COLLEGEOF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF STATISTICS

PREVALENCE AND FACTORS ASSOCIATED WITH CHILD BIRTH WEIGHT IN ETHIOPIA

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ABSTRACT

The study is conducted to determine prevalence and factor associated with child birth weight in Ethiopia. The main objective of this study is to examine the association between birth weights with predictor variables and to assess the factors associated with child birth weight in Ethiopia. In this study the data source is the Ethiopian Demographic and Health Survey conducted in 2016(EDHS 2016) by the Central Statistical Agency (CSA) with a total of 2083 Childs. data obtained was processed and analyzed with aid of SPSS16 statistical software. Both descriptive and inferential statistical methods were used to analyze the data (i.e. Chi- square and Logistic regression analysis). As the result and discussion, 20.5% child has low birth weight, 69.0% child has normal birth weight and 10.5% child has high birth weight. In chi square test of association some variables such as sex, region, weight of mother, mother educational level, place of deliver, father educational level and mother occupation has (p-value <0.05) was significant association with child birth weight. Also from the result of ordinal logistic regression model, the variables sex of child, region, weight of mother, father occupation, occupation of mother and mother educational level were found to be more significant association with birth weight of a child.

Key words: Prevalence, risk factor, child birth weight, ordinal regression, SPSS, EDHS and Ethiopia.

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ACRONYMS

BMI	Body Mass Index
CSA	central statically agency
EDHS	Ethiopia Demographic Health Survey
LBW	Low birth weight
MoH	Minster of Health
NGO	None government organization
UNICEF	United nation International Children's Emergency Fund
WHO	World Health Organization

CHAPTER ONE

1. INTORODUCTION

1.1. Background of study

Birth weight is the single most important factor determining the survival chances of the new-born. Birth weight is a central element in the conceptual framework. It shows the weight after the intrauterine growth of the child and is the starting point for the continued growth after delivery. The mean birth weight varies over time and between different contexts. Mean birth weight is normally from about 3,000 g to 3,500 g. The birth weight variation expressed as standard deviation is 10-15% of the mean birth weight. In any context studied so far there is a difference between boys and girls, the latter having lower mean weight and length. Low Birth Weight (LBW) has been defined by WHO as weight at birth less than 2,500 g (5.5, pounds) and High birth weight (overweight) is greater than 4,000 grams or 8.8 pounds (WHO).

Globally an estimated 13 million babies are born before 37completed weeks of gestation. This figure is high among middle and low income countries. According to reports of WHO, 16 million adolescent girls gave birth each year. Babies born from these mothers accounting 11% worldwide;95% in developing countries. The newborns of adolescent mothers are also more likely to have LBW, with the risk of long-term effects. More than 20 million LBW infants are born each year in the developing world. Incidence of LBW ranged from 6% to 18% across the globe with sub-Saharan Africa accounting 13% to 15% (WHO).

Throughout the world, among children and adolescents, overweight and obesity have become an epidemic. The World Health Organization further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. Globally, in 2010 the number of overweight and obese children under the age of five has been estimated to be over 42 million with about 35 million living in developing countries. Once considered a problem only in high-income countries,overweight and obesity are now dramatically on the rise in low- and middle income countries, particularly in urban settings (UNICEF and WHO, 2010).

In Africa there are a lot of women with low education, poverty and poor nutritional status who are therefore at increased risk of adverse reproductive outcomes including LBW and preterm birth. It is therefore important to identify such mothers during pregnancy in order to determine the level of care and priorities for referral to centers where reasonable obstetric and neonatal care is available. More babies are surviving despite being born early because of the tremendous advances in care of sick and premature babies. However, prevention of preterm births is one of the best ways to prevent babies born with LBW (Elshibly and Schmalisch, 2008).

The 2011 demographic health survey of Ethiopia (EDHS) showed that 29% of Ethiopian babies weigh low as perceived by their mothers (not weighed). In 2013, birth asphyxia (34%) and Prematurity (25%) were causes of neonatal mortality in Ethiopia which are the most common causes for LBW. Paternal educational status and presence of radio/television in the household were predictors of LBW. According to the 2011 EDHS, low birth weight was more common among children of the youngest mothers, age less than 20 (13%) and older mothers age 35-49 (17%), and children of birth order six and above (16%) (EDHS,2011).

The magnitude of the contribution of low birth weight to infant mortality is higher in developing countries given that the survival of such infants is dependent on environmental sanitation, effective post-natal nutrition and rehabilitation, and the availability of medical care (Mondale, 2008). birth weight in developing countries include maternal nutritional status at conception, gestational weight gain in accordance with dietary intake, parental socioeconomic status, malaria, anemia, and chronic infections during pregnancy (Podja and Kelly, 2009; Koupilova et al., 2005;Kramer et al.,2009). Social demographers (Singh and Yu, 2005) have long emphasized the importance of "nonmedical" barriers –behavioral, social, environment, and economic – to good or adverse birth outcomes (Mondale 2008).

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

1.2. Statement of the Problem

Birth weight is a challenging public health problem. Its high priority stems from the fact that it is the major predictor of infant morbidity and that it contributes substantially to the overall burden of childhood mortality. As far as the knowledge of the researcher's concerned there was no enough scientific investigation on the area of birth weight. Having seen this gap the current researchers was planned to clearly indicate the prevalence of low, normal and high birth weight so that different health sectors other policy makers and other concerned bodies can utilize the result to avoid and reduce the problem of birth. Moreover the researchers also tried to identify all significantly contributing factors of birth weight so that any concerned body who are responsible for low or high birth weight will be use the result for elimination or significant reduction of low and high birth weight.

Research questions: -

- What is the prevalence of low, normal and over birth weight of child in Ethiopia?
- What are the factors associated with birth weight of child in Ethiopia?

1.3. Objectives of the Study

1.3.1. General Objective

The main objective of this study was to determine prevalence and factor associated with child birth weight in Ethiopia.

1.3.2. Specific objectives

- ✓ To determine the prevalence low, normal and high child birth weight in Ethiopia.
- ✓ To examine the association between birth weight with predictor variables.
- ✓ To identify factors associated with child birth weight in Ethiopia.

1.4. Significance of study

The current study was expected to give the very important information for policy makers and other health sectors so that they can easily allocate appropriate resource for the target area and group. The current study was clearly identify the most contributing factors for high and low birth weight and these was help to indicate the area on which the MoH and other NGO's focus to significantly reduce the low and high birth weight. Moreover, this study was used as a base line for the coming researchers and gives a hint to conduct further investigations.

1.5. Scope of the study

The data for this study was taken from 2016 Ethiopia Demographic and Health Survey (EDHS) data. The study was focuses to the child which have low birth weight (LBW), and high birth weight.

1.6 Limitation of the Research

This study purposes to determine prevalence and factor associated with child birth weight in Ethiopia. There are a number of problems and difficulties that should be suggested during the accomplishment of this paper. Some of the limitations are:

- ✓ Data problem - Some important variables are not included because of missing values and non-responses.
- ✓ The data, used in this study are from the EDHS 2016. Thus, the results may not necessarily reflect the current situation of Ethiopia.

CHAPTER TWO

2. LITERATURE REVIEW

According to UNICEF, birth weight is an indicator of a newborn's chances for survival, growth, long-term health and psychosocial development. Infants with low birth weight put on weight more rapidly than infants who were heavier at birth and can risk overweight. A study to investigate risk factors of protein energy malnourishment among 0-5 year old children in Ethiopia found that low birth weight, higher birth order and sibling with history of underweight were risk factors.

The factors observed to be highly significantly associated with LBW included Antenatal Care (p-value =0.0040), Hemoglobin level (anemia) (p-value =0.0020), Residence (p-value =0.0000) and Fetal infection (p-value=<0.0000). There is also risk for maternal age (p-value=0.016Overall mean birth weight was found to be 2.64± 0.444 kg with 95% confidence interval (CI) of 2.59 - 2.69. Out of total 34.37% newborns were weighing less than 2.50 kg and 95% CI for the prevalence of LBW was 28.58-40.22.Maternal education ($\chi 2=8.78$, $p<0.005$), occupation ($\chi 2=8.14$, $p< 0.02$) and precipitate income of the family per month ($\chi 2=22.02$, $p<0.001$) were found to be significantly associated with birth weight of the newborn. Utilization of antenatal care was adequate (≥ 3 antenatal visits) in 58.20% mothers. All other variables considered such as mother's age, weight, height, Religion of households' place of deliver, Father education, were not significant (p-values > 0.05). In a nutshell, fetal infection, hemoglobin level (anemia in pregnancy), antenatal care and residence are highly significantly risk factors associated with child birth weight at the hospital. Early/late baby's' sex and maternal weight also showed some level of significance with birth weight. Gestational age, height, BMI of mother, and antenatal care among others were however not significant. The 21.1% prevalence of low birth weight (mean = 2.000±0.012) and 71.4% the normal mean birth weight of 4.012±0.062kg. (AASMA N.*et.al.* 2013)

Here the birth weight was found to be significantly associated with birth interval in relation to previous birth. Maternal age ($\chi 2=10.19$, $p<0.01$), parity ($\chi 2=13.4$, $p<0.01$) and BMI ($\chi 2=17.57$, $p<0.001$) were found to be significantly associated with LBW (Table V). Out of the total, 65 (25.39%) mothers had history of past adverse outcome of which 56.92% delivered LBW newborns. History of past adverse outcome was found to be significantly associated with LBW ($Z=4.36$, $p<0.001$) (Joshi H S.*et al*.).

The study suggests that there are several factors interplaying which lead to LBW babies. Socio-demographic factors (maternal weight, educational level and wealth compined) and antenatal care are more important. A total of 1426 birth occurred during the study period (December 2009 to January 2010), of which 306 met the study criteria. Among which 66(21.56%) were low birth weight (LBW) and 240 were normal birth weight (NBW). Overall mean birth weight was found to be 2.75 ± 0.639 kg. Out of total 21.56 % newborns were weighing less than 2.50 kg and mean birth weight was 1.96 ± 0.409 kg. The study also shows that majority 73 (86%) of the research centers didn't start the research yet. (J Nepal Health Res Counc, 2011)

In Ethiopia, 15% of babies were reported to be LBW in 2000.In 2011, the prevalence decreased to 11%. However, only 5% of children were weighed at birth. In Ethiopia, in 2014, there were 27,243 deaths due to low birth weight accounting 4.53% of the total deaths .Descriptive studies conducted in Gondar, Tigray region and Jimma zone of Ethiopia reported 11.2%, 14.6% and 22.5% prevalence of low birth weight respectively. Another cross-sectional study conducted in University of Gondar referral hospital reported that the prevalence of low birth weight was 17.1%.Cohort studies showed 18% and 28.3% prevalence of normal and high birth weight in Ethiopia (Bililign N,2018).

The prevalence of LBW in urban (9.9%) is in line with Ethiopian demographic and health survey 2011 and Tigray (10.1%) and a study conducted in Gambia (10.5%) . Unlike the urban area, the prevalence of LBW in rural (6.3%) is found to be lower than the report of EDHS 2011 for the rural of Ethiopia (17.0%). But the prevalence of LBW of the study in both urban and rural is lower than the studies conducted by WHO (15.5%) and UNICEF (13% to 15%). The result of this study was also lower than some other institutional based studies in South Western Ethiopia (22.5%), Zimbabwe (16%) and India (22.9%). This difference may be explained by the time gap between these studies and seasons of the year as birth weight may have seasonal variations and also the prevalence of LBW may vary between and within geographical regions. Other reasons might be, different study areas and study designs, influence of different risk factors were different, and health service utilizations might also be different. However, this study found out a higher prevalence of LBW compared to other hospital based studies in Ethiopia ranging between

5.6% and 8.6% and in Qatar (6.7%) and in Iran (8.8% and 6.3%) . It is also slightly higher than the prevalence of LBW in Egypt (6.2% in 2005 and 7.3%) . (Negassi T, 2014)

In the multivariate logistic regression analysis model, controlling potential confounder's maternal place of residence, mother age, weight of mother, sex of child, region, Antenatal care, wealth, mother education and presence of chronic medical illnesses were found to be significant predictor of low birth weight. Residence of the mother was strongly associated with low birth weight, mothers residing in rural area were more than 4 times more likely to have LBW babies when compared to those mothers who live in urban (AOR = 4.34 (95 % CI =1.98, 9.48)). The risk of having LBW baby was more than two folds higher in mothers who had a body weight less than 50 kg when compared to mothers having body weight > = 50 kg (AOR = 2.23 (95 % CI = 1.06, 4.80)).Gestational age of the fetus on the risk of having low birth weight babies, the odds of being LBW in babies born before gestational age of 37 weeks was 18 times higher when compared to babies born at gestational age of 37 weeks and more (AOR = 18.52 (95 % CI = 4.94, 69.43)).Of the maternal obstetric factors the presence of any chronic medical illnesses during current pregnancy was assessed and it was found to be associated significantly with LBW. The odds of being LBW in babies born from mothers with history of chronic medical illnesses during their current pregnancy were found to have greater than five times chance of delivering LBW baby when compared with mothers with no history of chronic medical illnesses (AOR = 5.33 (95 % CI = 1.12,25.45)(Negassi T,2014).

2.1. Factors Associated with LBW

LBW is a public health problem in many countries, where as much as 15 % of births result in LBW babies. Ninety-six percent of all LBW babies are born in low income, developing countries. LBW infants are at much higher risk of early death than infants with normal weight at birth. Infants with LBW put on weight more rapidly than infants who were heavier at birth and can risk overweight. Reducing LBW incidence is one of the major goals in "A World Fit for Children", the Declaration and Plan of Action adopted at the United Nations General Assembly Special Session on Children in 2008.

In binary logistic regression: sex of the neonate, ante natal care follow up, Pregnancy type and diet intake per 24 hours were significantly associated with low birth weight in Axum district and sex of the neonate, ante natal care follow up and pregnancy type were significantly associated with low birth weight in LaelayMaichew district. Significant variables in the binary logistic regression were entered in to multivariate logistic regression. Mothers who have had a history of greater than or equal to four ANC follow up were 71% less likely to deliver LBW babies when compared to those who have attended greater than or equal to three times [AOR=0.29, 95% CI:(0.12,0.73)]. Additionally, mothers who had unwanted and unplanned pregnancies were 4 times more likely to have LBW than those who had wanted and planned pregnancies[AOR=4.04,95% CI: (1.17, 13.90)].Female new born neonates were 6 times more likely to have LBW than their male counter parts [AOR=6.08, 95% CI:(1.60, 23.07)]. Additionally, mothers with unwanted and unplanned pregnancies were more than 7 times more likely to deliver LBW neonates than those who have had wanted and planned pregnancies [AOR=7.34, 95%CI:(2.050,26.292)((Negassi T,2014)

2.2. Factors Associated with high birth weight

The World Health Organization further projects that by 2015, approximately 2.3 billion adults will be overweight and more than 700 million will be obese. Globally, in 2010 the number of overweight and obese children under the age of five, has been estimated to be over 42 million with about 35 million living in developing countries. Once considered a problem only in high-income countries, overweight and obesity are now dramatically on the rise in low- and middle income countries, particularly in urban settings. In Chile, there is an elevated and increasing prevalence of obesity affecting about 10% of children under six years of age and increasing to 20% by the time they start elementary school. Overall, overweight and obesity affects over half of Chile's adult population (S loaiza.*et al.* Nutr Hosp.2011).

Biological and genetic factors coupled with environmental and socio- economic conditions have been found to determine obesity from early life to adulthood. There is solid scientific evidence of the inverse association of low birth weight and cardiovascular disease in adulthood. Existing evidence points out that high birth weight in addition to rapid weight gain at an early age, is a risk factor for childhood obesity at a later age. However, there is insufficient evidence of the relationship between birth weight and later obesity (S loaiza.*et al*. Nutr. Hosp.2011)

The association of birth weight as a risk factor for obesity at first grade in a cohort of elementary school Chilean children. Height and weight at birth and follow up measurements at first grade were analyzed from a national cohort of 119,070 new born. Subjects were classified by anthropometric characteristics: new born weight in kilograms, Ponderal Index, (birth weight/height3 x 100), and gestational age (physical maturity) categories at birth. The study tested the hypothesis that a macrocosmic new born (4,000 g or > 8.8 pounds) or Large for Gestational Age, would be at higher risk to be obese at first grade. A positive relationship between birth weight 4,000 g, (O.R.=1.55), ($p < 0.001$), high Ponderal Index (O.R. = 1.39),($p < 0.001$), large for gestational age (O.R. = 1.51),($p < 0.001$), and obesity at first grade was found. Macrocosmic children were more likely to be obese at first grade after controlling for the effects of confounding prenatal variables (O.R. = 1.67, ($p < 0.001$). When weight gain between birth and first grade was 120% of reference value, the obesity risk was 20 times higher ($p < 0.001$). A direct and statistically significant relationship between high birth weight and obesity at first grade in this group of Chilean children were observed. These results highlight the significance of birth weight as an important tool for healthcare providers that can be used as an indicator of obesity risk for children.(S loaiza.*et al*.Nutr Hosp.2011)

CHAPTER THREE

3. DATAAND METHODOLOGY

3.1. Study Area

The study was conducted in all parts of Ethiopia (Tigray, Afar, Amhara, Oromia, Somali, Benishangul-gumuz, south nation nationalities and people of Ethiopia, Gambela, Harari, Dire dawa and Addis Ababa). Ethiopia is one of the low income countries with gross domestic products (GDP) of 8%. Currently the Ethiopian population size is 108,587,149 about 49.8 % of the populations are male and 50.2% are female, were birth of this year are 123,080 and 93,680 was at reproductive age (EDHS, 2016)

3.2. Study Population

The target populations of this study were child of Ethiopia who was affected by explanatory variable from Ethiopian Demographic and Health Survey (DHS) data and the case area under consideration of Ethiopia.

3.3. Study design

A community based cross sectional study was conducted based on secondary data, which is obtained from EDHS 2016.

3.4. Data Source

This study was conducted by secondary data which was collected and compiled by a 2016 EDHS. It is defined as the study of all subjects having certain common characteristics that are being study. It is the collection of units or elements under investigation. The three EDHS surveys have been conducted at ten-year intervals. thus, the 2016 EDHS presenting results information of mothers whose age15-49.

3.5. Methods of Data collection and instrument

In this study secondary data was used and collected by Ethiopia Demographic and Health Survey for 2016 EDHS. The preliminary for 2016 Ethiopia Demographic and Health Survey were conducted by the Central Statistical Agency (CSA) under the auspices of the Ministry of Health. This data obtained from 2016 EDHS on the weight of child at birth

3.6. Study variable

3.6.1. Dependent Variable

The dependent variable is the birth weight of child at birth, which is categorized as,

Yi :- 0= low birth weight

1= normal birth weight

2=high birth weight

3.6.2. Independent Variable

The variables assumed to have an influence on birth weight. These are:-

Sex of child	male=[1],female=[2]
Mother of Age	<20= [1], 20-34= [2],35-49= [3]
Mother Education Level	No education= [1], primary= [2], secondary= [3], higher=[4]
Father Education Level	No education= [1], primary= [2], secondary= [3], higher=[4]
Place of delivery	Home=[0], health center= [1]
Antenatal care	no= [0], Yes= [1]
Weight of Mothers (Kg)	<40=[1], 40-49=[2],50-59=[3],60-69=[4],70-79=[5], 80 and above=[6]
Region	Tigray= [1], Afar= [2], Amhara= [3], Oromia = [4] Somali = [5] Benishangul- gumuz= [6] South nations nationalities and peoples= [7] Gambela= [8], Harari= [9], Addis Ababa=[10],Dire Dawa=[11]

Wealth	Poorest=[1]	Poorer=[2]	Middle=[3]	Richer=[4]	Richest=[5]
Mother occupation	Governmental employ=[0]	merchant=[1]	farmer=[2]	NGO=[3]	Other=[4]
Religion	Orthodox=[1]	Catholic=[2]	Protestant=[3]	Traditional=[4]	Other=[5]]
Father occupation	Governmental employ=[0]	merchant=[1]	farmer=[2]	NGO=[3]	Other=[4]
Residence	1) Rural	2) Urban			
BMI	<18.5=[0]	18.5-25=[1]	25-30=[2]	>30=[3]	

3.7. Method of Data Analysis

The method of analyzing the data was a descriptive and inferential statistics. From the descriptive statistics we were use frequency table, bar charts, bar graph and pi-chart. Whereas, the inferential statistics data was analyzed using different statistical methods like ordinal logistic regression, hypothesis testing, and estimating parameters .For this study we was use statistical software SPSS.

3.7.1. Descriptive Statistics

Descriptive Statistics is used to compare or describe data using table, graph, pie-chart and it is a collection, organization, summarization and presentation of data in a meaning full form by using different charts. It may be computed by the measure of central tendency like the mean of age, weight and height of mother.

3.7.2. Inferential Statistics

Inferential statistics is use data from sample to make inferences about population from which sample are drawn. In other word, it is the set of methods used to generalize sample to population by hypothesis testing, determining relationship among estimates of variable and making decision.

3.7.2.1. Chi-square test

Chi-square test is one of the most appropriate ways to use with categorical variables. It is uses to determine the significant association between the two variables the research was use the chi-square test of independence whether there is an association between the response and explanatory variables or not.

Hypothesis testing:

Ho: There is no significant association between dependent variable and independent variables.

H1: Not Ho

To test the null hypothesis, the two we compare$X^2{}_{tab}$. The test statistics is given by

$$X^2{}_{cal} = \frac{\sum\sum(O_{ij}-E_{ij})^2}{E_{ij}} \quad \text{(i=1,2.....n, j=1,2,3,…m)} \quad \ldots\ldots\ldots\ldots 1$$

Where: χ^2 = chi-square

O_{ij} =observed frequency

E_{ij}=the corresponding expected frequency.

R - number of rows

C - number of columns

The degree of freedom associated with contingency table possessing r-row and c-columns=, X^2(r-1) (c-1) the test x^2_{Cal} with $x^2_{\alpha/2}$(c-1)* (r-1)

Decisions: - if $x^2_{Cal} > x^2_{tab}$ then reject $H_{o.}$

If $x^2_{Cal} < x^2_{tab}$ then fail to reject $H_{o.}$

P-value is the smallest level of the test for which the null hypothesis (H_o) is rejected

That is when p-value greater than the significance level, Ho is not rejected.

Conclusion: based on the decision**.**

Assumptions of chi-squares

- The populations must be normally distributed for the variable under the study.
- The observations must be independent each other.
- The sample must be randomly selected from the population.
- The sample size is large.
- Each data cell should contain at least five observation

3.8. Ordinal logistic regression

The ordinal logistic regression is a type logistic regression analysis that when the response variable is categorized more than two with having natural order or rank. This ordinal logistic regression is similar with multinomial logistic regression, but in multinomial there is no order which it has meaningful in ordinal regression.

In statistics, the ordered logit model (also ordered logistic regression or proportional odds model), is a regression model for ordinal dependent variables. It can be thought of as an extension of the logistic regression model that applies to dependent variables, allowing for more than two (ordered) response categories. It is natural to consider methods for more categorical responses having more than two possible values.

The most well-known of these ordinal logistic regression methods is called the proportional odds model. The basic idea underlying the proportional odds model is re-expressing the categorical variable in terms of a number of tertiary variables based on internal cut-points in the ordinal scale. Many variables of interest are ordinal. That is, we will rank the values, but the real distance between categories is unknown.

3.9. The Model of Ordinal Logistic regression

Different links lead to proportional odds models or ordered probit models. The model cannot be consistently estimated using ordinary least squares; it is usually estimated using maximum likelihood. Typical response functions that were modeled are cumulative logits, adjacent-category logits, or continuation-ratio logits resulted in ordinal logistic models known as the cumulative logit model, the adjacent-category logit model and the continuation-ratio logit model. The proportional odds model and the partial proportional odds model were special cases of the cumulative logit model

$$\text{Logit}\,[P(y\leq j)]=\log[P(y\leq j)/P(y>j)]=\alpha j+\beta x, j=1,2,\ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots\ldots 2$$

Where, j goes from 1to the number of categories minus 1

3.9.1. Proportional odds model

This is a cumulative logit model that assumes the odds of response below a given response level are constant regardless of which level we pick. This model allows separate intercepts for the cumulative logit, but restricts the parameter sets for the predictors to be the same across all logits. A proportional odds model that constrains some predictors to have common parameters and leaves other predictors free to have separate parameters is called a partial proportional odds model. This document was describe the use of Ordered Logistic Regression (OLR), a statistical technique that can sometimes will be use with an ordered (from low to high) dependent variable. The dependent variable we was use in this document will be the child birth weight, with the values of: 0 = low birth weight,1= normal ,2 = high weight

Ordered logit model has the form:

$$\text{logit}(p1)=\log\frac{p1}{1-p1} = \alpha 1+\beta' x$$

$$\text{logit}(p1+p2) = \log\frac{p1+p2}{1-p1-p2} = \alpha 2+\beta' x$$

$$\log(p1+p2+...+pk) = \log\frac{p1+p2+...+pk}{1-p1-p2-...+pk} = \alpha k+\beta' x, \text{ and } p1+p2+...+pk+1=1 \quad ....3$$

This model is known as the proportional-odds model because the odds ratio of the event is independent of the category j. The odds ratio is assumed to be constant for all categories.

Generally, the ordinal logistic model is one of many models subsumed under the rubric of generalized linear models for ordinal data. The model is based on the assumption that there is a latent underlying continuum into j-ordered groups.

The basic form of the generalized linear model is:

$$Link(\gamma_j) = \frac{\theta_j-[\beta_1X_1+\beta_2X_2+\cdots+\beta_kX_k]}{\exp(\tau_1Z_1+\tau_2Z_2+\cdots+\tau_mZ_m)} .... 4$$

Where ,$\boldsymbol{\gamma_j}$is the cumulative probability for thej^{th} category,$\theta_j$is the threshold for the j^{th}category,β1,…,βk were the regression coefficients, $X_1,\ldots,X_k$are the predictor variables, and *k* is the number of predictors. The numerator on the right side determines the location of the model. The denominator of the equation specifies the scale. The $\tau_1\ldots\ \tau_m$are coefficients for the scale component and $Z_1\ldots\ Z_m$are m predictor variables for the scale component (chosen from the same set of variables as the x's). The scale component accounts for differences in variability for different values of the predictor variables.

3.10. Assumptions of ordinal logistic regressions

In 3 tertiary comparison, logit[Pr($Y \geq$ k)] = $\alpha + \beta_1X_1 + \beta_2X_2 + ... + \beta_kX_k$, then we choose to analyze our data using ordinal regression, part of the process involves checking to make sure that the data we want to analyze can actually be analyzed using ordinal regression. We needed to do this because it is only appropriate to used ordinal regression if the data "passes" four assumptions that are required for ordinal regression to give a valid result. These assumptions are:

- ✓ The dependent variable should be measured in ordinal scale.
- ✓ There should be at least one predictor variables (scale, nominal or ordinal).
- ✓ There should not be multi-collinearity between continuous predictor variables.
- ✓ The proportional odds assumption which states that there should identical slope parameter across the different categories of the dependent variable.

3.10.1 Testing of Parallel Lines:

Test of parallel lines helps us to determine whether it is reasonable to assume that the values of the location parameters are constant across categories of the response. The result of the test of parallel is the row labeled Null Hypothesis contains:–2log-likelihood for the constrained model, the model that assumes the lines are parallel and the row labeled Generalist contains:–2log-likelihood for the model with separate lines or planes.

The chi-square statistics the log likelihood difference between the two hypotheses. If the lines or planes are parallel, the observed significance level for the change should be large, since the general model doesn't improve the fit very much the parallel model is adequate. If there is evidence to reject the null hypothesis, it is possible that the link function selected is in correct or that the relationships between the in dependent variables and logits are not the same for all logits.

3.11. Model Building Using Logistic Regression

Variable Selection

The are several computational techniques for generating subset regression models and illustrate criteria for evaluating the model are all possible regression which requires that the analyst if all regression equations involving one candidate regressor, two candidate regressor and so on. And the second is step wise-type procedures which consists forward selection, back ward elimination and step-wise regressor. In this study we use back ward step –wise regression.

Step-wise Regression

Step-wise regression is a modification of forward selection in which at each step all regressor entered in to the model are reassessed. And also it is a combination of forward selection and backward elimination procedure. It has advantage in terms of the number of subset models check before each subset size is decided.

The criteria for a variable in the model may vary one problem to other and from one scientific discipline to another. The rational for minimizing the number of the variables in the model is that result model is more likely to be numerically stable and more easily generalized. The more variables included in the model, the greater estimated standard errors become and the dependent variable model becomes an observed data.There are several steps one can follow to aid in the selection variables of logistic regression.

The selection procedure should begin with care full an available analysis of each variable. For nominal, ordinal and continuous variables with few integer values, we suggest this contiguous table. Up on completion of unavailable analysis, we assume selected variables for multivariate analysis. Once the variable has been identified, we begin with a model, containing the entire selected variables.

3.12. Parameter Estimation

3.12.1. Maximum Likelihood Ratio Estimation

The goal of logistic regression is to estimate unknown parameters; this parameter estimation involves like maximum likelihood estimation. The logistic regression uses maximum likely-hood estimation after transforming the dependent variable in to a logic variable. The parametric approach to statistical modeling of family of probability distribution is the binomial for the response variable. In general for the binomial outcome of y success in n trial the maximum likely hood estimation equals.

Used to explore the extent to which the fitted response obtained from the postulated model compares with the observed data.

The equation to parameter estimation in logistic regression is the likelihood function for given(x_1, $x2_{\dots\dots}X_n$) can be expressed as;

$$L(\beta, Y) = Л\ P(Y_i/X_{i1}, X_{i2}\dots Xn) = Л\ [\exp^{X,\beta}/1+\exp^{X,\beta}]^{1-Y} \dots\dots\dots\dots 5$$

The summary measure of goodness of fit test statistics that will be used in this study are the Wald-test, the likely hood ratio test and score test.

3.12.2. Model adequacy checking

Once a model has fit to a given data, it is a good statistical practice to check the adequacy of the model, which is essentially checking the agreement between the observed values under the model. If the agreement between the observed and the corresponding fitted values is good, the model may be acceptable. If not, the current form of the model will certainly not be acceptable and the model will need to be revising. This aspect of the adequacy of a model is widely referred to as goodness off it. An ill fitted model is says to display lack of fit. The discrepancy between observed data and fitted values under an assumed model can be assesses by several statistical measures.

3.12.2.1. The Wald Statistic

The Wald statistic is an alternative test which is commonly used to test the significance of individual logistic regression coefficients for each predictor variable (that is, to test the null hypothesis in logistic regression that a particular logit (effect) coefficient is zero).The Wald test statistic is:

$$W = \left(\frac{\hat{\beta}}{SE(\hat{\beta})}\right)^2 \qquad \text{…………………………………………..6}$$

The Wald statistic, W under the null hypothesis is approximately chi-square distributed. Each Wald statistic is compared with an X^2 distribution with 1 degree of freedom. For data that produce large estimates of the coefficient, the standard error is often inflated, resulting in a lower value of the Wald statistic, and therefore the explanatory variable may be incorrectly assumed to be unimportant in the model. Likelihood ratio tests are generally considered to be superior.

Hypothesis testing:- The hypothesis testing for the i^{th} explanatory

Ho: The coefficient no associated with the predictor is equal to zero.

H1: The coefficient associated with the predictor is not equal to zero.

3.12.2.2. Goodness of Fit of the Model

After fitting a model, it is nature to enquire about the extent to which the fitted value of the response variables under the model compare with observed values of the response variables under the model compare with the observed values. The goodness of fit of the model in this study is to be tested in either of the following to approaches**.**

The Pearson goodness-of-fit statistic is

$$\chi^2 = \Sigma\Sigma\left(\frac{Oij - Eij}{Eij}\right)^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

Deviance analysis:-Is based on the likelihood function of the observed for the fitted model (current model), the likelihood function for the true success probability under the assumed perfect model (full or saturated model), say if Pearson X^2 statistics:-an alternative approach to test goodness of fit if to use person's X^2 test.

The deviance measure is

$$D = 2\Sigma\Sigma O_{ij}\ln\left(\frac{Oij}{Eij}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1 Descriptive statistics result

The study was aim to determine the prevalence and associated risk factor with child birth weight in Ethiopia. This chapter describe the basic finding of the study as follows.

Table 4.1: Frequency (Percentage distribution) of birth weight of child due to low, normal & high with their frequencies in each category are described as table instead:

Variable	Category	Birth Weight (%)			
		Low	Normal	High	Total (%)
Sex of child	Male	176(41.1%)	764(53.2%)	129(59.2%)	1069(51.3%)
	Female	252(58.9%)	673(46.8%)	89(40.8%)	1014(48.7%)
Region	Tigray	53(12.4%)	202(14.1%)	25(11.5%)	280(13.4%)
	Afar	12(2.8%)	25(1.7%)	2(.9%)	39(1.9%)
	Amhara	26(6.1%)	52(3.6%)	5(2.3%)	83(4.0%)
	Oromia	31(7.2%)	86(6.0%)	19(8.7%)	136(6.5%)
	Somali	35(8.2%)	91(6.3%)	23(10.6%)	149(7.2%)
	Benishangul-gumuz	36(8.4%)	120(8.4%)	12(5.5%)	168(8.1%)
	SNNPR	34(7.9%)	110(7.7%)	42(19.3%)	186(8.9%)
	Gambela	36(8.4%)	120(8.4%)	14(6.4%)	170(8.2%)
	Harari	29(6.8%)	174(12.1%)	21(9.6%)	224(10.8%)
	Dire dawa	49(11.4%)	166(11.6%)	28(12.8%)	243(11.7%)
	Addis Ababa	87(20.3%)	291(20.3%)	27(12.4%)	404(19.4%)
Weight of mother in kg.	<40	87(20.3%)	291(20.3%)	27(12.4%)	42(2.2%)
	40-49	11(2.8%)	28(2.1%)	3(1.5%)	533(27.7%)
	50-59	114(28.7%)	372(28.2%)	47(22.8%)	644(33.5%)
	60-69	149(37.5%)	419(31.8%)	76(36.9%)	370(19.3%)
	70-79	65(16.4%)	273(20.7%)	32(15.5%)	134(7.0%)
	>80	30(7.6%)	92(7.0%)	12(5.8%)	198(10.3%)
Age of mother	15-20	40(9.3%)	123(8.6%)	16(7.3%)	179(8.6%)

	20-35	314(73.4%)	1040(72.4%)	150(68.8%)	1504(72.2%)
	35-49	74(17.3%)	274(19.1%)	52(23.9%)	400(19.2%)
Antenatal care	Yes	74(22.0%)	229(20.4%)	36(22.4%)	339(20.9%)
	No	262(78.0%)	896(79.6%)	125(77.6%)	1283(79.1%)
Wealth combined	Poorest	40(9.3%)	129(9.0%)	16(7.3%)	185(8.9%)
	Poorer	40(9.3%)	134(9.3%)	21(9.6%)	195(9.4%)
	Middle	50(11.7%)	113(7.9%)	24(11.0%)	187(9.0%)
	Rich	43(10.0%)	158(11.0%)	38(17.4%)	239(11.5%)
	Richest	255(59.6%)	903(62.8%)	119(54.6%)	1277(61.3%)
Place of residence	Urban	249(58.2%)	894(62.2%)	112(51.4%)	1255(60.2%)
	Rural	179(41.8%)	543(37.8%)	106(48.6%)	828(39.8%)
Place of deliver	Home	25(5.8%)	48(3.3%)	14(6.4%)	87(4.2%)
	Health center	403(94.2%)	1389(96.7%)	204(93.6%)	1996(95.8%)
Mother educational level	No education	131(30.6%)	370(25.7%)	59(27.1%)	560(26.9%)
	Primary	169(39.5%)	516(35.9%)	94(43.1%)	779(37.4%)
	Secondary	75(17.5%)	314(21.9%)	33(15.1%)	422(20.3%)
	Higher	53(12.4%)	237(16.5%)	32(14.7%)	322(15.5%)
Husband/partner's education level	No education	81(21.1%)	242(18.3%)	40(20.7%)	363(19.1%)
	Primary	133(34.7%)	397(30.1%)	73((37.8%)	603(31.8%)
	Secondary	87(22.7%)	356(26.9%)	31(16.1%)	474(25.0%)
	Higher	82(21.4%)	326(24.7%)	49(25.4%)	457(24.1%)
Religion	Traditional	0(0%)	7(0.5%)	0(0%)	7(0.3%%)
	Catholic	2(0.5%)	8(0.6%)	3(1.4%)	13(0.6%)
	Protestant	64(15.0%)	236(16.4%)	41(18.8%)	341(16.4%)
	Muslim	167(39.0%)	552(38.4%)	101(46.3%)	820(39.4%)
	Orthodox	195(45.6%)	634(44.1%)	73(33.5%)	902(43.3%)
Father occupation	Governmental employed	74(19.3%)	328(24.8%)	64(33.2%)	466(24.6%)
	Merchant	66(17.2%)	213(16.1%)	22(11.4%)	301(15.9%)
	Farmer	103(26.9%)	312(23.6%)	48(24.9%)	463(24.4%)
	NGO	75(19.6%)	293(22.2%)	32(16.6%)	400(21.1%)

	Other	65(17.0%)	175(13.2%)	27(14.0%)	267(14.1%)
Mother occupation	Governmental employed	36(8.4%)	191(13.3%)	33(15.1%)	260(12.5%)
	Merchant	74(17.3%)	261(18.2%)	50(22.9%)	385(18.5%)
	Farmer	48(11.2%)	149(10.4%)	19(8.7%)	216(10.4%)
	NGO	31(7.2%)	63(4.4%)	10(4.6%)	104(5.0%)
	Other	239(55.8%)	773(53.8%)	106(48.6%)	1118(53.7%)
BMI of mother	<18.5	88(20.6%)	93(6.5%)	41(18.8%)	406(19.5%)
	18.5-25	248(57.9%)	254(17.7%)	120(55.0%)	1181(56.7%)
	25-30	72(16.8%)	813(56.6%)	33(15.1%)	359(17.2%)
	>30	20(4.7%)	277(19.3%)	24(11.0%)	137(6.6%)

Table 4.1 shows that about 41.1 %, 53.2 % and 59.2 % male were low, normal and high birth weight respectively. Similarly, 58.9 %, 46.8 % and 40.8 % female were low, normal and high birth weight. Muslim religion from (low, normal to high) was 39%, 38.4% & 46.3% respectively. And also for Protestants from (low, normal to high) weight were 15 %, 16.4% & 18.8% respectively.

In region Tigray, a total of 12.4, 14.1 and 11.5 percent of child were low, normal and high birth weight respectively. Similarly, in region SNNPR, about 7.9 %, 7.7 % and 19.3% child were low, normal and high birth weight respectively. About 8.4 %, 8.4 % and 5.5 % child in Benishangul-gumuz were low, normal and high birth weight respectively. And also, in Addis Ababa 20.3 %, 20.3% and 12.4% child were low, normal and high birth weight respectively.

Furthermore, out of mothers who attend antenatal care of 22 %, 20.4 % and 22.4 % child was low, normal and high birth weight respectively. And also, mother who had not attend antenatal care of 78.0 %, 79.6 % and 77.6% child were low, normal and high birth weight respectively.

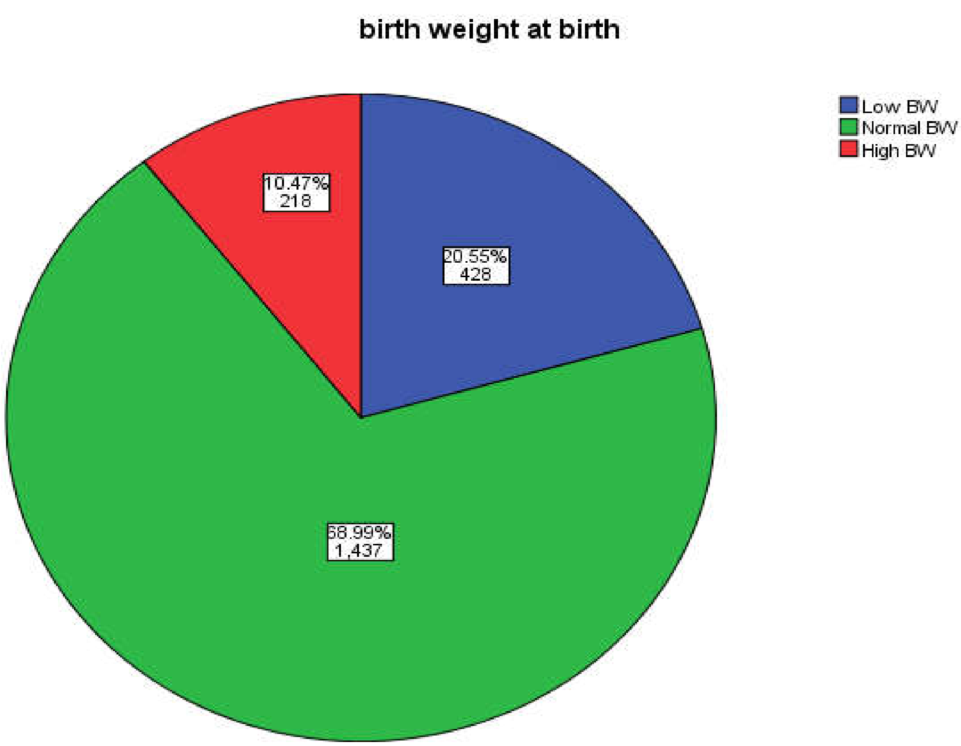
Among mothers who weren’t educated, of 30.6%, 25.7% and 27.1% were child has low, normal and high birth weight respectively. Whereas mother who attend higher education were 12.4%, 16.5% and 14.7% child has low, normal and high birth weight respectively.

Similarly, among father who weren't educated, of 21.1%, 18.3% and 20.7% were child has low, normal and high birth weight respectively. Whereas father who attend higher education were 21.4%, 24.7.5% and 25.4% child has low, normal and high birth weight respectively.

Table 4.2 Child birth weight

Birth weight	Frequency	Percent	Valid Percent	Cumulative Percent
Low	428	20.5	20.5	20.5
Normal	1437	69.0	69.0	89.5
High	218	10.5	10.5	100.0
Total	2083	100.0	100.0	

According to the above result, out of 2083 total 20.5%, 69.0% and 10.5% of child were low, normal and high birth weight respectively.



This pie-chart show that 428(20.55%), 1,437(68.99%) and 218 (10.47%) of child were low, normal and high birth weight respectively.

4.2. Result of Inferential statistics

Test of association of independent variables vs. birth weight of child at birth.

Table 4.3 Result of chi-square test

Characteristics	Pearson Chi-Square	Df	p-value
Sex	25.162a	2	.000
Region	68.506a	20	.000
Weight of mother	24.047a	20	.007
Age	4.571a	4	.334
Antenatal care	2.542a	2	.281
Wealth	8.076a	4	.089
Place of residence	3.083a	2	.214
mother educational level	15.564a	6	.016
Husband/partner's education level	16.649a	6	.011
Religion	14.387a	8	.072
Place of deliver	12.049a	2	.002
Father occupation	5.024a	2	.081
Mother occupation	17.408a	4	.002
BMI	1.311a	4	.860

According to the above result, the variables sex, region, weight of mother, mother educational level, place of deliver, father educational level and mother occupation was significant association with child birth weight at birth. Whereas age, place of residence, antenatal care, father occupation, religion wealth, BMI of mother had no significant association with child birth weight at birth.

4.3. Ordinal logistic regression results

Ordinal logistic regression analysis, consider model fitting information, goodness-of-fit, pseudo R-square, parameter estimation and test of parallel lines. Probit link function was used for the analysis since latent variable is normally distributed.

Table 4.4 Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	2165.608			
Final	2055.446	110.162	45	.000

Link function: Probit

Model fitting analyses indicate that table (4.4) using the model is better than simple guessing. P= 0.000 implies that, the model with predictor variables are better than null model or model with independent variables are significantly improve the prediction of birth weight.

Table 4.5 Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	2642.580	2615	.349
Deviance	2045.271	2615	1.000

Link function: Probit.

This table contains Pearson's chi-square statistic for the model and another chi-square statistic based on the deviance. These statistics are intended to test whether the observed data are inconsistent with the fitted model. Large significance values indicate that the data and the model predictions are similar and that you have a good model. Table 4.5 suggest that the model does fit very well ($p>0.05$) (i.e. fail to reject the null hypothesis depending on the observed data). Also the model fits adequately.

Table 4.6 Pseudo R-Square

Cox and Snell	.078
Nagelkerke	.098
McFadden	.051

Link function: Probit.

For ordinal logistic regression models, it is not possible to compute the same R^2 statistic as in linear regression, so three approximations were computed instead. What constitutes a "good" R^2 value depends upon the nature of the outcome and the explanatory variables. Here, the pseudo R^2 values (e.g. Nagelkerke = 9. 8%) indicates that there is relatively small proportion of the variation in birth weight between child. This is just as we would expect because there are numerous factors that affect weight of child at birth.

Table 4.6.Ordinary Logistic regression result

Parameter estimation

		Estimate	Std. Error	Wald	Df	Sig.	EXP(B)	95% Confidence Interval	
								Lower Bound	Upper Bound
Threshold	low intercept=1	-.673	.302	4.970	1	.026	0.51	-1.265	-.081
	Normal intercept=2	1.570	.304	26.625	1	.000	4.81	.974	2.167
mother education	no education	-.305	.151	4.083	1	.043	0.74	-.601	-.009
	primary	-.105	.131	.648	1	.421	0.90	-.361	.151
	secondary	-.071	.125	.319	1	.572	0.93	-.317	.175
	higher	0[a]	.	.	0	.		.	.
mother occupation	gov'tal employed	.321	.124	6.711	1	.010	1.37	.078	.564
	merchant	.131	.094	1.941	1	.164	1.14	-.053	.314
	farmer	-.046	.130	.124	1	.725	0.95	-.302	.210
	NGO	.030	.158	.037	1	.848	1.03	-.279	.339
	Other	0[a]	.	.	0	.		.	.
Father occupation	gov'tal employed	.299	.120	6.222	1	.013	1.35	.064	.535
	merchant	-.101	.130	.606	1	.436	0.90	-.357	.154
	farmer	.014	.124	.012	1	.913	1.01	-.230	.257
	NGO	.121	.120	1.015	1	.314	1.13	-.115	.358
	Other	0[a]	.	.	0	.		.	.
father education	no education	.168	.136	1.523	1	.217	1.18	-.099	.435
	primary	.154	.119	1.683	1	.195	1.17	-.079	.387
	secondary	.015	.108	.019	1	.890	1.01	-.197	.227

	higher	0a	.	.	0	.		.	.
Region	Tigray	.145	.151	.916	1	.338	1.16	-.152	.441
	Afar	-.385	.253	2.313	1	.128	0.68	-.881	.111
	Amahar	-.273	.191	2.052	1	.152	0.76	-.648	.101
	Oromia	-.027	.169	.025	1	.874	0.97	-.358	.305
	Somalia	.052	.186	.077	1	.782	1.05	-.314	.417
	Benishangul-gumuz	-.121	.163	.548	1	.459	0.89	-.441	.199
	SNNPE	.391	.162	5.829	1	.016	1.48	.074	.708
	Gambela	-.057	.179	.100	1	.752	0.94	-.408	.295
	Harari	.212	.142	2.222	1	.136	1.23	-.067	.491
	Addis Ababa	-.173	.133	1.699	1	.192	0.84	-.434	.087
	Dire dawa	0a	.	.	0	.		.	.
Sex of child	male	.246	.067	13.648	1	.000	1.28	.116	.377
	Female	0a	.	.	0	.		.	.
weight of mother	<40	-.683	.262	6.785	1	.009	0.50	-1.198	-.169
	40-50	-.293	.158	3.428	1	.064	0.75	-.602	.017
	50-60	-.172	.167	1.070	1	.301	0.84	-.499	.154
	60-70	-.126	.169	.554	1	.457	0.88	-.456	.205
	70-80	-.272	.191	2.021	1	.155	0.76	-.646	.103
	>80	0a	.	.	0	.		.	.
Age of mother	15-20	-.151	.146	1.076	1	.300	0.86	-.437	.134
	20-35	-.142	.090	2.515	1	.113	0.87	-.318	.034
	35-49	0a	.	.	0	.		.	.
Antenatal care	No	.032	.086	.135	1	.713	1.03	-.137	.201
	Yes	0a	.	.	0	.		.	.
BMI of mother	<18.5	-.136	.183	.549	1	.459	0.87	-.496	.224
	18.5-25	-.225	.188	1.437	1	.231	0.79	-.594	.143
	25-30	-.266	.187	2.024	1	.155	0.77	-.633	.101
	>30	0a	.	.	0	.		.	.
Wealth combined	poorest	.198	.152	1.704	1	.192	1.22	-.099	.495

	Poorer	.110	.143	.597	1	.440	1.12	-.169	.390
	Middle	.002	.142	.000	1	.989	1.00	-.277	.281
	Rich	.301	.127	5.646	1	.017	1.35	.053	.549
	Richest	0[a]	.	.	0	.		.	.
Place of deliver	Health center	.333	.174	3.685	1	.055	1.39	-.007	.674
	Home	0[a]	.	.	0	.		.	.
Religion	Traditional	.182	.557	.107	1	.744	1.20	-.909	1.273
	Catholic	.405	.374	1.173	1	.279	1.50	-.328	1.137
	Protestant	-.026	.122	.044	1	.835	0.97	-.265	.214
	Muslim	.154	.097	2.504	1	.114	1.17	-.037	.345
	Orthodox	0[a]	.	.	0	.		.	.

In table 4.7, age of mother, region, weight of mother, wealth, father occupation mother occupation and mother educational level were the factors that have negative effects on birth weight. The findings indicate that birth weight of child is associated with age of mother, sex of child, region, weight of mother, antenatal care, and wealth, place of residence, mother educational level, and place of deliver, father occupation, mother occupation and BMI. Child birth weight have no significance association with , age of mother , place of residence, place of deliver, father educational level, BMI and religion. However, the variables sex of child, region, weight of mother, father occupation, occupation of mother and mother educational level were found to be more significantly associated with birth weight of a child.

Odd ration interpretation

The adjusted odds ratio for the child whose mother's education is no educated was 0.74[CI = 0.601, 0.009]. This is shows that the odds of being high birth Wight of child versus the combined categories such as low birth weight and normal birth weight for child whose mother education is no educated was 26% less than child whose mother are primary and, secondary keeping other variables constant in the model. As well, the odds of being high birth weight and low birth weight versus normal birth weight category for child whose mother education is no education was 26% less than child whose mother are higher educational level, holding constant other variables in the model The result shows that, as the level of mothers education increase the chance of having child with normal birth weight is high.

The adjusted odds ratio for the child whose mother's occupation is engaged in farming was 0.95[CI=0.302 0.21]. This is shows that the odds of high birth weight versus the combined categories such as low birth weight and normal birth weight for child whose mother occupation is farmer was 5% less than child whose mother are other, keeping other variables constant in the model. As well, the odds of high birth weight and low birth weight versus the normal birth weight category for child whose mother occupation is farmer was 5% less than Childs whose mother occupation are other, holding constant other variables in the model.

The adjusted odds ratio for the child whose father's occupation is engaged in merchant was 0.90[CI=0.357 0.154]. This is shows that the odds of high birth weight versus the combined categories such as low birth weight and normal birth weight for child whose father occupation is farmer was 10% less than child whose father are other occupation, keeping other variables constant in the model. As well, the odds of high birth weight and low birth weight versus the normal birth weight category for child whose mother occupation is farmer was 10% less than Childs whose mother occupation are other occupation, holding constant other variables in the model.

The odds of being high birth weight versus the combined categories such as: low birth weight and normal birth weight for male Childs were 1.28 (95% CI: 0.116, 0.377) times more than that of female Childs, keeping other variables constant in the model. Likewise, for male child's, the odds of being high birth weight and low birth weight versus the category of normal birth weight were 1.28 (95% CI: 0.4925, 0.7053) times more than that of female child, keeping other variables constant in the model.

The adjusted odds ratio for the child whose mother's are delivered at health center was 1.39[CI=0.007, 0.674]. This is shows that the odds of high birth weight versus the combined categories such as low birth weight and normal birth weight for child whose mother are delivered at health center was 39% more than child whose mother are delivered at home, keeping other variables constant in the model. As well, the odds of high birth weight and low birth weight versus the normal birth weight category for child whose mother delivered at health center was 39% more than Childs whose mother are delivered at home, holding constant other variables in the model

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Table 4.7 Test of Parallel Lines[a]

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Null Hypothesis	2055.446			
General	1995.886	59.560	45	.072

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

a. Link function: Probit.

One of the assumptions underlying ordinal logistic regression is that the relationship between each pair of outcome groups is the same. This is commonly referred to as the test of parallel lines because the null hypothesis states that the slope coefficients in the model are the same across response categories (lines of the same slope are parallel). If it fails to reject the null hypothesis, it concludes that the assumption holds. From the above table shows parallel line test for general model with chi square value 59.560 and p-value=0.072 which is greater than the 5% level of significance, which is fail to reject the null hypothesis. Therefore, there is no enough evidence to reject the null hypothesis for general model. Thus, the proportional odds assumption appears to have held for general model

4.4. DISCUSSION

This study was undertaken to determine the factor that associated prevalence of child birth weight. The main objective of discussion is compare the variable explained in literature review and the research findings.

According to this finding, the significant factor were sex of child, region, weight of mother, wealth companied, mother occupation, father occupation and mother educational level. And also, out of 2083 total child 20.5%, 69.0% and 10.5% of child were low, normal and high birth weight respectively.

Then this finding is consistence or similar with finding identified by (Negassi T, 2014). And also identifying the factor that does not significant is religion of households, place of deliver, father education and place of residence. The cross-sectional study conducted in University of Gondar referral hospital reported that the prevalence of low, normal and high birth weight was 17.1%, 68% and 14.9% respectively in Ethiopia (Bililign N, 2018). This approximately closed to this study.

This finding is approximately closed to (AASMA N) study. All other variables considered such as mother's age, weight, height, Religion of households' place of deliver, Father education, were not significant (p-values > 0.05). In a nutshell, fetal infection, hemoglobin level (anemia in pregnancy), antenatal care and residence are highly significantly risk factors associated with child birth weight at the hospital. Early/late baby's' sex and maternal weight also showed some level of significance with birth weight. Gestational age, height, BMI of mother, and antenatal care among others were however not significant. The 21.1% prevalence of low birth weight (mean = 2.000±0.012) and 71.4% the normal mean birth weight of 4.012±0.062kg. (AASMA N.*et.al.* 2013)

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

The main objective of this study was to investigate the prevalence and factors associated child birth weight based on 2016 Ethiopian Demographic and Health survey (EDHS) data.

Furthermore the findings indicate that birth weight of a child is associated with sex of child, age of mother, region, Weight of mother ,Antenatal care, wealth , Place of residence, mother educational level, place of deliver, Father occupation, Mother occupation.

A finding obtained from descriptive statistics, indicate that, out of 2083 total child 20.5%, 69.0% and 10.5% of child were low, normal and high birth weight respectively. And also about 41.1 %, 53.2 % and 59.2 % male were low, normal and high birth weight respectively. Similarly, 58.9 %, 46.8 % and 40.8 % female were low, normal and high birth weight.

A finding obtained from ordinary logistics, we conclude that sex of child, region, mother occupation, father occupation, wealth, weight of mother and mother educational level were found to be more significantly associated with birth weight of child in Ethiopia. And also, Antenatal care, Place of residence, place of deliver, Father Education, age of Mother, religion and BMI were no significance association with birth weight of child in Ethiopia.

5.2. Recommendations

Based on the finding of the study, the researcher recommend that a number of interventions to be put forward about reduction effect of birth weight. These include:

- Create awareness regard to the problem of child birth weight related cause factors during pregnancy her weight should be measured continuously.
- Both mother and father of child must have to see their wealth as being with their families and those should be best worker.
- The education level of mother was found to be related with birth weight of child showing they need to educate mother. Measures to improve mother education must be taken into account by government.

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