

Prevalence and Determinants of Chronic Malnutrition Among Under-5 Children in Ethiopia

Berihun Megabaw^{1,*} and Azizur Rahman²

¹Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia

²Discipline of Mathematics and Statistics, School of Computing and Mathematics, Charles Sturt University, Australia

Abstract: *Objectives:* This paper studied the prevalence and determinants of chronic malnutrition in under-5 children from the 2011 Ethiopian Demographic and Health Survey dataset.

Methods: The 2011 EDHS collected data on the nutritional status of children by measuring the height and weight of all children under age five in the sampled households, and calculated anthropometric indicators using the new WHO (2006) growth standards.

Children whose height-for-age Z-score was below minus two standard deviations (-2 SD) from the median of the WHO reference population are considered *stunted* or chronically malnourished and if Z-scores are between -3 SD \leq Z-score < -2 SD were identified as *moderately stunted* and if below -3 SD as *severely stunted*. Some variables were computed by combining information for original variables. The 2011 Ethiopian DHS dataset was obtained for further analysis from MEASURE DHS after permission. Complete anthropometric data for 9,611 children aged 0 to 59 months were analyzed.

Results: The overall prevalence of stunting in children was 42.3%, with 20.4% severely stunted. Socio-demographic factors were significantly associated with both severe and moderate forms of stunting. Multivariate analysis showed that parents' education, household wealth index, age of household head, child's age, months of breast-feeding, place of delivery, media exposure, mother's BMI and residential differentials were the underlining determinants of stunting.

Conclusions: Chronic malnutrition in children is a public health problem in Ethiopia specifically as children grow older to age three. To achieve the Millennium Development Goal target of 34% malnutrition prevalence by 2015, it is imperative to have specific interventions focusing on causes that directly influence stunting in children.

Keywords: Nutritional status, Chronic malnutrition, Prevalence, Stunting, Ethiopia.

INTRODUCTION

Malnutrition is one of the major causes of morbidity and mortality among children in developing nations. Childhood malnutrition affects the future productivity of a society and it is continued to be a rising problem in most of the developing countries [1]. Poor nutritional status is the result of complex interactions between inadequate food consumption and the overall status of health and health care practices in a nation [2]. So, the nutritional status of children under-five years of age is an important outcome measure of children's health and is one of the significant indicators in public health and socioeconomic developments.

Malnutrition in children is the consequence of a range of factors, which are often related to poor food quality, insufficient food intake, and severe and repeated infectious diseases; or frequently it involves some combination of these three entities [3]. Causes of malnutrition are closely linked to the overall standards

of living and basic needs, such as access to food, housing and health care [4]. Children are more prone to suffer from nutritional deficiencies than adults as they are in a physiologically less stable situation. The period from birth to age two is especially important for optimal growth, health, and development. Unfortunately, this period is often marked by micronutrient deficiencies that interfere with optimal growth [2]. Approximately 12 million preschool children die every year, and most of these children live in developing countries [5]. Malnutrition is an associated cause in about half of all deaths occurring among children in developing countries with severe acute malnutrition associated with 1 to 2 million preventable child deaths each year [6, 7]. Additionally, Rahman and colleagues [7] reported that even children with moderate malnutrition, not just those with severe malnutrition, had an increased risk of dying. Recent global estimates indicate that nearly 60 million children have moderate wasting, and 13 million have severe wasting [8].

Several biological and social economic factors contribute to malnutrition. A conceptual framework developed by UNICEF and extended by Engle and colleagues [9] consolidated three levels of

*Address correspondence to this author at the Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Ethiopia; Tel:+251912127173; Fax: +25158 1116221; E-mail: beredomega@gmail.com

determinants of children's nutritional status, immediate, underlying and basic determinants. In addition, Rahman and colleagues [10] proposed a socio-demographic model to identify the crucial risk factors for childhood malnutrition in developing countries. Their model has detailed the four groups of significant factors, which are known as the socioeconomic, demographic, health-system and community factors.

Child nutritional status assessment not only serves as a means for evaluating the health condition and survival of children but also provides indirect measurements of the quality of life of a population [11]. Ethiopia, a nation having one of the highest child malnutrition rates in the world [12, 13] and a very high under five mortality rate (over half of childhood deaths is estimated to be attributed to mild or moderate malnutrition) is experiencing a faster growth these days. There is a need for further scrutiny of the societal and individual level root causes of malnutrition to mitigate the burden of deaths resulting from malnutrition in Ethiopia.

Anthropometric indicators such as height-for-age are important in evaluating the health and nutrition status of children in low-income countries where malnutrition is still a large public health problem [14]. The height-for-age index, affected when there is chronic malnutrition, provides an indicator of linear and cumulative growth in children [1]. Lower height-for-age than the standard represents the long-term effects of malnutrition in a population and is not sensitive to recent, short term changes in dietary intake. It reflects failure to receive adequate nutrition over a long period of time and is affected by recurrent and chronic illnesses.

Globally, prevalence of childhood stunting (defined as the percentage of children under age 5 whose height for age is more than two standard deviations below the median for the international reference population of same age) decreased from 39.7% in 1990 to 26.7% in 2010 while it has stagnated since 1990 at about 40% in Africa [15]. An analysis of the 2000 Ethiopian DHS dataset [12] reported that biological factors (such as child's age and mother's height) and social economic factors (such as household wealth and mother's education) were important determinants of a child's nutritional status.

Despite an overall decrease in developed countries, stunting remains a major public health problem in many developing countries including Ethiopia [15]. Several

studies have investigated the risk factors for malnutrition among young children in developing countries [11, 16, 17]. However, there is a need for more information on the determinants of chronic malnutrition among under-five children in order to prevent at different levels of the society.

This paper investigated the prevalence and impact of some significant determinants on chronic malnutrition or stunting among Ethiopian children aged less than 5 years. The government and community organizations require such explicit information for informed decision making process. It is also important to design more specific interventions by focusing on the key determinants that directly influence the stunting of children in Ethiopia.

METHODS

The 2011 Ethiopian DHS collected data on the nutritional status of children by measuring the height and weight of all children under age five in the sampled households. The details of the sampling technique used and steps followed during anthropometric measurements are well documented in the main DHS report [18]. Data were collected to calculate three indices of anthropometric indicators—weight-for-age, height-for-age, and weight-for-height and indicators of the nutritional status of children were calculated using the new WHO (2006) growth standards.

Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the WHO reference population are considered *stunted* (short for their age) or chronically malnourished. Among these stunted children whose Z-scores are below minus two standard deviations but above or equal to minus three standard deviations (-3 SD \leq Z-score < -2 SD) are identified as moderately stunted and whose Z-scores are below -3 SD are identified *severely stunted* [1].

Some variables were computed by combining information for original variables. For the variable '*exposure to mass media*' respondents were asked in the Ethiopian DHS 2011 whether they usually read a newspaper, listened to the radio, or watched television at least once a week and then indirectly computed and categorized as: 'no mass media', 'one of the three media' and 'at least two media'. '*Wealth index*' was measured by using the principal component analysis [18]. Other independent variables were simply taken from and/or re-categorized from the original dataset.

Statistical Analysis

In the Ethiopian DHS 2011 data, a total of 9,892 children had completed the anthropometric measurements of height and weight. Among the total children about 2.8% (281 children) had erroneous anthropometric data. That is, these children's height measurements were considered to be out of the range for their age of up to 5 years. Hence, this research is based on a sample of 9,611 under five children who had completed and valid height measurement data. The study has utilized both the bivariate and multivariate statistical methods for analyses. For instance, multinomial logistic regression is performed in multivariate analysis to identify the significant determinants and its relative effects on childhood malnutrition. All statistical analyses were carried out with the use of the software SPSS Version 20 for Windows.

RESULTS

The selected background characteristics of the study participants are presented in Table 1. Results reveal that majority (84.1%) of the children were from rural areas. According to the five scaled household wealth index, nearly half (49.3%) of children were from poor (30.8% poorest and 18.5% poorer) families. Roughly one in each five participant households (18.1%) had female household heads. About one-fifth of the children (20.5%) were aged less than one year and the mean age of the study sample was 29.4 ± 17.3 months. In addition, about 19.5% of the sampled households had more than two under five children and 55.6% household heads were older than 35 years.

Results of the demographic attributes show that one in every four (26.1%) mothers had a low BMI ($<18.5 \text{ kg/m}^2$). Nearly a third (31.8%) of children had a birth size smaller than average and 29.2% had larger size than average. Almost half (49.2%) of children had the birth order more than three, and nearly two-third of the total children were breast-fed for more than two years (among them about 12% were breast-fed for less than 7 months). Nearly three quarters of mothers (72.8%) were aged between 20-34 years. More than two-third of mothers (69.1%) and about half (51.5%) of fathers of children did not attend school. Three-quarter (74.4%) of households had no media exposure. Almost half (49.2%) of children were vaccinated for measles and majority (87.0%) of the children were delivered at home.

Table 1 presents the results of the prevalence of stunting by the background characteristics. Overall, about 57.7% of children had normal height-for-age z-scores or nutritional status, while the rest 42.3% of children were stunted (among them about 21.9% moderately and 20.4% severely stunted). Male children were slightly more likely to be stunted than female children (43.9% vs 40.3%; *Chi-squared value*=3.88, *p*=0.049). Similarly, children from rural areas were more likely to be stunted than those from urban areas (44.4% vs 26.6%). Stunting had regional variations with Amhara (51.8%), Tigray (51.7%) and Affar (51.3%) regions having stunting levels of more than fifty percent, whereas Addis Ababa (21.7%), Gambella (27.4%) and Harari (29.0%) having the least levels of stunting.

Moreover, educational status of the mother was one of the significant factors of stunting. Results demonstrate that mothers who have not attended formal education had more than double stunted children than those mothers who have attended secondary or higher education (45.7% vs 19.3%). Educational status of the father is also a significant factor for childhood malnutrition. About 46.8% of children whose fathers did not attend school were stunted while it was only 24.0% if their fathers had attended secondary or higher education.

Results of the multivariate analysis are given in Table 2. Male children had a 20% [with an odds ratio (OR)=1.19 & a 95% confidence interval (CI)=(1.07, 3.21)] higher risk of severe stunting than females. However, this difference was marginally insignificant in the risk of moderate stunting [OR=1.10 & 95%CI=(0.99, 1.21)].

Children from older mothers had a higher risk of malnutrition. The risk of severe stunting decreases by 25% if the mother is aged 20-34 years than if 35 and above. Similarly, if the mother is not educated, the child will have almost 3 times [OR=2.78 & 95%CI= (1.66, 4.64)] higher risk of moderate stunting and a 5 times [OR=4.89 & 95%CI=(2.27, 10.53)] higher risk of stunting compared to the child whose mothers attended secondary or higher education. Paternal education has a similar impact on level of stunting of the child (OR=2.11 for moderate stunting and OR= 3.15 for severe stunting). Children whose mothers had normal BMI were less likely to have stunting. This effect was significantly preventive for severe stunting where children of mothers with normal BMI weight (18.5-25.00) had a 12% [OR=.88 & 95%CI=(.79,.99)] with a

Table 1: Socio-Demographic Profile of Children Aged 0-59 Months and their Distribution by Level of Stunting in Ethiopia, 2011 (n=9611)

Characteristic		Total children		Stunting					
				Moderate		Severe		Total	
		N	%	N	%	N	%	n	%
Residence***	Urban	1545	16.1	263	17.0	148	9.6	411	26.6
	Rural†	8066	83.9	1846	22.9	1813	25.5	3659	45.4
Sex of the HH head	Male	7875	81.9	1723	21.9	1613	20.5	3336	42.4
	Female†	1736	18.1	386	22.2	348	20.0	734	42.2
Age of Household Head***	<25	607	6.3	132	21.7	101	16.6	233	38.3
	25-35	3658	38.1	808	22.1	716	19.6	1624	41.7
	>35†	5346	55.6	1169	21.9	1144	21.4	2313	43.3
Mother's age***	15-19	394	4.1	73	18.5	57	14.5	130	33.3
	20-34	6913	72.8	1532	22.2	1365	19.7	2897	41.9
	35-49†	2304	24.3	504	21.9	539	23.4	1043	45.3
Mother's BMI****	<18.5	2523	26.4	568	22.5	566	22.4	1134	44.9
	18.5-25.0	6480	67.8	1440	22.2	1332	20.6	2772	42.8
	>25.0†	556	5.8	88	15.8	50	9.0	164	24.8
Maternal education***	None	6696	69.7	1516	22.6	1543	23.0	3059	45.7
	Elementary	2448	25.5	534	21.8	387	15.8	921	37.6
	Secondary and above†	467	4.9	59	12.6	31	6.6	90	19.3
Paternal education***	None	4913	51.5	1098	22.3	1199	24.4	2297	46.8
	Elementary	3521	36.9	810	23.0	648	18.4	1458	41.4
	Secondary and above†	1020	10.8	159	15.6	86	8.4	245	24.0
Sex of child*	Male	4890	50.9	1092	22.3	1055	21.6	2147	43.9
	Female†	4721	49.1	1017	21.5	906	19.2	1923	40.7
Place of delivery***	Home	8272	87.0	1858	22.5	1836	22.2	3694	44.7
	HI†	1273	13.0	227	18.4	94	7.6	323	26.0
Birth order*	1	1818	18.9	413	22.7	295	16.2	708	38.9
	2	1649	17.2	377	22.9	257	15.6	634	38.4
	3+†	6144	63.9	1319	21.5	1409	22.9	2728	44.4
Age of Household Head†	<25	607	6.3	132	21.7	101	16.6	233	38.3
	25-35	3658	38.1	808	22.1	716	19.6	1624	41.7
	>35†	5346	55.6	1169	21.9	1144	21.4	2313	43.3
Child's age in months***	36-59	3989	41.5	1066	26.7	918	23.0	1984	49.7
	24-35	1878	19.5	462	44.4	578	55.6	1040	55.4
	12-23	1776	18.5	422	54.4	354	45.6	776	43.7
	0-11†	1968	20.5	159	58.9	111	41.1	270	13.7
Months of breast feeding***	25+	6159	64.1	1560	25.3	1542	25.0	3102	50.3
	12-24	1552	18.8	395	25.4	313	20.2	708	45.6
	<12†	1900	23.0	154	8.1	106	5.6	260	13.7
Measles vaccine***	No	4820	58.3	900	18.7	909	18.9	1809	37.5
	Yes†	4677	49.2	1169	25.0	1038	22.2	2207	47.2
Media exposure***	No	7524	78.4	1654	22.0	1672	22.2	3236	44.2
	Yes†	2067	21.6	451	21.8	287	13.9	738	35.7

†Reference category in the multivariate analysis.

*p<0.05; **p<0.01; ***p<0.001 (based on Chi-squared test).

Table 2: Multinomial Logistic Regression Results of Selected Variables on the Level of Severe and Moderate Stunting of Preschool Children in Ethiopia, 2011

Characteristic		Moderate stunting				Severe stunting			
		Coeff (B)	SE	OR (95%CI)	p-value	Coeff (B)	SE	OR (95% CI)	P-value
Residence	Urban	-.591	0.07	.55(.48,.64)	0.000	-1.15	0.09	.31(.27,38)	0.000
Age of Household Head	25-35	.09	.11	1.10(.89,1.35)	0.410	.33	.12	1.40(1.11,1.76)	0.004
	>35	.07	.11	1.07(.87,1.33)	0.520	.22	.12	1.24(.98,1.57)	0.071
Mother's age	15-19	-.34	.14	.70(.53,.92)	0.009	-.66	.15	.52(.38,69)	0.000
	20-34	-.05	.05	.96(.86,1.06)	.393	-.29	.05	.75(.67,83)	0.000
Mother's BMI	>25.0	-.66	.13	.52(.40,.66)	0.000	-1.23	.16	.29(.22,40)	0.000
	18.5-25.0	-.05	.06	.95(.85,1.07)	.379	-.13	.06	.88(.79,99)	0.033
Maternal education	None	1.02	.26	2.78(1.66,4.64)	0.000	1.59	.39	4.89(2.27,10.53)	0.000
	Elementary	.32	.30	1.38(.76,2.52)	.296	.65	.44	1.91(.80,4.56)	0.143
Paternal education	None	.75	.15	2.11 (1.57,2.53)	0.000	1.12	.20	3.15(2.14,4.63)	0.000
	Elementary	.15	.18	1.17(.82,1.67)	.393	.17	.24	1.19(.74,1.79)	0.475
Child's Sex	Male	.09	.05	1.10(.99,1.21)	0.075	0.17	0.04	1.19(1.07,1.32)	0.001
Delivery place	Home	.49	.08	1.64(1.14,1.91)	0.000	1.36	.11	3.91(3.14,4.87)	0.000
Birth order	1	-.04	.07	.96(.85,1.10)	0.575	-.44	.07	.64(.56,74)	0.000
	2	-.04	.07	.96(.84,1.10)	0.571	-.49	.08	.61(.53,.71)	0.000
Twin Birth	Yes	.37	.17	1.14(1.03,2.01)	0.031	.69	.16	1.99(1.46,2.72)	0.000
Child's age in months	36-59	1.74	.09	5.69(4.75,6.79)	0.000	1.95	.11	7.00(5.70,8.62)	0.000
	24-35	1.77	.10	5.89(4.83,7.18)	0.000	2.36	.11	10.55(8.47,13.14)	0.000
	12-23	1.51	.10	4.51(3.70,5.50)	0.000	1.69	.12	5.42(4.32,6.80)	0.000
Months of breast feeding	25+	1.69	.09	5.43(4.56,6.48)	0.000	2.06	.11	7.80(6.35,9.59)	0.000
	12-24	1.61	.10	4.98(4.07,6.11)	0.000	1.75	.12	5.74(4.53,7.26)	0.000
Wealth Index	Poor	.31	0.06	1.36(1.22,1.52)	0.000	.79	.06	2.20(1.94,2.49)	0.000
	Middle	.21	.08	1.23(1.06,1.43)	0.007	.75	.08	1.91(1.63,2.24)	0.000
Measles Vaccination	No	.46	.05	1.58(1.43,1.75)	0.000	.33	.05	1.39(1.26,1.54)	0.000
Media Exposure	No	.16	0.06	1.17(1.04,1.32)	.01	.62	0.07	1.86(1.62,2.14)	0.000

p -value=0.033)] lesser risk of severe stunting compared to children of under weighted mothers (BMI<18.5kg/m²).

Birth order of the child was also associated with stunting. If the child is first born there is a 36% [OR=.64 & 95%CI= (.56,.74)] lower risk of severe stunting and if the child is second born the risk decreases by 39% [OR=.14 & 95%CI= (.53,.71)] as compared to children who are third born or more. Twin births were twice [OR=1.99 & 95%CI= (1.46, 2.72)] more likely to be severely stunted compared to their counterparts. Similarly, home delivery was one of the risk factors for stunting. Children born at home had a 64% increased

risk of moderate stunting [OR=1.64 & 95%CI= (1.14,1.91)]. There is also almost a four times higher risk of severe stunting [OR=3.91 & 95%CI= (3.14,4.87)] among children born at home when compared to those delivered at health institutions.

DISCUSSION AND CONCLUSIONS

In Ethiopia, there has been a marked decline in the proportion of children stunted in the last 11 years. In the last three consecutive demographic and health surveys conducted in Ethiopia, the total prevalence of stunting decreased from 58% in 2000 to 51% in 2005 and 44% in 2011 among children under the age of five

years [2]. However, this decline was majorly contributed by the decline in moderate stunting. Severe stunting declined by 3.5 percent (from 24.1 in 2005 to 20.6 in 2011) in the five years period.

In this analysis, 42.3% of under-5 children were stunted (21.9% moderate and 20.4% severe). This was similar to a report from Tigray region, northern Ethiopia [19] and another report by WHO for developing countries [20] which reported 42.7% and 43% proportion of stunting among under-5 children, respectively. In our study, levels of stunting had significant regional variations ranging from 21.7% in Addis Ababa to over 50% in Amhara, Tigray and Affar regions of the country. This may be due to the geographical, climatic and socio-cultural differences amongst these regions in Ethiopia as stunting in children is one of the best indicators of social inequality [1].

Similar to other studies in Ethiopia [19, 21], in this study, stunting increases with age of the child. As clearly depicted in Figure 1, it appears that chronic child malnutrition develops during the weaning period and rises sharply thereafter to its maximum till age three and then slightly declines there after.

Severe stunting occurs among children aged two to three years while moderate stunting reaches its peak between the age of three and four years. Growth retardation commencing after the first year suggests problems associated with inadequacy of the complementary foods. Long term breast feeding adversely affects infant appetite and growth [22]. Breastfeeding beyond two years was very common (64.1%) in this study. Longer duration of breast feeding

practices might encourage lower acceptance of non breast milk foods and lower energy intake in children. In this study, risk of severe stunting is eight times higher among children breast fed for more than two years while it is about six times among those breast fed for one to two years duration. This indicates an increasing risk with longer duration of breast feeding.

Children from families of poor wealth index were twice highly likely to be severely stunted compared to those from rich households. At the same time, educational status of mothers and fathers were inversely associated with stunting i.e lower prevalence of stunting among children whose parents are well educated.

Similar to other studies [1, 10, 23], this analysis showed that parent's educational status has prominent effects on nutritional status of their children. The impact of maternal education is not only through its effect on nutrition but also through additional income and the mother's ability to make better decisions for herself and her child. Additionally, previous studies reported that causes of growth retardation are deep rooted in poverty and lack of education [20] and contribute each other in a complex manner.

There is also a higher risk of stunting (both moderate and severe) among rural children. This may be due to several reasons. Firstly, rural mothers have few opportunities to earn additional income or to make many changes in the child's food intake and hence the child becomes prone for prolonged lack of adequate nutrients. Secondly, rural mothers are usually uneducated and hence have little knowledge on child feeding recommendations. Thirdly, rural dwellers have

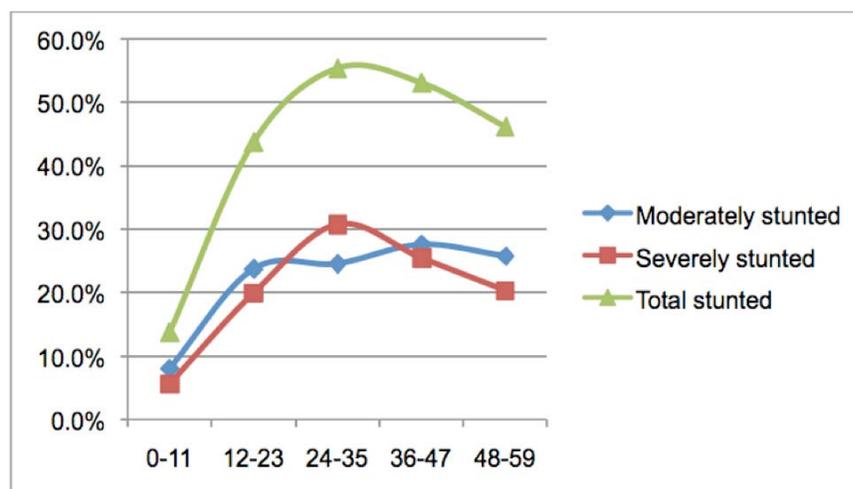


Figure 1: Levels of chronic malnutrition by child's age in months.

poor access to health care including vaccinations and curative care which subsequently may put rural children on chronic and/or repeated illnesses.

Stunting was determined by variables which show the health care related characteristics of children such as measles vaccination and place of delivery. Children who did not receive measles vaccinations had a 1.6 times and 1.4 times higher risk of becoming moderately and severely stunted; unlike the bivariate analysis.

In conclusion, this analysis revealed that chronic malnutrition (both severe and moderate stunting) in children is a public health problem in Ethiopia. Stunting becomes more apparent as children grow older to until age three and then levels off. Poor maternal and demographic situations such as parental education, rural residence, place of delivery and regional differentials are the most important factors for stunting. In addition, socioeconomic conditions including poor feeding, long term breast feeding and poor wealth index were significantly associated with both severe and moderate forms of stunting.

Hence, the continued attention to infant breast feeding practices is immensely important on top of the comprehensive socio-economic development programs with special emphasis to rural settings. A prospective study is recommended to find out the specific set of determinants of child and maternal nutrition since the two are strongly interlinked.

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