Nutritional status and associated factors among adolescent girls in Ethiopia: Analysis of the 2016 EDHS data.

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Abstract

Background: Despite the significant public health impact under nutrition has on adolescent girls themselves and their offspring, there are limited studies conducted at a national level in Ethiopia. Most of the published studies on adolescent girls' nutritional status in Ethiopia are small scale school-based surveys that marginalized non-school attending and non-pregnant adolescent girls. Understanding and identifying the distribution of adolescent malnutrition across the regions of the country and its determinants are vital for planning and implementing interventions that can help address the problem.

Methods: Secondary analysis of data was conducted on the 2016 Ethiopian Demographic and Health Survey (EDHS) and out of the 15,683 woman participants of the 2016EDHS a subsample of 3498 adolescent girls aged 15-19 were selected from which 3126 respondents with complete responses to all the variables of interest were retained the dependent variable was adolescent nutrition measured in terms of stunting and underweight. Height for age z score (HAZ) <-2 was used to identify stunting while BMI <18.5kg/m2 was used to identify underweight. Bi variable and multivariable regression was carried out.

Results: In this study the prevalence of stunting and thinness was 14.2 and 28.8% respectively. Type of place of residence and wealth index were significantly associated with stunting, Accordingly the odds of stunting among respondents living in rural areas was (AOR=1.6;95% CI;1.2,2.0)higher compared to adolescents girls living in urban settings .Adolescent girls from poor wealth group (AOR=1.5;95% CI;1.2,1.8)) Had a higher odds of being stunted compared to adolescent girls from rich group. Type of place of residence was significantly associated with underweight, accordingly the odds being thin among respondents living in rural areas was (AOR=1.7; 95% CI;1.2, 2.0) higher compared to adolescents girls living in urban settings.

Conclusion: the current study revealed that stunting and underweight are important public health problems among adolescent girls in Ethiopia

Introduction

According to the World Health Organization (WHO), adolescents are young people in the age group of 10-19 years [1]. Currently, there are around 1.8 billion adolescents in the world, and 90% reside in LMIC [2]. Africa has the most rapid growth in this particular age group, and its adolescent population will exceed Asia and Latin America in the coming years, mainly due to high fertility rates [1]. In Ethiopia, 25%of the population is adolescents [3].

Globally, the disease burden among adolescents is mainly due to infectious and injury related causes, but under nutrition remains a significant public health issue among these age groups [4]. In 2015, there were 1.2 million adolescent deaths in the world, of which 70% took place in low- and middle-income countries (LMIC), and Africa accounted for 45% of the deaths, where under nutrition was either an exacerbating or contributing factor [5].

The fact that adolescence is a crucial time characterized by rapid growth in all spheres of life puts them in a vulnerable position because of the higher energy and nutritional demand to meet their physical, mental, social, emotional, and sexual growth needs [6]. Despite the fact, adolescents are given little to no attention because they are less prone to infection, unlike under-five children and chronic diseases, unlike the elderly [7].

Under nutrition denotes an insufficient intake of energy and nutrients to meet an individual's needs to maintain good health. In most literature, under nutrition is used synonymously with malnutrition. In the strictest sense, malnutrition denotes both under nutrition and over nutrition [8]. Adolescent malnutrition takes three forms under nutrition (wasting, stunting, and thinness (underweight), Micronutrient deficiency or excess and overweight or obesity. Because of the cultural, social, and gender norms which favour boys over girls, adolescent girls are most vulnerable to under nutrition [2]. Stunting, height-for-age below 2 Standard Deviations (SD) of the WHO, is an indicator of poor nutrition and is essential to consider in adolescent girls [9]. Because globally, 16 million adolescent girls enter motherhood every year, and 20% of these take place in sub-Saharan Africa and Latin America [1]. This undue burden holds particularly in rural areas where girls are forced to get married and give birth [10], one in ten adolescent girls aged 15 to 19 in Ethiopia has already started childbearing [11]. Pre-pregnancy stunting imposes a major risk for adolescent girls that results in miserable pregnancy and birth outcomes such as preterm birth and Small for Gestational Age (SGA) babies [9]. Therefore, the nutritional status of adolescent girls and factors associated with it is vital, because adolescent girls provide a window of opportunity to break the intergenerational cycle of malnutrition and to prepare them for pregnancy and breastfeeding in the near future [5].

In adolescents underweight (thinness) is defined as BMI for age Z score <-2 and severe thinness as BMI for age <-3, which is mainly characterized by severe weight loss following extreme deprivation and scarcity of food [5]. All (mild, moderate, and severe) levels of underweight exist in Africa, putting lot of girls at risk of complication and death during pregnancy and childbirth. Since maternal pre-pregnancy nutritional status affects the birth outcomes, women with low BMI are likely to give birth to low-birth-weight babies, which in turn increase infant deaths [12].

The adolescence period is not just a period of vulnerability but an opportunity for catch-up growth. Linear growth peaks from the fetal period up to 3 years; it then declines. It peaks again during puberty beginning around the age of 12, particularly in girls, 15-25% of adult height and 50% of the adult weight is gained during adolescence, given this pattern adolescence may be a second window of opportunity for a catch-up growth [9].

A study reviewing trends in BMI from 1975 to 2016 showed that children and adolescents were moderately and severely underweight than obese the prevalence of underweight was highest among south Asia and central, east, and West Africa [1]. A most recent study done in 53 countries showed that southern Asia had the highest prevalence of underweight, which was two times higher than that of east Asia, the Pacific, and sub-Saharan Africa [5]. The same study showed that, in 2016, the mean BMI for boys and girls aged 10-19 years was less than 20. It also showed that Ethiopia, Niger, Senegal, India, Bangladesh, Myanmar, and Cambodia had the lowest BMI. Even though there are limited studies regarding stunting among adolescent girls globally, published studies showed that a significant number of adolescents girls, 52%,44%,8%, and 6% of the adolescents were stunted in Guatemala, Bangladesh, Kenya, and Brazil, respectively [9].

Studies done among school-going adolescent girls in a rural part of Tigray (Ethiopia) showed that the prevalence of thinness among the group was 21.4%, 21.6%, and 32.2% in Adwa, Wekro and Hawzen, respectively. Similarly, a study done in northwest Ethiopia Layguyint woreda showed that 29% of school-going adolescent girls were thin, which is three times higher than school-going adolescent girls in awash town of Afar (Ethiopia). A similar institutional-based study done in southeast Ethiopia, the prevalence of thinness was 11.9%.A study done in a different setting among refugee adolescent girls in the Somali region showed that the prevalence of thinness was 15.2%.in almost all studies that thinness was significantly associated with parents (mother's and father's educational) status, having a family size >5, sex, age, grade level, and being rural area resident [3,13-17].

In school-based studies done on the nutritional status of adolescent girls, the prevalence of stunting in a rural part of

Tigray was 12.2%,21.2%, and 32.2% in Adwa,Wekro, and Hawzen, respectively [3,13,18]. Similar studies showed that 22.9%, 16.3%,9.7%, and 20.9% of school-going adolescent girls were stunted in Awash town of Afar, Layguint, Adama, and Goba town, respectively [3-15,17-20]. Unimproved sources of drinking water, sex (boys), younger adolescents, ownership of the phone, dietary diversity score, and eating <4 food groups predicted stunting in adolescent girls.

Materials and Methods

A cross-sectional study was used to conduct EDHS 2016. The 2016 EDHS was used as a data source, the fourth DHS conducted in Ethiopia, following the 2000, 2005, and 2011 EDHS surveys; the 2016 EDHS provides valuable information on trends in key demographic and health indicators over time. The source population of the study was all adolescent populations aged 15-19 years in 2016 in Ethiopia. The study population was all adolescent girls aged 15-19 years and take part in the study in 2016 in Ethiopia

The sampling frame used for the 2016 EDHS was the Ethiopian population and housing census (PHC), which was conducted in 2007 by the Ethiopia central statistical agency that provided a complete list of 84,915 enumeration areas.

The sample for all DHS surveys was designed to represent all regions and administrative cities in the country. The survey participants were selected using stratified and two-stage sampling methods: enumeration areas (EAs) in the first stage and households in the second stage. Each region was stratified into urban and rural areas. Then proportional probability allocation to sample size was made. For the 2016 DHS, 645 enumeration areas (EAs) were selected. From this sample, 202 EAs were from urban, and 443 were from rural areas. In all selected households, height and weight measurements for women age 15-49 were conducted [21].

All individual women aged 15-49 were interviewed face to face and this study focused on data obtained from the girls aged 15-19 since the women questioner provides characteristics of the individual women, the house hold questioner provide information regarding the house hold such as source of drinking water, toilet facilities and dwelling characteristics were used as variables from the questioner pregnant adolescents and those with severe illness were excluded.

Data processing and analysis

After data collection, completed DHS questionnaires were carefully coded, entered, and edited by The EDHS 2016 investigators and analysts. The data analysis used the weighted samples to ensure the survey results were representative of the national and regional level findings.

The dependent variables were thinness and stunting, and BMI cut off point 18.5 is used to define underweight height-for-

age below 2 SD of the World Health Organization (WHO)/CDC reference standards) was used to define stunting. The outcome variables were coded as "1" for having thinness or stunting whereas "0" for not having these problems. Analysis started with summary of the socio demographic characteristics of the participants by using a Pearson chi square test in order to assess the distribution of the outcome variables with respect to the characteristics.

The association between the outcome variables (i.e. stunting and thinness) and independent variables were first analyzed using a binary logistic regression. Covariates having a p-value <0.25 were retained and entered into the multivariable logistic regression analysis using forward stepwise approach methods. The results are presented as Odds Ratios (OR) with 95% confidence interval a P-value <0.05 was considered a cutoff point for a predictor variable to be significantly associated.

Results

From the total 15,683 women participants of the 2016 EDHS a sub sample of 3498 adolescents aged 15-19 were selected from which 3126 adolescent girls with a complete response to all the variables of interest were retained and of the total participants 1223(39.1%) were married about 1986(63.5%) were in primary school while 711 (22.6%) were in secondary and higher education and regarding wealth index 1564(50.9%) of the participants were from the rich group and 35.3% of the participants did not have access to safe water supply and only 488(15.6%)of the participants had access to hygienic toilet (**Table 1**)

Factors associated with stunting and thinness

In bivariate logistic regression predictors such as place of residence, wealth index ,current marital status of the respondents ,type of toilet facility and source of drinking water were significantly associated with stunting and in multivariable analysis predictors such as place of residence and wealth index were significantly associated with stunting, Accordingly the odds of stunting among respondents living in rural areas was (AOR=1.6;95%CI:1.2,2.0) higher compared to adolescents girls living in urban settings. Adolescent girls from poor wealth group (AOR=1.5;95% CI 1.2,2.0) Had a higher odds of stunting compared to adolescent girls from rich group see (**Table 2**).

In bivariate logistic regression predictors such as place of residence, access to information , type of toilet facility and source of drinking water were significantly associated with underweight and in multivariable analysis predictors such as type of place of residence and wealth index were significantly associated with underweight, Accordingly the odds being thin among respondents living in rural areas was (AOR=1.7 95% CI:1.2,2.0) higher compared to adolescents girls living in urban settings .Adolescent girls from medium wealth group (AOR=1.4) 95% CI (1.1,1.7) Had a higher odds of being underweight compared to adolescent girls from rich wealth group see (**Table 3**).

Table 1. *Baseline characteristics and stunting and underweight among adolescent girls from 15–19 years in Ethiopia, EDHS, 2016 (n=3126).*

Characteristics			Stunted	Not stunted	normal	Thin
Educational attainment	no education	429(13.7)	53(12.4)	379(87.6)	307(71.6)	122(28.4)
	Primary	1986(63.5)	280(14.1)	1706(85.9)	1374(69.2)	612(30.8)
	Secondary	711(22.7)	110(15.5)	601(84.5)	545(76.7)	166(23.3)
Marital status	Currently married	1223(39.1)	159(13)	1064(87)	1366(71.8)	537(28.2)
	Not married	1903(60.9)	285(15)	1618(85)	861(70.4)	362(29.6)
Region	Tigray	256(8.2)	18(7)	238(93)	113(44.1)	143(55.9)
	Afar	26(0.8)	3(11.5)	23(88.5)	12(46.2)	14(53.8)
	Amhara	741(23.4)	93(12.6)	648(87.4)	255(34.4)	486(65.6)
	Oromiya	1140(36.5)	183(16.1)	957(83.9)	312(27.4)	828(72.6)
	Somalia	87(2.8)	26(29.9)	61(70.1)	40(46.5)	46(53.3)
	Benishangul	30(1)	5(16.7)	25(83.3)	6(20)	24(80)
	SNNPR	607(19.4)	93(15.3)	514(84.7)	109(18)	498(82)
	Gambella	9(0.3)	4(16.7)	5(55.6)	3(37.5)	5(62.2)
	Harari	6(0.2)	1(16.2)	5(83.3)	2(33.3)	4(67.7)
	Addis Ababa	206(6.6)	15(7.3)	191(92.7)	42(20.4)	164(79.6)
	Dire Dawa	18(0.6)	3(16.7)	15(83.3)	5(29.4)	12(70.6)
Residence	Urban	731(23.4)	82(11.2)	649(88.6)	144(19.7)	587(80.3)
	Rural	2394(76.6)	381(15.1)	2033(84.9)	755(31.5)	1639(68.5)
Wealth index	Poor	945(30.2)	115(12.2)	830(87.8)	287(30.4)	658(69.6)
	Medium	590(18.9)	94(15.9)	496(87.8)	213(36.1)	377(63.9)
	Rich	1591(50.9)	234(14.7)	1357(85.3)	400(25.1)	1191(74.9)
Source of drinking water	Improved	2023(64.7)	273(13.5)	1750(86.5)	560(27.7)	1462(72.3)
	Not improved	1103(35.3)	171(15.5)	932(84.5)	339(30.7)	764(69.3)
Type of toilet facility	Improved	488(15.6)	59(12.1)	429(87.9)	560(27.7)	1462(72.3)
	Not improved	2638(84.4)	384(14.6)	2554(85.4)	339(30.7)	764(69.3)
Access to information	Yes	1637(52.4)	237(14.5)	1400(85)	1215(74.2)	422(25.8)
	No	1489(47.6)	206(13.8)	1283(86.2)	1011(67.9)	478(32.1)

Table 2: *Bivariable and Multivariable analysis of the association between stunting and adolescents 'background characteristics, Ethiopia, EDHS, 2016.*

Covariates	Stunting		Odds ratio		
	Yes (n %)	No (n %)	COR (95%CI)	AOR (95%CI)	p-value
Educational attainment					**0.2**
no education	53(12.4)	379(87.6)	1	1	
Primary	280(14.1)	1706(85.9)	1.2(0.8,1.6)	1.4(0.8,1.5)	
Secondary	110(15.5)	601(84.5)	1.3(0.9,1.8)	1.4(0.9,2)	
Marital status					
Currently married	159(13)	1064(87)	1	1	
not married	285(15)	1618(85)	0.8(0.7,1.04)	0.8(0.7,1.1)	
Residence					**0.0002**
Urban	82(11.2)	649(88.6)	1	1	
Rural	381(15.1)	2033(84.9)	1.4(1.09,1.8)**	1.6(1.2,2)**	
Wealth index					**0.002**
Poor	115(12.2)	830(87.8)	1.3(1.01,1.6)**	1.5(1.2,1.8)**	
Medium	94(15.9)	496(87.8)	0.9(0.7,1.1)	0.9(0.7,1.3)	
Rich	234(14.7)	1357(85.3)	1	1	
Source of drinking water					**0.1**
Improved	273(13.5)	1750(86.5)	1	1	
Not improved	171(15.5)	932(84.5)	1.2(0.9,1.5)	1.2(0.9,1.5)	
Type of toilet facility					**0.9**
Improved	59(12.1)	429(87.9)	1	1	
Not improved	384(14.6)	2554(85.4)	1.2(0.9,1.6)	1(0.7,1.4)	
Access to information					**0.5**
Yes	237(14.5)	1400()85.5	1	1	
No	206(13.8)	1283(86.2)	1.2(0.9,1.2)	0.9(0.7,1.2)	

Table 3: Bi variable and Multivariable analysis of the association between underweight and adolescents 'background characteristics, Ethiopia, EDHS, 2016.

Covariates	Underweight		Odds Ratios		
	Yes%	No ,n%	COR (95%CI)	AOR (95%CI)	P-value
Educational attainment					0.2
no education	122(28.4)	307(71.6)	1	1	
Primary	612(30.8)	1374(69.2)	1.3(1,1.7)	1.2(0.9,1.5)	
Secondary	166(23.3)	545(76.7)	1.5(1.2,1.8)	1.1(0.8,1.5)	
Marital status					0.5
Married	537(28.2)	1366(71.8)	1	1	
Not married	362(29.6)	861(70.4)	1(0.9,1.3)	1.1(0.9,1.2)	
Residence					0.002
Urban	144(19.7)	587(80.3)	1	1	
Rural	755(31.5)	1639(68.5)	1.9(1.5,2.3)	1.7(1.4,2)	
Wealth index					0.03
Poor	287(30.4)	658(69.6)	1.3(1.1,1.6)	1.1(0.9,1.3)	
Medium	213(36.1)	377(63.9)	1.8(1.4,2.1)	1.7(1.4,2)	
Rich	400(25.1)	1191(74.9)	1	1	
Source of drinking water					0.7
Improved	560(27.7)	1462(72.3)	1	1	
Not improved	339(30.7)	764(69.3)	1.2(0.9,1.4)	1(0.8,1.2)	
Type of toilet facility					0.7
Improved	560(27.7)	1462(72.3)	1	1	
Not improved	339(30.7)	764(69.3)	1.6(1.2,1.9)	1.6(1.3,2)	
Access to information					0.1
Yes	422(25.8)	1215(74.2)	1	1	
No	478(32.1)	1011(67.9)	1.4(1.2,1.5)	1.2(1,1.3)	

*Level of significance: * p-value <0.05.*

Discussion

In this study the prevalence of stunting and thinness was 14.2 and 28.8% respectively. Type of place of residence and wealth index were significantly associated with stunting, Accordingly the odds of stunting among respondents living in rural areas was 1.6 times higher compared to adolescents girls living in urban settings .Adolescent girls from poor wealth group Had a higher odds of being stunted compared to adolescent girls from rich group. Type of place of residence was significantly associated with underweight; accordingly the odds being thin among respondents living in rural areas was 1.7 times higher compared to adolescent's girls living in urban settings.

The current study revealed that the prevalence of stunting is 14.2% which is similar to a study done in Jimma where the prevalence of stunting among adolescent girls is found to be 16% [22]. It is exactly the same as a study done in sagamu, south western Nigeria where by the prevalence of stunting is 14.2% [23]. The finding in this study is higher than the prevalence in the neighbouring Kenya which is found to be 12.1% [24]. However the prevalence in the current study is much lower than the finding from Indonesia (28.11%), south china (25.6%) [23,24].This difference in prevalence of stunting may be due to the differences in cultural feeding habits and the socio economic context among the study participants. The result also showed that adolescent girls from a poor wealth group had a 1.5 times higher odds of being stunted compared to adolescent girls from rich wealth group this may be due to the fact that adolescents from rich wealth group having better access to balanced diet and health care they are also privileged when it comes to accessing nutrition related information

compared to adolescent girls from a poor wealth this is in line with findings across literatures [27-30]. Adolescent nutritional status depends on socio economic status of the household they reside in socio economic status of household determines the quality and the quantity of food adolescent girls consume those with low socio economic status failing to purchase Varity of foods.

The prevalence of thinness is 28.8%which is similar to a study done in southern Ethiopia where the prevalence of thinness was found to be 27.5% [31]. The prevalence in this study is much lower than findings from India (49%) Nigeria (58.7%) [32,33]. And it is higher than study done in Chad (12.6%) Nepal (7.2%) [28,34]. It has been evident from this study that adolescent girls from a rural setting had 1.7 times higher odds of being underweight compared to those from urban setting this might be because adolescent girls from urban setting having better access to health care service they also are privileged when it comes to accessing nutrition related information through different media platforms. The other possible explanation for the difference can be explained by the common trend in rural Ethiopia whereby most people obtain their energy from grain and consume almost no protein on the daily basis [30].

The urban rural discrepancy can be also explained by the fact that place of residence particularly in less developed countries like Ethiopia determines people's life style, socio economic and cultural activities and most importantly health conditions those living in urban settings are privileged when it comes to accessing better health care developed roads facilitate supply of food staff to urban population and while cities are marked

by concentration of wealth power and suitable healthcare, villages are marked by poverty under development and lack of adequate health services [29].

Conclusion

The current study revealed that stunting and underweight are important public health problems among adolescent girls in Ethiopia. Rural residence and poor wealth were significantly associated with stunting and underweight among adolescent girls in Ethiopia having in mind the long term impact and the intergenerational nature under nutrition has on the public due attention should be given to adolescent nutrition in addition to the existing effort made to combat child under nutrition. Programs targeting vulnerable groups that are those living in rural setting and from poor wealth should be provided with nutritional intervention to support the healthy transition from childhood to adulthood this would be an important step in halting the intergenerational cycle of malnutrition.

Authors' Contribution

ST and SA: designed and implemented the research, conducted the data analysis.

YA: supervised the research and assist in data analysis, drafted and wrote the manuscript, reviewed the manuscript and proof read the final manuscript including preparation of tables and figure

AA: has participated in literature review and data entry. All authors approved the final version of the manuscript prior to submission

Availability of Data and Materials

The data that support the findings of this study will be available on request from the corresponding author

Declarations

Ethics approval and consent to participate

The 2016 Ethiopian Demographic and Health Survey were conducted after obtaining ethical clearance from Ethiopia Health and Nutrition Research Institute Review Board, the Ministry of Science and Technology, Institutional Review Board of ICF International, and the CDC. The overall process of the survey, including coordination of activities, questionnaire design, training of data collectors, supervisors, and all people involved in the process and report writing, were strictly followed. The data were collected after taking informed consent, and all information was kept confidential. In this study, permission was requested from the Demographic and Health Surveys Program to access EDHS data. The datasets was treated with the utmost confidentiality. Waiver for full ethical review is requested from the Addis Continental Institute of Public Health ethics review board.

Competing Interests

The authors have declared no conflict of interest.

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