

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF ALLIED HEALTH SCIENCES
DEPARTMENT OF NURSING AND MIDWIFERY

DETERMINANTS OF LOW BIRTH WEIGHT IN DEBRE BEREHAN
REFERAL HOSPITAL, NORTH SHOA ZONE, AMHARA REGIONAL STATE,
ETHIOPIA (A CASE – CONTROL STUDY)

BY: LEMA DESALEGN (Bsc, RN)

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF
ADDIS ABABA UNIVERSITY, DEPARTMENT OF NURSING AND
MIDWIFERY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE
DEGREE OF MASTERS IN PEDIATRICS AND CHILD HEALTH NURSING

JUNE 2015

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APPROVAL BY THE BOARD OF EXAMINER

This thesis by _____ is accepted by the Board of examination as satisfying thesis requirement for the degree of Master of Science in child health nursing.

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Abstract

Introduction: Low birth weight is defined as birth weight less than 2,500 grams. More than 20 million infants are born each year weighing less than 2500 gm, accounting for 17% of all births in the developing world. Similarly, according to Ethiopian demographic and health survey (EDHS 2011), 11% weighed less than 2500 gm. Birth weight plays an important role in infant mortality and morbidity, development, and future health of the child. Weight at birth is directly influenced by general level of health status of the mother.

Objectives: The main objective of the study is to identify determinants of low birth weight in Debre Berehan Referral hospital.

Methodology: The study was a facility based unmatched case-control study design conducted by reviewing cards of mothers and neonates who delivered in Debre Berehan Referral hospital just three years back from study period (February to June 2015). Data analysis was done by SPSS version 20 and bivariate and multivariate statistical methods were used.

RESULT: In this study 441 mothers and newborns cards were included yielding 100 % response rate. From this 147 mothers and newborn cards were selected for case group and 294 mothers and newborn cards were selected for control group .The mean birth weight was 2077.55gm (S.D $\pm$ 325.78 gm) for the neonates with low birth weight and 3230.0 (S.D $\pm$ 449.73 gm) for the neonates with normal birth weight. Out of 441 mothers in both case and control groups, most of them were between the age group of 21-25 years, which is 39.5% and 36.1% for case group and control group, respectively. Those newborns with gestational age less than 37 weeks were 4 times (AOR=4, 95%CI (1.61,8.13) p-value =0.0001) more likely to be delivered low birth weight than those new born greater than or equal to 37 weeks of gestation. So, significant association is found between gestational age and BW. Pregnancy induced hypertension (AOR =3.415, 95% CI (0.855, 13.645 p-value 0.047) have significant association. Another variable that have significant association with BW is hemoglobin level (AOR 1.0, 95% CI (1.0, 1.0) p-value =0.045).

Conclusion: According to the findings of this study the determinant factors for LBW are: Gestational age less than 37 weeks, hemoglobin level of the blood, PIH. So that interventions to prevent pre term, control blood hemoglobin level of the mothers, prevent anemia and prevent hypertension are important to manage LBW.

Key words: low birth weight, maternal factors, case control, Debre Berehan.

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List of Abbreviations

AOR:	Adjusted odds ratio
ANC:	antenatal care
BW:	birth weigh
CI:	confidence interval
COR:	crude odds ratio
CS:	cesarean section
DM:	diabetes mellitus
EDHS:	Ethiopia demographic and health survey
HIV:	human immunodeficiency virus
IOM:	institute of medicine
IUGR:	intrauterine growth retardation
LBW:	Low birth weight
MUAC:	mid upper arm circumference
NBW:	normal birth weight
OR:	odds ratio
PIH:	pregnancy induced hypertension
RCT:	random control trial
RPC:	Research and publication Committee
SGA:	small-for-gestational age
S.D:	standard deviation
UNICEF:	United Nations Children's Fund
UTI	urinary tract infection
VLBW:	very low birth weight
WHO:	World Health Organization

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CHAPTER ONE

INTRODUCTION

Background of the Study

Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams (1). This is based on epidemiological observations that infants weighing less than 2,500 g were approximately 20 times more likely to die than heavier babies. More commonly, in developing than developed countries, a birth weight below 2,500 g contributes to several poor health outcomes.

Birth weight is affected to a great extent by the mother's own fetal growth and her diet from birth to pregnancy, and thus, her body composition at conception (1). Mothers in deprived socio-economic conditions frequently have low birth weight infants. In those settings, the infant's low birth weight emerges primarily from the mother's poor nutrition and health over a long period of time. During pregnancy, the higher prevalence of specific and non-specific infections, or from pregnancy complications, underpinned by poverty aggravates the situation. Physically demanding work during pregnancy also contributes to poor fetal growth.

Several studies indicate that a baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or of restricted fetal (intrauterine) growth (1). Many factors affect the duration of gestation and of fetal growth, and thus, the birth weight. They are related either to the infant, or to the mother. The physical environment also plays an important role in determining the infant's birth weight and future health status.

The United Nations Children's Fund (UNICEF) report noted that, the global LBW rate was 15.5% and more than 95% of these LBW infants lived in developing countries (1). More than 20 million infants are born each year weighing less than 2500 gm, accounting for 17 percent of all births in the developing world (3). There is a strong consensus that birth weight plays an important role in infant mortality, morbidity, development, and future health of the child. Particularly, low birth weight is a most significant risk factor for adverse health outcomes including common childhood diseases. The association between LBW and a greatly elevated risk of infant mortality and other physical and neurological impairments are well established fact.

Demographic risk factors include young maternal age, primi-parity and low education level and poor maternal nutritional status –both before and during pregnancy—are well-recognized determinants of birth outcomes. Empirical studies from developed and developing countries show that maternal anthropometric measurements are associated with birth outcome (i.e. LBW) (4).

A recent study indicates the incidence of LBW to be 13% in Ethiopia. Consistently, another study from Jimma reported a prevalence of 11.8%. At a regional level, for East Africa, estimates indicate 13 % prevalence. The same estimate for Africa indicates up to 15% prevalence of LBW (5). It was established that early delivery and retarded fetal growth to be the major reason to the cause of low birth weight. Thus, the discussion about the cause and epidemiology of LBW should focus around risk factors that shorten the gestation's age and those that influence this.

World Health Organization (WHO) shows that factors contributing to LBW in developing countries include, in order of importance; inadequate weight gain during pregnancy, low pre pregnancy weight, short stature, malaria and female sex of the fetus (6). Other factors which are associated with LBW include hard physical work during pregnancy, and illness, especially infections, social factors such as lower status of women, malnutrition, lack of antenatal care (ANC) etc. Mothers who had multiple gestations had a higher risk of delivering LBW babies.

According to UNICEF statistics, the global rate of LBW is 17%, out of which 6% is observed in industrialized countries and 21% in developing (7); LBW is caused by preterm birth and intrauterine growth retardation (IUGR) or both. The predominant cause of LBW in the developed countries is pre term birth, whereas in developing countries, it is frequently caused by IUGR (7).

In Ethiopia, studies showed that the prevalence of LBW varies from 6-10 %. Another retrospective study conducted to establish BW changes at Tikur Anbessa Hospital showed that LBW has increased trend between 1976 and 1996 (8). According to the 2005/06 annual activity report of the Addis Ababa City Administration, Health Bureau, the rate of LBW among all deliveries attended from health institutions reporting to the city health bureau is 11%.

Statement of the problem

More than 20 million infants worldwide, representing 15.5 percent of all births, are born with low birth weight, 95.6 percent of them in developing countries (1). The level of low birth weight in developing countries (16.5 percent) is more than double the level in developed regions (7 percent). Half of all low birth weight babies are born in South-central Asia, where more than a quarter (27 percent) of all infants weighs less than 2,500 gm at birth. A low birth weight level in sub-Saharan Africa is around 15 percent (1). Central and South America have, on average, much lower rates (10 percent), while in the Caribbean the level (14 percent) is almost as high as in sub-Saharan Africa. About 10 percent of births in Oceania are low birth weight births.

The WHO country cooperation strategy 2008 – 2011 showed that the prevalence of low birth weight in Ethiopia, estimated that 14%, it is one of the highest in the world (9,10).

Low birth weight, thus defines a heterogeneous group of infants: some are born early, some are born growth restricted, and others are born both early and growth restricted (1). It is generally recognized that being born with low birth weight is a disadvantage for the baby. Short gestation (preterm birth) is the main cause of death, morbidity and disability. The shorter the gestation, the smaller the baby and the higher the risk of death, morbidity and disability. It has been shown that the mortality range can vary 100-fold across the spectrum of birth weight and rises continuously with decreasing weight.

Low birth weight due to restricted fetal growth affects the person throughout life and is associated with poor growth in childhood and a higher incidence of adult diseases, such as type 2 diabetes, hypertension and cardiovascular disease (1). An additional risk for girls is having smaller babies when they become mothers.

Birth weight has a significant impact on newborn mortality. Low birth weight (LBW) increases the risk of neonatal deaths and further increases the likelihood of developing cerebral palsy and the risk of infection (sepsis) (11). As adults, these LBW infants may continue to be lower in weight and shorter in stature in comparison to population averages. LBW is also associated with the development of chronic diseases such as hypertension, cardiovascular diseases, type II diabetes, metabolic syndrome, ischemic heart disease, decreased lung capacity and chronic lung disease.

Deliveries in low and middle income countries are often complicated by adverse birth outcomes such as stillbirth, early neonatal mortality and morbidity. Low birth weight (LBW) remains to be a leading cause of neonatal death, and is a major contributor to infant and under-five mortality (8). Infants weighing less than 2,500 gm at birth are regarded as LBW infants. LBW is associated with early and late morbid conditions such as coronary heart disease, non-insulin dependent diabetes, childhood hypertension, behavioral disorders, impaired cognitive function, psychological disorders, and these usually have long-term financial burden. Infants can have LBW either as a result of small-for-gestational age (SGA) or preterm delivery (12, 13). An infant is said to be small-for gestational-age when the gender-specific birth weight is below the 10th percentile for the appropriate gestational age; such a condition could be constitutional or pathological, in the latter case, it is referred to as Intrauterine Growth Retardation (IUGR) (12, 13).

LBW is a leading cause of neonatal mortality (14). It is now also incriminated in the occurrence of many chronic diseases in adult life time; these include adult-onset diabetes, coronary heart disease, and high blood pressure, intellectual, physical and sensory disabilities (15). However, little attention is paid to birth weight improvement as a means of reducing child mortality. In most developing countries, it was approximated that every ten seconds an infant dies from a disease or infection that can be attributed to LBW (16). Those who had a history of very low birth weight (VLBW) are 2.6 times at risk of respiratory failure requiring mechanical ventilation (17, 8).

Although about one-half of all LBW infants in industrialized countries are born preterm (<37 weeks of gestation), most LBW infants in developing countries are born at term and are affected by intrauterine growth restriction that may begin early during pregnancy (18,8) . As children, LBW infants are more likely to have disabilities, hospitalizations, brain damage, and poorer language development, be placed in special education classes, and display more intellectual impairments. Across the world neonatal mortality is 20 times more likely for LBW babies compared to heavier babies (>2500gm) and it increases sharply as birth weight (BW) decreases (19,8) .

According to the World Health Organization (WHO) definition, infants with birth weight less than 2500 gm are low birth weight (LBW). Out of 121 million births in a year 23 million has

LBW and high proportion of whom are found in developing countries (20). Birth weight is an important indicator of health status of an infant and is a principal factor that determines the infant's, physical, survival and mental growth. It also indicates past and present health status of the mother (21). LBW is considered as the single most important predictor of infant mortality, especially of deaths within the first months of life (22, 10). It is also a significant determinant of infant and childhood morbidity, particularly of neurodevelopment impairment such as mental retardation and learning disability. Half of all prenatal and one third of all infant deaths are directly or indirectly related to LBW. Mortality of LBW babies is 40 times more than the normal weight babies. Infants born with very low weight are more than 100 times more likely to die in the first year of life than are infants of normal birth weight (22, 10).

To the investigator's knowledge in north showa zone, no study has yet been done to identify risk factors associated with LBW following case control method. So that this study aims to identify determinant factors for LBW.

Significance of the Study

The result of this study serves as a baseline for other wide studies as well as for planning health intervention to improve the wellbeing of children and women in North Showa zone, Debre Berehan town in particular.

Due to lack of such studies in the Zone this study has been conducted to identify socio-demographic and other maternal factors which may be the cause for LBW and contributing to infant mortality in the Zone.

Greater knowledge about the socioeconomic determinants of LBW could lead to a better evidence based interventions in Ethiopia aimed at reducing neonatal mortality.

This study provides valuable information to the health professionals, researchers, regional health bureau and other stakeholders. By using this study the above professional plan their resource for interventions and for researchers used this research result as a baseline for future studies.

CHAPTER TWO

Literature Review

Magnitude of LBW

The study done in India shows that the majority (89%) of neonates had normal birth weight and eleven percent of them belonged to the low birth weight category. 46% males and 43% females had normal birth weight, whereas 5% males and 6% females had low birth weight(4).

Survey conducted in Jimma hospital showed that out of a total of One thousand four hundred and forty one live births One hundred forty seven (10.2%) mothers gave birth to LBW babies (5). Five (0.4%) mothers gave birth to twins (5). The study subjects with babies of LBW and NBW accounted to 25% and 75%, respectively (5).

A study done in Mekele university showed that 135 (75%) mothers gave birth to LBW and 45 (25%) gave birth to VLBW babies whereby the mean BW was $1.8 \pm 0.46\text{kg}$ within a range of 0.7-2.4 kg (8).

EDHS 2011 data shows that among children born in the five years before the survey with a reported birth weight, 11 percent weighed less than 2.5 kilograms (23). As noted, a mother's subjective assessment of the size of the baby at birth, in the absence of birth weight, may be useful. Mothers reported 21 percent of all live births in the five years preceding the survey to be very small and 9 percent as smaller than average (23). Nearly three children of every ten born to mothers residing in Affar (30 percent), Amhara (28 percent), Somali (26 percent), and Gambela (27 percent) were reported as very small at birth (23).

Another study in Gondar shows that the prevalence of low birth weight was found to be 17.4% (22.7% female and 13.5% male) (10).

Determinants of LBW

Infant sex

Survey conducted in Jimma hospital showed that there were 316(53.7%) males making a male to female ratio of 1.2:1. A Chi-square test gave no significant association of sex with LBW ($p>0.05$). Tests of strength of any association using other tests also indicated no association between sex and LBW ($V= 0.06$) (5).

A study done in Mekele university showed that 128 (71.1%) of new born babies with LBW were females (8). The result of this study indicated that there was statistically significant association between baby sex and BW that is; female newborn babies had a lower BW (1.74 ± 0.44) than male babies (1.95 ± 0.48)(8).

Another study in Gondar showed that Sex of the infant was significantly associated with birth weight; being female has two fold risks for low birth weight. (AOR= 2.1, 95%CI 1.18, 3.76)(10).

Maternal Height

The finding from India study showed that 43% of subjects' heights were in the range between 156 -162 cm (4). It is clear from this study that taller pregnant women (taller than 162 cm) gave birth to significantly heavier babies (3.6 kg) than shorter women (4).

Utilizing the knowledge from Donnelley, et al (24) maternal height of 150 cm or less was taken to constitute a risk factor to LBW. The Chi-square test on Jimma hospital study showed that (height and LBW) gave a significant association ($p<0.005$). Other tests also confirm this ($V= 0.328$) and the estimated odds ratio =0.98 ($0.64<OR< 1.50$)(5). Mothers of cases are shorter than controls (5).

Maternal pre-pregnancy weight

The study from India showed that Pregnant women who weighed less than 60 kg gave birth to neonates with the mean birth weight of 2.7 kg, while subjects who weighed more than 75 kg gave birth to heavier neonates (3.6 kg)(4).

Maternal age

Survey conducted in Jimma hospital showed that the age of most of the mothers in both groups lies between the age group of 25-29 years, which is 18.4% and 35.8% for LBW and NBW, respectively (5). But this study showed that mothers of cases of LBW are older than control mothers (5).

It is evident from India study that as maternal age increased from 20 to 36, the birth weight increased from 2.9 to 3.4 kg (4).

A study done in Mekele showed that the Chi-square test gave significant statistical association ($p = 0.0001$) between age of the mothers and birth weight. When Phi and Creamer's measures were applied to determine the strength of this association, a V value of -0.007 was obtained which was not conclusive. But a proportion of LBW was highest (42%) among mothers ≥ 35 years (8). There was statistically significant association between the age of the mothers and mean BW ($F=122.08$, $p=0.0001$) (8). Mothers who belong to the age category of 15-19 years had babies weighing 1.41 ± 0.47 kg. Whereas mothers in the range of 20-34 years old gave birth to babies weighing 2.14 ± 0.15 kg (8).

EDHS 2011 data shows that Low birth weight is more common among children of the youngest mothers, age less than 20 (13 percent) and older mothers, age 35-49 (17 percent) (23). Children born to very young mothers (<20 years) were the most likely to be reported as very small (23).

Socioeconomic status

The study from India showed that Subjects who had an income of less than 2.5 million in Rials per month gave birth to neonates with the mean birth weight of 2.9 kg, while pregnant women with > 3.5 million in Rials per month gave birth to neonates with the mean birth weight of 3.6

kg.(5). Different levels of education in pregnant women showed no significant influence on the birth weight of babies (4).

A study done in Mekele showed that Chi-square test gave no significant statistical association ($p > 0.05$) between maternal education and LBW. The Odd ratio was estimated as 0.81 with 95% confidence limits, which confirms there are significant associations (8).

EDHS 2011 data shows that children of mothers with no education were the most likely to be reported as very small (23). Children born to mothers in the lowest wealth quintile were the most likely to be reported as very small (23).

Marital status

A study done in Mekele showed that there was a mean BW difference among mothers of different marital status, ethnicity and religion, BW was not found to be statistically significant with the variables as supported by Turkey's test (8).

Fundal height

The study from India showed that fifty eight percent of subjects had fundal heights between 34 - 36 cm (4). Pregnant women with higher levels of fundal height (34-36 cm) at the end of the third trimester gave birth to neonates with significantly heavier birth weights (4).

Parity

The study from India showed that pregnant women who were pregnant for the second and third time gave birth to neonates with the mean birth weight of 3.5 kg, while women with first gravida gave birth to neonates with 2.9 kg (4).

Survey conducted in Jimma hospital showed that the higher the parity, the lesser the chance of having LBW baby (5). The examination in the trend of proportion of LBW decreases from 0.05 to 0.1 as one move from one parity to a higher one (the mothers of cases are less parous than controls) indicating a negative association between LBW and parity (5).

A study done in Mekele shows that on reproductive characteristics the finding indicated that 80(44.4%) of the mothers were primi-parous (8). A Significant association was found between

parity and BW; thus primi-para mothers had babies with mean BW of 1.41 ± 0.41 as compared to grand multi-parous which is 2.17 ± 0.18 (130.12, $P=0.0001$) (8).

Birth or pregnancy interval

A study done in Mekele showed that Seventy seven (42.8%) of the index baby belongs to the first birth order (8). BW was directly proportional to birth order and the association was found to be statistically significant ($F=89.24$, $P=0.0001$) (8).

EDHS 2011 data showed that children of birth order six and above (16 percent) and first-order births were the most likely to be reported as very small (23).

Intrauterine growth and gestational duration in prior pregnancies

Survey conducted in Jimma hospital shows that Fifty two (51.0%) of these babies were born below 37 completed weeks of gestation (pre-term), 32(31.4%) were considered small for date and 18(17.6%) were above 42 completed weeks of gestation (post-term) making the incidence rate of low birth weight to be 11.02% (5).

A study done in Mekele shows that Most (61.1%) of the mothers had given birth before they became a term (8). Significant association was also found between gestational age and BW ($t=7.76$, $P=0.0001$). The mean BW of preterm babies was (1.62 ± 0.47 kg), however, the BW for term babies was (2.09 ± 0.27 kg) (8).

Another study in Gondar shows that the mean gestational age of the newborns was 39.49 ± 1.53 weeks with minimum 31 and maximum 44 weeks (10). Out of the 540 newborn 516(95.5%) was delivered at greater than or equal to 37 weeks gestation. Of the total under weight babies 76 (14.7%) were term small-for gestational age infants and 18 (75%) preterm were low birth weight. Those newborns with gestational age less than 37 weeks were 18 times ($AOR=18$, 95%CI 5.84,31.2) more likely to be delivered low birth weight than those new born greater than or equal to 37 weeks of gestation(10) .

Prior spontaneous abortion

A study done in Mekele showed that Forty one (22.8%) of the mothers had a history of abortion and out of the mother who had abortions, 39.0 % of them had a history of repeated abortion (8). Mothers who had not history of abortion gave birth to babies with higher BW (2.11+0.16 kg) than mothers who had a history of abortion (1.70+0.48). This was also found to be significant at a P value of 0.0001. However, the number of abortion and BW was not found to be statistically significant (P- value = 0. 67)(8).

Gestational weight gain

The study from India showed that the majority of pregnant women (68%) weighed more than 65 kg, and 48% had normal gestational weight gain with reference to IOM guidelines (18). Women with normal weight gain gave birth to babies with the mean birth weight of 3.3 kg, while pregnant women with low gestational weight gain gave birth to babies with the mean birth weight of 2.5 kg (4).

The study from India shows that the majority of subjects (63%) had hemoglobin levels greater than 11 g/dl, which is considered normal as per WHO standards (4). Pregnant women with hemoglobin levels less than 9 g/dl, which is considered anemic, gave birth to neonates with low birth weights, while pregnant women with higher hemoglobin levels (> 11 g/dl), who were considered normal, gave birth to heavier and normal babies (3.5 kg)(4).

Another study in Gondar shows that regardless of anemia of the mothers 112 (20.7%) were screened. Out of them 17 (15.17%) were anemic (10).

Maternal morbidity during pregnancy

Survey conducted in Jimma hospital showed that Thirty (20.4%) of mothers with LBW had clinical diagnosis of malaria as compared to 12.4% among those with NBW (5).

Another study in Gondar shows that Malaria during pregnancy was also a risk factor for low birth weight. Those women attacked by malaria during pregnancy were 5 times (AOR=4.9, 95%CI= 1.95, 12.32) more likely to deliver low birth weight baby than their counterparts (10).

Survey conducted in Jimma hospital showed that Fifteen (10.2%) of LBW mothers had pre-eclampsia toxemia as against less than 2% among mothers with NBW. As shown from the result greater proportion of mothers with LBW (20.4%) had these complications and other complications as compared to mothers who had NBW. About 53% of mothers with LBW babies had one kind of complication during pregnancy, when compared to only 21.5% for mothers with NBW. When all kinds of complications are grouped together and tested for association between LBW and maternal complication all the measures indicated statistically significant association ($V=0.34$) (5).

Another study in Gondar show that Out of 540 women 499(92.4%) were tested for HIV infection and 28(5.6%) were positive for the infection. Out of the 540 mother 27(5%) were have UTI (10). Those women with PIH were 9 times ($AOR=9.23$, $95\%CI= 3.36, 25.36$) more likely to deliver low birth weight baby than those women without PIH (10).

Antenatal care

Survey conducted in Jimma hospital showed that the time when subjects visited antenatal clinic (1st, 2nd or 3rd trimester) was recorded to determine whether or not the time of the visit has any effect on LBW. Chi-square test gave a significant statistical association ($p < 0.0001$). Creamers V measure was relatively high ($V= 0.51$). Mothers who commenced ANC in the third {84(57.1%)} and second trimester {46(31.3%)} have highest number of LBW babies; the least 17(11.6%) was among those mothers who commenced ANC in early pregnancy, that is the controls attended ANC more than cases (5).

A study done in Mekele showed that Mothers who had ever attended ANC follow up gave birth to babies with higher mean BW (2.16 ± 0.14) than the mothers who had never attended (1.45 ± 0.42) and this was statistically significant at a P value of 0.001(8).

Another study in Gondar show that Four hundred eighty five (89.8%) mothers have ANC follow up during the course of pregnancy (10). Three hundred twenty four (66.8%) have four and above antenatal care visit during their pregnancy (10).

Overall, pregnant women who gave birth to LBW babies had significantly lower age, parity, family income, height, weight, fundal height, gestational weight gain and hemoglobin levels than

women who gave birth to neonates with normal birth weight. Thus the results of the study revealed that age, parity, family income, height, fundal height, weight, gestational weight gain and hemoglobin levels influenced the birth weight of the neonates (4).

A case control study done in Addis Ababa in public health facilities showed that mean birth weight was 2199.5gm (S.D $\pm$ 252.79) for the neonates with low birth weight and 3230.0 (S.D $\pm$ 449.73) for the neonates with normal birth weight (25). According to the findings of this study the determinant factors for term LBW are: Gestational weight gain of less than 8Kg , Maternal height of less than 155cm , Maternal MUAC of less than 23cm , Not taking antenatal iron & folic acid supplementation , ANC visits of three or less , Experiencing antenatal intimate partner violence and Experiencing antenatal depression of any grade(25).

When we see factors associated with low birth weight on Gondar study shows that the covariates pregnancy induced hypertension, malaria attack during pregnancy, being female sex and gestational age less than 37 week was found to be significantly associated with low birth weight in multiple logistic regression analysis (10).

Conceptual Framework

This frame work was developed by the researcher by reviewing different literatures and books. It describe that the proximal factors are more determinant than distal factors. Due to lack of data from birth cards the investigator only focus on available ones i,e age of the mother, gravidity, parity, gestational age ,abortion , complications during pregnancy, maternal morbidity, ANC visit, iron supplementation, hemoglobin level.

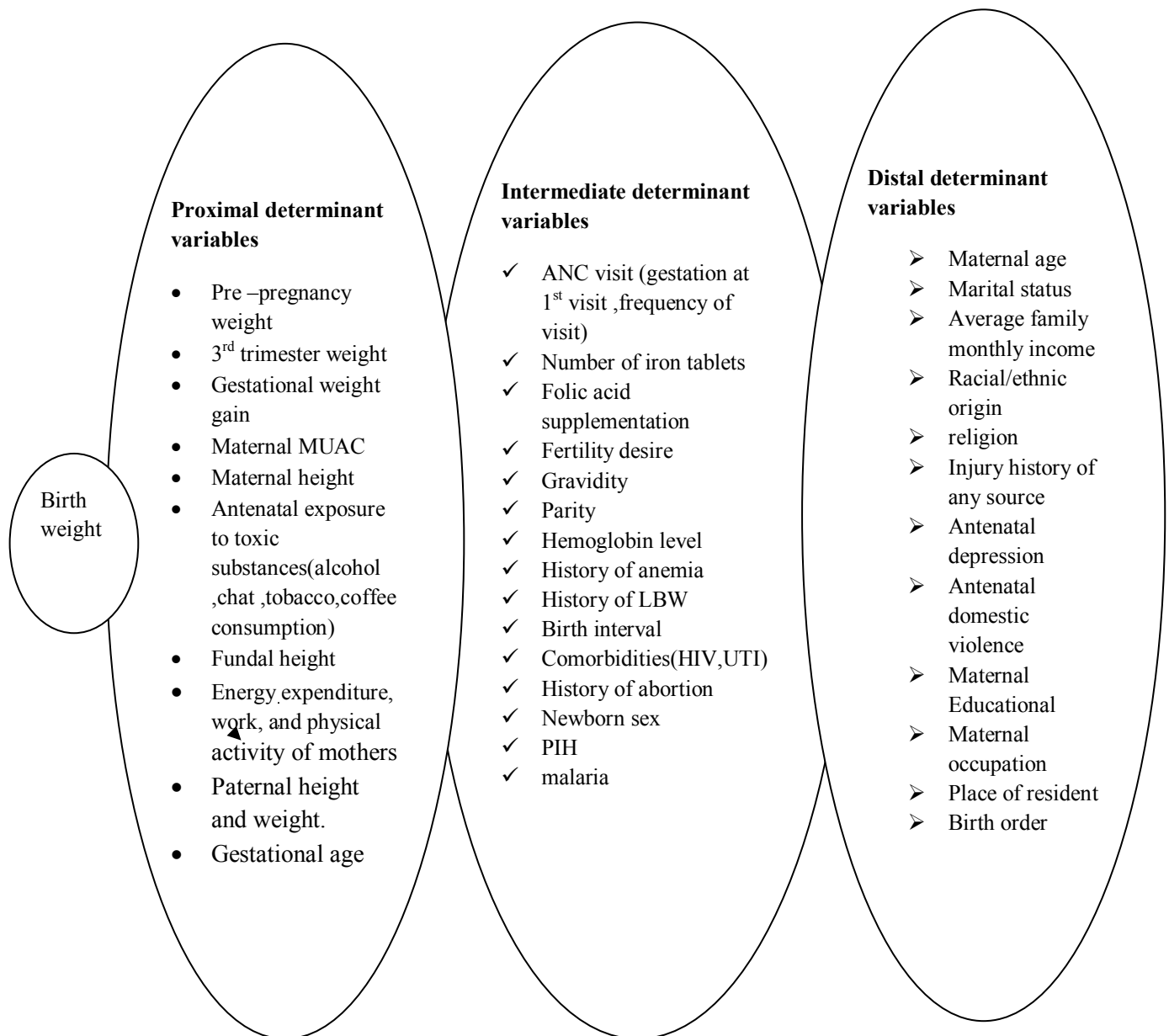


Figure: 1 conceptual framework on maternal risk factors associated with low birth weight (develop by the author after reviewing various literatures)

CHAPTER THREE

OBJECTIVES

General Objective

To assess the determinant factors associated with low birth weight neonates in Debre Berehan Referral hospital from April to June 2015.

Specific Objectives

The specific objectives of this study are,

1. To identify the relation between pregnancies related complication and LBW.
2. To identify the effect of maternal hemoglobin status (anemia) on LBW.
3. To identify the effect of maternal obstetric and gynecological status (parity, gravidity, abortion, mode of delivery) on Birth Weight.

CHAPTER FOUR

Methods and Materials

Study Design

The study was a facility based unmatched case-control study design conducted among women delivered in Debre Berehan Referral hospital just three year back from study period to assess determinates of LBW from May 1, 2012 to May 1, 2015.

Study area and study period

The study was conducted in area known as Debre Berehan. The town is one of the administrative towns in Ethiopia, Amhara region, which is the capital city of North Showa zone and it is located 130 kilometers from Addis Ababa to the North East. The town has 9 kebeles with total population of 94,829; out of this 50.8% are females. In the town there are about 22 health institutions, two hospitals (one private and one referral governmental hospital), 3 health centers, and 17 private clinics. The study was carried out in the Debre Berehan Referral hospitals from April to June, 2015.

Source Population

All mothers who delivered in Debre Berehan Referral hospital were the source population.

Study Population

The study population were the cards of those mothers who gave birth to a LBW (<2500 gm) neonate for the case group. For the control group the cards of those mother who gave birth to normal weight neonates.

Inclusion criteria and Exclusion criteria

Inclusion criteria

All birth cards (mother and neonate cards) with low birth weight and normal birth weight with no missing the most important information were included.

Exclusion criteria

The cards (mother and neonate cards) having incomplete information, multiple pregnancies and babies with congenital anomalies were excluded from the study

Sample size determination

Maternal age of <18, maternal height, gestational age and maternal weight during pregnancy were considered in order to calculate the required sample size. To calculate sample size all the above exposure variables were considered and maternal weight during pregnancy was chosen as an independent variable since it gives maximum sample size as compared to other exposure variables.

The sample size was determined using a formula for two population proportions and calculate by Open Epi version 2.3 statistical software package by considering that the percent of controls exposed (>60 kg) among the controls is 18% (main exposure variable), Percent of cases with exposure is 31.14% which is estimated from another study, 95% CI, 80% power of the study and control to case ratio of 1:2 with 2.06 odds ratio.

$$n1 = \left[z\alpha/2 \sqrt{\left(1 + \frac{1}{r}\right) p(1-p)} + z\beta \sqrt{p1(1-p1) + \frac{p2(1-p2)}{r}} \right]^2 / (p1 - p2)^2$$

Accordingly, after adding 10% for non-response rate 147 cases and 294 controls (a total sample size of 441) was planned to be involved in the study.

Sampling procedure

Consecutive sampling technique was used with the following steps. Birth cards of three year prior the study period were identified; cards with LBW were separated, and check for completeness of the necessary information. Incomplete birth cards, multiple pregnancies cards, cards revealing any congenital anomalies were excluded. The controls had been subsequent/consecutive two mothers who gave birth to a normal birth weight (≥ 2500 gm) neonate. All singleton alive newborns with mothers delivered in health institutions during the study period were included in the study. The data were collected by using structured checklist.

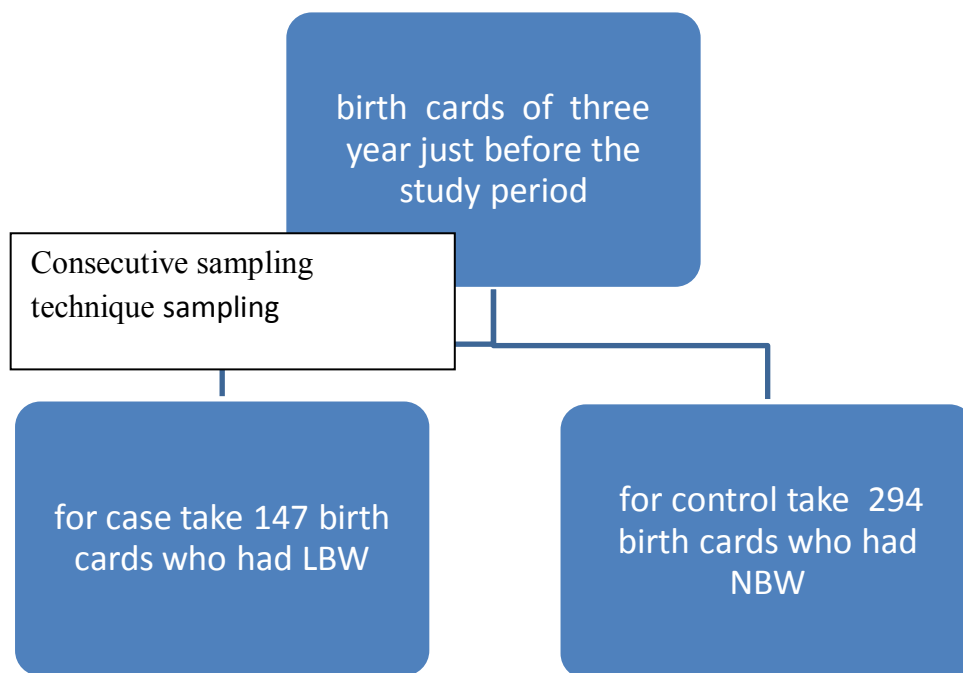


Figure: 2 Architecture of sampling procedure

Variables of the Study

Independent Variables

- Socio demographic characteristics, including newborn sex (Maternal age, family monthly income, Educational level, maternal occupation, religion, marital status ethnicity).
- Maternal and obstetrics characteristics(Pre –pregnancy weight , Maternal MUAC ,Maternal height ,maternal weight, Gravidity, Parity, Birth interval, History of abortion , Hemoglobin level ,gestational age at birth ,no of ANC follow up).

Dependent Variables

- Birth weight

Operational Definition

Birth weight: is the first weight of the fetus or newborn obtained after birth. Measured within the first hour of life before significant postnatal weight loss has been occurred by using a standard weight scale.

Low birth weight: neonate birth weight less than 2,500 gm (up to and including 2,499 gm).

Very low birth weight: neonate birth weight less than 1,500 gm (up to and including 1,499 gm).

Extremely low birth weight: neonate birth weight less than 1,000 gm (up to and including 999 gm).

Case: those newborns who have birth weight less than 2500 gm.

Control: those newborns whose birth weight greater than or equal to 2500 gm.

Gravida: number of pregnancy

Para: number of live births

Data Collection

Data had been collected by record review using a structured and pre-tested checklist. Training was given for both data collectors and supervisors.

Three midwives were assigned to record the data and three BSC holder supervisors' midwives were assigned to supervise the data quality. However, every morning, the investigator had been gone to medical record unit of the hospital and examined the records of all birth cards that had been recorded completely. The weight of the newborns must be recorded on the cards. In this study, low birth weight was taken as infants with birth weight less than 2500gm.

Mothers who gave birth to LBW (n=147) babies were identified. For every LBW baby, two babies that were born with NBW (n=294) during the same period had been randomly selected from the records. The mother's record total of both (LBW and NBW) were recorded by using pre-tested and structured checklist. The estimated gestation age of the fetus in weeks at the time of antenatal visit and history of maternal complications during pregnancy were recorded on to the check list from the ANC records. The other maternal variables that had been collected include: age, parity, ANC attendance and complication during pregnancy.

Case records and the corresponding obstetric data sheets of selected subjects and controls were retrieved. Relevant information had been extracted from the records and these related to their socio-demographic characteristics, obstetrics history, antenatal complications, laboratory investigations and peri-natal outcome.

All information obtained had been collected on a data collection sheet designed for the study.

Data Analysis

Statistical package for social sciences (SPSS) software version 20.0 was used to process the data. The commonest test of association (X^2) to examine the association of LBW with each of the variables was considered. Crude odd ratios and crude OR were computed to assess the presence and degree of association between the variables. Logistic regression was used to assess the relative effect of independent variables on dependent variable.

Quality control measures

Data quality had been ensured during collection, coding, entry and analysis. Pre prepared Structured checklist was used. Training was given to the data collectors and supervisors to prevent any confusion and had a common understanding about the study. Each card was checked for its consistency, provision of full information and appropriate documentation. Supervision of data collectors included observation of how the data collectors were collected data had been done by supervisors. The data collectors were instructed to write cards number on the check list during the data collection so that any identified errors were traced back using the cards number. The filled checklist was checked for completeness by data collectors, supervisors and PI on a daily basis. Consequently, any problem encountered were discussed among the team and solved immediately.

Ethical considerations

Ethical clearance was obtained from the Addis Ababa University Department of Nursing and Midwifery, Research and Ethics publication Committee (RPC) to conduct the study. Further permission was obtained from Medical Director of Debre Berehan Referral Hospital and the department head of the obstetric ward for the utilization of the cards. Since the cards include the name of the mothers, confidentiality was maintained by making the data collectors aware not to record any identification information found on the card.

Pretest

Pretest was conducted on 21 mother cards (LBW and NBW) before the actual data collection that was 7 cases and 14 control cards. The cards that had been used for pretest were not included in the main study. Based on the pretest modification on logical sequence, simplicity, and clarity of checklist had been done.

CHAPTER FIVE

Results

Characteristics of the newborn

In this study 441 mothers and newborns cards were included yielding 100 % response rate. From this 147 mothers and newborn cards were selected for case group and 294 mothers and newborn cards were selected for control group .The mean birth weight was 2077.55gm (S.D $\pm$ 325.78 gm) for the neonates with low birth weight and 3230.0 (S.D $\pm$ 449.73 gm) for the neonates with normal birth weight.

The result also show that the number of VLBW (BW <1500gm) is 9(2%), the number of LBW (BW<2500 gm) is 138(31.3%) and the number of NBW is 294 (66.7%).

Determinants of LBW

Maternal age

Out of 147 case group mothers 19(12.9%) of them are in age group 15-20 years,58(39.5%) of them are in age group 21-25years, 40(27.2%) of them are in age group 26-30years, 16(10.9%) of them are in age group 31-35years,10(6.8%) of them are in age group 36-40years , 4(2.7%) of them are in age group 41-45years.

Out of 294 control group mothers 20(6.8%) of them are in age group 15-20 years,106(36.1%) of them are in age group 21-25years, 103(35%) of them are in age group 26-30years, 43(14.6%)of them are in age group 31-35years,20(6.8%) of them are in the age group 36-40years, 2(0.7%) of them are in the age group 41-45years.

Out of 441 mothers in both groups most of them lie between the age group of 21-25 years, which is 39.5% and 36.1% for case group and control group, respectively. As mothers age increases from 21 to 45 the number of cases and controls decreases. The minimum and maximum age of the mothers included in the study was 15 years and 42 years respectively in both groups (Table 1).

Table: 1 Distribution of mother's age among mothers with case and control group in Debre Berehan Referral hospital 2015,

Age of the mother	Case(N=147)		Control(N=294)	
	Freq	Percent	Freq	Percent
15-20	19	12.9	20	6.8
21-25	58	39.5	106	36.1
26-30	40	27.2	103	35
31-35	16	10.9	43	14.6
36-40	10	6.8	20	6.8
41-45	4	2.7	2	0.7

Gravidity

Out of 147 case group mothers 86 (58.5%) had gravida 1, 29(19.7%) had gravida 2, 13(8.8%) had gravida 3, 9 (6.1%) had gravida 4, 5(3.4%) had gravida 5 and 5(3.4%) had gravida 6 and above.

Out of 294 control group mothers 156(53.1%) had gravida 1, 73 (24.8) had gravida 2, 29(9.9%) had gravid 3, 13(4.4%) had gravida 4, 11(3.7%) had gravid 5, 12(4.1%) had gravid 6 and above.

Parity

Out of 147 case group mothers 90(61.2%) had 0 parity ,28(19%) had 1 parity ,13(8.8%) had 2 parity ,7(4.8%) had 3 parity ,5(3.4%) had 4 parity and 3(2.7%) had 5 and above parity.

Out of 294 control group mothers 172 (58.5%) had 0 parity, 61(20.7%) had 1 parity, 28(9.5%) had 2 parity, 12(4.1%) had 3 parity, 11(3.7%) had 4 parity and 10(3.4%) had 5 and above parity.

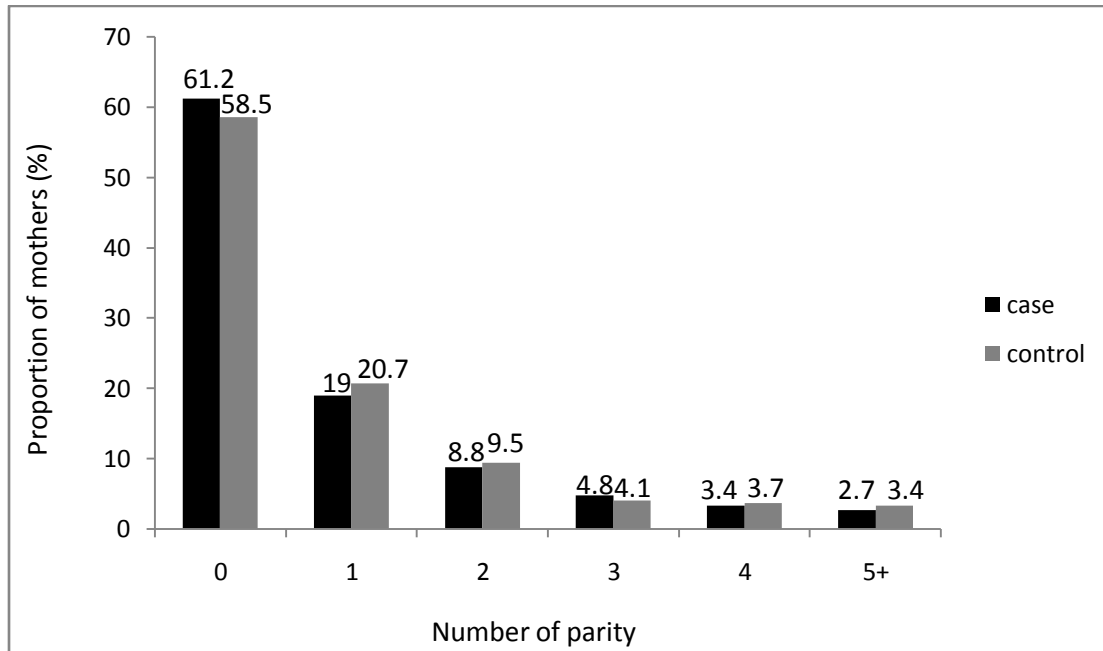


Figure: 3 comparison of number of parity in case and control group with percentage in Debre Berehan Referral hospital, 2015.

Gestational age

Out of 147 case group neonates 47(32%) are pre-term, 82(55.8%) are term, 4(2.7%) are post-term and 14(9.5%) are unknown. Out of 294 control group neonates 25(8.5%) of them are pre-term, 231(78.6%) of them are full term, 11(3.7%) are post-term and 27(9.2%) are unknown gestational age.

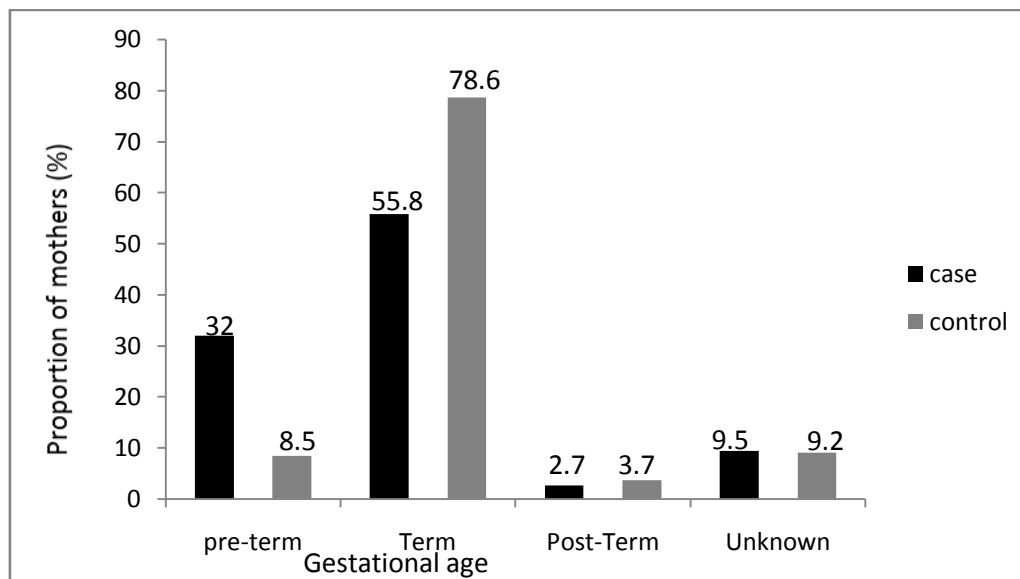


Figure: 4 Comparison of gestational age in case and control group with percentage in Debre Berehan Referral hospital, 2015.

History of abortion

From the total 147 case group mothers 10(6.8%) had history of abortion whereas 137(93.2%) had no any history of abortion. From total 294 control group mothers 21(7.1%) had history of abortion whereas 273(92.9%) had no history of abortion.

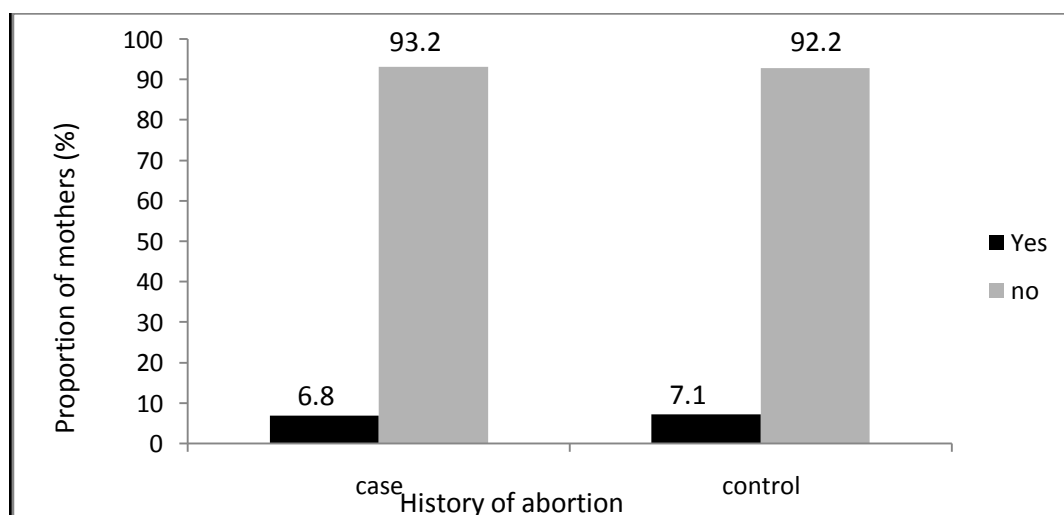


Figure: 5 Comparison of history of abortion in case and control group with percentage in Debre Berehan Referral hospital, 2015.

Signs of pregnancy complications

Some signs of pregnancy complications were not found in mother's card but as much as possible we try to include the available one. From the result we can see that 39(41.1%), 35(38.9%), 42(43.8%), 29(31.5%), 30(32.3%) and 26(28.6%) of the mothers had bleeding, gush, headache, blurred vision, fever and severe abdominal pain during pregnancy, respectively. whereas the remaining 56(58.9%), 55(61.1%), 54(56.3%), 63(68.5%), 63(67.7%) and 65(71.4%) had no bleeding, no gush, no headache, no blurred vision, no fever and no severe abdominal pain during pregnancy, respectively in case group.

And also 69(42.9%), 65(42.5%), 64(40%), 51(33.1%), 55(35.3%) and 49(31.8%) of the mothers had bleeding, gush, headache, blurred vision, fever and severe abdominal pain during pregnancy, respectively. whereas the remaining 92(57.1%), 88(57.5%), 96(60%), 103(66.9%), 101(64.7%) and 105(68.2%) had no bleeding, no gush, no headache, no blurred vision, no fever and no severe abdominal pain during pregnancy, respectively in control group.

Maternal morbidity

Out of 147 case group mothers 1(0.7%), 21(14.3%), 30(20.4%), 16(10.9%) and 29(19.7%) of them had Gestational DM, Type II DM, Anemia, PIH and Chronic hypertension in case group, respectively. whereas the remaining 146(99.3%), 126(85.7%), 117(79.6%), 131(89.1%), 118(80.3%) of them had no Gestational DM, no Type II DM, no Anemia, no PIH and no Chronic hypertension, respectively.

Out of 294 control group mothers 4(1.4%), 56(19.1%), 53(18%), 18(6.1%) and 55(18.7%) of them have Gestational diabetes mellitus (DM), Type II diabetes mellitus(DM), Anemia, pregnancy induced hypertension (PIH) and Chronic hypertension, respectively. whereas the remaining 290(98.6%), 237(80.9%), 241(82%), 276(93.9%) and 239(81.3%) of them have no Gestational DM, no Type II DM, no Anemia, no PIH and no Chronic hypertension, respectively.

ANC visit

From the total 147 case group mothers 93(63.3%) had no ANC visit ,13(8.8%) had 1 ANC visit ,15(10.2%) had 2 ANC visit , 20(13.6%) had 3 ANC visit and 6(4.1%) had 4 visit. From the total 294 control group mothers 187(63.7%) had no ANC visit, 18(6.1%) had 1 ANC visit, 21(7.1%) had 2 ANC visit, 52(17.7%) had 3 ANC visit and 16(5.4%) had 4 ANC visit.

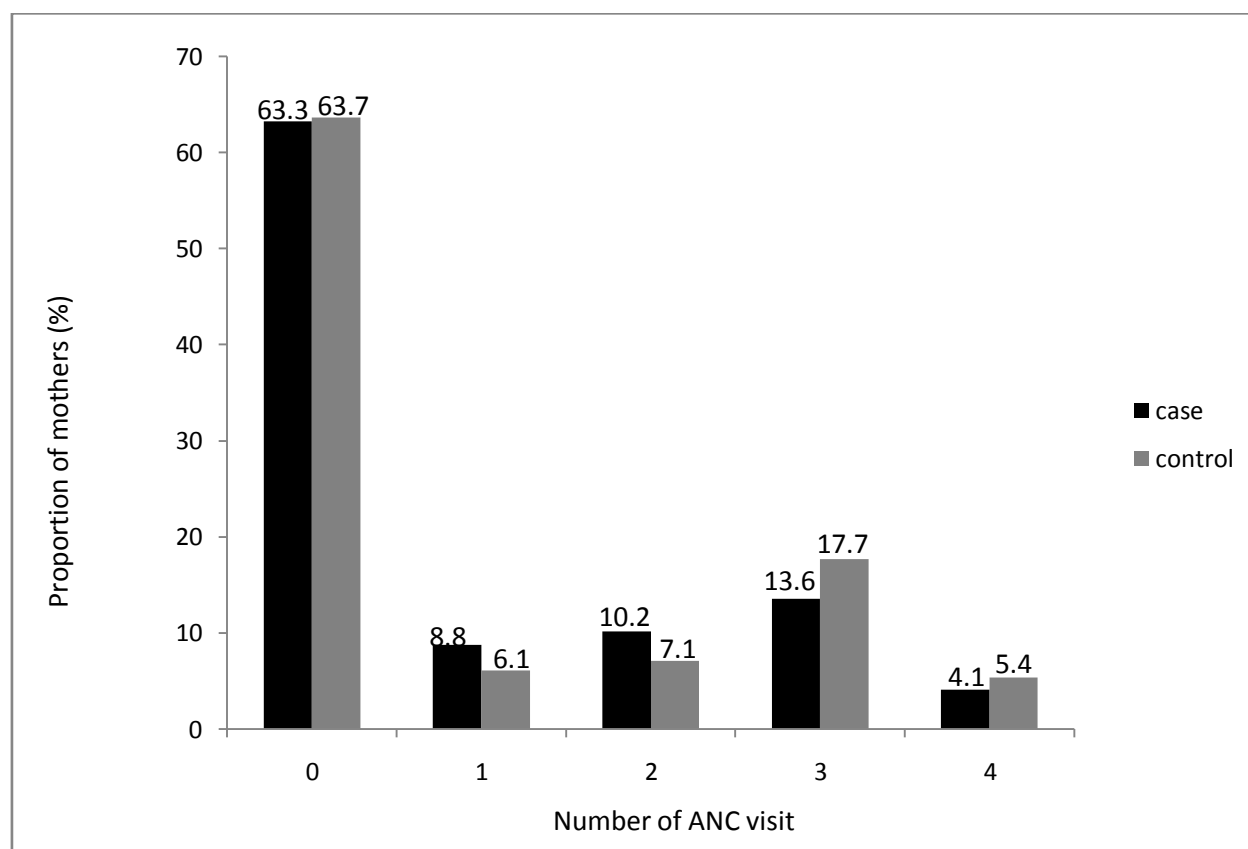


Figure: 6 Comparison of ANC visit for pregnant mothers with percentage in case and control group in Debre Berehan Referral hospital, 2015.

Iron supplementation

Out of 147 case group mothers 18(12.2%) had iron supplement during pregnancy whereas the rest 129(87.8%) have no iron supplement during pregnancy. Out of 294 control group mothers

43(14.6%) of them had iron supplement during pregnancy whereas the rest 251(85.4%) have no iron supplement during pregnancy.

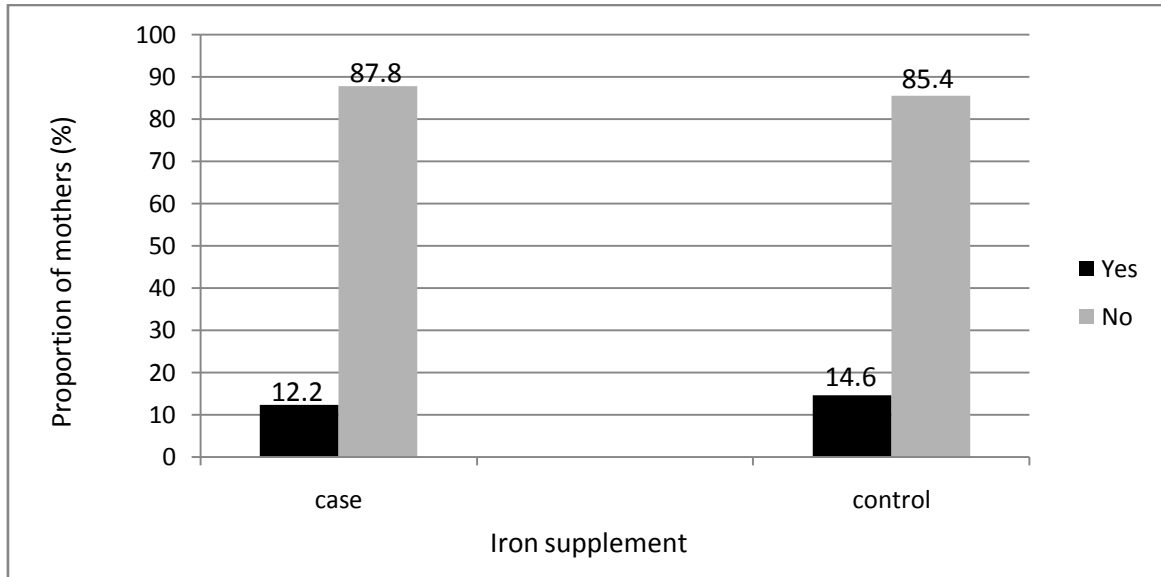


Figure 7: Comparison of iron supplements for mothers in case and control group with percentage in Debre Berehan Referral hospital, 2015.

Bivariant and Multivariate analysis

Table: 2 Bi - variant analysis showing crude Odds Ratio for an association between BW and maternal factors among cases and control.

Maternal characteristics	Case		Control		Crude OR,	95 %CI	P-Value
	Freq	Percent	Freq	Percent			
Age of the mother							
15-20 (Ref.)	19	12.9	20	6.8	1 (Ref.)		0.083
21-25	58	39.5	106	36.1	0.475	(0.078, 2.902)	0.42
26-30	40	27.2	103	35	0.274	(0.049, 1.539)	0.141
31-35	16	10.9	43	14.6	0.194	(0.034, 1.102)	0.064
36-40	10	6.8	20	6.8	0.186	(0.031, 1.116)	0.066
41-45	4	2.7	2	0.7	0.25	(0.039, 1.605)	0.144
Gravidity							
1 (ref.)	86	58.5	156	53.1			0.785
2	29	19.7	73	24.8	1.323	(0.451 , 3.880)	0.610
3	13	8.8	29	9.9	0.953	(0.308 , 2.947)	0.934
4	9	6.1	13	4.4	1.076	(0.314 , 3.686)	0.907
5	5	3.4	11	3.7	1.662	(0.433 , 6.381)	0.460
6+	5	3.4	12	4.1	1.091	(0.247 , 4.817)	0.909
Parity							
0 (ref.)	90	61.2	172	58.5			0.988
1	28	19	61	20.7	1.308	(0.399 , 4.288)	0.657
2	13	8.8	28	9.5	1.148	(0.331 , 3.977)	0.828
3	7	4.8	12	4.1	1.161	(0.306 , 4.402)	0.827
4	5	3.4	11	3.7	1.458	(0.329 , 6.456)	0.619
5+	3	2.7	10	3.4	1.136	(0.237 , 5.457)	0.873
Gestational age of the newborn							
Pre-term (ref.)	47	32	25	8.5			0.000
Term	82	55.8	231	78.6	0.701	(0.188 , 2.609)	0.597
Post-Term	4	2.7	11	3.7	3.626	(1.617 , 8.130)	0.002
Unknown	14	9.5	27	9.2	0.685	(0.342 , 1.369)	0.284
History of abortion							
Yes	10	6.8	21	7.1	1.046	(0.479 , 2.284)	0.91
No (ref.)	137	93.2	273	92.9			

Table 3 continued on next page

Maternal characteristics	Case		Control		Crude OR,	95 %CI		P-Value
	Freq	Percent	Freq	Percent		LB	UB	
Bleeding								
Yes	39	41.1	69	42.9				
No	56	58.9	92	57.1	0.929	0.555	1.553	0.778
Gush								
Yes	35	38.9	65	42.5				
No	55	61.1	88	57.5	0.862	0.506	1.466	0.582
Headache								
Yes	42	43.8	64	40				
No	54	56.3	96	60	1.169	0.699	1.948	0.555
Blurred vision								
Yes	29	31.5	51	33.1				
No	63	68.5	103	66.9	0.93	0.535	1.617	0.796
Fever								
Yes	30	32.3	55	35.3				
No	63	67.7	101	64.7	0.874	0.507	1.508	0.629
Severe Abdominal Pain								
Yes	26	28.6	49	31.8				
No	65	71.4	105	68.2	0.857	0.486	1.512	0.594
Gestational DM								
Yes	1	0.7	4	1.4				
No	146	99.3	290	98.6	0.497	0.055	4.483	0.525
Type II Dm								
Yes	21	14.3	56	19.1				
No	126	85.7	237	80.9	0.705	0.409	1.218	0.209
Anemia								
Yes	30	20.4	53	18				
No	117	79.6	241	82	1.166	0.708	1.921	0.547
PIH								
Yes	16	10.9	18	6.1				
No	131	89.1	276	93.9	1.873	0.926	3.789	0.047
Chronic hypertension								
Yes	29	19.7	55	18.7				
No	118	80.3	239	81.3	1.068	0.647	1.762	0.797
Number of ANC visit								
0 (no ANC)	93	63.3	187	63.7				0.480
1	13	8.8	18	6.1	1.326	0.502	3.501	0.569
2	15	10.2	21	7.1	1.926	0.593	6.259	0.276
3	20	13.6	52	17.7	1.905	0.604	6.007	0.272
4	6	4.1	16	5.4	1.026	0.352	2.992	0.963
Iron Supplement during pregnancy								
Yes	18	12.2	43	14.6				
No	129	87.8	251	85.4	0.814	0.452	1.469	0.466

Table: 3 Multiple logistic regression showing adjusted Odds Ratio for an association between BW and maternal factors among cases and control.

	B	S.E.	P-Value.	Adjusted OR	95% C.I. for	
					Lower	Upper
Age of the mother						
15-20 (Ref.)			.142			
21-25	-.634	1.450	.662	.530	.031	9.102
26-30	-.939	1.398	.502	.391	.025	6.058
31-35	-1.759	1.400	.209	.172	.011	2.678
36-40	-1.802	1.420	.205	.165	.010	2.669
41-45	-1.423	1.466	.332	.241	.014	4.265
Parity						
0 (ref.)			.938			
1	-.731	.870	.401	.482	.088	2.648
2	-.380	.925	.681	.684	.112	4.192
3	-.687	.972	.480	.503	.075	3.385
4	-.494	1.024	.629	.610	.082	4.538
5+	-.279	1.287	.828	.757	.061	9.431
Abortion	.061	.648	.925	1.063	.298	3.789
Bleeding	-.108	.634	.864	.897	.259	3.108
Gush	-.124	.621	.841	.883	.262	2.980
Headache	.316	.568	.578	1.371	.451	4.173
Blurred vision	.062	.713	.930	1.064	.263	4.301
Fever	-.242	.656	.712	.785	.217	2.839
Severe abdominal pain	.099	.665	.882	1.104	.300	4.066
GDM	-1.491	1.740	.391	.225	.007	6.810
DM (Chronic)	-.982	.703	.162	.375	.095	1.485
Anemia	1.128	.756	.136	3.090	.702	13.603
PIH	1.228	.707	.082	3.415	.855	13.645
Hypertension (Chronic)	-.350	.720	.627	.705	.172	2.888
ANC_visit_Number (0)			.249			
ANC_visit_Number (1)	-.995	.889	.263	.370	.065	2.112
ANC_visit_Number (2)	-.525	1.148	.647	.591	.062	5.610
ANC_visit_Number (3)	.321	.948	.735	1.379	.215	8.845
ANC_visit_Number (4)	-.905	.917	.323	.404	.067	2.439
Iron	-.828	.552	.134	.437	.148	1.289
Hemoglobin	.000	.000	.045	1.000	1.000	1.000
Constant	2.686	2.236	.230	14.667		

Table 4: chi-square value showing an association between BW and maternal factors among cases and control

Maternal characteristics	X² value	df	p-value
Age of the mother	10.334	5	0.066
Gravidity	2.456	5	0.783
Parity	0.591	5	0.988
Gestational age of the newborn	40.546	3	0.000
History of abortion	0.013	1	0.910
Bleeding	0.080	1	0.778
Gush	0.302	1	0.582
Headache	0.348	1	0.555
Blurred vision	0.067	1	0.796
Fever	0.233	1	0.629
Severe Abdominal Pain	0.284	1	0.594
Gestational DM	0.405	1	0.525
Type II Dm	1.580	1	0.209
Anemia	0.364	1	0.547
PIH	3.123	1	0.047
Chronic hypertension	0.066	1	0.797
Number of ANC visit	3.873	5	0.568
Iron Supplement during pregnancy	0.466	1	0.495
Hemoglobin	44.149	29	0.036

CHAPTER SIX

Discussion

LBW is still remains a significant cause of morbidity and mortality among neonates and children. This study shows the association between maternal and obstetric factors on LBW infants. The study assessed determinants of LBW among mothers who gave birth at Debre Berehan Referral Hospital, Northern Ethiopia from May 1, 2012 to May 1, 2015.

Some of the pre-disposing factors to LBW babies in this area were determined in this study. The study used hospital data for the analysis, but we are aware that the problems that exist in this type of data are selection bias. Even though most births occur at home where it's impossible to obtain records. Thus hospital data even though have limitations, will continue to be the source of data for this type of study in our country.

Low birth weight is more common among children of the youngest mothers, age less than 20 and older mothers, age 40-45 because the result showed that the percentage of case is greater than control group. This finding in line with EDHS (23).

From this result we can see that most mothers in both groups have gravida 1 and nulliparous. As number of parity increases the number of mothers in both group decreases (Figure 3). LBW is more common on primipara than multipara, as the number of para increase the percentage of LBW decrease. It is the same as control group, but when we compare the percentage of primiparas, in case groups are higher than control. This agrees with Jimma study.

Analysis of the unadjusted relative risks showed some factors to be associated with an increased risk of LBW. Since most of them were interrelated, multivariate analytic techniques were used to

study independent effects of each factor. The only variable that have significant association with BW by using multivariate analytic techniques is hemoglobin level (p-value =0.045).

This finding showed that in both case and control group majority of the neonates are full term but the percentage of pre-term in case group much higher than control group I,e 32% and 8.5%, respectively (Figure 4). Those newborns with gestational age less than 37 weeks were 4 times (AOR=4, 95%CI (1.61,8.13) p-value =0.0001) more likely to be delivered low birth weight than those new born greater than or equal to 37 weeks of gestation. So, significant association is found between gestational age and BW (Table 9). The results of this study revealed that the birth weight is significantly influenced by gestational age. Newborn with gestational age of less than 37 weeks was more likely to be LBW as compare to gestational age greater than or equal to 37 weeks. This finding is in agreement with study conducted in Jimma (6). This also support by research reported from study done in Italy, Iran and Tanzania, which shows significant association of gestational age with the weight of the newborn (26, 27, 16). Low gestational age is a risk factor contributing to LBW infants (30).

Gestational age plays an important role in determining infants' birth weight. Infants who are delivered prematurely (less than 37 weeks) are at higher risk to have low birth weight infants. The World Health Organization estimated about one third of low birth weight infants is caused by prematurity. With advanced technology, the prevalence of prematurity infants survived are increasing thus increased the number of LBW infants. This is one of the reasons identified why the prevalence of low birth weight infants remain unchanged since years ago. Thus, it is much more important in preventing the birth of premature baby by identifying and managing the associated risk factors. This result agreed with Mekele study (8). This again support by a research done in Malaysian gestational age was of the risk factor for LBW (28). This might be due to did not reach the optimal time which greater than or equal to 37 weeks of gestation. And also this could be most probably as a result of intrauterine growth retardation which is the most common cause of LBW in developing countries.

Generally the result show that in majority of the mothers both case and control groups had no morbidity during Pregnancy but in case of anemia, chronic hypertension and PIH the percentage of cases are greater than controls . Pregnancy induced hypertension (AOR =3.415 95%CI (0.926 ,3.789) p-value = 0.047) one of the risk factors for LBW and mother with PIH was 3.5 times more risk to deliver LBW than mother without PIH. this finding was in line with other studies done in Iran (27). Similar finding was also reported from the study done in India which revealed that mothers with PIH were more likely to delivery low birth weight as compared with those women without PIH (29). This is again supported by a research done in Malaysia which mother with PIH was three times more risk to delivery LBW infant than mother without PIH (28). This might be due to hypertension results in decreased blood flow through the spiral arterioles and decreased delivery of oxygen and nutrients to the placenta and fetus and Hypertension also might be associated with placental infarction (28). Hypertensive mother had significant association with LBW infants in this study. Mother with essential hypertension, gestational hypertension, pre-eclampsia or eclampsia has 4.5 times higher risk for LBW infants. Gestational hypertension has a major influence on maternal and neonatal morbidity and mortality with approximately 6% - 8% of all pregnancies is complicated by hypertensive disorders (33). This condition can lead to a low birth weight for the baby or premature delivery which poses additional health risks to the child. If the hypertension becomes severe, it can lead to preeclampsia or eclampsia which can cause serious injuries or even death to both the mother and child. These results indicated that hypertensive disorders might play a critical role in the incidence of LBW as supported by other studies (28) (31) (32). Evidence from earlier study showed that reduced placental blood flow leads to decreased fetal growth, with an increased risk of intrauterine growth restriction and low birth weight. This result is in line with Gondar study (10).

Another variable that have significant association with BW is hemoglobin level (AOR = 1, 95% CI (1.0, 1.0) p-value =0.045). Those mothers who have blood hemoglobin level lower are high risk for LBW than those who have higher hemoglobin level. Pregnant women with hemoglobin levels less than 9 gm/dl, which is considered anemic, gave birth to neonates with low birth weights, while pregnant women with higher hemoglobin levels (> 11 gm/dl), who were considered normal, gave birth to heavier and normal babies (4). This finding is in agreement with study conducted in India (4).

This result showed that majority of the mothers on both cases had no history of abortion, had no pregnancy complication and had no ANC visit. The result also showed that in both cases most mothers have no iron supplement during pregnancy but the percentage of mothers who had iron supplement in case group is lower than in control group. Bi-variate analysis showed that iron supplement have no association.

Generally age of the mother, gravidity, parity, history of abortion, signs of pregnancy complications, gestational DM, type II DM, anemia, chronic hypertension, number of ANC visit, iron supplement had no significant association with BW.

Strength and limitation of the study

Strength

1. This study is the first in the area, and it has generated new ideas for further studies.
2. The response rate of this study was high (100%).

Limitation

- As we utilized secondary data, cards lack some variables. Hence, these variables were excluded from the study, which could have yielded better results.
- There are also few variables such as other socio demographic characteristic such as maternal education level, paternal weight, maternal weight ,and height, mothers MUAC, smoking status of parents, occupation and drug ingestion that may have influence for LBW infants cannot be included in this study due to lacking of data. Exploring social determinants using population based study design would open up gaps in knowledge in this area.

Conclusion

Generally according to the findings of this study the determinant factors for LBW are: Gestational age, hemoglobin level of the blood, PIH. But the other variable that is I try to measure has no association and they are not determinant factors for LBW.

Recommendations

The following recommendations are forwarded based on the finding of the study.

- Effective treatment and prevention of anemia
- Effective treatment and prevention of pregnancy induced hypertension
- Close monitoring of the blood hemoglobin level.
- Routine antenatal iron tablet supplementation for a minimum 31 days.
- Ensuring women return after their ANC visit and reduce dropout.
- prevention of preterm birth could reduce low birth weight
- Further future researches
- RCTs that can assess the effect of multiple micronutrients on birth outcomes.
- Holistic understanding on the relationships among pregnancy, anemia.

References

1. United Nations Children's Fund, World Health Organization: Low Birth weight: Country, regional and global estimates. New York: UNICEF and WHO; 2004.
2. Ministry of Health and Population (MOHP) [Nepal], New ERA, ICF International Inc: Nepal Demographic and Health Survey 2011. Kathmandu, Nepal: Ministry of Health and Population, New ERA, and ICF International, Calverton, Maryland; 2012.
3. UNICEF. Progress for Children: A Report Card on Nutrition. Other Nutrition Indicators, Low Birth weight. New York: UNICEF; 2006.
4. Maternal anthropometric measurements and other factors: relation with birth weight of neonates Department of Studies in Food Science and Nutrition, University of Mysore, Mysore 500 006, India, Nutrition Research and Practice (Nutr Res Pract) 2012;6(2):132-137.
5. Gebremariam. A Factors predisposing to low birth weight in Jimma hospital south western Ethiopia, East African Medical Journal Vol 82 No. 11 November 2005.
6. Tema T. Prevalence and determinants of low birth weight in Jimma Zone, Southwest Ethiopia. East African Medical Journal 2006; 83:366-371.
7. WHO Regional Office for Europe the Introduction to Health for all policy for the WHO European Region. Copenhagen: Health 21; 1998.
8. Gessesew. B , Balem .D and Mussie .A , Socio Demographic and Maternal Determinants of Low Birth Weight at Mekelle Hospital, Northern Ethiopia: A Cross Sectional Study , American Journal of Advanced Drug Delivery www.ajadd.co.uk.
9. WHO. Nutrition and food safety, WHO country cooperation strategy 2008-2011, Ethiopia, page12.
10. Kahsay Z, Tadese A, Nigusie B , Low Birth Weight & Associated Factors Among Newborns in Gondar Town, North West Ethiopia: Institutional Based Cross Sectional Study, Indo Global Journal of Pharmaceutical Sciences, 2014; 4(2): 74-80.
11. Lawn J, Cousens S, Zupan J: 4 million neonatal deaths: When? Where? Why? Lancet 2005;365 (9462):891-900.
12. Report of the Ad Hoc Committee of the Whole of the twenty-seventh special session of the General Assembly New York, United States: United Nations. Available: <http://www.unicef.org/specialsession/documentation/documents/A-S27-19-Rev1E.pdf>. Accessed 2013 July 25.
13. Gbenga A. Kayode , Mary Amoakoh-Coleman , Irene AkuaAgyepong , Evelyn Ansah, Diederick E. Grobbee , et.al ,Contextual Risk Factors for Low Birth Weight: A Multilevel

Analysis Gbenga A. Kayode , Mary Amoakoh-Coleman , Irene AkuaAgyepong , Evelyn Ansah, Diederick E. Grobbee , Kerstin Klipstein-Grobusch PLOS ONE | www.plosone.org October 2014 | Volume 9 | Issue 10.

14. Ruth EKS, Michel JS, Laurie JB. Are children of moderately low birth weight at increased risk for poor health? A new look at an old question. *Pediatrics* 2006, 118:217. DOI: 10.1542/peds.2005-2836.
15. Zeleke B, Zelalem M, Mohammed N. Incidence and correlates of low birth weight at a referral hospital in Northwest Ethiopia. *Pan African Medical Journal* 2012; 12:4.
16. Siza JE. Risk factors associated with low birth weight of neonates among pregnant women attending a referral hospital in northern Tanzania. *Tanzania Journal of Health Research* 2008; 10:1210-1219.
17. Walter EC, EhlenbachWJ, Hotchkin DL, ChienJW, Koepsell TD. Low Birth Weight and Respiratory Disease in Adulthood: A Population-based Case Control Study. *American Journal of Respiratory and Critical Care Medicine* 2009; 180:176-180.
18. Ramakrishnan U. Nutrition and low birth weight. *American Journal of Clinical Nutrition* 2004; 79:17-21.
19. Badshah S, Mason L, McKelvie K, Payne R, Lisboa P. Risk factors for low birth weight in the public-hospitals at Peshawar, NWFP-Pakistan. *BMC Public Health* 2008; 8:197doi: 10.1186/1471-2458-8-197.
20. Roudbari M, Yaghmaei M, Soheili M. Prevalence and risk factors of low-birth-weight infants in Zahedan, Islamic Republic of Iran. *East Mediter Health J.* 2007; 13: 838–845.
21. Louangpradith Viengsakhone, Yoshitoku Yoshida, harun-or-rashi and Junichi. Determinant of low birth weight in Vientiane Laos, Sakamoto1 nagoya J.Med. Sci, 2010, 72.51-58.
22. U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. *Child Health USA 2011*. Rockville, Maryland: U.S. Department of Health and Human Services, 2011.
23. Ethiopia Demographic and Health Survey, 2011.
24. Donnelley, J. F., Flowers, C. E., Creadik, R. N., Greenberg, B. G., and Surles, K.B. Maternal, fetal and environmental factors in prematurity. *Amer J. Obstet. Gynaec*, 1994; 88:918.
25. Mahari Yihdego, Mizan-Tepi University Dr. Alemayohu Mekonnen, AAU ,Assessment of maternal risk factors associated with full-term low birth weight neonates in public health facilities of addis ababa, ethiopia: a case-control study.
26. Lasker JN, Coyle B, Li K, Ortynsky M. Assessment of risk factors for low birth weight deliveries. *Health Care Women Int.* 2005; 26:262–80.

27. Golestan M, AkhavanKarbasi S, Fallah R , prevalence and risk factors for LBW in Yazd, a central city of Iran Singapore. Med J 2011; 52(10): 730-73.
28. N Y Boo, S M Lim, K T Koh, K F Lau, J Ravindran, Risk factors associated with low birth weight infants in the Malaysian population, Medical journal of Malaysia (2008) Volume: 63, Issue: 4, Pages: 306-310
29. Mumbare SS, Maindarkar G, Darade R, et.al, maternal risk factors associated with full term low birth weight (LBW) neonates, Indian Pediatr. 2011. pii: S09747559INPE1000229-1.
30. Agarwal, K., Agarwal, A., Agarwal, V.K., Agarwal, P. and Chaudhary, V. (2011) Prevalence and Determinants of Low.
31. World Health Organization (1995) Physical Status: The Use and Interpretation of Anthropometry. Report of a WHO Expert Committee, WHO Technical Report Series 854, World Health Organization, Geneva.
32. Yihua, B., Zhan, Z., Qiao, L., et al. (2013) Maternal Risk Factors for Low Birth Weight for Term Births in a Developed Region in China: A Hospital-Based Study of 55,633 Pregnancies. The Journal of Biomedical Research, 27, 14-22.
<http://dx.doi.org/10.7555/JBR.27.20120046>
33. Bujold, E., Roberge, S., Lacasse, Y., et al. (2010) Prevention of Preeclampsia and Intrauterine Growth Restriction with Aspirin Started in Early Pregnancy: A Meta-Analysis. Obstetrics & Gynecology, 116, 402-414.
<http://dx.doi.org/10.1097/AOG.0b013e3181e9322a>

ANNEX-I CHECKLIST FOR DATA COLLECTION

Addis Ababa University

College of Health Sciences

Department of nursing and midwifery

Interviewer's Name: _____ **Code:** _____ **Signature:** _____

Supervisor's Name: _____ **Code:** _____ **Signature:** _____

Date: _____

INFORMATION SHEET

Greetings! My name is _____. I am here representing a team to conduct data collection among mothers card who gave birth to a live baby (either low birth weight or normal birth weight) about the risk factors associated with low birth weight. Low birth weight is defined as birth weight less than 2,500 grams. More than 20 million infants are born each year weighing less than 2500 g, accounting for 17% of all births in the developing world. Similarly, according to Ethiopian DHS 2011 11% weighed less than 2.5 kilograms. Birth weight plays an important role in infant mortality and morbidity, development, and future health of the child. Weight at birth is directly influenced by general level of health status of the mother.

The main objective of the study is to identify the risk factors associated with low birth weight in Debre Berehan Referral hospital. The data collection is supposed to get administered within this facility from medical records.

For more details: Contact Lema Desalegn (Principal investigator) with +251-913-125914

Checklist for data collection on maternal risk factors associated with low birth weight Neonates in DebreBerehan hospital

Note the inclusion criteria from clinical records:				
- Is the child born single 1: YES 2: NO - Is the child free of any visible major birth defect 1: YES 2: NO				
If –No” to any of the inclusion criteria, stop the collection of data.				
Health institution/facility type/ Codes		_____ / _____ / _____		
S.No	Coding categories	Questions and filter	Skip	Code
Section I. New borne characteristics				
101	Birth weight of the baby in grams?	Birth weight in gm: _____		
102	What is the sex of the newborn?	Male _____ 1		
		Female _____ 2		
Section II. Characteristics of mother				
201	How old were you at your last birth day?	Age in completed years: _____		
Section III. Obstetric history				
301	What is your gravidity? That is any pregnancy occurred.	Gravidity: _____		
302	What is parity of the mother? That is any delivery that passed 28 weeks of gestation.	Parity: _____	If she was Gravida-I skip to 303	
303	Have you ever had an abortion?	Yes -----1		
		No -----2	401	
304	How many abortions did you have?	Number of abortions: _____		
Section IV. Current pregnancy history				
If the mother had ANC follow-up, fill the required data from the ANC card when available.				
401	What was the gestational age at delivery, in weeks? Please calculate from the last menstrual period of the mother or record from ultrasound reading if available.	Gestational age at delivery in weeks: _____		
s.no	Coding categories	Questions and filter	Skip	Code
402	How did you give birth? That is mode of delivery.	Vaginal delivery-----1		
		Assisted delivery-----2		
		Cesarean section-----3		
403	Have you ever weighed prior your pregnancy (recent one) or prior 12 gestational weeks of your current pregnancy?	Yes ----- 1		
		No ----- 2	405	
		Do not remember -----99	405	
404	If yes what was your weight in kg?	Weight of the mothers: _____		
		Do not remember -----99		

405	Have you ever been weighed in your current third trimester pregnancy?	Yes ----- 1				
		No ----- 2		407		
		Do not remember -----99		407		
406	What was your weight in the last weight measurement taken?	Weight of the mothers: _____				
		Do not remember -----99				
407	Have you visit any health Institution for ANC services for the current pregnancy?	Yes ----- 1				
		No ----- 2		413		
408	How many months pregnant were you when you first received antenatalcare services for this pregnancy?	Months: _____				
		Do not remember -----99				
409	How many times did you receive antenatal care during your current pregnancy?	Number of visits: _____				
410	As part of your antenatal care during this pregnancy, were any of the following done at least once? Was your weight measured? Was your BP measured? Did you give a urine sample? Did you give a blood sample?	Service	YES	NO		
		Weight	1	2		
		BP	1	2		
		URINE	1	2		
		BLOOD	1	2		
s.no	Coding categories	Questions and filter			Skip	Code
411	During (any of) your antenatal care visit(s), were you told about the signs of pregnancy complications?	Yes -----1				
		No -----2		414		
		Do not remember -----99		414		
413	Which signs of pregnancy complications were you told about?		YES	NO		
		Vaginal bleeding	1	2		
		Vaginal gush of Fluid	1	2		
		Severe head ache	1	2		
		Blurred vision	1	2		
		Fever	1	2		
		Abdominal pain	1	2		
Other (specify): _____						
414	During this pregnancy, were you given or did you buy any iron tablets?	Yes ----- 1				
		No ----- 2		416		
		Do not remember -----99		416		
415	During the whole pregnancy, for	No of Days: _____				

	how many days did you take the tablets?	Do not remember -----99		
416	During this pregnancy, did you take any drug for intestinal worms?	Yes ----- 1 No ----- 2 Do not remember -----99		
417	Have you ever been told that you have chronic hypertension?	Yes ----- 1 No ----- 2 Do not remember -----99		
418	During this pregnancy, have you been told that you have developed pregnancy induced hypertension?	Yes -----1 No -----2 Do not remember -----99		
419	During your current pregnancy, have you been told that you have anemia?	Yes ----- 1 No ----- 2 Do not remember -----99		
420	What was her hemoglobin level on her current pregnancy, if available?	_____g%		
421	Have you ever been told that you have Diabetes Mellitus?	Yes -----1 No -----2 Do not remember -----99		
422	During your current pregnancy, have you been told that you have developed gestational diabetes mellitus?	Yes -----1 No -----2 Do not remember -----99		
s.no	Coding categories	Questions and filter	Skip	Code
423	During this pregnancy, did you have any history of vaginal bleeding prior to the onset of labor or delivery?	Yes -----1 No -----2 Do not remember -----99		
424	Did you have any history of trauma or injury, during your current pregnancy period? Probe for all kind of traumas.	Yes -----1 No -----2 Do not remember -----99		
Section V. Life-style/personal habits during pregnancy				
501	During your pregnancy, did you take drinks containing alcohol?	Yes ----- -1 No -----2 Do not remember -----99	503 503	
502	How often were you taking alcohol drinks?	Daily-----1 3 times per week-----2 1 times per week----- 3 Once a month-----4		
503	During your current pregnancy, did you ever	Yes ----- -1 No -----2	505	

	chew Khat?	Do not remember -----99	505	
504	How often were you chewing khat?	Daily-----1		
		3 times per week-----2		
		1 times per week----- 3		
		Once a month-----4		
505	During your current pregnancy, did you ever smoke?	Yes ----- -1		
		No -----2	601	
		Do not remember -----99	601	
506	How often were you smoking?	Daily-----1		
		3 times per week-----2		
		1 times per week----- 3		
		Once a month-----4		

ANNEX II: ASSURANCE OF PRINCIPAL INVESTIGATOR

Declaration

I the undersigned declare that this is my original work and has not been presented in this or any other University and all sources of materials used for this thesis have been fully acknowledged.

Name: Lama Desalegn (BSC, RN)

Signature: _____

Date of submission _____

This thesis has been given for examination with my approval.

Name of the advisor: Fekadu Aga (BSC, MSC, RN, ASST. PROFESSOR)

Signature: _____

Date _____