JIMMA UNIVERSITY FACULTY OF MEDICAL SCIENCE, DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

Determinants of low birth weight among newborns delivered at Jimma Medical Center, Jimma Zone, Oromia Region, and South–Western Ethiopia: Unmatched case-control study

BY: DR.BERHANU BEKELE

A RESEARCH PROJECT TO BE SUBMITTED TO FACULTY OF MEDICAL SCIENCE, DEPARTMENT OF GYNECOLOGY AND OBSTETRICS, JIMMA UNIVERSITY; IN PARTIAL FULFILLMENT FOR THE REQUIREMENT FOR GYNECOLOGY AND OBSTETRICS SPECIALITY.

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DECLARATION

I declare that this research thesis report entitled “Determinants of low birth weight among neonates delivered at Jimma Medical Center” is my own work that it hasn’t been addressed in study area as far as my knowledge touched and all resources I used has been indicated and acknowledged as complete reference. I understand that non-adherence to the principles of academic honesty and integrity, misconceptions/fabrications of any idea/data/source will constitute sufficient ground for disciplinary action by the University and also evoke penal action from the sources which have not been properly cited or acknowledged.

_____	_____	_____
Name of student	Signature	Date

APPROVAL SHEET

As thesis research advisor, I hereby certify that I have read and evaluated this thesis report prepared under my guidance by Dr.Berhanu Bekele entitled "Determinants of Low Birth Weight among neonates delivered at Jimma Medical Center". I recommended that the report be submitted for implementation and further action as fulfilling the thesis requirement.

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Name of major advisor	Signature	Date
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Name of co-advisor	Signature	Date

As member of the board of examiners of the Obstetrics and Gynecology thesis report open defense, we certified that we have read and evaluated the thesis report prepared by Dr.Berhanu Bekele and examined the candidates report. We recommend that the report be accepted for implementation and further actions as fulfilling the thesis requirements for Obstetrics and Gynecology Specialty.

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Examiner	Signature	Date

Abbreviations

AOR: Adjusted Odds Ratio

ANC: Antenatal Care

BW: Birth Weight

CI: Confidence Interval

COR: Crude Odds Ratio

CD: Cesarean Delivery

DM: Diabetes Mellitus

EDHS: Ethiopian Demographic and Health Survey

HIV: Human Immunodeficiency Virus

IUGR: Intrauterine Growth Restriction

JMC: Jimma Medical Center

LBW: Low Birth Weight

MUAC: Mid-Upper Arm Circumference

NBW: Normal Birth Weight

OR: Odds Ratio

PIH: Pregnancy Induced Hypertension

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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Acknowledgement

First, I would like to express my deepest gratitude and appreciation to Jimma University, Department of Obstetrics and Gynecology for giving me a chance to conduct this study.

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Abstract

Background:

Low Birth weight (LBW) remains the most important risk factor which attributed to mortality of 15–20% of newborns across the globe. An infant with low Birth weight is more likely to have stunting in childhood and develop markers of metabolic risk factors at his later age. Furthermore, LBW is a risk for inter-generational assaults of malnutrition as it is the risk for sub optimal growth until adulthood, affecting women's and male's reproductive capabilities. Thus, there is enough concern to study the determinants of LBW across different settings. Accordingly, this study was conducted to assess the determinants of low Birth weight at Jimma Medical Center (JMC), Oromia region, south western Ethiopia.

Methods: Facility based unmatched case control study was conducted from July 1 to September 30, 2022. The data were collected using structured, pretested, interviewer administered questionnaire. Consecutive live births of less than 2500g were selected as cases and succeeding babies with weights of at least 2500g but less 4000g as controls. Data were entered in to Epi-data software version 7.2.5.0 and exported to SPSS Version 25 and analyzed using frequency, cross-tabs and percentages. Factors with p-value <0.25 in Bivariate analysis were entered in to multivariable logistic regression and statistical significance was considered at p-value <0.05.

Result: From 194 selected participants, 194 new-borns (97 cases and 97 controls) participated. In logistic regression model, significant association was found with Merchant Mothers [(AOR (CI) = 7.65 (2.10-26.9))], Incomplete antenatal Contact [AOR 2.87 (95% CI 1.1–7.4)], Absence of Nutritional Counseling during Pregnancy [AOR 6.53 (95% CI 1.6–26.6], Pregnancy Induced Hypertension [AOR 14.27(95% CI 2.9-68), and Danger signs during pregnancy [AOR 3.8 (95% CI 1.5–9.6)].

Conclusions and Recommendation: Occupation, Number of ANC Contact, Nutritional counseling during Pregnancy, Danger signs, and Pregnancy Induced Hypertension were significant determinants of low birth weight. Stakeholders would better work together to reduce low birth weight by preparing appropriate intervention and monitoring policy.

Key words: low birth weight, determinants, maternal factors, case control, Jimma medical cente

Chapter one: Introduction

1.1. Background

The birth weight of a newborn baby is the first weight record, preferably taken within an hour of birth. Birth weight is a good summary of multifaceted public health problems, including long-term maternal malnutrition, chronic illness, and poor health care during pregnancy (1)

World Health Organization (WHO) defines low birth weight (LBW) as the weight of a newborn baby below 2500 g at birth regardless of the gestational age. Further classification of low birth weight includes; low birth weight (below 2500 g), very low birth weight (below 1500 g), and extremely low birth weight (below 1000 g). This practical cut-off for international comparison is based on epidemiological observations that infants weighing less than 2500g are approximately 20 times more likely to die than their heavier counterparts(2).

Birth weight is a key indicator of the child's vulnerability to the risk of childhood diseases. It also predicts the child's future health, growth, and development, and the probability of survival.LBW frequently resulted from preterm birth, intrauterine growth restriction, or a combination of both pathophysiologic conditions. The majority of LBW in low income countries is due to IUGR, while it is mostly due to preterm birth in high income countries (2).

Worldwide neonates born LBW are around 20 million, of which 95% live in developing countries. Moreover, Africa with 18.3% of high burden of LBW is only preceded by Asia, which accounts for 14.3 %(3). As EDHS 2016 report in Addis Ababa, Ethiopia 13% are LBW (1).

Being born with LBW is generally recognized as a disadvantage for the infant. Low birth weight is considered the single most important risk factor of infant mortality, mainly in deaths that occur within the first 28 days of life(4). Moreover, three fourth of neonatal deaths globally occurred among low birth weight (5).

LBW has also been linked to the high prevalence of stunting seen in low income countries and may be important in the ethology of chronic dietary diseases such as obesity, diabetes and cardiovascular diseases in adulthood [6].In the last 10 years, the incidence of LBW has not declined in Sub-Saharan Africa and Asia(7).

In Africa, low birth weight is approximately 22%, and in sub-Saharan Africa, it is around 13–15% with a small variation across the continent (8). According to the assessment carried out by the United Nations Children's Fund (UNICEF), the national prevalence of LBW in Ethiopia was 20 %(9).

Having basic knowledge about predictors for low birth weight is important to identify and to give appropriate attention to those mothers at risk.

In Ethiopia, LBW is still a significant public health concern. The attainment of a sustainable development goal is also intensely affected by the progress in newborn deaths. The Ethiopian government appreciates the severity of low birth weight, and some measures are addressed by the Ministry of Health, non-governmental organizations, WHO and health professionals like Ethiopian pediatric associations (10, 11).

The etiology of LBW is yet to be completely understood even though several studies have attempted to unravel the underlying causes. Constitutional factors, such as sex, maternal height, and weight have been identified as risk factors for LBW (5, 12, and 13).

On the other hand, in different studies, factors like lack of antenatal follow-up, preterm delivery, chronic medical illness, and lack of formal education and young age of the mother have been reported to be associated with low birth weight (3, 4, and 14).

A number of studies have shown correlates of infant's sex, Maternal nutritional status, young maternal age, bad obstetric history, maternal anemia and rural settlements, antenatal care received, prematurity, the birth interval with low birth weight. However, the majority of these studies did not address maternal nutritional status and maternal dietary practices. Therefore, the aim of this study was to determine nutritional and others factors associated with LBW among newborns delivered at Jimma Medical Center, West Ethiopia.

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 Jimma zone, Jimma town in particular.

This study provides valuable information to the health professionals, researchers, regional health bureau and other stakeholders.

By using this study above professionals could plan their resource for interventions and researchers could also use this research result as a baseline for future studies.

1.2 Statement of the problem

LBW is a global public health challenging problem .Out of 121 million births in a year, 23 million have LBW and high proportion of which are found in developing countries. A low birth weight level in sub-Saharan Africa is around 15 percent (2). The level of low birth weight in developing countries (16.5 percent) is more than double the level in developed regions (7 percent) (2).

Half of all perinatal and one third of all infant deaths are directly or indirectly related to LBW (2). Mortality of LBW babies is 40 times more than the normal weight babies (3). 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 (4).

Incident rates of >15% for low birth weight and >20% for intrauterine growth retardation indicate a major public health problem (6)

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 (2).

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, cardiovascular disease, metabolic syndrome, ischemic heart disease, decreased lung capacity and chronic lung disease (2). An additional risk for girls is having smaller babies when they become mothers.

The main causes of neonatal deaths in Africa are infections which contribute 39%, prematurity 25% and asphyxia 24%. Low birth weight underlies majority of these deaths and links to maternal health, nutrition and infections such as Malaria and HIV (4)

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

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 (4)

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 (10). Those who had a history of very low birth weight (VLBW) are 2.6 times at risk of respiratory failure requiring mechanical ventilation (2).

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. The increase in survival rates of LBW infants leads to increasing health care costs due to extensive hospital stays. It is estimated that extremely LBW babies are up to six times as costly as normal weight babies (20).

In the perinatal period, LBW infants are in a critical state with regard to survival, and approximately half of all neonatal deaths are directly or indirectly linked to LBW (13).

The third target of World Health Organization (WHO) document "Health for All in 21 Century" has stated that investing early in health typically pays off later in life and has shown that low birth weight is a marker for indices of deprivation and represents accumulated risk factors. The primary objective for the implementation of this target is to reduce the number of infants born below 2500g (10).

Different studies conducted in different corners of Ethiopia have tried to address factors associated with LBW, yet the prevalence remained to be significant despite the recommendation of their study. Many of the identified factors were non modifiable ones (e.g. maternal height) and thus designed strategies would be inefficient to decrease magnitude of LBW.

Here at Jimma Medical Center, it is not uncommon to find such newborns, majority of whom are referred to Neonatal Intensive Care Unit (NICU) with diagnosis of LBW. With the current facilities available at NICU, it is difficult to avert the immediate dangers of LBW, let alone the long term ones. It is therefore reasonable to focus on the possible factors, yet modifiable, which led to such delivery and establish strategies that would help prevent occurrence of this devastating complication. This study is aimed at assessing the Determinants LBW which would be essential for prevention before mothers ended up delivering LBW, where care for such infants would be not as satisfactory.

1.3 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 Jimma zone, Jimma town in particular.

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

CHAPTER TWO:

2.1 LITERATURE REVIEW

2.1.1 Magnitude of LBW

A study done in Tanzania showed that among a total of 3464 pregnant women who delivered at the Kilimanjaro Christian Medical Centre referral hospital, 469 (13.6%) gave birth to low birth weight neonates. The prevalence of low birth weight was higher (15.66%) in females than in males (12.06%) (24).

EDHS 2016 data shows that among children born in the five years before the survey with a reported birth weight, 13 percent weighed less than 2.5 kilograms (1). 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 16 percent of all live births in the five years preceding the survey to be very small and 10 percent as smaller than average (1).Nearly four children of every ten born to mothers residing in Affar (39.1 percent), Amhara (21.8 percent), Dire Adwa (20.5 percent), and Harari(20.3 percent) were reported as very small at birth (1).

Survey conducted in Gondar shows that the prevalence of low birth weight was found to be 17.4% (22.7% female and 13.5% male) (34).

A study done in Mekele university showed that 135 (75%) mothers gave birth to LBW and 45 (25%) gave birth to VLBW babies where by the mean BW was 1.8+0.46kg within a range of 0.7-2.4 kg (45).

2.1.2 Factors Associated with LBW

Socioeconomic status

According to the study conducted in Pakistan, family incomes of mothers were one of the most reliable indicators showing as much as 13.9 times at higher risk of having LBW babies among low income families (AOR 13.9; 95% CI=8.8–21.9) (33).

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 (**35**).

EDHS 2016 data shows that Births to mothers with no education are more likely to have low birth weight (18%) compared with births to women with primary and secondary education (11% and 8%, respectively)

Children born to mothers in the lowest wealth quintile were the most likely to be reported as very small (1).

A case-control study conducted in three hospitals in Mexico City shows that Women in the lower socio-economic level had a higher risk for LBW (AOR, 2.19; 95% CI, 1.18–4.07) than those in the medium and high socioeconomic levels (20).

Maternal age

It is evident from one Indian study that as maternal age increased from 20 to 36, the birth weight increased from 2.9 to 3.4 kg (28).

EDHS 2016 data shows that Low birth weight is more common among children of the youngest mothers, age less than 20 (16.9 percent). Children born to very old mothers (greater than 35 years) were the most likely to be reported as very small (1).

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 p value of -0.007 was obtained which was not conclusive. But a proportion of LBW was highest (42%) among mothers≥ 35 years (35).There was statistically significant association between the age of the mothers and mean BW (F=122.08, p=0.0001) (35). 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 (35).

Infant sex

A cross sectional study done in Kenya revealed, female infant to be at increased risk being LBW (AOR=3.37, 95% C.I. =1.14-10.00) (13).

A 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) (4).

It's been showed that 128 (71.1%) of new born babies with LBW were females (4). 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) (4).

In contrary, another survey 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) 10).

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) (20).

Another study from Libya did not show significant association between low maternal BMI (< 18.5) and LBW ($p= 0.092$ at df 10) (15).

Maternal Height

A case control study done in India showed that 43% of subjects 'heights were in the range between 156 -162 cm. 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 20).

Utilizing the knowledge from Donnelley, et al (13) maternal height of 150 cm or less was taken to constitute a risk factor to LBW. The Chi-square test on this 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<0R< 1.50(5) (35). Mothers of cases were shorter than controls (13).

Marital status

A retrospective cross sectional survey conducted in Tanzania showed Unmarried women were almost twice more likely to give birth to LBW neonates than the married ones (OR=1.65; (95% CI=1.25-2.17) contributing to about 5% of all low birth weights (PAF=5.4% (CI= 2.8- 7.4) (33).

Gessessew. B and colleagues did not find this at Mekele hospital in 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 (35).

Parity

A 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 gravida one women gave birth to neonates with 2.9 kg (20).

A study done in Mekele shows that on reproductive characteristics the finding indicated that 80(44.4%) of the mothers were primi-parous (35).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=0.001) (35).

Birth Order

EDHS 2016 data showed that children of birth order six and above (15.7 percent) and first-order births (15.4 percent were the most likely to be reported as very small (1).

A study done in Mekele showed that Seventy seven (42.8%) of the index baby belongs to the first birth order (35). BW was directly proportional to birth order and the association was found to be statistically significant (F=89.24, P= 0.0001) (35).

Prior spontaneous abortion

It's been showed in one study 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 (23). Mothers who had no 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) (23).

Maternal morbidity during pregnancy

A cross sectional study conducted in different developing countries showed the relative risk (at 95% confidence interval) of having a LBW neonate was high in maternal HIV (RR=3.25, C.I=1.51-6.97), hypertension in pregnancy (RR=3.07, C.I=1.52-6.22), ante partum hemorrhage (APH) (RR=7.20, C.I=5.79-8.95)(2).

One survey showed 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 (3).Proportion of mothers with LBW (20.4%) had these and other complications as compared to mothers who had NBW.

Again in study done in Gondar, 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 (4).

Antenatal care

Antenatal care (ANC) visits are important for maternal and fetus health. ANC refers to pregnancy-related healthcare services provided by skilled health personnel during pregnancy that monitor the well-being of both the mother and the unborn child. The frequency of ANC visits is significantly associated with birth outcomes such as birth weight. Pregnant mothers who attended less than four ANC visits double their risk of delivering LBW babies compared to those visiting four or more times (16).

A survey conducted using evidence from Nigerian DHS found that the frequency of ANC visits were significantly associated with the birth weights of the infants. Additionally the majority of the LBW infants were born to mothers who were late for their ANC registration (22).

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(35).

Hemoglobin Level

A case control study done in Debreberhan Referral hospital showed a significant association between BW and hemoglobin level (AOR 1.0, 95% CI (1.0, 1.0) p-value =0.045) (14).

2.2 Conceptual Frame Work

The following frame work is developed by the researcher by reviewing different literatures and books. It shows that birth weight is affected more likely by the "proximal" factors than the "distal" factors.

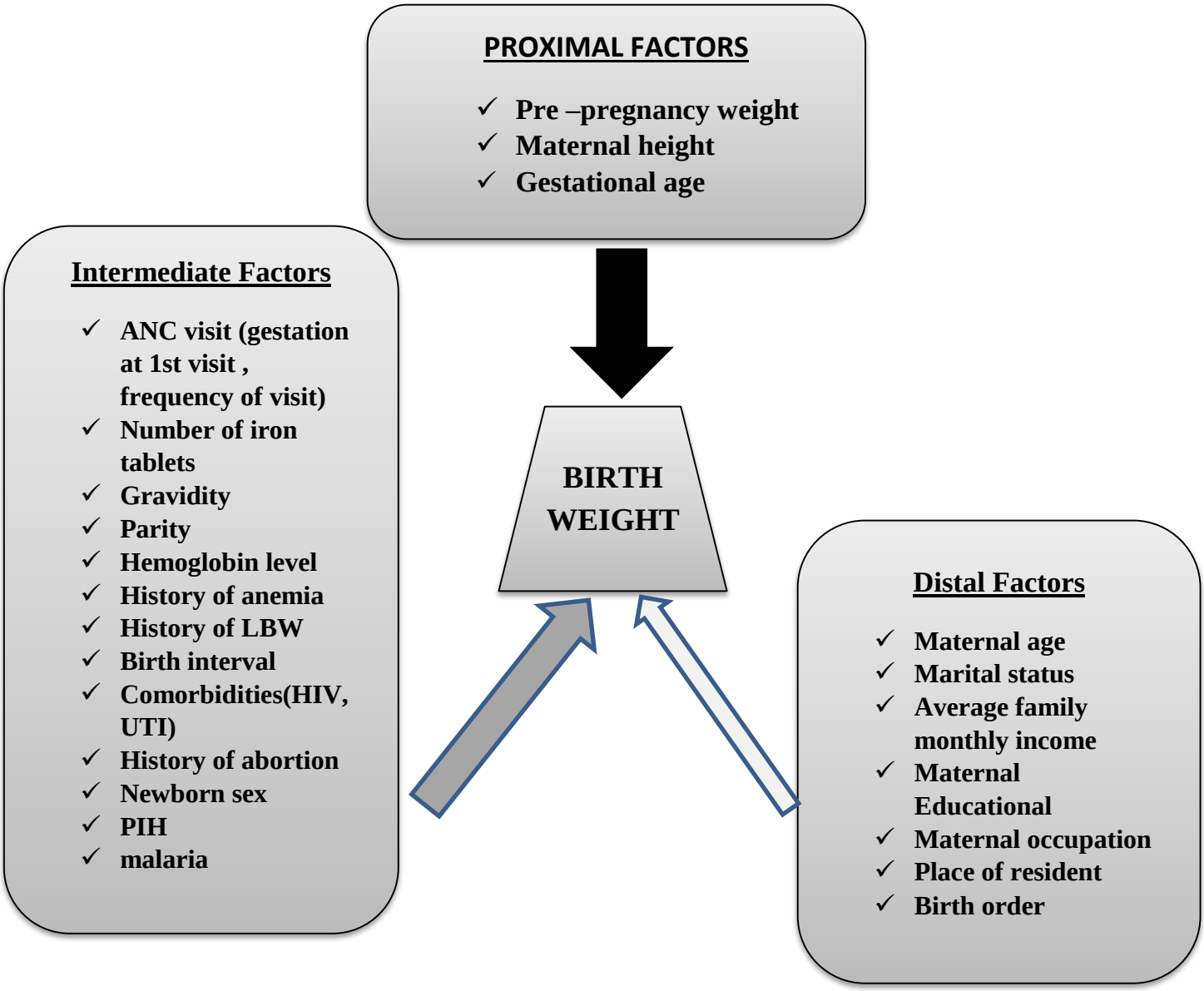

Figure 2: Conceptual framework on maternal factors associated with low birth weight.

CHAPTER THREE 3: OBJECTIVE

General objective: The objective of this study is to identify determinants of low birth weight at Jimma Medical Center from July 1 to September 30, 2022 G.C.

Specific Objective:

To assess low birth weight among new borns delivered at Jimma Medical Centers from July 1 to September 30, 2022 G.C.

To identify the determinant of low birth weight among new borns delivered at Jimma Medical Center from July 1 to September 30, 2022 G.C.

CHAPTER FOUR: METHODS AND MATERIALS

4.1. Study Design

A facility based unmatched case control study design was conducted on women who gave birth at Jimma Medical Center from July 1, 2022 to September 30, 2022 G.C

4.2. Study Area and Study Period

The study was conducted in Jimma Medical Center (JMC) which is found in Jimma Town, Jimma Zone, Oromia Region and South-Western Ethiopia. Jimma Town has 346 Km from the capital city of Finfinnee. Jimma Medical Center which serves as a referral hospital for zonal hospitals and health centers in the zones has different departments. Among these obstetrics department is the one under which delivery service for both normal and abnormal laboring mothers given caesarean section, instrumental delivery and spontaneous vaginal delivers. As per JMC statistics, the center is currently providing different services for approximately 18 million people in the catchment areas. Maternity services are one of the wards with highest patient flow.

The pediatric department is another department with high burden of patient flow. It gives service to neonates and has Neonatal Intensive Care Unit (NICU).The NICU is not well equipped to handle high burden of LBW.

Study period was from July to September, 2022 G.C

4.3. Population

4.3.1. Source Population

All mothers who gave birth in Jimma Medical Center were the source population.

4.3.2. Study Population

The study populations were those mothers who gave birth in Jimma Medical Center during the study period.

4...3.3.Study Unit

Study units were all the selected mothers.

4.3.4. Inclusion criteria and Exclusion criteria

4.3.4.1. Inclusion criteria

All mothers who delivered in Jimma Medical Center.

4.3.4.2. Exclusion criteria

Mothers who delivered: twins or higher order, babies with lethal congenital anomalies and still birth.

4.4. Sample Size Determination

The sample size was determined by using Open Epi Info version 7.2.5.0 using double population proportion exposure difference formula by considering major determinant variables (mothers with low educational level, maternal height ≤155cm ,Maternal complications during pregnancy, gestational hypertension and those mothers who had no ANC visit) from previous study done in Addis Ababa Public Hospitals(15). Considering mothers with complications during pregnancy (proportion=14.4% with OR 3)(15) as independent predictor since it gives maximum sample size as compared to other exposure variables, Following the assumptions (95% CI, 80% power and 1:1 control to case ratio the sample size was 176). By adding 10% non-response rate the final sample size was 194 (97 cases and 97 controls). Consecutive live births of less than 2500g were selected as cases and succeeding babies with weights of at least 2500g but less than 4000g as controls.

4.5. Variables of the Study

4.5.1. Independent Variables

- ✓ **Socio demographic characteristics of the mother** include: Residence, maternal age, marital status.
- ✓ **Newborn sex**
- ✓ **Maternal and obstetrics characteristics**: Gravidity, Parity, History of abortion, Hemoglobin level, gestational age at birth, nº of ANC follow up, history of chronic hypertension, Pregnancy induced hypertension, Gestational DM, Non-gestational DM, vaginal bleeding, gush of fluid per vagina, malaria, and previous history of LBW delivery.

4.5.2. Dependent Variable

- ✓ Birth weight

4.6. Data Quality Control

The questionnaire was first prepared in English and later translated to the local language (Afaan Oromoo and Amharic) and then back to English by an independent translator to keep the data collection instrument consistent. The tool was first pretested on 5% of the samples (5 cases and 5 controls) before the actual date of data collection. A necessary adjustment was considered following the result of the pre-test. One-day training has been given concerning the objective, instrument, and data collection procedure for data collectors. The principal investigator and Supervisor checked and reviewed the collected data for clarity, completeness, and accuracy.

4.7. Data Collection and Measurements

The data were collected by interviewing the mothers, observing medical records and measuring the anthropometry of the mothers and the newborns using structured and pretested questionnaires. The interview and anthropometric measurements were conducted by 4 trained midwives working in delivery room. The questionnaire was adopted from Ethiopian demographic health survey. The interviews were conducted at the delivery room after the mother had given birth.

The neonate's weight was measured using a balanced scale to the nearest 0.01g. The mid-upper arm circumference (MUAC) of the mother was measured right after delivery using flexible non-stretchable standard tape measure. The height of the mother was measured against a wall height scale to the nearest centimeter. Maternal Weight Measured after the mother started ambulation.
At birth, the gestational age was calculated using the last normal menstrual period (LNMP), a review of the maternal history for early ultrasound examination and urine test or Performing Ballard Score if none available. Maternal hemoglobin level was reviewed from client card.

4.8. Data Management and Analysis

Data was checked for completeness, coded and entered into Epi data version 7.2.5.0 and exported to SPSS version 25 statistical software for analysis. Descriptive statistics were presented using standard statistical parameters such as percentages, means and standard deviations. Bivariate analysis was done and all explanatory variables with a p-value less than 0.25 were included in multivariable analysis. Multi variable conditional logistic regression analysis was employed to determine independent determinant factors.

The level of multi-collinearity was checked and fitted using variance inflation factor and tolerance. An adjusted odds ratio (AOR) with a 95% confidence interval (CI) was reported to describe the

strength of association. The Omnibus test and Hosmer-Lemeshow goodness-of-fit were applied to check for model fitness.

In a multivariable regression, P-value, less than 0.05, was considered statistically significant. Finally, results were presented in the form of tables.

4.9. Operational Definition

Birth weight: Is the first weight of 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 g (up to and including 2,499 g).

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

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

Gravidity: number of pregnancy

Parity: number of live births

Danger signs of pregnancy: any one or more early or late pregnancy bleeding, leakage of amniotic fluid, reduced fetal movement, severe headache, convulsion, blurred vision, fever, and severe abdominal pain.

Iron and folic acid supplementation: For this study, mothers who supplemented and took iron and folic acid for at least 3 months were considered as "Yes."

Merchant: Women trades in commodities produced by other people, i.e., vegetables (onion, tomatoes, cabbage, potato), plastics (bucket, seat), clothing (trousers, underwear, shoes, t-shirt,) metals (metallic pot, teapot).

Incomplete ANC For the purpose of this study is less than four ANC Contact.

4.10. Ethical considerations

Ethical clearance was obtained from Jimma University, Institute of Health of review board. Further permission was be obtained from CEO of Jimma Medical Center 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. Oral consent was obtained from all caregivers, and this study is done in accordance with the Declaration of Helsinki.

4.11. Dissemination Plan

The final result of the study will be submitted to Jimma University, Institute of Health, department of Obstetrics and Gynecology in partial fulfillment of the requirements for the specialization in Obstetrics and Gynecology**.** In addition the result will be disseminated to the relevant organizations that can make use of the findings. Publication on professional journals will be considered.

CHAPTER FIVE: RESULT

Socio-Demographic Factors of the Mother

Of 1431 live born neonates delivered at Jimma Medical Center during the Study Period, 135 babies had birth weight less than 2500g making the Prevalence of low birth weight 9.4%.

From a total of 194 sampled populations, 194 new-borns (97 cases and 97 controls) were included which made the response rate 100% for both cases and controls. The mean (±SD) age of cases and controls were 25.99 ± 4.65 and 26.62 ± 5.36, respectively.

The mean height and Weight of the respondent were 157.5cm and 62.3 kg respectively. The mean monthly income of the family was 3378 Ethiopian birr. About 80.4% of cases and 71.1% of controls were within 20 – 35 years. Fifty-six (57.7%) cases reside in Urban areas, while seventy three (75.3%) of controls were urban residents.

Around 38.1% of cases and 31% of controls had attended primary school, and 60.8% of the case group and 42.3% of the control group mothers were within the weight range of $\leq$60 kg during their recent pregnancy. Further, 64 of mothers in cases (66%) and 62 of mothers in controls (63.9%) were housewives (Table 1).

Table 1 Frequency Distribution of Socio-Demographic Characteristics among Case and Control Groups in Jimma Medical Center, Jimma, 2022

	Variable	Case n (%)	Control n (%)	Total N (%)
Maternal Age	<20	14(14.4)	16(16.5)	30(15.5)
	20-34	78(80.4)	69(71.1)	147(75.8)
	≥35	5(5.2)	12(12.4)	17(8.8)
Religion	Orthodox	28(28.9)	36(37.1)	64(33)
	Muslim	53(54.6)	47(48.5)	100(51.5)
	Protestant	14(14.4)	14(14.4)	28(14.4)
	Others[a]	2(2.1)	0(0)	2(1)
Ethnicity	Oromo	67(69.1)	72(74.2)	139(71.6)
	Amhara	14(14.4)	10(10.3)	24(12.4)
	Kefa	6(6.2)	7(7.2)	13(6.7)
	Others[b]	10(10.3)	8(8.2)	18(9.3)
Educational Status	No Formal Education	16(16.5)	14(14.5)	30(15.5)
	Primary Education	37(38.1)	31(32)	68(35.1)
	Secondary Education	17(17.5)	19(19.6)	36(18.6)
	Higher Education	27(27.8)	33(34)	60(30.9)
Residency	Urban	56(57.7)	73(75.3)	129(66.5)
	Rural	41(42.3)	24(24.7)	65(33.5)
Occupation	House Wife	64(66)	62(63.9)	126(64.9)
	Employed	15(15.5)	27(27.8)	42(21.6)
	Merchant	17(17.5)	4(4.1)	21(10.8)
	Others[c]	1(1)	4(4.1)	5(2.6)
Maternal Weight During Pregnancy	≤ 60 Kg	59(60.8)	41(42.3)	100(51.5)
	61-70 Kg	29(29.9)	41(42.3)	70(36.1)
	71-80 Kg	2(2.1)	5(5.2)	7(3.6)
	≥80Kg	7(7.2)	10(10.3)	17(8.8)
Maternal Height	≤ 155 cm	48(49.5)	24(24.7)	72(37.1)
	≥155 cm	49(50.5)	73(75.3)	122(62.9)
Household Monthly Income	<1650 ETB	36(37.1)	20(20.6)	56(28.9)
	1650-3199 ETB	27(27.8)	39(40.2)	66(35)
	3200-5249 ETB	15(15.5)	20(20.6)	35(18)
	≥5250 ETB	19(19.6)	18(18.6)	37(19.1)

Obstetrics, Antenatal, Nutritional and New born Factors

The mean birth weight of the neonates was 2602 ± 709 gram with the minimum and maximum birth weight of new-borns 1035 g and 3900 g, respectively. 32 of case mothers (33%) were primigravida and 65(67%) were multigravida. From the control group, 25(25.8%) of the mothers were primigravida, and nearly three-fourth (74.2%) were multigravida. Mothers who had a history

of abortion in both cases and control groups were 21.6% and 22.7%, respectively. About half of the case group mothers had nutritional counseling during pregnancy, whereas from the control group mothers, 81 (83.1%) of them had nutritional counseling during pregnancy. Twenty-eight (28.9%) case group and 14 (14.4%) control group mothers had MUAC less than 23 cm. The majority of the case group (92.8%) and control group mothers (94.8%) had antenatal care (ANC) follow-up.52.2% of Case groups and 23.9% of Control groups had 1-3 ANC Contact. Only 5.6% of Cases and 13% of Control groups had ANC Contact $\geq$ 8. 81 of case group mothers (83.5%) had iron supplement during pregnancy, whereas in the control group mothers, 95(97.7%) of them had iron supplement during pregnancy. Table 2

Table 2 *Frequency Distribution of Obstetrics, Antenatal, Nutritional and New born Factors among Case and Control Groups in Jimma Medical Center, Jimma, 2022*

Variable	Categories	Case N (%)	Control N (%)	Total N (%)
Gravidity	Primigravida	32(33)	25(25.8)	57(29.4)
	Multigravida	65(67)	72(74.2)	137(70.6)
Parity	Primipara	40(41.2)	34(35.1)	74(38.1)
	Multipara	57(58.8)	63(64.9)	120(61.9)
ANC Follow up	Yes	90(92.8)	92(94.8)	182(93.8)
	No	7(7.2)	5(5.2)	12(6.2)
Number of ANC Contact	1-3	47(52.2)	22(23.9)	69(37.9)
	$\geq$4	43(47.8)	70(76.1)	113(62.1)
Iron and Folic Supplementation	Yes	81(83.5)	95(97.9)	176(90.7)
	No	16(16.5)	2(2.1)	18(9.3)
Nutritional Counseling During Pregnancy	Yes	46(47.4)	81(83.5)	127(65.5)
	No	51(52.6)	16(16.5)	67(34.5)
Maternal MUAC	<23cm	28(28.9)	14(14.4)	42(21.6)
	$\geq$23cm	69(71.1)	83(85.6)	152(78.4)
Infant Sex	Female	42(43.3)	43(44.3)	85(43.8)
	Male	55(56.7)	54(55.7)	109(56.2)
History of LBW	Yes	8(8.2)	3(3.1)	11(5.7)
	No	89(91.8)	94(96.9)	183(94.3)
History Of Abortion	Yes	21(21.6)	22(22.7)	43(22.2)
	No	76(78.4)	75(77.3)	151(77.8)
Gestational Age at delivery	Preterm	68(70.1)	4(4.1)	72(37.1)
	Term	29(29.9)	90(92.8)	119(61.3)
	Post Term	0(0)	3(3.1)	3(1.5)
Birth Defect	Yes	5(5.2)	3(3.1)	8(4.1)
	No	92(94.8)	94(96.9)	186(95.9)

Complications during Pregnancy

Regarding pregnancy-related complications, 26(26.8%), 28(28.9%), 6(6.2%), 1(1%) and 50(51.5%) had Anemia, Gestational HTN , Chronic HTN ,Diabetes Mellitus and Danger Signs During Pregnancy in the case group, respectively. From the control group mothers, 6(6.2%), 3(3.1%), 1(1%), 2(2.1) and 29(29.9) of them had Anemia, gestational HTN, Chronic HTN, Diabetes Mellitus and Danger Signs during pregnancy, respectively. 11(11.3%) Of Case groups and 3(3.1) Control groups had History of Malarial Infection during Current pregnancy. 11(11.3%) of Cases and 4(4.1%) of Control groups had history of Vaginal bleeding during Current Pregnancy. 9(9.3%) of Case groups and 2(2.1%) of Control groups had History of Gush of Fluid per vagina before labor during this pregnancy. Table 3

Table 3 *Pregnancy Related Complications among Case and Control groups in Jimma Medical Center, Jimma, 2022*

Variable	Categories	Case N (%)	Control N(%)	Total N(%)
Anemia	Yes	26(26.8)	6(6.2)	32(16.5)
	No	71(73.2)	91(93.8)	162(83.5)
Chronic Hypertension	Yes	6(6.2)	1(1)	7(3.6)
	No	91(93.8)	96(99)	187(96.4)
Pregnancy Induced Hypertension	Yes	28(28.9)	3(3.1)	31(16)
	No	69(71.1)	94(96.9)	163(84)
Danger Signs During Pregnancy	Yes	50(51.5)	29(29.9)	79(40.7)
	No	47(48.5)	68(70.1)	115(59.3)
Diabetes Mellitus	Yes	1(1)	2(2.1)	3(1.5)
	No	96(99)	95(97.9)	191(98.5)
History Of Vaginal Bleeding during Pregnancy	Yes	11(11.3)	4(4.1)	15(7.7)
	No	86(88.7)	93(95.9)	179(92.3)
Premature Rupture of Membrane	Yes	9(9.3)	2(2.1)	11(5.7)
	No	88(90.7)	95(97.9)	183(94.3)
History Of Malaria During Pregnancy	Yes	11(11.3)	3(3.1)	14(7.2)
	No	86(88.7)	94(96.9)	180(92.8)

Determinants of LBW

Those determinants like Maternal Age, Place of Residency, Occupation of the Mother, Maternal Weight during Pregnancy, Maternal Height, Number of ANC Contact, Iron and Folic Acid Supplementation during Pregnancy, Nutritional counseling, History of LBW, Maternal MUAC,Anemia, Chronic Hypertension, Pregnancy Induced Hypertension, Danger Signs During Pregnancy,Vaginal Bleeding During Pregnancy, Premature Rupture of Membranes and History of Malaria during pregnancy had P-value less than 0.25 in Bivariable logistic regression. Those variables were entered into multivariable logistic regression for further analysis (Table 4).

Table 4: Bivariable logistic regression analyses of Low Birth Weight in Jimma Medical Center, 2022

Variable	Categories	Case n (%)	Control n (%)	COR	P-Value
Maternal Age	<20	14(14.4)	16(16.5)	2.1(.59-7.45)	**.**251
	20-34	78(80.4)	69(71.1)	2.71(.91-8.09)	**.073**
	>35	5(5.2)	12(12.4)	1	
	Urban	56(57.7)	73(75.3)	1	
	Rural	41(42.3)	24(24.7)	2.23(1.21-4.11)	**.010**
Occupation	Employed	15(15.5)	27(27.8)	1	
	Merchant	17(17.5)	4(4.1)	7.65(2.17-26.94)	**.009**
	House Wife	64(66)	62(63.9)	1.86(.903-3.82)	**.023**
	Others[a]	1(1)	4(4.1)	.45(.046-4.4)	**.210**
Maternal Weight During Pregnancy	< 60 Kg	59(60.8)	41(42.3)	2.06(.72-5.84)	**.073**
	61-70 Kg	29(29.9)	41(42.3)	1(.34-2.96)	**.176**
	71-80 Kg	2(2.1)	5(5.2)	.57(.085-3.3.8)	.985
	>80Kg	7(7.2)	10(10.3)	1	.564
	< 155 cm	48(49.5)	24(24.7)	2.98(1.62-5.48)	**.000**
	>155 cm	49(50.5)	73(75.3)	1	
Number of ANC	1-3	47(52.2)	22(23.9)	**3.48(1.85-6.55)**	**.000**
	>4	43(47.8)	70(76.1)	1	
Iron and Folic Supplementation	Yes	81(83.5)	95(97.9)	1	
	No	16(16.5)	2(2.1)	9**.38(2.1-42**)	**.003**
Nutritional Counseling During Pregnancy	Yes	46(47.4)	81(83.5)	1	
	No	51(52.6)	16(16.5)	**5.6(2.88-10.95**)	**.000**
Maternal MUAC	<23cm	28(28.9)	14(14.4)	**2.4(1.17-4.9**)	**.016**
	>23cm	69(71.1)	83(85.6)	1	
History of LBW	Yes	8(8.2)	3(3.1)	2.82(.72-10.9)	**.135**
	No	89(91.8)	94(96.9)	1	
Anemia	Yes	26(26.8)	6(6.2)	**5.55(2.17-14.22**	**.000**
	No	71(73.2)	91(93.8)	1	

Chronic Hypertension	Yes	6(6.2)	1(1)	6.33(.75-53.6)	**.090**
	No	91(93.8)	96(99)	1	
Pregnancy Induced Hypertension	Yes	28(28.9)	3(3.1)	12.71(3.71-43.52)	**.000**
	No	69(71.1)	94(96.9)	1	
Danger Signs During Pregnancy	Yes	50(51.5)	29(29.9)	2.5(1.4-4.5)	**.002**
	No	47(48.5)	68(70.1)	1	
Vaginal Bleeding during Pregnancy	Yes	11(11.3)	4(4.1)	2.97(.91-9.7)	**.071**
	No	86(88.7)	93(95.9)	1	
Premature Rupture of Membranes	Yes	9(9.3)	2(2.1)	4.86(1.02-23.1)	**.047**
	No	88(90.7)	95(97.9)	1	
Malaria During Pregnancy	Yes	11(11.3)	3(3.1)	4(1-14.8)	**.038**
	No	86(88.7)	94(96.9)	1	

Variables having a statistically significant association in multivariable logistic regression were Merchant Mothers, Incomplete Antenatal Contact, Mothers not counseled about nutrition during pregnancy, Pregnancy Induced Hypertension, and danger signs during pregnancy. The risk of low birth weight was significantly higher among merchant mothers compared to those employed (AOR (CI) = 7.65 (2.10-26.9). Similarly, Mothers who had incomplete Ante natal contact (1–3 contacts) were three times more likely to give LBW than mothers who had four or more Antenatal contacts with [AOR2.87(95%CI1.1–7.4),P=0.031]. Mothers not counseled about nutrition during pregnancy had significantly higher odds of LBW than their counterparts [AOR6.5 (95CI1.6-26.6). Likewise, the odds of LBW were fourteen times more likely among mothers who had PIH than mothers without PIH with [AOR 14.2 (95% CI 2.9–68), P = 0.01]. Furthermore, mothers who had a danger sign during pregnancy were four times more likely to deliver low birth weight babies compared to those who have no danger signs (AOR (CI) = 3.8(1.5-9.6).Table 5

Table 5: Determinants of Low Birth Weight in Jimma Medical Center, 2022

Variable	Categories	Case N (%)	Control N (%)	COR(95%CI)	AOR(95%CI)	P-Value
Occupation	Employed	15(15.5)	27(27.8)	1	1	
	Merchant	17(17.5)	4(4.1)	**7.6(2.2-26)**	**7.65(2.1-26.9)**	**.003**
	House Wife	64(66)	62(63.9)	1.86(.9-3.8)	3.53(.29-42.4)	.320
	Others	1(1)	4(4.1)	.45(.046-4.4)	.95(.002-529)	.986
Number of ANC Contact	1-3	47(52.2)	22(23.9)	**3.48(1.8-6.5)**	**2.87(1.1-7.4)**	**.031**
	>4	43(47.8)	70(76.1)	1	1	
Nutritional Counseling During Pregnancy	Yes	46(47.4)	81(83.5)	1	1	
	No	51(52.6)	16(16.5)	**5.6(2.9-10.9)**	**6.53(1.6-26.6)**	**.009**
Pregnancy Induced Hypertension	Yes	28(28.9)	3(3.1)	**12.71(3.7-43)**	**14.27(2.9-68)**	**.001**
	No	69(71.1)	94(96.9)	1	1	
Danger Signs During Pregnancy	Yes	50(51.5)	29(29.9)	**2.5(1.4-4.5)**	**3.8(1.5-9.6)**	**.004**
	No	47(48.5)	68(70.1)	1	1	

CHAPTER SIX: DISCUSSION

LBW is a global challenging public health problem. Its high priority stems from the fact that it is the major predictor of infant morbidity and mortality. This study was conducted on the determinants of LBW among newborns delivered at Jimma Medical Center**.**

This study revealed that the risk of low birth weight was significantly higher among merchant mothers. This finding is concordant with Snijder et al and Mesfin et al findings which documented a significant association between being a merchant and low birth weight (16,17). This could result from work-related stress and involvement in strenuous activities or heavy physical work. Additionally, they spend most of their time in business or wholesale trade and may not have enough time to care for themselves. Further, such activities might require prolonged standing. In turn, this increases the action of the sympathetic nervous system in the active muscles and results in backflow of blood from visceral arteries to the active muscles, which results in increased sweating, reduced plasma volume, decreased blood perfusion to uterine and placental arteries, thereby reducing the oxygen and nutrients supply to the fetus (16).

However, this finding is in contrary with a study done in Addis Ababa Public hospitals that found no significant difference in the risk of delivering LBW babies between merchant and employed mothers (15). Possible explanations are Difference in geographic location, demography and Difference in study design.

According to this study, mothers who had three or fewer ANC contact were three times more likely to give birth to LBW than those who had four and above visits with [AOR 2.87 (95% CI 1.1–7.4)]. Similar findings were found in a study conducted in Addis Ababa Public Hospitals (15), Amhara region (18), Morocco (19) India and Eastern Nepal (20, 21).

This is related with ANC visits of the pregnant mother are very important to minimize adverse pregnancy outcomes including LBW as they provide chances for evaluating the fetal wellbeing and permit management soon by improving the health and wellbeing of the mother and preventing further complications by early detection and treatment of diseases(22).

In this study mothers not counseled about nutrition during pregnancy had significantly higher odds of LBW than their counterparts. Nutritional counseling may improve their feeding behaviour and hence, their nutritional status which may help mothers to decrease the risk of delivering LBW babies. The finding was consistent with studies done in Nekemte town (23), Northern Ethiopia and India (24, 25).There is mounting evidence from controlled trials that improving food intake during pregnancy effectively reduces the risk of giving birth to LBW babies [26, 27]. Similarly, iron and folic acid supplements during pregnancy had a significantly lowering incidence of LBW, in agreement with a study from Bangladesh (28). In contrary, Iron and folate supplementation was not associated with LBW in this study.

Pregnancy Induced hypertension was another predictor of LBW. According to this study, mothers who had PIH had fourteen times increased odds of giving birth to low birth weight babies than their counterparts .This result is consistent with a case-control study done in Addis Ababa Puplic Hospitals(15),Debre Markos(29) and a cross-sectional study in Gondar town(4).This may be associated with oxygen and nutrients supplied through the placenta to the fetus becomes compromised as a result of vasoconstriction of blood vessel walls during hypertensive state result in LBW(29).

Danger signs during pregnancy were also significantly increased the odds of low birth weight. According to this study, mothers who had a danger sign during pregnancy were four times more likely to deliver low birth weight babies. This finding was supported by previous studies done in Tirunesh Beijing General Hospital (17), India (31), Debre Berhan (30), Amhara regional state referral hospitals (18), and Bale zone (32). The danger signs and symptoms of pregnancy indicate some kind of complications that adversely affects the growth of the fetus. For instance, hypertensive disorders of pregnancy may cause pre-eclampsia, resulting in reduced perfusion and nutrient and oxygen supply to the fetus, resulting in low birth weight or fetal death (18). Thus, it is recommended that pregnant women be aware of this sign and timely report/seek medical care. In addition, regular antenatal care follow-up helps early detection and management of these disorders during pregnancy.

CHAPTER SEVEN: STRENGHT AND LIMITATION

Main strength of this study was taking birth weight Within 1 hour after birth. Measurement of some explanatory Variables were, however, prone to recall bias.

Findings of this study can have a significant implication For prevention of low birth weight and emphasis should be given to nutrition education, nutrition assessment.

This study was Institutional based, and therefore it may not be as good as population-based studies to generalize the results in the population.

CHAPTER EIGHT: CONCLUSION AND RECOMMENDATIONS

Several factors were found to be associated with low birth weight. Being merchant, Inadequate ANC, Absence of nutritional counseling during pregnancy, Pregnancy Induced Hypertension and Danger Signs during pregnancy were identified to be significant predictors of LBW. Increasing Number of ANC Contact according to new WHO guideline which recommends at least 8 ANC Contact should be practiced. Nutritional Counselling during pregnancy and Advising about danger Signs of pregnancy are recommended. Finally, Prevention of Pregnancy induced Hypertension is recommended. Governmental and non-governmental organizations working on maternal and child health should focus on identified factors in order to tackle the problem of LBW.

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Annexes: Questionnaire

Jimma University, Institute of Health, Department of Obstetrics and Gynecology

Data collector'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 who gave birth to a live baby with low birth weight to assess about the Determinants of 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 2016, 13% 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 Jimma Medical Center. The data collection is supposed to get administered within this facility from client chart and by interviewing

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Checklist for data collection on Determinants of low birth weight

Among mother Who give birth at Jimma Medical Center

Note the inclusion criteria from clinical records: • Is the child alive ---------- 1: YES 2: NO • Is the child born single ----------1: YES 2: NO • Is the child free of any visible major birth defect ------ 1: YES 2: NO • Did the mother deliver in Jimma Medical Center--------1: YES 2: NO If 'No' to any of the inclusion criteria, stop the data collection.	
MRN	_____
Data collector's Name	_____

S Nº	Coding Categories	Questions and filter	Remark
101	Birth weight of the baby in grams?	Birth weight in g: _____	
102	What is the sex of the newborn?	Male _____ 1 Female _____2	
103	Birth Defect	Yes---1 No----2	
104	Age of the mother	Age(years): _____	
105	Place of residence	Urban----------1	
		Rural----------2	
106	Ethnicity	Oromo—1 Amhara---2 Kefa—3 Other_____4	
107	Religion	Orthodox—1 Muslim—2 Protestant---3 other_____4	
108	Marital status	Married—1 divorced—2 Single—3 widowed—4	
109	Educational Status	No formal education---1 Primary---2 Secondary------3 higher education----4	
201	Occupation	Employed----1 Merchant---2 House Wife----3 Others----4	
202	Maternal weight during pregnancy	-------kg	
203	Household Monthly income	---------ETB	
204	Maternal stature	------cm	
205	Maternal MUAC	------cm	
206	Smoking status	Yes-----1 No------2	
207	Alcohol drunk during pregnancy	Yes---1 No-----2	
208	Gravidity	Gravidity: _____	
209	Parity	Parity:_____	
301	History of LBW	Yes---1 No----2	
302	History of abortion	Yes----------1	
		No----------2	
303	How many abortions did you have?	Number of abortions_____	
304		GA at delivery	

	What was the gestational age (GA) at Delivery, in weeks?	in weeks: _____	
305	How did you give birth?	Vaginal Delivery----------1	
		Assisted Delivery----------2	
		Cesarean Delivery----------3	
306	ANC Visit	Yes----------1	
		No----------2	
307	Iron and Folic acid supplementation	Yes-----1 No -----2	
308	Danger signs during pregnancy	Yes----1 No-----2	
309	Nutritional Counseling during Pregnancy	Yes-----1 No-----2	
401	How many months pregnant were You when you first received antenatal care services for this pregnancy?	Months_____	
		Not documented--------- 99	
402	How many times did you receive antenatal care during your current pregnancy?	Number of visits: _____	
		Not documented--------- 99	
403	Have you ever been diagnosed to have chronic hypertension?	Yes----------1	
		No----------2	
		Not Documented---------99	
404	During this pregnancy, have you been diagnosed to have pregnancy induced hypertension?	Yes----------1	
		No----------2	
		Not Documented---------99	
405	What was her hematocrit level on her current pregnancy	_____%	
406	Have you ever been diagnosed to have Diabetes Mellitus?	Yes----------1	
		No----------2	
407	During your current pregnancy, have you been diagnosed to have gestational diabetes mellitus?	Yes----------1	
		No----------2	
408	During this pregnancy, did you have any history of vaginal bleeding prior to the onset of labor?	Yes----------1	
		No----------2	
409	During this pregnancy, did you have any history of gush of fluid per vagina prior to the onset of labor?	Yes----------1	
		No----------2	
501	During your current pregnancy, have you been diagnosed to have malaria	Yes----------1	
		No----------2	