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Multi-Level Mixed-Effects Analysis of Stunting Among 6 to 59 Months Children in Ethiopia: Evidenced from Analysis of Health and Demographic Survey, 2000 to 2019

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Abstract

Background. Stunting remains a major public health issue in developing countries like Ethiopia. It is termed as a chronic malnutrition which leads to morbidity and mortality among children. This study aimed to assess the prevalence and factors associated with stunting among 6 to 59 months children in Ethiopia. *Methods.* A total weighted sample of 34 930 children aged 6 to 59 months was included in this study. A Multilevel Mixed-Effect logistic regression was carried out. The Median Odds Ratio (MOR) and the Intra class Correlation Coefficient (ICC) were calculated. An adjusted odds ratio along with a 95% confidence interval was reported and statistical significance was declared at a *P*-value ≤ .05. *Results.* The weighted prevalence of stunting in Ethiopia was 48.3% (95% CI: 47.8%, 48.8%). Being male, increased in age, having multiple births (twin), having less than 2 years birth interval, history of diarrhea, anemia, lack of maternal and paternal formal education, having poor and middle-wealth status, and living in rural areas were significantly associated with stunting. *Conclusions.* The prevalence of stunting is high in Ethiopia. The risk factors mentioned above increase the likely hood of stunting among children. Therefore, we recommend that responsible bodies place a greater emphasis and priority on promoting parental education, awareness on the impact of the birth interval on child nutrition, the prevention of childhood diarrhea and anemia, improving household economic status, and reducing rural-urban disparities.

Keywords

stunting, factors, predictors, multi-level analysis, DHS, Ethiopia

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Introduction

Stunting is one of the devastating outcomes of poor nutrition during pregnancy and early childhood.[1] It denotes a failure to reach one's genetic potential for height as well as an indication of severe, irreversible physical and cognitive impairment resulting from prolonged starvation.[2] Stunting remains a significant global public health issue and is responsible for an estimated 17% of the mortality burden in children less than 5 years old.[3] In 2020, about 149 million children under the age of 5 were stunted globally.[4] More than half of stunted children under the age of 5 were from Asia, while 2 out of every 5 were in Africa.[1]

Despite a steady fall in the prevalence of child stunting globally, the progress is too slow to achieve the 2025 global nutrition target of a 40% reduction,[5] and ending all forms of malnutrition including stunting by 2030.[6] According to recent data, 37 of the 124 nations, almost all of which are in Africa, have high rates of all 3 forms

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of malnutrition.[4] The prevalence of under-5 stunting in Africa is 29.1% which is greater than the global average of 21.3%. The highest prevalence of stunting (34.5%) is found in Eastern Africa. Ethiopia is one of the most populous countries found in east Africa with a high prevalence of stunting among under-five children.[7]

Stunting is the most common type of malnutrition, affecting areas of the brain involved in cognition, memory, and locomotor skills that leads to delays in children's cognitive and motor development which leads to poor educational performance.[3,8] Although stunted children are more vulnerable to infections, particularly diarrheal and respiratory diseases, as well as malaria.[9,10] Women who were themselves stunted as children are more likely to have stunted offspring which contributes to an intergenerational cycle of poverty and diminished human capital that is challenging to break.[10]

The chance of being overweight later in life is high among stunted children who experienced rapid weight gain after 2 years of life.[11] Furthermore, research revealed that the productivity loss (losses in per capita income) associated with a stunting range from 5% to 7% of GDP (Gross Domestic Product) in several low- and middle-income countries (LMICs).[12] Likewise, decreases in stunting are expected to boost countries' economic productivity by 4% to 11% of GDP across the African and Asian areas.[13,14]

Stunting is the outcome of a complex interplay of household, environmental, social, and cultural factors,[9] Poverty,[15,16] place of residence,[17] environmental and household variables such as lack of cleanliness, inadequate sanitation, and unprotected source of drinking water,[18,19] and shorter inter-pregnancy interval, maternal education,[20] anemia[21] were all contributes for child stunting. Besides, stunting may be influenced by agricultural practices, political situations, and climate change.[20]

The government of Ethiopia put several effort in improving nutrition through different policy, program like the Food Security Strategy, National Nutrition Strategy, National Nutrition Program, the Seqota Declaration roadmap, Nutrition Sensitive Agriculture Strategy, School Health and Nutrition Strategy, and the Productive Safety Net Program.[22] With those effort the prevalence of stunting has gradually decreased over the 3 waves of Ethiopian demographic and health survey (EDHS) data (2011-2019) from 44.4% to 36.8%.[23] But the problem still remains a major public health issue in the country. To inform policy and programmers about the intervention, strong evidence-based information on the prevalence and factors associated with stunting is required. Thus, the purpose of this study was to determine the prevalence and identify the factors associated with stunting among children aged 6 to 59 months using EDHS data (2000-2019).

Materials and Methods

Study Setting, Design, and Period

We used the EDHS data from 2000 to 2019 to conduct a pooled analysis. The EDHS was designed to provide demographic and health indicators at the national and regional levels. It is done every 5 years and is regarded as the key public health data source.

Data Source and Population

For this study, we used a child data set of EDHS 2000, 2005, 2011, 2016, and 2019. The data set was accessed from www.measuredhs.com. The data archivist for the Demographic and Health Surveys (DHS) Program permitted the current investigation to use the data.

Sampling Techniques

The participants were recruited through 2-stage stratified cluster sampling in the EDHS. The first stage was choosing the enumeration areas or clusters both for urban and rural areas. In the second stage, households per enumeration area were chosen by a systematic selection process with an equal probability for each enumeration area.

Inclusion and Exclusion Criteria

A total of 34 930 weighted samples (32 620 unweighted samples) were included in the analysis. Children below 6 months age, records lacking age, weight, height were excluded

Variables and Measurement

Outcome variable. The outcome variable of this study was stunting. Children whose height-for-age Z (HAZ) score below minus 2 standard deviations (−2SD) from the median of the reference population were considered to be stunted.[24]

Explanatory variables. The explanatory variables were selected based on an association with the outcome variable reported in the literature. Child sex (male, female), Child age (6-11, 12-23, 24-35, 36-47, and 48-59 months),

type of birth (single/ multiple(twin), preceding birth interval (Less than 2 years, greater or equal to 2 years), diarrhea, cough, or fever in the 2 weeks before the survey (yes/no), anemia status (severe, moderate, mild, and not anemic) were considered as child-level variables. Head of the household (male, female), education status of both parents (no formal education, have formal education), family size (less than 5, greater or equal to 5), and wealth status (poor, middle, rich) were considered as household level variables. In the analysis, the variables at the child and household levels together represent the variables at the individual level. Community-level variables were residence (urban/rural), source of drinking water (not piped/piped), time to get drinking water (30 minutes or less, more than 30 min), and type of toilet (improved, unimproved).

Data Processing and Analysis

Using STATA software version 17.0, the pooled data were cleaned, recorded, and analyzed. Before conducting any statistical analysis, the data were weighted using the child individual sample weights, (v005/1 000 000), to ensure the representativeness of the survey and to inform STATA to take the sampling design into account when calculating standard errors to produce reliable statistical estimates. Weighted samples and frequencies are summarized using the table and figure. The pooled prevalence of stunting with a 95% confidence interval was reported.

Multilevel mixed-effects logistic regression analyses were used to account for the clustering effect because the EDHS data was hierarchical where individuals in sampled households are nested within enumeration areas or clusters in the community. The variance between clusters was measured using the likelihood ratio, intracluster correlation coefficient (ICC), median odds ratio (MOR), and proportional change in variance (PCV).

Using ICC, the degree of heterogeneity, the proportion of the overall observed difference in child stunting that can be attributed to cluster variations was determined. To quantify the variation or heterogeneity in child stunting between clusters the MOR was used. The total variation in child stunting attributed to factors at the individual and community levels in the final model compared to the null model was measured using PCV. It is described elsewhere how to use the ICC[25] MOR and PCV formulas in detail.[26]

Ethical Approval and Informed Consent

Ethical approval was obtained from MEASURE Demographic and Health Surveys (DHS) program after acceptance of a research proposal to use its survey datasets. Participant consent was not applicable because the study used secondary data.

Random Effect Results

The random-effects model revealed that the prevalence of stunting varies among communities. The Intra-cluster Correlation Coefficient in the final model indicated that community-level factors accounted for 9% of the variation in stunting. Furthermore, the median odds ratio (MOR) in the final model was 1.7, indicating that if a child moved from a cluster with a low prevalence of stunting to a cluster with a high prevalence of stunting, the median increase in the odds of stunting would increase by 1.7-fold. Furthermore, −64.45% of the cluster-level variance in the empty model was attributable to the individual and community-level factors considered in the final model (Table 4).

An explanatory variable with a P-value of $<.25$ in the bivariable analysis was selected for multivariable analysis. Four models were fitted to identify the factors associated with stunting. The first model is a null model with no explanatory variables, followed by a model with individual-level factors, a model with community-level factors, and a model with both individual and community-level factors. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were used to estimate the goodness of fit of the models where the lowest values indicated the best-fit model.[27] An adjusted odds ratio (AOR) with a 95% CI was reported from the best-fitted model. Statistical significance was determined at a P value of $\leq .05$ in the multilevel logistic regression model.

Results

Socio-Demographic and Other Health-Related Characteristics

In this study, 34 930 weighted data were included in the analysis. Among the children, 50.9% were male, and 50.1% were female. About one-fifth, 21.4% of the children were in the age group of 24 to 35 months. The majority, 98.2% were born singleton, and 79.7% had a proceeding birth interval of greater or equal to 2 years. Most of the children 82.3% had diarrhea 2 weeks before the survey. Only 24.2% and 17.9% had cough and fever respectively, 2 weeks before the survey. Around half of them were not anemic 48.8% (Table 1).

Household Level Characteristics

The majority of children 86.7% belong to the male household head. Regarding the educational status of

Table 1. Socio-Demographic and Other Health-Related Characteristics of Children Aged 6 to 59 Months in Ethiopia from 2000 to 2019.

Variables	Characteristics	Weighted sample	Weighted percentage
Sex	Boys	17795	50.9
	Girls	17135	50.1
Age in months	6-11	4041	11.6
	12-23	7587	21.7
	24-35	7453	21.4
	36-47	8121	23.3
	48-59	7, 725	22.1
Type of birth	Single	34294	98.2
	Multiple	635	1.8
Preceding birth interval	Less than 2 years	5808	20.3
	Grater or equal to 2 years	22774	79.7
Diarrhea in the 2 weeks before the survey	Yes	5372	82.3
	No	25042	17.7
Cough in the 2 weeks before the survey	Yes	7365	24.2
	No	23064	75.8
Fever symptoms in the 2 weeks before the survey	Yes	6245	17.9
	No	28684	82.1
Anemia status	Severe	609	2.9
	Moderate	5225	25.2
	Mild	4764	23.0
	Not anemic	10113	48.8
Child stunting	Not stunted	18060	51.7
	Stunted	16870	48.3

parents, two third 71% of mothers, and 54.7% of fathers have no formal education. About half of the mothers were not working 51.5% while two third 70% of the fathers were a farmer, and 45.4% had a poor wealth index (Table 2).

Community Level Characteristics

The majority of the children 30306 (87.3%) were rural residents, 29546 (84.6%) used water from a non-piped source, and 22411 (65.6%) of them obtained it within less than 30 minutes. The majority of the households, 30286 (87.9%) had used improved toilet facilities (Table 3).

Prevalence of Stunting

The prevalence of stunting decreased over the 5 waves of EDHS. The weighted prevalence of stunting in 2000, 2005, 2011, 2016, and 2019 were 60.9% (95% CI: 59.9%, 61.9%); 53.9% (95% CI: 52.3%, 55.5%); 47.8% (95% CI: 46.8%, 48.9%); 39.1% (95% CI: 38.1%, 40.2%); and 36.3% (95% CI: 34.9%, 37.7%), respectively while the pooled prevalence of stunting was 48.3% (95% CI: 47.8%, 48.8%). (Figure 1).

Factors Associated With Stunting

The odds of being stunted increased by 16% [adjusted odds ratio (AOR) = 1.16, 95% CI: 1.09-1.24) among male children when compared to females. The odds of stunting increased with child age:12-23 months (AOR = 3.79, 95% CI: 3.28-4.37), 24-35 months (AOR = 6.08,95% CI: 5.24-6.99), 36-47 months (AOR = 6.05, 95% CI: 5.23-6.99), and 48-59 months (AOR = 5.52, 95% CI: 4.77-6.39) compared to children 6-11 months. As compared to singleton, multiple births (twin) were 3.08 times more likely to be stunted (AOR = 3.08, 95% CI: 2.36-3.84). Children born less than 2 years interval had 22% increased odds of being stunted (AOR = 1.22, 95% CI:1.13-1.33) than their counterparts. Compared to children with no history of diarrhea, those with diarrhea were 1.36 times increased odds of stunting (AOR = 1.36, 95% CI: 1.23-1.52). The odds of being stunted were more than 2-fold (AOR = 2.29, 95% CI: 1.85-2.84), 58% (AOR = 1.58, 95% CI: 1.44-1.72), and 33% (AOR = 1.33, 95% CI: 1.21-1.45) in children with severe, moderate, and mild anemia respectively when compared to non-anemic counterparts. The odds of being stunted were increased by and 22% and 20% (AOR = 1.22, 95% CI: 1.01-1.25), and (AOR = 1.20, 95% CI: 1.13-1.13) in children whose

Table 2. Household Characteristics of Children Aged 6 to 59 Months in Ethiopia from 2000 to 2019.

Variables	Characteristics	Weighted sample	Weighted percentage
Sex of household head	Male	30293	86.7
	Female	4637	13.3
Marital status	Never married	177	0.54
	Married	30447	93.3
	Widowed	549	1.7
	Divorced	989	3.0
	Not living together	458	1.4
Religion	Orthodox Christian	14089	40.6
	Muslim	7495	21.7
	Protestant	12207	35.1
	Others	947	2.7
Maternal educational status	No formal education	24816	71.0
	Formal education	10114	29.0
Paternal educational status	No formal education	16249	54.7
	Formal education	13425	45.3
Maternal occupation	Not working	14451	51.5
	Farmer/Agriculture	5798	20.7
	Business and others	7802	27.8
Paternal occupation	Not working	1048	3.8
	Farmer/Agriculture	19246	70.0
	Business and others	7184	26.2
Number of household members	Less than 5	8536	24.4
	5 or greater	26394	75.6
Wealth status	Poor	11769	45.4
	Middle	5320	20.5
	Rich	8830	34.1

Table 3. Community-Level Characteristics of Children Aged 6 to 59 Months in Ethiopia from 2000 to 2019.

Variables	Characteristics	Weighted sample	Weighted percentage
Residence	Urban	4424	12.7
	Rural	30306	87.3
Source of drinking water	Not piped	29546	84.6
	Piped clean	5383	15.4
Round trip time to obtain water	30 minutes or less	22411	65.5
	More than 30 minutes	11799	34.5
Type of toilet	Unimproved	4171	12.1
	Improved	30286	87.9

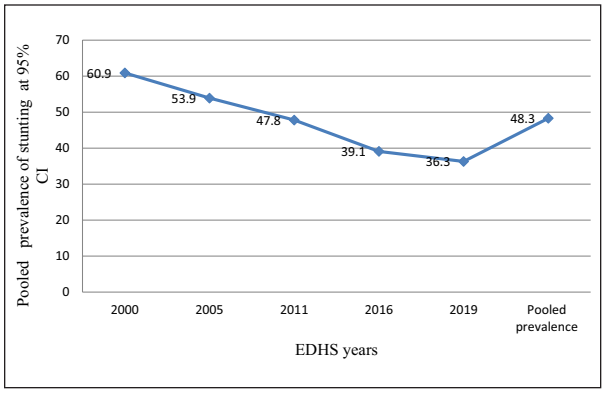

Figure 1. Weighted prevalence of stunting in children aged 6 to 59 months in Ethiopia from 2000 to 2019.

mother and father had no formal education compared to those whose mothers and fathers had formal education respectively. Children from poor households and middle wealth status were 1.22 times and 1.55 times more likely to be stunted (AOR = 1.22, 95% CI: 1.11-1.34) and (AOR = 1.15, 95% CI: 1.10-1.27) respectively when compared to those from rich households. Children from rural residents were 1.64 times more likely to be stunted (AOR = 1.64, 95% CI: 1.53-2.07) compared to those residing in urban areas (Table 4).

Discussion

The present study has determined the prevalence and factors associated with stunting among 6 to 59 months

Table 4. Multivariable Multilevel Mixed Effect Logistic Regression Model Result of Stunting Among Children Aged 6 to 59 Months in Ethiopia from 2000-2019.

		Model 1	Model 2	Model 3	Model 4
Fixed effects model					
Individual-level variables			AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Sex of a child	Boys		1.16(1.09-1.24)**		1.16(1.09-1.24)**
	Girls		Reference		Reference
Age of a child	6-11		Reference		Reference
	12-23		3.73(3.23-4.29)**		3.79(3.28-4.37)**
	24-35		5.95(5.15-6.87)**		6.08(5.24-6.99)**
	36-47		5.97(5.18-6.89)**		6.05(5.23-6.99)**
	48-59		4.42(4.69-6.27)**		5.52(4.77-6.39)**
Type of birth	Single		Reference		Reference
	Multiple (twin)		2.87(2.26-3.65)**		3.08(2.36-3.84)**
Preceding birth interval	Less than 2 years		1.23(1.13-1.33)*		1.22(1.13-1.33)*
	Greater or equal to 2 years		Reference		Reference
Diarrhea in the 2 weeks before the survey	Yes		1.35(1.22,1.50)**		1.36(1.23-1.52)**
	No		Reference		Reference
Cough in the 2 weeks before the survey	Yes		0.93(0.0.84-1.03)		0.91(0.82-1.01)
	No		Reference		Reference
Fever in the 2 weeks before the survey	Yes		1.05(0.94-1.17)		1.07(0.95-1.19)
	No		Reference		Reference
Anemia status	Severe		2.35(1.90-2.91)**		2.29(1.85-2.84)**
	Moderate		1.57(1.44-1.71)**		1.58(1.44-1.72)**
	Mild		1.33(1.22-1.45)**		1.33(1.21-1.45)**
	Not anemic		Reference		Reference
Head of the household	Male		Reference		Reference
	Female		1.00(0.89-1.11)		1.02(0.91-1.14)
Maternal education	No formal education		1.45(1.05-1.25)*		1.22(1.01-1.25)**
	Have formal education		References		References
Father's education	No formal education		1.22(1.14-1.32)**		1.20(1.13-1.31)**
	Have formal education		References		References
Household family size	<5		Reference		Reference
	≥5		1.05(0.95-1.16)		1.04(0.94-1.45)
Wealth status	Poor		1.34(1.23-1.47)**		1.22(1.11-1.34)**
	Middle		1.26(1.44-1.39)**		1.15(1.04-1.27)*
	Rich		Reference		Reference
Community-level variables					
Residence	Urban			Reference	Reference
	Rural			1.94(1.77-2.23)**	1.64(1.37-1.96)**
Source of drinking water	Not piped			1.14(1.06-1.24)**	0.95(0.84-1.08)
	Piped clean			Reference	Reference
Round trip time to obtain water	30 minutes or less			Reference	Reference
	More than 30 minutes			1.01(0.96-1.06)	0.93(0.87-1.00)
Toilet facility	Improved			Reference	Reference
	Unimproved			1.34(1.24-1.44)**	1.14(0.99-1.30)
Random effects and model comparison					
Community-level variance (SE)		0.199(0.179)	0.33(0.034)	0.20(0.018)	0.33(0.03)
ICC (%)		5.7	9	5.7	9
MOR		1.5	1.7	1.5	1.7
PCV (%)		Ref	−63.78	61.18	−64.45
Model fit statistics					
Log-likelihood		−23799.69	−10629.858	−23049.491	−10489.075
AIC		47660.37	21301.72	46110.98	21028.15
BIC		47620.16	21461.73	46161.15	21218.34

Significant at *$P < .05$; **$P < .01$

children in Ethiopia based on EDHS data collected in 2000, 2005, 2011, 2016, and 2019. The pooled prevalence of stunting was 48.3%. Being male, advancing age, having multiple births (twin), having less than 2 years birth interval, history of diarrhea, anemia, lack of formal maternal and paternal education, poor and middle-wealth status, and living in rural were independently associated with stunting.

Despite the government's and stakeholders' efforts, stunting remains a serious public health issue in Ethiopia. The present study found that the prevalence of stunting decreased over 2 decades from 60.9% in 2000 to 36.3% in 2019. A similar study from Nepal[28] and Uganda[29] reported a decrement in stunting among under-five children. However, much more intervention is required to attain a 40% reduction of stunting by 2025 and end all forms of malnutrition by 2030.[4]

In this study, the odds of being stunted were high among boys compared to girls. This finding is comparable with the studies from Sub-Saharan Africa, Rwanda,[30] and Nigeria.[31] However, little is known about the underlying mechanisms generating the biological difference.[32] Some literatures indicated that because males are more likely than females to suffer from disorders that are frequent in children, such as lower respiratory infections, diarrheal diseases, malaria, and preterm birth.[33] All of these factors can lead to weight loss, sluggish growth, or severe under nutrition in young children.[34] The explanation could be that in some communities, particularly in rural areas, social beliefs hold that females are an asset to the family and are valued more than males.[35] In contrast to this finding, one study reported girls are more stunted than boys.[33] Study also reported no significant difference between boys and girls.[34]

Consistent with other studies from Cambodia,[36] Ghana,[37] and Nepal[38] our study found that an increase in the age of the child is significantly associated with stunting. This may be explained by the fact that as a child gets older, breastfeeding practices decline and they begin weaning, which is inadequate and unhealthy.[39] Also, as the infant begins to crawl, contamination from unsanitary living conditions and the surroundings could make them more susceptible to infections like diarrhea.[18]

This study found that being a twin child is significantly associated with stunting. A consistent finding was reported from Nigeria,[32] and Cambodia.[36] This might be owing to multiple births being associated with a variety of adverse birth outcomes such as premature birth, low birth weight, and cerebral paralysis, all of which can impair infant growth([40]). Due to mothers' lack of breastfeeding expertise, lack of information, and the perception that they do not have sufficient breast milk to adequately feed 2 babies, many babies of multiple births are unable to get the amount of milk they require.[41]

The present study found that children with a birth interval of fewer than 2 years were more likely to be stunted than their counterparts. Comparable studies from India,[42] and Bangladesh[43] were reported. This may be explained as the maternal nutrient reserves becoming depleted due to short birth intervals which may increase the likely hood of intrauterine growth restriction, both infants and mothers fail to store nutrients which is important to prevent stunting.[44] In addition caring for a new infant limits the amount of time that the mother can dedicate to the older child. The future pregnancy may alter care habits that have a greater impact on the current child's health. Even though the length of the lactating period is reduced when the birth interval is short, breast milk is still regarded as a significant source of nutrients throughout the second year of life.[45]

This study revealed that children with a history of diarrhea are more likely to be stunted when compared to children with no diarrhea. This finding is in line with the study conducted in Tanzania,[46] a multicenter study conducted in 4 countries Peru, Brazil, Guinea-Bissau, and Bangladesh.[47] This might be due to its interference with nutrient absorption through the intestine as diarrheal disease has a considerable negative effect on nutritional status.[48] Diarrhea causes a loss of fluids and electrolytes, as well as a decrease in food appetite which leads to malnutrition.

In agreement with the other study conducted in Ethiopia,[49] and Lesotho[21] our study found that children with severe and mild anemia were more likely to be stunted compared to those with non-anemic. The possible explanation might be growth is negatively impacted by anemia at all stages of development (infancy, childhood, and adolescence).[8]

Our study demonstrated that maternal educational status is associated with child stunting. This finding is in line with a similar study from Nepal,[28] and Rwanda.[30] The explanation might be formal education enable the mothers to practice nutritional and other related behaviors that prevent chronic malnutrition/stunting. As the mother is the direct caregiver for the babies, the health-seeking behavior for child illness became better in educated mothers than in uneducated.[50] Moreover, education is also a key instrument for improving income, which enables people to meet their nutritional needs.[51] Additionally, education enhances abilities and has a strong correlation with a variety of socioeconomic parameters, including lifestyle, and fertility.[52] This study also found that the father's educational status is linked to stunning. This finding is consistent with another study from Bangladesh.[50]

The current study reported a significant association between stunting and the wealth status of the family. Children whose families were poor and in the middle wealth status had increased odds of stunting compared to those from rich families. This finding is in line with the study from Rwanda,[28] and Zambia.[53] The possible explanation might be at the household level, access to nutritious foods is associated with a household's economic status, which may have an impact on the early growth and development of children. The quantity and quality of dietary intake also depend on the economic status of the family.[54] According to the literature, there is an urban-rural difference in child stunting that is driven by numerous factors such as inequalities in socioeconomic characteristics such as parental education and wealth status.[55] And also it might be due to the fact that mothers in urban areas with greater levels of education have better access to information about child feeding practice and better healthcare services, which in turn influences health-related decisions that enhance children's nutritional status.[56]

The present study found that children from rural areas were more likely to be stunted compared to children from rural areas. Studies from Tanzania,[57] and Sierra Leone,[17] and Reviews in sub-Saharan African counties[58] reported consistent findings.

Strengths and Limitations of the Study

The first strength is the use of an advanced model (Multi-level Mixed effect model) by taking into account the clustered nature of the data. Second, the large size of nationally representative data is used that can be used for generalization. However, the study has some limitations. Due to the cross-sectional nature of the data, the causal effect was not established. Moreover, factors such as micronutrient consumption of children and maternal body mass index (BMI) that are closely related to children's nutritional status were not included. In addition we did not calculated the sample size because the DHS survey draw a representative sample using a 2-stage cluster design.

Conclusion and Recommendation

In Ethiopia, nearly half of the children were stunted. Stunting is significantly associated with being boy, increased in age, having multiple births (twin), having less than 2 years birth interval, history of diarrhea, anemia, lack of formal maternal and paternal education, poor and middle-wealth status, and living in rural areas. The study showed both individual and community factors are associated with stunting in children and most of them are modifiable.

Policies and programs aimed at improving maternal and child nutrition should be accompanied by policies and programs aimed at enhancing parental education to reduce the burden of stunting in the country. A poverty reduction plan, particularly in rural regions, must be strengthened.

Abbreviations

AIC, Akaike Information Criteria; AOR, adjusted odds ratio; BIC, Bayesian Information Criteria; BMI, Body Mass Index; CI, confidence interval; ICC, Intra-cluster Correlation Coefficient; EDHS, Ethiopian Demography health survey; MOR: Median OR; PCV: proportional change in variance; SSA, Sub-Saharan Africa; SE: Standard Error

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Author Contributions

All authors made a substantial contribution to the conception, design, acquisition, and interpretation of data. All authors have revised the article critically for important intellectual content. All authors read and approved the final version of the manuscript.

Availability of Data

All the analyzed data is included in the manuscript.

Declaration of Conflicting Interests

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Ethics Approval and Consent to Participate

The data was obtained from the DHS program available at www.dhsprogram.com. There are no personal identifiers reported in this manuscript. All data management and analysis were carried out following DHS manuals.

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