International Journal of
Health Sciences
(IJHS)

Maternal Factors Associated with Low Birth Weight Among Neonates Born at Thika Level 5 Hospital in Kiambu County, Kenya.

CARI Journals

International Journal of Health Sciences
ISSN: 2710-2564 (Online)
Vol. 6, Issue No. 5, pp 58 - 97, 2023
www.carijournal.org

Maternal Factors Associated with Low Birth Weight Among Neonates Born at Thika Level 5 Hospital in Kiambu County, Kenya.

[1*] Joyce Osebe Kenyanya, [2] Prof. Gideon Kikuvi, [3] Dr. Peter Wanzala, [4] Dr. Josephat Nyagero

[1*]Postgraduate student school of public health

[1,2] Jomo Kenyatta University of Agriculture and Technology

[2]Lecturer School of Public Health and Community Health

[3]Lecturer of Graduate School, Kenya Medical Research Institute

[4]School of Public Health, Senior Lecturer, Amref, International University

https://orcid.org/0009-0006-1454-1846

Accepted: 3rd Sep 2023 Received in Revised Form: 14th Sep 2023 Published: 1st Oct 2023

Abstract

Purpose: To determine maternal factors associated with low birth weight among neonates born at Thika Level Five Hospital in Kiambu County, Kenya.

Methodology: Cross sectional convergent design was employed. The target group composed of mothers who delivered in the hospital during the study period (July-August, 2019). Census method was used to recruit participants for a quantitative study. Purposive sampling was used to select participants for FGDs and KIIs. Sample size was determined using the Cochran formula. Desired sample size was 210 mothers which was adjusted to 215 participants. Independent variables included: socio-demographic, socio-economic, socio-cultural, behavioral, and health of the mothers. Dependent variable was LBW which was classified further into LBW, very LBW, extremely LBW. (UNICEF, 2010). Quantitative and qualitative data were analyzed using Stata statistical version 14, logistic regression and NVivo version 14 respectively,

Findings: ≥35 years of mothers OR=13.67, p=0.018, CL [1.55-120.12] and the second born children OR=2.98; p=0.025; CL [1.15-7.73] were associated with the overall LBW. Secondary level education OR=0.35; p=0.03; CL [0.14-0.91] was a protection against LBW. Meru OR=17.429, p=0.016, CI [1.7162-176.991] and other tribes OR=10.479, p=0.048, CI [1.025-107.124] were associated with low birth weight. Hypertension OR=3.59; p=0.038; CL [0.14-0.91] and malaria (OR=51.250, p=0.005, CL [3.185-822.132]) were associated with very LBW. ANC-attendance (OR=0.068, p=0.37, CL [0.0055-0.845]) was a protection against extremely LBW OR= 0.07; p=0,037; CL [0.01-0.85].

Unique Contribution to Theory, Policy and Practice: ≥35 years of mothers are risk factors for low birth weight. Second child is at risk of being low birth weight**.** Neonates of Meru origin and other minority ethnic groups in Thika are at risk of being LBW. Secondary level education is a protection against low birth weight. Hypertension and malaria are risk factors for very low birth weight. ANC-attendance is a protection against extremely low birth weight. The County Government of Kiambu should develop suitable strategies of strengthening maternal and child services at level one.

Keywords: *Socio-demographic, Socio-economic, socio-cultural, maternal health and behavior, low birth weight (LBW)*

INTRODUCTION

1.1 Background to The Study

Low birth weight (LBW), defined as a birth weight less than 2500 g, remains a significant public health problem in many parts of the world and is associated with a range of both short- and long-term adverse consequences. Although about one-half of all LBW babies in industrialized countries are born preterm (less than 37 weeks' gestation), most LBW babies in developing countries are born at term and are affected by intrauterine growth restriction that may begin early in pregnancy United Nations Children's Fund & World Health Organization [UNICEF & WHO], 2018). Preterm birth accounts for 70% of all low birth weight babies. Preterm birth contributes to the majority of the prenatal morbidity and mortality due to the resultant prematurity (Blencore , 2012).

In 2018, about 22 million neonates (16%) had LBW globally United Nations Children's Fund [UNICEF], 2019). Approximately 97% of LBW occurs in low-and-middle-income countries, particularly among the vulnerable populations, including the poor in remote areas (UNICEF & WHO, 2018). South Asia has the highest prevalence of LBW of 28%, followed by Sub-Saharan Africa at 13%, Latin America and the Caribbean at 9%, and 6% in East Asia and the Pacific (Kim & Saada, 2013; UNICEF & WHO, 2004; WHO, 2018). According to Center for Disease Control and Prevention [CDC], 2014 shows great variation in LBW by place of residence; LBW is higher in rural areas (8%) compared with urban areas (6%), and varies across the country's regions, from 5% in Battambang/Pailin provinces to over 12% in Siem Reap Province National Information Service [NIS], 2015).

The overall prevalence of low birth weight in Africa is 9.49% with variations among African regions ranging from 8.9% in Eastern Africa to 10.3% in Southern Africa (Tessema ZT *et al*, 2021). WHO and UNICEF estimate LBW in Kenya as 11% and 6% by 2009 Kenya Demographic Health Survey. The same survey estimated LBW to be 9.2% in Central Province, Kenya Demographic Health Survey [KDHS, 2017]. According to Kiambu County Department of Health Services report of 2017, the county overall low birth weight was 42% .

1.2 Statement of the Problem

There is paucity of data on the factors contributing to the high prevalence of low birth weight in Kiambu County. From the promulgation of 2010 constitution and the devolution of health services; this has brought economic and political challenges hence paralysing a number of healthcare systems. This paralysis has resulted to critical concerns, including whether changes in socio-economic and demographic factors has contributed to poor birth outcomes reflected in LBW. While several studies have established determinants of LBW (Asp *et al*., 2014; Class *et al*., 2017; Kaur *et al*., 2014; Miranda *et al*., 2013), there still exist a gap in understanding the high prevalence of LBW in Kiambu County.

Additionally, researchers do not know the degree of each determinant's effect on LBW. Due to this knowledge gap, health delivery systems face issues, as the same techniques of health care delivery

continue to be supplied but do not effectively address population requirements. Nevertheless, the known determinants are evaluated at the same level of impact, despite the fact that investigation has revealed no difference in their magnitudes. Girma *et al.*, (2019) stated that public health interventions should avoid focusing exclusively on changing individual risk profiles for a particular health concern, but rather on modifying the factors that contribute to the population's risk distribution. Failure to develop population-based solutions early in life may jeopardize funding for other public health efforts, as scarce resources may be diverted to addressing the effects of LBW, a condition that could have been avoided even before birth.

It is alarming, at 86% of the LBW prevalence in Thika Level Five hospital in Kiambu county, this is significantly higher than the national average. With over ten thousand infants born each year, the incidence of LBW might be worrying for a county whose health care system is already eroding. As the notion of social suffering implies, LBW poses social obstacles to the family (Kleinman, 2010). Additionally, the repercussions of LBW are manifested not only through impaired cognitive development or prenatal morbidity and mortality, but also through chronic illnesses such as diabetes and hypertension later in life Linsel *et al*., 2015; Risnes *et al*., 2011). The cost expense of addressing such chronic illnesses (UNICEF & WHO, 2018) may be a significant burden on government, as health care in Kenya is primarily funded by public funds. Conn *et al*., (2010) noted that reducing the prevalence of LBW results in long-term economic benefits for a county, including increased quality of life.

1.3 Justification of Study

This study provides information that can assist in formulation of policies and setting up of appropriate intervention measures for maternal and infant health. Low birth weight is a major public health problem in under-resourced setting and is closely associated with fetal and neonatal morbidity and mortality due to the need of specialized neonatal care. For proper planning of preventive measures and for specialized care, data is required on the magnitude and determinants of the problem of low birth weight. Moreover, having proper knowledge of associated factors of low birth weight is important to identification and giving appropriate attention to those mothers at risk. It will be of great relevance also in identifying mothers and children at risk, designing appropriate measures, and undertaking timely interventions.

1.4 Study Objective

To determine the maternal factors associated with low birth weight among neonates born at Thika Level 5 Hospital in Kiambu County.

1.5 Research Question

What are the maternal factors associated with low birth weight among neonates born at Thika Level 5 Hospital in Kiambu County?

2.1 LITERATURE REVIEW

2.1.1 Public Health Importance of Low Birth Weight

Having a LBW baby can cause emotional, social and financial stress for the family because LBW babies can have life-long health problems and it is also the main reason babies die in the first year of life (UNICEF & WHO, 2004). Poor health imposes a heavy burden on society and slows down economic growth. Illness is one of the major causes in the reduction of incomes and assets of poor Kenyans, (Government of Kenya [GoK], 2007). In the light of this, LBW is one of the causes of ill health and future developmental problems in addition to the existing burden of early infant mortality (Alkema *et al*., 2016; Assefa, 2012). Reducing the incidence of LBW not only lowers infant mortality rates but also has multiple benefits over the life cycle. A study by Awoleke, (2012) that was aimed at estimating the economic benefits of reducing the incidence of LBW in low income countries proved that this lowers the mortality rates and medical costs and also increases learning and productivity.

Worldwide, neonatal mortality is 20 times more likely for low birth weight babies compared to heavier babies (UNICEF & WHO, 2004). While in industrialized countries the majority of LBW infants do well, thanks to the advances of modern obstetric and neonatal care, the chances for survival of LBW infants is much lower in African and other developing countries due to inadequate or limited medical care including proper antenatal care (Banchani, 2014). In addition to its impact on infant mortality, LBW especially that due to IUGR has been associated with higher probabilities of infection, malnutrition and handicapping conditions during childhood, including cerebral palsy, mental deficiencies and problems associated to behavior and learning (Hack & Fanaroff, 2010).

Morbidity among low birth weight infants has significant implications for health services. Most of the interest in medical care use by low birth weight infants has focused on the intensive care services required to increase the survival of very low birth weight infants (Blencore, 2012; Bourbonnais, 2013). The length of hospital stays in the neonatal period for infants who survive to the first year of life averages 3.5 days for normal birth weight infants, but is much longer for smaller infants: 7 days for those between 2,001 and 2,500 grams at birth; 24 days for those between 1,501 grams and 2,000 grams; 57 days for those less than 1,500 grams; and 89 days for those less than 1,000 grams (Conrad *et al.,* 2012). The length of stay for non-surviving infants tends to be much less, although not proportionally less expensive. Wide variations both in length of stay and direct medical costs per day occur within birth weight groups, depending on the need for ventilation, the presence of congenital anomalies, the need for surgery, and other factors (Tamir, 2016).

2.1.2 Social Demographic Factors of Mothers associated with LBW

Yadav, 2011 and Ganesh, 2010 found out that LBW was common in younger (<20 years) and older (31 years and above) mothers. In their study, age was an important predictor of LBW deliveries. According to Alkema *et al*., (2016) the risk of delivering LBW babies is almost twice

among mothers aged <20 (19 years and below) years and those who are over 30 years. Nair *et al*., (2011) argue that below 20 years of age, growth and development are still ongoing and so these mothers have not attained their optimal height. Competition for nutrients between the growing teenager and the developing foetus is also high therefore inadequacies which result in poor foetal growth hence poor pregnancy outcomes. LBW is strongly associated with maternal factor such as younger and older age. Mothers aged under 17 and over 35 years are at risk of delivering LBW babies (Hamburg, 2017).

A number of studies show that mother's age (at the time of giving birth) is associated with LBW (Mahmud *et al.,* 2017). A recent analysis of Department of Health Services [DHS] data in 10 developing countries (Mahmud *et al.,* 2017) found that older mothers (age 35-49) had significantly higher risk of delivering LBW babies compared with younger mothers, while other studies have found a higher prevalence of LBW among babies born to younger mothers (Rajashree *et al*., 2015; Sutan *et al*. 2014). Extremes of maternal reproductive age are associated with increased risk of preterm birth with resultant low birth weight infant. Both adolescent (below 18 years) and women of 35 years and older have been reported to have high rates of preterm birth. It's not clear however, whether these age differentials are due to biological mechanisms or other characteristics associated to pregnancies at the extremes of maternal age (Ganesh, 2010).

Various studies likewise have discovered that status of the mother whether married or not is a risk variable for low birth weight, with not married mothers more likely to have LBW babies than married mothers (Raatikainen et al., 2015). There has not been a study in the region to co-relate the marital status with LBW, thus this study will seek to find the relation and come up with the best intervention measures.

2.1.3 Social Economic Factors of Mothers associated with LBW

Evidence from past studies show that the birth weight of a neonates increases with higher maternal education. For instance, a study in Germany by Nair *et al.,* (2011) revealed that the risk of LBW deliveries is significantly higher in women with no education or low education compared to those with higher education. Torres *et. al.,* (2015) too obtained similar findings where by women with the lowest education had significantly elevated risk for small for gestational age neonates (SGA). The explanation behind these findings could be women with higher education are able to make wiser decisions concerning their health compared to those who are not educated. Ignorance rates are also higher in women with no education hence the poor birth outcomes. The similar scenario also applies to women married to educated spouses as they can help them make informed decisions concerning their health (Gupta *et al*., 2014). In Africa, poverty, low education and poor nutritional status among women are some of the risk factors associated with adverse reproductive outcomes including LBW and preterm deliveries (Hack & Fanaroff, 2010).

LBW is strongly associated with illiteracy (Nair et al., 2011). Other risk factors linked with LBW include (Awoleke, 2012), paternal factors such as level of education, age, and employment which

also is significantly linked to the incidence of LBW. Mothers with lower educational attainment are generally at a higher risk of having a baby with LBW compared with mothers with more education (Anjum *et. al*., 2011). Mahmud *et al.,* (2017) and Rajashree *et al*., (2015) found that illiterate mothers (no formal education) had approximately 1.5 times more risk of delivering LBW babies compared with those with a secondary or higher education.

Low birth weight has also been associated with socioeconomic indicators such as education and income as well as with stress during pregnancy. LBW is strongly associated with low socio-economic status (Assefa, 2012). Mothers in deprived socio-economic conditions frequently have LBW infants (Alkema *et al.,* 2016).

Factors associated to household characteristics include the household's socioeconomic status, place of residence (urban-rural), and geographic area. An asset-based household wealth index, a proxy indicator of family socioeconomic status, is associated with LBW; mothers in poorer households have greater risk of having LBW babies than those in richer households (Ghaemmaghami *et al.,* 2013; Mahmud *et al.,* 2017). The prevalence of LBW is higher among babies born in rural areas compared with urban areas (Gebremedhin *et al.,* 2015; Kayode *et al.,* 2014). LBW prevalence also differs by region within Cambodia (province or group of provinces). Although existing studies on LBW have not included health insurance, some studies show that health insurance coverage can reduce financial barriers to accessing health care (Hack & Fanaroff, 2010), thus facilitating women's access to necessary care during pregnancy.

Current employment of the mother is considered a potential factor associated with LBW and has been investigated in a number of studies, but without finding any significant association. Therefore, this study seeks to find whether there exist an association about economic status and LBW new born (Torres-Arreola *et al.,* 2015).

The conventional theory of consumer behavior as outlined by (Becker 1960, 1981) and Becker and Lewis (1973) contends that couples behave in a rational way when they decide on their number of children and they view children more or less as consumption goods. They argue that there is a negative relationship between birth weight and income which is one of the social-economic factors of small size birth of babies. A similar research has also been done affiliated with Moi University in department of Behavioral science where Discriminant analysis was used to identify predictors of low birth weight. The analysis was based on 123 cases who had complete data on all the variables used in the equation. Of those included in the analysis, 14 women (11%) delivered low birth weight babies and 109 had normal birth weight babies. Results of the discriminant analysis showed that socioeconomic status (SES) is one of the best predictor of low birth weight.

The execution of proof educated mediations to handle low birth weight will be progressively effective and greatly affect wellbeing value if usage is energized by joint effort among projects and divisions. All projects ought to be conscious of the convictions and inclinations of ladies as for their wellbeing, the unequal sex relations and power appropriation among ladies and men, and

the disparities between gatherings of ladies regarding race, ethnicity and private isolation (UNICEF, 2015).

The scale-up of mediations ought to be a thorough and proof based procedure, regardless of whether it is the development of a pilot or little undertaking, or the strengthening and growth of a noteworthy program. Scaling up ought to infer conscious efforts to expand the effect of effectively trying advancements, with the goal that more populaces can profit by these effects (Heaman, 2013)

Then again, Hamburg, (2017) noticed that "financial components, ethnicity and race contrasts, the status of subsidizing of social insurance and may additionally add in contrasts to the report results" yet that frequently they are not adequately controlled for. Ultimately, Torres-Arreola *et al*., (2015) discovers that the reason for the current irregularities between various investigations on LBW was "contrary thinking about the significant effect of the monetary and social variables". Mostly in developing nations, the prevalence of LBW infant brought into the world with little sizes has been a subject important to scholastic, specialists and arrangement creators for quite a while.

From an examination completed in Bangladesh, financial factors as a social gathering are among the significant determinants of LBW which at that point is a noteworthy indicator of neonatal deaths (Ijadunola, 2010).

There is a solid connection between the mother's economic wellbeing (being socially impeded) and having a low birth weight infant. Despite the fact that there is no conclusive proof on the causal pathways between explicit social weakness and bringing forth low birth weight child, perpetual lack of healthy sustenance, weakness looking for conduct, undesirable ways of life, expanded danger of contamination and stress are accepted to be essential determinants of low birth weight (Anjum *et al.*, 2011).

On the other hand, Kim & Saada, (2013) have noted that "socio-economic factors, racial and ethnic differences, the nature of funding of health care may further contribute to differences in the report outcomes" but that quite often these are not sufficiently controlled for. Finally, Lawn *et al.*, (2010) found that one of the reasons for the existing inconsistencies between different studies on low birth weight was "not considering the impact of the social economic factors". In most developing countries, low birth rate and babies born with small sizes has been a subject of interest to academic, researchers, and policy makers for a long time.

According to Population Reference Bureau, World Data Sheet (2018) gives the population of Kenya as 51.0 million, a crude birth rate of 31 per 1000 population and a crude death rate of 6 per 1000 population. The annual estimated number infant mortality rate is 36% and the small size births contributes significantly and puts this situation and high rate of infant mortality in the country. From a research carried out in Bangladesh, socio-economic factors such as a social group is one of the major determinants of low birth weight which then is a major predictor of infant death (Isomaa, 2013).

2.1.4 Social Cultural Factors of Mothers associated with LBW

Culturally appropriate care and gender-sensitive interventions are essential to reach women who face greater barriers in access to health care. The implementation of evidence-informed interventions to tackle low birth weight will be more effective and have a greater impact on health equity if implementation is fueled by collaboration among programmes and sectors. All programmes should be cognizant of the beliefs and preferences of women with respect to their health, the unbalanced gender relations and power distribution between women and men, and the inequalities between groups of women with respect to race, ethnicity and residential segregation (UNICEF, 2015).

Cultural practice is one of the important factors that the healthcare workers need to focus when providing maternal and child health care services. It involved the management of most illnesses at any stages for an individual who lives in society with strong cultural beliefs. Many studies done earlier had shown the association between cultural practice, its shared beliefs and norms that influence family behaviors in obtaining maternal and child health care. Modern healthcare practice is not well accepted or utilized if family awareness and knowledge level is inadequate for them to make good decision. Even though the young are not keen to practice cultural practice, they have no choice but to follow since they live with their family and especially when the bonding as part of extended family is strong. They do that for the purpose of not offending their parents or society. Scarce researches are available focusing on neonatal health and cultural practice. Many cultural practices are still commonly practiced without knowing its existing health benefits or potential harm. The common reasons for cultural practicing were due to self-belief, convenience, family pressure and to please the elders (Awoleke, 2012).

Developing countries are rich with cultural practices (Ganesh, 2010). There is an insignificant association between birth weight and religion (Yadav, 2011). This study disagrees with Yadav on the association between LBW and religion, Kenya has various major religions but various beliefs is very high in regard to medication, seeking medical care and delivery care. Therefore, this research will extensively analyze this risk factor in order to determine whether any association exists.

2.1.5 Behavioural Factors of Mothers associated with LBW babies

There is a strong relationship between mother's social status (being socially disadvantaged) and having a low birth weight baby. Although there is no definitive evidence on the causal pathways between specific social disadvantage and giving birth to low birth weight baby, chronic malnutrition, poor health seeking behavior, unhealthy lifestyles, increased risk of infection and stress are believed to be important determinants of low birth weight (Maloni, 2010).

Antenatal care (ANC) visits are important for maternal and fetus health. ANC refers to pregnancy-associated healthcare services provided by skilled health (Krueger, 2015). Even when birth takes place in hospital, non-attendance or attending antenatal clinic fewer times carries a substantially

elevated risk of severe adverse pregnancy outcome. The optimal amount and content of antenatal care in either low- or high- risk pregnancies is not yet resolved. There is, however, evidence showing some unquestionable benefits of antenatal care (Lee *et al.*, 2013). Muhwava, (2016) found out that, pregnant women who choose not to use maternity care had poor pregnancy outcomes although delivery took place in hospital, in conditions of modern obstetric care. They found specifically, the risk of placental abruption, intrauterine infections, preterm birth, LBW and even intrauterine fetal death and neonatal death to be significantly higher in those who did not attend clinic than in the general obstetric population who attended routine antenatal care. Clinically, attending antenatal care fewer times appeared to be a significant contributor to LBW, and this association was chiefly the result of preterm delivery, not that of growth restriction (Migwi, 2014).

Factors associated to mother's health-associated behaviors include: whether the mother perceived any problems in accessing care, number of antenatal care (ANC) visits during pregnancy, and whether the mother received ANC with nutritional counseling. Literature shows that lack of attending 4 ANC visits is a risk factor of LBW (Zheng *et al.*, 2016). A number of studies show that the number of ANC visits is also associated with LBW (Feresu *et al*., 2015; Mahmud *et al*., 2017). A study conducted by Rondon *et al*., (2015) found attending fewer than four ANC visits to be a maternal risk factor for LBW, whereas the other studies did not specify a threshold number of ANC visits, but only an inadequate number of ANC visits. Quality of ANC is also included in some studies as a potential risk factor of LBW.

Low birth weight can be attributed to two major phenomena: intrauterine growth retardation and preterm delivery. The primary risk factor for intrauterine growth retardation is smoking, which accounts for 20% to 30% of all LBW births in the United States (Nyamtema *et al.*, 2012) followed by low maternal weight gain and low pre-pregnancy weight (Zikmund, 2010).

High-risk behaviors, such as smoking, may be associated with psychosocial stress and LBW (Torres *et. al*., 2015). There is ample evidence to show that maternal factors and risk behaviors during antenatal period play significant roles in the birth weight of babies (Ganesh, 2010). Pregnant mothers with unhealthy lifestyles that include activities such as smoking were found to be at high risk of delivering LBW babies (Rajashree *et al*., 2015). A previous study also had showed that drugs taken during pregnancy, such as malaria prophylaxis, were associated with the incidence of LBW (Takai, 2014). High-risk behaviors, such as smoking, may themselves be associated with LBW (Nair *et al*., 2011).

According to WHO, it recommends healthcare providers to ask all pregnant mothers about their tobacco use (past and present) and exposure to second hand smoke as early as possible in pregnancy and at every antenatal care visit. There exists a gap since the available literature is only on active smoking; this study seeks to examine all the SHS exposures as recommended by (WHO, 2013). Also it seeks to determine about use of alcohol and other substances (past and present) as this may likely be a risk factor as well.

2.1.6 Maternal health factors associated with LBW

Maternal health and child outcomes including LBW is interconnected (Murima, 2016). Measures of maternal health include: anemia, body mass index (BMI) and hemoglobin levels (Mahmud *et al* 2017, Sutan *et al*., 2014 and Sacker, 2017). Mothers with hemoglobin levels below 11g/dl at the time of delivery are at risk of having babies with LBW (Rajashree, *et al*., 2015). Body Mass Index (BMI) is an indicator of mother's nutritional status mothers with low BMI - less 18.5kg/m^2 are at a greater risk of having LBW babies compared with babies born to mothers with normal weight (Kader & Perera, 2014; Mahmud *et al* 2017, Sutan *et al*., 2014 and Sacker, 2017).

3.1 MATERIALS AND METHODS

3.1.1 Study Area Description

The study was Thika Level 5 Hospital found in Kiambu County, Kenya. Data was collected from four sites; maternity, post-natal ward, MCH clinic, and Newborn unit. This hospital is a general public hospital with a capacity of 265 beds. It is strategically placed to serve three counties namely; Kiambu, Muranga, and Machakos. The hospital delivery services are provided 24 hours. It conducts about 23 deliveries per a day.

3.1.2 Study design

Cross-sectional convergent study design was employed.

3.1.3 The study Population

The study population constituted of women who delivered at the Thika Level 5 Hospital during the study period.

3.1.3 (i) Inclusion Criteria

Mothers ≥18 years old who delivered at the Thika Level 5 Hospital during the study period and consented to participated in the study.

Mothers < 18 years old who were emancipated minors whereby the mother was any of the following: an orphan, heading a household, adolescent living in the street, married, parent or legal guardian was absent and the minor consented (WHO, 2018). Where either a parent or guardian was present, he or she took consent on behalf of the mother and the minor only assented (WHO, 2018).

3.1.3 (ii) Exclusion Criteria

Mothers who were referred to another facility immediately after delivery or mothers who had stillbirths.

3.1.4 Sample Size Determination

The population sample was resolved utilizing the normal proportion (p) of 16.4% from the predominance of LBW in the recorded report done in Narok District Hospital in 2011 (Migwi, 2014)

In the determination of population sample, Cochran formula (1963:75) was utilized (Israel, 1992).

$$n_0 = \frac{z^2 \times p \times q}{e^2}$$

Where;

n_o: anticipated population sample to use;

z : standard typical deviation at 95% CI of 1.96

q : the extent evaluated in the objective populace 1-p (0.164) = 0.836

e : the level of precision at 95% CI of 2.5% two-tailed test.

$$n_0 = \frac{1.96^2 \times 0.164 \times 0.836}{0.025^2} = 210$$

Therefore, the sample size was **210.** This sample size was adjusted to **215** participants.

3.1.5 Sampling Technique

Purposive sampling was used to select Thika Level 5 Hospital due to its high prevalence of low birth weight. Census method was used to select mothers for the quantitative study. All mothers who delivered at Thika Level 5 Hospital during the study period and were willing to participate in the study were recruited. The recruitment process was done at the post-natal ward and it was guided by the delivery records. The order of the interview depended on the length of period a mother stayed in the facility, mothers who were discharged on the same day of delivery were interviewed first, followed by those with long stay. The recruitment process was done in all days except Saturday and Sunday. The recruitment time started at 8 am and ended at 5 pm.

Participants who took part in qualitative study were purposively sampled. Mothers who were able to sit for a minimum of 20 minutes were selected for a focus group discussion (FGD). Health workers who were knowledgeable and skilled on mothers and neonates were selected for key informant interviews (KIs). Participants were nurses who worked directly under mothers and their neonates, and they included nurses in charges of the following areas: maternity, postnatal ward, MCH and newborn unit.

3.1.6 Variables

The independent variables included: age of the mother, mother's ethnic group, the mother's marital status, mother's education status, mother and spouse income status, household size, social groups, cultural norms and taboos, ANC attendance, drug and substance use (tobacco, marijuana, heroin

and alcohols), The dependent variable was LBW which was classified further as low birth weight, very low birth weight, extremely low birth weight. The primary focus was first to identify low birth weight which was then categorized according to the standard classification (UNICEF, 2010).

3.1.7 Data Collection Instruments

Various instruments were developed for data collection. An interviewer administered questionnaire was used to collect quantitative data for 215 mothers, while Focus Group Discussion (FGD) guide was used to collect qualitative data for focus group discussions. The questionnaire was designed in English, but was administered to the respondent in Kikuyu (local language), Kiswahili, or English subject to the choice of the client. A Key Informant guide was used to collect qualitative data for health workers who were mainly nurses working directly under neonates and mothers. A checklist was developed and used to collect data on maternal health and ANC attendance. Maternal clinic cards were used to confirm the ANC visits to health facilities and the overall health of the mother.

3.1.8 Data Collection Procedures

3.1.8. (i) Quantitative Data

The interviewer explained to the mothers the importance of the study and why their participation would be significant. Those who agreed to participate in the study were asked to sign a consent form before the questionnaire was administered to them through face to face interview. Prior to the interview, the interviewer was blinded on the birth weight of the neonates to the selected mothers to avoid bias. Once the client was selected, she was interviewed in a private room in the maternity unit so as to ensure privacy. Mothers who had undergone caesarian section were recruited after 48-72 hours. A note was fixed on the outside to indicate that an interview was in progress. Gestational age was determined using the mother's recorded or reported Last Normal Menstrual Period and the date of delivery. A confirmation was done by checking the mother and child health booklet.

The interviews were carried out 12 hours after delivery. Clinical records were also reviewed to verify information on the respective neonates and other clinical information given by the mothers.

3.1.8 (ii) Qualitative data

Focus Group Discussions (FGDs) was conducted on a different group of mothers who delivered at Thika Level 5 Hospital after quantitative data collection was completed. FGDs gave diverse information on low birth weight babies and the characteristics of the mothers giving birth to these children. The time for group discussion was between 9 am and noon. A FGD guide was used to guide the focused group discussion. The discussions took place within the hospital set up where the environment was conducive with circular seating arrangements. All the discussions were tape recorded and each one of them took a maximum of 20 minutes moderated by the Researcher.

3.1.9 Quality Assurance Procedures

3.1.9 (i) Pre-testing of data collection tools

Pre-testing took place at Machakos Level Five Hospital to test whether the questions in the questionnaires had captured the needed information as well as checked for redundant and misleading words. The pre-test was also to ensure mothers of different background were asked appropriate questions. This was important since it ensured that the interviewer was able to administer the questions properly. The questionnaire was standardized based on the consistency of the results obtained.

3.1.9 (ii) Recruitment of Research Assistant

Two research assistants who were nurses working at Thika Level 5 Hospital and trained on data collection were used. They also had previous experience in data collection. They spoke Kikuyu, Kiswahili, and English.

3.1.9 (iii) Training of Research Assistant

The research assistants were trained on the following: the purpose and objective of the study; their role and motivation; duties and responsibilities; strategies of recruiting the respondents; how to use the questionnaire and conduct the actual interview; how to overcome difficulties that may be encountered such as a nervous or reluctant respondent; distracting environment or interference from others present; how monitoring of data collection was to be conducted and finally on ethical issues.

3.1.9 (iv) Monitoring of Data Collection

The research investigator received all the filled questionnaires on a daily basis and she critically reviewed interviewers' returns and checked for unusual or inconsistent responses in the questionnaire. She met daily with the research assistants to check together if the responses were properly filled and completed, moreover to discuss any difficulty that might be encountered.

3.1.10 Data Management

The Data was stored in a laptop of the Research investigator and a backup copy in an external hard drive that was accessible to the Researcher Investigator and the two research assistants only. The original data remained unmodified and in case of modifications, one was able to track how and which changes were made and by whom. A score was kept on who had access to analysis of data and with whom data has been shared with. Data was always accompanied by a file that included a description of the data. In statistical analyses, the codes were written in a format that anyone who would like to repeat the analyses was able to do so by following the codes made by the researcher.

3.1.10 (i) Data Entry, Cleaning, and Coding

Data obtained from the field was edited in order to eliminate errors and biases that might have resulted from data collection. The data was cleaned, coded and entered into a computer and

analyzed. Codes were assigned to categorical data before entering it on the computer. Numerical data such as the weight of the neonates was entered with the same precision as they were measured and the unit of measurement remained constant. Missing values were also coded. An asterisk to indicate missing values was used.

3.1.10 (ii) Quantitative data analysis

Data was entered and analyzed using Stata statistical software version 14. Univariate analysis, multiple logistic regression and a two-tailed test of significance with a 95% confidence interval were performed. Descriptive analysis was done to determine the prevalence of low birth weight and factors associated with LBW of neonates for mothers delivering at Thika Level Five Hospital. Bivariate, stratified and logistic regression analysis was performed to determine the association between the independent and the outcome variable and to control for potential confounders. A two-tailed test of significance was used. The measures of association were reported with a 95% confidence interval. Factors with a p-value of <0.05 was regarded as statistically significant.

3.1.10 (iii) Qualitative Data Analysis

The recordings were translated to verbatim, using a transcription developed protocol thematic analysis by NVivo version 14. The accuracy of the transcripts was verified. A content-driven, thematic codebook using an interactive process was created each focus group transcripts were viewed independently and new themes were created. All codes were defined using NVivo14 (QSR, 2014) and applied to the transcripts. The incremental progression of theme identification by log to determine when each code was identified. Code frequencies were then documented whereby the number of focus groups in which a code tallied. Data was also analyzed based on a 90% metric to provide a more robust measurement of saturation. Code frequencies were used as a proxy measure and to group the results into -low, medium and high frequencies in order to determine salient of the themes.

3.1.11 Ethical Considerations

Permission to carry out the study was obtained from the Kenyatta National Hospital Ethical Committee and the medical superintendent of Thika Level 5 Hospital. The purpose of the study was explained to the mothers and subsequently consent was obtained for participation in the study. The respondent mothers were interviewed in a private room. No name was recorded on the questionnaire or any other identifier relating to the respondent. A study subject number was used as the unique identifier. Mothers under 18 years old were considered as emancipated minor whereby if the mother was an orphan, heading a household, adolescent living in the street, married, parent/legal guardian was absent, then the minor consented. If the parent/guardian was present at the time of study he/she took consent on behalf of the mother and the minor was only to asset.

4.1RESULTS

4.1.1 Socio-Demographic Factors of Mothers at Thika Level 5 Hospital in Kiambu County

This information is displayed in Table 1

The key informants at the health facility gave the characteristics of the mothers who delivered at the facility. "*Majority of the mothers who deliver here are between 16 and 40 years. In terms of marital status majority are married. The majority of the mothers are Kikuyus and Kambas. Majority of the mothers are unemployed, and when it comes to the level of education, the mothers commonly have attained secondary education with very few having university education or certificate from college. A greater proportion of the spouses have a source of income*" Nurse 1

A good number of mothers who participated in a Focus Group Discussion indicated that their spouses gave them money to facilitate their movement and buy necessary requirements as advised at the health facility.

"*Most of us are not working and we rely on our husbands to give us transport to the hospital and buy what the health authorities tell us to buy*" Mother 7.

The Focus Group Discussion of mothers gave various causes of low birth weight among the neonates. "*Doing a lot of work when pregnant can lead to a mother having a low birth weight baby. Even family planning is also another cause of getting low birth weight baby*" Mother 1

'*Some mothers don't follow instructions given from the hospital. For example, they are told not to work but they continue working*" Mother 3.

The mothers on a Focus Group noted that nutrition and stress were a great concern. "*Some mothers have difficulties with finances and eating well is a problem and also stress contributes a lot to a mother getting a low birth weight baby"* Mother 5.

Mothers in the Focus Group indicated that they attended ANC clinic depended on the health of the mother and the stage of the pregnancy during the first visit to the hospital.

"*Most mothers attend ANC but number of visits depends on the body of the mother. If the mother is having health issues, then she will have more ANC visits. Again, number of visits to hospital will also depend the months one has been pregnant*" Mother 6.

The Key Informants "*The majority of the mothers do attend ANC during their pregnancy period. The majority attend ANC during their first and second trimester. The majority attend more than one ANC visits during the entire pregnancy period"* Nurse 4.

Mothers in the focus group discussion (FGD) indicated that they do not drink or smoke tobacco and other illicit drugs but their husbands drank and abused drugs.

"*I don't smoke or drink alcohol but my husband drinks alcohol, smokes and also takes bang. He is not the only one but there are also others who behave like him*" Mother 2.

The health facility workers had no records of the mother's income, household size and whether mothers belonged to a social group or not. Most of the mothers who delivered at the facility were Christians with the minority being Muslims. On socio-cultural attributes of the mothers, there was no clear information on the norms that are attached to foods and excess work on pregnant mothers. The Key Informants gave other causes of low birth weight. "*Other factors causing low birth weight include overworking by the pregnant mothers, underlying health conditions of the mothers, stress which leads to poor feeding by the mother during pregnancy. Poor nutritional status of the mother during pregnancy"* Nurse 4.

The mothers gave their opinions on some complications during pregnancy that could result to having low birth weight. "*Doing a lot of work when pregnant can lead to a mother having a low birth weight baby. Even family planning is also another cause of getting low birth weight baby*" Mother 12

'*Some mothers don't follow instructions given from the hospital. For example, they are told not to work but they continue working*" Mother 6.

Key informants gave reasons leading to low birth weight. "*The gestation period and uterine conditions affect birth weight of babies born at this facility. Babies born below 37 weeks normally have a preterm birth and a high chance of having a low weight. Mothers with high blood pressure also have a high chance of giving birth to babies with low birth weight because we have to remove the baby before term*" Nurse 3.

On socio-cultural myths and beliefs on foods during pregnancy, some indicated that in their community they are not allowed to eat some kinds of foods like eggs and beef. On the role of the spouses in helping the pregnant mothers, majority indicated that their spouses give them money to facilitate their movement and buy necessary requirements as advised at the health facility.

Of those who indicated that they were restricted from taking certain foods, listed the foods as beef, eggs, avocado, chips and pork. On socio-cultural myths and beliefs on foods during pregnancy, some indicated that in their community they were not allowed to eat some kinds of foods like eggs and beef

Some of the respondents indicated that their spouses did smoke and took alcohol and other substances like bhang.

The life style of the mothers who deliver at the facility was also examined. Very few mothers do smoke cigarette and do take alcohol.

5.1 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1.0 Discussion

.1.1 Prevalence of Low Birth Weight

The overall prevalence of low birth weight at Thika Level 5 Hospital was found to be 34.4% compared with the national prevalence of 11% (KDH, 2009). This translates to over three times higher than that of the national low birth weight prevalence. According to the classification of low birth weight by UNICEF/WHO, 2010, the prevalence of low birth weight <2.5kg (1.5-2.499kg) was 14.22%; very low birth weight < 1.5kg (1.499-1kg) was 18.8%; and extremely low birth weight < 1kg (0.999 and below) was 1.38%. These findings indicate that majority of children born with low birth weight were classified as very low birth weight and this means that their mothers needed to have along stay in the hospital.

5.1.1 Social-demographic, Socio-economic and Socio-cultural factors associated to LBW

This research established that age was a predictor of low birth weight similar to the results of Nair *et al*, 2011. Mothers who were ≥35 years were more likely to have infants with low birth weight compared to mothers of <35 years. This is in contrast to other researchers who found out that even the youthful mothers were more likely to get low birth weight infants ((Rejeshree et al. 2015, Sutan et al, 2014, Hamburg, 2017). However, this research is in agreement with the findings of Alkama *et al*., 2016 where mothers ≥35 years were more likely to get low birth weight babies than mothers below 35 years.

Marital status of mothers did not have any association with low birth weight of their infants in contrast with other researches where married women were less likely to have low birth weight infants (Raatikainen, Heiskanen, & Heinonen, 2015).

According to this research, education was found to be a protection against low birth weight (2.489-1.5kg). The findings specified secondary education as a protection of low birth weight. This is in agreement with Nair *et al*., 2011 who revealed that the risk of low birth weight deliveries was higher in women of lower education than those of higher education. Mothers at secondary level are able to make decisions about their health Gupta et al., 2014. This research did not establish why secondary education was a protection against low birth weight and not college or university education.

The results of this research showed that the income of the mother and her husband were not associated to low birth weight contrary Assefa, 2012; Hamburg, 2017; Ijadunala, 2010; and Alkema *et al*., 2016 who stated that mothers who lack finances as often as possible have low birth weight neonates. In agreement with the other researchers is Anjum and his group who stated that there was a connection between the mother's economic wellbeing (being socially impeded) and having a low birth and stress as determinants of low birth weight (Anjum *et. al.*, 2011).

Household size was found to be associated to low birth weight. The second child was at risk of being low birth weight contrary Mazharul found out that the first-born child was at risk of being LBW than other children since the mother has inadequate information on pregnancy matters. during the first pregnancy (Mazharul M at al.,2020). The reasons behind the findings were unknown. However, mothers' focus group discussion cited family planning as one of the factors associated with low birth weight. Normally women do family planning after the first child. This might have led to the second child becoming a victim of family planning side effects. Probably the mother stopped using family planning methods at the second child after realizing that she was not doing well in terms of her health allowing the third child to be born healthy. Other researchers studied household size in terms of resources which in return affected birth weights (Barker, 2007; Raatikainen *et al*., 2015).

The research noted that norms, taboos and values of communities were not associated to low birth weight. Mothers stated clearly that there was nothing they were prevented from doing by their communities. Although some mothers stated that they were prohibited from eating beef, eggs and avocado. This was not a threat to the health of the mother since there were alternative foods which catered for the nitrites in the prohibited foods. This is contrary to other researchers who found out that culture on medicinal services administration (Raman *et al*., 2009) as well as religion were associated to low birth weight (UNICE, 2015; Awoleke, 2012; Ganesh, 2010; Yadav, 2011).

On ethnicity, this research found out that ethnicity is associated with low birth weight. The Meru and other minority ethnic groups were likely to bear LBW babies. Similar findings were found by the other researchers. UNICEF, 2015, Hidalgo-Lopezosa P, 2019; Martinson ML, Reichman NE, 2016). These researchers revealed inequalities and maternal genetics (Goldstein RF, 201 Urquia ML, 2012) as causes of LBW among ethnic groups. This study did not find out the reasons why Meru and other minority ethnic groups had LBW babies. This research did not establish the causes of LBW among the second born children. Secondary education was found to be a protection against LBW similar to Nair *et al.*, 2011; Torres *et. al.*, (2015) Increase in level of education reduces LBW similar to Muhmud *et al*., 2017; Bhaskar R.K at al, 2015 findings.

Women with higher education are able to make wiser decisions concerning their health
Hypertension was found to be associated with very LBW. Several findings have concurred with this research that hypertension is a risk factor for LBW. Geteneh *et al*., 2020; Desta, M., Tadese, M., Kassie, B. *et al, 2019;* Zhuomin Huang at al., 2023

5.1.2 Maternal Behavioral factors associated to LBW

This research established that ANC attendance was a protection against extremely low birth weight. Similarly, Krueger, 2015 revealed that non-attendance carriers a substantial risk of a severe pregnancy outcome. This was also the same as Maloni's 2010 and Muhwava's, 2016 findings who discovered that low birth weight was higher in the individuals who did not go to the facility than those who went to routine antenatal consideration. Number of ANC visits were not associated to

low birth weight contrary to other researchers who noted that going to antenatal consideration fewer occasions seemed, by all accounts, to be a huge supporter of LBW (Krueger, 2015; Muhwava, 2016 and Migwi, 2014).
Focus group discussion for the mothers indicated that those mothers who attended many ANC visits were unhealthy.

Smoking, alcohol and drug abuse was not associated to low birth weight. It was noted from the health workers and mothers that very few mothers were smokers and substance abusers. These findings were contrary to Nyamtema et al., 2021 who approved that smoking is an essential hazard factor for intrauterine development hindrance.(Nyamtema et al, 2012; Rajashree et al., 2015) trailed by the low maternal weight put on and low pre-pregnancy weight (Zikmund, 2010).

5.1.3 Maternal Health Factors

Body mass index and hemoglobin levels were not associated to low birth (BMI) contrary to other researchers who discovered that anemia, body mass index (BMI) were associated with low birth weight (Zikmund, 2010; Rajashree et al, 2015; Gupta *et al*., 2014).

The health workers and mothers who participated in FGDs cited underlying health conditions of a mother as one of the factors for LBW infants. The research established that mothers who suffered from hypertension were more likely to get very low birth weight babies than those without hypertension. The research also revealed that malaria was a risk factor for low birth weight. These findings were similar to Isomaa's findings of 2013 which found out that malaria was associated with low birth weight.

5.2 Conclusions

Conclusions

Risk factors of LBW are mother 's age of ≥35 years, second born child, ethnicity, hypertension and malaria.

Level of education and ANC attendance are factors that provide protection against LBW.

5.3.1 Recommendations for Policy

Recommendations

1. There is need to provide special management for mothers of ≥35 years.
2. County Government of Kiambu to provide effective management of hypertension among pregnant mothers
3. County Government should promote ANC attendance and education.
4. The County Government of Kiambu should prevent and control malaria as per the guidelines of malaria policy.

5. Further research is needed to establish the reasons for second child and ethnicity as risk factors for LBW

REFERENCES

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A.-B., Gemmill, A., … Mathers, C. (2016). Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: A systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. The Lancet, 387(10017), 462–474.

Asp, G., Odberg Pettersson, K., Sandberg, J., Kabakyenga, J., & Agardh, A. (2014). Associations between mass media exposure and birth preparedness among women in southwestern Uganda: A community-based survey. Global Health Action, 7, 22904. doi:10.3402/gha. v7.22904

Anjum, F., Javed, T., Afzal, M. F., & Sheikh, G. A. (2011). Maternal risk factors associated with low birth weight: A case-control study. Annals of King Edward Medical University, 17(3), 223–223.

Assefa N, B. Y. (2012). Wealth status, mid-upper arm circumference (MUAC) and antenatal care (ANC) are determinants for low birth weight in Kersa, Ethiopia. PLoS One , 7:e39957.

Awoleke, J. (2012). Maternal risk factors for low birth weight babies in Lagos, Nigeria. Arch Gynecol Obstet; 285:1–6. 18

Banchani, E. &. (2014). Implementation challenges of maternal health care in Ghana: the case of health care providers in the Tamale Metropolis. BMC health services research, 14 (1), 1.

Barker, D. J. (2007) The origins of the developmental origins theory. Journal of Internal Medicine, 261(5), 412-417

Becker G.S, 1960 Demographic and Economic Change in Developed. Countries, An Economic Analysis of Fertility. National Bureau of Economic Research, 209-240.

Becker G. S. and Lewis H. G., 1973 Interaction between Quantity and Quality of Children: In Schulz TW, editor. Economic is of the family, Marriage, Children and Human Capital. National Bureau of Economic Research, 81-90.

Blencore H, C. S. (2012). National, Regional and Worldwide Estimates of Preterm Birth. The Lancet, 9;379(9832);2162-72.

Bourbonnais, N. (2013). Implementing Free Maternal Health Care in Kenya: Challenges, Strategies, and Recommendations.

Becker G. S., 1960 An Economic Analysis of Fertility. URL: http://.www.nber.org/chapters/c2387 (209-240).

CDC. (2014). Guidelines for Growth and Gestational Age Adjustment for Low Birth Weight and Very Low Birth Infants. Retrieved September 17, 2018, from www.cdc.gov

Class, Q. A., Rickert, M. E., Oberg, A. S., Sujan, A. C., Almqvist, C., Larsson, H., & ... D'Onofrio, B. M. (2017). Within-Family Analysis of Interpregnancy Interval and Adverse Birth Outcomes. Obstetrics & Gynecology, 130(6), 1304-1311. doi:10.1097/AOG.0000000000002358

Conn, V. S., Algase, D. L., Rawl, S. M., Zerwic, J. J., & Wyman, J. F. (2010). Publishing pilot intervention work. Western Journal of Nursing Research, 32(8), 994–1010.

Conrad, P. D. (2012). Antenatal Care Services in Rural Uganda: Missed Opportunities for Good-Quality Care. Qualitative Health Research, 22, 619-629.

Desta, M., Kassie, B., Chanie, H. *et al.* (2019). Adherence of iron and folic acid supplementation and determinants among pregnant women in Ethiopia: a systematic review and meta-analysis. *Reprod Health* **16**, 182. https://doi.org/10.1186/s12978-019-0848-9

Ganesh S, H. H. (2010). Determinants of low birth weight: a case-control study in a district hospital in Karnataka. Indian J Pediatr, 77:87-8.

Feresu SA, Harlow SD, Woelk GB, (2015) Risk factors low birth weight in Zimbabwean women: A secondary data analysis. PLoS One 10 (6), e0129205

Gebremedhin M., Ambaw F., Admassu E., and Berhane H. (2015) Maternal associated factors of low birth weight: a hospital based cross-sectional mixed study in Tigray, Northern Ethiopia. BMC Pregnancy Chldbirth 15, 222: https://doi.org/10.1186/s12884-015-0658-1.

Ghaemmaghami M. HanleyGP, Jessel J, Landa R., (2018) Shaping Complex Functional Community Responses. J Appl Bahav Analysis, 51 (3). 502-520 doi: 10.1002/jaba 468 Epub 14, PMID: 29761485.

Girma, S., Fikadu, T., Agdew, E. *et al.* (2019) Factors associated with low birth weight among newborns delivered at public health facilities of Nekemte town, West Ethiopia: a case control study. BMC pregnancy child birth 19, 220.

Gupta, S. Yamada, G., Mpembeni, R., Frumence, G., Callaghan-Koru, J. A., Stevenson, R., Baqui, A., H. (2014) Factors associated with four or more antenatal cre visits and its decline among pregnant women in Tanzania between 1999 and 2010. PLoS ONE. 9(7), e101893. https://doi.org/10.1371/journal.pone.0101893.

Hack, M., & Fanaroff, A. A. (2010). Outcomes of children of extremely low birthweight and gestational age in the 1990s. Early Human Development, 53(3), 193–218.

Hamburg B. A. (2017) Subsets of adolescent mothers: Developmental, biomedical, and psychosocial issues. In school-age pregnancy and parenthood, 115-146.

Heaman M, K. D. (2013). Risk factors for preterm birth and small for gestational age births among Canadian women. Paediatr Perinat Epidemiol, 27:54-61.

Ijadunola, K. T. (2010). New paradigm old thinking: The case for emergency obstetric care in the prevention of maternal mortality in Nigeria. BMC Women's Health, 10,6.

Isomaa, B. (2013). A major health hazard: The metabolic syndrome. Life Sciences, 73(19), 2395–2411.

Israel, G. (1992). Determining Sample Size. Fact Sheet POD 6.

Kader M, and Perera KP., ()2014 Socio-economic and nutritional determinants of low birth weight in India. North American Journal of Medical Sciences 6 (7), 302.

Kaur, S., Upadhyay, A.K., Srivastava, D.K., Srivastava. R. and Pandey, O.N. (2014) "Maternal correlates of birth weight of newborn: A hospital based study", Indian Journal of Community Health 26 (2), 187-191.

Kayoed A. Ansah E. Agyepong I. A., Coleman M. A., Grobbee D. E., Grobusch K. K., (2014) Context Risk Factors for Low Birth Weight: A Multilevel Analysis. BMC Pregnancy and Childbirth 14, 165.

Kenya Demographic Health Survey (KDHS) 2017: Central Bureau of Statistics, Ministry of Health.

Kim, D., & Saada, A. (2013). The social determinants of infant mortality and birth outcomes in Western developed nations: a cross-country systematic review. International journal of environmental research and public health, 10(6), 2296-2335.

Kleinman, A. (2010). Four social theories for global health. The Lancet, 375(9725), 1518-1519. doi:10.1016/S0140-6736(10)60646-0

Krueger, R. A., & Casey, M. A. (2015). Participants in a focus group. Focus Groups A Practical Guide for Applied Research, edited by Krueger, RA, and Casey, MA, Sage Publications, Inc, USA.

Lawn JE, Gravett MG, Nunes TM, Rubens CE, Stanton C; GAPPS Review Group. (23rd Feb 2010). Global Report on Preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. BMC Pregnancy Childbirth, 23;10.

Linsell, Malouf, Morris, Kurinczuk, & Marlow, 2015; Prognostic Factors for Poor Cognitive Development in Children Born Very Preterm or with Very Low Birth Weight: A Systematic Review JAMA Pediatr. 169(12): 1162–1172. doi: 10.1001/jamapediatrics.2015.2175

Mahmud S, Zaman A. U, Zahid GS, Kazi M., (2017) Impact of maternal respiratory infections on low birth weight-a community based longitudinal study in an urban setting in Pakistan. BMC Pregnancy and childbirth 17(1), 1-7

Maloni, J. A. (2010). Preventing low birth weight: How smoking cessation counseling can help. Nursing for Women's Health, 5(1), 32–35.

Migwi, P. (2014). Prevalence of low birth weight deliveries and associated factors in Narok District Hospital, Kenya: University of Nairobi. Retrieved July 23, 2018, from http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/7354

Ministry of Health [MoH]. (2013). Kenya Service Availability and Readiness Assessment Mapping (SARAM) Report.

Ministry of Health [MoH] (2014) a. Health Sector Strategic and Investment Plan (2012-2018).

Ministry of Health [MoH]. (2014) b. Public Expenditure Tracking and Survey Delivery Indicator Survey 2013.

Ministry of Health [MoH]. (2015). Status of Implementation of Free Maternity Services Program in the devolved health system in Kenya. A Comprehensive Assessment Report.

M. Mazharul Islam MM, Ababneh F, Akter T, Khan HR, (2020) Prevalence and risk factors for low birth weight in Jordan and its association with under-five mortality: a population-based analysis. East Mediterr Health J. 13;26(10):1273-1284. doi: 10.26719/emhj.20.096. PMID: 33103755.

Muhwava, L. S., Morojele, N., & London, L. (2016). Psychosocial factors associated with early initiation and frequency of antenatal care (ANC) visits in a rural and urban setting in South Africa: A cross-sectional survey. BMC Pregnancy and Childbirth, 16(1). https://doi.org/10.1186/s12884-016-0807-

Miranda, M., Edwards, S., Chang, H. and Auten (2013) Proximity to roadways and pregnancy outcomes. Exposure and Environmental Epidemiology Journal 23, 32-38.

Murima, J. (2016). The effect of free maternal health care services on the perceived quality of service4 delivery at Nakuru Provincial General Hospital. Nairobi: Strathmore University.

Nair, N. S., Rao, R. P., Chandrashekar, S., Acharya, D., & Bhat, H. V. (2011). Socio-demographic and maternal determinants of low birth weight: A multivariate approach. The Indian Journal of Pediatrics, 67(1), 9–14.

National Information Service [NIS], (2015). Perfluoroalkyl and polyfluoroalkyl substances and human fetal growth: a systematic review. Critical reviews in toxicology, 45(1), 53-67.

Nyamtema, A. S., Jong, A. B., Urassa, D. P., Hagen, J. P., & van Roosmalen, J. (2012). The quality of antenatal care in rural Tanzania: What is behind the number of visits? BMC Pregnancy and Childbirth, 12(1). https://doi.org/10.1186/1471-2393-12-70

Population Reference Bureau. (2018). World Data Sheet. Washington DC: PRB.

Raatikainen, K., Heiskanen, N., & Heinonen, S. (2015). Marriage still protects pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology, 112(10), 1411–1416.

Rajashree K, P. H. (2015). Study on the factors associated with low birth weight among newborns delivered in a tertiary-care hospital, Shimoga, Karnataka. 2015; 4:1287-90. Int J Med Sci Pub Health, 4:1287-90.

Risnes, K. R., Vatten, L. J., Baker, J. L., Jameson, K., Sovio, U., Kajantie, E., Bracken, M. B. (2011). Birthweight and mortality in adulthood: A systematic review and metaanalysis. International Journal of Epidemiology, 40, 647–661. doi:10.1093/ije/dyq267

Rondon MB, Zaslarsky AM, Fann JR, Geley ., (2015) Diagnostic validity of the generalized anxiety disorder – 7 (GAD) among pregnant women. PLoS One 10 (4) e01257196.

Sacker, M. S. (2017). Does group prenatal care affect satisfaction and prenatal care utilization in Iranian Pregnant Wome? Iranian J Public Health, 39:52-62.

Sarker, M. S. (2010). Quality of antenatal care in rural southern Tanzania: A reality check. BMC Research Notes, 3, 209.

Sutan R, Mohtar M, Mhat N A, Tamil., (2014) Determinants of Low Birth Weight Infants at University Kbangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia. A Matched Case Control Study. DOI: 10 4236/OJPN.43014.

Takai I.U, B. M. (2014). A prospective study of maternal risk factors for low birth weight babies in Maiduguri, North Eastern Nigeria. Niger J Basic Clin Sci, 11:89-98.

Tamir S., N. S. (2016). Intrauterine growth retardation - small events big consequences. Italian Journal of Pediatrics, 2-4.

Tessema ZT. Tamirat KS. Teshale AB. Tessema GA, 2021 Prevalence of low birth weight and its associated factor at birth in Sub-Saharan Africa: A generalized linear mixed model PLoS One. 11; 16 (3).

Torres-Arreola, L. P., Constantino-Casas, P., Flores-Hernandez, S., Villa-Barragán, J. P., & Rendón-Macías, E. (2015). Socioeconomic factors and low birth weight in Mexico. BMC Public Health, 5(1), 20.

UNICEF. (2015). Levels and trends in Child Mortality. Report 2015. Estimates developed by the Inter-Agency Group for Child Mortality Estimation. New York: United Nations Children's Fund.

World Health Organisation [WHO]. (2018). Guidance on ethical considerations in planning and reviewing research studies on sexual and reproductive health in adolescents.

Yadav, U. C. (2011). Risk factors associated with low birth weight. Journal of Nepal Health Research Council, vol. 9, no.19, 159-164.

Zheng W, Selehi S, Ahmad A. S, Mir K, Kim C., (2016) An equity analysis of utilization services in Afghanistan using a national household survey. BMC Public Health (16) 1-11. British Biomedical Central.

Zikmund, W. G., Babin, B. J., & Carr, J. C. dan Griffin, M. (2010). Business research methods South-Western Cengage Leaning. ISBN 0324320620, 9780324220625

Tables and Figures

Figure1 below is a conceptual framework with independent variables and independent variable.

Independent variable

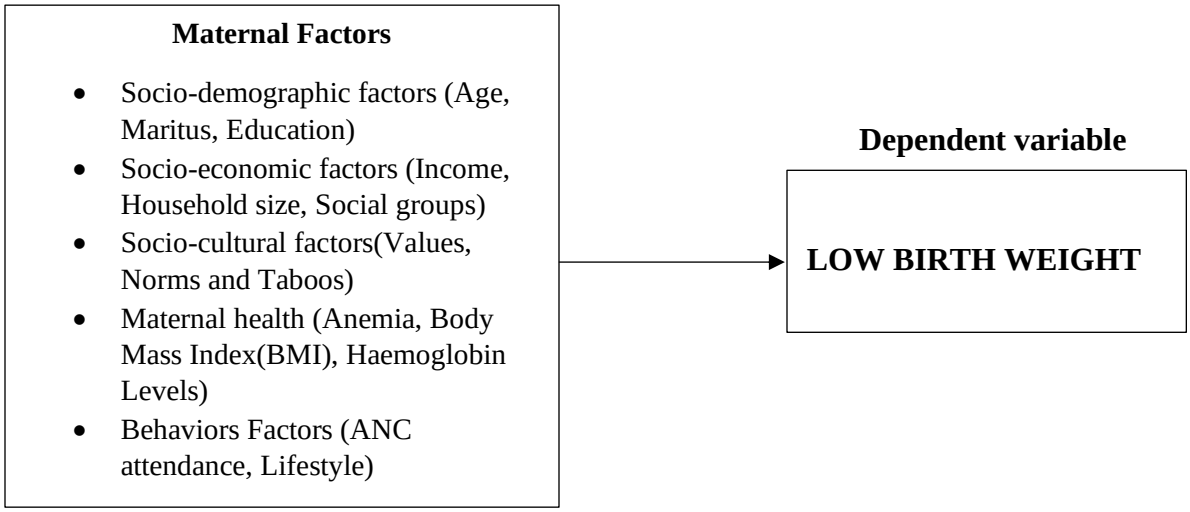

Figure 1 Conceptual Framework

Figure 1 above shows independent variables that are maternal factors which include: socio-demographic, socio-economic, socio-cultural, maternal health and behavioral factors of mothers. The dependent variable is low birth weight which is classified further to low birth weight, very low birth weight and extremely low birth weight.

Descriptive Analysis

1 Response Rate

Table 1 presents the response rate.

Table 1 Response rate

	Frequency	Percent
Returned	215	100.00
Not Returned	0	0.00
Total	215	100.00

Table 1 above indicated 100% of the total sample size which is an excellent response rate. This indicates that all the sampled respondents, fully participated in the study.

2 Socio-demographic and Socio-economic Factors of Mothers

Table 2 presents the socio-demographic and socio-economic factors of mothers. They include age, marital status, county residence, ethnicity, level of education, occupation, income and spouse income.

Table 2 Socio-demographic and Socio-economic Factors of Mothers

Maternal characteristic	Frequency	Percentage
Age Category		
Less than 18 years	3	1.40
18-34 years	201	93.49
35 and above years	11	5.12
Marital Status		
Divorced	3	1.41
Married	176	82.63
Never Married	33	15.49
Single	1	0.47
County of residence		
Kiambu	167	78.04
Murang'a	33	15.42
Machakos	8	3.74
Others	7	3.29
Ethnicity		
Kamba	30	14.22
Kikuyu	124	58.77
Kisii	9	4.27
Luhya	12	5.69
Luo	8	3.79
Meru	15	7.11
Others	15	7.11
Level of education		
College/University	57	26.51
Primary	43	20
Secondary	115	53.49
Occupation		
Business	35	16.4
Casual labor	13	6.1
Employed	39	18.2
Farming	9	4.2
None	8	3.7
Student	16	7.5
House wife	94	43.9
Income		
0-10000	157	73.02
10001-20000	0	0.00
20001-30000	0	0.00
Above 30000	58	26.98

Spouse Income		
0-10000	27	24.77
10001-20000	59	54.13
20001-30000	12	11.01
Above 30000	11	10.09

As indicated for age category, the common age was between 18 and 34 years with 93.49%; 6.42% were aged 35 years and above and 1.38% were aged less than 18 years. For marital status, 82.63% were married, 15.49% were never married,1.41% were divorced and 0.47% were single. On the county of residence, 78.04% were from Kiambu, 15.42% were from Murang'a, 3.74% were from Machakos and 3.29% were from other counties. On the ethnicity background, 58.77% were kikuyus, 14.22% were Kamba, 5.69% were luhyas, 4.27% were Kisii, 3.79% were Luos, 7.11% were Meru and 7.11% were from other tribes. Level of education of the mothers, 53.49% had attained secondary education, 26.51% had attained college education and 20% had attained primary education. The occupation, most were house wives with 43.9%, 18.2% were employed, 16.4% were business ladies, 7.5% were students, 6.1% were casual laborer, 4.2% were farmers and 3.7% had no occupation.

3 Complications During Pregnancy

Table 3 shows the complications the mothers had during pregnancy. They included anaemia, P.V bleeding, hypertension, urinary tract infection, malaria, febrile illness and the BMI issues.

Table 3 Complications during pregnancy

	Low birth weight	
	Yes	No
Complication	n (%)	n (%)
Anaemia		
Yes	2 (2.8)	1 (0.7)
No	69 (97.2)	139 (99.3)
P.V Bleeding		
Yes	10 (13.9)	11 (7.9)
No	62 (86.1)	129 (92.1)
Hypertension		
Yes	5 (6.9)	7 (5.0)
No	67 (93.1)	132 (95)
Urinary Tract infection		
Yes	12 (16.4)	19 (13.6)
No	61 (83.6)	121 (86.4)
Malaria		
Yes	2 (2.8)	1 (0.7)
No	69 (97.2)	138 (99.3)
Febrile illness		
Yes	1 (1.4)	0 (0.0)
No	70 (98.6)	140 (100.0)
BMI		
Underweight	3(2.1)	4(5.3)
Normal weight	97(69.3)	54(72.0)
Overweight	37(26.4)	13(17.3)
Obese	3(2.1)	4(5.3)

As indicated in Table 3 above, 2.82% of the babies who had low birth weight, their mothers had anaemia during pregnancy while 97.18% did not have anaemia during pregnancy. 13.89% of the newborns who had low birth weight their mothers had P.V bleeding during pregnancy and 86.11% did not have that complication during pregnancy. About 6.94% of the newborns who had low birth weight, their mothers had hypertension complication during pregnancy while 93.06% did not experience hypertension during pregnancy. Similarly, 16.44% of the newborns who had low birth weight, their mothers had urinary tract infection while 83.56% did not have urinary tract infection. In addition, 2.82% of the newborns who had low birth weight their mothers had malaria complication during pregnancy while 97.18% do not have malaria during infection. Further 1.41% of the newborns who had low birth weight, their mothers experienced febrile illness during complication while 98.59% did not experience the febrile illness during pregnancy.

4 Cultural Factors of Mothers

The cultural factors that are likely to be risk factors for low birth weight include cultural beliefs on food and work.

Figure 2 below, shows the percentage of respondents who said that they were restricted on taking certain foods during their pregnancy

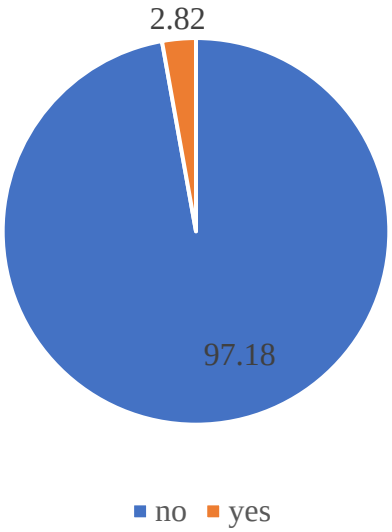

Figure 2 Restrictions of certain foods during pregnancy

As indicated in Figure 2 above, 2.8% of the respondents indicated that they were restricted on taking certain foods while 97.2% indicated that they were not restricted.

Restrictions on doing some duties during pregnancy

Figure 3 shows the restrictions on doing some duties during pregnancy period by the respondents.

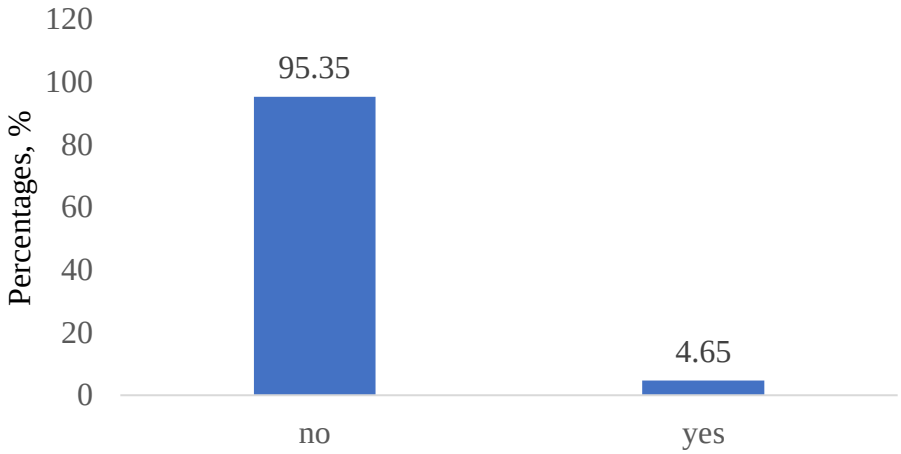

Figure 3 Restriction of Activities during Pregnancy

As indicated in Figure 3 above, 95.4% were not restricted while 4.7% were restricted. Of those who said that they were restricted indicated that the duties were, doing any difficult job, overworking and taking medicine.

5 Behavioral Factors of Mothers

Behavioral factors of mothers that are likely to be the risks for low birth weight include ANC attendance and alcohol and tobacco smoking.

Table 4 ANC Attendance and stages of ANC attendance among mothers at Thika Level Five Hospital in Kiambu County

	Low birth weight	
	Yes n (%)	No n (%)
ANC attendance		
Yes	70 (93.3)	137 (97.9)
No	5 (6.7)	3 (2.1)
Stage		
First trimester	14 (20.0)	23 (16.7)
Second trimester	96 (69.0)	48 (68.6)
Third trimester	8 (11.0)	19 (13.8)

Table 4 indicates whether mothers did attend ANC and the stage the mother attended ANC clinic. As indicated, 93% of the neonates who had low birth weight, their mothers attended ANC while 7% of the neonates who had low birth weight their mothers did not attend ANC at all. In addition,

20% of the neonates who had low birth weight, their mothers attended ANC during the first trimester, 69% attended during the second trimester and 11% attended during the third trimester.

Table 5 Frequency of ANC attendance among mothers at Thika Level Five Hospital in Kiambu County

Table 5: Number of times mothers attended ANC clinic

Times attended ANC	Low birth weight Yes n (%)	No n (%)
Once	4 (5.7)	3 (2.1)
Twice	22 (31.4)	17 (12.0)
Thrice	15 (21.4)	41 (29.0)
4 and Above	28 (40.0)	77 (54.6)
None	1 (1.4)	3 (2.1)

Table 5 gives the times the mothers attended ANC. As indicated, 5.7% of the newborns who had low birth weight, their mothers attended ANC once, 31.4% attended ANC twice, 21.4% attended ANC thrice, 40% attended four times and above and 1.4% did not attend ANC at all.

Tobacco Smoking and Alcohol Abuse Among Mothers

Table 6 below shows the smoking and alcohol abuse among mothers at Thika Level Five Hospital in Kiambu County

Table 6 Substance abuse among mothers at Thika Level Five Hospital in Kiambu County

	Low birth weight Yes n (%)	No n (%)
Smoke		
Yes	1 (1.3)	0 (0.0)
No	74 (98.7)	140 (100.0)
Alcohol		
Yes	4 (6.0)	0 (0.0)
No	63 (94.0)	129 (100.0)

Table 6 gives the status of mothers who smoke and who take alcohol. As indicated, 1.3% of the neonates who had low birth weight their mothers smoke while 98.7% do not smoke. In addition, 6.0% of the neonates who had low birth weight, their mothers take alcohol while 94.0% do not take alcohol.

Inferential Analysis

Univariate analysis for socio-demographic and socio-economic and socio-cultural factors associated with LBW

Table 7 indicates the univariate analysis of the socio-demographic, socio-economic factors and socio-cultural factors associated with low birth weight.

Table 7 Univariate Analysis of Socio-demographic, social cultural factors and socio-economic factors of mothers associated with overall LBW

Variable	Odds Ratio	Std. Err.	Z	P>z	95% Conf. Interval	
Marital Status	0.8026873	0.250735	-0.7	0.482	0.435169	1.480592
Ethnicity	1.043912	0.063616	0.71	0.481	0.926386	1.176349
Education	0.9934763	0.166629	-0.04	0.969	0.71514	1.380142
Income	1.026803	0.109779	0.25	0.805	0.832689	1.266168
Age	**3.977268**	**2.445189**	**2.25**	**0.025**	**1.191993**	**13.27076**
Social Group	0.6229314	0.206012	-1.43	0.152	0.325789	1.191088
Household size	**1.857548**	**0.538834**	**2.13**	**0.033**	**1.052023**	**3.279858**
Restriction doing any hard work	1.92871	1.252374	1.01	0.321	0.54011	6.8899
Restriction eating some foods	1.9154	1.58894	0.78	0.433	0.37837	9.73575
Occupation	0.8371041	0.438686	-0.34	0.734	0.299713	2.338046
Spouse Income	2.375	2.941192	0.7	0.485	0.209671	26.90225

As indicated age and household sizes of the respondent had a significant association with low birth weight. This is because the p-values were less than 0.05. The other factors, marital status, income, education, ethnicity, social groups, restrictions on eating certain foods and restrictions on doing some duties did not have a significant association with low birth weight.

Multivariate Analysis

Table 8 gives the multivariable analysis of socio-demographic and socio-economic factors associated with LBW.

Table 8: Multivariable analysis of socio-demographic and socio-economic factors associated with overall LBW

Variable	Odds Ratio	Std. Err.	Z	P>z	95% Conf.Interval	
Age						
16-34 years	Reference					
35 and above	**13.66607**	**15.15541**	**2.36**	**0.018**	**1.55481**	**120.1185**
Number of children						
One	Reference					
Two	**2.980785**	**1.450006**	**2.25**	**0.025**	**1.148849**	**7.733899**
Three	2.032738	1.359855	1.06	0.289	0.547831	7.54251
Constant	0.2684509	0.088462	-3.99	0.000	0.140725	0.512106

The factors that were significant at the univariate level were taken into the multivariable section. As indicated the mothers aged 35 years and above were 13.66 times more likely to give birth to babies who had low birth weight compared to the mothers aged below 35 years. Mothers who had 2 children were 2.980 times more likely to give birth to babies with low birth weight compared to mothers with one child or three children.

9 Behavioral factors associated with LBW among Neonates at Thika Level Five Hospital in Kiambu County

Table 9 Univariate Analysis of behavioral factors of mothers associated with low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% Conf. Interval	
ANC attendance	0.3065694	0.228372	-1.59	0.112	0.071194	1.320119
Stage attended	0.8777055	0.226434	-0.51	0.613	0.529362	1.455274
Tobacco Smoking	2.546273	1.69413	1.4	0.16	0.691145	9.380824
Alcohol abuse	0.5877743	0.286363	-1.09	0.275	0.226207	1.527267

As indicated in Table 9, univariate analysis was conducted to investigate the factors associated with low birth weight. No behavioral factor was significantly associated with low birth weight since all p-values were greater than the level of significance 0.05.

10 Maternal health factors associated with LBW among Neonates at Thika Level Five Hospital in Kiambu County

Table 10 Univariate analysis of maternal health factors associated with low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Anaemia	4.028983	4.970018	1.13	0.259	0.359072	45.20737
PV bleeding	1.891496	0.876622	1.38	0.169	0.762627	4.691357
Hypertension	1.407249	0.85061	0.57	0.572	0.430391	4.601281
UTI	1.252804	0.502096	0.56	0.574	0.571137	2.748058
Malaria	3.999997	4.934348	1.12	0.261	0.356474	44.884
Fibril illness	0.1250001	0.157468	-1.65	0.099	0.010583	1.476409
BMI	0.830969	0.2129738	-0.72	0.470	0.5028303	1.373228

FACTORS ASSOCIATED TO EACH CATEGORY OF LOW BIRTH WEIGHT

(i) Low birth weight

Univariate analysis of socio-demographic and socio-economic factors associated with low birth weight

Univariate analysis of socio-demographic and socio-economic factors associated with low birth weight

As indicated in Table 11 below, the maternal factors associated with low birth weight included ethnicity background of the mothers and the level of education of the mothers. Since is because the p values were less than 0.05.

Table 11 Univariate analysis of socio-demographic and socio-economic factors associated with low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% Conf.Interval	
Marital Status	0.919091	0.386538	-0.2	0.841	0.403063	2.095774
Ethnicity	**1.210076**	**0.085828**	**2.69**	**0.007**	**1.053026**	**1.390549**
Education	**0.6285279**	**0.139218**	**-2.1**	**0.036**	**0.407178**	**0.970208**
Income	1.104993	0.154438	0.71	0.475	0.840219	1.453204
Age	2.546273	1.69413	1.4	0.16	0.691145	9.380824
Social Group	0.5877743	0.286363	-1.09	0.275	0.226207	1.527267
Household size	1.440326	0.567047	0.93	0.354	0.665807	3.115826

Table 12 Multivariable analysis of socio-demographic and socio-economic factors associated with low birth weight

Low birth weight	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Ethnicity						
Kamba	Reference					
Kikuyu	4.139096	4.3825	1.34	0.18	0.51952	32.9776
Kisii	2.1988	3.2637	0.53	0.596	0.11987	40.3310
Luhya	1.910834	2.8101	0.44	0.66	0.10701	34.1207
Luo	4.071915	6.08144	0.94	0.347	0.21803	76.0459
Meru	**17.4287**	**20.612**	**2.42**	**0.016**	**1.71624**	**176.991**
Others	**10.47893**	**12.429**	**1.98**	**0.048**	**1.02505**	**107.124**
Education						
College/University	Reference					
Primary	1.023331	0.5466	0.04	0.966	0.35922	2.91521
Secondary	**0.350131**	**0.1697**	**-2.17**	**0.03**	**0.13541**	**0.90536**
Constant	0.060953	0.0655	-2.6	0.009	0.00741	0.501021

Table 4.29 indicates the multivariable analysis of socio-demographic and socio-economic factors associated with low birth weight. Being of the Meru ethnicity is significantly associated with low birth weight. A mother who is a Meru is 17.42 times more likely to give birth to a child with low birth weight compared to a mother who is of Kamba origin. In addition, coming from a different ethnic background apart from Kikuyu, Kisii, Luo and Luhya, a mother is 10.47 times more likely to have a child who has low birth weight compared to a mother who is a Kamba. A mother who has attained secondary level of education is 0.35 times less likely to have a child who has low birth weight compared to a mother who has attained university or college education.

Univariate analysis for behaviors factors associated with low birth weight

No behavior factors were significantly associated with very low birth weight since all p-values were greater than the level of significance 0.05.

Table 4.19 Univariate analysis for behaviors factors associated with very low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% Conf. Interval	
ANC attendance	0.3065694	0.228372	-1.59	0.112	0.071194	1.320119
Stage attended	0.8777055	0.226434	-0.51	0.613	0.529362	1.455274
Tobacco Smoking	1.186441	1.289809	0.16	0.875	0.140891	9.990984
Alcohol abuse	0.6767171	0.23364	-1.13	0.258	0.343974	1.331341

No behavior factors were significantly associated with very low birth weight since all p-values were greater than the level of significance 0.05.

Table 4.14 Univariate analysis of behaviours factors associated with low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Anaemia	4.028983	4.970018	1.13	0.259	0.359072	45.20737
PV bleeding	1.891496	0.876622	1.38	0.169	0.762627	4.691357
Hypertension	1.407249	0.85061	0.57	0.572	0.430391	4.601281
UTI	1.252804	0.502096	0.56	0.574	0.571137	2.748058
Malaria	3.999997	4.934348	1.12	0.261	0.356474	44.884

4.7.2 Very low birth weight

Univariate analysis of socio-demographic and socio-economic factors associated with very low birth weight

No socio-demographic and socio-economic factors was significantly associated with very low birth weight since all p-values were greater than the level of significance 0.05.

Table 4.21 Univariate analysis of socio-demographic and socio-economic factors associated with very low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Marital Status	0.8117317	0.313576	-0.54	0.589	0.380706	1.730754
Ethnicity	0.8779585	0.081594	-1.4	0.161	0.731756	1.053371
Education	1.355416	0.29382	1.4	0.161	0.886244	2.072964
Income	0.9969172	0.130149	-0.02	0.981	0.771851	1.287611
Age	2.800349	1.726758	1.67	0.095	0.836262	9.37739
Spouse Income	-0.422	0.617	-0.690	0.493	-1.631	0.786
Social Group	0.809434	0.31522	-0.54	0.587	0.377308	1.736467
Household size	1.82876	0.600717	1.84	0.066	0.96062	3.481465

Univariate analysis for behaviors factors associated with very low birth weight

No behavior factors were significantly associated with very low birth weight since all p-values were greater than the level of significance 0.05.

Table 4.22 Univariate analysis for behaviors factors associated with very low birth weight

Variable	Odds Ratio	Std. Err.	z	P>z	95% Conf. Interval	
ANC attendance	0.3065694	0.228372	-1.59	0.112	0.071194	1.320119
Stage attended	0.8777055	0.226434	-0.51	0.613	0.529362	1.455274
Tobacco Smoking	1.186441	1.289809	0.16	0.875	0.140891	9.990984
Alcohol abuse	0.6767171	0.23364	-1.13	0.258	0.343974	1.331341

No behavior factors were significantly associated with very low birth weight since all p-values were greater than the level of significance 0.05.

Table 15 Univariate analysis for maternal health factors associated with very low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Anaemia	9.885714	12.24533	1.85	0.064	0.872235	112.0424
PV	1.496212	0.818323	0.74	0.461	0.512207	4.370596
Hypertension	**3.593075**	**2.212542**	**2.08**	**0.038**	**1.074766**	**12.01209**
UTI	0.8371041	0.438686	-0.34	0.734	0.299713	2.338046
Malaria	2.375	2.941192	0.7	0.485	0.209671	26.90225

As indicated in Table 16, those mothers who had hypertension were 3.59 times more likely to have babies who have very low birth weight compared to mothers who did not have hypertension during their pregnancy.

Table 16 Multivariable analysis for maternal health factors associated with very low birth weight

Very low birth weight	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Hypertension						
No	Reference					
Yes	**3.59308**	**2.21254**	**2.08**	**0.038**	**1.0748**	**12.0121**
Constant	0.19880	0.03789	-8.48	0	0.1368	0.2888

(iii) Extremely low birth weight

Univariate analysis of socio-demographic and socio-economic factors associated with extremely low birth weight

No socio-demographic and socio-economic factor was significantly associated with extremely low birth weight since all p-values were greater than the level of significance 0.05.

Table 16 Univariate analysis of socio-demographic and socio-economic factors associated with extremely low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
Marital Status	0.2511085	0.614892	-0.56	0.573	0.002068	30.49361
Ethnicity	0.2187934	0.293742	-1.13	0.258	0.015749	3.039607
Education	1.355416	0.29382	1.4	0.161	0.886244	2.072964
Income	0.0535757	0.270631	-0.58	0.562	2.69E-06	1068.315
Age	0.5170506	1.296876	-0.26	0.793	0.003789	70.55582
Social Group	0.809434	0.31522	-0.54	0.587	0.377308	1.736467
Household size	0.8157853	0.86617	-0.19	0.848	0.101813	6.536564

Univariate analysis for behavioral and maternal health factors associated with extremely low birth weight

Table 17 gives the univariate analysis of the maternal health factors associated with extremely low birth weight. As indicated malaria is significantly associated with very low birth weight.

Table 4.26 Univariate analysis for behaviors factors associated with extremely low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
ANC Attendance	**0.0682927**	**0.087663**	**-2.09**	**0.037**	**0.005517**	**0.845302**
Stage attended ANC	1.198873	1.508248	0.14	0.885	0.101839	14.11338

Multivariable analysis for behaviors factors associated with extremely low birth weight

As indicated in Table 4.30, those mothers who attended ANC were 0.068 times less likely to have babies who have extremely low birth weight compared to mothers who did not attend ANC.

Table 4.30 Multivariable analysis for behaviors factors associated with extremely low birth weight

Extremely low birth weight	Odds Ratio	Std. Err.	Z	P>z	95% Conf.Interval	
ANC attendance						
No	Reference					
Yes	**0.0682927**	**0.08766**	**-2.09**	**0.037**	**0.00551**	**0.845302**
Constant	0.1428572	0.15272	-1.82	0.069	0.01757	1.161114

Table 17 Univariate analysis for maternal health factors associated with very low birth weight

Variable	Odds Ratio	Std. Err.	Z	P>z	95% CI	
UTI	3.000001	3.721559	0.89	0.376	0.263748	34.12349
Malaria	**51.25**	**72.56678**	**2.78**	**0.005**	**3.194817**	**822.1324**
ANC attendance						
No	Reference					
Yes	**0.0682927**	**0.0876**	**-2.09**	**0.037**	**0.0055**	**0.84530**
Constant	0.1428572	0.15272	-1.82	0.069	0.01757	1.161114

ANC attendance was significantly associated with extremely low birth weight since it's p-value is less than 0.05.

Table 18 Multivariable analysis for behaviors factors associated with extremely low birth weight

Extremely low birth weight	Odds Ratio	Std. Err.	Z	P>z	95% Conf.Interval	
ANC attendance						
No	Reference					
Yes	**0.0682927**	**0.08766**	**-2.09**	**0.037**	**0.00551**	**0.845302**
Constant	0.1428572	0.15272	-1.82	0.069	0.01757	1.161114

Multivariable analysis for maternal health factors associated with extremely low birth weight

As indicated in Table 18, those mothers who had malaria were 51.25 times more likely to have babies who have extremely low birth weight compared to mothers who did not have malaria during their pregnancy.

Table 19 Multivariable analysis for maternal health factors associated with extremely low birth weight

Extremely low birth weight	Odds Ratio	Std. Err.	Z	P>z	95% Conf.Interval	
Malaria						
No	Reference					
Yes	**51.2500**	**72.5668**	**2.78**	**0.005**	**3.1948**	**822.1324**
Constant	0.0098	0.0069	-6.52	0	0.0024	0.0393