

DETERMINANTS OF LACTATING MOTHERS' NUTRITIONAL STATUS IN KENYA

by Mungai Maureen

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**DETERMINANTS OF LACTATING MOTHERS' NUTRITIONAL STATUS IN
KENYA**

BY

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**Research proposal submitted to the University of Nairobi, School of Economics, in
Partial fulfilment of the requirements of the Degree of Master of Arts, Economics**

August, 2016

DECLARATION

This is my own original work and has never been presented for any degree in any other university for award of degree.

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This research proposal has been submitted for examination with our approval as university supervisors.

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Signature

Date

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LIST OF ABBREVIATIONS

BMI – Body Mass Index

BMR – Basal Metabolic Rate

CED – Chronic Energy Deficiency

DHS – Demographic Health Survey

IV- Instrumental Variable

MDG – Millennium Development Goals

RNI – Recommended Nutrient Intake

WC – Waist Circumference

WHO – World Health Organization

2SLS – Two-Stage Least Squares

DEFINITION OF TERMS

Lactation- This is the process of synthesizing and producing milk from the breasts to provide for the young ones. It is an essential part in physiologic conclusion of the reproductive cycle in mammals inclusive of human beings (Girma, 2007).

Nutrition- This refers to the science of food, its use within the body, and its relationship to good health or can be defined as the process by which living things take in foods and use it. It is therefore the study of food and the process of receiving nourishment from the food we eat after digestion and metabolism (Digman, 2001).

Nutritional status- This refers to the present body status of a person or a population group correlated to their nourishment state (the intake and usage of nutrients). Nutritional status is evaluated using anthropometry which is the measurement of body height/length, weight and proportions. These measurements are usually compared with the WHO Growth Standards (2006) of the same age and sex in order to assess the nutritional status.) (Demissie, 2003).

Malnutrition ²² This is the condition that builds up when the body lacks or acquires in excess sufficient amount of vitamins, minerals and other essential nutrients that are required to maintain healthy tissues and functioning of body organs (Fewtrell, 2004).

Under-nutrition- This is a condition brought about by consumption of very few essential nutrients or utilizing and excreting them more frequently than they are obtainable. Infants, small children and lactating women require these additional nutrients (Allen, 2001).

Over-nutrition- This is a condition that results from consuming too much of the unnecessary nutrients, insufficient exercises and intake of many vitamins or other dietary needs. This condition mostly results from consumption of a diet with high fats and salt (Hawkes, 2007).

CHAPTER ONE

INTRODUCTION

1.1 Background

Over the past years world economies have been much concerned with the attainment of global health success; much of which was fuelled by the establishment and implementation of Millennium Development Goals-MDGs (WHO, 2014). However, this success has been achieved in the eradication of vaccine-preventable diseases, yet still a startling number of women die yearly of causes linked to pregnancy, childbirth and malnourishment. According to the most recent consensus estimates approximately 287,000 women die annually and nearly 85% of these deaths take place in Sub-Saharan Africa and South Asia (World Bank, 2013). This is a big loss especially to an emerging economies guaranteeing development of pro-health policies (Meyerhoefer and Sahn, 2010).

A nation's investment in its health sector is important among its investments in the human capital sectors (Riordan, 2005). According to WHO (2010) Sub-Saharan Africa, especially Kenya is faced by fertility-related health challenges namely, newborn illnesses, pregnancy and childbirth complications, childhood infections, and malnutrition, all of which have a direct impact on the socio-economic status of the economy.

In essence, without good health a person cannot achieve anything meaningful in life. For instance, a person's ability to participate in economic, social and political activities depends on the person's health status, either in good or poor health as this is an important factor in determining person's ability to cope with learning environment (Mulingwa, 2005). Moreover, a healthy population promotes economic growth of the nation through productivity, savings and investment; hence, may be regarded or used as a tool for macroeconomic policy.

1.2 An Overview of Lactation in Women and Maternal Health Status

Lactation is the enhanced episodic secretion of prolactin and oxytocin suppression of hypothalamic- pituitary- gonadal axis and hypoinsulinemia (Vernon 1989; Allen, 2001). Lactation needs both an increased nutrients supply and improvement of mechanisms that ensure preferential use of nutrients by the mammary gland. Since sex steroids prevent the lactogenic effects of prolactin, the respective withdrawal of estrogen and progesterone is essential for lactogenesis. Prolactin not only stimulates synthesis and secretion of milk

components in the mammary glands, but also reduces lipogenesis in the liver and adipose tissue and increases delivery of glucose and lactate lipogenic precursors to the mammary gland (McNamara, 1995). During lactation, the hypothalamic-pituitary adrenal axis changes in the case of exercise- induced stress (Altemus et al. 1995). These neuroendocrine changes preserve energy and store substrate for milk synthesis and enable nutrient delivery to the mammary gland, (Macintosh, 2011).

Changes of the body configuration during lactation are a function of the species, stage of lactation and nutritional state (Robinson, 1986). The metabolic fat of weight change varies depending on the diet and nutritional state of the lactating mother. High metabolism during lactation is depicted by increase in appetite and dietary intake (Goldberg, 2003). Anthropometric facts recommend that women depend on body fat and should increase dietary intake to meet the demand of lactation (Hailelassie, Mulugeta and Girma, 2013). This implies that women need to be healthy such that malnourishment is addressed to meet required lactation.

Maternal health status includes maternal mortality ratio (McCarthy and Maine, 1992) and maternal morbidity and malnutrition. Maternal mortality refers to **the number of maternal deaths per 10,000 live birth** (WHO, 2008). **The death of a woman is said to be a maternal death if it results from the causes related to or aggravated by the pregnancy or its management** (Awiti, 2013).

Maternal morbidity refers to illness and injury related to pregnancy and childbirth. Other indicators of maternal health include percentage of women experiencing a live birth or stillbirth, maternal mortality ratio, skilled birth deliveries, antenatal and postnatal care coverage and the use of modern family planning techniques, (Awiti, 2013). Malnutrition is also a maternal health indicator which refers to both under nutrition (inadequate nutrients for growth and maintenance) or over nutrition (consuming too many calories) or in the wrong proportions. This indicator is rarely used yet it is contributing to decline of the health status of the population. The most common form of malnutrition is under nutrition caused by inadequate calories and protein (Smith and Haddad, 2000).

Maternal health also considers body mass index of an individual that includes, individual **weight in kilograms by the square of the individual's height in meters**. The measure is used to clarify individual as either underweight, overweight or normal. A person is underweight if she has a BMI less than 18.5. Between 18.5 and 24.9 for normal BMI and obese if she has

BMI above 30, (Hiza, et al., 2000). BMI values of above 25 are unhealthy and have been shown to increase the hazard of chronic diseases such as high blood pressure, diabetes, heart disease, stroke, certain types of cancer, arthritis, and breathing problems.

Kenya is among nine countries consisting of India, Pakistan, Sudan, Nigeria, Indonesia, Uganda, Ethiopia and Tanzania contributing to 60% of the world's maternal death based on the world health statistics (WHO, 2014). The maternal mortality ratio as at 2010 was 454 per 100, 000 live births while in 2013, the rate changed to 410 (World, Bank, 2013). This reduction may be attributed to increase in universal health coverage which includes improved access to hospital services, provision of free maternal and immunization programs.

1.3 Problem statement

Kenya has made progress towards attaining the Millennium Development Goals (MDGs) currently referred to as Sustainable Development Goals (SDGs). The ultimate goal for SDGs is to improve the socio economic status of a nation through sustainable development, (WHO, 2014). For this to be achieved, however, it is clear that there is need for improved health status of the population which is an important aspect which is directly related to economic growth of a country. There is no doubt that among main drivers and indicators of health status in a country, nutritional status is the most prominent factor for policy interventions in improving people's wellbeing (Asmah, Twerefou and Smith, 2013; Awiti, 2013; Oyakale, 2014). Few studies, however, employ malnutrition indicators with regard to health status in developing countries (Owoo, 2012). For instance, the nutritional status of a mother has major effects for her health and the health of her children, (Namubiru, 2014). According to KDHS (2014), breastfeeding practices and introduction of supplemental foods are critical in enhancing nutritional status of children. This implies that improved nutritional status of the lactating mother, the risk of child mortality is reduced and consequent development is boosted. This is because breast milk possesses all the nutrients children need in the first six months of life.

There are a lot of available literatures on nutritional status among women largely conducted (Conways and Kutinoyal, 2006; Ajieroh, 2009; Adeoti and Awoniyi, 2012; Kurkalni, Kurkalni and Gahia, 2014 and Ogechi, 2014). Findings in some developed countries established that malnourished women with BMI below 18.5 display a progressive rise in mortality rates and also increase risk of illness (Girma and Genebo, 2002). BMI below 18.5 indicates chronic energy deficiency among non-pregnant women (ACC/SCN 2000).

Literature has shown that age, residence, education, socio economic status, family size and income, timely and adequate prenatal care, accessibility to safe water, hygienic toilet, being literate and female autonomy as significantly related to maternal nutritional status, (Conways and Kutinoyal, 2006; Ajieroh, 2009; Adeoti and Awoniyi, 2012; Koryo-Debrah, et al., 2013; Maisibo, et al., 2013; Kurkalni, Kurkalni and Gahia, 2014; Achieng', 2014 and Hundera et al, 2015). Some of these studies considered small localities like province(s) or towns and cities leaving other areas (Mbochi, et al., 2012; Gameda, et al., 2013; Koryo-Debrah, et al., 2013; Ogechi, 2014 and Sholeye et al., 2014) while other studies were facility or institution based (Ndanu, 2013 and Hundera, et al., 2015) whereas others were national surveys (Conways and Kutinoyal, 2006; Ajieroh, 2009; Mwendu, 2009; Adeoti and Awoniyi, 2012; Maisibo, et al., 2013; Kurkalni, Kurkalni and Gahia, 2014; Achieng', 2014). These differences are likely to contribute to the mixed results obtained.

Similarly, little attention has been put to address the causes of malnutrition among lactating mothers given explored determinants of the whole population. Few studies have focused on this segment of the population (Chen, et al., 2012; Ogechi, 2014 and Hundera, et al., 2015). Exploring these three studies, the first two studies have not estimated any econometric model and rely only on the descriptive and correlation analysis which does not infer causality. On the other hand, Hundera, et al., (2015 is a case of a referral hospital in Ghana and thus may not be generalized to the entire population. Also the authors have not taken all demographic, socio economic and environmental factors into consideration. Unfortunately, there are zero studies available on the determinants of nutritional status among lactating women in Kenya. This study shall therefore be carried out using the recent Kenya Demographic and Household Survey (2014). The dataset will be used in estimating the impact of the different factors on nutritional status of lactating women for policy formulation at county and national levels respectively.

1.4 Research Questions

1. What are the general profiles of lactating mothers in Kenya?
2. What are the effects of these determinants on nutritional status of the lactating mothers in Kenya?
3. What are the policy implications for improving lactating mothers' nutritional status in Kenya?

1.5 Research objectives

1. To identify the general profiles of lactating mothers in Kenya.

2. To measure the effects of these determinants on nutritional status of the lactating mothers in Kenya.
3. To develop appropriate policies based on the outcome of the study.

1.6 Justification of the Study

Kenya is committed to achieving its set targets in an effort to realize the predetermined vision 2030 through social pillar under which health sector lies. This effort is evident through the signing and embracing the sustainable development goals in this year (2015). Indeed, improved health status is an important aspect related to economic growth of a country. Thus, the understanding of the relationship between lactating women nutrition and the respective determinants, exploring more linkage to socio-economic factors is imperative for policy formulation and consequent implementation. Therefore, the findings from this study may benefit other researchers, policy makers and stakeholders, particularly in the designing of specific policies for improving health status of lactating mothers whose vulnerability exceeds those of their counterparts. If the health of a lactating mother improves through achieving better nutritional status, then there is high a consequent likelihood of a newborn nourishing up well. The study results on the other hand, may contribute towards policies that are likely to help alleviate poverty and empower women in Kenya. This study will lead to significant contribution to the literature by addressing research gaps on health status of the lactating women in Kenya.

1.7 Organization of the Study

The rest of the research proposal is organized as follows; Chapter two reviews relevant theoretical and empirical literature on nutritional status among women in Kenya and around the world, chapter three presents the methodology and estimation models to be adopted in estimation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Health care is both a consumer good and investment good. The theory of health production proposed and developed by Grossman (1972) under expected utility, reveals that demographic and socio economic conditions significantly affects the production of health through the demand for health capital stock. This chapter therefore explores theoretical and empirical studies relating to demand for health especially nutritional status.

2.2 Theoretical Literature Review

Health status indicators classified under infant and child health, maternal health and indicators of general health can be made for individuals or for the whole populations (Saikia and Singh, 2008). Studies indicate that observed health status of a specific individuals, groups or population refers to all forms of the individual's or population's health (Lopez, et al., 2006; Awiti, 2013). The anthropometric measure commonly used for adults is referred to as **Body Mass Index (BMI)**. The BMI is computed by dividing an individual's weight (in kilograms) by the square of the individual's height in meters, (WHO, 2004). The measure is used to classify an individual as either underweight, normal, overweight or obese. If an individual has a BMI of less than 18.5, he /she is considered to be underweight. According to Wu, (2009) a low BMI is more related to malnutrition. Hubert, et al., (1983) concludes that underweight is as a result of either insufficient food or little health investment. A normal BMI (Between 18.5 and 24.9) is better while a BMI of between 25 and 29.9 implies one is overweight and if a BMI exceeds 29.9, then one is said to have obese (Hiza, et al., 2000). According to Awiti (2013) BMI values of above 25 are unhealthy and are likely to increase the risk of chronic diseases¹. Hence, we conclude that the production of nutrition is also partly determined by individual health status and other factors such as age, sex, residence, education attainment etc. This implies that a proper consideration of nutritional status especially among lactating women is urgent.

¹ Chronic diseases include high blood pressure, diabetes, heart disease, stroke, certain types of cancer, arthritis, and breathing problems (see Colditz, et al., 1995 and Walker et al., 1996).

This study further considers standard neoclassical consumer model under the demand theory where each consumer has utility as well as the preference function that allows him or her to rank alternative combinations of goods and services purchased in the market. Under the assumption, consumers have a rational behaviour, preferences and are faced by a budget constraint and therefore must make decisions about what they buy based on their limited budget, (Pindyck and Rubinfeld, 2008). When producing goods and services, quantities are determined by maximizing a utility function subject to prices and a constraint of resources. Other studies indicate that utility is maximized by households depending on consumption of commodities and leisure (Thomas, 1991; Achieng', 2014; Orayo, 2014). However, to attain highest utility, marginal utility should be equal for each good or service a consumer purchases, (Becker, 2007). In this case, respective demand and consumption functions are derived from utility maximization. Mathematically, the consumer demand for a good is derived from utility maximization using the Lagrangian and equations to solve the first order conditions to yields the marshallian demand functions.

Note that as the theory provides a satisfactory explanation of the demand for commodities, Grossman, (2000) who is also a health economist is of the opinion that what consumer demand when they purchase medical services are not these services per se but rather better health. This argument is backed up by Schiff and Valdes (1990). These authors argue that the process of producing nutrition is determined by inputs of nutrients, inputs of non-nutrient food attributes which affect nutrition. These include cleanliness and storability of food, privately and publicly provided inputs such as potable water and nutritional information. This study builds on utility maximization model to analyze the determinants of lactating nutritional status (malnutrition) among women in Kenya.

2.2 Empirical literature review

Conway & Kutinova (2006) examined the effect of prenatal health care on maternal health status in USA using secondary data drawn from the National Maternal and Infant Health Survey (NMIHS) for 1988. The study constructed two measures of maternal health (whether the mother's hospital stay after delivery exceeded her infant's and also used weight status that is body mass index) of pregnant women to capture different aspects of maternal health. The study estimated two stage-least square because prenatal care measures are endogenous in the maternal health equation. The findings showed that both timely and adequate prenatal care had a significant effect on the body mass index of a mother and consequently avoidance of length of hospitalization after delivery. This study was conducted in USA and analysed

maternal health status in terms of body mass index and length of hospitalization after delivery. The present study will also consider body mass index to analyse nutritional determinants of lactating women in Kenya.

Ajieroh, (2009) conducted a study on the determinants of child and maternal malnutrition in Nigeria. The study used data drawn from the Nigeria Demographic Health Survey (NDHS) for 2009 to a sample of 7000 women and 6029 children of age between 0 and 3. Basically, the study was geared towards understanding the determinants of maternal malnutrition and whether they differ considerably in terms of their nature and effect across socio-economic groups. The study examined socioeconomic, demographic and public related factors on mother's body mass index (BMI). The study estimated a probit regression model and two stage-least square approach to correct the endogeneity of public health related activities in the maternal health model. The study results showed that socioeconomic, demographic and public health related activities had positive and significant effect on the women nutritional status in Nigeria.

Kulkarni, Kulkarni and Gaiha (2014) conducted a study on double burden of malnutrition in Indian specifically focusing reasons factors behind increased likelihood of women being obese and underweight. The study used data from Indian Demographic and Health Survey (IDHS), 2005. The results of the findings indicated that; marital status, age, education, socio-economic status (SES), location, physical activity, media exposure, dietary composition and eating frequency as significant factors determined this burden. The authors concluded that nutrition is related to diets and relative food prices whereas cereals are the main source of diet in India which contains a lot of calories. The relative food prices were shown to be significant determinants of risks of underweight or overweight.

Adeoti and Awoniyi (2012) conducted a study on the determinants of child, maternal health status and the demand for health care services in Nigeria. The study utilized 7,864 sample data drawn from the Nigerian Demographic Household and Health Survey for 2008. Specifically the study examined factors responsible for the demand for health care by household and factors affecting the health status of mothers and children. The study estimated probit regression model with two- stage least square and instrumental variable to account for the endogeneity of health inputs to the child and mother's health status equation. Moreover, the study applied control function to correct for the non-linearity, complementarities and heterogeneity caused by the interaction health inputs with child and maternal health status.

The study used body mass index to represent maternal health status. The findings revealed that while mother's education, occupation, health inputs and living in urban centres improves the maternal health status household size significantly reduced the maternal health status. Other significant variables were age of the woman which indicates that the health of the woman improves with age.

¹ Descriptive statistics and Pearson correlation coefficient was used to determine association between BMI and nutrient intake in Nigeria among lactating women. This was based on the study conducted by Ogechi (2014) who explored the nutritional status and dietary intake of lactating women in Umuahia, Nigeria. The results show that majority of the women up to 71.3% were in the age range of 26-35 years and had a total family monthly income greater than 20,000 Naira. Energy, protein, calcium and vitamin A intake were lower than recommendations. As a result the study proposed that intervention programs such as nutrition education and dietary diversity should be emphasized during antenatal and lactation period to improve better health and nutrition outcomes.

² Gemeda et al. (2013) carried out an assessment of nutritional practices of pregnant mothers on maternal nutrition and associated facts in Guto Gida Woreda, East Wollega Zone, Ethiopia. Multiple logistic regression model was applied in the study to assess the factors associated with the dependent variable. The results of the study showed that only 33.9% of the respondents were found to have good nutritional practices during their pregnancy. It also found a positive significant relation between information about nutrition and nutritional practices of mothers during pregnancy. The study proposed that the government in collaboration with concerned bodies should focus on nutritional education to increase the practices of pregnant mothers on maternal nutrition during pregnancy in the study area.

Gollner and Nimeh (2014) investigated the prevalence and associated factors of obesity in Jordan. The study found that the overall prevalence of obesity in Jordanian women was 26.3% in 2002, 19.7% in 2007 and 28.2% in 2009. Multivariate analysis demonstrated that being obese was significantly associated with increasing age, being married and having only primary education.

³ Sholeye et al (2014) examined dietary habits of pregnant women in Ogun State, Nigeria. A cross-sectional comparative assessment of the dietary intake of 720 pregnant women accessing antenatal care at selected rural and urban primary health centres was carried out. The results showed that the mean intake of most nutrients was significantly higher ($p < 0.05$)

among the rural women than their urban counterparts. In general, the rural women had higher nutrient consumption compared to their urban counterparts. The study proposed continuous nutrition education will go a long way in ensuring adequate nutrient intake among pregnant women.

Chen et al (2012) carried out an evaluation of dietary intake of lactating women in China and its potential impact on the health of mothers and infants. From the descriptive statistics, the results showed that the mean daily energy and carbohydrate intake was lower than that of the Chinese Recommended Nutrient Intake (RNI). Intake of vitamin C, zinc, dietary fibre and calcium was also lower than the Chinese RNI. The lactating women on a self-selected diet did not meet the Chinese RNI for many important micronutrients which may influence the nutritional composition of breast milk and thus impact the potential health of mothers and infants.

Koryo-Dabrah et al (2012) investigated dietary practices and nutrient intakes of pregnant women in Accra, Ghana. The study found the mean energy, vitamin B12, folate, iron and zinc intakes were found to be inadequate compared with the Recommended Intakes. The correlation analysis revealed that women with larger household size had higher intake of energy and nutrients; and protein and zinc are associated with income and educational levels of the pregnant women in the study. The study recommended more attention be focused on nutrition education and intervention programs during pregnancy as well as dietary approaches such as fortification of foods to increase both macronutrient and micronutrients.

Hundera et al (2015) assessed nutritional status and associated factors among lactating mothers in Nekemte Referral Hospital and Health Centers in Ethiopia. The association of nutritional status with socio-economic and demographic factors was analyzed using descriptive statistics, multiple logistic regression analysis. The study revealed that majority of the women (81.3%) were in the age range of 17-25 years and (91.3%) were attending school. Family size and family income were significantly associated with the nutritional status of the study participants. In general the study found that the lactating mothers were short of the national and international recommendations. It therefore recommended sustained nutrition education to the lactating mothers, their families and communities to improve food intake, proper dietary knowledge during lactation in order to enhance health and nutrition outcomes of lactating mothers and their children.

Achieng' (2014), conducted a study on the determinants of women nutritional status in Kenya. The study employed instrumentation or two stage least square estimation technique. From the probit regression model, it was shown that socio-economic status was exogenous to women's nutrition status. Data was collected from Kenya Demographic and Health Survey of 2008. The study findings established that factors like; marital status, employment status, education level, place of residence, socio-economic status and age of the woman were significant determinants of under nutrition while environmental factors like type of toilet facility and source of drinking water were insignificant. The results also indicated that under nutrition was higher among urban residents than rural.

Mwende (2009) carried out a study on the determinants of children health status in Kenya using the Kenya Integrated Household Budget Survey of 2005/2006. The study considered children between the ages of 0 to 60 months and used both descriptive and econometric methods to help achieve the study objectives. The results showed that child characteristics, and household characteristics including household expenditure, maternal years of education, household size, household residence, absolute poverty level and region were found to have significant impact on the nutritional status of a child. The study also found that community variables such as tap and protected water sources and availability of sanitary facility have significantly improved nutritional status of children.

Ndanu (2013) investigated feeding practices and nutritional status of children aged 0-59 months accompanying incarcerated mothers in selected women's prisons in Kenya. The study focuses on children but it is likely to give us a perspective on the lactating mother's nutrition as well. Descriptive statistics and Pearson product moment correlation coefficient were applied to the study to show relationship between continuous variables such as the age of with nutrition status. The findings showed that in terms of nutritional status, 21.4% of the children were stunted, 3.8% wasted and 7.5% underweight. The dietary practices were associated with underweight children. The study also found that the children of mothers with higher educational status tended to be more wasted and also underweight meaning that the educational level of the mother did not positively influence the nutritional status of their children in such an environment.

Maisibo et al (2013) examined the prevalence and determinants of under and over nutrition among adult Kenyan women; evidence from the Kenya Demographic and Health Survey 2008-2009. In the findings, 30% of Kenyan women had over-nutrition as measured by

overweight and obesity while 11% were underweight. Regional differentials also existed in the distribution of women's nutritional status as those living in Eastern province were 2 times significantly more likely to be undernourished compared to those living in Nairobi. The study also found that women from households of middle and lower quintiles were less likely to have over-nutrition compared to those from the highest wealth index households and that married women were 1.9 times more likely to have over-nutrition compared to those who were married.

Mbochi et al (2012) carried out a study on predictors of overweight and obesity in adult women in Nairobi Province, Kenya. The results found that higher age, higher socio-economic group, increased parity, greater number of rooms in the house and increased expenditure showed greater mean body mass index (BMI), % body fat and waist circumference (WC) at highly significant levels. The study also found that adult women in high socio-economic groups exhibited a sedentary lifestyle and consumed a diet high in energy, protein, fat, cholesterol and alcohol and lower in fiber and carbohydrate compared with those in the low socio-economic groups.

2.3. Overview of the literature

The study has comprehensively interrogated both theoretical and empirical literature(s) on nutritional status among women from different parts of the world. Different studies have applied different methodologies and datasets in studying the determinants of nutritional status of women.

The Body Mass Index (BMI) has been widely used in several studies as a reliable indicator of nutritional status of mothers (Conways and Kutinoyal, 2006; Ajieroh, 2009; Adeoti and Awoniyi, 2012; Kurkalni, Kurkalni and Gahia, 2014 and Ogechi, 2014). Findings in some developed countries established that malnourished women with BMI below 18.5 display a progressive rise in mortality rates and also increase risk of illness (Girma and Genebo 2002). BMI below 18.5 indicates chronic energy deficiency among non-pregnant women (ACC/SCN 2000). Literature has shown that age, residence, education, socio economic status, family size and income, timely and adequate prenatal care, accessibility to safe water, hygienic toilet, being literate, access to health information and female autonomy as significantly related to maternal nutritional status, (Conways and Kutinoyal, 2006; Ajieroh, 2009; Adeoti and Awoniyi, 2012; Koryo-Debrah, et al., 2013; Maisibo, et al., 2013; Kurkalni,

Kurkalni and Gahia, 2014; Achieng', 2014 and Hundera et al, 2015). Also distance to accessing healthcare increases the probability of malnutrition.

Despite varied conclusions arrived at, by different studies examined in this study, some studies considered small localities like province(s) or towns and cities leaving other areas (Mbochi, et al., 2012; Gameda, et al., 2013; Koryo-Debrah, et al., 2013; Ogechi, 2014 and Sholeye et al., 2014) while other studies were facility or institution based (Ndanu, 2013 and Hundera, et al., 2015) whereas others were national surveys (Conways and Kutinoyal, 2006; Ajieroh, 2009; Mwendu, 2009; Adeoti and Awoniyi, 2012; Maisibo, et al., 2013; Kurkalni, Kurkalni and Gahia, 2014; Achieng', 2014). These differences are likely to contribute to the different results obtained. However, of the most important that cannot be overlooked; many studies are conducted on women as a whole without considering the specific factors relating to lactating mothers who may be more vulnerable compared to their counterparts. Few studies have focused on this segment of the population (Chen, et al., 2012; Ogechi, 2014 and Hundera, et al., 2015). Exploring these three studies, the first two have not estimated any econometric modelling and rely only on the descriptive and correlation analysis which does not infer causality. The former is a case of a referral hospital in Ghana and thus may not be generalized to the entire population. Also the authors have not taken all demographic, socio economic and environmental factors into consideration. Hundera et al., (2015) never addressed any estimation issues in their works like endogeneity and heterogeneity. This leaves a gap to be filled by this study.

Unfortunately, studies available on the determinants of lactating women nutritional status in Kenya are zero. This study shall therefore be carried out using the recent Kenya demographic and Household Survey (2014) which has information on nutritional Status of lactating women at County and national levels. Any potential endogeneity and heterogeneity will be addressed using the right instrument suggested in the literature to avoid interpreting and presenting biased estimates. The results will be used in measuring the impact of the different factors affecting nutritional status of lactating women for policy formulation at county and national levels respectively.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that will be used in undertaking the study. The section describes the theoretical framework, econometric model and estimation issues, variable definition and data sources.

3.2. Theoretical framework

The determinants of maternal health status have been explored by various studies such as Rosenzweig & Schultz, (1992; 1993); Wu, (2009); Bategeka et al., (2009); Okurut et al., (2013) and Awiti (2013). Employing modified utility maximization theory which was introduced by Rosenzweig & Schultz, (1992) and utilized in various literatures, this study will also adopt this model to address the research objectives. The theoretical fundamentals are based on utility maximization which is subject to the health production function and income constraints. Following Awiti (2013) we shall assume a lactating mother maximizes utility (U_L) as a result of consumption of goods and services that have no direct effect on health, (X), those goods that yield utility directly but also affect individual health, (Y) and the individual's health status (H). We can write this utility function as follows;

$$U_L = f(X, Y, H) \dots \dots \dots (1)$$

Individual health status in this case is a production function which produces women nutrition (Thomas, 1991; Achieng', 2014). Following, Grossman, (1972) and Awiti, (2013) health cannot be purchased from the market, it has to be produced using both marketed and non-marketed inputs, implying that nutritional status is a function of market purchased inputs for example nutrient in form of food and health services. Therefore, households will choose to maximize nutritional status given resources and information constraints they face (Kabubo-Mariara et al. 2008; Achieng', 2014). However, to arrive at this conclusion, we shall make an assumption that good nutritional status is desirable in its own right as suggested by Rosenzweig and Schultz, (1983).

Following Mwabu, (2009); Awiti, (2013) and Achieng' (2014) we shall have the nutritional status of the lactating women expressed in a linear form in the following production function:

$$H = F(Y, Z, \epsilon) \dots \dots \dots (2)$$

Where Y is the immediate inputs (water and cooking fuel) chosen by household to achieve the desired nutritional status and Z are other factors and ϵ unobservable biological endowments. According to Pindyck and Rubinfeld (2008) an individual demand curve is related to indifference curves preferences and budget constraints. Similarly, consumers allocate income among various goods and services with a concern of welfare maximization. To maximize utility, the household chooses the optimal consumption bundle, subject to a production function and a budget constraint. This is because gross consumption of goods and services cannot exceed total income given market price and wages (Strauss and Thomas, 1998). The individual is assumed to maximize the utility function subject to the above health production function and a budget constraint indicated in the following representation;

$$I = XP_X + YP_Y \dots \dots \dots (3)$$

I represent the household income

P_X is the price of the consumption good with no direct effect on nutrition such as clothing

P_Y is the price of nutrition related good

We shall ignore X which is a nutrition-neutral good following Ajakaiye and Mwabu (2007). Following Achieng' (2014) that prices and income are exogenous to the household, the reduced form household demand function² for Y will be substituted in health production function (2) to obtain the following final expression;

$$H = F(P_Y, Z, I, \epsilon) \dots \dots \dots (4)$$

Therefore, lactating women's nutrition status is a function of relative price P_Y , household knowledge (Z), household income (I) and woman's health endowment ϵ . However, the price of X is allowed to affect demands for Y through the budget constraint. The next section (3.3) presents a model leading to establishing the effects of exogenous changes in the socioeconomic, demographic and environmental factors of the household on nutrition outcomes of lactating women in Kenya.

3.3 Econometric Model

From the literature, the available health outcomes considered in this study are as a result of anthropometric measures which include weight, height and blood pressure used in analyses the nutritional health status (Wu, 2009). From these measures, Body Mass Indicator (BMI) for lactating women in Kenya is obtainable. Therefore, the study shall utilize woman nutritional status as dependent variable constructed as a dichotomous variable with outcomes

² The demand function is expressed as; $Y = D_Y(P_X, P_Y, K, W, \epsilon)$

(1,0) such that underweight, normal and obese shall measure lactating women health outcomes. Thus the binary variable is as presented below;

$$N_i^* = x'\beta' + \varepsilon \dots\dots\dots 5$$

Where N_i^* is the latent dependent variable while x' is a vector of independent variables such as individual characteristics (current age of the woman, age of the woman at first birth, sex etc), socioeconomic characteristics (education, wealth, current residence etc) and community characteristics and; β is a vector of parameters and ε is the error term.

Here, the dependent observed variable 'N' can only be observed³ if $N_i^* > 0$ and $N_i^* < 0$ otherwise. The probit model according to Ani, (2013) is presented as:

$$\Pr(N_i = 1/X = \Phi(X'\beta) \dots\dots\dots 6$$

Where $\Pr(N_i = 1/X$ represents the probability, while Φ is the cumulative distribution function (CDF) of the standard normal distribution and β is a vector of parameters to be estimated. The probit model is estimated using the maximum likelihood method and an increase in X increases/decreases the likelihood of observing an event. However, for interpretation purposes, the study shall compute the predicted probabilities interpreted as changes in the probabilities (Ani, 2013). The impact of a unit increase in one of explanatory variable implies a percentage change in the dependent variable. Note that the resulting coefficients shall be used primarily in determine sign and statistical significance.

³ A woman is underweight, normal or obese

3.4 Estimation Issues

3.4.1 Endogeneity

Endogeneity can be defined as a ⁴ situation where an independent variable is correlated with the disturbance term of the model. This may arise from three sources; first omission of variables due to data limitations thus the researcher may fail to include the unobserved variables in a regression model. Second, endogeneity may arise from measurement error such that a researcher includes an imperfect measure of variable in the regression model, instead of its true measure (Wooldridge, 2003). Third, endogeneity due to reverse causality occurs when at least one of the explanatory variable(s) is jointly determined with the dependent variable (Kabubo-Mariara et al., 2009). To solve for the endogeneity, specification and measurement of appropriate instruments is essential. Therefore instrumental variables and/or two stage least squares (2sls) will be used as deemed appropriate (Mwabu, 2008; Kabubo-Mariara et al., 2009; Awiti, 2013).

Literature suggests application of IV estimation as appropriate in a health production function. This is based on the fact that health inputs are regarded as chosen by households and consequently there is likely to be a problem of endogeneity especially in the use of OLS (Mwabu, 2007; Achieng', 2014). Further, studies have pointed out that socioeconomic status of the household is potentially endogenous in the women nutrition status model (Marinda, 2006; Mugo, 2012). However, Achieng', (2014) revealed socio economic status of a woman as exogenous in the women nutrition status model. This may be associated with difficulties of validating some of the instruments suggested in the literature through instrumental variable approach. Nevertheless, this study shall also employ the number of household members as an instrumenting variable due to the fact that it may be strongly correlated with household socioeconomic status and not with nutrition status of lactating women. Kabubo-Mariara, et al., (2009) however, cautions that at times it is rare to arrive at the instruments that satisfy all of the above properties.

3.4.2 Heterogeneity

Heterogeneity in the health production function may arise if there is presence of exogenous health factors known to the individual but unobserved by the researcher (Ajakaiye and Mwabu, 2007). Bias may arise from unobserved characteristics, preferences and endowments of members of household that affect the choice of health inputs but are also correlated with the health outcomes (Kabubo-Mariara *et al.*, 2009). For example, heterogeneity may arise

from unobserved community characteristics that are correlated with socio-economic as well as nutritional outcomes of a lactating woman. This includes cultural beliefs and perceptions in some communities which may influence choices of health inputs or eating habits of a woman. To account for heterogeneity, the study shall utilize the control function approach.

3.5 Definition and Measurement of Variables

3.5.1 Dependent variable

The study shall use BMI of a lactating woman as the dependent variable in the OLS model and the probability of being undernourished/ underweight as an indicator for lactating woman nutritional status. Following WHO, (1995) and Achieng' (2014), a lactating woman with a BMI less than 18.5 kg/m² will be under a category under nutrition or underweight. We shall use equation 6 to estimate and predict the probabilities.

3.5.2 Explanatory variables

The study has indicated the nature and measurement of the study variables in Table 3.1 below.

Table 3.1: Description and measurement of Variables

Variable	Nature of Variable	Measurement of variables
Lactating woman Nutritional outcomes	Dependent Variable	Lactating woman Nutritional health outcome is estimated using BMI and probability of being undernourished
Socio economic Factor	Endogenous Variable	Wealth Index
Current Age of the woman	Exogenous variable	Current Age in complete years
Age of the mother at first birth	Exogenous variable	Age in complete years
Education level of the mother	Exogenous variable	Education will be created in four categories as: No education (0), Primary education (1), Secondary Education (2) and Higher education

		(4).
Current residence	Exogenous variable	Household characteristics: 1 if rural and 0 otherwise.
Age at first marriage	Exogenous variable	Age in complete years
Mothers height	Exogenous variable	Height in centimetres
Source of drinking water	Exogenous variable	1 if piped water source, 0 otherwise 1 if river water source, 0 otherwise
Toilet facility	Exogenous variable	1 if possess toilet, 0 otherwise
Religion	Exogenous variable	1 if no religion, 0 otherwise; 1 if Christian, 0 otherwise; 1 if Muslim, 0 otherwise
Marital status	Exogenous Variable	1 if married, 0 otherwise

3.6 Data Source

The study will use Kenya Demographic Household Survey 2013/2014 (KDHS) household-based secondary cross sectional data. This survey is usually conducted after duration of five years in Kenya. This data provides general information including overall health state of the population. The survey collects anthropometric measures used in computation of BMI of lactating women. Women respondents also reported on their educational levels, age, wealth index, environmental/ sanitation characteristics such as type of toilet and source of drinking water.

3.7 Diagnostic Tests

To ensure that estimates obtained are unbiased and consistent, diagnostic tests will be undertaken.

3.7.1 Normality of the data

The study will test the distribution of the error term whereby the Shapiro Wilk test will be applied. The null hypothesis states that the error terms are normally distributed and alternative hypothesis states that the error terms are non-normally distributed. If the p value is less than the 5% significant level, then we reject the null hypothesis of normality (Mukras, 1993).

3.5.2. Multicollinearity test

Multicollinearity is deemed present if collinearity between two pairs of variables is high. Variance inflation factors (VIF) shall be used to detect for its presence. If $VIF > 10$, then it's present and if less than 10, then it's absent. If present, one of the collinear variables is dropped.

3.5.3 Other tests

Wald tests and F test will be used to test for goodness. Ramsey Reset test will be used to test whether the model is correctly specified. Breusch pagan test will be used to test for heterogeneity and or misspecification.

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