, zinc, and a form vitamin A. Sekiyama (2015) reported that, the "High-animal products" dietary intake was associated with low risk of maternal-child double burden. The study concluded that the association was greatly related to the strong negative correlation of the intake of "High-animal products" with child stunting. Further, the negative correlation is linked to high intake of animal protein which interferes with the absorption of calcium this results are similar to the current study hence the disparity in the nutrition status (Sekiyama *et al.*, 2015).

5.2.2 Morbidity Status Among Mother Child Pairs

Our findings showed that majority of children were suffering from different illnesses prior to four weeks before the study. Respiratory tract infections were the most reported by the mothers also indicated that the rate of morbidity stood at 56.4% in children between the age of 24-59 months. The most common type of disease affecting the mother child pairs in Kericho was Respiratory tract infections and gastrointestinal

illnesses. This manifested with symptoms such as diarrhoea and vomiting these results was similar to a study done on a number of Ethiopian children, which showed an episode of diarrheal diseases in the past two weeks doubled their likelihood of becoming wasted and stunted also in India.

5.3 Nutrition Status and Prevalence of Double Burden Malnutrition

As the prevalence of childhood under nutrition goes down, maternal overweight and obesity among women of reproductive age has increased (KNBS, 2015) while under nutrition seems to be higher in rural areas more than the urban areas. The national statistics of children stunting rates continues to go down albeit slowly, the burden of over nutrition is slowly rising, this agrees with a previous study (Kimani-Murage *et al*., 2015) The occurrence of high levels of under nutrition in urban poor settings is not surprising.

In Kenya, significant levels of overweight/obesity have been recorded in addition to high levels of under nutrition. Overweight or obese women account for 25% of women of reproductive at the national level. In urban areas, where 40% of women are overweight or obese, the prevalence is considerably higher (Kimani-Murage *et al*., 2015). The study findings agreed to the results of the current study showing that majority of Kericho mothers were overweight while majority of children were underweight.

According to Sunuwar *et al*. (2020), the prevalence of an overweight/obese mother and a stunted child was 8.30%, overweight/obese mother and wasted child was 1.25%, overweight/obese mother and underweight child was 3.37%, and overweight/obese mother and anemic child was 18.9%. The DBM was found to be present in 6.60% of the population. The outcomes from this current study revealed that, the total prevalence of DBM with respect to stunting stood at 5.0% while DBM rate was 8.5% when child under nutrition was measured in terms of underweight and wasting attributed to relatively few

children in the study area who suffered from stunting. This has led to DBM since mothers who are overweight are under risk of becoming obese and children may be at risk of becoming severely malnourished.

5.3.1 Association between Demographic and Socioeconomic Characteristics, Dietary intake, Morbidity Status and Nutritional Status of Mother-Child Pairs

According to the findings by Muthuri *et al. (*2014), the factors that were found to be associated with nutrition status included sex of the child, age of the child, mother's age at birth, mother's education level, mother's BMI and mothers' work status. These factors resonated with the research findings of the double malnutrition in the same group. Since malnutrition can occur as a result of, maternal nutrition before and during pregnancy becomes important in the first year of life is to be prevented. The mother's age is also a determinant of the nutritional status of the child this finding agreed with (Amugsi *et al*., 2019)(Amugsi et al., 2019)(Amugsi et al., 2019)(Amugsi et al., 2019)(Amugsi et al., 2019)who found the correlates of the double burden of malnutrition (DBM) among women in five SSA countries (Ghana, Nigeria, Kenya, Mozambique and Democratic Republic of Congo). They found that the risk of being underweight, overweight, and obese in all 5 countries was correlated with older age. This means that age appears to be correlated with a greater probability of DBM among women.

Similarly, a study on double burden of malnutrition access to improved water and sanitation facilities, lack of maternal education, younger maternal age, higher maternal parity and older child age, were associated with the overweight/obese mother−stunted child pairs. However, these associations were not statistically significant by the method of analysis used(P. K. Masibo et al., 2020).

Similarly, Sunuwar *et al*. (2020) carried a study to explore the coexistence of various forms of malnutrition and associated factors among mother-child pairs residing in the same household. The results revealed that mothers with aged over 35 years and those who had achieved at least secondary level education were more likely to suffer from this phenomenon. This study indicated that maternal age as well as the education level could be used to estimate the DBM at the household level.

A couple of studies had similar results and revealed that women who had higher levels of education were more likely to be overweight or obesity. In comparison, more studies have also reported that the double burden of malnutrition is associated with a higher level of mother's education and wealth status (Jehn & Brewis, 2009); Oddo *et al*., 2012;Sekiyama *et al*., 2015). A valid reason may because of the working environment where educated women take part in jobs that are not physically demanding, therefore developing overweight and obesity (Das *et al*., 2019).

Another study proposed that the relationship between education and overweight/obesity is complex and is different in each country. The proposition for these conflicting results could be that having a higher level of education by the mother may not well be sufficient to adopt a better behavior change and healthy lifestyle, therefore resulting with the mothers having poor health and nutritional knowledge. It also adds to women being less sensitive to child and her nutritional status or less reactive to health and nutrition issues in terms of food choices and barriers such as food cost, accessibility, availability, food preparation skills (Moubarac *et al*., 2013).

5.4 Conclusion of the Study

The results showed that majority of the respondents 57.6% were aged between 36 and 49 years. Majority of mothers are married (68.8%), had attained secondary level of

education (38.8%) and were in business (28.1%). A proportion (25.6%) the households did not access adequate food. Total mean maternal daily energy consumption was 1,441.3±343.2 kcal while for children it was 1,564.9 ±253.7 kcal. The numbers of meals taken per day were 3.2 ± 0.43 for mothers and 4.1 ± 0.71 for children. In the same household mothers were found to consume more than the children. In circumstances where the children consumed the recommended amount, issue related to sickness led to under nutrition.

Slightly above half (56.4%) of the children were reported to have suffered from one or more of illnesses. Common illnesses include; common cold, diarrhea, malaria, and skin conditions representing 13.1%, 9.3%, 7.3% and 6.9% cases, respectively. The top illness by prevalence are as follows; respiratory infections (13.1%), gastro-enteritis (9.3%) and malaria (7.3%). The number of mothers who suffered from illnesses was 39.6% with the most prevalent disease among the mother was respiratory tract infections (44.5%) and diabetes (10.2%).

This study revealed the double burden of malnutrition exists between child and maternal pair in Kericho. About 28.1% of mothers were overweight while 7.7% were obese. The number of sampled children who were severely wasted was 11.5% while 23.1% were moderately wasted. This forms a GAM of 34.6%. The results also indicated that a total of 18.9% of the total sampled population of interest was found to be stunted. Out of these, 2.4% were severely stunted while 16.5% were moderately stunted. In terms of obese mothers, a prevalence (1.9%) cases of child underweight as compared to wasted children at 0.4%. Total prevalence of DBM with respect to wasting was at 8.5%. The total prevalence of DBM with respect to overweight and obese children was 5% and 2.3%, respectively. Stunting was (3.1%), in overweight mothers as compared to those coexisting with obese mothers at 1.9%. About 28.1% of mothers were overweight while

7.7% were obese. The children who were wasted were 34.6%, while 18.9% were stunted. The total prevalence of DBM with respect to wasting was at 8.5% of the pairs, 5.0% for stunting while underweight was 6.6%.

The mother's age, are significant at 5% level while marital status, education level, occupation, household income and dietary intake. The result findings reported that nutrition status is influenced by child's age and gender therefore influences nutrition status while household income and dietary intake show no significance.

5.5 Recommendations

5.5.1 Recommendations for Policies and Practices

The study recommends that health actors educate the mothers on maternal, infant and young child nutrition policy to fill in the existing gaps. The nutrition departments in the county provide nutrition health education to households on good dietary practices.

The study also recommends that policy makers to review the Maternal, Infant and Young Child Nutrition policy to take into consideration of double burden of malnutrition.

Policy on Young Child Nutrition to take into consideration of double burden of malnutrition.

5.5.2 Suggestions for Further Research

  i.   The data of the research was cross-sectional and may not have measured the cause-effects of double burden of malnutrition therefore further research to be done using a longitudinal study.

 ii.   Further studies can be done on the role of gender on double burden of malnutrition.

iii.   A wider research can be done that can capture the wider Kenyan region on the double burden of malnutrition across the country at large.

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Appendix I: Informed Consent Form

I am Faith J, Kimutai, a Masters student at Kabarak University main campus in Nakuru. We are doing research on the **"Predictors of double burden of malnutrition among mother-child pairs in Kericho County".** This study will identify the prevalence and what predictors may drive the double burden of malnutrition among mothers and children at household levels in Kericho County.

Your household has been randomly selected from among many others. The information you give us will be treated confidentially and your name will not reflect in the main report. I am going to give you information and invite you to be part of this research. Your decision to participate is purely voluntary. Before you decide, you can talk to anyone you feel comfortable with about the research. There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them from me or write directly to Kabarak University ethical review committee through the addresses I have provided.

Study procedures

We will take your weight, height, together with your child's height/length and weight. You will also be interviewed on your 24-Hour dietary recall and food consumption frequency.

Benefits and Compensation

There may not be any benefit for you but your participation is likely to help us find the answer to the research question. There may not be any benefit to the society at this stage of the research, but future generations are likely to benefit from the findings. You will not be given any other money or gifts to take part in this research.

Risks and Discomforts

There are no risks associated with your participation in the study.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. Whether you choose to participate or not, all the services you receive

at this clinic will continue and nothing will change. You may change your mind later and stop participating even if you agreed earlier.

Confidentiality and Privacy

With this research, something out of the ordinary is being done in your community. It is possible that if others in the community are aware that you are participating, they may ask you questions. We will not be sharing the identity of those participating in the research. The information that we collect from this research project will be kept confidential. Information about you that will be collected during the research will be put away and no-one but the researchers will be able to see it. Any information about you will have a number on it instead of your name. Only the researchers will know what your number is and we will lock that information up with a lock and key.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Print Code of Participant   _____

Signature of Participant   _____

Date   _____

If you wish to ask questions later, you may contact any of the following:

Contacts: Faith Kimutai Cell Phone: 0718240038; Email. faithjerono89@gmail.com or Kabarak University Ethical Review Committee. Contact Address: Box 20157 PRIVATE BAG KABARAK.

Appendix II: Questionnaire

Questionnaire Code No. ------------------

County-------------------------------

Sub-county----------------------------

Location------------------------------

Village-------------------------------

Ward----------------------------------

Section A: Demographic Data and Socio-Economic Characteristics

Name of the interviewer-----------------------------------

Date of interview--

Codeof the study subject--------------------------------

Use the codes provided at the bottom of the page in the Table below. For 'age', record to the nearest 1 and for 'Others', specify in the space provided below the codes

No.	Age	Relationship to household head	Sex	Occupation	Marital status	Education	Income

Codes:

Relation to the household head: Head of households [   ]Spouse [] Son [] Daughter [ ]Relative [   ] Other, specify…………………………..

Marital Status: Married [] Separated[   ] Divorced[   ] Widow[   ] Single [   ]

Education: Pre-school [   ]Primary [   ]Secondary [   ]Post-secondary [   ]

Occupation Salaried employee[   ] Business[   ] Housewife [   ] Casual laborer[   ] Student[   ]others, specify…………………..

Income <5,000   [   ] 5,001- 10,000   [   ] 10,001- 20,000   [   ]   20,001- 50,000   [   ] 50,0001- 100,000   [   ]>100,001   [   ]

What is the estimate the amount of money your household spends per month on food Ksh ___

<5,000 [ ] 5,001- 10,000 [ ] 10,001- 20,000 [ ] 20,001- 50,000 [ ]

50,0001- 100,000 [ ]>100,001 [ ]

Section B: Household Food Security and Dietary Intake

1. Do you have your own farm? Yes [ ]No [ ]

2. If yes in question 1, what is the size in acres?

3. What is your household income per month? Ksh ………………

4. Estimate the amount of money your household spends per month on food Ksh_____

5. Do you have your own livestock? Yes[ ]No [ ]

6. What is your common staple diet? List diet

----

7. How often do you consume the above staple diet per week? Circle the correct response],

1=Once in a week2= week in a week 3= Thrice in a week4 More than 4 times in a week

8. Does your household always have adequate food? Yes [ ]No [ ]

. (If No) how long does the household face food shortage? _____

9 Which particular time of the month or the year?

10. How does the household overcome food shortage? Circle the numbers)

Purchase food[ ] Receive food aid [ ]

Borrow food [ ] Other (Specify) [ ]

Receive gift[ ]

Food Frequency Questionnaire

 1. (A) Over the past 7 days, how often did you drink eat vegetable such as kales, cabbages, traditional vegetables?

   a) 1 time per day

   b) 2-3 times per day

   c) 1-2 times per week

   d) 3-4 times per week

   e) 5-6 times per week

1. (b). Each time you eat vegetables, how much did you usually eat?

   a) Less than3/4 cup (250 mls)

   b) ¾ -1 ¼ cup (250 mls)

   c) More than 1 ¼ mls)

2. (a) Over the past 7 days, how often did you eat cereals such as rice, ugali, mashed potatoes and arrow roots

   a) 1 time per day

   b) 2-3 times per day

   c) 1-2 times per week

   d) 5-6 times per week

2. (b) Each time you eat cereals such as rice, ugali, mashed potatoes and arrow roots, how much did you usually eat?

   a) Less than3/4 cup (250 mls)

   b) ¾ -1 ¼ cup (250 mls)

   c) More than 1 ¼ mls)

3. (a) Over the past 7 days, how often did you eat food such as meat, poultry and fish?

   a) 1 time per day

   b) 2-3 times per day

   c) 1-2 times per week

   d) 5-6 times per week

3. (b) Each time you eat meat, poultry or fish, how much do you usually eat?

   a) Less than3/4 cup (250 mls)

   b) ¾ -1 ¼ cup (250 mls)

   c) More than 1 ¼ cups (250 mls)

4. (a) In the past 7 days, how often did you eat legumes such as beans. (baked beans, kidney, peas lentils and soy beans

   a) 1 time per day

   b) 2-3 times per day

   c) 1-2 times per week

   d) 3-4 times per week

   e) 5-6 times per week

4. (b). Each time you eat vegetables, how much do you usually eat?

a) Less than3/4 cup (250 mls)
b) ½ -1cup (250 mls)
c) More than 1(250 mls)

5. (a) Over the past 7 days, which fat were usually added to your vegetables, meat, poultry or legumes such food during cooking? (Please mark all that apply)

a) Margarine (including low fat)
b) Butter (including low fat)
c) Corn oil
d) Solid vegetable fat
e) Other kinds of oils

5. (b).Now thinking again about all the vegetables and other cooked food you ate in the past

7 days, how often was some sort of fat, sauce or dressing added after cooking or at the Table?

a) 1 time per day
b) 2-3 times per day
c) 1-2 times per week
d) 3-4 times per week
e) 5-6 times per week

6. (a).If margarine, butter, or bacon fat was added to cooked vegetables after cooking or at the Table, how much did you add?

a) Did not usually add
b) Less than one tea spoon
c) 1 to 3 teaspoons
d) More than 3 tea spoons 74

Now think about all the meat, poultry, and fish you ate in the past 7 days and how they were prepared.

6. (b) How often was oil, butter, margarine, or other fat used to fry, sauté or marinates any meat, poultry, or fish you ate?

a) 1 time per day

b) 2-3 times per day

c) 1-2 times per week

d) 3-4 times per week

e) 5-6 times per week

The next questions ask about your intake of bread. First we will ask about bread you eat as part of sandwiches only. Then we will ask all other bread you eat.

7. (a) How often did you eat breads or rolls as part of sandwiches (including samosa and hot dog)

a) 1 time per day

b) 2-3 times per day

c) 1-2 times per week

d) 5-6 times per week

7. (b).Each time you ate breads or rolls as part of your sandwiches how many did you usually eat?

a) 75 1 slice or ½ roll

b) 2 slices or 1 roll

c) More than 2 slices

8. (a) Over the past 7 days, how often did you drink fresh milk, sour milk, mala or yoghurt?

a) 1 time per day

b) 2-3 times per day

c) 1-2 times per week

d) 3-4 times per week

e) 5-6 times per week

f) Never

8. (b). Each time you drink fresh milk, sour milk, mala or yoghurt, how much do you drink?

    a) Less than ½ a cup (250 mls)

    b) ½ to 1 cup

    c) More than 1 cup

9. (a) How often do you add sugar or honey to your tea, coffee or porridge?

    a) 1-3 cups per day

    b) 2-4 cups per week

    c) 5-6 cups per week

    d) 1 cup per day

    e) 2-4 cups per day

    f) Never

9. (b) .Each time sugar or honey was added to foods you ate, how much was usually added?

    a) Less than 1 tea spoon

    b) 1 to 3 teaspoons

    c) More than 3 teaspoons

Describe your eating patterns in the last 3 months

Breakfast

Always [ ]   sometimes [ ]   only on weekends [ ]   never [ ]

Lunch

Always [ ]   sometimes [ ]   only on weekends [ ]   never[ ]

Supper

Always [ ]   sometimes [ ]   only on weekend [ ]   never [ ]

Snacks

Always [ ]   sometimes [ ]   only on weekends [ ]   never[ ]

Dietary Intake Using 24 Hour Recall

Tick the day of the week, which you are recalling

Monday   [ ]   Tuesday [ ] Wednesday   [ ] Thursday [ ]   Friday [ ]

Saturday   [ ]   Sunday   [ ]

Yesterday from the time you woke up to the time you went to sleep, remember the foods

and drinks you consumed (or the child) then tell me (give a brief minute then continue)

Remembered foods

Forgotten foods

Now transfer the foods to the following Table:

Time	Food Item	Ingredients of the Food Item & Preparation Method	Amount of Meal inthe Pot	Amount Served tothe Mother	Amount Served tothe Child	Amount Left Over bythe Mother or Child

Section C: Anthropometric Measurements

Weight and Height for mothers

Measurement	1ˢᵗ	2ⁿᵈ	Average
Weight			
Height			

Weight and Height for children

Measurement	1ˢᵗ	2ⁿᵈ	Average
Weight			
Height/length			

Section D: Morbidity Status

1. Have you been sick in the previous two weeks? _____ 1. Yes _____No_____

2. If yes, what type and duration of illness

Type of illness	Duration of illness

Appendix III: KUREC Approval Letter

KABARAK UNIVERSITY RESEARCH ETHICS COMMITTEE

Private Bag - 20157
KABARAK, KENYA
Email: kurec@kabarak.ac.ke

Tel: 254-51-343234/5
Fax: 254-051-343529
www.kabarak.ac.ke

OUR REF: KABU01/KUREC/001/01/05/21

26th May, 2021

Faith Jerono,
Kabarak University,

Dear Faith,

SUBJECT: ETHICS REVIEW DECISION

Kabarak University Research Ethics Committee (KUREC) received application for a protocol titled "FACTORS ASSOCIATED WITH DOUBLE BURDEN OF MALNUTRITION AMONG CHILD-MOTHER PAIR IN KERICHO COUNTY, KENYA" on 17th April, 2021. The protocol was reviewed and discussed during a virtual meeting held on 3rd May, 2021 at 1000 Hours. The committee considered the application in accordance with the Kabarak University procedures on review of research protocols for ethical clearance and decided as follows:

1. **PROPOSED STUDY SITE**

    Kericho County

2. **KUREC DECISION**

    <u>Approved</u> for data collection for a minimum period of ONE year from 26th May, 2021

This approval is subject to the following conditions:

i.   The researcher shall obtain a RESEARCH PERMIT from NACOSTI before commencement of data collection & submit a copy to the Kabarak University Institute of Postgraduate Studies (IPGS);
ii.   The researcher shall immediately notify KUREC in case of any adjustments to the protocol;
iii. The researcher shall within 7 days of occurrence notify KUREC of any adverse events associated with the conduct of this study;
iv.   The researcher shall apply for extension of the study period should the initial 1 year expire before completion of data collection;
v.   The researcher shall submit study progress reports to KUREC after every 6 months and a full report at completion of the study/project

Thank you.

Sincerely,

Prof. Jackson Kitetu PhD.
KUREC-Chairman

KABARAK UNIVERSITY
INSTITUTIONAL RESEARCH ETHICS COMMITTEE
2 6 MAY 2021
APPROVED
P.O. PRIVATE BAG - 20157, KABARAK

Cc   Vice Chancellor
        DVC-Academic & Research
        Registrar-Academic & Research
        Director-Research Innovation & Outreach
        Institute of Post Graduate Studies

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord.
(1 Peter 3:15)
Kabarak University is ISO 9001:2015 Certified

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Appendix IV: Authorization from the University

BOARD OF POST GRADUATE STUDIES

Private Bag - 20157   Tel: 0773265999
KABARAK, KENYA   E-mail: directorpostgraduate@kabarak.ac.ke
http://kabarak.ac.ke/institute-postgraduate-studies/

24th March, 2021

The Chairman
Kabarak University Research and Ethics Committee (KUREC)

Dear Sir,

RE: FAITH J. KIMUTAI – GMND/M/2308/09/16

The above named is a candidate at Kabarak University pursuing Master's degree in Human Nutrition and Dietetics. She is carrying out a research entitled "*Factors Associated with Double Burden of Malnutrition Among Child Release among Child- Mother Pair in Kericho County. Kenya*". The student has defended her proposal and has been authorised to proceed with field research.

The information obtained in the course of this research will be used for academic purposes only and will be treated with utmost confidentiality.

Please provide the student with KUREC clearance to enable the student obtain NACOSTI research permit.

Thank you.

Yours faithfully,

Dr. Wilson O. Shitandi
DIRECTOR, INSTITUTE OF POST GRADUATE STUDIES

Kabarak University Moral Code
As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord. (1 Peter 3:15)

Appendix V: NACOSTI Research License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION

Ref No: 271813

Date of Issue: **16/June/2021**

RESEARCH LICENSE

This is to Certify that Miss.. FAITH KIMUTAI of Kabarak University, has been licensed to conduct research in Kericho on the topic: FACTORS ASSOCIATED WITH DOUBLE BURDEN OF MALNUTRITION AMONG CHILD MOTHER PAIRS IN KERICHO COUNTY. for the period ending : 16/June/2022.

License No: NACOSTI/P/21/11175

271813

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

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THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is Guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014

CONDITIONS

1. The License is valid for the proposed research, location and specified period
2. The License any rights thereunder are non-transferable
3. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research
4. Excavation, filming and collection of specimens are subject to further necessary clearence from relevant Government Agencies
5. The License does not give authority to tranfer research materials
6. NACOSTI may monitor and evaluate the licensed research project
7. The Licensee shall submit one hard copy and upload a soft copy of their final report (thesis) within one year of completion of the research
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice

Appendix VI: County Commissioner Authorization Letter

OFFICE OF THE PRESIDENT
MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

Telegrams: ....
Telephone: Kericho 20132
When replying please quote
kerichocc@yahoo.com

THE COUNTY COMMISSIONER
KERICHO COUNTY
P.O. BOX 19
KERICHO

REF: MISC 19 VOL.VII (117)

21st June, 2021

To whom it may concern

RESEARCH AUTHORISATION –MISS FAITH KIMUTAI

I am pleased to inform you that you are authorized to undertake research as per the licence No. NACOSTI P/21/11175 dated 16th June, 2021 on *"Factors Associated with Double Burden of Malnutrition among child mother pairs"* in *Kericho County, Kenya* for a period ending 16th June, 2022.

J.N. NYAMWAMU
FOR: COUNTY COMMISSIONER
KERICHO COUNTY

Cc
County Director of Education
KERICHO

Appendix VII: County Government of Kericho

REPUBLIC OF KENYA

COUNTY GOVERNMENT OF KERICHO
OFFICE OF THE GOVERNOR

P. O. Box 112 – 20200
KERICHO
Ref: KEC/CS/PSM/VOL.III 3)

Email: *info@kericho.go.ke*
Date: 28th June, 2021

TO WHOM IT MAY CONCERN

<u>Faith J. Kimutai</u> - GMND/M/2308/09/16

**RE; AUTHORIZATION FOR COLLECTION OF DATA AT THE COUNTY
GOVERNMENT OF KERICHO**

The above named person is hereby authorized to conduct his related research
within the departments of the County Government of Kericho.

Her area of study is titled "Factors Associated With Double Burden Of
Malnutrition Among Child-Mother Pair in Kericho County, Kenya"

Kindly accord her any necessary assistance.

COUNTY SECRETARY
THE COUNTY GOVERNMENT OF KESICHO

2 8 JUN 2021

P. O. Box 112-20200,
KERICHO - KENYA

Mr. Joel K. Bett
COUNTY SECRETARY AND HEAD OF COUNTY PUBLIC SERVICE

Appendix VIII: Evidence of Conference Participation

Appendix IX: List of Publication

Original Research Article

Predictors Associated with Double Burden of Malnutrition among Child-Mother Pairs in Kericho County, Kenya

Faith Jerono Kimutai[1*], Dr. Wesley Bor[2], Dr. Peter Chege[3]

[1]MSc (Human Nutrition and Dietetics), Department of Human Nutrition and Dietetics, Kabarak University, Kenya
[2]Lecturer, Department of Human Nutrition and Dietetics, Kabarak University, Kenya
[3]Lecturer, Department of Food, Nutrition and Dietetics, Kenyatta University, Kenya

Abstract: In low-and middle-income nations, the double burden of malnutrition is a rising problem. It is unusual for an underweight child and an overweight mother to exist together in the same household because they both occupy a shared environment and have access to the same dietary patterns and habits. The aim of this study was to investigate the predictors associated with double burden of malnutrition among the child-mother pairs living in Kericho County. The research design employed was cross-sectional descriptive study. The target population was 346 comprising of a child-mother pairs within the six sub-counties within Kericho County. The research employed the multi-stage stratified cluster sampling method to obtain the target households. A pre-tested questionnaire collected data from socioeconomic demographic characteristics, nutrition status for mother (Body Mass Index,) child (BMI- Z-scores,) food consumption and frequency. Data processing was done using Ms Excel, SPSS vs. 26.0 and Nutri survey 2005 software. Categorical variables were analyzed, while measures of central tendencies and dispersion were computed. The benchmark for the level of significance were at 0.05 alpha level ($p < 0.05$. The results showed that majority of the respondents (57.6%) were between 36-49 years. The study findings also revealed that 18.9% of children were stunted, 11.5% wasted, 5.8% obese and 8.1% overweight. The study also found that 28.1% of mothers were overweight while 7.7% were obese and 16.9% were underweight. The variables: Weight of; mother's age, weight and height, child's age, gender and weight were significantly associated with double burden of malnutrition among child-mother pairs. The mother's weight, height and age, the child's weight, age and gender influences the nutritional outcomes which has an influence in controlling DBM. The study recommends that policy makers to review the Maternal, Infant and Young Child Feeding Nutrition (MIYCN) policy to take into consideration the double burden of malnutrition.
Keywords: Double Burden Malnutrition, socio-demographics, morbidity status and nutritional status.

INTRODUCTION

According to WHO (2020) up to 41 million young children worldwide are overweight or obese, 144 million are stunted, and 47 million are wasting. In contrast, 246 million women of reproductive age worldwide are overweight or obese, making up 1.9 billion adults worldwide. Around 45% of deaths in children under the age of five are attributed to nutrition-related variables (mostly under nutrition), whereas over nutrition is frequently connected to the majority of diet-related non-communicable diseases and mortality worldwide. While low- and middle-income (LMIC) nations are presently going through a transition as a result of a simultaneous rise in overweight and obesity as well as an increase in under nutrition (World Health Organization, 2018).

This complex shift produces a new triad referred to as the double burden of malnutrition which implies the presence of both under nutrition and over nutrition (overweight or obesity) either at the individual, household or population level. It may appear

*Corresponding Author: Faith Jerono Kimutai
MSc (Human Nutrition and Dietetics), Department of Human Nutrition and Dietetics, Kabarak University, Kenya

1