DETERMINANTS OF LOW BIRTH WEIGHT AMONG NEWBORNS DELIVERED IN PUBLIC HEALTH FACILITIES OF DESSIE TOWN, NORTHEAST ETHIOPIA: A CASE CONTROL STUDY

BY: SEMIRA AHMED (BSc)

THESIS SUBMITTED TO JIMMA UNIVERSITY, INSTITUTE OF HEALTH, FACULTY OF PUBLIC HEALTH, DEPARTMENT OF POPULATION AND FAMILY HEALTH, IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF MASTERS' DEGREE IN HUMAN NUTRITION (Msc.)

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JIMMA, ETHIOPIA

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Advisors

1. **Dr Kalkidan Hassen (MSc, PhD)**
2. **Tolassa Wakayo (BSc, MSc)**

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Abstract

Background: Low birth weight (LBW) remains the single most important risk factor which attributed to mortality of 15% -20% of newborns across the globe. Most of the lifecycle cycles of nutritional outcomes are deeply rooted in birth weight. 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 intergenerational assaults of malnutrition as it is the risk for sub optimal growth till adulthood, affecting women's reproductive capabilities. Thus, there is enough concern to study the determinants of LBW across setting. Accordingly, this study was conducted to assess the determinants of low birth weights in Dessie Town, Northeast Ethiopia.

Methods: A facility based unmatched Case Control study was employed from February to April 2017. The data were collected using structured, pretested interviewer administered questionnaire in all public health facilities of Dessie Town. Consecutive live births of less than 2500 grams in each of hospitals and the health centers were selected as cases and succeeding normal weight babies as controls. Data were entered in to Epi-data software version 3.1 and exported to SPSS Version 21 and analyzed using frequency, crosstabs and percentage. Factors with p-value <0.25 in Bivariate analysis were entered to multivariable logistic regression and statistical significance were considered at p-value <0.05.

Results: The mean ± sd of birth weight was 2138.28gm ± 206.87 for cases and 3145.16gm ± 414.99 for controls. After using multivariate logistic regression analysis, iron and folate supplementation during pregnancy (AOR=2.84(95%CI: 1.15,7.03)), mothers who did not receive nutritional counseling during the current pregnancy (AOR = 4.05 (95%CI: 1.95, 8.38)), mothers who did not take additional meal (AOR=3.25(95%CI: 1.64, 6.44)), undernourished mothers (AOR =5.62(95%CI: 2.64,11.97)), anemic mothers (AOR= 3.54 (95%CI: 1.46,8.61)) and inadequate MDD-W (AOR=6.65(95%CI: 2.31, 19.16))were found as a risk factor associated for low birth weight.

Conclusion and recommendations: Lack of nutrition counseling at ANC, lack of iron and folate supplementation during pregnancy , mothers not receive additional food during pregnancy, maternal under nutrition, maternal anemia and inadequate M-WDDS were significant determinants of LBW. The importance of nutritional counseling and iron and folate supplementation during pregnancy, malnutrition screening and proper identification of high risk-mother needs to be strengthened effort to reduce incidence of LBW infants. In addition, behavioral change communications targeting pregnant women in improving women dietary diversity needs to be enhanced by health extension workers and health professionals in each health facility working at ANC clinic

Key words: Low birth weight, maternal nutritional status, determinants.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANC - Antenatal Care

AOR – Adjusted odds ratio

BMI - Body Mass Index

CI - Confidence interval

COR - Crude odds ratio

EDHS - Ethiopian Demographic and Health Survey

HC - Health Center

Hgb - Hemoglobin

HIV/AIDS - Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

IUGR - Intrauterine growth retardation

LBW - Low birth weight

LMP- last menstrual period

MUAC - Mid-Upper Arm Circumference

MDD-W – Minimum dietary diversity for women

NBW - Normal birth weight

NGO – Non- governmental organization

OR - Odds ratio

PIH - Pregnancy induced hypertension

RCT - Randomized control trial

S.D - Standard deviation

SGA – Small for Gestational Age

SPSS - Statistical Package for Social Sciences

STI – Sexually transmitted infection

UNICEF - United Nations International Children's Fund

UNSCN - United Nations System Standing Committee on Nutrition

WHO - World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 Background information:

Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth less than 2500 grams. Being more common in developing than developed countries, low birth weight contributes to a range of poor health outcomes (1).

Prematurity (born before 37 weeks of gestation) and intrauterine growth retardation (IUGR - a condition where fetal growth has been constrained) are two main causes of low birth weight (2). IUGR is usually responsible for small size for gestational age (SGA, defined as weight for gestation <10th percentile). LBW thus defines a heterogeneous group of infants: some are born early, some are born at term but are SGA, and some are both born early and SGA (3). Evidence shows that prematurity accounts for a one third of LBW while IUGR for the remaining two thirds (4).

The majority of LBW in developing countries is due to IUGR, while it is mostly due to preterm birth in developed countries. Although in many cases, the causes of prematurity is uncertain, they may include maternal high blood pressure, acute infections, hard physical work, multiple births, stress, anxiety, and other psychological factors such as gender based violence. Causes of IUGR are complex and multiple, but center either on the fetus, the placenta, the mother or combination of all three. The causes of IUGR include, poor maternal nutritional status at conception, low gestational weight gain due to inadequate dietary intake or due to excess expenditure of calories (hard work), short maternal stature due to the mother's own childhood under-nutrition and infections, malaria, anemia, acute and chronic infections that could result under-nutrition and consecutive poor pregnancy outcomes including LBW (2). Many factors determine the duration of gestation and fetal growth, and thus, the birth weight. They might be related to the infant, the mother, or the physical environment and play an important role in determining the infant's birth weight and future health(1).

In both developed and developing countries, LBW is strongly associated with perinatal morbidity and increased risk of long-term disability ; inhibited growth and cognitive development, and chronic diseases later in life (2,3).

In 2012, one of the World Health Assembly a Comprehensive implementation plan for 2025 was 30% reduction of the number of infants born with a LBW, with 3.9% relative reduction per year between 2012 and 2025. That is a reduction from approximately 20 million to about 14 million infants with LBW(5).

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. Mothers in deprived socio-economic conditions frequently have LBW infants. In those settings, the infant's LBW stems primarily from the mother's poor nutrition due to poor dietary practices and poor health during their pregnancy, the high prevalence of specific and non-specific infections, or from pregnancy complications, underpinned by poverty. Also engaging in physically demanding work during pregnancy contributes to poor fetal growth resulting in LBW (1).

1.2. STATEMENT OF THE PROBLEM

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 that it contributes substantially to the overall burden of childhood mortality. LBW has also been linked to the high prevalence of stunting seen in developing countries and may be important in the etiology of chronic dietary diseases such as obesity, diabetes and cardiovascular diseases in adulthood (2).

The incidence of LBW is estimated to be 15% to 20% worldwide, representing more than 20 million births a year(5). The great majority of low birth weight births occur in low- and middle-income countries and especially in the most vulnerable populations accounting for 28% in south Asia, 13% in sub-Saharan Africa and 9% in Latin America(6). According to EDHS 2011 among children born with a reported birth weight in Addis Ababa, 11.4% LBW, in Ethiopia(7).

Being born with LBW is generally recognized as a disadvantage for the infant. LBW contributes to 60% to 80% of all neonatal deaths (3). In both developed and developing countries, LBW is an important cause of perinatal mortality and both short- and long-term infant and childhood morbidity. Infants with LBW die at rates of up to 40 times those of infants of normal weight, and they are many times more likely to end up with long-term handicapping conditions (8). They are also at higher risk of perinatal death, adulthood stunting that in turn leading to the intergenerational effect of malnutrition in the affected community (9). In addition they are also increased risk of infection, malnutrition and children who survive LBW have a higher incidence of diseases, mental retardation and chronic disease such as coronary heart disease and non−insulin dependent diabetes mellitus increased risk of high blood pressure, obstructive lung disease, high cholesterol and renal damage(3,10,11).

Poor maternal nutrition is a known cause of LBW accounting for about 50% of cases of LBW in many developing countries(12). Under nutrition of the fetus occurs when the maternal supply of nutrients is unable to meet fetal demands, and is due to a range of factors including genetics, maternal body composition, dietary intake, metabolic state, and placental function(4,9,13). Coincides of LBW with poor maternal nutritional status indicates that mothers are not merely the affecting group but rather, it adversely affects the optimum fetal and child nutrition

and development, increasing childhood morbidity and mortality, impairs cognitive function, motor and socio-emotional development, accompanied with poor school performance and learning capacities as well as lowering work capacity and productivity being adult (14).

Despite its known negative consecutives, studies have identified common prevalence that of LBW and its associated risk factors in many countries. A recent study done in India has reported that maternal age (<19 years), rural residence, maternal weight (<45kg), gestational age (<37 week), bad obstetric history and Pregnancy induced hypertension have a strong association with low birth weight(15). Low socio-economic status, anemia, primiparity, short maternal height and less than average weight(16).A number of studies have shown correlates of infants maternal nutritional status, young maternal age, bad obstetric history, maternal anemia and rural settlements, antenatal care received, prematurity, birth interval with occurrence of low birth weight(14,17–22).

A case control study done in Bale zone hospitals in southern Ethiopia showed that the presence of significant association between the socio-economic, maternal and household environmental factors and birth weight of the newborns(23). An institution based comparative cross-sectional study in Axum (urban) and Laelay Maichew (rural) districts in northern Ethiopia shows a birth weight prevalence of 9.9% and 6.3% in Axum and Laelay Maichew districts, respectively showing the prevalence is more common among participants from urban setting. In Axum district (Urban): low birth weight was associated with inadequate ANC service utilization and unwanted Pregnancy. Sex of the neonate and pregnancy type were also significantly associated with low birth weight in Laelay Maichew district (rural) (24). While Nega et al reported that the incidence of LBW in kersa district in eastern Ethiopia was 28.3%. In this study the identified determinants of LBW factors were being poor, not attending ANC, undernourished mother(MUAC less than 23 cm), and experience of physical violence during the index pregnancy and longer time to walk to health facility(25). A cross-sectional study in Jimma southeastern Ethiopia shows a LBW prevalence of 22.5 %. In this study urban residence, prematurity, having weight loss and receiving no additional diet during pregnancy and multiple gestations were significant factors associated with LBW (26). Another study from North Wollo Zone shows the proportion of LBW was 11.5% and the associated factors were rural residence, marital status, monthly family income, HIV positive mothers and those who refused HIV testing and mothers

with no history of UTI or urinalysis was not done during their current pregnancy (27). Major determinants for LBW in developing countries including Ethiopia, however, are poor maternal nutritional status at conception, low gestational weight gain due to inadequate dietary intake and short maternal stature due to the mother's own childhood under nutrition, infection and / or malaria and female sex of the fetus, suggesting maternal nutrition plays a central role in determining fetal birth weight(28).

Though there are some studies undertaken in Ethiopia aiming at determining the prevalence and associated factors of LBW using cross-sectional study and risk factors of LBW using case-control study (23,24,26,29–35) these studies considered only socioeconomic, maternal and newborns characteristics as either factors associated with LBW or risk factors of LBW and few studies(25,36) have been conducted regarding the maternal nutritional status and dietary practices with regard to the incidence of low birth weight in Ethiopia. Therefore, the aim of this study is to determine nutritional and others factors associated with LBW among newborns delivered at public health facilities in Dessie Town, Northeast Ethiopia.

CHAPTER TWO: LITERATURE REVIEW

LBW is a multifaceted public health problem and a major determinant of mortality, morbidity and disability in neonatal period, infancy and child hood. LBW has a long term impact on health outcomes of adult life with a substantial cost to the health sector and imposes a significant burden on the society due to non-communicable diseases. Further it is an intergenerational problem in which infants with low birth weight, if not interfere adequately, grow up to be undernourished and stunted as children and adolescents and, ultimately, undernourished women of child bearing age who will be undernourished during pregnancy and then will deliver LBW infants(2).Hence, birth weight is an essential element in the success of national and global efforts to improve child health, and a major target for public health intervention. AS a result, birth weight-especially low birth weight and its determinants have become a focal area for clinical and epidemiological investigations word wide(1,2).

2.1. Determinants of LBW

Identifying the determinants of low birth weight is important because of the health risks associated with low birth weight. These factors are related to the infant, the mother or the physical environment and play an important role in determining the infant's birth weight and future health (1).The following are some factors found to be determinant of LBW broadly falls into four categories: socio-demographic and socioeconomic factors, medical and obstetric, and food security and dietary factors, behavioral factors and environmental factors.

2.1.1. Socio-demographic and socioeconomic factors

A number of factors have been identified to influence LBW. These Socio demographic characteristics are: maternal age, education, residence and socio-economic status. SES is a complex construct that has been used to define social inequality and usually includes measures of income, occupation, and/o r educational attainment(37).

Women in low socio-economic status have an increased risk of delivering a low birth weight infant, this may stem from poor nutrition and health over a long period of time, high prevalence of specific and non-specific infections or from pregnancy complications underpinned by poverty(23,27,38). The fact that social class can affect low birth has been

elucidated by many studies, Kramer concluded that low socioeconomic status may be a social cause of other nutritional, toxic, anthropometric and infectious factors that are causal (12). Maternal low level of education has been associated with increased risk of delivering a low birth weight infant. This may be due to poor diet as a result of low income and low dietary literacy(23,37–39).

Maternal age, marital status and place of residence are also associated with LBW. The younger age group is at risk of having LBW babies compared to older age group. The explanation could relate to maternal nutritional depletion that presence normally in teenage pregnancy and older age group because of poor eating pattern. Increased risk of chronic disease such as hyper-tension, diabetes mellitus and heart disease for advanced maternal age required them to deliver preterm or their babies developed IUGR due to poor maternal health (12,18,21,23,33).

A cross sectional study in Jimma shows mothers residing in urban areas had high proportion of delivering LBW babies compared to rural mothers (26). Whereas other studies shows residing in rural have higher odds of delivering LBW baby (14,23). The study from Tanzania showed that unmarried women were almost twice more likely to give birth to LBW neonates than the married ones contributing to about 5% of all low birth weights (PAF=5.4% (CI= 2.8- 7.4) (39). Similarly a facility based cross-sectional survey conducted in north wollo zone showed that women who were not married were ten times to deliver LBW baby than married women (27) . While Kramer in his metanalysis concludes that there is no effect of marital status on low birth weight and prematurity"(12).

2.1.2. Infant factor

For the same gestational age, girls weigh less than boys, firstborn infants are lighter than subsequent infants, and twins weigh less than singletons (1). And also other studies shows that being neonate was significantly associated with birth weight and increase risks for low birth weight(24,35,39).

2.1.3 Medical and obstetrics factor

Medical and Obstetric factors such as gravidity, parity, birth interval, gestational age at birth, bad obstetric history (previous history of low birth weight, prematurity and abortion), and number of ANC follow up during current pregnancy. Maternal illness such as sexually transmitted

infection, malaria, anemia, HIV/AIDS, chronic conditions e.g. Diabetes mellitus, hypertension, heart disease, respiratory disease and renal disease.

A number of obstetric factors include parity, birth or pregnancy interval (multiple pregnancies in short intervals), gravidity, gestational age and bad obstetric history (previous history of low birth weight, prematurity and abortion) also associated with low birth weight. Generally, incidence of LBW is higher among mothers with primigravida, and primiparity delivered LBW babies higher than for respondents with multigravida and multiparty. This is mainly related to maternal nutritional status. If a mother cannot recover fully from the effects of her last pregnancy and period of breast feeding before becoming pregnant again her nutritional status might deteriorate sufficient to result in an increased risk of premature birth and LBW babies(15,18,33,38) . Birth spacing has also a significant association with LBW. Mothers with birth interval of 2 years and below between the current and previous birth were more likely to give low birth weight baby than mothers who gave birth greater than 2 years apart (23,33).In addition newborns with prematurity (born before completed 37 weeks of gestation) had higher risk for LBW compared to term baby (born at ≥37 weeks of gestation)(15,20,21,33,35).

A study done in Mekele hospital shows that 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 (33). Similarly mothers with history of LBW infants are higher risk of delivering LBW infant compared to mothers with no history of LBW (20,21). In addition women with common maternal complications during delivery namely abruption placenta and placenta previa had the highest proportions of low birth weight babies (39).

Fertility desire also associated with LBW. In most developed countries, pregnancies are planned, complications are few and outcomes are generally favorable for both mother and infant. Adverse outcomes are far more frequent in developing world (14). A prospective institution based comparative study from Axum and Laelay Maichew districts found that new born neonates from women with unwanted and unplanned pregnancies were more than 7 times more likely to be of LBW than those from wanted and planned pregnancies (24).

Some maternal diseases and infections in the mother during pregnancy have also been associated with LBW. A case control study conducted in Malaysia showed that hypertensive mother had significant association with LBW infants. Mother with essential hypertension, gestational hypertension, preeclampsia or eclampsia has 4.5 times higher risk for LBW infants (21). Another case control study from India also showed that women with pregnancy induced hypertension have 2.5 times more risk of giving birth to LBW babies(15). Similarly the study from Tanzania reported that Pregnancy and labor complications and illness during pregnancy were also significantly associated with LBW infants. These included hypertension, pre-eclampsia and eclampsia disease complex, bleeding, schistosomiasis, thromboembolic diseases, placenta praevia, abruption placenta, premature rupture of membranes, anemia, tuberculosis and malaria in pregnancy (39). HIV positive women were twice more likely to give LBW neonates as compared with the HIV negative ones (27,39). Institution based cross sectional study conducted in Gondar town reported that those women with PIH were 9 times more likely to deliver low birth weight baby than those women without PIH. Malaria during pregnancy was also a risk factor for low birth weight. Those women attacked by malaria during pregnancy were 5 times more likely to deliver low birth weight baby than their counterparts (35). A study conducted in Bale zone Hospitals showed that mothers who encountered pregnancy related health problems during current pregnancy were at higher risk to deliver low birth weight baby than mothers who didn't encounter any health problem (23). In contrary a study from Jimma zone found that factors such as history of STI, hypertension, anemia, family size and history of chronic illness had no association with LBW delivery(26).

ANC follow up during pregnancy also associated with LBW. Provision of ANC is expected to reduce the risk of LBW; it creates health awareness and timely identification of complications. Lack of ANC showed that significantly associated with LBW(16). Lack of access to ANC could be influenced by many factors including lower socio-economic status and poor knowledge (38). A case control study done from Nepal shows that the risk of low birth weight was higher among mothers who didn't attend antenatal care for current pregnancy as compared to mothers who attended ANC(23–25,39). However in twelve studies reviewed by Kramer on the influence of antenatal care on birth weight neither early initiation nor frequency had an independent effect. There it is supposed that it is the quality of the visits rather than the number of antenatal visits that is important(12).

2.1.4 Nutritional factors:

According to the Kramer survey, nutrition plays an important role in intrauterine growth. In both developed and developing countries, low caloric intake is one of the most important modifiable contributors to IUGR. Under nutrition, evident by decreased maternal height (stunting), and below−normal pre pregnancy weight and pregnancy weight gain, are among the strongest predictors of delivery of a low birth weight infant (12). Some of these nutritional factors include: women dietary diversity, maternal MUAC, maternal height, hemoglobin level, Iron and Folate supplementation, counseling about diet, maternal dietary habit e.g. avoidance of food in pregnancy, additional food intake during pregnancy.

A study conducted from Ghana showed that dwelling in a community with a high proportion of people living in extreme poverty increased the likelihood of having a LBW infant by twofold (22). Similarly severe maternal starvation during pregnancy has a major impact on fetal growth. During winter 1944-1945 Dutch population suffered severe famine and mean maternal caloric intake fell to 450-750 Kcal a day with subsequent decrease of 250 gm in baby's birth weight (16).

Maternal dietary practice is also associated with LBW. Under nutrition of the fetus occurs when the maternal supply of nutrients is unable to meet fetal demands, and is due to a range of factors including genetics, maternal body composition, dietary intake, metabolic state, and placental function (10). A study from Ghana shows that Women dietary diversity score and dietary patterns were found to be protective against low birth weight while Poor dietary practices during pregnancy such as 'pica' and 'out of home eating' were found to be associated with increase odds for low birth weight. women who ate outside the home during pregnancy were 1.6 times more likely to give birth to low birth weight infant than those who ate regularly at home during pregnancy. In the same study, those who practice 'pica' during pregnancy were 1.7 times more likely to give birth to a low birth weight baby as compare to those who did not practice pica. Mothers who consumed more food (increased food intake compare to pre-conception period)during pregnancy period were 88% less likely to give birth to a low birth weight infants than those who ate the same as before pregnancy (40).There is mounting evidence where controlled trials have shown that improving food intakes during pregnancy effectively reduces the risk of giving birth to LBW babies (9).

A study from Auckland, New Zealand they have named the dietary patterns ‘junk’, ‘traditional’ and ‘fusion’. There is an associations between dietary patterns and birth weight of infant, mothers who had higher ‘traditional’ diet scores in early pregnancy were less likely to deliver a SGA infant (41).Similarly, A follow-up study of Danish women indicated that a diet in pregnancy, compared to the Western dietary pattern (n = 7619) characterized by a high intake of high-fat dairy, refined grains, processed meat, beer, and sweets, 26%–32% reduced odds for SGA were found for both the health conscious dietary pattern (n = 7479), characterized by a higher intake of fruits, vegetables, poultry, and breakfast cereals, and for the intermediate dietary pattern (n = 29,514), characterized by low fat dairy and fruit but also including some red meat, dairy, and vegetables (42).

A cohort study conducted in Oromia region shows that the risk of LBW was lower in the adequate Women’s Dietary Diversity Score group than in the inadequate Women’s Dietary Diversity Score group. Compared with women in the inadequate group, those in the adequate group consumed more dairy, fruits, and vegetable, but also other animal-source foods such as meat and eggs (36). A study from jimma zone shows that Mothers who had weight loss, and those who didn’t receive additional food during pregnancy had an increased risk of delivering LBW babies and the difference was statistically significant (26).

A study done in Tigray, northern Ethiopia found that the culture of preference of nutritionally poor food items (they did not prefer animal source of food instead they eaten plant source of food) during pregnancy; it was profound and largely performed based on their family, parents and religious leaders despite medical advice. This predisposes mothers to miss timing nutritious food items and malnutrition during conception. The condition of malnutrition is also supported by the quantitative results of this study that showed the presence of maternal malnutrition as recognized on the anthropometric measurements that larger numbers of mothers were unable to achieve the average MUAC of pregnant women and weight during pregnancy. The risk having LBW was more than two fold for women weighing less than 50 kg compared to mothers with greater than or equals to 50 kg body weight(43). Mothers who didn’t have ANC follow up had higher odds of giving LBW babies while this finding was ascribed to the routine provisions of nutritional counseling during ANC visits (29).

Micronutrient deficiencies have also been found to be closely associated with LBW. Various studies investigated the effect on birth weight of micronutrients including iron, folic acid, vitamin B12, zinc, copper, calcium, phosphorus, vitamin D, vitamin B6. The studies generally found significant association of varying magnitude. The effect of micronutrients are specially pronounced in poor countries where multiple micronutrients deficiencies prevail due to inadequate food intake poor dietary quality or when micronutrients are not released from foods, not absorbed efficiently (10,13,14,29,32,35,41). Anemia is the commonest medical disorder in pregnancy, 56% of pregnant women in developing countries are anemic. A strong relationship exists between maternal anemia and LBW babies(16). Anemia could impair oxygen delivery to the fetus and thus interfere with normal intrauterine growth(12). The Study conducted in Bangladesh showing association between LBW and maternal anemia during .pregnancy. Most of the mothers 52.6%(71/135) were found anemic who gave birth LBW and anemia was absent among majority (67.9%) of the mothers of NBW(44). D. K. Dubey and D. C. Nath (2016) also reported that iron deficient anemia significantly contributed to low birth weight in India(45)and recently published systematic review and meta-analysis has been carried out by Rahman and colleagues in order to estimate the pooled prevalence of anemia, the association between maternal anemia and pregnancy outcomes, and the population-attributable fraction (PAF) of these outcomes that are due to anemia in low- and middle-income countries . This finding was consistent with various other studies done in different areas (16,19,21,46). This might be because of that micronutrient deficiencies during pregnancy had been shown to have serious implications on the developing fetus and hence, birth size (47).

The study from Yemen found that maternal anemia was significantly associated with LBW, indicating that mothers with iron deficiency anemia are more likely to produce LBW (14).A study done in Bangladesh that showed intake of iron and folate supplements during pregnancy was found to have a protective effect against LBW (44). These findings were also consistent with other similar studies done in rural Oromia region in Ethiopia, Pakistan and a study from developed country (36,46,48). Iron supplementation during pregnancy protects women from becoming anemic and consecutive increased risk of giving low birth weight babies because the required amounts may not be supplied from dietary intake during this period (46). This is further supported by stronger randomized, double-blind controlled trial that compared standard iron supplementation with multiple micronutrients during pregnancy and its effect on

birth size in which women in iron supplementation group had babies with higher birth weight, suggesting iron-alone supplementation could protect against low birth weight than even multiple micronutrients supplementation (49). Furthermore, an overview of controlled trials suggested a 41% reduction in the prevalence of intrauterine growth retardation with folic acid supplementation, suggesting folate added to antenatal iron could independently affect birth weight of newborns (50).

Maternal anthropometry measurements are also associated with LBW. Anthropometric measurements directly or indirectly measures nutritional status. Malnourished mothers and underweight gave rise to the higher proportions of low birth weight babies (39). The study conducted from Yemen reported that Maternal under-nutrition with MUAC less than 23 cm was significantly correlated to LBW outcomes(14). Similarly a cohort study done in Kersa shows that maternal MUAC less than 23 cm is associated with 60% higher odds of LBW (25).

A case control study done from North-west province of Iran showed that maternal height was significantly associated with LBW, such that, with ten centimeter increase in the height, probability of LBW decreased by 42 %(46). Another studies also shows maternal height <145 cm is significantly associated with LBW (18). Similarly short stature (<150 cm) is significantly associated with LBW (23,30). While a study from Bangladesh found that no relationship was found between LBW and maternal height but significant relationship was found between maternal weight and birth weight(44).

2.1.5 Behavioral risk factors

UNCIF/WHO reported that physically demanding work during pregnancy contributed to poor fetal growth (1). Studies also shows that hard physical work during pregnancy was found to be significantly associated with LBW (19,39) . In addition a study conducted in Jimma zone show that engaging in light work during pregnancy had no association with LBW delivery (26). A facility based cross-sectional survey conducted in north wollo zone showed that the odds of facing poor birth outcomes was 70% lesser among mothers who were engaged on physical work daily for 4 - 8 hours during their pregnancy as compared to those mothers who were not engaged on work at all (27).

The adverse effects of maternal smoking for human pregnancy are well known. Use of smoking during pregnancy is associated with pregnancy complication and Low birth weight. Maternal smoking reduces mean birth weight by about 150-200 gm and doubles the risk of LBW associated with restriction of intra uterine growth (16). A study in Jimma zone, South West Ethiopia found 65 percent of the mothers attending the maternity facilities to be of rural residence. Those mothers residing in urban areas had high proportion of delivering LBW babies compared to rural mothers and the differences were statistically significant. The study related the association with urban residence to social lifestyles like heavy cigarette smoking and alcohol intake (26).However the study from Tanzania shows that both maternal and paternal smoking habits did not show any influence in birth weights in the study subjects. Frequency of intake of alcoholic beverages seemed to influence birth weight only in pregnant women who took the drinks on regular basis(39).A facility based cross-sectional survey conducted in north wollo zone found that maternal height, alcohol, coffee consumption; parity, birth interval, and abortion history were associated with LBW (27). A study conducted in Bale zone Hospitals showed that mothers who had history of Khat chewing were statistically higher at risk to deliver LBW as compared to mothers who didn't chew Khat(23).

2.1.6 Environmental factors

Various household environmental factors have been implicated in adverse pregnancy out comes, such as LBW. Toilet facilities , water sources and cooking environment are associated with LBW, the odds of LBW babies among mothers with daily house hold water consumption less than 50 l were higher than mothers with daily household water consumption of 50 l and above (23).Mothers living in a neighborhood with a low coverage of safe water were observed to have LBW infants more often than those dwelling in a neighborhood with a high coverage of safe water supply. In neighborhoods with a high coverage of safe water supply the odds of having a LBW infant reduced by 28% (22).

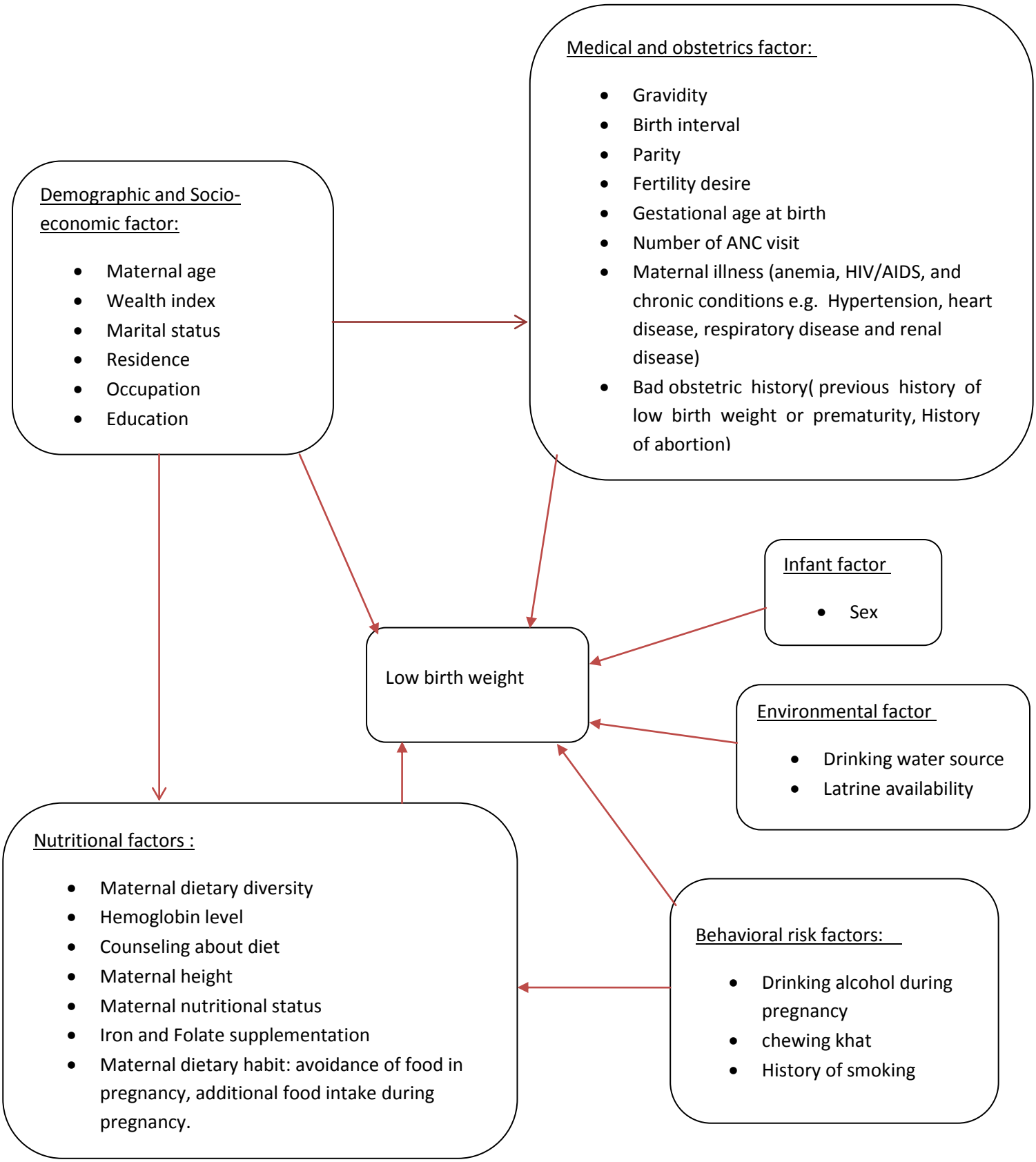

Figure 1: Conceptual framework on determinants of low birth weight (developed by reviewing different literature)

2.2. Significance of the study

Preventing LBW became critical undertaking thus far which may worsen the health of the upcoming adult generation. Since LBW is preventable, it is important to establish clear understanding of setting specific drivers of attaining optimal neonatal birth weight. the factors associated with this outcome and interventions need to be put in place to reduce its incidence. Emerging evidence on the role of intergenerational effects in determining maternal preconception nutritional status indicates the need for continued investment in strategies that improve women's nutrition and health throughout the life cycle, especially during the early years (51).

The current study can uncover the determinants of LBW in the setting so that public health intervention can be possible. The study also can be useful to other researchers as reference material while conducting further studies on similar problems. More importantly, the study will be specifically will help Dessie town Health Bureau , stakeholders and other concerned organizations in the setting to design and take appropriate measures towards the initiation of a suitable nutrition and health promotion programs for pregnant women, which contribute its great share for decreasing the prevalence of LBW neonates.

CHAPTER THREE: OBJECTIVE

3.1 General objective:

- ✓ To assess the determinant factors associated with low birth weight among newborns delivered in public health facilities in Dessie Town, Northeast Ethiopia.

3.2 Specific objectives are:

- ✓ To identify factors associated with LBW among neonates delivered in public health facilities in Dessie town.
- ✓ To examine nutritional factors associated with LBW among neonates delivered in public health facilities in Dessie town.

CHAPTER FOUR: METHOD AND MATERIAL

4.1 Study area and Period

The study area was conducted from February to April 2017 in Public health facilities, Dessie town, which is found in south wollo, northeast Ethiopia. Dessie Town is one of the oldest town located 401km northeast of Addis Ababa the capital of Ethiopia and 523 km from Bahir Dar capital of the regional state. It situated at a latitude and longitude of 11°8′N 39°38′E, with an elevation between 2,470 and 2,550 meters above sea level. It had ten sub city and six rural Kebeles. According to the 2007 National Censes, the total population was about 151,174 with 78,242 female and 120,095 urban populations (52).Based on health profile of Dessie City Administrative health office, the town has eight health center with 10 health posts, one district and one zonal referral government hospitals and 3 private general hospitals and 3 specialized junior clinics, 5 private medium clinics, 2 NGO medium clinics, 15 private junior clinics, (For profit and Nonprofit), pharmacies and drug stores which deliver routine preventive and curative health services to the community. The referral hospital is designed to serve up to 5,000,000 populations and the health center serves up to 25,000 populations. All public health facilities that means one district and one zonal referral government hospitals and the eight health centers were included in this study.

4.2 Study Design:

A facility based unmatched case-control study design was employed.

4.3 Population

4.3.1 Source population:

All neonates delivered in public health facilities of Dessie Town were the source population.

4.3.2 Study population:

For cases: The study population were those neonates delivered with low birth weight of <2500 gm in the health facilities of Dessie town.

For the controls: those neonates delivered with normal weight of ≥2500gm in the health facilities of Dessie town.

4.4 Inclusion criteria:

For cases: neonate with term low birth weight, a live-birth and singleton.

For control: neonate with term normal birth weight, a live-birth and singleton.

4.5 .Exclusion criteria:

Both for cases and controls: a neonate with congenital anomalies, a neonate whose mother is a known diabetic, whose mother doesn't know last menstrual period (LMP) or whose mother critically ill.

4.6 Sample size determination and sampling procedure

The sample size was determined considering a proportional difference approach for case-control study using EpiInfo version 7 statistical software package taking into account the following exposure variables for low birth weight; maternal height, maternal anemia and maternal nutritional status as determined by MUAC.

The sample size was determined using a formula for two population proportions and calculate by Epi info version 7 statistical software package by considering that the percent of controls exposed anemia among the controls is 11.6%(main exposure variable) (53). Assuming a 15% difference in cases, proportion of cases with exposure becomes 26.6% producing the least extreme Odds Ratio of 2.76 to be detected. Furthermore, 95% confidence level , 80% power of the study and control to case ratio of 2:1 with were assumed to estimate a required sample size.

Accordingly, after adding 10% for non-response rate 95 cases and 191 controls (a total sample size of 286) was planned to be involved in the study.

4.7 Sampling procedure:

All of public health facilities in the study were included in this study because of the rare cases of LBW. The allocation of the study subjects to each hospital was determined based on the proportion of number of deliveries of the same period last year (from records) in each health facilities. The cases and controls were defined according to the birth weight in the labour rooms of the facilities. Consecutive live births of less than 2500 grams in each hospitals and health centers were selected as cases and two normal birth weight babies succeeding each case were selected as controls. The data were collected by using structured interviewer administered questionnaire (Figure 1).

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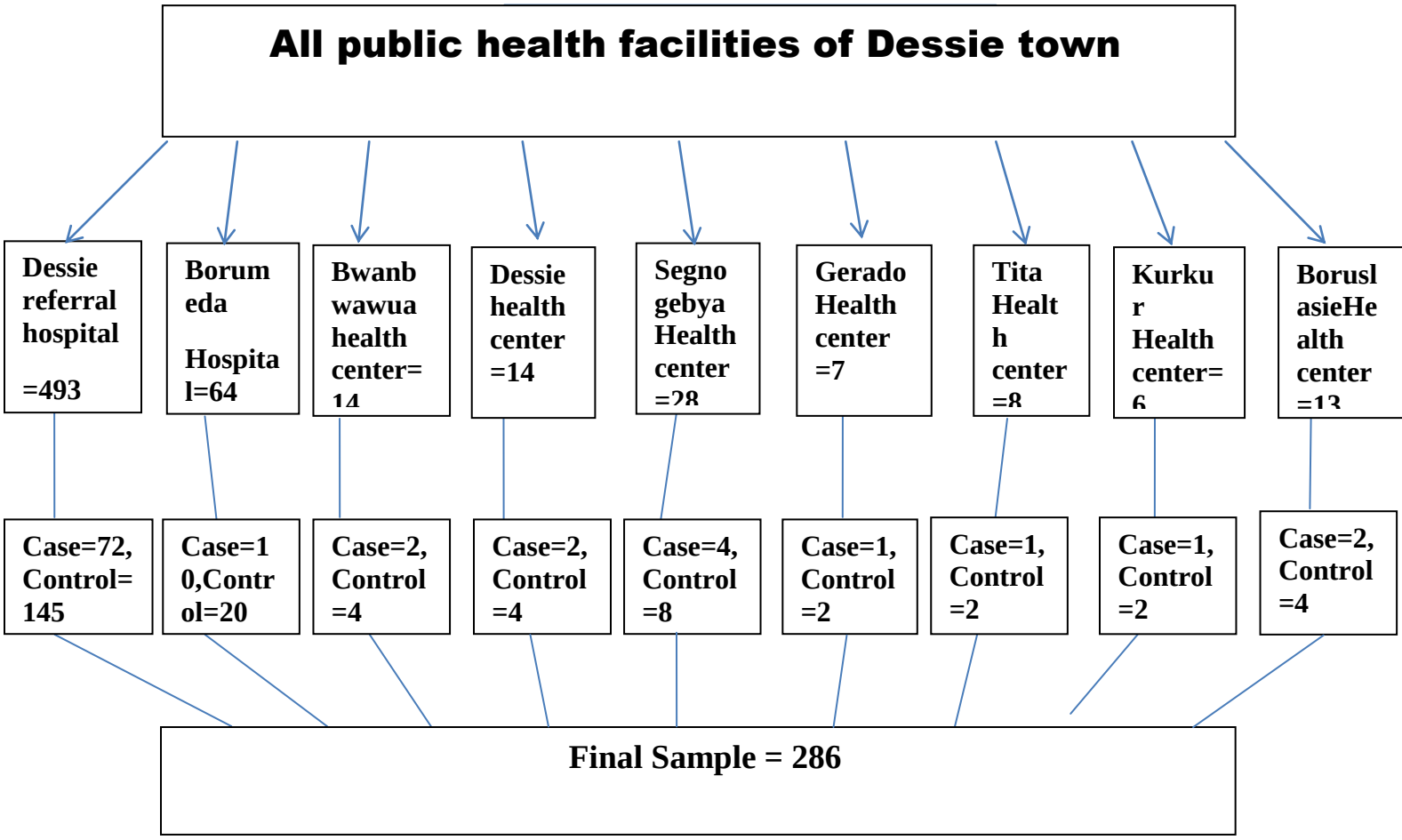

Figure 2: schematic diagram showing sampling procedure for selecting cases and controls from each health facility in Dessie Town, Northeast Ethiopia

4.8 Study Variables:

4.7.1 Dependent variable:

- ✓ Low Birth Weight

4.7.2 Independent variables:

- ✓ Nutritional factors: maternal dietary practice, maternal nutritional status, maternal height, iron and folate supplementation, hemoglobin level, counseling about diet, maternal dietary habit: avoidance of food in pregnancy, additional food intake.
- ✓ Socio demographic and socio-economic factors: maternal age, wealth index, residence, occupation, marital status, education level.
- ✓ Medical and obstetrics factors: Gravidity, Parity, Birth interval, pregnancy type, gestational age at birth, number of ANC follow up during current pregnancy, history of maternal illness (Anemia, HIV/AIDS, and chronic conditions e.g. hypertension, heart disease, respiratory disease and renal disease) , bad obstetric history(previous history of low birth weight or prematurity, history of abortion).
- ✓ Behavioral factors: alcohol consumption, chewing khat and smoking during pregnancy.
- ✓ Infant factor: infant sex
- ✓ Environmental factors: drinking water source, latrine availability

4.9 Data Collection:

Data were collected by trained nurses through face to face interview using structured and pretested questionnaire adapted from related literatures. Data collection instruments were prepared in English and translated in to 'Amharic' the local language and back translated into English by independent persons to see consistency between the two versions by different language experts . The questionnaire contain all the relevant information to meet the objectives of the study for primary data in the following items of divisions; Nutritional and dietary factors, socio demographic and socio-economic factors, medical and obstetrics factors, behavioral risk factors, environmental factors and infant factor. The interviews were conducted at the health facility after the mother had given birth and the neonate weight was measured within one hours of delivery. Household economic status was measured using EDHS 2011 Wealth Index.

Ten data collectors, 10 midwifery and 4 BSc nurses were recruited to accommodate the wide range of health facilities. Four supervisors (BSc. Nurses/Midwifes) were involved to supervise overall situation of data collection in each health facility they were assigned to while principal investigator had overall role of facilitating research works during data collection. In addition, prior to data collection two days training were given to data collectors and to the supervisors. One week prior to the data collection, the questionnaire were pretested on 5 % of the sample size in Kombolcha health centers, Kombolcha town prior to the main study in order to enhance its reliability.

4.8.1 Anthropometric measurement

Anthropometric measurements were done using standardized techniques. The weight of the newborns was measured within one hour upon delivery using a balanced digital Seca scale (Germany brand). The scale were always checked and zeroed before weighing each newborn. The height of mother was measured using a Height board. Height was measured using standard procedure (bare foot, Frankfurt position, ankle, buttock and shoulder touching) in standing position using height measuring board / stadiometry to the nearest 0.1 cm. Mothers were asked to stand without shoes in front of the height board, with the head erect and the arms hanging naturally at the sides. The mid-upper arm circumference (MUAC) of the mother was measured right after delivery using flexible non-stretchable standard tape measure in cm. The circumference was measured at the mid-point between the tip of the acromion process of the scapula and olecranon process of the ulna. For left-handed women, the right arm was used instead. Measurement were taken while the arm is hanging down at the side and relaxed to the nearest 0.1cm.

4.8.2 Dietary assessment

MDD-W will be collected using 24-hour recall method by MDD-W (54). Briefly, the pregnant women were asked to recall the foods they had consumed in the previous 24 h, first spontaneously followed by probes to ascertain that no meal or snack was left out. A detailed list of all the ingredients of the dishes, snacks, or other foods consumed was generated to enable better classification of mixed dishes. The foods were then categorized into 10 food groups. Folate and iron supplementation along with history of ANC were asked for each mother while

hemoglobin level of each mother were taken from the card as hemoglobin is routinely done for each mother receiving delivery service in each public service to determine anemia.

4.9. Data quality control:

Data were collected by trained data collectors after full understanding the objectives of the study and the contents of the questionnaire and method of data collection was achieved. The questionnaire was prepared in English and translated in to Amharic and translated back to English to keep the consistency of the questions and increase understanding with respondents. Both supervisor and principal investigator were closely following the data collection process. The instrument was pretested in other health facilities on 5% of the sample size before the actual data being collected. The collected data was checked for completeness and consistency on daily basis by investigator and supervisors.

4.10. Plan for Data analysis

Data were checked for completeness and consistencies, and then edited, coded and entered using Epi Info version 3.1, then exported to SPSS version 21 and checked for missing values before analysis. Tabulation of the MDD-W was done by SPSS.A pregnant woman was assigned in the adequate if her MDD-W >=5 food groups or inadequate group if her MDD-W < 5. Additionally wealth index were determined using a principal components analysis and ranked into tertiles. After this procedure, descriptive statistics were computed for all variables according to type. Frequency, means, medians and standard deviation were described obtained for continuous variables after checking normality of data while the categorical variables were described by computing frequencies to determine the distribution of the variables in cases and controls. Bivariate analysis was done to see the association between the explanatory and LBW. The unadjusted (crude) and their corresponding 95% confidence intervals will be computed by binary logistic regression. Upon the completion of the bivariate analysis, we select variables for the multivariable analysis. Any variable whose bivariate test has a p-value ≤ 0.25 were a candidate for multivariate analysis. The Hosmer - Lemeshow goodness -of-fit statistic was used to check if the necessary assumptions for multiple logistic regressions were fulfilled and the model had p -value >0.05 which proved the model was good. This multivariate analysis allows us to control for alternative effects and thus assess the extent of spuriousness (confounding, mediating and interacting effect)

4.11. Standard and Operational Definition

Low birth weight: neonate birth weight less than 2,500 gm (up to and including 2,499 gm)(1).

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

Term baby: a baby delved after 37 completed weeks and before 42 weeks

Intrauterine growth restriction (IUGR): describe a fetus that has not reached is growth potential because of genetic or environmental factor

Abortion: a fetus born before 28 week of gestation

Alcohol use: those mothers who were drank any type of alcohol at least once during the index pregnancy.

Previous history of delivery of LBW: babies were only subjectively assessed from the mothers speaking of "small or very small baby".

Preterm birth: Preterm birth is the birth of an infant before 37 weeks of pregnancy.

Multiple births: It refers when more than one fetus is carried to term in a single pregnancy.

Adequate Minimum Dietary Diversity-Women: - proportion of women who received foods from five or more food groups of the ten food groups(54).

Inadequate Minimum Dietary Diversity-Women: - proportion of women who received foods from five or more food groups of the ten food group(54).

Khat use –those mothers who uses **khat** at least once during the index pregnancy.

Alcohol use- those mothers who were drank any type of alcohol at least once during the index pregnancy.

4.12. Ethical consideration:

Ethical clearance letter was obtained from Jimma University institute of health, Research and community service office and then written permission letter to conduct the research was obtained from Ethical review board to Dessie City Administration Health Department and accordingly presented to respective public health facilities in dessie town. The interviewers discuss the issue of confidentiality and obtained verbal consent before the actual interview was maintained.

4.13. Dissemination plan:

At the end of the study, study findings will be presented to the academic of Jimma University. Copies of the paper will be submitted to Jimma University Institute of health, department of population and family healthy; human nutrition unit. The finding will also distributed to Dessie town's health Bauru, all health facilities in Dessie town. Also all attempts will be made to publish the result of the study on national or international journals.

CHAPTER FIVE: RESULT

5.1. Socio demographic characteristics

From a total of 286 sample size, 279 mothers of (93 cases and 186 controls) were included in the interviews which made the response rate of 97.6 % for both cases and controls. The mean ± sd of birth weight was 2138.28gm ± 206.87 for cases and 3145.16gm ± 414.99 for controls. A higher proportion of newborns were males both in cases and controls that account for 52.7% and 62.9%, respectively. The mean ± sd of maternal age among the cases was 27.27 ± 5.46 years and it was 26.19 ± 4.71 years among controls. The majority, 82.8% vs. 79.6%, of mothers among the cases and the controls were in the age group of 21–35 years, respectively. The largest proportion, 82.8% vs. 90.3%, of mothers among cases and controls were Amhara, while 74.2% of mothers among cases and 75.3% among controls were Muslim in religion. About one-third 34.4% of mothers of LBW babies had informal education and this accounted for 17.2% among the mothers of normal birth weight (NBW) babies. Overall, most of the mothers in both cases and control groups were married (93.5% and 92.5%, respectively). Fifty eight, 62.4%, of mothers among the cases and 54.3% of mothers among controls were in lower wealth index category. Moreover, 44.1% of mothers among cases and 40.3% among controls were living in rural setting. The higher number of mothers in both case and control group were housewife, (69.9% and 48.9%, respectively) followed by employed (18.3% and 33.9%, respectively) (Table 1).

Table 1: Distribution of socio-economic and demographic characteristics among mothers of LBW cases and NBW controls in public health facilities of Dessie Town, Northeast Ethiopia, 2017.

Variables		**Cases** **no (%)**	**Controls** **no (%)**	**Total N (%)**
Infant sex	Male	49(52.7)	117(62.9)	166(59.5)
	Female	44(47.3)	69(37.1)	113(40.5)

Maternal age (year)	≤ 20	9(9.7)	32(17.2)	41(14.7)
	21–35	77(82.8)	147(79.6)	225(80.6)
	> 35	7(7.5)	6(3.2)	13(4.7)
Residence	Rural	41(44.1)	75(40.3)	116(41.6)
	Urban	52(55.9)	111(59.7)	163(58.4)
Religion	Muslim	69(74.2)	140(75.3)	209(74.9)
	Orthodox	20(21.5)	42(22.6)	62(22.2)
	Others(catholic and	4(4.3)	4(2.2)	8(2.9)
Ethnicity	Amhara	77(82.8)	168(90.3)	245(87.8)
	Oromo	10(10.8)	7(3.8)	17(6.1)
	Others(Gurage and Tigrae)	6(6.5)	11(5.9)	17(6.1)
Marital status	Married	87(93.5)	172(92.5)	259(92.8)
	Others(single, separated and divorced)	6(6.5)	14(7.5)	20(7.2)
Educational status of mothers	Informal education	32(34.4)	32(17.2)	64(23.0)
	Formal education	61(65.6)	154(82.8)	214(77.0)
Occupation of mothers	Employed	17(18.3)	63(33.9)	80(28.7)
	Merchant	5(5.4)	24(12.9)	29(10.4)
	Housewife	65(69.9)	91(48.9)	156(55.9)
	Others	6(6.5)	8(4.3)	14(5.0)
Wealth index	Lower	58(62.4)	101(54.3)	159(57.0)
	Middle	16(17.2)	49(26.3)	65(23.3)
	Upper	19(20.4)	36(19.4)	55(19.7)

5.2. Nutritional and Anthropometric characteristics

The mean ± sd of maternal height for cases and controls was 1.55(0.07), 1.59(0.07) centimeters respectively. Mothers with a height of less than 150cm were twice among cases (23.7%) than controls (12.4%). Undernutrition in mothers as defined by MUAC < 23cm was 52.7% and 13.4%

among cases and controls respectively. Mothers who had not received iron and folate supplementation during pregnancy were 31.2% and 10.8% among cases and controls respectively. The largest proportion of mothers 93.5% among cases and 62.9% of mothers among controls had inadequate MDD-W. Maternal anemia among cases was 32.3% while it was 9.1% among controls. Maternal Chat chewing habit was 35.5% among cases compared to 26.9% among controls. Mothers who had history of alcohol intake during pregnancy were 5.4% and 8.1% among cases and controls respectively. A detail of Nutritional and Anthropometric characteristics is presented below in table 2.

Table 2: Distribution of nutritional characteristics among mothers of LBW and NBW controls in public health facilities of Dessie Town, Northeast Ethiopia, 2017.

Variables		**Cases** **no (%)**	**Controls** **no (%)**	**Total N (%)**
Height (Cm)	< 150	22(23.7)	23(12.4)	45(16.1)
	> =150	71(76.3)	163(87.6)	234(83.9)
MUAC	<23	49(52.7)	25(13.4)	74(26.5)
	>=23	44(47.3)	161(86.6)	205(73.5)
Iron and folate supplementation	Yes	64(68.8)	166(89.2)	230(82.4)
	No	29(31.2)	20(10.8)	49(17.6)
Any multivitamin	Yes	9(9.7)	36(19.4)	45(16.1)
	No	84(90.3)	150(80.6)	234(83.9)
Nutritional counseling during pregnancy	Yes	40(43.0)	153(82.3)	193(69.2)
	No	53(57.0)	33(17.7)	86(30.8)
Additional food intake during pregnancy	Yes	34(36.6)	134(72)	168(60.2)
	No	59(63.4)	52(28)	111(39.8)
MDD-W	inadequate	87(93.5)	117(62.9)	204(73.1)
	adequate	6(6.5)	69(37.1)	75(26.9)
Anemia	Yes	30(32.3)	17(9.1)	47(16.8)
	No	63(67.7)	169(90.9)	232(83.2)
Eating out of home	Yes	81(87.1)	167(89.8)	248(88.9)
	No	12(12.9)	19(10.2)	31(11.1)
Chat chewing	Yes	33(35.5)	50(26.9)	83(29.7)
	No	60(64.5)	136(73.1)	196(70.3)
Alcohol consumption	Yes	5(5.4)	15(8.1)	20(7.2)
	No	88(94.6)	171(91.9)	259(92.8)

5.3. Medical and Obstetrics Characteristics:

Proportions of antenatal care follow up among cases and controls were 89.2% and 96.8% respectively. Mothers who described their pregnancy as unplanned but wanted were 24.7% and 17.2% among cases and controls, respectively. Maternal chronic disease among cases was 14.0% while controls had 15.1%. Whilst, maternal pregnancy induced hypertension was 9.7% and 6.5% among cases and controls, respectively. Few mothers among cases and controls, had history of preterm delivery and reactive for HIV test. History abortion was observed among 23.7% of mothers in cases and 11.8% of mothers in controls. Majority of mothers both in cases and controls were primigravida (Table 3).

Table 3: Distribution of medical and obstetrics characteristics among mothers of LBW cases and NBW controls in public health facilities of Dessie Town, Northeast Ethiopia, 2017.

Variables		**Cases** **no (%)**	**Controls** **no (%)**	**Total N (%)**
Parity	Primigravida	50(53.8)	100(53.8)	150(53.8)
	Multipara	43(46.2)	86(46.2)	129(46.2)
History of abortion	Yes	22(23.7)	22(11.8)	44(15.8)
	No	71(76.3)	164(88.2)	235(84.2)
History of preterm delivery	Yes	10(10.8)	5(2.7)	15(5.4)
	No	83(89.2)	181(97.3)	264(94.6)
ANC follow up	Yes	83(89.2)	180(96.8)	263(94.3)
	No	10(10.8)	6(3.2)	16(5.7)
HIV status	Reactive	5(5.4)	4(2.2)	9(3.2)
	Non- reactive	88(94.6)	182(97.8)	270(96.8)
Chronic disease	Yes	13(14.0)	28(15.1)	41(14.7)
	No	80(86.0)	158(84.9)	238(85.3)
Pregnancy induced hypertension (PIH)	Yes	9(9.7)	12(6.5)	21(7.5)
	No	84(90.3)	174(93.5)	258(92.5)
Type of pregnancy	Planned and wanted	66(71.0)	149(80.1)	215(77.1)
	Unplanned but wanted	23(24.7)	32(17.2)	55(19.7)
	Unplanned and unwanted	4(4.3)	5(2.7)	9(3.2)

5.4. Determinants of LBW

In bivariate logistic regression analyses performed to identify candidate variables for multivariable logistic regression model in identifying determinants of low birth weight, all variables having p-value less than 0.25 were considered for the final multivariable logistic regression model (Table 4).

Table 4: Bivariate analyses to identify candidate variables for multivariable logistic regression to identify determinants of LBW, Dessie Town, Ethiopia, 2017.

Factors		Cases	Controls		p -value
		No %	No %	Crude OR (95%CI)	
Maternal age (year)	**≤ 20**	9(9.7)	32(17.2)	0.54(0.25,1.19)	0.127*
	21–35	77(82.8)	147(79.6)	1	
	> 35	7(7.5)	6(3.2)	2.24(0.73,6.91)	0.159*
Residence	Urban	52(55.9)	111(59.7)	1	
	Rural	41(44.1)	75(40.3)	1.17(0.71,1.93)	0.548
Educational status of mothers	Informal	32(34.4)	32(17.2)	2.53(1.42,4.48)	0.002*
	Formal	61(65.6)	154(82.8)	1	
Occupation of mothers	Employed	17(18.3)	63(33.9)	1	
	Merchant	5(5.4)	24(12.9)	0.77(0.26,2.33)	0.646
	Housewife	65(69.9)	91(48.9)	2.65 (1.42,4.94)	0.002*
	Others	6(6.5)	8(4.3)	2.78 0.85,9.1)	0.091
Wealth index	Lower	58(62.4)	101(54.3)	1.09 (0.57,2.07)	0.797
	Middle	16(17.2)	49(26.3)	0.62 (0.28,1.37)	0.235*
	Upper	19(20.4)	36(19.4)	1	
Height (Cm)	< 150	40(43.0)	153(82.3)	2.21(1.15,4.21)	0.017*
	> =150	53(57.0)	33(17.7)	1	
MUAC	<23	49(52.7)	25(13.4)	7.17(3.99,12.88)	<0.0001**
	>=23	44(47.3)	161(86.6)	1	
Any multivitamin	Yes	9(9.7)	36(19.4)	1	
	No	84(90.3)	150(80.6)	2.24(1.03 ,4.88)	0.042*
Iron and folate supplementation	Yes	64(68.8)	166(89.2)	1	
	No	29(31.2)	20(10.8)	3.76(1.99,7.12)	<0.0001**
Anemia	Yes	30(32.3)	17(9.1)	4.73(2.44 , 9.17)	<0.0001**
	No	63(67.7)	169(90.9)	1	
ANC follow up	Yes	83(89.2)	180(96.8)	1	
	No	10(10.8)	6(3.2)	3.61(1.27 , 10.28)	0.016*

Nutritional counseling	Yes	40(43.0)	153(82.3)	1	
	No	53(57.0)	33(17.7)	6.14(3.52 ,10.72)	<0.0001**
Additional food intake during pregnancy	Yes	34(36.6)	134(72)	1	
	No	59(63.4)	52(28)	4.47(2.63, 7.61)	<0.0001**
MDD-W	inadequate	87(93.5)	117(62.9)	8.55(3.55, 20.61)	<0.0001**
	adequate	6(6.5)	69(37.1)	1	
Chat chewing	Yes	33(35.5)	50(26.9)	1.51 (0.88 , 2.55)	0.14*
	No	60(64.5)	136(73.1)	1	
History of abortion	Yes	22(23.7)	22(11.8)	2.31(1.20, 4.44)	0.012*
	No	71(76.3)	164(88.2)	1	
History of preterm delivery	Yes	10(10.8)	5(2.7)	4.36(1.45 , 13.16)	0.009*
	No	83(89.2)	181(97.3)	1	
HIV status	Reactive	5(5.4)	4(2.2)	2.59(0.68 , 9.87)	0.164*
	Non-reactive	88(94.6)	182(97.8)	1	
Type of pregnancy	Planned and wanted	66(71.0)	149(80.1)	1	
	Unplanned but wanted	23(24.7)	32(17.2)	1.62(0.88 , 2.98)	0.119*
	Unplanned and wanted	4(4.3)	5(2.7)	1.81(0.47, 6.94)	0.389
Infant sex	Male	49(52.7)	117(62.9)	1	
	Female	44(47.3)	69(37.1)	1.52 (0.92, 2.52)	0.102*

**P<0.0001 * p< 0.25

5.5. Multivariate logistic regression

The selected independent covariates with p-value < 0.25 in bivariate logistic regression were entered into the multivariable logistic regression model to isolate the independent predictors of LBW using backward elimination stepwise likelihood ratio method. The result of the analysis showed that mothers who did not take iron and folate supplementation were more likely to deliver low birth weight babies than mothers who did take iron and folate supplementation during pregnancy AOR=2.84(CI (1.15,7.03)).Mothers who did not receive nutritional counseling during the current pregnancy were 4.05 times more likely to have low birth weight neonate (AOR = 4.05 (CI;(1.95, 8.38) than mother who did receive nutritional counseling. Similarly, mothers who did not take additional meal during the current pregnancy were more likely to have a neonate with low birth weight compared to those mothers who had additional meal during pregnancy (AOR =; 3.25 (CI (1.64, 6.44). The odds of LBW among undernourished mothers as compared to their well-nourished counterparts was nearly six fold

(AOR =5.62(CI (2.64, 11.97)). Similarly, anemic mothers had nearly four times odds of giving LBW neonates compared to non-anemic mothers (AOR= 3.54 (CI; (1.46, 8.61).Furthermore, the odds of LBW babies among mothers with inadequate MDD-W were higher than mothers with adequate MDD-W (AOR=6.65(CI;(2.31, 19.16). Details of multivariate analysis were presented below (Table5)

Table 5: Determinants of LBW IN multivariable logistic regression analysis for newborns delivered in public health facilities in Dessie Town, Ethiopia, 2017.

Factors	Cases No %	Controls No %	COR (95%CI)	AOR [95 % CI]	p -value
Iron and folate supplementation					
Yes	64(68.8)	166(89.2)	1	1	
No	29(31.2)	20(10.8)	3.76(1.99,7.12)	2.84(1.15,7.03)	0.023*
Nutritional counseling					
Yes	40(43.0)	153(82.3)	1	1	
No	53(57.0)	33(17.7)	6.14(3.52 , 10.72)	4.05(1.95, 8.38)	<0.0001**
Additional meal during current pregnancy					
Yes	34(36.6)	134(72)	1	1	
No	59(63.4)	52(28)	4.47(2.63, 7.61)	3.25(1.64, 6.44)	0.001*
MUAC					
<23	49(52.7)	25(13.4)	7.17(3.99,12.88)	5.62(2.64,11.97)	<0.0001**
>=23	44(47.3)	161(86.6)	1	1	
Anemia					
Yes	30(32.3)	17(9.1)	4.73(2.44 , 9.17)	3.54(1.46,8.61)	0.005*
No	63(67.7)	169(90.9)	1	1	
MDD-W					
Inadequate	87(93.5)	117(62.9)	8.55(3.55, 20.61)	6.65(2.31,19.16)	<0.0001**
Adequate	6(6.5)	69(37.1)	1	1	

*P-value<0.0001 **p<0.05

CHAPTER SIX: DISCUSSION

The present study revealed that mothers who did not receive nutritional counseling during current pregnancy had significantly higher odds for giving LBW in comparison to mothers who did receive nutritional counseling. This might be due to the fact that nutritional counseling might improve their feeding behavior and hence, their nutritional status too which might in turn could help the mothers to decrease the risk of delivering LBW baby. This finding was consistent with other study conducted in Gondar University Hospital where mothers who didn't have ANC follow up had higher odds of giving LBW babies while this finding was ascribed to the routine provisions of nutritional counseling during ANC visits (53).

The risk of low birth weight was higher among mothers who didn't receive additional food during current pregnancy as compared to mothers who did receive additional food during current pregnancy. These findings were consistent with other similar studies done in Jimma, Ethiopia and Ghana (26,40). Mothers who consumed more food (increased food intake compare to pre-conception period)during pregnancy period were 88% less likely to give birth to a low birth weight infants than those who ate the same as before pregnancy (40). There is mounting evidence where controlled trials have shown that improving food intakes during pregnancy effectively reduces the risk of giving birth to LBW babies (9). Likewise, intake of iron and folate supplements during pregnancy had significant association with LBW. Mothers who did not take iron and folate supplementation were more likely to deliver low birth weight babies than mothers who did take iron and folate supplementation during pregnancy. This finding is in agreement with a study done in Bangladesh that showed intake of iron and folate supplements during pregnancy was found to have a protective effect against LBW (44). These findings were also consistent with other similar studies done in rural Oromia region in Ethiopia, Pakistan and a study from developed country (36,46,48). Iron supplementation during pregnancy protects women from becoming anemic and consecutive increased risk of giving low birth weight babies because the required amounts may not be supplied from dietary intake during this period (46). This is further supported by stronger randomized, double-blind controlled trial that compared standard iron supplementation with multiple micronutrients during pregnancy and its effect on birth size in which women in iron supplementation group had babies with higher birth weight,

suggesting iron-alone supplementation could protect against low birth weight than even multiple micronutrients supplementation(49). Furthermore, an overview of controlled trials suggested a 41% reduction in the prevalence of intrauterine growth retardation with folic acid supplementation, suggesting folate added to antenatal iron could independently affect birth weight of newborns (55).

Moreover, our study showed that anemic mothers were higher odds to deliver LBW neonates compared to non-anemic mothers. This finding was consistent with other studies (14,44,45). Maternal anemia during pregnancy was found to increase odds of giving LBW babies in Yemen (14). It was also reported that maternal anemia had a negative effect on birth weight among neonates in Bangladesh (44). D. K. Dubey and D. C. Nath (2016) also reported that Anemic mothers were more likely to have LBW than not anemic and model was shown significant impact on the likelihood of having low birth weight babies. (45). and the finding is in agreement with an excellent, recently published systematic review and meta-analysis has been carried out by Rahman and colleagues in order to estimate the pooled prevalence of anemia, the association between maternal anemia and pregnancy outcomes, and the population-attributable fraction (PAF) of these outcomes that are due to anemia in low- and middle-income countries (14). This finding was consistent with various other studies done in different areas (16,19,21,46).This might also be because of that micronutrient deficiencies during pregnancy had been shown to have serious implications on the developing fetus and hence, birth size (56). Anemia could impair oxygen delivery to the fetus and thus interfere with normal intrauterine growth (20).

Inadequate women dietary diversity and maternal undernutrition during pregnancy independently and significantly affected low birth weight in our study. The consequences of inadequate nutritional intake and poor nutritional status for women during pregnancy not only directly affects women's health status, but may also have a negative impact on birth weight and early development. Mothers having inadequate MDD-W had significantly higher odds of giving birth to LBW babies. This finding was consistent with a study done in rural Oromia region in Ethiopia, in which women in the inadequate MDD-W group had an increased risk of LBW and PTB compared with women in the adequate MDD-W group (36). Similarly, a study from Ghana shows that Women dietary diversity score and dietary patterns were found to be protective

against low birth weight (40).However, a recent randomized controlled trial in India reported that an intervention that increased consumption of dairy, fruits, and green leafy vegetables before and during pregnancy through a specially formulated snack had no effect on birth weight (57). This discrepancy might be due to differences in study population, geographical location, and the study design.

Similarly, maternal undernutrition as measured by maternal MUAC of less than 23 cm significantly increased the odds of having LBW babies in the present study. This finding is in agreement with an observational cohort study conducted on 1295 live birth and pregnant women to measure the incidence and determinants of LBW in a rural population in Kersa district, Eastern Ethiopia, where maternal MUAC of less than 23cm was found to significantly predict LBW in this cohort (25). Moreover, recent study from Yemen showed that maternal under-nutrition defined by MUAC of less than 23 cm was significantly correlated to LBW (14). Other groups of researchers also indicated that maternal nutritional status is the most important determinant of newborn children's birth weight in India (45). The observed findings might be because of the fact that anthropometric measurements directly or indirectly measures nutritional status. Even though either acute or chronic maternal malnutrition has direct effect on the birth weight of a baby, acute maternal malnutrition has more pronounced effect (25).

Strength and limitation of the study

The present study has some strengths; conducting the study in all public health facilities in the study area, and taking new born weight within one hour of delivery can be considered as a major strengths of this study. Further, using case-control study design can be considered as another important strength of the current study.

However our study has limitations: private health facilities were not included in this study. The completed gestational age was taken from verbal response of respondents. There might be recall bias as respondents had to remember there last date of menstruation. There might be chances of recall bias as this study sought some data based on respondents past history like dietary diversity, number of ANC visit, number of iron tablet taken.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

Conclusion and recommendations

Conclusion

Lack of iron and folate supplementation, absence of nutritional counseling during pregnancy, lack of additional food during pregnancy, MUAC less than 23, maternal anemia and inadequate MDD-W were identified as significant predictors of LBW among infants under the study.

Recommendations

Most of these determinants can be modified by public health nutrition interventions. Thus, we recommend;

For health sectors

- The health facilities should strengthen nutritional education during pregnancy and prevention and proper management of risk.
- Health service providers should focus on health information related to nutrition diversification and balanced diet.
- Nutritional assessment of women during anti natal care and providing individual level interventions accordingly.
- Regular assessment of Iron-Folate adherence
- Enhancing screening and management of maternal anemia
- Mothers should be advised about proper weight gain during pregnancy since maternal weights are linked with fetal weight gain and birth weight.

For policy makers and program managers and other professionals

- The policy makers should be strengthening the maternal and child health services
- To work towards alleviating LBW targeting key predicting variables in their programs.
- Strengthen government programs for fortified cereals and micronutrient supplements

For researchers

- Further future researches
- Observational and randomized controlled trials that can assess the effect of multiple micronutrients and improved diet on birth outcomes.

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ANNEX

Annex1: English Version Questionnaire

Jimma University, College of Health Sciences, School of Graduate Studies; Department of Population and Family Health; Human Nutrition Unit.

Hello! My name is……. I am here on behalf of: Semira Ahmed student of Jimma University, Institute of Health, Department of Population and Family Health Human Nutrition Unit. She is conducting a research for the Partial fulfillment of second degree on 'Determinants of LBW among newborns delivered in public health facilities of Dessie Town, Northeast Ethiopian''.The information you provide will help to indicate potential intervention points for stakeholders by identifying major risk factors of LBW. Your name will not be recorded in any part of the questionnaire in order to ensure confidentiality of the information you provide. The study doesn't have any harm to the study mothers and to their newborn.You may ask us to clarify questions if you do not understand them or can stop the interview at any time.

Are you willing to participate in this study? No (say thank you) Yes (continue interviewing)

Name of health facility……..

Name of interviewer_____ signature_____

Name of supervisor _____ signature_____

Date of interview (Ethiopian calendar) _____/_____/_____

Part A: Socio-demographic and socio-economic characteristics of the mother.

Q.no.	Questions	Choices for response	Skip
A01	Questionnaire with name of health facility & ID Number of study subjects **(to be numbered before interview)**	Name of Health Facility_____ Mather's full name_____ ID Number a newborn _____ Kebele_____ Zone_____ Gote_____	
A02	Date of interview	[_____|_____| _____| DD |MM |YYYY	
A03	Age of the mother	Age in years_____	
A04	Religion of the mother	1. Muslim 2. Orthodox 3. Protestant 4. Other	
A05	Ethnicity of the mother	1. Amhara 2. Oromo 3. Gurage 4. Other	
A06	Educational status of the mother	1. Not read and write 2. Read and write only 3. Primary education 4. Secondary school 5. Collage and above	
A07	Educational status of husband	1. Not Read and Write 2. Read and Write only 3. Primary education 4. Secondary school 5. Collage and above	
A08	Residence of the mother?	1. Rural 2. Urban	
A09	Current marital status of the mother	1. Married 2. Single 3. Divorced 4. Widowed	

A10	Current occupation of the mother	1. Student 2. Government employed 3. Private employee 4. Merchant 5. House wife 6. Day laborer 7. Farmer 8. Others (Specify)	
A11	Current occupation of husband	1. Student 2. Government employed 3. Private employee 4. Merchant 5. Farmer 6. Day laborer 7. Others (Specify)	
A12	Your household family size	Number_____	
A13	Head of your household	Wife ……..…..01 Husband …….……02	
A14	Matrimonial status of husband	Monogamist……..01 Polygamist…….02	

Part B: wealth index

Now I will ask you about some fixed assets that your household has.

Q.no.	Questions	Yes	No
	Does the household have any of the following properties? (Circle)		
B01	Has household access to electricity?	1	0
B02	Functioning Television	1	0
B03	Watch/clock	1	0
B04	Refrigerator	1	0
B05	Radio	1	0
B06	Mobile telephone	1	0
B07	Non-mobile telephone	1	0
B08	Table	1	0
B09	Chair	1	0
B10	Bed with cotton/sponge/spring mattress	1	0
B11	Electric mitad	1	0

B12	Kerosene lamp/pressure lamp	1	0
B13	Bicycle	1	0
B14	Motor cycle/ Bajaj	1	0
B15	Car	1	0
B16	Animal-drawn cart	1	0
B17	Tanker truck	1	0
B18	Cart with small tank	1	0
B19	Water pump	1	0
B20	Piped water	1	0
B21	Piped into dwelling	1	0
B22	Piped to yard/plot	1	0
B23	Public tap/standpipe	1	0
B24	Borehole	1	0
B25	Dug well	1	0
B25	Water from spring	1	0
B27	Rainfall water	1	0
B28	Surface water	1	0
B29	River/Lake/Pond/Stream/Dam	1	0
B30	Bottled water	1	0
B31	Has household toilet facility?	1	0
B32	Do you share this toilet facility with other households?	1	0
B33	Does any member of this household own any agricultural land?	1	0
B34	Does any member of this household have a bank or microfinance saving account?	1	0

	Does the household have any of the following animals? (Circle)	Yes	No	How many?
B35	Oxen	1	0	
B36	Cows	1	0	
B37	Horse/mules	1	0	
B38	Goats/Sheep	1	0	
B39	Chickens	1	0	
B40	Donkey	1	0	

Part C: New born characteristics

Q.no.	Questions	Choices for response	
C01	Sex of the newborn?	Male _____ 1 Female _____2	
C02	Birth weight of the newborn?	Birth weight in gm: W1_____W2._____W3_____	
C03	Birth length of the newborn?	Birth length in cm: L1_____L2._____L3_____	
C04	Birth order of the newborn	Number_____	

Part D: Maternal medical and obstetrics factors

Q.no.	Questions	Choices for response	Skip
D01	What is gravidity of the mother?	Gravidity: _____	
D02	What is parity of the mother? That is any delivery that passed 28 weeks of gestation.	Parity: _____	If she was Gravida-I skip to D03
D03	Was there any history of abortion?	1. Yes 2. No 3. Don't know	If answer is "No" skip to QD05
D04	Total number of abortion	……	
D05	Was there any history of preterm delivery (≤37wk)?	1. Yes 2. No 3. Don't know	
D06	When did your last menstrual period starts? (Gestational age)	Gestational age at delivery in weeks: _____	
D07	Birth interval(if any preceding birth)	----------	
D08	What type of pregnancy is it?	1. Panned and wanted 2. Unplanned but wanted 3. unplanned and unwanted	
D09	Have you ever attended ANC follow up for your current delivery?	1. Yes 2. No 3. Don't know	
D10	At what months of the current pregnancy you started ANC?	At _____ months	
D11	How many times did you have ANC visit for the current pregnancy?	In number------	
D12	During this pregnancy, did you receive any multivitamin tablets or syrups? (Show tablets and syrup). Ask to see the tablets and syrups.	1. Yes 2. No 3. Don't know	

D13	During this pregnancy, did you receive any iron tablets/syrups? [show tablets and syrup]Ask to see the tablets and syrups.	1. Yes 2. No 3. Don't know	
D14	If yes to #D13, how many iron tablets have you ever receive?	In number------	
D15	During this pregnancy or any time, were you given an injection in the arm to prevent the baby from getting tetanus that is convulsion after birth?	1. Yes 2. No 3. Don't know	
D16	During this pregnancy have you received nutritional counseling during pregnancy?	1. Yes 2. No 3. Don't know	
D17	During this pregnancy, did you take any drug for intestinal worms?[show mebendazole tablets and syrup]	1. Yes 2. No 3. Don't know	
D18	Since your pregnancy, were the 'number of your meals' less than usual, about the same amount, or more than usual than before the pregnancy?	1. Less than usual 2. About the same 3. More than usual 4. Don't Know	
D19	Do you have any chronic medical illness?	1. Yes 2. No 3. Don't know	
D20	Which chronic medical illness (more than one response is possible)	1. Chronic hypertension 2. Diabetes mellitus 3. Pregnancy induced hypertension 4. Others (Specify)	if she had "Diabetes mellitus" exclude
D21	During your current pregnancy, have you been told that you have developed gestational diabetes mellitus?	1. Yes 2. No 3. Don't know	
D22	During this pregnancy, have you been told that you have developed pregnancy induced hypertension?	1. Yes 2. No 3. Don't know	
D23	HIV status of the mother(PICT)	1. Reactive 2. Non-reactive 3. Don't know	

Part E: Minimum Dietary Diversity-Women

Now I would like to ask you about the types of foods you have consumed over the past 24 hours, from sunrise yesterday to sunrise today. Did you have:

	READ OUT THE LIST Circle "1" for mentioned and "0" for not mentioned **Food categories**	Coding	
E01	Any food made from grains (sorghum, maize, wheat, teff, millet,)…….	1	0
E02	Any other food made from roots or tubers? (potato, sweet potato, cassava, or other local roots or tubers)……..……	1	0
E03	Any food made from pulses (e.g. lentils, beans, soybeans, or peas)…….....	1	0
E04	Any food made from nuts (e.g. peanut better, peanuts)….....	1	0
E05	Any food made with oil, fat or butter?…….	1	0
E06	Any dairy product (e.g. milk, cheese or yoghurt)……	1	0
E07	Meat (e.g. lamb, beef, veal, goat , liver, brain, all other organ meats like tripe, offal)…….…….……	1	0
E08	Poultry (e.g. chicken, turkey, duck)…….…….**.....**	1	0
E09	Fish ……..……..	1	0
E10	Eggs…….....	1	0
E11	Dark green leafy vegetables (Swiss chard, kale, lettuce, spinach)…….....	1	0
E11	Any food made from pumpkins, carrots, cabbage, red sweet potatoes, mango, papaya, bell paper, green ……..……..…….....	1	0
E12	Any other fruits? (e.g., bananas, apples, avocados, fig, grapes, guava, orange, lime….....	1	0
E13	Any other vegetables? (e.g. onion, tomatoes, garlic) …….....	1	0

Part F: Maternal dietary habit

Know I would like to ask you about the habit of your diet during the current pregnancy

Q.no.	Questions	Choices for response	Skip
F01	During the current pregnancy, how many meals do you usually eat within a day?	1. Once 2. Twice 3. Thrice 4. Four times 5. Five times and above	
F02	Have you taken additional food than usual during the current pregnancy?	1. Yes 2. No 3. Don't know	
F03	During the current pregnancy, what is your most typical meal pattern within a day?	1. Breakfast- lunch- dinner 2. Breakfast-snack - lunch- dinner 3. Breakfast- lunch-snack- dinner 4. Breakfast-snack- lunch-snack-dinner 5. Breakfast-snack- lunch-snack-dinner- late night snack	
F04	What was your meal frequency within a day before this pregnancy?	_____ Times.	
F05	During the current pregnancy, did you have any habit of skipping meal?	1. Yes 2. No 3. Don't know	If answer is "No/don't know" skip toQ.F08.
F06	If yes to # Q06, what is/are your reason/s to skip your meal?	1. Tiredness 2. Busy at work so I forget 3. Not to increase weight 4. Other (specify)	
F07	Do you fast while you are pregnant?	1. Yes 2. No 3. Don't know	
F08	Is there any food item that you avoided after you became pregnant	1. Yes 2. No 3. Don't know	If answer is "No/don't know" skip topart G
F09	If yes to # Q09, which food item did you avoid most?	1. Coffee 2. Porridge, "atmit", bread, linseed 3. "Shirowot"(other legumes) 4. Key sir, tomato, chilly (other vegetables) 5. Egg, milk and milk products 6. Banana or other fruits 7. Meat 8. Other(specify) _____	

F10	What is/are your reason/s to avoid the above mentioned food item/s?	1. Personal dislike (aversion) → AskQ.F12 2. Not allowed to pregnant woman to eat(Cultural belief) → AskQ.F13 3. Religion 4. Other (specify)_____	
F11	If personal dislike, what do you think is/are the reason/s for your dislike?	1. Smell/taste of food 2. Heart burn/discomfort 3. Feeling of nausea/vomiting 4. I don't know the reason	
F12	If cultural belief, what cultural reason/s make the above food items forbidden to eat?	1. Will make baby big &labour difficult 2. Will be plastered on fetal head & body 3. Fear of abortion 4. Evil eye 5. Fetal abnormality 6. Will bring fetal hair loss 7. Other(specify)	
F13	In the last nine months, how often did you eat meals outside of your home?	1. Per day 2. Per week 3. Per month 4. Never	

Part G. Behavioral risk factors

Q.no.	Questions	Choices for response	Skip
G01	During your current pregnancy, have you ever chew Khat?	1. Yes 2. No	
G02	If yes, how frequently you were chewing Khat?	1. Always 2. Usually 3. Some times	
G03	During your current pregnancy, have you ever smoked?	1. Yes 2. No	
G04	If yes, how frequently you were smoking?	1. Always 2. Usually 3. Some times	
G05	During your current pregnancy, have you ever drunk alcohol?	1. Yes 2. No	
G06	If yes, how frequently you were drinking alcohol?	1. Always 2. Usually 3. Some times	

Part H. Environmental factors

Know I would like to ask you about the sources of water and availability of latrine for your household members.

Q.no.	Questions	Choices for response	Skip
H01	What is the main source of drinking water for your household members?Source of drinking water	Piped into dwelling ……01 Public tap/standpipe……02 Tube well/borehole…….…….....03 Tanker-truck……04 Surface water (river, lake, pond, and irrigation channel…….05 Other (specify)_____ 77	
H02	How long does it take to fetch water? That means get water and come back to your home?	Less than an hour…… ……..…01 One hour or more……..02 Water on premises…….03	
H03	Do you treat your water in any way to make it safer to drink? (Do not include washing water container)	No……...…...00 Yes, always……...01 Yes, sometimes……..…..…02	
H04	What do you usually do to the water to make it safer to drink? Anything else? (More than one answer is possible)	No…….…00 Boil…….01 Add bleach/chlorine/wuha agar…….…02 Strain it through a cloth……..…….....03 Use water filter (sand, composite, etc).04 Let it stand and settle……....05 Water purifying product…..…….....06 Other (specify)……..…..77	
H05	What kind of toilet facility do members of your household usually use?	Flush to piped sewer system……..…01 Flush to septic tank ……...…02 Flush to pit/latrine.……03 Flush to somewhere else…….04 Ventilated improved pit/latrine (VIP)…05 Pit/latrine with slap……..….06 Pit/latrine without slap/open pit ……07 Composting toilet……...……08 No facility/bush (field)..……09 Other (specify)…. ……..…..…….77 Don't know ……..…88	
H06	How does your household primarily dispose of household waste?	Collected by municipality……...01 Buried……...……....02 Collected by private establishment.....03 Dumped in street/open space……..…....04 Disposed in the compound……....…..05 Dumped in river…….....06	

		Burned…….....07 Other (specify)…… …….……...77	
H07	Do you wash your hands after coming from the toilet?	No …….00 Yes, usually…….;.....01 Yes, sometimes ……02	
H08	If yes, what do you use when you wash your hands after coming from the toilet? (more than one answer is possible)	Soap……...……01 Ash…….02 Plant…….....……..…….03 None…….…….04 Other, specify……...…….77	

Part I. Maternal anthropometric measurement

I01	Maternal MUAC in cm	----------	
I02	Maternal Height in meter	In meter---------	
I03	MaternalHgb before delivery(during labor)	In mg/dl---------	

Thank you!

Annex 2: Amharic Version Questionnaire

የአማርኛ ቋንቋ መጠይቅ

ጤና ይስጥልኝ ፡፡ ስሜ..... ሲሆን ዛሬ እዚህ የተገኘሁት የጅማ ዩኒቨርሲቲ ኢንስቲቱት ኦፍ ሄልዝ ዲፓርትመንት ኦፍ ፖፑሌሽን ኤንድ ፋሚሊ ሄልዝ ሁዩማን ኑትሪሽን ዩኒት ተማሪ የሆነችውን ሰሚራ አህመድን በመወከል ሲሆን ጥናቱም የማስተርስ ዲግሪዋን ለማግኘት የሚጠቅማት ሆኖ ከትክክለኛዉ (2.5 ኪ.ግ) መጠን በታች ሆነዉ የሚወለዱ ህጻናትን የሚያጋልጡ ነገሮች ምን እነደሆኑ ደሴ ከተማ ውስጥ በሚገኙ የመንግስት የጤና ተቋማት በሚል ርእስ የሚሰራ ነው ፡፡ የዚህ ጥናት ውጤቶች ለተለያዩ ባለድርሻ አካላት መፍትሄ የሚያስፈልጋቸውን ነጥቦች ከትክክለኛዉ (2.5 ኪ.ግ) መጠን በታች ሆነዉ የሚወለዱ ህጻናትና የሚያጋልጡ ነገሮች ምን እነደሆኑ በመለየት ያግዛሉ፡፡የሚሰበሰበውን መረጃ ምስጢራዊነቱን ለሚጠበቅ መጠይቁ ሲሞሊ ስምዎ በየትኛዉም ቦታ ላይ አይፃፍም፡፡ ጥናቱ በእናትየዋ ላይም ሆነ በልጁ ላይ ምንም አይነት ጉዳት አያስከትልም፡፡መጠየቅ የሚፈልጉት ማንኛውም አይነት ግልጽ ያልሆነ ጥያቄ መጠየቅ የሚቻል ሲሆን ለመመለስ ፈቃደኛ ያልሆኑባቸውን ያለመመለስ ወይንም ደግሞ የማቆም መብትዎ የተጠበቀ ነው፡፡

በዚህ ጥናት ለመሳተፍ ፈቃድኛ ነዎት 1.አዎ (ቃለመጠይቁን እንቀጥላለን)---------- 2.አይደለሁም (አመሰግናለው) ----------

የጤና ተቋሙ ስም:----------

የጠያቂው ስም_____ ፊርማ._____

የሱፐርቫይዘር ስም_____ ፊርማ._____

የተጠየቀበት ቀን (በኢትዮጵያ አቆጣጠር)------/-----/--------

ክፍሌ ነ. ይህ መጠይቅ የእናቶቸን ማህበራዊ ና ኢኮኖሚዊ ሁኔታዎች የሚገልጽ ነዉ

ተ.ቁ	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	እለፍ
A01	መጠይቅ የጤና ተቀሙ ስም ና የልጁ መለያ ቁጥር **(ከቃለ መጠይቁ በፊት ቁጥር መሰጠት አለበት)**	የሆስፒታለ/ጤና ጣቢያዉ ስም: _____ የእናት ሙሉ ስም_____ የልጁ መለያ ቁጥር _____ ቀበሌ_____ ዞን_____ ጎጥ_____	
A02	የተጠየቀበት ቀን	[_____|_____| _____| ቀን |ወር |ዓ.ም	
A03	እድሜሽ ስንት ነዉ?	እድሜ በአመት_____	
A04	ሃይማኖትሽ ምንድን ነዉ?	5. ሙስሉም 6. አርቶዶክስ 7. ፕሮቴስታንት 8. ሌላ ካለ ጥቀስ	
A05	ብሄርሽ ምንድን ነዉ?	5. አማራ 6. ኦሮሞ 7. ጉራጌ 8. ሌላ ከሆነ ይጠቀስ----	
A06	የትምህርት ደረጃ	6. ማንበብ እና መጻፍ የማልችል 7. ማንበብ እና መጻፍ የምችል 8. የመጀመሪያ ደረጃ 9. ሁለተኛ ደረጃ 10. ኮላጅና ከዚያ በላይ	
A07	የባለበቤትሽ የትምርት ደረጃ	6. ማንበብ እና መጻፍ የማይችል 7. ማንበብ እና መጻፍ የሚችል 8. የመጀመሪያ ደረጃ 9. ሁለተኛ ደረጃ 10. ኮላጅና ከዚያ በላይ	
A08	መኖሪያሽ የት ነዉ?	3. ገጠር 4. ከተማ	
A09	በአሁኑ ወቅት የትዳር ሁኔታዎ ምንድ ነው?	5. ያገባው 6. ግሊዊ/ብቸኛ 7. የተፋታች 8. ባለቤቷ ህይወቱ ያለፈ	

A10	የስራ መስክዎ ምንድን ነው?	9. ተማሪ 10. የመንግስት ተቀጣሪ 11. የግል ድርጅት ተቀጣሪ 12. ንግድ 13. የቤትእመቤት 14. የቀን ሰራተኛ 15. ገበሬ 16. ሌላ (ይገለፅ).....	
A11	የባለበቤትሽ የስራ መስክ ምንድን ነው?	8. ተማሪ 9. የመንግስት ተቀጣሪ 10. የግል ድርጅት ተቀጣሪ 11. ንግድ 12. ገበሬ 13. የቀን ሰራተኛ 14. ሌላ (ይገለፅ).....	
A12	የቤተሰባችሁ አባላት ብዛት ስንት ነው?	በቁጥር_____	
A13	የቤተሰብ ሀላፊ	ሚስት ……..…..01 ባል……..……02	
A14	የባለበቤትሽ የጋብቻ ሁኔታ	አንድ ሚስት ብቻ……..……01 ከአንድ በላይ ሚስቶች……02	

ክፍል 2: የቤተሰብ የገቢ ሁኔታ

አሁን የምጠይቅሽ የቤተሰብ የንብረቶች ሁኔታ ነዉ

ተ.ቁ	ጥያቄዎች	አዎ	የለም
	ቤተሰቡ ወይንም ከቤተሰቡ መካከል አንዱ አባል ከታች የተዘረዘሩት ንብረቶች ባለቤት ከሆነ ካጠገቡ ነ ይፃፉ ከሌለ ደግሞ o ይፃፉ፡፡ (ማክበብ)		
B01	የኤሌትሪክ አገልግሎት በቤት ውስጥ ይገኛል?	1	0
B02	ቴላቪዥን	1	0
B03	ሰኣት (የግድግዳ ወይም የእጅ)	1	0
B04	ማቀዝቀዣ	1	0
B05	ሬድዮ	1	0
B06	ተንቀሳቃሽ ስልክ	1	0
B07	መኖበኛ ስልክ	1	0
B08	ጠረንጴዛ	1	0
B09	ወንበር	1	0
B10	አልጋ ሞዝቮልድ የጥጥ/የስፖንጅ/የስፕሪንግ ፍራሽ	1	0

B11	የኤሌክትሪክ ምጣድ	1	0
B12	በጋዝ የሚሰራ አምፖል(ኩራዝ)	1	0
B13	ብስክሌት	1	0
B14	ሞተር ሳይክል / ባጃጅ	1	0
B15	መኪና	1	0
B16	በእንስሳት የሚንተት ጋሪ	1	0
B17	መኪና/የጭነት መኪና	1	0
B18	የጭነት ጋሪ	1	0
B19	የዉሀ ፓንፕ	1	0
B20	የባንባ ዉሀ	1	0
B21	የባንባ ዉሀ መኖሪያ ቤት ዉስጥ	1	0
B22	የባንባ ዉሀ አጥር ግቢ ዉስጥ	1	0
B23	የህዝብ የባንባ ዉሀ	1	0
B24	የጉድጉድ ዉሀ	1	0
B25	የምንጭ ዉሀ	1	0
B26	የዝናብ ዉሀ	1	0
B27	የመሬት ዉሀ	1	0
B28	ወንዝ/ሀይክ/ኩሬ /ግድብ	1	0
B29	የታሸገ ዉሀ	1	0
B30	መጸዳጃ ቤት	1	0
B31	የጋራ መጸዳጃ ቤት	1	0
B32	የሚታረስ መሬት	1	0
B33	የባንክ ወይም የቁጠባ ደብተር	1	0

	ቤተሰቡ ወይንም ከቤተሰቡ መካከል አንዱ አባል ከታች የተዘረዘሩት እንስሳት አሉት (ማክበብ)	አዎ	የለም	ብዛት
B34	በሬ	1	0	
B35	ላም	1	0	
B36	ፈረስ/በቅሎ	1	0	
B37	ፍየል/በግ	1	0	
B38	ዶሮ	1	0	
B39	አህያ	1	0	

ክፍል 3: የህጻኑ ሁኔታ ዎች

ተ.ቁ	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	
C01	የልጁ ፆታ	ወንድ _____ 1 ሴት _____2	
C02	የልጁ ክብደት	ክብደት በግራም: ክ1____ክ2.____ ክ3___	
C03	የልጁ ቁመት	ቁመት በሴ.ሜ:ቁ1____ቁ2.____ቁ3_____	
C04	ስንተኛ ልጅ ነዉ?	በቁጥር_____	

ክፍል 4: የእናተየዋን የጤና እና የማህጸን ሁኔታ

ተ.ቁ.	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	እለፍ
D01	ምን ያህል ግዜ እርግዝና ነበርወት?	እርግዝና: _____	
D02	ስንተኛ ጊዜ ነው አሁነ ስትወልጂ? እርግዝናዉ ከ28 ሳምንት በላይ የሆነ .	የተወለዱ ልጆች ብዛት: _____	እርግዝናዉ-I ከሆነ ወደ ጥ.ቁ. D03 ይለፉ
D03	ከአሁን በፊት የተቋረጠ ፅንስ ነበር?	4. አዎ 5. አያውቅም 6. አላስታውስም	መልሱ አያውቅም ከሆነ ወደ ጥ.ቁ. D05 ይለፉ
D04	የተቋረጠ ፅንስ ምን ያህል ነበር?	……	
D05	ከጊዜው ቀድሞ የተወለደ ፅንስ ነበር? (≤37ሳምንት)?	4. አዎ 5. አያውቅም 6. አላስታውስም	
D06	ለመጨረሻ ጊዜ የወር አበባሽ መፍሰስ የጀመረው መቼ ነው? (የእርግዝና ቆይታ)	የእርግዝና ቆይታ ስትወልድ በሳምንት : _____	
D07	በአሁኑ እና ከዚህ በፊት በወለድሽዉ ልጅ መሀከል ያለዉ የጊዜ ልዩነት ምን ያህል ነዉ? (ከዚህ በፊት የተወለደ ልጅ ካለ)	----------	
D08	እርግዝናው እንዴት አይነት ነበር?	4. የታቀደና የተፈለገ 5. ያልታቀደ ግን የተፈለገ 6. ያልታቀደና ያልተፈለገ	
D09	በእርግዝናሽ ወቅት የጽንስ ክትትል ነበረሽ?	4. አለኝ 5. የለኝም 6. አላስታውስም	መልሱ የለኝም ወይም አላስታውስም ከሆነ ወደ ጥ.ቁ D12 ይለፉ
D10	የቅድመ ወሊድ ክትትል እርግዝናው ምን ያህል ጊዜ ሲሆነው ጀመርሽ?	በ _____ ወር	
D11	በአጠቃላይ ስንት ክትትል ነበረሽ?	በ ቁጥር----------	
D12	በዚህ እርግዝና ወቅት የተሰጠሽ ወይንም ገዝተሽ የወሰድሽው የመልቲቫይታሚን ኪኒን ወይም ሽሮፕ አለ ? (ኪኒኑን ወይም ሽሮፑን አሳይ).	4. አዎ 5. አልወሰድኩ 6. አላስታውስም	

D13	በዚህ እርግዝና ወቅት የተሰጠሽ ወይንም ገዝተሽ የወሰድሽው የደም ማነስ ኪኒን/ሽሮፕ አለ?(ኪኒኑን ወይም ሽሮፑን አሳይ).	1. አዎ 2. አልወሰድኩ 3. አላስታውስም	
D14	የ D13 ጥያቄ መልስሽ አዎ ከሆነ ምን ያህል እነክብሎችን ወስደሻል?	በ ቁጥር ------	
D15	በዚህ እርግዝና ወቅት ወይንም ከዚህ እርግዝና በፊት በማንኛውም ጊዜ የቲታነስ ክትባት ወስደሻል?	1. አዎ 2. አልወሰድኩ 3. አላስታውስም	
D16	በዚህ እርግዝና ወቅት ስለ አምጋገብሽ ምክር አግኝተሻል?	4. አዎ 5. አላገኘሁም 6. አላስታውስም	
D17	በዚህ እርግዝና ወቅት የትላትል መድሀኒት ወስደሻል?(ኪኒኑን አሳይ)	4. አዎ 5. አልወሰድኩም 6. አላስታውስም	
D18	በዚህ እርግዝና ወቅት የአመጋገብ ሁኔታሽ እንዴት ነበር?	5. ከወትሮዉ ያነሰ 6. ከወትሮዉ ተመሳሳይ 7. ከወትሮዉ የበለጠ 8. አላስታውስም	
D19	የታወቀ ህመም አለብሽ?	4. አዎ 5. የለም 6. አላውቅም	
D20	የትኛዉ አይነት በሽታ	5. ከዚህ በፊት የነበረ ግፊት ህመም 6. የስኳር ህመም 7. በእርግዝና ወቅት የተከሰተ ግፊት ህመም 8. ሌላ (ይገለፅ).....	የስኳር ህመም ካለባት ጥያቄዉን አቁም
D21	በእርግዝናዎ ወቅት የስኳር ህመም እንዳለብዎት ተነግሮዎት ያውቃሉ?	4. አዎ 5. የለም 6. አላስታውስም	
D22	በእርግዝናዎ ወቅት የደም ግፊት ህመም እንዳለብዎት ተነግሮዎት ያውቃል?	4. አዎ 5. የለም 6. አላስታውስም	

D23	የ HIV ቫይረስ ምርመራ ዉጤት	4. ፖዘቲቭ 5. ነጌቲቭ 6. አላውቅም	

ክፍል 5: የእናት አመጋገብ ሁኔታ

ከዚህ በመቀጠል ደግሞ ባለፉት 24 ሰአት ዉስጥ ማለትም ትላነት ፀሀይ ከወጣችበት ጀምሮ እስከ ዛሬ ፀሀይ እስከወጣችበት ጊዜ ድረስ ስለተመገቡት የምግብ አይነት ይሆናለ።

	ዝርዝሩን አንብብ ማክበብ“1” ለተገለፀዉ እና “0” ላልተገለፀዉ የምግብ አ	መለያ	
E01	ማንነኛዉም ከእህል የተሰሩ ምግቦች (ማሽላ፣ በቆሎ፣ ስንዴ፣ ጤፍ,)…….	1	0
E02	ማንነኛዉም ከስራስር የተሰሩ ምግቦች (ድንች፣ ስኩዋር ድንች፣ ቀይ ስር፣ ወይም ሌላ በአካባቢዉ ያሉ ከስራስር የተሰሩ ምግቦች)……..……	1	0
E03	ማንነኛዉም ከጥራጥሬ የተሰሩ ምግቦች (ምሳሌ. ምስር፣ ባቄላ፣ አኩሪአተር፣ ወይም አተር)……	1	0
E04	ማንነኛዉም ከለዉዝ የተሰሩ ምግቦች (ምሳሌ የለዉዝ ቅቤ፣ ለዉዝ)….....	1	0
E05	ማንነኛዉም በዘይት ፣ በስብ ወይም በቅቤ የተሰሩ ምግቦች …….	1	0
E06	ማንነኛዉም የወተት ውጤቶች (ምሳሌ ወተት፣ አይብ ወይም እርጎ)	1	0
E07	ስጋ (ምሳሌ. የበግ፣ የበሬ፣ የጥጃ፣ የፍየል፣ ጉበት፣ አንጎል፣ ሌሎች እንደ ጨጉዋራ፣ የከብት አንጀቶች ያሉ ምግቦች)…….……	1	0
E08	የሚበሉ የወፍ ዘሮች (ምሳሌ. ዶሮ፣ የአሜሪካ ዶሮ፣ ዳክዬ)…….….	1	0
E09	አሳ ……..……..	1	0
E10	እንቁላል…….....	1	0
E11	አረንጉዋዴ ቅጠላማ አትክልቶች (ቆስጣ፣ ሰላጣ፣ ጎመን)…….....	1	0
E11	ማንነኛዉም ከዱባ፣ ካሮት፣ ጥቅል ጎመን፣ ቀይ ስኩዋር ድንች፣ ማነኛ፣ ፓፓያ፣ ……..	1	0
E12	ሌሎች ፍራፍሬዎች? (ምሳሌ ሙዝ፣ አፕል፣ አቮካዶ፣ የሾላ ፍሬ፣ ወይን፣ ብርትኳን፣ሎሚ	1	0
E13	ሌሎች አትክልቶች ? (ምሳሌ ሽንኩርት፣ ቲማቲም፣ ነጭ ሽንኩርት) …….....	1	0

ክፍል 6: የእናት የአመጋገብ ዘይቤ ጥያቄዎች

ከዚህ በመቀጠል ደግሞ በዚህ እርግዝና ወቅት ስለሚከተሉት የምግብ አወሳሰድ ልምዶ የተመለከቱ ጥያቄዎችን እጠይቆታለሁ::

ተ.ቁ	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	እለፍ
F01	አብዛኛውን ጊዜ በቀን ውስጥ ስንት ጊዜ ምግብ ይመገባሉ?	6. አንድ ጊዜ 7. ሁለት ጊዜ 8. ሶስት ጊዜ 9. አራት ጊዜ 10. አምስት ጊዜ እና ከዚያበላይ	
F02	በዚህ እርግዝና ወቅት ከወትሮ የተለየ ተጨማሪ ምግብ ትወስጂ ነበር?	4. አዎ 5. አልወሰድኩም 6. አላስታውስም	
F03	በቀን ውስጥ የሚከተሉት መደበኛ የአመጋገብ ስርአት ምን ይመስላል?	6. ቁርስ ፣ምሳ ፣እራት 7. ቁርስ ፣መክሰስ ፣ምሳ ፣እራት 8. ቁርስ ፣ምሳ ፣መክሰስ ፣እራት 9. ቁርስ ፣መክሰስ ፣ምሳ ፣መክሰስ ፣እራት 10. ቁርስ ፣መክሰስ ፣ምሳ ፣መክሰስ ፣እራት፣ለሊት መክሰስ	
F04	ከማርገዝዎ በፊት በቀን ውስጥ ስንት ጊዜ ምግብ ይመገቡ ነበር?	_____ ጊዜ	
F05	መደበኛ የምግብ ጊዜዎን የመዝለል ልምድ አሎት?	4. አለኝ 5. የለኝም 6. አላስታውስም	መልሱ የለኝም ከሆነ ወደ ጥ.ቁ F07 ይለፉ
F06	የጥ.ቁ F05 መልስዎ አለኝ ከሆነ, የምግብ ጊዜዎን የሚዘሉበት ምክንያት ምንድነው?	5. ስለሚደክመኝ 6. ስራ ስለሚበዛብኝ እረሳዋለው 7. ክብደቴ እዳይጨምር(እንዳልወፍር) 8. ሌላ ከሆነ ይጥቀሱ	
F07	በዚህ እርግዝና ወቅት ፆም ይፆማሉ?	4. እፆማለሁ 5. አልፆምም 6. አላስታውስም	
F08	ነፍሰጡር ከሆኑ በኋላ መብላት የማይፈልጉት ወይም መመገብ ያቆሙት የምግብ አይነት ይኖራል?	4. አለ 5. የለም 6. አላስታውስም	መልሱ የለም ከሆነ ወደ ክፍል G ይለፉ
F09	የጥ.ቁ F08 መልስዎ አለ ከሆነ, የትኛውን የምግብ አይነት አብዝተው ይጠላሉ?	9. ቡና 10. ገንፎ፣ አጥሚት፣ ደቦ፣ተልባ 11. ሽሮ ወጥ(ሌላ ጥራጥሬ) 12. ቀይስር፣ ቲማቲም፣ ቃሪያ (ሌሎች አትክልቶች)	

		13. እንቁላል ፣ወተት እና የወተት ውጤቶች 14. ሙዝና ሌሎች ፍራፍሬዎች 15. ስጋ 16. ሌላ ከሆነ ይጥቀሱ _____	
F10	ይህንን ምግብ ላለመመገብዎ ምክንያት ምንድነው?	5. ስለሚያስጠላኝ → ወደጥ.ቁ F11 ይለፉ 6. ነፍሰጡር እናት ልትመገበው የተፈቀደ ስላልሆነ(ባህላዊ) → ወደጥ.ቁ F12 7. ሀይማኖቴ ስለማይፈቅድ 8. ሌላ ከሆነ ይጥቀሱ	
F11	ምግቡ ስለሚያስጠላኝ ካሉ በምን ምክንያት ነው የሚያስጠላዎ?	5. የምግቡ ሽታ (ጣዕም) 6. ደረቴንስለሚያቃጥለኝ(ቃር)/ምቾትስለ ማይሰጠኝ/ 7. ስለሚያቅለሸልሸኝ/ስለሚያስመልሰኝ/ 8. ምክንያቱን አላውቀውም	ወደ ጥ.ቁ F13 ይለፉ
F12	የላይኞቹ ምግቦች በነፍሰጡር እናቶች እንዳይበሉ የሚከለክልበት ባህላዊ ምክንያት ምንድነው?	8. ልጁን ትልቅ በማድረግ ምጥ አስቸጋሪ እንዲሆን ያደርጋል 9. የፅንሱ ጭንቅላትና ሰውነት ስለሚለጠፍ 10. ውርጃ ስለሚያመጣ 11. የቡዳ አይን እንዳይበላ 12. ፅንሱ ላይ ችግር ስለሚያመጣ 13. የሕፃኑን ፀጉር ይመልጣል 14. ሌላ ከሆነ ይጥቀሱ	
F13	ባለፉተ ዘጠኝ ወራት ዉስጥ ከቤት ዉጭ ስንት ጊዜ ምግብ ተመግበዋል?	5. በየቀኑ 6. በሳምንት 7. በወር 8. በፍፁም	

ክፍል 7. የእናትየዋ የልምድ (አድራጎት) ሁኔታ

ተ.ቁ	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	አለፍ
G01	በእርግዝናሽ ወቅት ጫት ትቅሚ ነበር?	3. አዎ 4. አይደለም	
G02	አዎ ካልሽ, የአቃቃም ሁኔታሽ እንዴት ነበር?	4. በየእለቱ/ያለማቆራረጥ 5. አንዳንድ ጊዜ/በተቆራረጠ መልኩ 6. አልፎ አልፎ	
G03	በእርግዝናሽ ወቅት ሲጋራ ታጨሽ ነበር?	1. አዎ 2. አይደለም	
G04	አዎ ካልሽ, የአቃቃም ሁኔታሽ እንዴት ነበር?	4. በየእለቱ/ያለማቆራረጥ 5. አንዳንድ ጊዜ/በተቆራረጠ መልኩ 6. አልፎ አልፎ	
G05	አልኮልነት ያለው መጠጥ ጠጥተሽ ታውቂያለሽ?	3. አዎ 4. አይደለም	

G06	አዎ ካልሽ, የአቃቃም ሁኔታሽ እንዴት ነበር?	4. በየእለቱ/ያለማቆራረጥ 5. አንዳንድ ጊዜ/በተቆራረጠ መልኩ 6. አልፎ አልፎ	

ክፍል 8. የ አካባቢያዊ ሁኔታዎች

ከዚህ በመቀጠል ስለመጠጥ ዉሀ ምንጭ እና መፀዳጃ ቤት ሁኔታዎች እጠይቅሻለሁ።።

ተ.ቁ	ጥያቄዎች	ለምርጫ የቀረቡ ምላሾች	እለፍ
H01	የቤቱ የመጠጥ ዉሀ አይነት ምንድነዉ?	የባንባ ዉሀ መኖሪያ ቤት ዉስጥ……01 የህዝብ የባንባ ዉሀ……02 የጉድጉዷድ ዉሀ…….....03 የታንከር ዉሀ…….04 የመሬት ዉስጥ ዉሀ (ዉሀ፣ ሀይቅ፣ ኩሬ……)05 ሌላ ከሆነ ይጥቀሱ _____ 77	
H02	ዉሀ ለመቅዳት ምን ያክል ጊዜ ይወስዳል? ማለትም ዉሀ ለመቅዳት እና ወደ ቤት ለመመለስ?	ከአንድ ሰአት በታች…… ……01 አንድ ሰአት እና ከዛ በታች ……02 ከህንፃ እስከ መሬቱ……...03	
H03	የዉሃ ማጣሪያ ትጠቀሚያለሽ?	አይ……...…...00 አዎ, ሁልጊዜ…….....01 አዎ, አንዳንድ ጊዜ ……..…..…..02	
H04	ለማጣሪያነት የምትጠቀሙት ምንድን ነዉ?	አይ ……..……00 ማፍላት……01 ማንጫ/ክሎሪን/ዉሀ አጋር…….……02 በጨርቅ ማጣራት…….…….....03 ዉሀ ማጣሪያ በመጠቀም (አሸዋ፣ ወዘተ)……04 ወደታች እንዲዘቅጥ በማድረግ……....05 ዉሀ ማጣሪያ ዉጤቶች…….....06 ሌላ ከሆነ ይጥቀሱ ……..…...……..77	
H05	የምትጠቀሙት የመፀዳጃ ቤት አይነት	ቆሻሻ መተላለፊያቀዉ ዉሃ ማፍሰሻ ያለዉ……..01 ዉሃ ማፍሰሻዉ ወደ ታንኩ የሚገባ……....02 ዉሃ ማፍሰሻዉ ወደ ጉድጉዋድ የሚገባ……..03 ወደ ሌላ ቦታ የሚፈስ……04 አየር ማስወጫ ያለዉ(VIP)… ……05 የጉድጉዋድ ክዳን ያለዉ....……..……06 የጉድጉዋድ ክዳን የሌለዉ ……07 ቆሻሻ ያለዉ……...……08 መፀዳጃ ቤት የለም/ሜዳ ላይ..……..09 ሌላ ከሆነ ይጥቀሱ …. ……..…..……77 አላስታዉስም ……..……88	
H06	ቆሻሻን የምታስወግዱበት መንገድ	በከተማ ማዘጋጃ ቤት ይሰበሰባል……...01 ይቀበራል……...……....02 በግል ማህበሮች ይሰበሰባል…….....03	

		መንገድ ላይ ይጣላል /ባዶ ቦታ ላይ ……..…....04 Disposed in the compound……....…..05 ወንዝ ዉስጥ ይ…….....06 ይቃጠላል…….....07 ሌላ ከሆነ ይጥቀሱ …… …….……...77	
H07	ከመፀዳጃ ቤት መለስ እጅሽን የመታጠብ ልማድ አለሽ?	የለኝም ……00 አዎ, ብዙጊዜ…….;.....01 አዎ, አልፎ አልፎ ……02	
H08	አዎ ካልሽ, እጅሽን ለመታጠብ የምትጠቀሚዉ ምንድን ነዉ (ከአንድ በላይ መልስ ይቻላለmore than one answer is possible)	በሳሙና……...……01 Ash…….02 በቅጠል…….....…….…….03 በምንም…….……04 ሌላ ከሆነ ይጥቀሱ……...…….77	

ክፍል I. የእናትየዋ anthropometric ልኬት

I01	የእናትየዋ MUAC በ ሴ.ሜ	----------	
I02	የእናትየዋ ቁመት በሜትር	በሜትር ---------	
I03	የእናትየዋ Hgb(የደም መጠን ከመዉለዱዋ በፊት	በ mg/dl---------	

አመሰግናለሁ!

DECLARATION

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

Name: __Semira Ahmed_____

Signature: _____

Name of the institution: _____

Date of submission: _____6/ 13/ 2017_____

This thesis has been submitted for examination with my approval as University advisor

Name and Signature of the first advisor

_____ _____

Name and Signature of the second advisor

_____ _____