

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF STATISTICS

Risk Factors associated with Child Malnutrition in Ethiopia

Prepare By:

Name	**IDNO**
1. Serkalem Demissie	NCSR/305/09
2. Rahwa G/hiwet	NCSR /361/08

Advisor: Kebadu Tadesse (MSc.)

A research Submitted to Statistics Department in Partial Fulfillment of the BSc degree in Statistics,

JUNE, 2019

Wolkite University

Wolkite, Ethiopia

WOLKITE UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF STATISTICS

This is to certify that the thesis prepared by Serkalem Demissie and Rahwa G/hiwet, entitled: Risk Factors associated with Child Malnutrition in Ethiopia, and submitted in partial fulfillment of the requirements for the Degree of Bachelor of Science complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the Examining Committee:

Advisor _____Signature _____Date _____

Examiner _____Signature _____Date _____

_____

Chair of Department or Graduate Program Coordinator

ACKNOWLEDGEMENT

First of all, we would like to express our deepest and warmest gratitude to the God, who help us from the beginning to the end of this research. Secondly, we are also greatly interested to express hearted our thanks to our advisor Kebadu T (MSc.); for his great assisting, contribution, useful suggestion and constructive criticism on this excellence advising and limitless effort in encouraging us in our work, correcting and giving comments by devoting a deal of his time from the beginning to the end of this research. In addition to this, we would like to express our heartfelt and appreciation to our friends for their psychological, moral supports during our stay at Wolkite University.

Abstract

Malnutrition is one of the most important causes for improper physical and mental development of children.The objective of this study was to identify the most important factors that affect child malnutrition status of children in Ethiopia. In this study the data was obtained from the Ethiopian Demographic and Health Survey conducted in 2016 by the Central Statistical Agency. Descriptive statistics and ordinal logistic regression were used for statistical data analysis and variables significant at 5% level of significance were considered as significant. From chi-square test, Partner occupation (group), partner education level, birth order number, wealth index combined, region, sex of child and place of residence had significant association with child malnutrition. From the result of our study we have concluded that the wealth index combined, Partner occupation (group), birth order number, sex of child, place of residence and region were found to have significance effect on child malnutrition in Ethiopia using ordinal logistic regression model. Since in Amehara more affected by malnutrition relatively other regions; then the government should impose an action to create opportunity for improving the Childs health. For prevention of malnutrition the government and the concerned bodies should encourage education of family planning methods to be applicable by families.

Key Words: Malnutrition, DHS, CSA, Ordinal Logistic Regression, Odds Ratio, Chi Square

.

Table of Contents

ACKNOWLEDGEMENT I
Abstract II
ACRONYMS V
CHAPTER ONE 1
1. Introduction 1
1.2 statement of the problem 5
1.3. Objectives of the study 6
1.3.1 General objective 6
1.3.2 Specific objectives 6
1.4. Significance of the study 7
1.5. Scope of the study 7
CHAPTER TWO 8
2. LITEATURE REVIEW 8
CHAPTER THREE 11
3. DATA AND METHODOLOGY 11
3.1. Study Area 11
3.2. Sampling Design 11
3.3. Study Population 11
3.3.1. Data Source and Method of Data Collection 11
3.4. Variables of the study 12
3.4.1. Dependent variable 12
3.4.2 Independent variable 12
3.5. Method of data processing and analysis 13
3.5.1 .Chi-square test of independence 13
3.6. Logistic regression model 14
3.6.1. Ordinal logistic regression 14
3.6.2. The Model of Ordinal Logistic regression 14
3.6.3Assumptions of ordinal logistic regressions 15
3.7. Model Building Using Logistic Regression 16
3.7.1. Parameter Estimation 16

3.7.2. Model adequacy checking 17
3.7.2.1. The Wald Statistic 18
3.7.2.3. Goodness of Fit of the Model 18
3.7.2.4. Parallel Lines test Assumption 18
CHAPTER FOUR 20
DATA ANALAYSIS 20
4.1 Descriptive statistics 20
4.2. Inferential statistics 22
4.2.1 Ordinal Logistic Regression 23
4.2.2. The final Ordinal Logistic Regression Model 25
4.2.2.1 Wald test 25
CHAPTER FIVE 30
5. CONCLUSIONS AND RECOMMENDATION 30
5.1 Conclusions 30
5.2. Recommendations 30
References 31

ACRONYMS

BMI..... Body Mass Index

CIAF .....Composite Index of Anthropometric Failure

CSA…….……..Central Statistical Agency

DHS……Demographic Health Survey

EDHS……...Ethiopian Demographic and Health Survey

EAs…….Enumeration Areas

GTP……..Growth and Transformation Plan

HSTP……Health Sector Transformation Plan

IDA……..…….……Iran Deficiency Anemia

IDD……..…..…….…….Iodine Deficiency Disorder

MOFED…….…....Ministry of Finance and Economic Development

PHC……..…….Population Housing Census

SNNP……. South nations, nationalities and people

SSA…….…….Sub Sahara Africa

VAD…….……..……Vitamin A Deficiency

WHO……World Health Organization

CHAPTER ONE

Introduction

1.1 Background

Child malnutrition is one of the measures of health status that the World Health Organization (WHO) recommends for equity in health. The term malnutrition generally refers to both under nutrition and over nutrition. Stunting, wasting, and underweight are among those Anthropometric indicators commonly used to measure malnutrition in a population of children. Underweight (low weight-for-age) reflects both low height-for-age and low weight-for-age and therefore reflects both cumulative and acute exposures of malnutrition (EDHS 2016).

Under nutrition, which is the focus of the study, conversely has been estimated to be an underlying cause for around half of all child deaths worldwide. It has different types of measurements. Due to this fact, malnutrition continues to be a significant public health and development concern not only in developing country but also in the world. Then child malnutrition still remains a public health problem mostly in developing countries including Ethiopia (Mandefro, *et al* 2015).

Malnutrition is a serious problem because it causing the deaths of 3.5 million children under 5 years old per- year in the world, as well as it is at third level in the world of the disease burden in this age group. Even though globally, childhood malnutrition declined relatively during the year 1990's; its prevalence in Africa actually increased even during 1990'. More than 25% under five children in the developing world are malnourished which accounts about 143 million children. Among these 143 million malnourished children, nearly three quarters live in just 10 countries in Sub-Saharan Africa region and more than one-quarter of children are malnourished in Ethiopia alone accounts more than 33% (Bantamen.,*et al* in 2014).

The country has the second highest rate of malnutrition in Sub-Saharan Africa (SSA).Ethiopia faces the four major forms of malnutrition: acute and chronic malnutrition, iron deficiency anemia (IDA), Vitamin A deficiency (VAD) and iodine deficiency disorder (IDD).The 2005 DHS has shown that about 47% and 11%of Ethiopian children under five years of age were stunted and wasted respectively.38% of children under five years of age were underweight and

11% were severely underweight. Malnutrition is also very high amongst women. One in four women (27%) in Ethiopia are thin i.e. they have body mass index less than 18.5 (EDHS, 2005).

Malnutrition is alarmingly decreasing the two-decade, but still major public health problems in the world, especially in developing countries, include Ethiopia. According to (2000-2016) data Stunning and wasting rates are dropping but 159 million and 50 million children around the world still affected respectively. Malnutrition is attributed to one third of under-five death in the first five years of live, which is preventable by economic growth. Globally, one out of every 13 children were wasted and hence 16 million children were severely wasted. Children malnutrition affects academic performance, physical and mental development throughout their lives. Child malnutrition is an indicator of one's countries health status as well as economic conditions. Malnutrition among children is a critical problem because its effects are long lasting and go beyond childhood. It has both short and long term consequences(EDHS,2000-2016).

Child malnutrition is associated with childbirth size and maternal malnutrition. Children who are smaller at birth are more likely to be stunted, wasted, or underweight than children who are normal or larger at birth. Likewise, children whose mothers are thin (with BMI less than 18.5) are more likely to be stunted, wasted, or underweight than children whose mothers have a normal BMI, or those children whose mothers are overweight or obese.(2016 DHS).

Most causes of child mortality in developing countries are preventable. Malnutrition alone is responsible for over half the under-five-year-old deaths in developing countries, making it one of the most important public health problems in the developing world (Pelletier, 1994; Shanghvi and Murray, 1997).

Child malnutrition in Ethiopia constitutes a particularly daunting challenge the country had a 17 percent under-five mortality rate in 2001, of which an estimated 57 percent was linked to severe and mild to moderate malnutrition. National data from 1999–2000 show that wasting (acute malnutrition) and stunting (chronic malnutrition) in children aged six to fifty-nine months were 9.6 and 56.7 percent respectively (MoFED, 2002a, 2002b).

Child malnutrition may also lead to higher levels of chronic illness and disability in adult life which may have intergenerational effects as malnourished females are more likely to give birth

to low-weight babies (Silva, P (2005)). Inability to reduce the prevalence of malnutrition in children under five will lead to non-achievement of one of the key targets of the first Millennium Development Goal, eradication of extreme poverty and hunger.

According to Ethiopia demographic health survey of 2011, 29 percent of children under age five are underweight and 9% are severely underweight and it is highest in Amhara Region which is 33.4%. The proportion of under-weight children vary with each age cohort and it is highest in the age groups 24-35 months (34%) and lowest among those under six months (10%). This may be their exposure infections and susceptible illness because foods for weaning are typically introduced and they expose to the environment those children in 24-35 age groups. This is due to inappropriate or inadequate feeding practices may contribute to influence nutritional status among children in these age groups.

The 2016 EDHS data on the nutritional status of children by measuring the weight and height of children under age 5 in all sampled households regardless of whether their mothers were interviewed in the survey. Children's height/length, weight, and age data were used to calculate three indices: height-for-age, weight for height, and weight-for-age. Each index provides different information about growth and body composition for assessing nutritional status. As indicated below, *stunting* (low height-for-age) is a sign of chronic under nutrition that reflects failure to receive adequate nutrition over a long period. Stunting can also be affected by recurrent and chronic illness. Wasting (low weight-for-height) is a measure of acute under nutrition that represents the failure to receive adequate nutrition in the period immediately before the survey.

In recent years, Ethiopia only had limited success in reducing the prevalence of child malnutrition. In the case of wasting, the rate increased slightly from 9.2 percent to 9.6 percent between 1995 and 2000. However, the proportion of severely wasted children declined by 47.1percent (from 3.4 percent to 1.8 percent) over the same period. Much of this change can be accounted for by change in rural areas where severe wasting was halved. Disaggregating by gender, the data indicates that girls were better off in 1999–2000 while males fared better in 1995 -96 in terms of both wasting and severe wasting.

Turning to stunting, CSA data shows that stunting for children under five declined from 66.6 percent in 1995-1996 to 56.8 percent in 1999-2000,while there was a decline in stunting both in

rural and urban areas from 1995 to 2000, the rate of change was greater in urban than rural areas, 20.4 percent decline compared to 15.3 percent decline. While the problem of malnutrition in Ethiopia is relatively well documented, its specific determinants are not well understood. To reduce malnutrition one must understand its causes. Not only are existing studies based predominantly on small-scale surveys that focus on particular regions of the country, but also there is a lack of agreement about the relative importance of factors affecting nutritional status. This question is not only of academic interest but of considerable policy relevance, both among national and international policy-makers. Thus it is important to better understand the child, household, community and policy level determinants of malnutrition and the way in which they differ across different regions. Without such knowledge it will not be possible to develop effective policy strategies to tackle this problem.

Children's health is often evaluated as a function of growth by using anthropometrical measurements, usually weight and length (or height). Malnutrition cannot be tackled without understanding its causes that is why the study was crucial to identify underlining factors of malnutrition among children's in the study area.

1.2 statement of the problem

Malnutrition is one of the main health problems facing women and children in Ethiopia, Africa, and worldwide. In Ethiopia Child malnutrition remains major public health problems that cause illness and death of children in EDHS 2016.

A study conducted by Tadios in 2013 on Determinants of Child Malnutrition Empirical and qualitative Evidence by using binary logistic regression found that child's age, gender, immunization status and the mother's use of antenatal care, farm size, household size, water source, latrine use and incidence of morbidity was the determinants of Child Malnutrition in Ethiopia. But these studies not include the explanatory variable like Region, Residence, marital status and wealth status. The ordinal nature of the variable in our study is show that the most effects of child malnutrition in Ethiopia by using ordinal logistic regression model, because of a number of problems relate with child malnutrition in our country

The basic question to be addressed in this study was:

- ✓ What is the prevalence of child malnutrition in Ethiopia?
- ✓ What is the association between malnutrition status of children and its explanatory variables?
- ✓ What are the factors that affect child malnutrition in Ethiopia?

1.3. Objectives of the study

1.3.1 General objective

The main objective of this study was to identify the determinant factors of child malnutrition in Ethiopia.

1.3.2 Specific objectives

The specific objectives of this study were;

- ✓ To assess the prevalence of child malnutrition.
- ✓ To explore the association between malnutrition status of children's and Explanatory variables
- ✓ To identify the factors affecting child malnutrition in Ethiopia.

1.4. Significance of the study

This study was important to know factors that affect child malnutrition in Ethiopia and in order to give appropriate measures for those factors and to improve the prevalence of under nutrition and increase the nutrition status of child. The study estimating the prevalence and identify the key risk factors of malnutrition of children in Ethiopia. The result of the study would provide some important strategies or procedure to solve the problem that can affect malnutrition of child.

1.5. Scope of the study

This study would mainly focused on the evaluation of the factors related to child malnutrition in Ethiopia. Malnutrition status was one of the sensitive issues in a developing country to achieve the aim of this study make manageable in terms of coverage, the scope of this study was limited to Ethiopia based on the 2016 DHS data.

CHAPTER TWO

LITEATURE REVIEW

According to Neima Endris, *et al* in 2017 on the prevalence of malnutrition and Associated Factors among children in rural Ethiopia, by using Logistic regression was fitted. The result to found that Age of the children, preceding birth interval, educated status of mother, wealth status, and region were factors independently associated with nutritional status of children in rural Ethiopia. The prevalence of malnutrition among children in rural Ethiopia was high. A child older than 12 months, having uneducated mother, living in a household with poor wealth status, born with short birth interval, and living in some region of the country are associated with increased odds of being malnourished.

A study conducted by Tadios in 2013 on Determinants of Child Malnutrition Empirical Evidence from Kombolcha District of Eastern Hararghe Zone, Ethiopia using binary logistic regression found that child's age, gender, immunization status and the mother's use of antenatal care, farm size, household size, water source, latrine use and incidence of morbidity was the determinants of Child Malnutrition in Ethiopia.

According to Dereje ,*et al*in 2015 to estimate and identify determinants of nutritional status among under five children in Hawassa Zuria District Southern Ethiopia using Binary and Multinary logistic regression were used to relate underlying factors to the adjusted odds of malnutrition indices. The results indicated that the overall prevalence of stunting, underweight and wasting. Children who had uneducated mothers were significantly more likely to be moderately underweight as compared.

Malnutrition among children under five years of age is a chronic problem in mostregions of Ethiopia, including the study region (Tigray). This study estimated the prevalence and identified the key risk factors of malnutrition in children under-five years of age in Shire Indaselassie Town, North Ethiopia. This study estimated the prevalence of malnutrition and investigated the effects of demographic, socioeconomic, child health and sanitary conditions, feeding and dietary variables on malnutrition: stunting (low height for age), underweight (low weight for age) and wasting (low weight-for-height) among children. Logistic regression was used to identify the determinants of Small nutrition in the study area (Mulugeta Mola, 2015).

According to Anware*et al* in 2016 the determinants of child nutritional status from Jimma Ethiopia using multilevel binary logistic regression the empirical results that children from households in Tigray, Affar and Amhara regions were less-nourished. Level of education of parents, possession of media infrastructure (TV and radio), assets of household, contraceptive adoption and the condition of sanitation and water were considered to be important determinants of nutritional status of children. The report finds that household assets, maternal and paternal education, antenatal care, and birth intervals are the most consistent predictors of under nutrition outcomes, urban areas.

According 2016 DHS data Seqota Declaration (2015-2030) aims to eliminate all forms of malnutrition among children under age 2 by 2030 (FDRE 2015). Nutrition is fully integrated in the Health Sector Transformation Plan (HSTP) (FDRE 2015). In a broader context, nutrition indicators are included in the Growth and Transformation Plan (GTP), an economic development plan of the Government of Ethiopia (FDRE 2016).

According to Bantamen *et al in* 2014 using Logistic regression was used to analyze data by using backward variable selection technique to found total of 102 cases and 201 controls were included in the study with overall response rate of 94.4%.65 (63.20%) of cases and 49 (24.40%) controls had fathers that cannot read and write. 39(38.23%) of cases and 44(21.89%) of controls had history of diarrheal episode. Those children whose family uses drinking water from unprotected source were 3 times more likely to have malnutrition as compared to those children in Machakel woreda of North West Ethiopia.

A study conducted by Mandefro *et al* in (2007) in Bulehora district, South Ethiopia using Bivariate and multivariate logistic regression analyses were conducted to identify factors associated to nutritional status of the children Statistical association was declared the result found 47.6%, 29.2% and 13.4% of them were stunted, underweight, and wasted respectively. Presence of diarrhea in the past two weeks, male sex, uneducated fathers and > 4 children ever born to a mother were significantly associated with being underweight. Presence of diarrhea in the past two weeks, male sex and pre-lacteal feeding was significantly associated with stunting. Similarly, presence of diarrhea in the past two weeks, age at complementary feed was started and not using family planning methods were associated to wasting.

According to Sebsibe *et al* in2014 to identify urban- rural differences in the magnitude and determinant of under-five child malnutrition in Gondar Ethiopia using bivariate and multivariate logistic regression analyses were done to see the strength of association. The magnitudes of underweight were observed to be 32.7% is rural children and 15.8% Aruban children. Multivariate show that living in urban of Tigray and Somali region, poor household wealth status and lack of toilet facility were the urban determinants of child underweight in Ethiopia, whereas living in rural of Gambela and Harari region, child age of 2 and over, mothers age at first birth being 18 and under, poor and medium household wealth status and child did not tack drugs for intestinal parasites in the last 6 months were factors independently association with child underweight in the rural of Ethiopia.

A study conducted by Nigatu*et al* in 2014 to identify the determinants of malnutrition in the Hawassa using Logistic regression found that 56.6% of the children under age five have chronic malnutrition, are underweight (20.9%) and wasting (4.1%) and well-nourished standard reference children of the same age). Children's age, maternal education, maternal employment, child weight at birth, mothers' body mass index and early initiation of breast feeding were the major factors associated with stunting among children. The main contributing factors of underweight among the children were found to be household size, marital status of mothers, decision on income allocation, contracting diarrhea two weeks preceding the survey, early initiation of breast feeding and bottle feeding.

CHAPTER THREE

DATA AND METHODOLOGY

3.1. Study Area

Ethiopia is one of the African countries which were located in the eastern part of Africa around the place called horn of Africa. This place located in the north eastern extension of the continent. The country lies west of Somalia, north of Kenya, east of Sudan, south of Eretria and Djibouti. The country has 9 region (Oromiya, Amhara, Tigray, Affar, Somali, Ben-Gumuz, SNNPR, Gambela, and Harari) and two city administration that is (Dire-Dawa and Addis-Ababa).

3.2. Sampling Design

The 2016 EDHS sample was stratified and selected in two stages. Each region was stratified into urban and rural areas, yielding 21 sampling strata. Samples of enumeration areas were selected independently in each stratum in two stages. Implicit stratification and proportional allocation were achieved at each of the lower administrative levels by sorting the sampling frame within each sampling stratum before sample selection, according to administrative units in different levels, and by using a probability proportional to size selection at the first stage of sampling. In the first stage, a total of 645 EAs (202 in urban areas and 443 in rural areas) were selected with probability proportional to EA size (based on the 2007 PHC) and with independent selection in each sampling stratum. In the second stage of selection, a fixed number of 28 households per cluster were selected with an equal probability systematic selection from the newly created household listing

3.3. *Study Population*

The target populations of this study was all children's surveyed in 2016 EDHS who was under the age of five years old in Ethiopia.

3.3.1. Data Source and Method of Data Collection

Basically we have two main categories of data source mainly primary source of data and secondary source of data**.** Depending on the source, Primary method, consist of obtaining data or information by any one of the following ways: direct personal interview, in direct oral interview, information from correspondents, mailed questionnaire and so on. The data collected with the

help of primary method is usually published in journals, newspaper, magazines, reports or books. It may also remain unpublished by the investigator some other office (Cochran, 1977).In case of our study would be conducted by using secondary source of data .The data for this study would be obtained from the Central Statistical authority (CSA)under the Demographic and Health Survey conducted in2016 (EDHS, 2016).

3.4. Variables of the study

3.4.1. Dependent variable

The response variable of this study was child malnutrition expressed as underweight to be obtained from weight by age standard Z-score of Anthropometric measurement. Underweight Y=1 severe from under -3 Z-score, 2 moderate from -3 abetu-2 Z-score and 3 nourished from above -2.

3.4.2 Independent variable

The explanatory variables that were considered to be related with the response variable according to EDHS 2016 were detailed in Table 3.1.

Table 3.1 Categorical variable coding

variable	category
Sex of child	0=male,1=female
Region	0=Tigray,1=Affar,2=Amhara,3=Oromiya,4=Somali,5=Ben-Gumuz,6=SNNPR,7=Gambela,8=Harer,9=Addise Abeba,10=DireDewa
Number of house hold member	0=2-5,1=6-10,2=11-19
Type of place of residence	0=urbane,1=rural
Wealth index combined	0=poorest,1=poorer,2=middle,3=rich,4=richest
Husband education level	0=no education,1=primary,2=secondary,3=higher,4=don't know
Husband/partner occupation	0=didnotwork,1=professional/technical,2=clerical,3=sales,4=agricultural self-employee,5=agricultural-employee,6=household and domestic,7=skilledmanual,8=unskilled,9=other,10=don't know,11=services

Birth order number in month	0=1-3,1=4-6,2=7-19

3.5. Method of data processing and analysis

Both descriptive and inferential statistics was used. The study used bar chart, and tables from descriptive statistics, and from that of inferential statistics, the study was used chi-square test of independence and ordinal logistic regression

3.5.1 .Chi-square test of independence

Chi-square(x^2) is a statistical measure with the help of which it is possible to access the significance of the different between the observed frequencies and expected frequencies obtained from some hypothetical universe. It is a measure of the different between the observed and expected counts. In addition it helps us to determine whether two categorical variables are associated or not. In order to do that chi-square test may be applicable both the frequencies must be grouped in the same way and the theoretical distribution must adjust to give the same total frequency, which is equal to that of observed frequency.

The Assumption of Chi-square Test of independency was:

- ✓ The observation must be independent of each other.
- ✓ The sample must be randomly selected from the population.
- ✓ The expected frequency of each category must be at least 5.
- ✓ It is always positively skewed.

The Statistical Test:

$$X2cal = \sum_{j=1}^{r}\sum_{i=1}^{c}\frac{(Oij - Eij)2}{Eij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (3.1)$$

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)

Where, O_{ij}=is the observed class frequency, Eij=is expected cell frequency, r= number of row variables, and C= number of column variable

Decisions: -If $x2\ Cal > x^2\ tab$ then reject $H_{o,}$ or 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.

Test of Hypothesis

H_0: Response and explanatory variable are independent vs H_1: Response and explanatory variable are dependent.

Decision Rule: Reject the null hypothesis and accept the alternative hypothesis if p-value is less than α-value. Conclusion: based on the decision**.**

3.6. Logistic regression model

Logistic regression is a special case of generalized linear models in which the mean of the response variable is related to explanatory variables through a regression equation. The elements of such a model are a distribution for the response variable and a function that links the distribution to the explanatory variables called a link function. Logistic regression can be binary, multinomial and ordinal logistic regression. The response variable is usually dichotomous for the response taken as success and failure. Logistic regression model in a single explanatory variable x for binary response variable(y =1, as probability of success and y = 0, as probability of failure) and when is probability of success at value x. The binary logistic regression is a type of regression which used to when the dependent variables dichotomous and the independent variables are continuous or catagorical.

3.6.1. Ordinal logistic regression

Ordinal logistic regression is a type logistic regression analysis applied 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. For our study we use ordered logistic regression, because of the response variable is malnutrition categorized into three categories, which is severe, moderate, nuorished.

3.6.2. The Model of Ordinal Logistic regression

The ordinal logistic regression model is written as:

$$Logit\ [P(y \leq j)] = log[P(y \leq j)/P(y > j)] = \alpha j + \beta x, j = 1,2, \ldots \ldots \ldots . . j - 1.$$

there is a very clear and intentional ordering to these responses like as low medium and high If we know that a category is ordinal then there are special models that tell us how independent variables relate to someone being higher or lower on the scale. We will use the ordered logit model so that we will use the categories directly as our dependent variable.

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 logit, 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.

3.6.3Assumptions of ordinal logistic regressions

Using this method of categorizing the data enables the order to be accounted for as all comparisons are being made between low, medium and high of the variable ($Y > j$ and $Y \leq j$). In 3 tertiary comparison, $\text{logit}[\Pr(Y \geq k)] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$, 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 dependent variable should be measured at the ordinal level, One or more independent variables that is continuous, ordinal or categorical (including dichotomous variables). However, ordinal independent variables must be treated as being either continuous or categorical; there is no multi co linearity. Multi co linearity occurs when two or more independent variables that were highly correlated with each other. We had proportional odds, which was a fundamental assumption of this type of ordinal regression model. We had proportional odds, which was a fundamental assumption of this type of ordinal regression model.

3.7. 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 repressor, two candidate repressor and so on. And the second is step wise-type procedures which consists forward selection, back ward elimination and step-wise repressor. In this study we used back ward elimination.

Step-wise Regression

Step-wise regression is a modification of forward selection in which at each step all repressor 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.

Upon 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.

3.7.1. Parameter Estimation

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.

P= this is the sample proportion success for the n trial. Agresti, A. (1996).

The likelihood-ratio test statistic is given by:-

$$G2 = -2log\ (L0/L1)\ = -2[log\ (L0) - log\ (L1)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (3.3)$$

Where,L_0 is the log likelihood value of the model which has the intercept term only and L_1 is the log likelihood value of the full model.

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, $x2_{\ldots\ldots}X_n$) can be expressed as;

$$L\ (\beta, Y)\ =\ Л\ P\ (Yi/Xi1, Xi2 \ldots Xn)\ = Л\ [expX, \beta/1 +\ expX, \beta]\ 1 - Y$$

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. Agresti, (2008).

3.7.2. 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.

3.7.2.1. The Wald Statistic

The Wald test is a way of testing the significance of particular explanatory variables in a statistical model. In logistic regression, we have a ordinal outcome variable and one or more explanatory variables. For each explanatory variable in the model, there will be an associate parameter. The Wald test, described by Polit (1996) It is one of a number of ways of testing whether the parameters associated with a group of explanatory variables are zero. Used to test the statistical significant of each coefficient (β) in the model, the statistic is defined as:

$$Z = \beta / SE\ (\beta) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.4)$$

Where is the estimated parameter for the population i and SE (β) is standard error of the square of z, z^2 yields the Wald statistics with a chi-square distribution (Alan Agresti, 1996).

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.

3.7.2.3. 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 two approaches.

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), and say if Pearson X^2 statistics:-an alternative approach to test goodness of fit if to use person's X^2tests.

3.7.2.4. Parallel Lines test Assumption

In ordinal logistic regression models there is an important assumption which belongs to ordinal odds. According to this assumption parameters should not change for different categories. In

other words, correlation between independent variable and dependent variable does not change for dependent variable's categories; also parameter estimations do not change for cut-off points. In an ordinal logit regression, whenthe assumption holds for j – 1 logit comparison in a J categorized variable,a-1 cut-off points and j –1.parameters are found. At this point ordinal logistic model differs from multinomial logistic regression(Kleinbaum and Klein, 2010). In a way, this assumption states that the dependent variable's categories are parallel to each other. When the assumption does not hold, it means that there is no parallelity between categories.

CHAPTER FOUR

DATA ANALAYSIS

In this study, we were going to identify factors that may affect malnutrition status of children's in Ethiopia. The data used in this study for the analysis were obtained from the 2016 Ethiopian Demographic and Health Survey data with a response of underweight in an ordinal basis.

Descriptive and ordinal logistic regression methods were used to measure the effects of child malnutrition in Ethiopia. The descriptive part provides prevalence in terms of counts and percentages of underweight child malnutrition. The ordinal logistic regression analysis was used to identify factors that effect on nutrition status and the data were analyzed using SPSS.

4.1 Descriptive statistics

From Table 4.1, child's underweight malnutrition status was observed in the Birth order number of 1-3 is 2499(80%), 13(0.4%) and 610(19.5%) were severe, moderate and nourished respectively. In the Birth order number of 4-6, 1625 (84.5%), 9(0.5) and288 (15%) were severe, moderate and nourished respectively had underweight child malnutrition status and7-19 were 895(84.7%S), 11(0.6%) and156 (14.8%) are severe, moderate and nourished respectively had underweight child malnutrition status.

Underweight of child malnutrition status in urban areas 932(74.2%), 6(0.5%) and318 (25.3%) are severe, moderate and nourished respectively and 4087(84.4%), 22(0.5%) and 736(15.2%) are severe, moderate and nourished respectively in Rural.

The child's underweight malnutrition status in of males were 2630(83.6%), 19(0.6%) and 497(15.8%) respectively for severe, moderate and nourished and 2389(80.8%), 9(0.3%) and 557 (18.8%) of female were severe, moderate and nourished respectively and details are depicted in Table 4.1.

Table 4.1. Descriptive statistics

	Childs underweight malnutrition status						
		severe		moderate		nourished	
		count	percent	count	percent	count	percent
Birth order	1-3	2499	80%	13	0.4%	610	19.5%

number	4-6	1625	84.5%	9	0.5%	288	15%
	7-19	895	84.7%	6	0.6%	156	14.8%
Partner education level	No education	2254	85.8%	11	0.4%	362	13.8%
	Primary	1535	81.1%	8	0.4%	350	18.5%
	Secondary	482	76.6%	4	0.6%	143	22.7%
	Higher	342	69.9%	4	0.8%	143	29.2%
	Don't know	34	77.3%	0	0%	10	22.7%
Partner occupation	Did not work	445	83.2%	2	0.4%	88	16.4%
	Professional/technical	307	74.3%	3	0.7%	103	24.9%
	Clerical	25	73.5%	0	0%	9	26.5%
	Sales	328	71.9%	4	0.9%	124	27.2
	Agricultural employee	2603	85.2%	11	0.4%	442	14.5%
	Skilled manual	320	75.3%	3	0.7%	102	24%
	Unskilled manual	192	83.5%	1	0.4%	37	16.1%
	Other	194	78.2%	1	0.4%	53	21.4%
	Don't know	56	90.3%	0	0%	6	9.7%
	services	177	79.4%	2	0.9%	44	19.7%
Region	Tigray	623	88%	1	0.1%	84	11.9%
	Afar	460	88.1%	2	0.4%	60	11.5%
	Amhara	627	89.4%	1	0.1%	73	10.4%
	Oromia	726	80.8%	6	0.7%	166	18.5%
	Somail	495	80.2%	6	1%	116	18.8%
	Benishangul	425	85.9%	2	0.4%	68	13.7%
	SNNPR	600	77%	3	0.4%	176	22.6%
	Gambela	362	83.8%	4	0.9%	66	15.3%

	Harari	257	77.9%	1	0.3%	72	21.8%
	Addis Abeba	199	61.2%	1	0.3%	125	38.5%
	Dire Dawa	245	83.3%	1	0.3%	48	16.3%
Sex	Male	2630	83.6%	19	0.6%	497	15.8%
	Female	2389	80.8%	9	0.3%	557	18.8%
Types of residence	Urban	932	74.2%	6	0.5%	318	25.3%
	Rural	4087	84.4%	22	0.5%	736	15.2%
Wealth index combined	poorest	1693	85.6%	14	0.7%	270	13.7%
	poorer	905	86.1%	5	0.5%	141	13.4%
	Middle	753	84.1%	3	0.3%	139	15.5%
	Richer	656	81.5%	1	0.1%	148	18.4%
	richest	1012	73.7%	5	0.4%	356	25.9%
Number of house hold members	2-5	2426	81.5%	12	0.4%	540	18.1%
	6-10	2465	83.0%	16	0.5%	488	16.4%
	11-19	128	83.1%	0	.0%	26	16.9%

4.2. Inferential statistics

Inferential statistics is statistical method that deals with making inference or conclusion about the population based on data obtained from a limited number of observations that come from the population.

4.2.1. Chi Square Test of Association

The Chi-square test of association was implemented for testing the association between the ordinal response variable and the categorical explanatory variables.

The tests of hypothesis for this statistics used in this study were:

H0: There is no significant association between underweight and explanatory variables.

H1: There is a significant association between underweight and explanatory variables.

From Table 4.2, variables which had p-value of Pearson chi-square less than 0.05 was considered to have significant association with child malnutrition, whereas variables which had p-value greater than 5% had no significant association with child malnutrition. Accordingly, number of household members had not significant association with underweight child malnutrition. The rest variables such as wealth index combined, types of place of residence, Sex of child, region, Partner occupation, Birth order number and Number of household member had statistically significant association with underweight child malnutrition.

Table 4.2 Chi-square test of independence

Independent variable	X^2-Value	Degree of freedom	p-value
Birth order number	23.204	4	0.000
Partners education number	87.642	8	.000
Partner occupation (grouped)	91.014	18	.000
Number of household member	4.269	4	0.371
Region	1.905E2	20	.000
Sex of child	12.592	2	.002
Type of place of residence	71.724	2	.0000
Wealth index combined	1.082E2	8	.000

4.2.1 Ordinal Logistic Regression

Logistic regression examines the relationship between one or more predictor variables and an ordinal response variable and hence the logistic regression equation can be used to examine how the probability of an event changes as the predictor variable changes.

From Table 4.3, the model fitting information informs the -2 log likelihood chi square at 25 degree of freedom which is equal to 0.000 is less than the level of significance (0.05). Therefore the null hypothesis is rejected and the child malnutrition is at least affected by one explanatory variable. To know which explanatory variables affect the response variable we should look for individual test or Wald test.

Table4.3 Model Fitting Information

Model	-2LogLikelihood	Chi-square	df	p-value
Intercept only Final	2646.253 2417.046	229.046	25	.000

For goodness of fit test, the Hypothesis of interest were:

Ho: $\beta 1 = \beta 2 = \ldots = \beta 5$ Vs H1: βj not equal

From Table 4.4 we conclude that the goodness of fit indicates that the model is good fitted model since the p-value of Pearson is less than 5% or 0.05 (level of significance).

Table 4.4 Goodness of Fit

	Chi-Square	Df	p-value
Pearson	2738.224	2555	0.006

From Table 4.5, we conclude that likely as in goodness of fit test the pseudo R-square indicate the model is good fitted model since the value of Nagelkerkeis found b/n 0 and 1. About 63% of child's underweight malnutrition status is explained by independent variables.

Table 4.5: Pseudo R-Square

COX and Snell	0.040
Nagelkerke	0.63
McFadden	0.041

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 (and lines of the same slope are parallel).

The null hypothesis states that the location parameters (slope coefficients) are the same across response. If we fail to reject the null hypothesis, we conclude that the Assumption holds. Table 4.6 showed parallel line test for general model with p-value of 1.000 which is greater than the 5% level of significance and hence 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**.**

Table 4.6Test of Parallel Lines

Model	-2LogLikelihood	Chi-square	df	P-Value
Null Hypothesis	2417.206			
General	2411.242	5.964	25	1.000

4.2.3. Variable selection method

In this study, data analysis was done primarily by conducting univariable analysis fitting the response with an individual explanatory variable and variables significant at 25% level of significance was taken to the variable selection approaches. The final ordinal logistic regression model was fitted using the backward elimination procedure.

4.2.2. The final Ordinal Logistic Regression Model

4.2.2.1 Wald test

In the Parameter Estimates from Table 4.7, we see the coefficients, their standard errors, the Wald test and associated p-values, 95% confidence interval of the Coefficients and odds ratios. Since p-values less than alpha level they are statistically significant; otherwise not. The significance of the Wald statistic tells the importance of the predictor variable in the model. The column exp (β̂), is the factor by which the odds of child malnutrition change when the ith independent variable increases by one unit. If $\hat{\beta}i$ is positive, $exp\ (\hat{\beta}i)$ will be greater than one, which means the odds of child malnutrition increases. If βi is negative, exp (β̃i) will be less than one, which means the odds of child malnutrition decreases.

The fitted model can be written as:-

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

$$\boldsymbol{Logit}\ (\boldsymbol{p}\ (\boldsymbol{severe}) = 2.058 - 0.103x1 + 1.021x21 + 1.067x22 + 0.96x23 + 0.486x31 + 0.459x32 + 0.667x33 + 0.517x34 + 1.011x35 - 0.2x4 - 0.268x51 - 0.393x52 - 0.268x53$$

$$\boldsymbol{Logit}\ (\boldsymbol{p}\ (\boldsymbol{moderate}) = 2.092 - 0.103x1 + 1.021x21 + 1.067x22 + 0.96x23 + 0.486x31 + 0.459x32 + 0.667x33 + 0.517x34 + 1.011x35 - 0.2x4 - 0.268x51 - 0.393x52 - 0.268x53$$

Where β0=1.98 and2.014

$X1$=Birth order

$x2$ =Partner occupation: - Professional/technical(x_{21}), sales(x_{22}), others(x_{23})

$X3$=Region: - Oromia(x_{31}), Somali(x_{32}), SNNPR (x_{33}), Harari(x_{34}), Addis Ababa(x_{35})

$x4$=Sex (male)

$x5$ =Wealth index combined:-poorest(x_{51}), poorer(x_{52}), and middle (x53)

Since Wald test is used to test the statistical significance of individual coefficient (β) in the model and the test statistic is a chi-square statistic.

HO: Bj=0 the coefficient of individual independent variables are zero.

H1: at least Bj≠0 the coefficients of individual independent variables are different from zero.

The significance of the Wald statistic therefore tells that Birth order, Partner occupation, region, Sex of child and Wealth index combined are the significant predictor variables for underweight child malnutrition in the model.

Table 4.7Result of Ordinal logistic regression

variable	Category	B	S.E.	Wald	df	sig	EXP(β)	95% CI	
								Lower bound	Upper bound
constant	severe	2.058	0.472	19.00	1	.000		1.133	2.984
	moderate	2.092	0.472	19.624	1	.000		1.166	3.017
Birth order		-0.103	0.050	4.226	1	0.04	0.902	-0.230	-0.005
Partner occupation	Did not work	0.65	0.449	2.094	1	0.148	1.915	-0.23	1.531
	Professional/technical	1.021	0.447	5.687	1	0.023	2.776	0.141	1.901
	clerical	1.083	0.589	3.384	1	0.066	2.953	-0.071	2.237
	sales	1.067	0.447	5.687	1	0.017	2.907	0.19	1.943
	Agricultural-employee	0.62	0.438	2.00	1	0.157	1.859	-0.239	1.479
	Services	0.77	0.466	2.733	1	0.098	2.16	-0.143	1.683
	Skilled manual	0.842	0.451	3.484	1	0.062	2.321	-0.042	1.725
	Unskilled manual	0.699	0.47	2.209	1	0.137	2.012	-0.223	1.62
	others	0.96	0.46	4.348	1	0.037	2.612	0.058	1.863

	Don't know	0[a]	.	.	0	.			
region	Tigray	-0.102	.211	0.278	1	0.629	0.903	-0.515	0.311
	Afar	-.125	.227	0.303	1	0.582	0.882	-0.57	0.32
	Amhara	-.206	.217	0.906	1	0.341	0.814	-0.631	0.219
	Oromia	.486	.197	6.087	1	0.014	1.167	0.100	0.872
	Somali	.459	.206	4.966	1	0.026	1.582	0.055	0.863
	Benishangul	.116	.220	0.277	1	0.599	1.123	-0.315	0.547
	SNNPR	.667	.196	11.599	1	0.001	1.948	0.283	1.051
	Gambela	0.073	.223	0.107	1	0.744	1.076	-0.365	0.547
	Harari	.517	0.218	5.601	1	0.018	1.677	0.089	0.945
	Addis Abeba	1.011	0.213	22.478	1	0.000	2.748	0.593	1.430
	Dire Dewa	0a			0				
Sex of child	Male	-0.232	0.070	10.842	1	0.001	0.793	-0.37	0.094
	Female	0[a]			0				
Wealth index combined	Poorest	-0.268	0.123	4.762	1	0.029	0.765	-0.508	-0.027
	Poorer	-0.393	0.134	8.603	1	0.003	0.675	-0.655	-0.130
	Middle	-0.268	0.136	3.896	1	0.048	0.765	-0.535	0.136
	Richer	-0.124	0.133	0.88	1	0.348	0.883	-0.384	0.136
	Richest	0[a]			0				

We can interpret the odds ratio of severe verses nourished in region obtained from the above table using the reference category Dire Dawa. Being severely underweight Childs underweight of malnutrition in Oromia, Somali, SNNPR, Harari and Addis Ababa is1.167, 1.582, 1.948, 1.677and2.748times more likely than that of Dire Dawa respectively controlling for other variable in the model.

The odds ratio of severe and moderate verses nourished in region obtained from the final ordinal logistic regression fitted model using the reference category Dire Dawa.Oromia is 1.167 times more likely than that of Dire Dawa controlling for other variable in the model. Somali, SNNPR,

Harari and Addis Ababa is 1.582, 1.948, 1.677and2.748 respectively times more likely than that of compared with Dire Dawa.

For odd ratio of severe verses nourished for wealth index combined, the reference category is richest. The estimated odds ratio of child's underweight of malnutrition in poorest are 0.268 times less likely than that of richest. The estimated odds ratio of child's underweight malnutrition in poorer are 0.393 times less likely than that of richest controlling for other variable in the model. Children in middle are 0.268 times less likely to underweight malnutrition status in comparison with children who richest controlling for other variables in the model.

For odd ratio of severe and moderate verses nourished for wealth index combined the reference category is richest. The estimated odds ratio of child's underweight malnutrition poorest were 0.268 times less likely than that of richest. Poorest are 0.393 times less likely than that of richest. Middle is 0.268 times less likely to malnutrition status in comparison with children who richest controlling for other variables in the model.

For odd ratio severe verses nourished for partner occupation, the reference category is don't know. The estimated odds ratio of child's underweight malnutrition of Professional/technical is 2.776 times more likely than that of don't know (ref). The estimated odds ratio of child malnutrition of sales is 2.907 times more likely than that of don't know. The estimated odds ratio of child underweight malnutrition of other is 2.612 times more likely than that of don't know.

The estimated odd ratio of severe and moderate verses nourished for partner occupation of Professional/technical is 2.776 times more likely than that of partners whose education level was unknown and sale is 2.907 times more likely than that of don't know. Other is 2.612 times more likely than that of don't know.

The estimated odds ratio of underweight severe verses nourished child's underweight malnutrition male is 0.793 times less likely than that of female controlling for other variables in the model.

For odds ratio severe and moderate verses nourished for sex of child maleswas 0.793 times less likely than that of female.

4.3. Discussion

This study has an attempt to identify the well-known factors that affect child malnutrition based on 2016 Ethiopian Demographic and Health survey (EDHS) data. Among different factors, covariates affecting underweight child malnutrition was the wealth index combined, Region, Partner occupation, Birth order and sex of child.

In our study, under-five children from poor household were at higher risk of underweight malnutrition than children from rich households. This findingis consistent with a study by Sebsibe*et al* in 2014.

Gender of child wasalso a factor which affects status of underweight child malnutrition in Ethiopia. The risk of malnutrition was found significantly higher for male children compare with female children. Similar result were also reported ina studyby Mandefro*et al*.,in 2007.

Birth order numbers are factors which affected child's underweight of malnutrition in Ethiopia. Similar result is also reported from other studies by Neima Endris*et al*. in 2017.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATION

5.1 Conclusions

The main objective of this study was to identify the most important factors that affect child malnutrition based on 2016 Ethiopian Demographic and Health survey (EDHS) data. According to the result this study was an attempt to examine the impact of some factors on the child malnutrition in Ethiopia. For these purpose, descriptive statistics and ordinal logistic regression were used.

We have found that partner occupation (group), partner education level, birth order number, wealth index combined, region, sex of child and place of residence had a significant association with child malnutrition. From the result of our study we have concluded that partner occupation (group), birth order number, wealth index combined, sex of childand region were found to have significance effect with underweightchild malnutrition in Ethiopia at five percent level of significance.

5.2. Recommendations

Based on the findings of our study, the following recommendations are put forward to bring about reduction in child's underweight malnutrition. In Amhara more affected by underweight malnutrition relatively other regions; then the government should be to create opportunity for peoples. For prevention of malnutrition the government and the concerned bodies should improve education for families on planning methods to be used. Each regional administrative and the concerned bodies should provide programs focused on decreasing about the malnutrition status in Ethiopia. We recommend further studies by applying Multivariate approach taking Stunting and wasting with Underweight child Malnutrition in the study area.

References

Anware M, Muhdin M, Krishan K, 2016. Socio-Economic Determinants of Nutritional Status of Children in Ethiopia. International Journal of Scientific and Research Publications. 6, 3, ISSN 2250-3153

Agresti, A (1996).An Introduction to categorical data Analysis. John Wiley and Sons, Inc., New York.

Agresti A, 2008. An introduction to categorical data analysis second edition. John Wiley and Son Inc, New York.

Hosmer, D.WandLemeshow(2001): *Applied logistic regression*. 2nd Edition John Wiley and Sons, Inc; New York.

Ethiopian Demographic and Health Survey 2016.Defining the nutrition status of children by measuring the weight and height of children. (Shorr Board®).1995 and 2000.

Tadiwos Zewdie 2013.Determinants of Child Malnutrition: Empirical Evidence from Kombolcha District of Eastern Hararghe Zone, Ethiopia. Quarterly Journal of International Agriculture 4,357-372.

Sebsibe,*et al* 2014.Urban- rural differentials in child under nutrition in Ethiopia. International Journal of nutrition and metabolism.

Bantamen,*etal*in 2014. Assessment of Factors Associated with Malnutrition among Less than Five Years Age Children at MachakelWoreda, Northwest Ethiopia: A Case Control Study. Journal of Nutrition and Food Sciences.4, 1.1000256.

Mandefro, *et al* 2015. Prevalence of under nutrition and associated factors among children aged between 6-59 months in Bule Hora district South Ethiopia.

Central Statistical Agency (CSA), Ethiopia Demographic and Health Survey: Key Indicators Report. Addis Ababa, Ethiopia, and Rockville, Maryland, USA, CSA, and ICF. 2016.

EDHS (2016) Ethiopian demographic and health survey. Addis Ababa: EDHS

Neima Endris,*et al.,*2017.Prevalence of Malnutrition and Associated Factors among Children in Rural Ethiopia.

ZemenuYohannes,*et al*in 2017 Malnutrition and associated factors among under five children (6-59 Months)At Shashemene Referral Hospital, West Arsi Zone, Oromia, Ethiopia.

Nigatu,*et al* in 2014.Nutritional status of children under five years of age in Shire Indaselassie, North Ethiopia: Examining the prevalence and risk factors.

Dereje Danbe,*et al*.in 2015.Nutritional Status of Under- five Children in HawassaZuria District, Southern Ethiopia. Journal of Health Research. 3, 5, 2015, pp. 286-292.

MoFED (Ministry of Finance and Economic Development) (2002a) *Development and* Poverty Profile ofEthiopia, Addis Ababa, Welfare Monitoring Unit (March), MoFED.

MoFED (2002b) Ethiopia: Sustainable Development and Poverty Reduction Programmes, Addis Ababa, Welfare Monitoring Unit (July), MoFED.

Pelletier, D L (1994) 'The relationship between child anthropometry and mortality in developing countries: Implications for policy, programs and future research', Journal of Nutrition, 124: 2047–81S.

Shanghvi, T and J Murray (1997) Improving Child Health through Nutrition: The Nutrition Minimum Package. Arlington, VA, BASICS (Basic Support for Institutionalizing Child Survival) Project for the US Agency for International Development.

Silva, P (2005) 'Environmental factors and children's malnutrition in Ethiopia', World Bank PolicyResearch Working Paper 3489.

AlemuMekonnen., *et al.,* 2004.Tackling ChildMalnutritioninEthiopia: Do the SustainableDevelopmentPovertyReductionProgram'sunderlyingpolicyassumptions reflect local realities?

MulugetaMola 2015.estimated the prevalence and identified the key risk factors of malnutrition in children under five years of age in Shire Indaselassie Town, North Ethiopia.

Kleinbaum, D.G. and Klein M., (2010). Logistic Regression. A Self- Learning Text, Third Edition, Springer, 590 p.

Declaration

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

Declared by:

Name: _____

Signature: _____

Date: _____

Name: _____

Signature: _____

Date: _____

Confirmed by Advisor:

Name: _____

Signature: _____

Date: _____