Undernutrition Determinants Among Under Five Children in Ethiopia

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Abstract

The objective of this study was to estimate undernutrition determinants among under-five children in Ethiopia. Multiple logistic regression was computed to estimate explanatory variables. P-value < 0.05, 95% CI and odds ratio (OR) were considered. The analysis was done using SPSS, version 24.There was an association between distances from the borders and out of the borders with height for age Z score (P-value <0.05), but not associated with weight for height Z score (P value=0.18), and weight for age Z score (P value=0.16). Education of mother (P-value < 0.05), nutrition status of mothers (P-value <0.05), the wealth index of the households (P-value <0.05), employment status of mothers (P-value <0.05), place of residence (P-value < 0.05), age of the child (P-value <0.05), birth intervals (P-value < 0.05) and breastfeeding (P-value <0.05), were determinant factors for the stunting of children. Wealth index, region and place of residence, age of the child, the size of the child at birth, nutrition and employment status of the mothers, a birth interval of the child, and breastfeeding status of the child were the determinant factors.

Key Words Undernutrition, Determinants, Borders, Children, Ethiopia

INTRODUCTION/SECTION HEADERS ARE IN ALL CAPS

Malnutrition is a global public health problem and it's defined as, the imbalance between the supply of energy and the body's requirement to ensure growth, maintenance and different activities of the cell [1]. Malnourished children are easily affected by infection and high chance to die, repeated illness, this is because the immune capacity of the body to resist from disease is low. Malnourished children have low learning capacity and their growth is affected [2].

Ethiopia is one of the sub-Sahara Africa countries with the highest rates of child undernutrition, though small change observed from the previous year [3]. Among the total Ethiopians population 102.4 million (UNICEF 2017), 15.2 million are under-five children, among that 38 % of them were stunted and 24%) underweight [4]. In Ethiopia undernutrition cause 44% of health cost, 28% of all child mortality, 16% of primary school repetitions and the overall cost of undernutrition estimated as $ 4.7 billion, which is about 16.5% gross domestic product (GDP) of the country [5]. Undernutrition rates in Ethiopia are among the highest in the world [6]. Especially during the drought season, undernourished prevalence becomes very harsh. About 10% of Ethiopia's citizens are chronically food insecure and this figure rises to more than 15% during frequent drought years; 2.7 million People require emergency food assistance in 2014 and 238,761 children require treatment for severe and acute malnutrition in 2014 [7].

Investigating factors that cause malnutrition is important and that helps to identify areas of intervention to reduce malnutrition problem. Therefore, this study aims to estimate undernutrition and identify the determinant factors that are responsible for increasing child undernutrition in the country, and to

estimate the impact of the borders on nutritional status of children, 50km distances from the borders for each administrative region and the rest children, out of borders in Ethiopia were compared. By which ministry of health, especially health extension program of the country and researchers may use it as a baseline data for their future intervention and activities related to children's malnutrition.

OBJECTIVES OF THE STUDY General Objective
The general objective of this study was to estimate the overall undernutrition and determinants factors that could predict the nutritional status of under-five children and to estimate the association between child malnutrition and borders in Ethiopia.

Specific Objectives
1. To estimate the overall undernutrition burden among children in Ethiopia.
2. To identify determinant factors of undernutrition among children's in Ethiopia.
3. To estimate the association between child malnutrition and borders in Ethiopia.

MATERIALS AND METHODS

This study was conducted by using central statistical agency, demographic and health survey (CSA, DHS 2016) data of Ethiopia. All outcome and explanatory variables used for this study were extracted from this data source.

Data extraction and analysis methods

A total of 10641 children age 0-59 month were included in the study. From DHS 2016, the measured value of weight and height of children was converted into Z-scores based on the National Center for Health Statistics (NCHS) reference population and (WHO). Children with a Z score below (-2) standard deviations of the NCHS median reference for height-for-age, weight-for-age and weight-for-height are categorized as stunted, underweight, and wasted, respectively. Children with a Z score below (-3) height-for-age, weight-for-age and weight-for-height categorized as severely stunted, severely underweight, and severely wasted, respectively. And also, Children with a Z score above (-2) height-for-age, weight-for-age and weight-for-height, classified as not stunted, not underweight, and not wasted, respectively.
And also, the measured BMI values of mothers were recorded converted as normal weight 18.5-24.9, underweight <18.5, Overweight 25-29.9, and Obesity ≥30 to see the nutritional status of mothers about the nutritional status of children. The height-for-age Z score continues variables have transformed two categorical variables as stunted/ not stunted by recoding. The chi-square test applied to see the association between nutritional status of children and explanatory variables and to select variables for further analysis. Results presented with stratification by all explanatory variables that were included in the analysis. Multiple logistic regression was computed to estimate which explanatory variables have a major effect on the nutritional status of children, by including all available factors in the model.

To see the impact of living near or on the borders of the regions as a proxy for conflicts, the children's measured nutritional status samples were extracted within 50km distance from the borders and the rest of the country. Nutritional status of children samples was extracted from the projected central statistical, demographic and health survey data (DHS 2016). On 50km distances from the borders 54 Survey clusters were counted using (QGIS: View->Measure->Measure Line). The clusters were converted to total numbers of children's living within 50km from the borders by using 28 multiplying factors based on central statistical agency. Then samples within 50km distance became 1513 for each weight for age, weight for height and height for age Z scores. The remaining children nutritional status measured values were obtained from the survey. To estimate the nutritional status of children for 50km distance and the rest of country variables had created based on the geographical distances from the border of each administrative region within Ethiopia.

Analysis of variance (ANOVA) was computed to compare the variety of mean Z score of weight for age, weight for height and height for age between 50km distance from the borders and the rest of children's who were living out of the borders. For statistical significance p-value < 0.05, 95% CI and odd ratio (OR) were considered. Analyses were done using SPSS, version 24.

RESULTS

Overall undernutrition status of under-five children and sociodemographic characteristics of the households (CSA, DHS 2016), Ethiopia.

A total of 10641 children with interviews, respondents were extracted from (CSA, DHS 2016). From the total under-five children analyzed, 5883(51.5%) were males and 5158(48.5%) of them were females. Majority of sampled children were within the age groups 48-59 month, 12-23 month and 24-35 month age groups.

In Ethiopia the magnitude of under-five child undernutrition was high. Males (35.1 %) and females' (30.6%) under-five children were chronically malnourished (stunted) or height for age less than -2Zscore SD of the reference population. The average prevalence of stunting in Ethiopia was 32.9%, which was high malnutrition in the population level.

Males' (29.9%) and females' (27.4%) of children under five years of age were underweight weight for age less than -2 Z score SD of the reference population. And also 8.5% of males' and 8.6% of females' under-five children were acute malnourished (wasted).

When compare malnutrition prevalence between the urban and rural residents of under-five children, rural children were more affected by malnutrition than an urban residence. Among children who have been living in rural areas, 39.8% stunted, 10.2% wasted and 24.6% underweight respectively, whereas those living in urban were 25.3% stunted, 9%wasted and 13.3% underweight respectively.

Multiple logistic regression analysis was examined to see the impact of multiple risk factors on stunting and the contribution of individual factors on dependent variables. The result had shown that 12-23 month age children were 3.27 times more likely to be stunted than children less than 6 months age. (OR=2.23,95%CI=1.88-2.70). Children 6-11 months were 2.2 times more likely stunted than < 6 months child, (OR=2.23, 95%CI=2.57-4.15) and sex of the child, wealth index of the household, mother's education level, duration of breastfeeding and mother nutritional status were significantly associated with stunted children. (Table 1).

Nutritional status of children and borders in Ethiopia

The variation of the nutritional status of children was checked from different places where children living (50km distances from the borders and the rest of country). This was based on the principle that a mean Z-score of less than 0 (a negative mean value for stunting, wasting, or underweight) suggests a downward shift in the sampled children nutritional status relative to the reference. The farther away the mean Z-scores is from 0, the higher the prevalence of undernutrition (17).

The result revealed that there had statistically significant variation (P-value < 0.05) mean Z score of height for age for 50km distance from the borders and out of the borders. The mean Z score of weight for height for 50km distances from the border had not statistically different (P value=0.95) from the rest of the country. And also the variation means Z score of weight for age for 50km distance from the borders had not statistically significant (P value=0.37) from children's who were living out of the borders. (Table 2).

To see the association between the place where children were living from the borders and children's Z score height for age, weight for height and weight for age, Pearson Chi-square test was performed. mean children height for age Z score for 50 km distances from the border had associated significantly (P-value <0.05). But Child weight for age Z score within 50 km distances from the borders and the rest of the country had not associated significantly (P value=0.16). And also Children weight for height Z score and distances of 50 km from the border and children out of the borders had not associated significantly (P value=0.18). (Table 3).

TABLE I.

Variables	OR/Exp (B)	95%CI	P-value
Age(month)			
<6(ref.)			
6-11	2.23	[1.88,2.70]	< 0.05
12-23	3.27	[2.57,4.15]	< 0.05
24-35	1.32	[1.13,1.54]	< 0.05
36-47	0.81	[0.69,0.94]	< 0.05
48-59	0.84	[0.72,0.97]	< 0.05
Gender			
Male	0.96	[0.78,1.02]	< 0.05
Female(ref.)			
Region			
Tigray	1.785	[1.39,2.28]	< 0.05
Afar	0.812	[0.64,1.02]	0.077
Amhara	1.377	[1.08,1.76]	< 0.05
Oromia	1.563	[1.23,1.95]	< 0.05
Somali	1.391	[1.11,1.74]	< 0.05
Benishangul	0.938	[0.74,1.19]	0.601
SNNP	1.318	[1.05,1.66]	< 0.05
Harari	1.153	[0.89,1.45]	0.284
Gambela(ref.)			
Wealth index			
Poor	0.5	[0.39, 0.51]	< 0.05
Middle	0.7	[0.47, 0.63]	< 0.05
Rich(ref.)			
Mothers' education			
No education		[0.301, 0.52]	
Primary	0.396	[0.430, 0.76]	< 0.05
Secondary	0.572	[0.572, 1.10]	< 0.05
Above secondary (ref.)	0.793		0.166
Size at birth			
Very small	0.819	[0.45, 1.48]	0.507
Small	0.813	[0.45, 1.47]	0.493
Average	0.710	[0.39, 1.27]	0.248
Larger(ref.)			
Birth interval (month)			
Nutritional status of mothers			
BMI <18.5	0.500	[0.40,0.62]	<0.05
BMI 18.5-24.9	0.552	[0.45,0.67]	<0.05
BMI >25(ref.)			

a. (CSA,DHS 2016).

Figure 1. Multivariate logistic regression of explanatory variables and stunted children (height for age < -2Z score), Ethiopia.

TABLE II.

Variables	n=9696	Mean Z score	P value
Height for age Z score			
50km from the borders	1513	-1.6441	< 0.05
The remaining child	8183	-1.9412	
Weight for height Z score			
50km from the borders	1513	5.46	0.95
The remaining child	8183	6.76	
Weight for age Z score			
50km from the borders	1513	4.34	0.37
The remaining child	8183	5.05	

Figure 2. The variation of height for age Z score, weight for height Z score and weight for age Z score within 50km distances from the borders of each regional states and the rest of the population in Ethiopia.

TABLE III.

Variables	N=9696	X^2 _value	P value
Height for age Z score			
Child on 50km distance from the borders	1513	1070.25	< 0.0
The remaining child	8183		
Weight for height Z scores			
Child on 50km distance from the borders	1513	779.6	0.184
The remaining child	8183		
Weight for age Z score			
Child on 50km distance from the borders	1513	765.28	0.16
The remaining child	8183		

Figure 3. The association between children height for age Z score, weight for height Z score, weight and borders in Ethiopia.

DISCUSSION

The objective of this study was to identify the determinant factors that are responsible for causing child malnutrition. To find out those factors for child malnutrition, binary regression and multivariate logistic regression analysis were performed.

Based on the result, in addition to inadequate food intake, many factors increase malnutrition. Multiple factors, such as the child's size at birth and the mother's nutritional status, mother's employment status, mother's education, place of children's residence, birth intervals of children, child age and the other factors increase child malnutrition.

Stunting is one of the indicators of chronic malnutrition. This study result indicated that there was a significant regional variation of stunting (P <0.05) for under-five children. Amhara (46%), Benishangul Gumize (43%), and Afar (41%) were the most affected regions respectively, whereas Gambela (24%) was least affected region. Diredawa (40%) was more affected than Addis Ababa (14%), which are two administrative cities in Ethiopia.

DHS 2000 survey of Ethiopia has shown that Amhara (57%), Tigray (56%), and SNNP (54%) were the most affected regions were as Addis Ababa (27%) was a relatively less affected city (18). In 2011 DHS also have indicated that Amhara (52%), Tigray (51%) and Afar (50.2) were respectively were the most affected regions, but Addis Ababa was less affected by stunting under-five children (19). As we have observed from the three surveys of Ethiopia that the Amhara region is continuously affected by stunting and child undernutrition is the most serious health and welfare problem facing the population of Ethiopia. Stunting of children had been significantly associated with children's age (Pvalue<0.05) and the risk of stunting variation within different child age groups in both sexes after 6 months increasing. The highest stunting prevalence was 47%, within 24-35 month age group. This might be due to mostly this age's groups' breastfeeding terminated, but complementary feeding children might not be easily started, but the body requires energy that leading imbalance for energy deficiency. Age less than six months and age between 6-8 month of the child were less affected by stunting, that were 16% and 15%, respectively, this is due to child up to six months exclusively feed breast milk that has enough source of energy and up to eight months a child also adds complementary feeding in addition to breastfeeding. Study of Somali region, Ethiopia showed that children age 6-11month and 24-35 month were highly affected by stunting (20).

The burden of stunting among under-five children was higher in rural area (39.8%) than in urban areas (25.3%). And the variation of stunting between urban and rural areas was significant (P-value < 0.05). The ratio of stunting among male children was higher (35.1%) than female children (30.6%) and the variation also statistically significant (P value=0.03). Another study in Ethiopia showed that children living in rural areas were more stunted than urban children, Amhara region was more affected than other regions, but no malnutrition difference between males and female children (19). This difference might be due to the sample size variation between genders.

A study conducted in Congo showed that the geographic difference affected significantly on child malnutrition (21) and the prevalence of stunting was significantly higher among the 6–24 months old children (13.3%) compared to the children aged 25–72 months old (7.8%). Whereas the study in Armenia showed that did not find any differences in the prevalence of stunting by place of residence in either age group (22).

Mothers educational level has important role of children nutritional status, the prevalence of stunting children among non-educated mothers was higher (41%), 35% of stunted children were found among mothers educated up to primary school, 21% of stunted children were found among mothers educated up to high school and 17% of stunted children were found mothers educated above high school. Mothers' education was statistically negatively associated with stunting of children (P-value <0.05) that means the more educated mothers would be, the less the prevalence of stunting children. Another study in Ethiopia showed that mothers' education level and their relative household status are important determinants of the nutritional status of children. Also, household economic status and age of a child showed a strong association with nutritional status (23).

This study also showed that the variation of stunting children among employment status of mothers was significant (P-value <0.05), that means more stunted children were recorded among non-employed mothers whereas the least number of stunted children were observed from employed mothers. As understand from this study, mother education and employment have a vital role to prevent child malnutrition. The educational level of mothers can play a better role in ensuring to prevent children's undernutrition. Educated mothers may have better-paid jobs thus be able to earn a higher income and take better care of their children, be resident in urban areas where there are functioning social infrastructures, possess commendable culture of hygiene needed to protect children from diseases, be more likely to participate in child health-enhancing programs.

Another study in Ethiopia also showed the variation of child malnutrition between employed and non-employed mothers (24). And Child undernutrition has long-term negative effects on people's lives, most notably in health, education, and productivity, and seriously affects the human capital of a country. The wealth index of households also an important determinant factor in the prevalence of stunted children. Stunting prevalence within the lowest (poorest) households was higher (43%), stunting children from the second (poorer) households was (42%), stunted children from middle-level households was (38%),

the prevalence of stunting children from richer households was (37%) and stunting children from those of richest households was (27%). The association between wealth index of households and stunting children was statistically significantly correlated (P-value < 0.005 (1)). This showed that children's stunting could be reduced by improving the economic status of households, i.e. The wealthiest households could be the less children's stunting.

Another study based on Ethiopian (DHS 2011) was estimated that children from households in Tigray, Afar 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 was considered to be important determinants of nutritional status of children (25). Birth intervals were significantly negatively associated (P-value < 0.05) with stunting among under-five children. The highest prevalence of stunting was found for children of birth interval less than 24 months (45%) and relatively less stunted children were observed in birth interval greater than 48 months (35%).

Another study also estimated that the prevalence of malnutrition among children in rural Ethiopia was high. A child older than 12 months, having an uneducated mother, living in a household with poor health status, born with short birth interval, and living in some region of the country are associated with increased malnutrition (26).

Child malnutrition also depends on the size of the child at birth and the nutritional status of mothers. 86% of stunted children was observed among very small size children at birth and 43% of stunted children were found from children those sizes was small and also average/larger size children at birth the prevalence of stunting was 36%. The association between the size of children at birth and stunting was statistically significant (P-value <0.05).

The prevalence of stunted children from those malnourished mothers was higher and the association was significant (P value=0.04). A high number of stunted (42%) children were found from mothers of BMI less than 18.5 and 39% of stunted children were recorded from mothers of BMI (18.5-24.9) whereas those mothers of BMI (>25) stunting children were 20%.
The estimated variance of mean height for age Z score from 50km distances from the borders and the rest of the country were significant (P-value <0.05). And also the association between height for age Z score with 50km distance from the borders and out of the borders were significant (P-value < 0.05). This may due to the long term effects of border proximity for conflicts on chronic malnutrition of children, and further investigation is needed.

Child weight for age Z scores 50 km distances from the border and out of the borders had not associated significantly (P value=0.16). And also Children weight for height Z score and distances for 50 km from the border had not associated significantly (P value=0.18). The mean Zscore of weight for height and weight for age did not show difference on the borders and out of the borders. Whether families of children are living on the borders of each administrative region, or they are living far from the border, at the centre of the country, for example, wasting and underweight problems have been found in all areas of the country. This was due to all-region borders might not be affected by conflicts.

In Ethiopia conflicts against the government occurred anywhere in the country, especially in Amhara, and Oromia region. If conflict happened to the borders of the regions, that disturbs the day to day activities of the population who are living around the borders, in that case, affect the nutritional status of children and the life of the society in general.
It is obvious that children's who are living in the unstable environment due to conflict or war, that destruct the health and well being of their life and have long-lasting health and economic consequences. On the other side, poor health and nutritional status can play a key role in inducing conflicts (27).

Limitation of the study:
Food security data, which is a determinant factor for malnutrition, but this data had not included in the analysis, this was due to the absence of food security variable in (CSA, DHS 2016), Ethiopia. This study used a cross-sectional study, this design can't show the cause and effect relationship between determinant factors those associated with undernutrition, that means association did not mean

causation. Samples were not allocated proportionally across the regions and among children age groups (sampling bias) and measurement errors, were some of the limitation of this study.

CONCLUSION

Based on the result, come up the following conclusion. Malnutrition was the main problems affecting the health and well being of children in Ethiopia. Stunting prevalence was very high among children of all regions and it was extremely high in Amhara region.

High wasted prevalence had observed in Somali region as compared to the other region of Ethiopia. Children's who were living in rural areas were more affected than children who were living in urban areas.

The nutritional status of children had influenced by many explanatory factors. Among those factors, wealth index, region and place of residence, age of the child, the size of the child at birth, nutrition and employment status of the mothers, the birth interval of the child, and breastfeeding status of the child were among the determining factors for chronic energy deficiency of the child.
Mean Z scores of height for age had seen a difference on borders and out of the borders and the association also significant. But weight for age and weight for height mean Z scores had not shown variation and the association also not significant.

ACKNOWLEDGMENT

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