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Determinants of Stunting and Wasting Among Under-Five Children of Ethiopia: Analysis of Mini-demographic and Health Survey 2019 of Ethiopia

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Abstract: In Ethiopia stunting and wasting is long term year round health problem, which makes difficult to end all forms of malnutrition by 2030. But, there were progresses in the reduction of under nutrition level among under five children. The aim of this study therefore is, to identify determinants of stunting and wasting among under-five children in Ethiopia. Cross-sectional data from the 2019 mini demographic and health survey was used. A total of 5279 and 5408 under-five children were involved for the analysis of stunting and wasting respectively. According to a multivariate logistic regression, the odds of being stunted for a child 36-47 months was three times higher (aOR=3.47; 95% CI: 2.15, 5.59) compared to less-than six months child. The odd of stunting (aOR =0.72; 95% CI: 0.58, 0.89) and wasting (aOR =0.59; 95% CI: 0.43, 0.81) was lower for female sex children. Children born richest family had lower risk of being stunted (aOR=0.43; 95% CI: 0.24, 0.79). *In conclusion* there were higher prevalence of stunting and wasting among under- five children in Ethiopia when referencing the global and national target of nutrition. Male sex was the associated factors for both stunting and wasting. Creating awareness for the proper and optimal feeding of male sex and older age children are recommended.

Keywords: Stunting, Wasting, Under-Five Children, Ethiopia

1. Introduction

Malnutrition is a deficiency or improper intake of energy and nutrients. Under nutrition is one form of malnutrition [1]. Under nutrition includes stunting and wasting [2]. It is a major public health problem and an important health indicator for monitoring nutritional status under- five years [3]. According to world health organization (WHO) stunting and wasting are defined as Z-scores less than -2 standard deviations of height for age and weight for height respectively [4].

The prevalence of under nutrition among under-five children is falling. In 2016, the numbers of stunted and wasted were 155 million and 52 million respectively globally [5]. But, it remains endemic in southeastern Asia (SA) and sub-Saharan Africa (SSA) [6, 7]. SSA had the highest and persistent burden of under nutrition [8, 9], where more than one-third of stunted children (38%) and more than one-quarter of wasted (27%) children lived [3]. In Ethiopia, malnutrition among under-five children is one of the highest in SSA [10-13]. Under nutrition in Ethiopia is also long term year round health problem of under five children, Though there were progress in the reduction of under nutrition level among children [14, 15].

Stunting and wasting caused morbidity and mortality among under-five children [16]. Stunting is the critical health problem, because it has irreversible effects that include impaired cognitive and physical development, lower economic productivity, poorer reproductive performance and increased susceptibility to metabolic and cardiovascular diseases [5, 12, 15]. More than half of 10 million under five deaths is due to malnutrition [2, 5, 17], 98% of these mortalities occurred in developing countries [18]. In Ethiopia malnutrition is the major underlying cause of under-five child death, contributing to around 45% of child mortality [19].

Malnutrition is the complex overall interaction of household, environmental, socioeconomic, and [2, 5, 20].

Household socio economic status are the most commonly associated factors of child growth [21]. Mother's educational status, child age, birth order, water sanitation and hygiene services are also the determinants of child nutritional status [21, 22]. Several previous studies documented sex of child, mother's age, household food insecurity and father's education were an important contributing factors of child malnutrition [5, 10, 13, 15, 23].

The United Nations Sustainable Development Goals (SDGs) targets to end all forms of malnutrition by 2030 [10, 13]. To achieve this goal Ethiopia must reduce up to 40% of stunting and wasting from the current burden [2]. This is not simple task, but it require highest possible commitment of government and several stakeholders [7] High quality evidence generated from updated and nationally representative data is an important step to achieve the goal. With this regard, this study on the determinants of wasting and stunting among under-five children in Ethiopia helps policy makers, health managers and other responsible bodies to prioritize actions in reducing the risks of malnutrition among under- five children in Ethiopia. The study was based on the mini demographic and health survey of Ethiopia 2019.

2. Methodology

2.1. Study Setting

Ethiopia is situated in the horn of Africa covering about 1.1 million square kilometers area. It is also one of the second populous countries in Africa, where more than 13.2 million under-five children lived. Ethiopia currently implement the growth and transformation plan (GTP) and a plan for accelerated and sustained development to end poverty (PASDEP) as part of transforming the nation economy [19].

2.2. Data Source

Data from 2019 Ethiopian mini demographic and health survey (EMDHS) was used in this study, which is the second mini survey conducted in Ethiopia. The survey data is publically available on DHS program. It was implemented by the Ethiopian Public Health Institute (EPHI), in partnership with the Central Statistical Agency (CSA) and the Federal Ministry of Health (FMoH). The survey was conducted March 21, 2019 to June 28, 2019 [24].

2.3. Sampling and Participants

The national representative sample for 2019 EMDHS was obtained using two stage stratified cluster sampling. Each of the nine geographical regions and two administrative cities (Addis Ababa and DireDawa) were stratified into urban and rural areas. Enumeration areas (EA) sample frame based from 2019 Ethiopia population and housing census (EPHC) and the central statistical agency (CSA). At the first stage of sampling, a total 305 EAs were selected using independent probability proportional to EA size. In the second stage, from household listing of each cluster in the first stage 30 household were selected using probability systematic selection. The total sample household selected to collect data were 9,150 households, of them data from 8,663 household were collected. 8,855 women of reproductive age (age 15-49) were interviewed during the survey period. Height and weight measurements were done for children age 0-59 months of interviewed households [24, 25].

2.4. Study Variables

2.4.1. Dependent Variables

Stunting and wasting among under-five children were used as dependant variable. They were defined using the WHO child growth standards and coded as binary variables based on standard deviation [25]. Normal height-for-age/not-stunted (HAZ-2SD and above) coded as "0" and stunted (HAZ < -2) coded as"1". Normal weight-for-height/not-wasted (WHZ-2SD to +2SD) coded as "0" and wasted (WHZ < -2SD) coded as"1".

2.4.2. Independent Variables

The predicator variables used in this study were selected after reviewing previous literature [5, 10, 13, 26, 27] and from EMDHS background characteristics for child nutrition report [24]. The predictor variables categorized into child characteristics and household level variables. The child characteristics include sex, age, and birth interval and birth order of the child. The variables included under household level were maternal education, age and sex of the head of household, wealth index, and drinking water, type of toilet facility, fuel type and place of residence.

The coding plan for the independent variables were conducted based on the classification used by WHO/UNICEF 2018 water and sanitation survey report (DHS) and Ethiopia mini demographic and health survey 2019 [24]. The child age categorized as <6, 6-8, 9-11, 12-17, 18-23, 24-35, 36-47 and 48-59. The child birth interval categorization were <24, 24-47 and >= 48. The variable drinking water coded into unimproved sanitation=1; improved sanitation=0. Cooking fuel coded as Clean fuels=0; solid fuel for cooking=1. Drinking water coded as improved drinking water=0; unimproved drinking water=1.

2.5. Statistical Analysis

Stat software version 14.2 was used to analyze the data. The svy: command was applied to adjust sample design and weight in the EMDHS dataset. The prevalence of stunting and wasting among under-five children were also calculated using svy: command prefix. Variables with p-value <0.05 in the bi-variate logistic analysis were used in multivariate logistic analysis to determine associations between the independent variables and outcome variables (stunting and wasting). The result was presented in form of odds ratio (OR) with 95% confidence interval (CI).

3. Result

From the total of 5279 under-five children with

anthropometric data 37% were stunted. While the prevalence of wasting, from the total of 5408 under-five children were 7%. (See table 1).

Table 2 shows the associations of each determinant with stunting and wasting. Determinants associated with stunting at p- value<0.05 were sex of child, age of child, mothers educational level, wealth index, sex of the head of household, household fuel type, type of toilet facility, place of residence and region. For wasting the associated determinants at p-value<0.05 were sex of child, birth order, mother's highest educational level, sex of the head of household, wealth index and region.

Table 3 revealed the adjusted effect of determinants on stunting and wasting. Sex of child was the only determinant associated with both stunting and wasting. Female sex was at low risk of being stunted (aOR=0.72) and wasted (aOR=0.59) compared to their male counterpart. The risk of children being stunted for children aged 9-23 months and 24-59 months compared to for less than six months aged children was two and three times higher respectively. The odds of being stunted for children from richest family were 0.38 times lower compared to their poorest counterpart. As it is seen below, the risk of being stunted for children lived in Addis Ababa were 0.25 times lower compared to children lived in Tigray region,. The odds of being wasted for children between fourth to fifth birth order was 1.67times higher compared to first birth order. While the odds of children being wasted lived in Somali region, were 1.84 times higher compared to children lived in Tigray region.

Table 1. *Prevalence of Stunting and Wasting among under-five children in Ethiopia, EMDHS, 2019.*

Nutritional status	Frequency	Prevalence (%)
Stunting (N = 5279)		
no stunting	3338	63
Stunting	1941	37
Wasting (N=5408)		
no wasting	5029	93
Wasting	379	7

Table 2. *Bivariate analysis of factors associated with Stunting and Wasting among under-five children in Ethiopia, EMDHS, 2019.*

Study variables	**Stunting**		**Wasting**	
	COR (95% CI),	**P-value**	**COR (95% CI)**	**p-value**
Sex of child				
Male	1		1	
Female	0.77 (0.63, 0.93)	0.006	0.58 (0.43, 0.78)	0.000
Child age (months)				
<6	1		1	
6-8	1.29 (0.762.14)	0.325	0.46 (0.21, 0.99)	0.048
9-11	2.42 (1.44, 4.07)	0.001	0.87 (0.40, 1.89)	0.733
12-17	2.08 (1.42, 3.04)	0.000	0.91 (0.48, 1.73)	0.776
18-23	2.67 (1.64, 4.35)	0.000	0.70 (0.38, 1.29)	0.255
24-35	3.90 (2.47, 6.14)	0.000	0.77 (0.45, 1.32)	0.340
36-47	3.33 (2.22, 4.98)	0.000	0.51 (0.30, 0.87)	0.014
48-59	3.73 (2.44, 5.70)	0.000	0.78 (0.44, 1.37)	0.382
Preceding birth interval (months)				
<24	1		1	
24-47	0.88 (0.70, 1.11)	0.293	1.26 (0.86, 0.60)	0.463
>=48	0.56 (0.44, 0.72)	0.000	0.68 (0.41, 1.13)	0.139
Birth order				
1	1		1	
2-3	1.013 (0.81, 1.28)	0.910	1.66 (1.06, 2.60)	0.027
4-5	1.13 (0.84, 1.52)	0.422	2.22 (1.40, 3.53)	0.001
>=6	1.25 (0.94, 1.67)	0.117	1.97 (1.26, 3.08)	0.003
Mother's highest educational level				
No education	1		1	
Primary	0.76 (0.64, 0.91)	0.002	0.51 (0.35, 0.73)	0.000
Secondary	0.33 (0.22, 0.48)	0.000	0.59 (0.26, 1.34)	0.209
Technical /vocational	0.39 (0.20, 0.74)	0.004	0.02 (0.01, 0.08)	0.000
Higher	0.18 (0.08, 0.46)	0.000	0.25 (0.06, 1.15)	0.074
Age of head of household (Years)				
<20	1		1	
20-34	1.24 (0.26, 5.79)	0.785	0.30 (0.08, 1.15)	0.078
35-49	1.48 (0.32, 6.88)	0.616	0.32 (0.09, 1.19)	0.090
50-95	1.40 (0.286.88)	0.679	0.29 (0.08, 1.07)	0.062
Sex of head of household				
Male	1		1	
Female	0.67 (0.52, 0.86)	0.002	1.83 (1.26, 2.65)	0.002
Wealth index				

Study variables	Stunting		Wasting	
	COR (95% CI),	P-value	COR (95% CI)	p-value
Poorest	1		1	
Poorer	0.82 (0.58, 1.17)	0.273	0.56 (0.37, 0.84)	0.005
Middle	0.95 (0.71, 1.29)	0.766	0.41 (0.25, 0.66)	0.000
Richer	0.71 (0.48, 1.06)	0.093	0.50 (0.30, 0.83)	0.007
Richest	0.38 (0.26, 0.56)	0.000	0.31 (0.18, 0.51)	0.000
Source of drinking water				
improved drinking water	1		1	
unimproved drinking water	1.07 (0.87, 1.31)	0.528	1.02 (0.71, 1.47)	0.898
Type of toilet facility				
improved sanitation	1		1	
un improved sanitation	1.50 (1.11, 2.02)	0.008	0.97 (0.66, 1.43)	0.875
Household fuel type				
Clean fuel	1		1	
solid fuel	2.14 (1.44, 3.17)	0.000	1.19 (0.46, 3.08)	0.715
Place of residence				
Urban	1		1	
Rural	1.90 (1.33, 2.72)	0.000	1.42 (0.95, 2.10)	0.085
Region				
Tigray	1		1	
Afar	0.78 (0.57, 1.08)	0.134	1.56 (0.91, 2.67)	0.103
Amhara	0.76 (0.53, 1.08)	0.124	0.82 (0.49, 1.37)	0.451
Oromia	0.58 (0.43, 0.80)	0.001	0.45 (0.26, 0.79)	0.006
Somali	0.47 (0.32, 0.68)	0.000	2.72 (1.74, 4.27)	0.000
Benishangul-Gumuz	0.73 (0.42, 1.29)	0.281	0.67 (0.38, 1.26)	0.221
SNNR	0.61 (0.44, 0.85)	0.004	0.67 (0.34, 1.34)	0.259
Gambela	0.22 (0.14, 0.35)	0.000	1.51 (0.94, 2.43)	0.089
Harari	0.61 (0.42, 0.89)	0.010	0.43 (0.22, 0.81)	0.009
Addis Ababa	0.19 (0.11, 0.32)	0.000	0.23 (0.10, 0.52)	0.001
Dire Dawa	0.36 (0.26, 0.51)	0.000	0.63 (0.34, 1.16)	0.136

Table 3. *Multivariate analysis of factors associated with Stunting and Wasting among under-five children in Ethiopia, EMDHS, 2019.*

Study variables	Stunting	Wasting
	AOR (95% CI),	AOR (95% CI)
Sex of child		
Male	1	1
Female	0.72 (0.58, 0.89)	0.59 (0.43, 0.81)
Child age (months)		
<6	1	1
6-8	1.17 (0.61, 2.23)	0.47 (0.22, 1.00)
9-11	2.93 (1.605.39)	0.83 (0.35, 1.96)
12-17	2.02 (1.33, 3.07)	0.97 (0.51, 1.84)
18-23	2.36 (1.37, 4.07)	0.80 (0.42, 1.54)
24-35	3.95 (2.20, 7.10)	0.79 (0.45, 1.37)
36-47	3.47 (2.15, 5.59)	0.41 (0.24, 0.72)
48-59	3.12 (1.93, 5.05)	0.75 (0.41, 1.37)
Preceding birth interval (months)		
<24	1	-
24-47	0.85 (0.68, 1.05)	-
>=48	0.55 (0.43, 0.71)	--
Birth order		
1	-	1
2-3	-	1.43 (0.88, 2.31)
4-5	-	1.67 (1.01, 2.77)
>=6	-	1.38 (0.83, 2.29)
Mother's highest educational level		
No education	1	1
Primary	0.84 (0.69, 1.02)	0.72 (0.47, 1.09)
Secondary	0.25 (0.14, 0.45)	0.92 (0.382.21)
Technical /vocational	0.38 (0.19, 0.74)	0.04 (0.01, 0.13)
Higher	0.26 (0.07, 0.91)	0.46 (0.10, 2.16)
Sex of head of household		
Male	1	1
Female	0.71 (0.53, 0.95)	1.28 (0.83, 1.97)
Wealth index		
Poorest	1	1

Study variables	Stunting	Wasting
	AOR (95% CI),	AOR (95% CI)
Poorer	0.81 (0.53, 1.25)	0.95 (0.56, 1.61)
Middle	0.95 (0.64, 1.41	0.63 (0.35, 1.17)
Richer	0.78 (0.47, 1.29)	0.85 (0.48, 1.49)
Richest	0.43 (0.24, 0.79)	0.59 (0.32, 1.06)
Household fuel type		
Clean fuel	1	-
solid fuel	0.42 (0.22, 0.78)	-
Region		
Tigray	1	1
Afar	0.54 (0.35, 0.84)	1.19 (0.64, 2.22)
Amhara	0.59 (0.40, 0.85)	0.76 (0.43, 1.34)
Oromia	0.39 (0.26, 0.59)	0.46 (0.25, 0.83)
Somali	0.28 (0.16, 0.49)	1.84 (1.04, 3.25)
Benishangul-Gumuz	0.55 (0.29, 1.02)	0.57 (0.301.08)
SNNR	0.44 (0.29, 0.67)	0.63 (0.31, 1.29)
Gambela	0.26 (0.14, 0.46)	1.48 (0.77, 2.83)
Harari	0.54 (0.35, 0.83)	0.51 (0.26, 0.99)
Addis Ababa	0.25 (0.12, 0.49)	0.39 (0.14, 1.05)
Dire Dawa	0.33 (0.22, 0.49)	0.66 (0.34, 1.27)

4. Discussion

This study reports the prevalence and determinants of stunting and wasting among under- five children in Ethiopia from the nationally representative 2019 mini survey. The paper examined that the prevalence of stunting (37%) was reduced as compared to 2016 demographic and health survey of Ethiopia and 2014 mini demographic and health survey (38%). It is also lower than the study conducted in Congo, which reports 43% stunted children [28]. However, the reduction of stunting did not achieved the national target of 26% by the year 2019 [14, 29] and very far away from 2030 sustainable development goal of eliminating stunting [27]. This may explained by the fact that some region did not run according to the national plan [15, 28] or nutritional crisis [23] due to displacement or conflict in the nation may affect success in reducing stunting and wasting. My paper also showed the prevalence of wasting was 7%, which is lower than the 2014 EMDHS report and the study done in Nigeria [30]. This might be because of the nutritional intervention taken by the government of Ethiopia [31].

The result of the present study showed that male children are at risk of being stunted and wasted compared to female children. Similar finding were reported in the previous studies [13, 26, 32, 33]. This is maybe explained by the fact that male child need more calories for growth and development in their early childhood than female counterparts [5, 26] or male child usually involve in high energy consuming tasks [34]) or early introduction of complementary feeding to male child due to parental preferences, which expose child to frequent infection [35].

My study evidenced that children aged between 48-59 months are three times stunted compared to children below six months age. A similar finding were observed in the previous study done in Ethiopia, South Asian countries [13, 27, 36]. This can explained by the fact that insufficient feeding for older children by their parents [13, 37, 38] or initiation of low nutritional quality food as the age of the child increase [37, 39]. However, this age group are at lower risk of being wasted compared to six months aged children. Consistent to this previous study showed that older children were less likely develop wasting [10, 11]. The possible explanation is as children grow older they are less vulnerable to infection [11].

The current study found that children born with more than 48 months of preceding birth interval are at low risk of developing stunting. This finding consistent with the previous studies done in Bangladesh, Ethiopia [10, 40]. This might be for the fact that the family get enough time for child care in over all wellbeing [27, 37]. In this study I found that children born between fourth and fifth birth order are at risk of developing wasting compared to the first birth order children. This might be explained by the fact that household food allocation is reduced with the increasing of birth order or children of higher birth order mostly get less attention and care from their family [41].

This study showed that children from richest family were not at risk of being stunted as compared the poorest counterpart. This was reported in previous study [10, 13, 42, 43]. It might be explained by the fact that wealthiest family have the capacity to purchase adequate and diversified foods for their children [44]. Another finding of the current study is that household utilized solid fuel for cooking had lower stunted children as compared to those utilized clean fuel. Contrary to this finding previous study reported that the burden of stunting is higher among household utilized solid fuel for their cooking [26, 45, 46]. This may be due to the fact that easily accessibility and lower cost of solid fuel [47] may help parents to replace expenses in buying child food or the context of the study area may affect the result.

The use of most recently nationally representative collected data for analysis was the strength of the study. However, this study had several limitations. Firstly, it is

difficult to establish cause and effect relationship between the study variables and outcome variable. Secondly, there may be over or under estimation of result due to recall bias and measurement error occurred during survey. Thirdly, the 2019 Mini-demographic and health survey of Ethiopia did not collect all data required for analysis, like religion of participants that may affect the outcome.

5. Conclusion

This study revealed there was higher prevalence of stunting and wasting among under- five children in Ethiopia when referencing the global and national target of nutritional status. Male sex was the associated factors of both stunting and wasting. Factors like child from poorest family, older age and lower birth interval children were at higher risk of developing stunting. But children were at high risk of being wasted, as they were younger age and higher birth order children. Children lived in Oromia and Harari were at lower risk of developing stunting and wasting. While children from Gambela and Somali, were at higher risk of developing wasting.

6. Recommendation

I recommend creating awareness for proper and optimal feeding of male sex, older and very young age and higher birth order children by their family. Strengthening intervention like safety net and others implemented on children born from poorest family is very important, especially for regions commonly affected by under nutrition. Further studies should be done to clear the effect of household cooking material on stunting among under-five children.

Author Contribution

Conceptualization, Formal analysis, Methodology, Writing Original Draft, Review & Editing was done by Bashaw Wogderes.

Conflict of Interest Statement

The author declares that he has no competing interests.

Abbreviation

SSA: Sub Saharan Africa; EMDHS: Ethiopian Mini Demographic and Health Survey; EA: Enumeration area; WHO: world health organization; DHS: Demographic and Health Survey.

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