FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT DELIVERIES IN PUMWANI MATERNITY HOSPITAL, NAIROBI-KENYA

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FactorsAssociated with Low Birth Weight deliveries in Pumwani Maternity Hospital, Nairobi-Kenya

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DECLARATION

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

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DEDICATION

I dedicate this work to my dear parents Mr. Zablon Mogire and Mrs. Alice Magoma for making me who I am today, for their financial support and for teaching me the value of education. To my sisters Edna, Lilian, Gladys and Rachel for their daily encouragement and inspiration and to my nephews Nathan and Ari and niece Amani.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACOG	American College of Obstetricians and Gynecologists
AGA	Appropriate for Gestational Age
APH	Antepartum Haemorrhage
BMI	Body Mass Index
CDC	Centre for Disease Control
g	Grams
HB	Haemoglobin
IUGR	Intra Uterine Growth Retardation
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KEMRI	Kenya Medical Research Institute
LBW	Low Birth Weight
LL	Lower Limit
MUAC	Mid Upper Arm Circumference
NICU	Neonatal Intensive Care Unit
NPGH	New Nyanza Provincial General Hospital
PDA	Patent Ductus Arteriosus
PET	Pre-eclamptic Toxaemia
PLBW	Preterm Low Birth Weight

PMH	Pumwani Maternity Hospital
PPROM	Preterm premature rupture of the membranes
RDS	Respiratory Death Syndrome
SES	Socioeconomic status
SGA	Small for Gestational Age
SIDS	Sudden Infant Death Syndrome
SVD	Spontaneous Vaginal Delivery
UD	Undefined
UL	Upper Limit

DEFINITION OF TERMS

APH: Haemorrhage from the genital tract after 28 weeks of gestation but before the delivery of the baby. APH can be due to placenta praevia, abruption placentae, indeterminate cause or local causes of genital tract.

Fetal phase: The phase that begins at the end of the eighth week of development and lasts until the time of birth.

Gestational age: It is the length of a newborn's gestation up to delivery. It helps in predicting what problems a newborn might be prone to develop.

Gravidity: The number of times that a woman has been pregnant.

Low Birth Weight: A term used to describe babies born weighing less than 2500 g regardless of gestational age.

Morbidity: An incidence of ill health or disease. It is measured in various ways, often by the probability that a randomly selected individual in a population at some date and location would become seriously ill in some period of time.

Mortality: Incidence of death in a population. Infant mortality is the death of an infant before his or her first birthday.

Multiple gestation: Delivery of twins and higher order multiples e.g. triplets, quadruplets. It occurs when more than one foetus is carried to term in a single pregnancy.

Neonate: A newborn child, especially in the first week of life and up to four weeks old.

Obstetric: The surgical specialty dealing with the care of women and their children during pregnancy (prenatal period), childbirth and the postnatal period.

Parity: The number of times that a woman has given birth to a foetus with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn. It is also used for the number of previous successful live births.

Prenatal: The period occurring "around the time of birth", specifically from 22 completed weeks of gestation to 7 completed days after birth.

Primiparity: A woman who has given birth to one child or who is giving birth for the first time.

Post natal: The postnatal period begins immediately after the birth of a child and then extends for about six weeks.

ABSTRACT

Low birth weight (LBW) is a major determinant of morbidity, mortality and disability in infancy and childhood and has a long-term impact on health outcomes in adult life. It results in substantial costs to the health sector and imposes a significant burden on society as a whole. This study sought to determine risk factors associated with LBW deliveries in Pumwani Maternity Hospital (PMH), Nairobi, Kenya. It focused on LBW and maternal socio-demographic characteristics, lifestyle and medical factors. This was a cross-sectional study which comprised of 405 women who delivered at Pumwani Maternity Hospital between December 2010 and February 2011. Systematic Random sampling was used to select the study participants. Face to face interviews using semi-structured questionnaires were used for data collection. Data analysis was conducted using SPSS version 16.0. The prevalence of LBW was 32.8%. There was a significant association between LBW and average number of meals consumed per day during pregnancies (OR= 2.65, p=0.001), maternal anaemia (OR= 22.53, p=0.001), hypertension (OR= 7.14, p<0.001), vaginal bleeding (OR 74.50, p<0.001), abdominal pain (OR= 12.73, p<0.001), lower backache (OR=2.92, p=0.005) and pelvic pressure (OR=9.20, p<0.001). Occurrence of LBW was definite (100%) among mothers who suffered pPROM. The prevalence of LBW in PMH (32.8%) was high compared to the previous prevalence rates that have been reported in Kenya. Since most of LBW deliveries in PMH were due to medical factors, it implies that if proper and timely diagnosis as well as treatment is undertaken, the prevalence can be reduced. Therefore, it

is important to upscale antenatal clinic services especially on reproductive health education. There is also need to educate pregnant women on signs and symptoms that could predict adverse pregnancy outcomes like vaginal bleeding.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Low birth weight (LBW) is a term used to describe babies born weighing less than 2,500g regardless of gestational age (WHO, 1992). The average newborn weighs about 3500g. Babies of LBW are at increased risk of complications and health problems soon after birth. It is difficult for these babies to eat, gain weight and fight infection. Because of their low body fat, it is also difficult for them to stay warm. Most of these babies require specialized care, usually in a nursery (Back, 2010). Low birth weight is therefore a major determinant of morbidity, mortality and disability in infancy and childhood and has long-term impact on health outcomes in adult life (WHO, 2010).

The incidence of LBW (<2.5 kg irrespective of gestational age) is estimated to be 16% worldwide, 19% in the least developed and developing countries and 7% in the developed countries (UNICEF and WHO, 2004). Globally, more than 20 million infants are born with LBW (UNICEF and WHO, 2004). The largest number of LBW babies is concentrated in two regions of the developing world which are Asia and Africa. Seventy-two percent of LBW infants in developing countries are born in Asia, specifically, in South Asia which accounts for half of the LBW, and 22% are born in Africa. The prevalence of LBW in sub-Saharan Africa ranges between 13% and 15%, with little variation across the region as a whole (UNICEF and WHO 2004). In East Africa the prevalence of LBW is 13.5% (UNICEF and WHO, 2004)

and in Kenya between 2006 and 2010, UNICEF estimated the prevalence of LBW to be 8%.

Low birth weight is mainly due to premature birth and Intra Uterine Growth Retardation (IUGR) (UNICEF and WHO, 2004). Premature birth is the primary cause of LBW and it describes babies born before 37 completed weeks of gestation. The earlier a baby is born, the more likely it will weigh less. This is because the baby has less time in the mother's uterus to grow and gain weight (Back, 2010).

Intra uterine growth retarded babies are also known as small-for-gestational age (SGA). These babies may be full term, but they are underweight. Some of these babies are healthy, even though they are small and may be small because their parents are smaller than average. Others are underweight because something slowed or halted their growth in the uterus, for example problems with the placenta, the mother's health (chronic health problems) or birth defects (Back, 2010).

Risk factors for pre-term delivery include maternal or fetal stress, infections, and violence. Low birth weight has also been associated with socioeconomic indicators such as education and income as well as with stress during pregnancy. In addition, high-risk behaviors, such as smoking, may themselves be associated with LBW (Ricketts *et al.,* 2005).

In Africa there are a lot of women with low education, poverty and poor nutritional status who are therefore at increased risk of adverse reproductive outcomes including LBW and preterm birth. It is therefore important to identify such mothers during pregnancy in order to determine the level of care and priorities for referral to centres

where reasonable obstetric and neonatal care is available (Elshibly and Schmalisch, 2008).

More babies are surviving despite being born early because of the tremendous advances in care of sick and premature babies. However, prevention of preterm births is one of the best ways to prevent babies born with LBW (UNICEF and WHO, 2004). This study aimed at identifying the factors associated with LBW deliveries at Pumwani Maternity Hospital.

1.2 PROBLEM STATEMENT

Low birth weight is a challenging public health problem. Its high priority stems from the fact that it is the major predictor of infant morbidity and that it contributes substantially to the overall burden of childhood mortality. Low birth weight babies are at increased risk for serious health problems, long-lasting disabilities and even death. It is therefore a major determinant of mortality, morbidity and disability in infancy and childhood and has a long-term impact on health outcomes in adult life. Although advances in newborn medical care have greatly reduced the number of deaths associated with LBW, a small percentage of survivors develop mental retardation, learning problems, cerebral palsy and vision and hearing loss. Low Birth Weight is ranked 15th among the top 20 causes of mortality in Kenya (WHO, 2011). Studies have also indicated that 14.2% infants who die during infancy in the country are born with very low birth weight (Were and Bwibo, 2009). The Kenya Demographic Health Survey placed the prevalence of LBW in Kenya in 2009 at 16% (KDHS, 2009). However, not many studies have been done in Kenya to indicate the factors associated with low birth weight and the last study done on the same was in 1998.

1.3 JUSTIFICATION

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 and WHO, 2004). It is a public

health problem and interventions need to be put in place to reduce its incidence. Since LBW is preventable, it is important to establish the factors associated with this outcome. This study therefore aimed at providing data and information that will help healthcare providers administer proper education to mothers during pregnancy with regards to risk factors associated with LBW especially the modifiable ones. Weight at birth is also a good indicator not only of the mother's health and nutritional status but also of the newborn's chances for survival, growth, long-term health and psychosocial development. Approximately 1500 women deliver at PMH each month. The hospital caters for women of a lower socio-economic status (SES) as most of them came from informal settlements and other low income residence areas. These women are predisposed to various factors associated with low SES and which contribute to LBW for example access to better nutrition, good clinics and information on pregnancy.

1.4 RESEARCH QUESTIONS

1. What is the prevalence of LBW at Pumwani Maternity Hospital?

2. What are the factors associated with LBW in Pumwani Maternity Hospital?

1.5 OBJECTIVES

1.5.1 General objective

To determine risk factors associated with the low birth weight deliveries at Pumwani Maternity Hospital, Nairobi, Kenya.

1.5.2 Specific objectives

1. To determine the prevalence of LBW in PMH, Nairobi, Kenya between December 2010 and February 2011.

2. To identify the risk factors associated with LBW in PMH, between December 2010 and February 2011.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 LOW BIRTH WEIGHT

Low birth weight (LBW) is a reliable indicator of monitoring and evaluating the success of maternal and child health programs and has been defined as a birth weight less than 2500 g (WHO, 1992). It is a multifaceted public health problem (UNICEF and WHO, 2004) and a major determinant of morbidity, mortality and disability in neonates, infancy and child hood (WHO, 2010). It has a long term impact on health outcomes in adult life. Low birth weight results in substantial costs to the health sector and imposes a significant burden on the society as a whole. Worldwide, neonatal mortality is 20 times more likely for low birthweight babies compared to heavier babies (UNICEF and 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 (Elshibly and Schmalisch, 2008).

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 related to behavior and learning (Berkowitz and Papiernik, 1993). Children who survive LBW have a higher incidence of diseases, retardation in cognitive

development, and undernourishment (Barker *et al.,* 2001). There is evidence that LBW or its determinant factors are associated with a predisposition to higher rates of diabetes, cardiac diseases and other future chronic health problems (Torres-Arreola *et al.,* 2005). In a systematic review, de Onis *et al,* (1998) found that IUGR babies are at increased risk of perinatal mortality and morbidity, including sudden infant death syndrome, poor cognitive development and neurologic impairment, cardiovascular disease, high blood pressure, obstructive lung disease, diabetes, high cholesterol concentrations and renal damage in adulthood. Such babies remain a burden on government expense and a permanent problem for their families.

Low birth weight in developing countries occurs primarily because of poor maternal health and nutrition. Diseases such as diarrhoea, malaria and respiratory infections, which are common in many developing countries, can significantly impair fetal growth when women become infected during pregnancy (Blanc and Wardlaw, 2005).

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 (Chomitz *et al.,* 1995) followed by low maternal weight gain and low pre-pregnancy weight (Alexander and Korenbrot 1995). Risk factors for pre-term delivery include maternal or fetal stress, infections, and violence. However, a clear etiology or effective intervention for preterm delivery has not yet been identified (Goldenberg and Rouse, 1998) Low birth weight has also been associated with socioeconomic indicators such as education and income as well as with stress during

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pregnancy. High-risk behaviors, such as smoking, may be associated with psychosocial stress and LBW (Ricketts *et al.,* 2005).

2.1 Factors associated with LBW

The factors associated with preterm birth and IUGR can be grouped into three categories which are; maternal lifestyle, socio-demographic and medical factors (Stewart and Nimrod, 1993).

2.1.1 Maternal lifestyle

Factors under maternal lifestyle include smoking, nutrition, low pre-pregnancy weight, inadequate maternal weight gain, high alcohol consumption, drug abuse, environmental toxins, stress, strenuous working conditions, prolonged standing and lack of social support (Stewart and Nimrod, 1993).

Maternal smoking during pregnancy impairs foetal growth and shortens gestation causing premature birth with significant foetal and infant mortality and morbidity. Studies have suggested that carbon monoxide and nicotine are among the main ingredients in cigarette smoke responsible for adverse foetal effects (Haustein, 1999). In pregnant women, carbon monoxide and high doses of nicotine interfere with oxygen supply to the foetus. Nicotine readily crosses the placental barrier and reduces foetal blood supply, altering oxygen delivery to the foetus (Oncken *et al.,* 1998). The carbon monoxide from smoke also causes foetal hypoxia and blunts the adaptive response that would normally occur.

Pregnant women who smoke cigarettes are nearly twice as likely to have a low-birthweight baby as women who do not smoke. Smoking slows fetal growth and increases the risk of premature delivery (CDC, 2004). Results of seven studies reviewed by Haustein (1999) on effects of cigarette smoking and nicotine on pregnancy outcomes indicated that the mean birth weight of infants of women who smoke during pregnancy is 200–300 grams less than that of infants of nonsmokers. Newborns born to smokers are smaller at every gestational age.

Prenatally, women who smoke during pregnancy have a higher risk of placental abruption, spontaneous abortions, and premature birth. Postnatally, the most dramatic effect of maternal smoking is the increased risk of sudden infant death syndrome (SIDS). It has also been linked to an increased likelihood of asthma in childhood and a lower IQ in adulthood (Lanting *et al.,* 2009). A pilot study done by Stark and Stepans (2004) indicated an elevation in systolic and diastolic blood pressure in term, low birth-weight infants of smoking mothers when compared to infants born to nonsmoking mothers. Passive smoking can also be a contributing factor. Maternal use of smokeless tobacco should also receive specific attention as a part of routine prenatal care (Gupta and Sreevidya, 2004).

Alcohol and illicit drugs can limit foetal growth and cause birth defects (Berghella, 2007). Some drugs, such as cocaine, may increase the risk of premature delivery.

Poor maternal nutrition is a known cause of LBW, especially in developing countries (UNICEF, 2009). A review by Kramer (1998) concluded that maternal nutritional factors both before and during pregnancy account for more than 50% of cases of LBW in many developing countries. During the foetal phase, growth depends on the

nutritional condition of the mother, indicating that pregnant women should not only increase their weight but also consume essential nutrients. For many women in the developing world, however, economic, social and cultural factors make it difficult for them to obtain the necessary food and healthcare, which are closely interrelated (Torres-Arreola *et al.,* 2005).

The WHO recommends a weight gain of 1 kg/month in the last 2 trimesters, in order to prevent LBW. A pregnant woman therefore, should have access to adequate nutrition before, during and after delivery in order to maintain a good nutritional status (Ramakrishnan, 2004) Women who don't gain enough weight during pregnancy increase their risk of having a low birth weight baby (Goldenberg & Culhane, 2007).

2.1.2 Socio-demographic factors

Socio-demographic factors include maternal age, education and income level, poverty and unemployment, among others. Teenage pregnancy or low maternal age has been associated with maternal complications, premature birth, LBW, perinatal mortality and increased infant mortality. It has also been observed that in developing countries, teenage mothers were at increased risk of maternal anaemia, pre-term birth and caesarean delivery (Yadav *et al.,* 2008). Low income and lack of education are associated with increased risk of having LBW babies although the underlying reasons are not well understood (ACOG, 2000).

2.1.3 Medical Factors

These include infections in the mother like bacterial vaginal infections, chronic infections like diabetes, maternal hypertension and uterine anomalies. Others are primiparity, multiple gestation, previous LBW baby, abortion, birth defects among others.

Babies with certain birth defects are more likely to be growth restricted because genetic conditions and structural abnormalities may limit normal development (ACOG, 2000). Babies with birth defects are also more likely to be born prematurely.

Some diseases and infections in the mother during pregnancy have also been associated with LBW. These can be subdivided into non-communicable and communicable diseases. Non-communicable diseases include chronic health problems in the mother, such as maternal high blood pressure, diabetes, and other heart, lung and kidney problems, can reduce birthweight (ACOG, 2000).

Communicable diseases include certain infections, especially those involving the uterus which may increase the risk of preterm delivery (Goldenberg and Culhane, 2007), Other infections such as urinary tract or vaginal infections which cause labour to start early leading to preterm delivery. Certain viral and parasitic infections in the foetus, including cytomegalovirus, rubella, chickenpox and toxoplasmosis can slow foetal growth and cause birth defects (ACOG, 2000).

Placental problems can reduce flow of blood and nutrients to the foetus, limiting growth. In some cases, a baby may need to be delivered early to prevent serious complications in mother and baby (ACOG, 2000).

2.2 Medical problems common in low-birthweight babies at birth

Serious medical problems are common in babies born at very LBW. According to Back, (2010) some of the problems associated with LBW babies at birth are, low oxygen levels at birth, inability to maintain body temperature, difficulty feeding and gaining weight, infection and sudden infant death syndrome (SIDS).

2.2.1 Respiratory Diseases

Respiratory diseases include respiratory distress syndrome (RDS), a respiratory disease of prematurity caused by immature lungs common in babies born before the 34th week of pregnancy. Babies with RDS lack a protein called surfactant that keeps small air sacs in the lungs from collapsing. Treatment with surfactant helps affected babies breathe more easily. Babies with RDS may need additional oxygen and mechanical breathing assistance to keep their lungs expanded.

2.2.2 Intraventricular Haemorrhage

Intraventricular haemorrhage is a neurologic problem characterized by bleeding in the brain. It occurs in some very low- birthweight premature babies, usually in the first three days of life and is usually diagnosed with an ultrasound. Most bleedings are mild and resolve themselves with no or few lasting problems. More severe bleedings can cause pressure on the brain that can lead to brain damage. In such cases, surgeons may insert a tube into the brain to drain the fluid and reduce the risk of brain damage. In milder cases, drugs sometimes can reduce fluid accumulation.

2.2.3 Necrotizing enterocolitis (NEC)

Necrotizing enterocolitis (NEC) is a potentially dangerous intestinal problem that usually develops two to three weeks after birth. It can lead to feeding difficulties, abdominal swelling and other complications. Babies with NEC are treated with antibiotics and fed intravenously. In some cases, surgery is necessary to remove damaged sections of intestine.

2.2.4 Patent Ductus Arteriosus (PDA)

This is a heart problem that is common in premature babies. Before birth, a large artery called the ductus arteriosus lets the blood bypass the baby's nonfunctioning lungs. The ductus normally closes after birth so that blood can travel to the lungs for oxygenation. When the ductus does not close properly, it can lead to heart failure. This disorder can be diagnosed with a special form of ultrasound (echocardiography) or other imaging tests. Babies with PDA are treated with a drug that helps close the ductus, although surgery may be necessary if the drug doesn't work (Back, 2010).

2.2.5 Poor Immunity

Low-birth weight babies have lower immunity compared to normal birth weight babies and therefore, they are more susceptible to infections even with minor exposure to microorganisms. The poor immunity of low birth weight babies predisposes them to infections, especially diarrheal disease and lower respiratory infections. This contributes to the high mortality observed in these babies (UNICEF and WHO, 2004).

2.3 Low birth weight and health problems in later life

Babies who are born with low birthweight may be at increased risk for certain chronic conditions in adulthood. These conditions include high blood pressure, Type II diabetes and heart disease Back, 2010. Barker *et al.,* (1993) found out that individuals born small for gestational age have an increased risk for later development of cardiovascular diseases and metabolic syndrome. It is not yet known how low birthweight contributes to these adult conditions. However, it is possible that growth restriction before birth may cause lasting changes in certain insulin-sensitive organs like the liver, skeletal muscles and pancreas. Before birth, these changes may help the malnourished foetus use all available nutrients. However, after birth these changes may contribute to health problems, (Back, 2010).

Low birthweight has also been associated with increased incidence of cerebral palsy, deafness, blindness, epilepsy, chronic lung disease, learning disabilities, and attention deficit disorder (Hack *et al.,* 1995). Results from a study by Mayor (2005), reveal that extremely low birthweight children have high rates of chronic conditions compared with children born at normal weight. These conditions include asthma, cerebral palsy, and visual disability, as well as poorer cognitive ability, academic achievement, motor skills, and social adaptive functioning.

2.4 Antenatal care and Low Birth Weight

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 (Carrolii *et al.,* 2001). Raatikainen *et al.* (2007) 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 (Raatikainen *et al.,* 2007)

2.5 Low birth weight in Kenya

UNICEF estimates the prevalence of LBW in Kenya between 2006 and 2010 to be 8% (UNICEF, 2010). The Kenya Demographic Health Survey estimated the prevalence of LBW between 2005 and 2009 to be 16% (KDHS, 2009)

Studies that have been conducted in Kenya determining factors that associated with LBW include: A four month prospective study carried out in Machakos Provincial Hospital by Njuki (1983) to investigate the incidence, aetiology and mortality in LBW infants placed the incidence of LBW at 9.3%. Factors that contributed to delivery of LBW infants in this study were maternal factors including the age, parity, height, marital status, maternal illness and attendance of the antenatal clinic and maternal medical diseases which included febrile illness, pre-eclampsia and eclampsia, and antepartum haemorrhage. Another study was conducted in Kisumu by

Were and Karanja (1994) on LBW deliveries in the Nyanza Provincial Hospital over a period of four months in estimated the incidence of LBW at 15.0%. The most common antenatal complications associated with LBW delivery were pyrexia, premature rupture of membranes before term and multiple pregnancy. Of the multiparae who delivered LBW babies gave history of previous abortion, premature delivery, neonatal death and stillbirth.

Ngare and Neumann (1998) carried out a study on predictors of LBW at the community level over a two year period in a rural area in Western Kenya. The main objective of the prospective longitudinal study was to study the functional effects of mild to moderate malnutrtition. Results of the discriminant analysis showed that mid upper arm circumference (MUAC), body mass index (BMI), Blood haemoglobin levels (HB) and socioeconomic status (SES) are significant predictors of low birthweight. Low birthweight prevalence was estimated at 11.2%.

Another study carried out in Mombasa (Mwanyumba *et al*., 2001) to determine the correlation between maternal and infant HIV infection and LBW, indicated that maternal HIV infection was associated with LBW. Maternal age, primiparity, sex of the baby, religion, syphilis infection, anaemia and previous history of stillbirth were also associated with LBW.

All these studies have been carried across wide year gaps and in different environments. There was therefore the need for another study on LBW in another different environment to be carried out so as to see if the trend had changed or if there are other factors that could be associated with LBW apart from the ones previously considered in these studies.

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CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study design

A cross-sectional study was carried out. Data collection was done using semi-structured questionnaires between the months of December 2010 and February 2011.

3.2 Study site

The study was carried out at Pumwani Maternity Hospital (PMH) in Nairobi, Kenya. This is mainly an obstetric hospital but also provides other medical services related to pregnancies such as antenatal and postnatal clinic services. It is the largest referral maternity hospital in Kenya. The hospital is located in the eastern side of Nairobi and is surrounded by low income residential areas of Eastleigh, Mathare, Muthurwa and Majengo. It is a city council hospital and therefore maternity fees are lower with a normal delivery costing Ksh. 3,400 while a caesarian section costs Ksh. 6,400. This maternity hospital handles a large number of deliveries monthly, approximated at 1,500 deliveries.

3.3 Study population

The study population constituted of mothers who delivered at the PMH between the months of December 2010 and February 2011.

Inclusion criteria

Mothers, above 18 years who delivered at the PMH hospital during the period of December 2010 to February 2011 and consented to be included in the study.

Mothers, below 18 years who delivered at PMH, were accompanied by guardians and assented to be included in the study.

Exclusion criteria

Mothers, above and below 18 years, who delivered at PMH during the period of December 2010 to February 2011 and did not consent to be included in the study.

3.4 Sample size

Sample size was calculated using the formula below (Fisher *et al.,* 1998):

$$n = \frac{Z^2 pq}{d^2}$$

Where:

n = the desired sample size.

Z = the standard normal deviate that provides 95% confidence interval (1.96)

p = proportion of the pregnant women who deliver LBW infants.

q = 1-p.

d = absolute precision (error bound) 0.05.

The percentage of low birth weight babies (% of births) in Kenya in 2009 was 16%. However, to increase the sample size so as to strengthen the power of the study, an assumed prevalence of 50% was used. The desired accuracy of results was at 95% confidence.

$$n = \frac{(1.96)^2 (0.50) (0.50)}{0.05^2}$$

$$n = 385$$

To allow for non-responses, 5% of the sample size 385 (5% × 385 =19.25) was included.

This was added to 385 and gave a total sample size of 405 participants.

3.5 Sampling procedure

The birth register was used to obtain the sampling frame. Systematic sampling was used to enroll women into the study. A sampling interval of 11 was computed and after selecting a random starting point, mothers were then selected according to sampling interval from the birth register until the desired number was achieved.

Computing the skip interval:

Since approximately 1500 women deliver at the hospital monthly, and since the study was conducted over a period of three months, the total number of women who delivered over the months was expected to be 4500.

With a calculated sample size of 405, therefore the sampling interval was,

$$\frac{4500}{405} = 11$$

The interval was 11. After choosing a random start point using a random number table, every 11th delivery was selected until the desired sample size was achieved.

3.6 Data collection procedure

Information obtained from previous studies on low birth weight and other obstetrics and gynaecology sites was used in addition to other variables, to design a semi-structured questionnaire for data collection. The questionnaire was pretested at PMH prior to the main study in order to enhance its reliability.

Among the variables identified in previous studies as being associated with LBW and which were factored in the questionnaire included: gestational age, maternal weight and height, parity, life style factors such as dietary habits, tobacco, alcohol or caffeine consumption, socioeconomic and socio-demographic factors like maternal education and household income, mothers health and nutrition status among others (Appendix 2).

The variables were categorized into 3 main groups: socio-demographic factors, maternal lifestyle and medical and obstetric factors.

The interviews were carried out 12 hours after delivery. 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 signed a consent form (Appendix 1) before the questionnaire was administered via face to face interviews.

Prior to the interview, the interviewer was blinded on the birth weight of the infants born to the selected mothers to avoid bias. Clinical records were also reviewed to verify information on the respective newborns and other clinical information given by the mothers. Some of the information that was obtained from the clinical records included; participants' age, weight, infections suffered during pregnancy including

vaginal infections, UTIs, syphilis infection, chronic illness, HIV status, any complications that could have affected the pregnancy, birth status i.e. if singleton or multiple birth, baby's gestation age, baby's weight, if baby was discharged alive or dead, any complication present in the baby and any deformities present in the baby. The information obtained from the clinical records was used to fill in the clinical forms (Appendix 3).

3.7 Data management and analysis

Data was entered into an Ms Access database. It was then cleaned, coded and saved. For backup it was stored in a flash disk and compact discs. For the purpose of enhancing data quality, skip patterns and double entry were employed.

Data was analyzed using SPSS for windows version 16.0. Descriptive statistics were used to describe and summarize the data. Bivariate analysis was carried out using Pearson's chi-square test to assess associations between variables and to calculate the strength of the associations using odds ratios. Factors that were found to be significantly associated with the outcome at p-value less than 0.05 were considered for multivariate analysis. Binary logistic regression analysis was used to determine factors predictive of LBW. P-value equal to or less than 0.05 was considered significant.

3.9 Ethical considerations

Permission to carry out the study was obtained from the Scientific Steering Committee (Appendix 4) and Ethical Committee at KEMRI (Appendix 5). Administration authorization to carry out the study was sought from the research and ethics committee and the medical superintendent of PMH (Appendix 6).

Prior to administering the questionnaires and conducting the interview, the participants filled in an informed consent form. They were informed of the purpose of the study and its expected benefits. Participation in the study was purely by consent and those who did not desire to be included were not forced to participate. For mothers below 18 years consent was sought from their guardians and if not present they were not included in the study. Those whose guardians consented for them to participate in the study and who assented were included.

The interviews were carried out between an interval of twelve to twenty-four hours after delivery when the mothers had gained enough rest and energy. Care was taken when interviewing mothers. For confidentiality purposes, numbers and not names were used to identify the mothers.

The study did not have any physical risk to the women but some of the questions triggered emotional discomfort. The interview process was also stressful if the mother had not rested enough or if the mother was experiencing post-labour pain. In such cases the interview process was carried forward to another time.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of the study population

A total of 405 study participants were interviewed. The mean age was 24.6 $\pm$ 5.2 years with a range of 14 to 42 years. Of the 405 participants, 40.5% were aged between 20 - 24 years, 15.6% were aged below 20 years old, 26.2% were aged between 25-29 years and 17.8% were above 30 years old. Those who reported to be married were 79.0%. The proportion of participants with primary level of education was 44.4%, secondary level of education was 44.0%, tertiary level of education 10.1% and no formal education 1.5% as shown in Table 4.1. Of the 320 married participants, majority (61.3%) of their spouses had secondary school as the highest level of formal education. Ninety seven percent of the study participants resided in the low income areas of Nairobi, with 2.0% residing outside Nairobi.

Table 4.1: Summary of selected demographic characteristics of the study participants

Demographic characteristics	n=405	Proportion (%)	95% CI Lower Limit	95% CI Upper Limit
Age of the respondent (years)				
Mean age (Range)	24 (14-42)			
<20 years	63	15.6	12.0	19.1
20 - 24 years	164	40.5	35.7	45.3
25 - 29 years	106	26.2	21.9	30.5
30 or more	72	17.8	14.1	21.5
Marital Status of Respondent				
Single	82	20.2	16.3	24.2
Married	320	79.0	75.0	83.0
Widowed	1	0.2	0.0	0.7
Separated/Divorced	2	0.5	0.0	1.2
Highest Level of Education of Respondent				
None	6	1.5	0.3	2.7
Primary	180	44.4	39.6	49.3
Secondary	178	44.0	39.1	48.8
Tertiary	41	10.1	7.2	13.1

4.1.2 Employment status of the study participants

Assessment of the employment status revealed that 56.5% of the study participants were unemployed, 23.7% self-employed and 19.8% were formally employed as shown in Figure 4.1. Out of the 320 study participants who reported they were married, 43.8% of the spouses were formally employed, 41.8% were self-employed and 14.3% were unemployed.
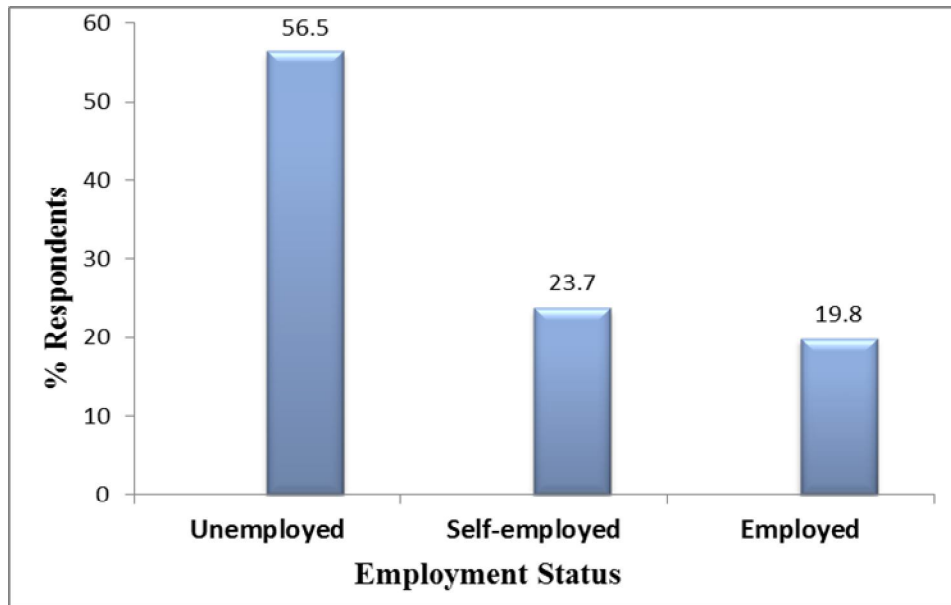
Figure 4.1: Employment Status of women who delivered in Pumwani Maternity Hospital

4.2 Maternal lifestyle characteristics of the study population

4.2.1 Work related characteristics of the study participants

Analysis of work status among 187 women who reported that they worked during the pregnancy period revealed that 34.2% did strenuous jobs. Of these, 16.0% indicated that their work usually involved standing over a long period with 70.0% of them standing for more than 4 hours per day. Among the 405 participants, 12.3% indicated that they lifted heavy loads while 44.0% indicated that they engaged in extensive bending (Table 4.2).

Table 4.2: Work related characteristics of the study participants

Work related characteristics	n=405	Proportion (%)	95% CI Lower Limit	95% CI Upper Limit
Work environment				
Strenuous	64	34.2	27.4	41.0
Not strenuous	119	63.6	56.7	70.5
Not Known	4	2.1	0.1	4.2
Not applicable	218			
Work involved standing over a long period of time (continuously for more than 4hrs)				
Yes	30	16.0	10.8	21.3
No	157	84.0	78.7	89.2
Heavy lifting				
Yes	50	12.3	9.1	15.5
No	355	87.7	84.5	90.9
Extensive bending				
Yes	178	44.0	39.1	48.8
No	227	56.0	51.2	60.9

4.2.2 Number of meals consumed by the study participants

Among the 405 participants, 69.4% consumed an average of three or more meals per day during pregnancy as shown in Figure 4.2. Among the 124 participants who reported to consume less than three meals a day, 83.9% reported that it was due to lack of appetite, 9.7% reported that it was due to lack of money, 3.2% due to lack of time and 3.2% reported that it was out of choice.
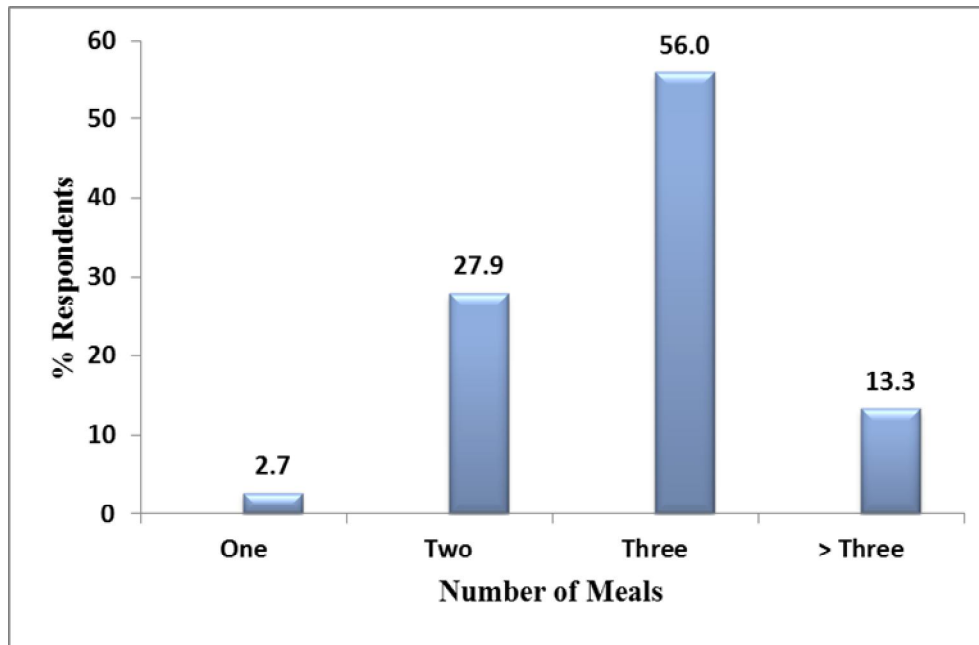
Figure 4.2: **Average number of meals consumed per day by women who delivered in Pumwani Maternity Hospital**

4.2.3 Micronutrient use among the study participants

Use of micronutrients supplements during pregnancy was reported by 51.4% of the participants. The most commonly used supplements were: multivitamin by 36.4% study participants, folic acid by 34.9% and iron by 15.3% as shown in Figure 4.3. Among the 197 participants who reported not to have used any micronutrient supplements, 77.2% reported that they had not been prescribed for them.
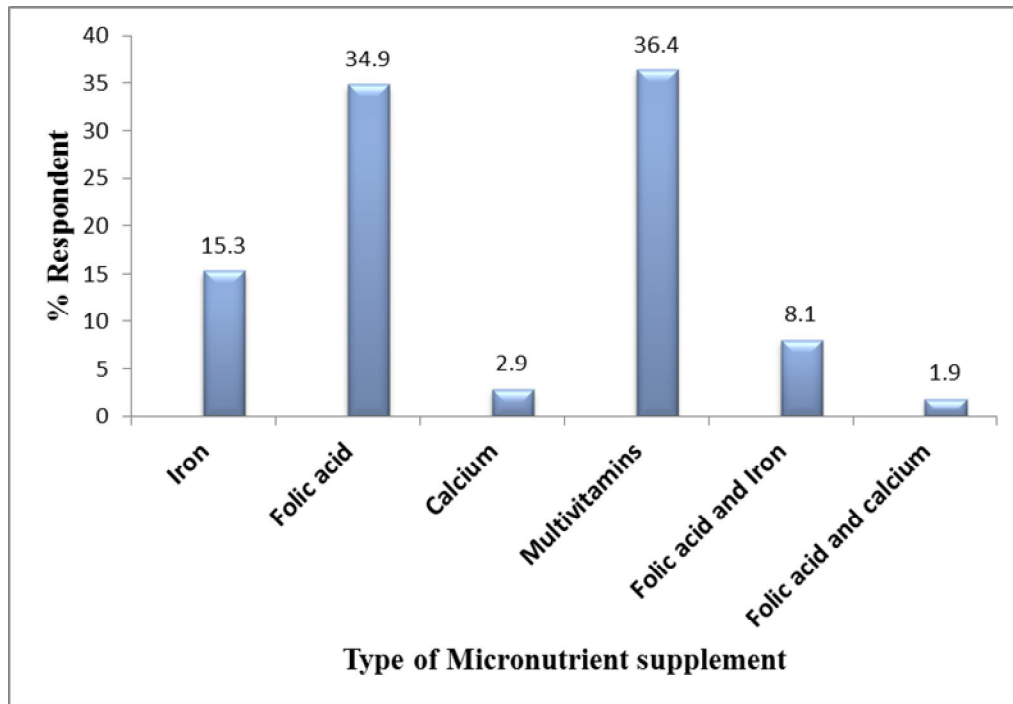
Figure 4.3: Type of Micronutrient supplement used by women who delivered in Pumwani Maternity Hospital

4.2.4 Behavioural characteristics of study participants and spouses

a) Alcohol consumption during pregnancy

The participants behavioral characteristics categorized as a risk were assessed and 1.7% reported that they consumed alcohol, 57.1% of whom consumed alcohol during pregnancy.

b) Cigarette smoking by study participants and spouses

Further assessment of study participants' behavior categorized as 'a risk' showed 1.2% reported that they smoked cigarettes, 40.0% of whom reported that they smoked during some months of the pregnancy.

Among the 320 married participants, 21.6% reported that their husbands smoked cigarettes, 37.7% of whom smoked in presence of their wives during pregnancy. When further interviewed, 69.2% reported that their husbands smoked in their presence through the entire pregnancy period.

4.3 Medical factors of study participants

4.3.1 Parity of study participants

Among the 405 participants 60.5% reported that they had ever been pregnant before, 78.8% of who had been pregnant once or twice and 0.8% reported that they had been pregnant more than five times. Of the 245 participants, 70.6% reported that they had carried the pregnancies to term (Table 4.3). Of the 72 who reported that they were not successful in carrying the pregnancies to term, 79.2% was due to miscarriage, 4.2% due to pregnancy termination. Another reason cited was giving birth prematurely. Out of the 245 participants that reported to have ever been pregnant, 10.2% had given birth to premature babies, 1.6% to low birth weight babies while 4.5% had previously given birth to still born babies.

Table 4.3: Self-reported parity of the study participants

Pregnancy history	n	Proportion (%)	95% CI Lower Limit	Upper Limit
Ever been pregnant before				
Yes	245	60.5	55.7	65.3
No	160	39.5	34.7	44.3
Pregnancies successful i.e. carried to term				
Yes	173	70.6	65.1	76.1
No	72	29.4	23.9	34.9
Previously given birth to a premature baby				
Yes	25	10.2	6.4	14.0
No	220	89.8	86.0	93.6
Previously given birth to a low birth weight baby				
Yes	4	1.6	0.0	3.2
No	241	98.4	96.8	100.0

4.3.2 History of miscarriage among the study participants

Out of 245 participating mothers that had ever given birth before, 23.3% had experienced a miscarriage, with 86.0% experiencing it once. Of the 57 miscarriages reported, 42.1% of them occurred between two to four months of pregnancy while 29.8% occurred after four months and 28.1% between the first and second months.

4.3.3 Prenatal clinic attendance by study participants

Prenatal clinic attendance was assessed and is shown in Table 4.4. Of the 405 participants, 94.8% attended prenatal clinic with 86.7% starting the visits at 4 months or more. Among the 21 that never attended prenatal clinic, 52.4% reported that it was out of choice while 14.3% indicated that it was due to work burden.

Table 4.4: Prenatal clinic attendance by the study participants

Clinic attendance	n	Proportion (%)	95% CI Lower Limit	Upper Limit
Attended prenatal clinic				
Yes	384	94.8	92.7	97.0
No	21	5.2	3.0	7.3
If yes, month the visits started				
1-3 Months	51	13.3	9.9	16.7
4-6 Months	265	69.0	64.4	73.6
7-9 Months	68	17.7	13.9	21.5

4.3.4 Urinary tract and vaginal infections among study participants during pregnancy

Assessment of UTI's and vaginal infection during pregnancy is presented in Table 4.5. Of the 405 participants, 31.9% suffered from vaginal infection. Of the 129 who suffered from vaginal infections, 96.9% suffered from candidiasis with 20.2% occurring during the first trimester, 49.6% infections occurring during the second trimester and 30.2% during the third trimester. Urinary tract infection (UTI) was reported by 11.6% of the mothers, with 51.1% occurring during the second trimester, 44.7% during the third trimester and 4.3% during the first trimester.

Table 4.5: Urinary tract and vaginal Infection reported during pregnancy among the study participants

Infection	n	Proportion (%)	95% CI Lower Limit	95% CI Upper Limit
Suffer from any vaginal infection				
Yes	129	31.9	27.3	36.4
No	276	68.1	63.6	72.7
If yes, type of vaginal infection				
Bacterial vaginosis	4	3.1	0.1	6.1
Candidiasis	125	96.9	93.9	99.9
Suffer from any urinary tract infection				
Yes	47	11.6	8.5	14.7
No	358	88.4	85.3	91.5

4.3.5 Morbidity rates reported among study participants during pregnancy

Assessment of complaints and illnesses that occurred during pregnancy was analyzed and is presented in Table 4.6. High blood pressure was reported in 6.2% of the study participants. Abdominal pain/cramping was reported by 8.9% of the mothers, with 58.3% cases occurring during the second trimester. Pelvic pressure was experienced by 18.8% of the participants with 80.3% occurring during the third trimester. Low back pain was experienced by 14.3% of the mothers, with 51.7% cases occurring during the third trimester. Of the 405 participants, 7.7% had vaginal bleeding with 54.8% cases of bleeding occurring during the third trimester, and 45.2% during the second trimester. The most commonly reported complications were; Antepartum Haemorrhage (APH) both placenta praevia and abruption placenta 35.5%, Preterm Premature Rapture of Membranes (pPROM) 20.8% and severe anaemia 16.6%.

Table 4.6: Summary of Morbidity rates reported during pregnancy by study participants

Complaints and illnesses	n=405	Proportion (%)	95% CI Lower Limit	95% CI Upper Limit
High Blood pressure				
Yes	25	6.2	5.1	10.2
No	380	93.8	89.8	94.9
Experience Abdominal pain				
Yes	36	8.9	6.1	11.7
No	369	91.1	88.3	93.9
Experience Pelvic pressure				
Yes	76	18.8	15.0	22.6
No	329	81.2	77.4	85.0
Experience Lower backache pain				
Yes	58	14.3	10.9	17.7
No	347	85.7	82.3	89.1
Complications that affected the pregnancy				
Abruptio placenta	15	31.3	18.1	44.4
Placenta praevia	2	4.2	0.0	9.8
PET	6	12.5	3.1	21.9
Severe Anaemia	8	16.6	5.4	27.8
PPROM	10	20.8	9.3	32.3
Breech	3	6.3	0.0	13.1
Oligohydramnios	2	4.2	0.0	9.8
pPROM and oligohydramnios	2	4.2	0.0	9.8
Not applicable	357			

4.3.6 Selected clinical characteristics among study participants

Assessment of maternal clinical characteristics is presented in Table 4.7. Mothers' nutritional assessment revealed that 77.5%) of the participants had a Mid Upper Arm Circumference (MUAC) that ranged within 24 – 32 cm. A MUAC of 23cm and below was considered as undernourished and above 33cm was considered obese. Those women who delivered via spontaneous vaginal delivery were 94.8% and 5.2%

delivered via caesarian section. Singleton births were 96.5% and multiple births were 3.5%. Assessment of maternal HIV serostatus revealed that 35(8.6%) of the mothers were HIV positive.

Table 4.7: Summary of clinical characteristics of the study participants

Clinical characteristics	n=405	Proportion (%)	95% CI Lower Limit	Upper Limit
Mid upper arm circumference (cm)				
<24	50	12.3	8.5	16.1
24 - 32	314	77.5	72.7	82.3
>32	41	10.1	6.3	13.8
Mode of birth delivery				
SVD	384	94.8	92.7	97.0
Caesarian section	21	5.2	3.0	7.3
HIV status of the mother				
Positive	35	8.6	5.9	11.4
Negative	370	91.4	88.6	94.1
Birth status				
Singleton birth	391	96.5	94.8	98.3
Multiple birth	14	3.5	1.7	5.2

4.3.7: Selected clinical characteristics and status at birth of the infants born to study participants

Analysis of infant gestational age revealed that 23.7% were born before 37 weeks with 76.3% being born after 38 weeks. The prevalence of low birth weight was 32.8% and 67.2% of the infants had normal birth weight (Figure 4.4).
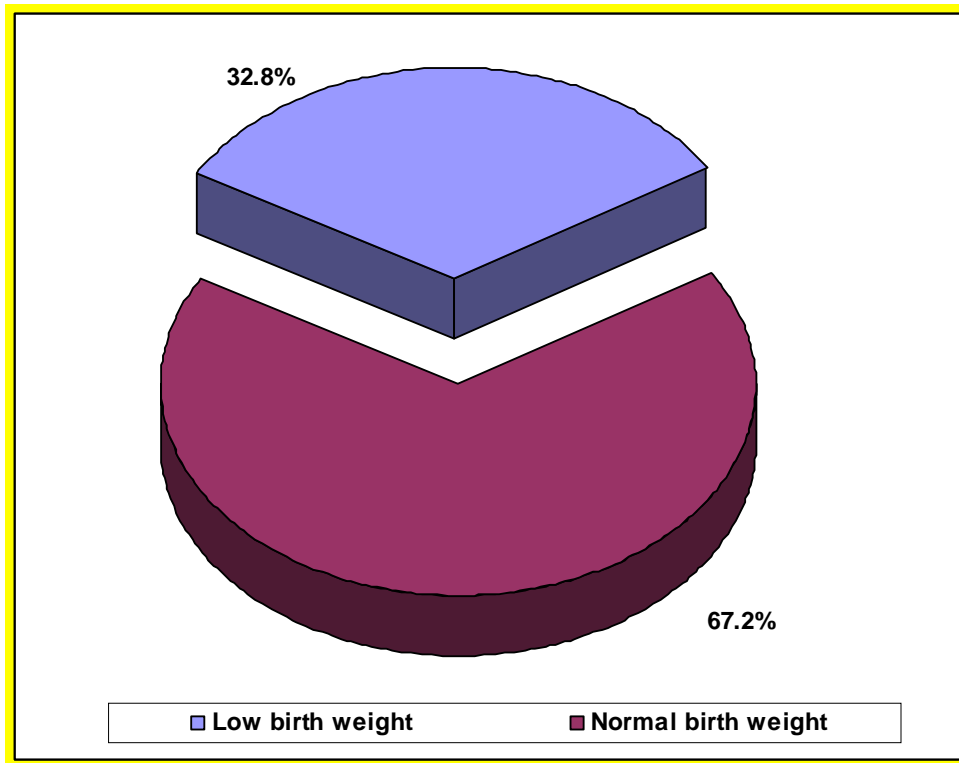
Figure 4.4: Proportion of babies born with LBW and Normal Birth Weight

4.3.8 Complications reported among infants born to study participants

Out of 405 deliveries, 124 newborns experienced complications, the most common being asphyxia 41.9% and respiratory disease syndrome (RDS) 32.3% as shown in Table 4.8. Among the 52 experiencing asphyxia, 75.0% had mild asphyxia, 19.2% severe asphyxia and 5.8% moderate asphyxia. Among the 40 who experienced RDS, 60.0% had mild RDS, 20.0% moderate and another 20.0% severe RDS.

Table 4.8: Complications reported among infants born to study participants

Complications among newborns	n=405	Proportion (%)	95% CI Lower Limit	Upper Limit
Complications present in the baby at birth				
RDS	40	9.8	6.8	12.8
Asphyxia	52	12.8	9.2	16.4
Granting respiration	17	4.2	2.2	6.2
Prematurity	10	2.5	1.0	4.0
Low HB	1	0.2	0.0	0.7
Malformation	4	1.0	0.0	2.0
None	281	72.1	67.6	76.6

4.4 Factors associated with Low Birth Weight among study participants at bivariate analysis.

The relationship between LBW and selected maternal and infant characteristics revealed the following findings.

4.4.1 Association between LBW and selected socio-demographic characteristics of study participants

Association between low birth weight and selected socio-demographic characteristics is presented in Table 4.9. There was no significant association between low birth weight and any of the socio-demographic factors.

Table 4.9: Summary of selected socio-demographic characteristics of study participants in relation to infant birth weight

Variables	Low Birth Weight (n=133)		Normal Birth Weight (n=272)		OR	95% CI		p- value
	n	%	n	%				
Age of the respondent (years)								
<20 years	20	31.7	43	68.3	1.06	0.51	2.19	0.882
20 - 24 years	54	32.9	110	67.1	1.12	0.61	2.03	0.720
25 - 29 years	37	34.9	69	65.1	1.22	0.64	2.31	0.545
30 or more	22	30.6	50	69.4	Reference			
Marital Status of Respondent								
Not married	31	36.5	54	63.5	1.23	0.74	2.02	0.423
Married	102	31.9	218	68.1	Reference			
Highest level of Education Attained by respondent								
None/Primary	60	32.3	126	67.7	0.95	0.63	1.44	0.818
Secondary/Tertiary	73	33.3	146	66.7	Reference			
Employment Status								
Unemployed	74	32.3	155	67.7	0.94	0.55	1.61	0.814
Self-employed	32	33.3	64	66.7	0.98	0.52	1.84	0.954
Employed	27	33.8	53	66.3	Reference			

4.4.2 Association between LBW and selected lifestyle characteristics of study participants

Association between low birth weight and selected lifestyle characteristics is shown in Table 4.10.

There was a significant association between low birth weight and lifting of heavy weights (p<0.05). A newly born baby of a mother who used to lift heavy loads during

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pregnancy was 1.90 [95% CI = 1.04 – 3.46] times more likely to be underweight compared to one of a mother that was not lifting heavy loads.

The average number of meals consumed in a day during pregnancy was significantly associated with low birth weight (p=0.002). A child born to a mother who used to consume less than three meals per day during pregnancy was 1.97 [95% CI = 1.27 – 3.06] times more likely to have low birth weight compared to one whose mother used to consume three or more meals per day.

Table 4.10: Summary of selected maternal lifestyle characteristics of study participants in relation to infant birth weight

Maternal lifestyle characteristics	Low Birth Weight (n=133)		Normal Birth Weight (n=272)		OR	95% CI		p-value
	n	%	n	%				
Have domestic House help								
Yes	30	33.3	60	66.7	1.03	0.63	1.69	0.910
No	103	32.7	212	67.3	Reference			
Heavy lifting								
Yes	23	46.0	27	54.0	1.90	1.04	3.46	**0.034**
No	110	31.0	245	69.0	Reference			
Extensive bending								
Yes	64	36.0	114	64.0	1.29	0.85	1.95	0.237
No	69	30.4	158	69.6	Reference			
Average number of meals consumed per day during pregnancy								
Less than three	54	43.5	70	56.5	1.97	1.27	3.06	**0.002**
Three or more	79	28.1	202	71.9	Reference			
Used micronutrients supplements during pregnancy								
Yes	70	33.5	139	66.5	1.06	0.70	1.61	0.773
No	63	32.1	133	67.9	Reference			

4.4.3 Association between LBW and selected behavior characteristics

The association between low birth weight and selected behavioral characteristics is shown in Table 4.11. Among the study participants, none of the behavioral characteristics categorized as a 'risk' were significantly associated with low birth weight (p<0.05).

Table 4.11: Summary of selected behavior characteristics of study participants in relation to infant birth weight

Selected behavior	Low (n=133) n	Low (n=133) %	Normal (n=272) n	Normal (n=272) %	OR	95% CI		p-value
Alcohol consumption								
Yes	2	50.0	2	50.0	2.06	0.21	20.69	0.601
No	131	32.7	270	67.3	Reference			
Cigarette smoking								
Yes	2	40.0	3	60.0	1.37	0.23	8.29	0.732
No	131	32.8	269	67.3	Reference			

4.4.4 Association between LBW and maternal medical factors

Nine out of eleven medical and obstetric factors were associated (p<0.05) with low birth weight as shown in Table 4.12.

High Blood pressure was significantly associated with low birth weight (p=0.001). Mothers who developed high blood pressure were 4 [95% CI = 1.72 – 9.30] times more likely to deliver babies with low birth weight compared to those without high blood pressure.

There was a significant association between low birth weight and occurrence of urinary tract infection among the mothers (p=0.005). A child born to a mother who suffer from urinary tract infection during pregnancy was 2.38 [95% CI = 1.29 – 4.41] times more likely to have low birth weight compared to one whose mother did not suffer from urinary tract infection.

There was a significant association between low birth weight and occurrence of anaemia (p=0.007). A child born to a mother who suffered from anaemia during pregnancy was 1.54 [95% CI = 1.54 – 36.62] times more likely to have low birth weight compared to one born to non-anaemic mother.

Occurrence of vaginal bleeding during pregnancy was significantly associated with low birth weight (p<0.001). A child born to a mother who suffered from vaginal bleeding in the third trimester was 41.54 [95% CI = 5.44 – 317.20] times more likely to have low birth weight compared to one born to a mother who did not suffer from vaginal bleeding.

Similarly, other maternal characteristics which included abdominal pain [OR, 12.91, 95% CI = 5.22 – 30.94, p<0.001], lower backache pain [OR, 3.26, 95% CI = 1.85 – 5.76, p<0.001] and Pelvic pressure [OR, 9.16, 95% CI = 5.18 – 16.22, p<0.001] were associated with a sugnificantly low birth weight. Occurrence of low birth weight was definite (100%) among mothers who suffered from pPROM.

Table 4.12: Summary of selected maternal medical factors of study participants in relation to infant birth weight

Maternal medical factors	Low Birth Weight (n=133)		Normal Birth Weight (n=272)		OR	95% CI		p-value
	n	%	n	%				
Ever been pregnant before								
Yes	82	33.5	163	66.5	1.08	0.70	1.65	0.738
No	51	31.9	109	68.1	Reference			
Prenatal clinic attendance								
Yes	128	33.3	256	66.7	1.60	0.57	4.47	0.366
No	5	23.8	16	76.2	Reference			
High Blood pressure								
Yes	16	64.0	9	36.0	4.00	1.72	9.30	**0.001**
No	117	30.8	263	69.2	Reference			
Vaginal infection								
Yes	37	28.7	92	71.3	0.75	0.48	1.19	0.223
No	96	34.8	180	65.2	Reference			
Urinary tract infection								
Yes	24	51.1	23	48.9	2.38	1.29	4.41	**0.005**
No	109	30.4	249	69.6	Reference			
Anaemia								
Severe	6	75.0	2	25.0	9.60	1.88	49.07	**0.007**
Moderate	14	26.4	39	73.6	1.15	0.58	2.29	0.693
Mild	10	24.4	31	75.6	1.03	0.47	2.25	0.936
Normal	103	77.4	200	73.5	Reference			
Vaginal bleeding								
7 - 9 months	16	94.1	1	5.9	41.54	5.44	317.20	**<0.001**
4 - 6 months	13	92.9	1	7.1	33.75	4.36	261.25	**0.001**
No bleeding	104	27.8	270	72.2	Reference			
Abdominal pain								
Yes	30	83.3	6	16.7	12.91	5.22	31.94	**<0.001**
No	103	27.9	266	72.1	Reference			
Lower backache pain								
Yes	33	56.9	25	43.1	3.26	1.85	5.76	**<0.001**
No	100	28.8	247	71.2	Reference			
Pelvic pressure								
Yes	56	73.7	20	26.3	9.16	5.18	16.22	**<0.001**
No	77	23.4	252	76.6	Reference			
pPROM								
Yes	10	100.0	0	0.0	UD	UD	UD	**<0.001**
No	123	31.1	272	68.9	Reference			

4.4.5 Association between LBW and maternal and infant clinical characteristics

Five out of seven maternal and infant clinical characteristics were associated with low birth weight (p<0.05) as shown in Table 4.13.

There was a significant (p=0.001) association between low birth weight and mode of delivery. A newborn delivered via caesarian section was 50.00 [95% CI = 6.25 – 333.33] times more likely to have low birth weight compared to one delivered via SVD.

Birth weight status was significantly associated with multiple births (p=0.003). A child born in a multiple birth was 5.56 [95% CI = 1.67 – 16.67] times more likely to have low birth weight compared to one born in singleton birth. Gestational age (weeks) was significantly associated with low birth weight (p<0.001). Newborns delivered at less than 37 weeks gestation period were 119.79 [95% CI = 40.31 – 355.99] times predisposed to low birth weight in relation to newborns delivered after 37 weeks gestation period.

Infant complications were significantly associated with low birth weight (p<0.001). A higher proportion (95.7%) of low birth weight was observed among newborns with RDS and/or Asphyxia complications (95.7%) compared to those without any complication (7.8%). Newborns delivered with RDS and/or Asphyxia complications were predisposed 259.00 [95% CI = 86.87 – 772.23] times to low birth weight in comparison to newborns delivered without any complication. Similarly, proportion

of low birth weight among newborns delivered with other forms of complications was equally high (71.9%) compared to newborns those without any complication. Newborns delivered with other forms of complications were predisposed 30.09 [95% CI = 12.42 – 72.90] times to low birth weight in relation to newborns delivered without any complication.

Table 4.13: Summary of selected maternal clinical factors of study participants and infant clinical factors in relation to birth weight

Variables	Low (n=133)		Normal (n=272)		OR	95% CI		p-value
	n	%	n	%				
Mid upper arm circumference (cm)								
<24	17	34.0	33	66.0	1.40	0.57	3.47	0.462
24 - 32	105	33.4	209	66.6	1.37	0.66	2.84	0.398
>32	11	26.8	30	73.2	Reference			
Mode of delivery								
Caesarian section	20	95.2	1	4.8	50	6.25	333.33	**<0.001**
SVD	113	29.4	271	70.6	Reference			
Discharged alive or dead								
Dead	18	75.0	6	25.0	7.14	2.70	16.67	**<0.001**
Alive	115	30.2	266	69.8	Reference			
HIV status of the mother								
Positive	12	34.3	23	65.7	1.07	0.52	2.23	0.849
Negative	121	32.7	249	67.3	Reference			
Birth status								
Multiple birth	10	71.4	4	28.6	5.56	1.67	16.67	**0.003**
Singleton birth	123	31.5	268	68.5	Reference			
Baby's gestational age (weeks)								
≤ 37 weeks	92	95.8	4	4.2	150.34	52.42	431.19	**<0.001**
>37 weeks	41	13.3	268	86.7	Reference			
Complication								
RDS and/or Asphyxia	88	95.7	4	4.3	259.00	86.87	772.23	**<0.001**
Others	23	71.9	9	28.1	30.09	12.42	72.90	**<0.001**
None	22	7.8	259	92.2	Reference			

4.5 Multivariate analysis

Twelve factors associated with low birth weight at p<0.05 in bivariate analysis were considered for multivariate analysis. Four successive iterations were performed using backward conditional method retaining seven factors in the final model. The results are shown in Table 4.14.

There was a significant association between low birth weight and average meals consumed in a day during pregnancy. Mothers who consumed less than three meals per day were 2.65 [95% CI, 1.45 – 4.85, p=0.001] times more likely to deliver low birth weight babies (43.5%) compared to those who that were consuming three or more meals per day (28.1%).

There was a significant association between maternal anaemia and low birth weight. Babies born to mothers with severe anaemia were 22.53 [95% CI, 3.41 – 148.71, p=0.009] times more predisposed to low birth weight (75.0%) compared to infants delivered by non-anaemic mothers (23.8%). Similarly, mothers who developed high blood pressure were 7.14 [95% CI, 2.58 – 19.76, p<0.001] times more likely to deliver babies with low birth weight (64.0%) compared to those without high blood pressure (30.8%).

There was a significant association between low birth weight and vaginal bleeding in the second and first trimesters. Newborns delivered by mother who experienced vaginal bleeding in the second trimester were 74.50 [95% CI, 6.75 – 822.56, p<0.001] times more likely to have low birth weight (92.9%) compared to those

delivered by mothers who never experienced vaginal bleeding (27.8%). Newborns delivered by mother who experienced vaginal bleeding in the third trimester were 42.12 [95% CI, 4.1. – 432.94, p<0.001] times more likely to have low birth weight (94.1%) compared to those delivered by mothers who never experienced vaginal bleeding (27.8%).

Occurrence of abdominal pain was significantly associated with low birth weight (p<0.001). Mothers who experienced abdominal pain during pregnancy were 12.73 [95% CI, 4.42 – 36.61] times more likely to deliver low birth weight babies (83.3%) compared to those who never experienced abdominal pain (27.9%). lower backache was associated with low birth weight (p=0.005) . Mothers who experienced lower backache during pregnancy were 2.92 [95% CI, 1.37 – 6.19] times more likely to deliver low birth weight babies (56.9%) compared to those who never experienced lower backache (28.8%). Pelvic pressure had a significant role on newborns birth weight. Newborns delivered by mothers who experienced pelvic pressure were 9.20 [95% CI, 4.63 – 18.26, p<0.001] times more likely to have low birth weight (73.7 %) compared to those delivered by mothers who never experienced pelvic pressure (23.4%).

Table 4.14: Multivariate Logistic regression model predicting low birth weight (LBW) among newborns delivered at Pumwani maternity hospital using maternal characteristics

Predictor variables	AOR	95% CI Lower	95% CI Upper	p-value
Average meals consumed during pregnancies				
Less than three	2.65	1.45	4.85	0.001
Three or more	Reference			
Suffered High Blood pressure				
Yes	7.14	2.58	19.76	<0.001
No	Reference			
Severity of Anaemia				
Severe	22.53	3.41	148.71	0.001
Normal	Reference			
Experienced Vaginal bleeding				
7 - 9 months	42.12	4.10	432.94	0.002
4 - 6 months	74.50	6.75	822.56	<0.001
No bleeding	Reference			
Experienced Abdominal pain				
Yes	12.73	4.42	36.61	<0.001
No	Reference			
Experienced Lower backache pain				
Yes	2.92	1.37	6.19	0.005
No	Reference			
Experienced Pelvic pressure				
Yes	9.20	4.63	18.26	<0.001
No	Reference			

CHAPTER FIVE

5.0 DISCUSSION

5.1 Prevalence of low birth weight in PMH

The prevalence of low birth weight in this study was estimated at 32.8%. This prevalence was higher compared to other studies done in Kenya. In one study done in a rural area in Kenya by Ngare and Neumann (1998), the prevalence of LBW was estimated at 11% while in another study conducted in Kisumu by Were and Karanja (1994), the estimated prevalence was 15%. The Kenya Demographic Health Survey estimates the prevalence between 2005 and 2009 to be 16%. There is a big difference from 16% to 32.8%. This could be because the 16% is a pooled national prevalence and the 32.8% is for a selected population in the nation. However, it should be noted that PMH which was the study site is an obstetric hospital and the largest maternity referral hospital especially for the lower socio-economic class and so it may be hypothesized that women from the lower socioeconomic class who are therefore at high risk of adverse reproductive outcomes including LBW and pre-term would more likely choose this specific hospital for their delivery, thus leading to high prevalence of LBW. The prevalence of LBW did not vary much with the level of education with those with none/primary education being 32.3% and those with secondary/tertiary education having 33.3%. The prevalence of LBW also did not vary much among the different age groups, employment status and marital status of the study participants.

5.2 Risk factors associated with Low Birth Weight

Several factors were found to be significantly associated with low birth weight. The significant predictors included antenatal complications especially anaemia, high blood pressure and pPROM which if identified earlier could be managed to reduce the incidence of low birth weight. Sometimes maternal medical conditions like high blood pressure increase the risk of preterm birth because labour has to be induced for medical reasons (Goldenberg *et al.* 1998). Women with vaginal bleeding during pregnancy are at higher risk for preterm birth either when it occurs in the third trimester due to APH or even early bleeding that is not due to APH (Krupa *et al.,* 2006).

5.2.1 Relationship between LBW and socio-demographic characteristics

In this study, there was no significant association between low birth weight and socio-demographic factors such as maternal age, marital status, level of education and employment status. This outcome could be because the sampled population did not have major differences in the socio-demographic characteristics. It could also be because this was a cross-sectional study and so there was a limitation in inferring causation. There have also been changes in the distribution of these factors over recent years (Fairley, 2005). The relationship between maternal age and LBW has been found to be U shaped in many studies, with teenagers and older mothers at highest risk. However, this particular trend was not revealed in this study which did not show a high risk of LBW in older mothers and younger mothers. Studies have indicated that mothers with lower educational level give birth more to LBW

neonates. However in this study there was no significant difference between LBW and the different levels of education attained by the study participants.

5.2.2 Relationship between LBW and selected maternal behavioural characteristics

None of the behavioral characteristics considered a 'risk' were significantly associated with low birth weight in this study. These results contrast with those of a study carried out in the Netherlands which indicated that prenatal exposure to alcohol as well as cigarette smoking increases the risk of preterm birth and low birth weight (Lanting *et al.,* 2009). It is also known that maternal cigarette smoking reduces birth weight and increases risk of preterm delivery. In contrast to this, results of this study indicated that there was no significant association between maternal smoking, alcohol consumption and LBW. The contrast noted in this study could be because the study participants who reported to have smoked during pregnancy only did it once. A dose-response effect has been observed in single studies, in which mothers who smoke greater amounts during pregnancy have progressively higher rates of preterm deliveries. This was also similar to the women who reported consumption of alcohol during pregnancy. They were few and consumed alcohol once in the entire pregnancy period.

5.2.3Relationship between LBW and number of meals consumed in a day during pregnancy

Relationship between average meals consumption per day during pregnancies and occurrence of low birth weight was statistically significant. Mothers who used to consume less than three meals per day were 2.65 times more likely to deliver low birth weight babies compared to those who that were consuming three or more meals per day. This finding concurred with that of a study carried out in North Carolina, USA by Siega-Riz *et al.,* (2000) which showed an association between decreased frequency of eating and preterm delivery. They found out that women who consumed food at a less frequency were at a slightly higher risk for delivering preterm babies in general and were more likely to deliver after premature rapture of the membranes.

5.2.4 Relationship between LBW and medical factors among study participants

Selected medical factors were evaluated in relation to LBW and the following were found to be significantly associated with LBW.

5.2.4.1 Relationship between LBW and preterm Premature Rapture of Membranes (pPROM)

Adjusting for other medical and obstetric factors, occurrence of low birth weight was definite (100%) among mothers who suffered from pPROM. This may be explained by the fact that a mother who suffered from pPROM was likely to deliver preterm and consequently a LBW infant. Preterm premature rapture of membranes is one of the leading identifiable causes of prematurity. A study done in the USA by McElrath *et al.,* (2008), to classify pregnancy disorders that lead to preterm delivery identified

pPROM as one of the antecedent conditions associated with extremely preterm delivery. Another study by Noor *et al.,* (2006) in Pakistan concluded that pPROM is an important cause of preterm birth resulting in a large number of babies with low birth weight.

5.2.4.2 Relationship between LBW and maternal anaemia

There was a significant association between LBW and severe maternal anaemia. According to this study, maternal anaemia increased the risk of having a low birth weight baby by 22.53 times. The findings of this study are similar to a study done in Turkey by Karasahin *et al.,* (2007), which indicated that pre eclampsia and preterm birth rates were higher among anaemic mothers than the non anaemic ones. Similarly, a study done by Lone *et al.,* (2004) in Pakistan, showed that maternal anaemia in pregnancy increased the risk of delivery of premature and LBW babies.

5.2.4.3 Relationship between LBW and hypertension

The findings of this study showed that mothers who developed high blood pressure were 7.14 times more likely to deliver babies with low birth weight compared to those without high blood pressure. Similarly, a study carried out in Iran by Vahdaninia *et al.,* (2008) indicated that maternal history of chronic diseases including hypertension increased the risk of giving birth to a LBW infant by 3.70 fold. In addition, a study done by Samadi and Mayberry (1998) in Atlanta USA, indicated that preterm births were almost two times more likely for women with pregnancy-induced hypertension, more than 1.5 times more likely for women with

chronic hypertension preceding pregnancy and more than four times more likely for women with pregnancy-aggravated hypertension compared with normotensive women.

5.2.4.4 Relationship between LBW and vaginal bleeding

This study showed a significant association between low birth weight and vaginal bleeding. Newborns delivered by mothers who experienced vaginal bleeding in the second and third trimesters were 74.50 and 42.12 times respectively more likely to have low birth weight compared to those delivered by mothers who never experienced vaginal bleeding. The findings of this study concurred with the findings of several studies: A study conducted in USA by Yang *et al.,* (2004) indicated that intense vaginal bleeding, especially in the second trimester during pregnancy was associated with preterm birth. Another conducted in Egypt by Arafa *et al.,* (2000) also indicated that risk of LBW and preterm delivery significantly increased with second trimester bleeding while another done in the UK by Saraswat *et al.,* (2010) indicated that there was a higher risk of preterm delivery, having a low birth weight baby and risk of intrauterine growth retardation in women who experienced first-trimester bleeding. Vaginal bleeding in the third trimester of pregnancy is considered to be antepartum haemorrhage. A study done in Hong Kong by Lam *et al.,* (2000), concluded that there was an increased risk of premature delivery in women with antepartum haemorrhage and placenta praevia. A study done in the USA by McElrath *et al.,* (2008) to classify pregnancy disorders that lead to preterm delivery identified placental abruption as one of the antecedent conditions associated with extremely preterm delivery. A study done in Tanzania by Siza (2008) showed that

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complications during pregnancy such as placenta abruption was directly associated with LBW.

5.2.4.5 Relationship between LBW and pelvic pressure, lower back pain and abdominal pain

The finding of this study showed that occurrence of abdominal pain was associated with low birth weight. Mothers who experienced abdominal pain during pregnancy were 12.73 times more likely to deliver low birth weight babies compared to those who never experienced abdominal pain.

Similarly, occurrence of lower back pain was significantly associated with low birth weight. Mothers who experienced lower backache during pregnancy were 2.92 times more likely to deliver low birth weight babies compared to those who never experienced lower backache.

Pelvic pressure was also significantly associated with low birth weight. Newborns delivered by mothers who experienced abdominal pain were 9.20 times more likely to have low birth weight compared to those delivered by mothers who never experienced pelvic pressure.

Low abdominal pain or cramping, low back pain and pelvic pressure are among the symptoms suggestive of preterm labour when they occur at <37 weeks and consequently may predict preterm delivery.

5.3 STUDY LIMITATIONS

➢ Some of the mothers could not recall their pre-pregnancy weight and therefore pre-pregnancy BMI had to be ruled out as a measure of nutritional status of the mothers.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

1. In this study, the prevalence of low birth weight was 32.8% and there was no significant association between low birth weight and maternal socio-demographic characteristics.

2. The significant predictors included maternal anaemia, high blood pressure, vaginal bleeding, abdominal pain, lower back pain and pelvic pressure.

6.2 RECOMMENDATIONS

1. In view of the high prevalence of LBW, the health care givers need to place more emphasis on reproductive health education especially on;

   - Signs and symptoms that could indicate adverse pregnancy outcomes like pre-term labour.

   - How to identify high risk pregnancies.

   - Importance of consuming enough meals in a day during pregnancy.

2. Future studies should endeavour to classify the antecedent conditions associated with LBW and determine their effects in hypothesis testing designs.

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APPENDICES

APPENDIX I: CONSENT FORM

Hallo. How are you? My name is Grace Mogire. I am a research scientist from KEMRI now working together with Pumwani Maternity. You are being requested to join a research study. This consent form explains the study and your part in it. Please read carefully and use as much time as you need. You can ask questions where it is not clear.

TITLE

Factors Associated with Low Birth Weight Deliveries in Pumwani Maternity Hospital.

PURPOSE OF STUDY

Low birth weight is the major predictor of infant deaths. Low birth weight babies are also at increased risk for serious health problems, lasting disabilities and even death. This study will help identify the factors that lead to LBW deliveries. The study will also help find out the number of children who have LBW at birth so that the extent of the problem can be determined.

PROCEDURE

If you agree to be in study, you will be asked to provide a written informed consent.

I will ask you questions for about an hour, so I request you to be patient.

RISKS/ DISCOMFORTS

Study will not have any physical risk to you but some of the questions may trigger emotional discomfort. You will be asked questions by people skilled in it. All the

information you share will be kept only and only within the research team and the information you give will be used for the purpose of this study only.

BENEFITS

If you are intending to get pregnant in future, you as a mother will receive direct benefit from participating in this study.

Through your voluntarily participation, the proposed study will come up with the prevalence of LBW and the factors associated with it.

This information will help the health care workers to provide the necessary advice to pregnant mothers and on their pre-natal visits in order to reduce the incidence of LBW.

In case of any abnormality noted in your behavior during pregnancy, you will be given the necessary advice to help you in your next pregnancy if you intend to get pregnant.

ALTERNATIVES TO PARTICIPATION

Participation is by choice. You may choose to or not to take part.

CONFIDENTIALITY

All information you share will be kept within research team. No names will be used on study material. You will be assigned a unique identity number.

The information you give will be kept strictly confidential and used ONLY for the purpose of this study.

VOLUNTARINESS

You are a volunteer. You can choose not to take part. If you decide to take part, you will sign this form. You can use thumb print if you do not want to put your signature.

I have read the consent form for the study. I understand the risks, benefits and any alternatives to study. I wish to proceed with the study to add to the information on factors that contribute to LBW.

Name of adult participant…………………………………………………...

Signature……………………..   Date………………………….

Name of guardian……………………………………………………………..

Signature……………………   Date…………………………

Name of researcher…………………………………………………………..

Signature…………………….   Date………………………..

If you require further information please contact **KEMRI/ERC: The secretary, tel. 2722541 ext 3307,0722205901, 0733400003**

APPENDIX II: QUESTIONNAIRE

QUESTIONAIRE FOR THE STUDY ON FACTORS ASSOCIATED WITH LOW BIRTH WEIGHT DELIVERIES IN PUMWANI MATERNITY HOSPITAL, NAIROBI, KENYA

(Please fill in or tick where appropriate)

(A) SOCIO-DEMOGRAPHIC FACTORS

Study number ……….

1. Age: …………… (years)

2. Marital status (tick where appropriate)

> I.   Single
> II. Married
> III. Widowed
> IV. Separated/ divorced

3. Level of education attained (tick where appropriate indicating grade and type of higher institution)

> I.   None ………..
> II. Primary grade………
> III. Intermediate/secondary…………….
> IV. High……………………...

5. If married, what is your spouse's level of education attainment?

> I.   None ………..
> II. Primary grade………
> III. Intermediate/secondary…………….
> IV. High……………………...

6. Employment status

       I. Unemployed
      II. Self-employed
      III. Employed

ii. If (I) above what do you do to generate income?

iii. If (II) what is your main source of income?

iv. If (III) what kind of job do you do?

      I. Casual
      II. Business
      III. Formal

7. If married, what is your spouse's employment status?

      I. Unemployed
      II. Self-employed
      III. Employed

8. Area of residence…………………………………………………………

B) MATERNAL LIFESTYLE

Work

1. Is the environment you work in strenuous? (tick where appropriate)

       I.   Yes
      II. No
     III. Don't know

2. Does it involve prolonged standing or standing for long periods of time? YES/NO

    If YES, on average how long do you stand?

       I.   1-2 hrs
      II. 3-4 hrs
     III. Above 5 hrs

3. Does your work involve dealing with a lot of people in a day? YES/NO

4. Does your work involve a lot of paper work? YES/NO

5. Do you have a domestic house help or anyone who helps with house work? YES/NO

6. Did you do any heavy lifting (lifting of loads heavier than the participant could handle and which put strain especially on the lower back like water jerricans either from a height, up a flight of stairs and also level ground.)? YES/NO

7. Did you do any extensive bending? YES/NO

Nutrition

1i) On average in a day how many meals did you consume during the pregnancy?

       I.   One
      II. Two
     III. Three
     IV. More than three

ii) If you consumed less than three meals, why?
- I. Lack of appetite
- II. Lack of money
- III. Lack of time
- IV. Out of choice

2. What was your dietary diversity (type of food consumed during the specific meal times)

- I. Breakfast
- II. Lunch
- III. Supper

3. Did you use micronutrient supplements during the pregnancy? YES/NO

If NO, why?

- I. Not prescribed
- II. Lack of knowledge about them
- III. Lack of access to them
- IV. Prescribed but did not take

If YES, which type did you use?(sample of drug will be used as a prompt)
- I. Iron
- II. Folic acid
- III. Calcium
- IV. Multi vitamins
- V. Folic and Iron
- VI. Folic and calcium

Risky behavior

4i) Do you drink alcohol? YES/NO

ii) If YES, did you ever consume alcohol during the entire period of the pregnancy?

YES/NO

iii) If YES how many times did you drink?

- I. Once
- II. Some months of the pregnancy (specify)
- III. During the entire pregnancy period

5i) Do you smoke? YES/NO

 ii) If YES, did you ever smoke during the pregnancy?YES/NO

iii) How many times?
   I. Once
   II. Some months of the pregnancy (specify)
   III. During the entire pregnancy period

6i) Does your husband smoke? YES/NO

 ii) If YES, did he ever smoke in your presence during your pregnancy?

   YES/NO

iii) How many times?
   I. Once
   II. Some months of the pregnancy
   III. During the entire pregnancy period

 7) What is the main type of fuel you use when cooking?

   I. Firewood
   II. Charcoal
   III. Stove
   IV. Gas/ Electricity

C) MEDICAL FACTORS

1) Have you been pregnant before? YES/NO

   If YES how many times? ………………..

2) Were all the pregnancies successful, were they carried to term? YES/NO

   If NO specify……………………………..

3) Have you previously given birth to a

        I. Premature baby? YES/NO
        II. Low birth weight baby? YES/NO
        III. Still born baby? YES/NO

4) How old is the child born before the present one…………

5) Have you experienced a miscarriage? YES/NO

If YES:
  a) How many times?
        I. Once
        II. Twice
        III. More than thrice
  b) At what month of the pregnancy
        I. First trimester (1st – 3rd month)
        II. Second trimester (4th – 6th month)
        III. Third trimester (7th – 9th month)
  c) Cause of miscarriage
        I. Natural
        II. Self-induced
  d) If natural specify cause
        I. Sickness
        II. A lot of work
        III. Accident
        IV. Weak placenta
        V. No known cause

6) Have you experienced prior pregnancy termination? YES/NO

7) Did you attend prenatal clinic? YES/NO

If YES, at which month of pregnancy did you commence antenatal/prenatal clinic visits?

…………………………………………………………………………………………………
……..

If NO, why?

....
....

8 a) Did you suffer from any vaginal infections (any events of increased amount of vaginal discharge, a foul oduor vaginal discharge or itching or burning around vagina) during pregnancy?   YES/NO

If YES, at which month did you suffer from the above?
  I. First trimester (1st – 3rd month)
  II. Second trimester (4th – 6th month)
  III. Third trimester (7th – 9th month)

b) Type of vaginal infection
  I. Bacterial vaginosis
  II. Candidiasis

9) Did you suffer from any urinary tract infections during pregnancy (pain or burning during urination, urge to urinate but not much urine comes out, cloudy urine or smelly urine)?

YES/NO

If YES, at which month did you suffer from the above?
  I. First trimester (1st – 3rd month)
  II. Second trimester (4th – 6th month)
  III. Third trimester (7th – 9th month)

10) Do you suffer from any of the following?

	Yes	No
High blood pressure	___	___
Heart problems	___	___
Kidney problems	___	___
Lung problems	___	___
Diabetes	___	___

12) Did you experience any of the following?

	Yes	No	If YES, Month
Vaginal bleeding	___	___	…………………..
Lower backache	___	___	…………………..
Pelvic pressure	___	___	…………………..
Pain when urinating	___	___	…………………..
Abdominal pain	___	___	…………………..

APPENDIX III: CLINICAL RECORD FORM

MOTHER

Participants study number…….................

Age………. (years)

Pre-pregnancy weight………. (kg)

Weight ………… (kg)

Height ….................

Weight gain during pregnancy…………. (kg)

Did the mother suffer from any vaginal infections during pregnancy…………………

Did mother suffer from urinary tract infections during pregnancy………………..

Syphilis infection…………………..

Chronic illnesses present in the mother………………………………..

HIV status…………………

Any complications that could have affected the pregnancy…………………

Birth status; singleton birth ( )   multiple birth ( )

INFANT

Baby's gestational age at birth………………………

Baby's status at birth; low birth weight ( )   normal birth weight ( )

Baby's health status;   healthy ( )   not healthy ( )

Baby discharged; Alive ( )   Dead ( )

Complication present in baby………………………………………..

Any other complication present in baby……………………………..

If multiple birth, complication in second twin ……………………

APPENDIX IV: KEMRI SCIENTIFIC STEERING COMMITTEE (SSC) APPROVAL LETTER

KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840 - 00200 NAIROBI, Kenya
Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@kemri.org info@kemri.org Website:www.kemri.org

ESACIPAC/SSC/6888   23rd September, 2010

Grace K. Mogire

Thro'

    Director, CPHR
    NAIROBI

Forwarded

24/09/2010

REF: SSC No.1870 (Revised) - Factors associated with low birth weight in
Pumwani maternity Hospital, Nairobi-Kenya.PI: Grace K. Mogire
(CPHR)

I am pleased to inform you that the above-mentioned proposal, in which you are
the PI, was discussed by the KEMRI Scientific Steering Committee (SSC), during
its **171st meeting** held on **7th September, 2010** and has since been approved for
implementation by the SSC.

The SSC however, advises that work on this project can only start when ERC
approval is received.

for

Sammy Njenga, PhD
SECRETARY, SSC

24 SEP 2010

In Search of Better Health

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APPENDIX V: KEMRI ETHICAL REVIEW COMMITTEE (ERC) APPROVAL LETTER

KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840 - 00200 NAIROBI, Kenya
Tel: (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@kemri.org info@kemri.org Website:www.kemri.org

KEMRI/RES/7/3/1   30th November, 2010

TO: MS. GRACE K. MOGIRE,
            PRINCIPAL INVESTIGATOR

THRO':   DR. YERI KOMBE,
            THE DIRECTOR, CPHR,
            NAIROBI

RE: SSC PROTOCOL NO. 1870 (*RE- SUBMISSION*): FACTORS
            ASSOCIATED WITH LOW BIRTH WEIGHT DELIVERIES IN
            PUMWANI MATERNITY HOSPITAL, NAIROBI KENYA.

Make reference to your letter dated 25th November, 2010 received on 26th November, 2010. Thank you for your response to the issues raised by the Committee. This is to inform you that the issues raised during the 183rd meeting of KEMRI/National Ethical Review Committee held on 19th October, 2010, have been adequately addressed.

Due consideration has been given to ethical issues and the study is hereby granted approval for implementation effective this **30th day of November 2010,** for a period of twelve (12) months.

Please note that authorization to conduct this study will automatically expire on **29th November 2011.** If you plan to continue with data collection or analysis beyond this date, please submit an application for continuing approval to the ERC Secretariat by **15th October 2011**.

You are required to submit any amendments to this protocol and other information pertinent to human participation in this study to the ERC prior to initiation. You may embark on the study.

Yours sincerely,

R. C. KITHINJI,
FOR: SECRETARY,
KEMRI/NATIONAL ETHICS REVIEW COMMITTEE

In Search of Better Health

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APPENDIX VI: PUMWANI MATERNITY HOSPITAL RESEARCH AND ETHICS APPROVAL LETTER

PUMWANI MATERNITY HOSPITAL

Tel: 02/6763291– 4
Fax: 02/6762965

P.O. Box 42849
Code: 00100- GPO

PMH/DMOH/45(A)35/2010

10TH SEPTEMBER 2010

TO:

GRACE KWAMBOKA MORIGE
P.O. BOX
N A I R O B I.

RE: APPROVAL FOR RESEARCH ENATITLED "FACTORS ASSOCIATED WITH LOW BIRTH WIEGHT IN PUMWANI MATERNITY HOSPITAL NAIROBI KENYA"

This is to inform you that the Pumwani maternity hospital research and ethics committee has approved your research proposal.

On behalf of the committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

Yours Sincerely

PUMWANI MATERNITY
HOSPITAL
P. O. Box 42849-00100, NAIROBI.
TEL. NRB. 6763291-4/ 6762965

DR. F. GOVEDI
MEDICAL SUPERINTENDENT