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Determinants of Child Nutritional Status in Debre Berhan Town, North Shewa Zone, Amhara Region, Ethiopia

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Abstract
The study examined the main Determinants of Child nutritional status in Debre Berhan Town, North Shewa Zone, Amhara Region, Ethiopia. It employed institution-based case control study design that used both descriptive and inferential approaches. A total of 603 randomly selected children under the age of five participated in the study. Among them 201 were malnourished (cases) and 402 were normal (controls). Data was collected using interviewer administered questionnaire, infant-meter, weight-scale and checklist. OLS regression model was used for the analyses the relation between child malnutrition statuses with its main determinants. From the given explanatory variables, Breast feeding, status of the child, residence, marital and educational status of mother, family size, mothers average working hours per day outside home, age of mother, age difference with husband, satisfaction of women on others supports and access to media showed statistically significant contributions to child nutritional status. Based on those finding our study recommends that to improve the nutritional status and alleviate the problem of malnutrition, there should be a lot to be done on improving the status of women through various empowering programs including education.
Keywords: Child nutritional status, anthropometrics, Infant meter, OLS
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1. Introduction

Adequate nutrition is essential in early childhood to ensure healthy growth, proper organ formation and function, a strong immune system, neurological and cognitive development. Economic growth and human development require well-nourished populations who can learn new skills, think critically and contribute to their communities. Nutrition has increasingly been recognized as a basic pillar for social and economic development. Improvements in nutrition will contribute significantly in poverty reduction via maximizing the potential and productivity of the human capital (Liu et al., 2012).

Malnutrition on the other hand, in all of its forms; is a global burden that affects almost every country in the world and leads to serious public health risks and high economic costs. Though it can occur at any stage of life, child malnutrition; specially that occur at early stage of development, in particular the first two years of life is most serious and life threatening with lifelong health and economic impacts (UNICEF, 2013). It impairs cognitive function, contributes to poverty through impeding individuals' ability to lead productive lives and cause millions of deaths in each year globally. It is estimated that nearly half of the global under-five deaths are attributable to under nutrition (Liu et al., 2012 and Black et al., 2013).

In its economic impact, malnutrition is thought to be a cross continental issue that knocks the doors of both the haves and the have-nots. In that, societies in the developed nation are at risk of over nutrition and economical loses associated with obesity and its consequences; for instance, in the United States, when one person in a household is obese, the household faces additional annual health care costs equivalent to 8% of its annual income. In China, a diagnosis of diabetes results in an annual 16.3% loss of income for the patient. On other hand, the annual GDP losses from low weight, poor child growth and micronutrient deficiencies on average 11 percent in Asia and Africa; this is greater than the loss experienced during the 2008–2010 financial crises. All of these figures mean that the burden of malnutrition falls heavily on all of us, whether directly suffering or not; on both the developed and developing nations (IFPRI, 2016).

Malnutrition is thus a primary obstacle to the development processing all nations. Hence, it is believed that; improved nutrition and health is a key priority in international development; with better health and nutrition is both an end in itself and a means to escape from poverty. Child malnutrition and ill health become a greater concern since deprivation in early childhood often causes irreversible damage to physical and mental health that

lasts long till adulthood. Thus, In the year 2016, global estimation showed; stunting affected 22.9 % or 155 million children of under 5 years, overweight 6.0 percent or 40.6 million and wasting continued to threaten the lives of an estimated 7.7 per cent or nearly 52 million children (UNICEF, 2017). Compared to the global burden reported half a decade ago, 165 million children stunted and 51 million wasting that uninterruptedly kills 3.1 million under-five children every year (Black et al., 2013).

Consequently, the data for the same year, 2016; showed that, the number of stunted, over weighted and wasted children under five years of age; in Asia were 87 million, 20 million and 36 million; in Africa were 59 million, 10 million and 14 million; in Latin America were 6 million, 4 million and 1 million; while in Oceania were 0.5 million, 0.1 million and 0.1 million respectively; pointing the highest proportion still exists in the poorest Asian and African countries (UNICEF, 2017).Africa is the only region where the number of stunted children has risen. Among the five sub-regions worldwide with stunting rates that exceed 30%, three sub-regions are in Africa i.e., Northern Africa with 31.4%, Middle Africa with 32.5% and Eastern Africa with the highest 36.7%. Nearly half of the African stunted children live in east Africa (UNICEF, 2017).

In Ethiopia, 38% of under five children are stunted, 10%wasted and 24%underweight (CSA, 2016). Ethiopia is a country with high under five mortality rates of 53%majority of this death is attributable to severe and mild to moderate malnutrition (USAID, 2016). In all cases, there are variations among regions in the country; of which the highest 46 %stunting seen in the Amhara region and the lowest15% in Addis Ababa. Likewise, 9.8% wasting and 28.4% underweight were reported in the region, emphasizing children in the region are at higher risk. The data also revealed 38 %, 24 % and 10 % prevalence of stunting, underweight and wasting respectively among children less than five years. It evidences that, children in the country are still hosting the worst child malnutrition; with some variations among regions in the country. Amhara regional state, where the current study area; Debre Berhan town belongs, hosts the most extensive child malnutrition prevalence of all.

In addition, most of the previously done studies both in Ethiopia and abroad Tadiwos & Degnet. (2013), Bantamen, et,al., (2014), Neima et al., (2017), Abebe, &Tigist. (2018), Ashenafi et al., (2019) and Zerihun et al., (2019) were mainly focused on exploring factors in gross, rather than clearly concentrating on specific groups i.e., either related to the community, the household, the father or the mother. In relation to this; taking the theoretical background that mothers are the main care givers of their children, studies that investigate women status related determinants of child malnutrition show promising start both in Ethiopia and overseas, however they are very rare and based on secondary data; especially in Ethiopian context. Therefore, to fill some of the above gaps and generate valuable information in relation to determinants of Child nutritional status: conducting this study, which was done at micro-level, based on a primary data focusing to identify the main determinants of child nutritional status in Debre Berhan town, North Shewa Zone, Amhara region, Ethiopia.

2. Literature Review

This section reviews some of the available reports and studies that investigated the magnitude of child nutrition and reviews some of the studies that investigated the determinants of child nutrition. For this purpose, different studies have been conducted in different parts of the world including Ethiopia such as Abbi et al., (1991), Sumonkanti & Rajwanur . (2011),Benta, et al., (2012), Maysaloun (2012), Adrianna et al., (2013), Maren (2013), Tadiwos & Degnet , (2013), Bantamen, et,al., (2014), Asabe, et al., (2015), Anware et al., (2016),Neima et al., (2017) ,Tebeje et al., (2017), Abebe, &Tigist (2018),Ashenafi et, al., (2019), Zerihun et,al.(2019) and Lijalem & Haile. (2021). Thus, those studies, the study used the following literature as follows:

Abbi et al., (1991) studied on the impact of maternal work on the nutrition and health status of children. The study used secondary data and logistic regression model with odds ratio showed that, although women's employment enhances the household's accessibility to income, it may also have negative effects on the nutritional status of children, as it reduces a mother's time for childcare. Due to very limited researches that studied the mother employment status with the nutritional status of children, we are forced to use these available researches of old enough time; with contradicting ideas.

Sumonkanti & Rajwanur., (2011) undertook the study of Application of ordinal logistic regression analysis in determining risk factors of child malnutrition in Bangladesh. The study analyzed differences in nutrition outcomes among children whose mothers work full time, part time, and not at all, and the role of a Food Program plays in meeting the nutrition needs of participating children, especially those whose mothers' work. All these, tell us the need of further researches to be conducted in the area.

Benta et al., (2012) studied the Effect of mother's education on child's nutritional status in the slums of Nairobi, Kenya; they used secondary data from a maternal and child health project nested within the Nairobi Urban Health and Demographic Surveillance System (NUHDSS). The study involves 5156 children aged 0–42 months. Data on nutritional status used were collected between October 2009 and January 2010. Applied binomial and multiple logistic regressions to estimate the effect of education in the unavailable and multivariable models respectively maternal education is a strong predictor of child stunting with some minimal attenuation of the association by other factors at maternal, household and community level. Other factors including at child

level: child birth weight and gender; maternal level: marital status, parity, pregnancy intentions, and health seeking behavior; and household level: social economic status are also independently significantly associated with stunting.

Maysaloun (2012) conducted the study of Assessment and determinants of nutritional status in a sample of under five-year-old Iraqi children. A cross sectional study was conducted in three primary health care centers in Baghdad, Iraq, sample of 606 under 5-year-old children (2-59 months) of both genders was included in the study. Data were gathered by direct interviews with the children's parents, and the weight, height, and BMI measurements of each child were taken. The study showed that significant association was estimated between; the age of a child and being underweight, lower levels of parental education and stunting, and between extended families and stunting. The rates of being obese were higher than that of those of under nutrition. The factors associated with under nutrition in under five-year-old children are especially related to lower socioeconomic status such as rural residence, lower levels of maternal education, unemployed mothers, and extended larger families.

Adrianna et al., (2013) undertook the study on Differences in nutritional status of preschool children in the context of the maternal social characteristics in Poland, a cross-sectional study was conducted and five hundred thirty mothers of preschool children from 5 different regions of Poland were interviewed. Mothers were interviewed on their socio-demographic and socio-economic status. The results showed that mother's education and professional status did not differentiate any of the indices of the child's nutritional status. However, maternal age and her relationship status occurred significant. Children of younger mothers had higher BMI z-score and higher %EC as compared to children of older mothers. Moreover, %EAR was higher among children of single mothers and it was closer to the recommended nutrition standards as compared to children of mothers with a partner.

Maren (2013) studied a cross-sectional study conducted on Breastfeeding practices among infants in Bhaktapur, Nepal. The study was conducted among 489randomly selected mother-infant pairs in Bhaktapur. Socioeconomic status of the parents significantly affected the feeding practices. Mothers who were unemployed or working in agriculture were less likely to introduce breastfeeding within one hour after birth and to maintain exclusive breastfeeding for 6 months. Literacy level was also associated with feeding practices, and found a significant correlation between the mothers' knowledge about WHO's recommendations on exclusive breastfeeding and duration of exclusive breastfeeding.

Tadiwos & Degnet. (2013) conducted the study of Determinants of Child Malnutrition: Empirical Evidence from Kombolcha District of Eastern Hararghe Zone, Ethiopia; The study used a two-stage sampling procedure to collect cross-sectional data from 249 under five years of age children. The data collected were analyzed and discussed using several descriptive statistics and logit regression model. The survey result revealed that 45.8%, 28.9% and 11.2% of sample children are stunted, underweight and wasted, respectively. The estimation results indicate that child nutritional status is strongly associated with the 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.

Bantamen et al., (2014) studied on the Assessment of Factors Associated with Malnutrition among Under Five Years Age Children at Machakel Woreda, Northwest Ethiopia: The Case Control Study. The author fitted a logistic regression model based on primary data showed that, inappropriate child carrying and feeding practice were strongly associated with under five malnutrition. By which, these factors might be associated with the educational status of the parents in that; Sixty-five (63.20%) of cases and 49 (24.40%) controls had fathers that cannot read and write. Recommended to strongly identify risk factors was limited in clearly setting the possible risk factors for child malnutrition and it was not concentrated on the risk factors which are related to women's/mothers' status.

Asabe, et al., (2015) conducted the study on The Effect of Women's Empowerment on Child Health Status: Study on two Developing Nations. The finding showed that, there is a strong and positive influence of the active participation of women in decision making process in the household on their children's health status. Furthermore, the influence of women's empowerment and/or autonomy on children's health and well-being has emerged as an issue of considerable research and interest in the developed as well as developing countries.

Anware et al., (2016) studied on the Socio-Economic Determinants of Nutritional Status of Children in Ethiopia. The study used secondary data obtained from Ethiopia demographic and health survey database, collected in 2011. They applied a multilevel binary logistic regression model with random-intercepts was used for estimating the determinants of child nutritional status. The empirical results revealed 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 pattern of growth-faltering in children by age was identified. Children aged 13-59 months were less-nourished than those aged 0-12 months. Finally, based on the results of the study, the paper proposes several policies aimed at improving the delivery of nutrition to more effectively address the problem of under-nutrition.

Neima et al., (2017) studied on the Prevalence of Malnutrition and Associated Factors among Children in Rural Ethiopia. A cross sectional study conducted in rural Ethiopia based on secondary data that fitted a logistic regression revealed that wealth status a household was significantly associated with the nutritional status of the child age of the children, preceding birth interval were the significant factors that determine the nutritional status of children, educated status of mother, and region were factors independently associated with nutritional status of children in rural Ethiopia.

Tebeje et al., (2017) applied a Systematic Review and meta-analysis on the prevalence and major contributors of child malnutrition in developing countries; conducted an exhaustive search of literature published between 2006 and 2015 on under-five malnutrition. Data has been abstracted from 10 articles published in developing countries. This Revealed that Even though heterogeneity was high between studies the overall prevalence under-five malnutrition in developing countries was about 43% but it varies between 20% and 71%. Meta-analysis and subgroup analysis has revealed high heterogeneity between included studies and meta-regression by using the year of publication as covariate has indicated insignificant coefficient.

Abebe & Tigist. (2018) conducted the study of the Children's nutritional status and its determinants in small towns, Sebeta Hawas district, Oromia, Ethiopia. Cross-sectional design was employed in the existing two small towns selected randomly. The sample size was determined by using single population proportion formula then adjusted by finite population correction factor to draw the final 230 sample children and then allocated proportionally to each small town. The result revealed that the prevalence of overall malnutrition was 46%. Specifically, stunting was (22.6%), underweight (16.1%) and wasting (7.4%), respectively. Bivariate and multivariate logistic regression model was employed to analyze determinants child malnutrition. Multivariate model revealed that age of child, number of under-five children in the household, no formal fathers and no formal maternal education, less than1500ETB monthly income, Antenatal care visit less than four times during pregnancy, not exclusive breast feeding and no fully vaccination were found positive and significant determinants for child malnutrition. And, child birth order was negative and significant determinant for child malnutrition.

Ashenafi et al., (2019) analyzed the Factors affecting child malnutrition in Ethiopia. From the findings, the comparison of results using the cumulative logit model with and without complex survey design are presented. The study results revealed that to produce the appropriate estimates and standard errors for data that were obtained from complex survey design, model fitting based on taking the survey sampling design into account is better. It has also been found that for children under the age of five, weight of a child at birth, mother's age, mother's Body Mass Index (BMI), marital status of mother and region (Affar, Dire Dawa, Gambela, Harari and Somali) were influential variables significantly associated with under-five children's nutritional status in Ethiopia. Besides, the child's age of a child, sex, weight of child at birth, mother's BMI and region of residence were significant determinants of malnutrition of children under five years in Ethiopia. The effect of these determinants can be used to develop strategies for reducing child malnutrition in Ethiopia.

Zerihun et al., (2019) Investigated the Determinants of Nutritional Status among Children Under five ages in Ethiopia: A Further Analysis of the Ethiopian Demographic and Health Survey (EDHS) 2016 Data. This study used stunting and wasting as dependent variables for the analysis. Children's, mothers, households, and environmental characteristics were used as determinant variables. Sample weights were applied in all analysis due to the two-stage cluster sampling design in the EDHS datasets. Bivariate analysis was also used to analyze the association between the dependent and independent variables. From the findings, Children from 24-59 months of age group were less likely to be wasted than 0-6 months. Female children were less likely to be wasted than male. Overweight mothers and normal in their body mass index have less wasting than children from underweight mothers. Children born from rural residents were less likely to be wasted than children born from urban resident households. Households reside in Addis Abeba and SNNP were less likely to have wasted children. Households from Somali region were more likely to have wasted children.

Lijalem & Haile. (2021) studied on the Multivariate logistic regression analysis on the association between anthropometric indicators of under-five children in Nigeria: NDHS 2018 data. From the research findings, 11,314 under-five children the study considered 36.2, 21.4 and 6.7% of them suffered from stunting, underweight and wasting, respectively. About half (50.7%) of the children were male, 24.1% was obtained from North West region of Nigeria, and 37.8% of them were from households having unimproved drinking water. The pairwise dependency between stunting and underweight; underweight and wasting was measured using odds ratio (OR) of 15.796, and 16.750 respectively. The estimated odds of children from richest household to become stunted, underweight, and wasted was respectively 0.392, 0.540, 0.786 times that of the estimated odds of children from poorest households.

From ongoing empirical discussion showed that the prevalence of malnutrition is very high; assuring that child malnutrition continued being a major public health problem globally. However, the most significantly harmed children are found in Asian and African countries; more over the Sub Saharan African countries, especially the East African countries where Ethiopia is one of those are highly harmed. All these assure that

conducting researches in this country. In relation to the studies done to identify determinants of child nutritional status, most of the studies were based on secondary data collected at a country level Asabe et al., (2015), Anware et al., (2016), Neima et al., (2017), Ashenafi et al., (2019) and Zerihun et al., (2019) which might not consider local contexts that may affected by local situations; hence to forecast the results to all locality might be a little bit ambiguous; and most of which were focusing on rural settings. On the other hand, studies that utilized primary data are rare; despite their number they also had some limitations for example the study done in Kombolcha district Ethiopia Tadiwos& Degnet. (2013) was based on primary data, but it followed the usual way of assessing the magnitude of malnutrition rather than due attention for the determinant factors, which a cross sectional method was employed. Hence, for filling those gaps needs more to be done.

3. Methodology

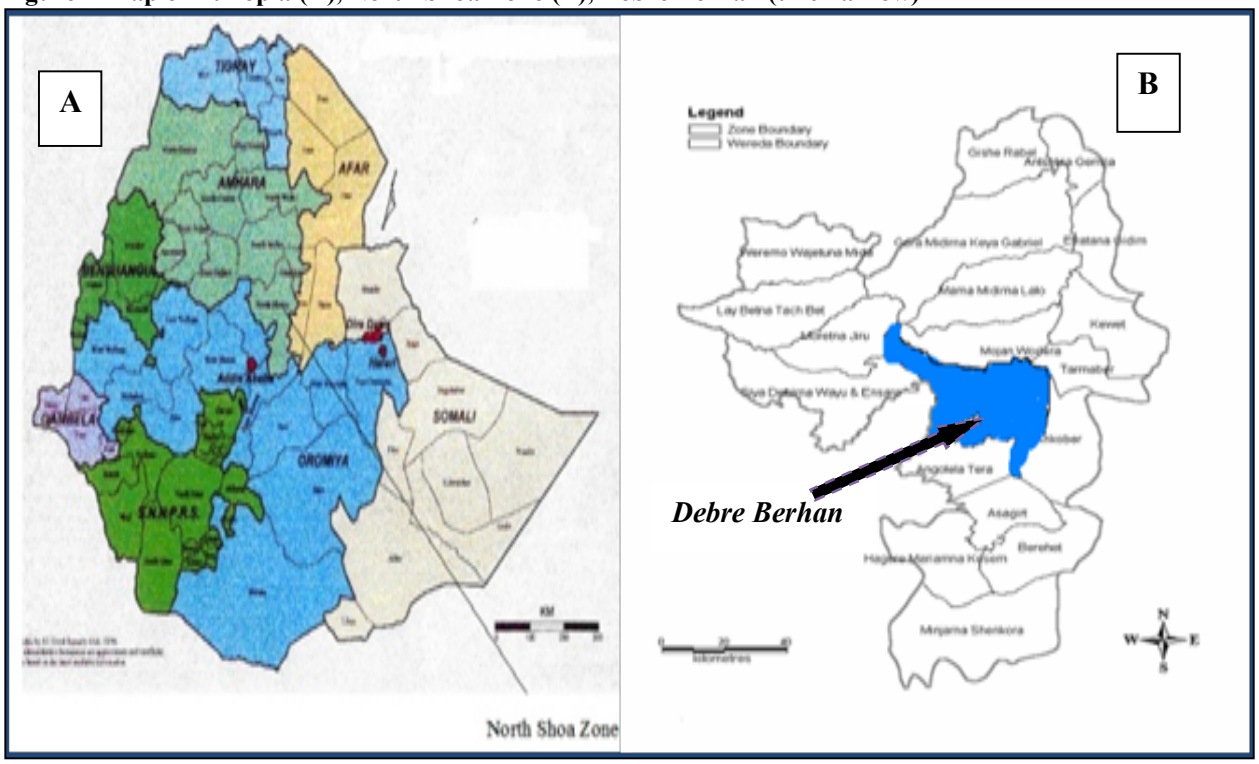
3.1. Research Design

Research design is a master plan specifying the methods and procedures for collecting and analyzing the needed information. It ensures that the study would be relevant to the problem and that it uses economical procedures. From the types of research design this research was employed descriptive and empirical research. Moreover, the study utilized cross-sectional data in the sense that all relevant data were collected at a single point in time. The reason for preferring a cross-sectional study is because of getting organized long year data was difficult in the area. Obtaining information from a cross-section of a population at a single point in time is a reasonable strategy for pursuing many descriptive researches (Janet et al., 2006). Thus, Institutional based cross-sectional data was used to examine the main determinants of child malnutrition status under the age of five years in Debre Berhan town.

3.2. Description of the Study Area

The study was conducted in Debre Berhan town, North Shoa Zone, Amhara Regional state of Ethiopia. The area is one of the thirteen zone cities of the region. It is located around 130 Km to North West of the country's capital city Addis Ababa; and around 700 Km away from the region's capital Bahir Dar city. Based on the 2013, population projection estimation for the year 2017; the town has a total population of 113, 693 of whom 56, 995 are men and 56, 698 women (CSA, 2016). The town is a home for governmental and private health facilities including Debre Berhan Referral hospital, Tebassie, 08 and 04-Health centers.

Figure 1-Map of Ethiopia (A), North Shoa Zone (B), Debre Berhan (thick arrow)



Source: mereja.com, www.maplandia.com/ethiopia/amhara

3.3. Source population

All under five years old children who examined and identified as malnourished in the past years in any of the

governmental health facilities i.e., Debre Berhan Referral hospital, 04, Tebassie and 08-Health centers were the source populations to take the cases for the present study. In addition, children less than the age of five years, who visited the above health facilities and not malnourished, were the source population for the controls.

3.4. Study population

All under five years children who examined and identified as malnourished or not from January 15 /2017 to April 30/2018 in Debre Berhan Referral hospital, Tebassie and 04-Health centers were the study population from whom the cases were taken randomly; while children under five years of age, who visited the above three health facilities during the data collection period (from January 15 /2018 to April 30/2018)and not malnourished *i.e.,* for any of the three anthropometric indices were the study population from whom the controls were randomly selected for this study.

3.5. Inclusion and Exclusion criteria

Inclusion criteria:

All under five years children, examined and identified as malnourished from January 15/2017 to April 30, 2018 in Debre Berhan Referral hospital, Tebassie and 04-Health centers

- Above the age of 6 months
- Who have a registered record in the respected health facility?
- Whose parent address was clearly stated to meet the parents in person
- Whose hospital record was clear, readable and complete for the necessary demographic and anthropometric data were eligible for the study

Exclusion criteria:

- Less than the age of 6 months
- Who have no registered record in the respected health facility?
- Whose parent address not registered clearly
- The hospital record is unclear, unreadable and incomplete for the necessary demographic or anthropometric data were excluded.

3.6. Sample Size Determination

The sample size or number of the cases to the present study was determined using the following unmatched case control formula –two population proportions formula (Kim, 2016). Considering the advantage of maximum or larger sample size in providing better estimations, a major risk factor that can provide lager sample size was taken from a previous study. The risk factor considered was family size, in that children from larger family size were more likely to be malnourished than those from small family size.

The proportion of children from larger family size among cases (malnourished) and controls (normal) was taken from previously research done in Machakel district in Amhara regional state. The study was selected because of the following points. First, there was no similar study previously done in the present study area, second it was a case control study, which is similar with our study, so can clearly provide proportion of cases and controls in relation to family size (the selected risk factor), and thirdly it was a study done in similar Region as ours. Based on the above assumptions, our study that considered family size as major risk factor took the following proportions from the report of Bantamen et al., (2014) *i.e.,*62.5% of malnourished children(cases) were from lager family size and 50.0% of well-nourished children(controls) were from small family size. Besides, a 95% Confidence Interval (CI), 5% level of significance or α= 0.05; (two-sided) or the hypothesis of no significant difference, a power of 80% and a two to one (2:1) allocation ratio of not malnourished (controls) to malnourished (cases) was assumed.

$$n = \left(\frac{r+1}{r}\right)\frac{(\bar{p})(1-\bar{p})(Z_{\beta}+Z_{\alpha/2})^2}{(p_1-p_2)^2}$$

Where: n=Sample size in the case group

- r=ratio of controls to cases; which is 2 (twice controls are taken to the number of cases)
- Z_{β} =Represents the desired power. Statistical power is the probability of finding an effect (or association) if it's real, which is 80% power; hence Z_{β} is 0.84
- $Z_{\alpha/2}$ =Represents the desired level of statistical significance; which $Z_{\alpha/2}$ at 95% Confidence level is (1.96).
- p_1 = proportion of children from large family size among cases (62.5%)

- p_2 = proportion of children from large family size among controls (50.0%)
- $p_1 - p_2$ = effect size/difference in proportions; which is 0.125
- $\bar{p}$ =A measure of variability (similar to standard deviation) which is 0.5625 (average of $p_1 + p_2$ taken)

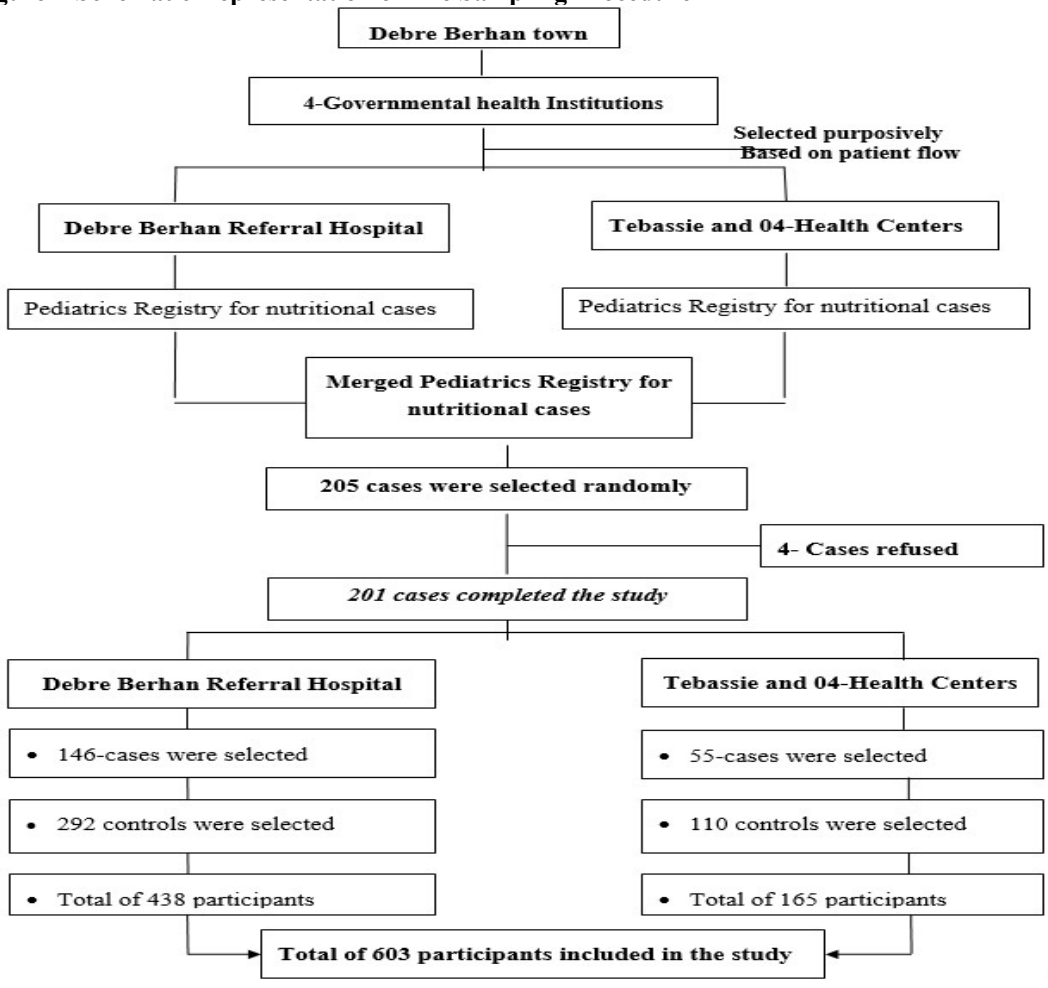
Using the formula, the number of cases calculated was: 185.22≈186; adding 10% non-response rate *i.e.*, 18.6 ≈ 19; gave a final number of cases = 205. Our study assumed unmatched case control design so number of controls need not be to be equal with the cases. As a two to one (2:1) allocation ratio of controls to cases was predefined, our study used number of controls that were twice the number of cases. Hence, number of controls = number of cases multiplied by 2. That was, 186 * 2 = 372 controls. Adding 10% non-response rate ≈ 38; gave final number of controls = 410. Hence, a total sample size of 615 children (205 cases and 410 controls) was calculated for our study.

3.7. Sampling Procedure

In Debre Berhan town, there are three health centers and one referral hospital owned by the government. Among these governmental health institutions, the referral hospital and two of the three health centers, i.e., Tebassie and 04-Health centers were selected to take the samples; by taking the flow of outpatients in each of the health facilities and availability of enough number of cases and controls in to consideration.

The pediatrics patient recording book was reviewed in all of the three health facilities and then merged and special code was given for the purpose of the present study. Then, children who fulfilled the inclusion criteria were selected by simple random selection technique. In the same way the controls were selected by a simple random selection/lottery method; among those who visited the three health institutions, during the data collection period, i.e., from January 15/2018 to April 30/2018 G.C. The number of controls that were selected in each of the three health institutions was determined based on the number of cases available/taken from each of the health institutions; it is shown in the diagrammatic representation of the sampling procedure (Figure-2).

Figure 2-Schematic Representation of The Sampling Procedure



3.8. Data Collection Techniques and Procedure

The data collection was carried out; using variety of techniques with the necessary procedures followed accordingly.

- ✓ ***Demographic and associated risk factors***

Demographic and associated risk factors for nutritional status of children were collected by interviewer administered questionnaire for the mothers/guardian women. Each mothers/guardian women were interviewed by trained interviewers (health extension workers). For the controls and some remarkable number of cases, it was done during the day of anthropometric data collection. But, for the rest of the cases; it was done after the anthropometric data was taken from the pediatrics registry and the exact address of the child's parent was identified.

- ✓ ***Anthropometric data collection***

Anthropometric data was collected by recording the age, sex, weight and height of participants. For the cases who were not met face to face, the necessary information was taken using a check list from the pediatrics registry book to calculate the recommended anthropometric indices; by trained data collectors (pediatrics nurse). For the controls similar data needed to calculate recommended anthropometric indices were directly taken by measuring the height and weights of children, this was done by trained data collectors (BSc nurses). For this purpose, the WHO recommended portable digital weighing scale, both a stand-meter with sliding headpiece and a plastic meter to take the child's height in sleeping position were used to measure weight to the nearest 0.1 kg and height to the nearest 0.1 cm respectively. Each child was weighted with minimal clothing and barefooted. Measurements were recorded with the unique code of each child given by the study.

3.9. Model specification

This study used the OLS model for estimations of child malnutrition status in Debere Berhan town as below.

3.9.1. Theoretical Model

To determine the child nutrition status, the theory of household production function was used as a useful starting point. Households use human capital and other goods as inputs to produce a final good which is health (Rosenzweig and Schultz, 1983). This model was modified to include women's status/characteristics and their relative status to study the impact on child nutrition.

$$\boldsymbol{U = U(C, l, N)} \quad \textbf{(1)}$$

Where U is the utility function, C is the consumption of goods and services l is the amount of leisure time and N is the nutritional health status of a child. The nutritional status of the child is given by the production function:

$$\mathbf{N = N\ (C, I, k, m, h)} \quad \textbf{(2)}$$

C is the consumption of goods and services by households under consideration, **I** is inputs into child health such as medical care, **k** is the child's observable characteristics including age, birth order, size at birth and sex; **m** is a vector of maternal characteristics such as maternal education, mother's height, employment, decision making ,domestic violence, age at first marriage, **h** denotes household characteristics which include household wealth, sex of household head, age of household head and geographical location.

The budget constraint for the household is

$$\boldsymbol{\sum_{I}^{T} = PiXi = M} \quad \textbf{(3)}$$

Where ***Pi*** the price of the $\boldsymbol{i^{th}}$ commodity; ***Xi*** is the complete set of commodities consumed including **C**and **M** is the total money income.

Constrained optimization of the utility function is subject to the budget, time and the nutrition preference function that gives reduced form demand functions for the purchased goods and the nutritional status of children.

$$\boldsymbol{H=\beta\ (p, M, k, m, h)} \quad \textbf{(4)}$$

Where the particular functional form of the function **β (.)** depends on the underlying function characterizing household preferences and the nutrition preference function

This final equation presented above allows for health demand which in turn reflects child nutritional status to be expressed as a function of the right-side variables all of which are exogenous independent variables of the model. Thus, In this study, a child's nutrition status as measured by anthropometric indicators is the dependent variable and the explanatory variables include maternal status, such as maternal education, marital status, family size, income and other socio-economic status of the mother; and child related characteristics, as well as some environmental factors.

Anthropometry is a technique that uses human body measurements to draw conclusion about the nutritional status of individuals and population. Anthropometry is more often applied to pre-school children below the age of 5 years. To carry out anthropometric analysis, several variables such as child's age, sex, height and weight of children will be used. These measurements will be used in generating indices such as, height-for-age, weigh-for-age and weight-for-height.

The indices generated compared with standard reference values of the World Health Organization (WHO) to obtain the Z-scores. Specifically, the height-for-age Z-score, for example is given as:

$$Z = \frac{x-\mu}{\sigma} \text{..... (5)}$$

Where let for example **X** is the child's height-for-age, **μ** is the median height-for-age of the reference population of children of the same age and sex group, **σ** is the standard deviation of the reference population. The same is true for weigh-for-age and weight-for-height measures. From the z-scores, the nutritional statuses of children will be determined. Children whose height-for-age Z-score is below -2 standard deviation from the median of the reference population classified ***as stunted,*** those with weight-for-age and weight-for-height Z-score is below -2 standard deviation from the median of the reference population classified as ***underweight and wasted*** respectively. Thus, in this study the Z-scores were approached by taking the Z-scores of children as a continuous numeric variable using the Z-scores as normal nourished or malnourished based on the cut values (-2).

3.9.2. Model Estimation

The OLS-model

Using the above econometric equations as an initial and by combining it with the anthropometric calculation, the OLS model was used to estimate the child malnutrition status by considering the Z-scores of children as a continuous numeric variable. Thus, we specified a child nutrition status model represented as:

$Y = \beta 0 + \beta 1WS + \beta 2HHI + \beta 3CCs + \beta 4EFs + e$ **..... (6)**

Where;

- **Y –** is a vector of dependent variable consisting of the Z-scores of a child's nutrition status as measured by anthropometric indicators
- **β0** - is a constant
- ***WS- women's status indicator variables,*** such as, Age of Mother/guardian **(AOM),** Marital Status **(MS),** Residence **(RS),** Time to visit health facility **(TTVHF),** Family Size **(FS),** Education Status of Mother **(ESM),** Occupation of Mothers **(OOM),** Average Working Hours per Day outside Home **(AWHPDOH),** Age differential with Husband**(ADWH),** Decision Making Role of Women**(DMROW),** Satisfaction of women on the support they got from others **(SOWOSFO),** Access to media **(ATM)** and Knowledge level of Mother on Child Nutrition **(KNOMCN).**
- ***HHI***-The average Monthly Income of the household **(MI).**
- ***CCs***-is a vector of child characteristics such as Birth order of the child **(BOC),** Breastfeeding Status **(BFSC)**and Child Illness History **(CIH):**
- ***EFs*** **–** Environmental factors include Source of drinking water/Regular Use of tap water **(RUTW)** and Availability of toilet **(AVT).**
- ***e*** –the error term (the standard error) of the model

Table 1-Summary of all explanatory variable with its expected sign

S.no	**Variables**	**Types of variables**	**Expected Effect**
Women Status Related Factors			
1.	Age of Mother/guardian (AOM)	Continuous	(+)
2.	Marital Status (MS)	Categorical	(+)
3.	Residence (RS)	Dummy	(+)
4.	Time to visit health facility (TTVHF)	Dummy	(-)
5.	Family Size (FS)	Continuous	(-)
6.	Education Status of Mother (ESM)	Categorical	(+)
7.	Occupation of Mothers (OOM)	Categorical	(+)
8.	Average Working Hours per Day outside Home (AWHPDOH)	Continuous	(-)
9.	Age differential with Husband (ADWH)	Continuous	(-)
10.	Decision Making Role of Women (DMROW)	Dummy	(+)
11.	Satisfaction of women on the support they got from others (SOWOSFO)	Categorical	(+)
12.	Access to media (ATM)	Dummy	(+)
13.	Knowledge level of Mother on Child Nutrition (KNOMCN)	Categorical	(+)
Child Related Factors			
14.	Birth order (BOC)	Continuous	(-)
15.	Breastfeeding Status (BFSC)	Dummy	(+)
16.	Child Illness History (CIH)	Dummy	(-)
Household economy			
17.	Monthly Income of the household (MI)	Dummy	(+)

S.no	**Variables**	**Types of variables**	**Expected Effect**
Environmental Factors			
18.	Source of drinking water/Regular Use of tap water (RUTW)	Dummy	(+)
19.	Availability of toilet (AVT)	Dummy	(+)

3.10.Data Quality, Reliability and Validity

3.10.1. Data Quality

Our study employed a verity of techniques that can help to ensure data quality. These include, the training given to the data collectors and supervisors, questionnaire originally developed in English was translated to Amharic and back to English for consistency, The interview was conducted in the local language Amharic, and finally the questionnaire and other data collecting tools were tested for feasibility and generation of reliable and valid information taking 30(5%) of total sample. In addition, on spot checks, re-interviewing and vigilant examination of completed questionnaires and quality of the recordings were done through daily supervisions. Measurements of weight and height were taken twice by a trained clinical nurse and the average was recorded.

3.10.2. Validity

Validity refers to the capacity of data collecting tools, in our study context, the questionnaire to generate the information as intended. This is mainly assured by the deep examination of tools by referring previous literatures, collogues, advisors of the student researcher, other researchers and professionals; in our study context professionals of child nutrition. Taking this fact in to account, the researcher of this study made immense discussions with many of the recommended bodies.

3.10.3. Reliability

Reliability on the other hand refers to the consistency of the information generated by the same tool from different respondents, or it is the measure of the tools to be understood by different respondents in the same way. This is usually addressed by employing a Cronbach's Alpha test. This test is usually used for questionnaire that made based on Likert scale. Our study used Cronbach's Alpha to check reliability of tools, specifically the questionnaire, because other anthropometric variables were collected with standard equipment's that measure the variables based on scientific and internationally convenient ways. Based on our data result of the Cronbach's Alpha test for 27 Items, which composed mothers' age in categorical form for the 30 respondents during the pretest ***was 0. 804.(See annex 1)***.

4. Result and Discussion

4.1. Descriptive Analyses

4.1.1. Demographic and Socio-economic Characteristics of Participants

A total of 603 study participants *i.e.,* children under the age of five took part in the present study for the assessment of their nutritional status. Among these children 299 (49.6%) were male and the rest were female. Likewise, of the total study participants 317(52.6%) were from the nearby areas outside Debre Berhan and the other 286 (47.4%) were from the urban Kebeles of Debre Berhan town (Table-2).

Similarly, the mothers of the 603childrenwere took part in the present study and provided the necessary child related as well as mother related information. Based on that, 68 (11.28%) of the mothers were in the age range of 20 to 25 years, 90 (14.9%) in the age range of 26 to 30 years, 155 (25.7%) in the age range of 31 to 36 years, 168 (27.86%) in the age range of 37 to 40 years and the rest were between the age of 41 to 49 years (Table-2).Among the mothers of the 603 children took part in the present study 155 (25.7%) reported as never married, 350(58.04) while mothers reported married and the rest were either divorced or widowed (Table-2).

In addition to the above characteristics, other socio-demographic characteristics of the study participants, such as family size category of children, the mothers' educational status, mothers' occupation and category of the households' monthly income in relation to the minimum individual per day income of $ 1.90set by the IMF, are presented in the table below (Table-2).

Table 2-Demographic and socio-economic characteristics of participant children and mothers who visited government health institution of Debre Berhan town 2018

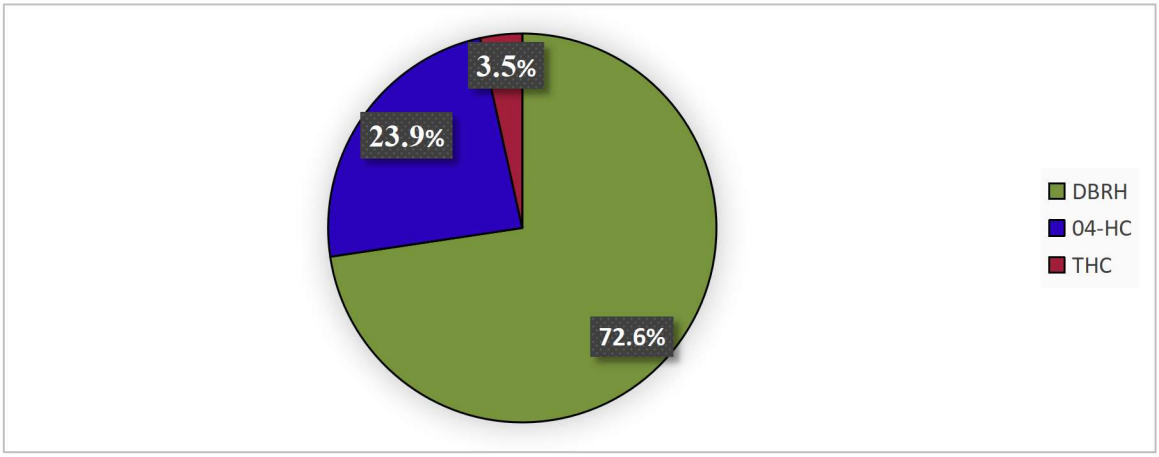
Characteristics	Category	Frequency	Percent	Cum. Percent
Sex of child	Female	304	50.41	50.41
	Male	299	49.59	100.0
Residence	Around Debre Berhan	317	52.57	52.57
	Urban Kebeles of D. Berhan	286	47.43	100.0
Age of mothers in year	20 to 25 years	68	11.28	11.28
	31 to 36 years	155	25.70	36.98
	37 to 40 ye	168	27.86	64.84
	41 to 49 years	122	20.23	85.07
	26 to 30 years	90	14.93	100.0
Marital Status of mother	Never married	155	25.70	25.87
	Divorce/ Widowed	98	16.25	42.12
	Married	350	58.04	100.00
Family Size	2 to 4	199	33.00	33.00
	5 and above	404	67.00	100.0
Mother Education	No education	274	45.44	45.44
	Primary education	208	34.49	79.93
	Secondary or Tertiary Education	121	20.07	100.0
Mother Occupation	House wife	109	18.08	18.08
	Farming or labor work	286	47.43	65.51
	Petit trade	117	19.40	84.91
	Govt or NGO employed	91	15.09	100.0
Household Income	Below $ 1.90 Per day	440	72.97	72.97
	Above $ 1.90 Per day	163	27.03	100.0

***Key**:In relation to the household income, the monthly income of the household was gathered in Ethiopian birr; in order to get the individuals income in the household, it was divided to the total family size then divided to thirty to get the daily income level and transformed to US dollar (using the, Current currency of 27.46 ETB at the time of Data collection).*

Source: - Filed survey, 2018

Based on their calculated anthropometrics indices, from the total 603 under five years of age children took part in the present study 201 (33.3%) were cases/malnourished, 402(66.7%) were controls/normally nourished. Among them, 438(72.6%), 144 (23.9%) and 21(3.5%) children, both cases and controls were taken from Debre Berhan Referral hospital (DBRH), Kebele 04 Health Center, and Tebassie Health Center (THC) respectively **(Figure-3).**

Figure 3. Distribution of selected participant children and mothers who visited government health institution of Debre Berhan town 2018



Source: - Filed survey, 2018

4.1.2. Nutritional Status of Participant Children

The participant children in the present study were categorized in to cases and controls based on their nutritional

status. As presented in the operational definition of this cases were malnourished children or children whose calculated anthropometric indices either for one, two or three of the indicators, *i.e.,* ***WAZ (Weight-for-Age Z-score), HAZ (Height-for-Age Z-score) or WHZ (Weight-for-Height Z-score)*** were found less than the cut off values (-2). And, the controls were children whose calculated anthropometric indices for all of the above three indicators were above the cut off values (-2). The cases and the controls were taken independently from children who visited three government health institutions in Debre Berhan town, namely Debre Berhan Referral Hospital, Kebele 04 and Tebassie Health Centers.

Accordingly, among the total 603 under five years of age children took part in the present study 201 (33.3%) were cases/malnourished, while two-fold of them were controls/normally nourished based on their calculated anthropometrics indices **(Table-3)**. Of the 201 cases, 146 (24.2%) were taken from Debre Berhan Referral hospital (DBRH), 48 (8.0%) cases or malnourished children from Kebele 04 Health Center, and the rest were from Tebassie Health Center (THC) **(Table 3).**

It should be noted that, these cases are less than the 205 cases planned to be included, because of the refusal of 4 (1.9%) children's parents to participate in the study. However, this refusal was below the 10% non-response rate considered at planning, so couldn't affect the final analyses.

Table 3-Distribution of the Participant Children as Cases and Control.

Characteristics	Category	Normal/Control 402 (66.7%)	Malnourished/Cases 201 (33.3%)	Total 603 (100.0%)
Sex of children	Male	196(32.5)	103(17.1)	299(49.6)
	Female	206(34.2)	98(16.2)	304(50.4)
Age in months	6 to 17	167(27.7)	60(10.0)	227(37.6)
	18 to 29	53(8.8)	44(7.3)	97(16.1)
	30 to 41	56(9.3)	37(6.1)	93(15.4)
	42 to 53	79(13.1)	41(6.8)	120(19.9)
	54 to 59	47(7.8)	19(3.2)	66(10.9)
Health Institution	DBRH	292(48.4)	146(24.2)	438(72.6)
	04-HC	96(15.9)	48(8.0)	144(23.9)
	THC	14(2.3)	7(1.2)	21(3.5)

Source: - Field Survey, 2018

4.2. Econometric Analysis

4.2.1. Diagnostic test and Assumptions

In using the OLS model, especially using the multivariate linear regression that fitted with more than one Independent Variable (IV) and a continuous Dependent Variable (DV); it is suggested that the data need to be tested for the basic assumptions of ***There is no Multicollinearity in the data*****;** this is essentially the assumption that the predictors are not too highly correlated with one another. To test this assumption, *co linearity diagnostics* need to be done. For the assumption to be met we want Variable Inflation Factor (VIF) scores to be well below 10, and Tolerance scores to be above 0.2. In our data, analysis of co linearity statistics showed this assumption has been met successfully, as VIF scores for all predictors were well below 10, and Tolerance scores all were well above 0.2. And, the average VIF scores of 1.28 was resulted. (***See Annex II). Besides, the assumption of the variance of the residuals is constant;*** this is called ***homoscedasticity***, and is the assumption that the variation in the residuals (or amount of error in the model) is similar at each point across the model. In other words, the spread of the residuals should be fairly constant at each point of the predictor variables (or across the linear model). According to the data finding indicated that there is no heteroscedasticity problem in the model. It shows that the probability of chi square is equal to 0.83 which is significantly higher than alpha value=0.05 implies that the null hypotheses could not be rejected ***(See Annex III).***

4.2.2. Determinants of Child Nutritional status estimation with the OLS Model

The Determination of child nutrition status was estimated by Multivariate Linear Regression model by the following equation below. As shown in the below table, the following twelve variables are Birth order (BOC), Breastfeeding Status (BFSC), Time to visit health facility (TTVHF), Residence (RS). Age of Mother/guardian (AOM), Marital Status (MS), Family Size (FS), Education Status of Mother (ESM), Average Working Hours per Day outside Home (AWHPDOH), Age differential with Husband (ADWH), Satisfaction of women on the support they got from others (SOWOSFO) and Access to media (ATM) found statistically significant at 1 % and 5 % level of precision. On other hands, the remaining seven variables are Child Illness History (CIH), Occupation of Mothers (OOM), Decision Making Role of Women (DMROW), Knowledge level of Mother on Child Nutrition (KNOMCN), Monthly Income of the household (MI), Availability of toilet (AVT) and Source of drinking water/Regular Use of tap water (RUTW) found to be statistically insignificant (See Table 4.).

Table 4-Multivariate Linear Regression Analyses for Child Nutrition Status

Source	SS	df	MS		
Model	661.376271	19	34.8092774	Number of obs =	603
Residual	562.540992	583	.964907362	F(19, 583) =	36.08
Total	1223.91726	602	2.03308516	Prob > F =	0.0000
				R-squared =	0.5404
				Adj R-squared =	0.5254
				Root MSE =	.9823

IndicesFOCNS	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Birthorder	-0.08	0.04	-1.933	0.054	-0.15	0.00
Breastfeedingstatusofthechild	0.35	0.09	3.962	0.000	0.18	0.52
Childhistoryofdisease	-0.09	0.13	-0.675	0.500	-0.35	0.17
Timetovisithealthfacility	-0.38	0.09	-4.284	0.000	-0.56	-0.21
Residence	0.50	0.09	5.673	0.000	0.33	0.68
Ageofmother	0.02	0.01	2.437	0.015	0.00	0.03
Maritalstatusofmother	0.31	0.05	6.122	0.000	0.21	0.41
Familysize	-0.14	0.03	-4.269	0.000	-0.21	-0.08
Educationalstatusofmother	0.14	0.06	2.373	0.018	0.02	0.25
Occupationofmother	0.00	0.04	0.088	0.930	-0.08	0.09
AWHPDOH	-0.07	0.01	-5.307	0.000	-0.09	-0.04
ADWH	-0.05	0.01	-4.491	0.000	-0.07	-0.03
DMROW	0.03	0.09	0.331	0.741	-0.15	0.21
SOWSFO	0.21	0.04	5.813	0.000	0.14	0.28
KNOMCN	0.01	0.05	0.226	0.821	-0.09	0.11
MI	0.16	0.10	1.572	0.117	-0.04	0.35
AVT	0.12	0.08	1.485	0.138	-0.04	0.28
RUTW	0.13	0.09	1.495	0.135	-0.04	0.30
ATM	0.28	0.09	2.965	0.003	0.09	0.46
_cons	-3.22	0.56	-5.738	0.000	-4.32	-2.12

Source: - Field survey, 2018

From above table, we developed the following model for the discussions as below

Y = -3.22 - 0.08(BOC) + 0.35(BFSC) - 0.09(CIH) - 0.38(TTVHF) + 0.50(RS) + 0.02(AOM) + 0.31(MS) - 0.14(FS) + 0.14(ESM) + 0.001(OOM) - 0.07(AWHPDOH) - 0.65(ADWH) + 0.03(DMROW) + 0.21(SOWOSFO) + 0.01(KNOMCN) + 0.16(MI) + 0.12(AVT) + 0.13(RUTW) + 0.28(ATM).

According to the linear regression model results of our study the child related factors birth order and breast-feeding status are showed observable associations with the nutritional status of children. Birth order had negative relation with increased child nutritional status, which means increased birth order affect the children's nutritional status negatively. It means that, if Birth order increases by one more baby, keeping other variables constant, the child nutritional status decreases by 8% on average level. This can be due to more birth order leads to have less nutritional status and may be have small opportunity to give or deliver different types of children diet in that family by have more births. On other hands, breast-feeding status of children showed positive effect on child nutritional status. Children who were well fed their mother breast milk for their age had better anthropometric indices. It means that, if Breast feeding increases by 1% keeping other variables constant, the child nutritional status increases by 35% on average level. This can be due to Breastfed babies are healthier, have better growth and development compared to those who are under breast feed babies. Thus, this finding is similar to the works of Maren (2013), Tadiwos & Degnet .(2013) and Abebe &Tigist. (2018).

Residences for Mothers showed a positive effect on the improved child nutritional status as evidenced from the linear regression result. It means that, if Residence of mothers is nearer to urban, keeping other variables constant, and the child nutritional status increases by 50% on average level. It might be due to the fact that urban dweller mothers could have better opportunity of health facilities and better access to obtain more child nutrition information so as to improve the nutritional status of their children. This result is in agreement with the study done by Maysaloun, (2012), Neima et al., (2017), Ashenafi et al., (2019) and Zerihun et al., (2019)

The Time to visit health facility showed a negative association with child nutritional status. It means that, if Time to visit health facility increases by one more time or period, keeping other variables constant, and the child nutritional status decreased by 38% on average level. It can be due to, if mother of children travels more time to health centers or needs more health facilities, it may be shown that children are less access to different nutritional status or have more probability to being more malnutrition in that family. This finding of this study is consistent to the works of Adrianna et al., (2013) and Tadiwos & Degnet. (2013).

Age of mother also showed positive effects on child nutritional status. It means that, if age of mothers increases by one more year, keeping other variables constant, and the child nutritional status increases by 2% on average level. This result can be explained by the fact that mothers at lower age could have the chance of

malnourished children as that of mothers at older ages; however, mothers at Middle Ages (26-36 years of age) could have the possibility of having well-nourished children, which further could be associated with many biological facts. This finding of this study is consistent to the works of Maysaloun (2012), Adrianna et al., (2013), Tadiwos & Degnet. (2013) and Ashenafi et al., (2019).

Marital status is the other women related factors that showed strong association with the nutritional status of children. That is, if the mother of children becomes married, keeping other variables constant, and the child nutritional status increases by 31% on average level. This could be due to the fact that women who gave birth in marriage have the full freedom and social acceptance of growing their children than women who gave birth while not engaged in marriage. In addition, the children from mothers who were in marriage, but now either widow or divorced could have responsibilities of caring for their children and other family responsibilities so could have their limited resources including time that can be given for their children to grow them better. While, mothers who were married may have these opportunities so could have children with better nutritional status. This result is in agreement with the findings of Benta et al., (2012) and Adrianna et al., (2013),

Family size showed negative effects on the improved child nutritional status. It means that, if family size increases by one more baby, keeping other variables constant, the child nutritional status decreases by 14% on average level. This is in line with the theoretical aspects that children from increased number of family members are expected to have limited resources, including food, so are less likely to be well nourished. This result is also consistent with the result of Maysaloun, (2012), Tadiwos & Degnet. (2013) and Ashenafi et al., (2019).

The educational status of mothers also showed positive contribution to the improved nutritional status of children with its coefficient value of 0.14. According to the results, mother educational status changes by one more year of schooling, the child nutritional status increases by 14 %. This result was in agreement with the theoretical basis that, mothers who are well educated are expected to be more aware of their children health and nutritional status. And, this result is consistent with the works of Maysaloun, (2012), Anware et al., (2016), Neima et al., (2017) and Abebe &Tigist. (2018).

Age difference with husband was the other variable that showed negative relation with the nutritional status of children. It means that, if Age differences with husband increases by one more year, keeping other variables constant, and the child nutritional status decreases by 5% on average level. This might be due to the women whose age showed higher difference with their husband had children of low anthropometric indices and the theoretical ground that if the age difference of the two parents is wider their attitude towards the logic and science of child care including the way that children should be fed may also show greater gaps. This result is also in agreement with the result of Maysaloun, (2012) and Tadiwos & Degnet. (2013).

The other variable that our study investigated as the main women related variable that has positive relation with the children nutritional status was the level of women satisfaction on the support, they got from other members of their family including their husband. It means that, if was the level of women satisfaction on the support they got from other members of their family including their husband increases by one more support, keeping other variables constant, and the child nutritional status increases by 21% on average level. This might be due to women critically need s support from their family members to care of their children's and in most of developing countries exercises caring of children in social or group activities. This finding is similar to the works of Benta et al., (2012), Adrianna et al., (2013) and Zerihun et al., 2019).

Access to media was the other most variable the present study assumed to measure the availability and use of media that can help mothers to improve their knowledge, attitude as well as their practice on child nutrition or child care. According to the linear regression model result, access to media showed a positive relation with improved child nutritional status with a coefficient of 0.28. It means that, if access to media increases by one more choices or opportunity, keeping other variables constant, the child nutritional status increases by 28% on average level. It might be the mothers with more access to different media, they will have more opportunity to learn and know how to make or prepare children food in balanced aspects in particular, how to grow healthy children in general. This result is consistent with the works Anware et al., (2016) and Zerihun et al., (2019).

Besides, the variable that related with women's status, working hours that mothers spent outside their home. According to our linear regression model result this variable seems contributed little to our model with a coefficient value of 0.07. It means that, if average working hours that mothers spent outside their home increases by one more hour, keeping other variables constant, and the child nutritional status decreases by 7% on average level. This can be due to a good implication of that mothers can play immense role for their children growth at home as well as the wellbeing of the whole family. This finding is similar to the works of Abbi et al (1991), Sumonkanti &Rajwanur (2011) and Asabe et al., (2015).

Finally, the study tested the model goodness of fitness in the above table 4. The linear regression model with the continuous dependent variable of child nutritional status indices and nineteen predictor variables that measures child related factors, women status related factors and environmental related factors was found to be significant to predict. This is evidenced by the F-value = 36.08, and significance level (P-value) value of < 0.001 given in the model summary. Besides, as the model summary table showed that, Goodness of fit of the model

can be tested by the R Square value =0.54 evidences that our model can predict 54% of Child nutritional Status from the predictor or explanatory variables.

5. Conclusion and Recommendation

Child malnutrition currently remains a basic problem of most of developing countries including Ethiopia in which a large number of children, specifically below the age of five years have been suffering from it. The causes of child malnutrition are multidimensional that may range from factors as broad as the underlying causes such as political instability, to basic like socioeconomic growth and immediate causes such as disease. Thus, from this study, among 603 total number of observations the distribution of women's status related variables such as mothers who visit health facility between 24 to 48 hours, while their child ill, showed that 218(36.2%) and 62(10.3%) were normally nourished and malnourished children respectively. And the rest were for mothers who take above 72 hours to visit health facility. Similarly, mothers who had lower decision-making role relative to their husband had 129(21.4) normally nourished children and 116(19.2%) malnourished children. In addition, from 201 total numbers of malnourished children 189 children were children born from mothers who were not satisfied with others support on child caring activities.

Multivariate linear regression models were used and equally fitted with 19 independent variables related to individual child characteristics, mothers'/women's status and environmental related factors. Of which, most of the variables were those related to mothers. Collectively, these variables explained 54% of child nutritional status indices in the linear regression model. According to the result, child nutritional status indices showed positive linear relations with the independent variables like, Breastfeeding status of the child, Residence, Age of mother, Marital status, Education of mother, Occupation of mother, Decision making role of women relative to husband, Satisfaction of women on others' support, Monthly income of the Household, Availability of toilet, Regular use of tap water, Access to media, Knowledge of mother on child nutrition, Household income etc., while a negative linear relation with independent variables including, such as Birth order, Child history of disease, Time to visit health facility, Family size, Average working hours per day outside home and Age difference with husband.

Though, a lot has been done so far to make improvements in child nutritional status, in making decisions and in planning, policy makers or high-level officials in all development sectors should give due attention for child nutritional status through

- ✓ The intervention programs should focus on mothers' or in general women's status would contribute to the effort towards alleviating the problem of child malnutrition in Ethiopia. In particular, taking into account the low level of mothers' education and household status, policy actions that are meant to improve the educational status of women and other issues are critical in addressing the problem through improving their income earning capacity and also enhancing the quality of care and attention they can provide to their children.
- ✓ Also bridging the educational attainment gap between women and men, and encouraging women's participation in income generating activities can improve women's status and thereby their children's nutritional status.
- ✓ Concerned body should create awareness for women's by using medias don't give birth before marriage including coaching family planning programs, also we should fight against increasing divorce as much as possible since, it may keep children from not to be malnutrition due to having divorce, never married mother and large no of family simultaneously.
- ✓ Government and non-government organizations should concentrate on interventions in the three most important stages of a child's life: pregnancy, exclusive breastfeeding for the six first months and complementary feeding of the child from six to twenty-four months by creating awareness especially mother's breast milk feed to child.

Thus, further researches should conduct similar studies in different health institutions found in different parts of the country; which will help to conducted Meta analyses at least at a country level. Besides, studies should also give emphasis to promote the rarely used way of addressing child nutritional status using case control design approach, so as to make ease of comparing results, and for other econometric issues.

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Conflict of Interest Statement

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Operational Definitions

- **Access to media:** *the availability of a radio or television etc., and women's tendency to use these resources as a means to get health information.*
- **Anthropometric indices:** *the measure of the nutritional status of children using the age, weight and height variables; finally changed to the commonly used indices recommended for the age group using Z-scores less than -2; as Underweight, Stunted and Wasted.*
- **Malnourished:** *a child with Z-scores less than -2 in any form of the three anthropometric indices.*
- **Normally nourished** *child with Z-scores greater than -2 in any form of the three anthropometric indices.*
- **Cases:** *malnourished children*
- **Controls:** *normally nourished children*

Annexes

Annex 1-Cronbach's Alpha Test of Questionnaires Reliability during Pretest

Case Processing Summary			
		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0
a. List wise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	No of Items
.804	27

Source: - Field survey, 2018.

Annex II-Multicollinearity Test for All Explanatory Variables

```
. vif

    Variable |      VIF      1/VIF
-------------+----------------------
  Familysize |     2.20    0.454138
  Birthorder |     1.92    0.521565
         ATM |     1.34    0.748290
       DMROW |     1.29    0.775412
Educationa~r |     1.25    0.798966
     AWHPDOH |     1.25    0.803117
Timetovisi~y |     1.24    0.804769
      SOWSFO |     1.24    0.808460
 Ageofmother |     1.23    0.813476
   Residence |     1.22    0.818289
          MI |     1.22    0.822710
        ADWH |     1.21    0.823971
Maritalsta~r |     1.20    0.830253
Breastfeed~d |     1.20    0.832228
      KNOMCN |     1.11    0.901092
Childhisto~e |     1.07    0.933749
Occupation~r |     1.05    0.952090
        RUTW |     1.05    0.956873
         AVT |     1.02    0.983056
-------------+----------------------
    Mean VIF |     1.28
```


Annex III-Breusch-Pagan Test Result for Heteroskedasticity Test

```
. estat hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of IndicesFOCNS

         chi2(1)       =      0.05
         Prob > chi2   =    0.8311
```