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Predictors of nutritional status of Ethiopian adolescent girls: a community based cross sectional study

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Abstract

Background: Malnutrition is a major health issue affecting children, women and adolescents globally and developing countries in particular. Adolescence is a time of enormous physiological, cognitive, and psychosocial change but it remain a neglected, difficult-to-measure and hard-to-reach population. The critical role of adolescent nutrition in the intergenerational cycle of Growth failure has not been well addressed in Ethiopia. Hence, this study assesses level of low BMI-for- age and height-for- age and their associated factors among adolescent girls in northwest Ethiopia.

Methods: Community based cross-sectional quantitative study was employed. A total of 1281 adolescent girls were included in the study. Multistage cluster sampling method was used. Pretested questionnaire were used to collect the data. The collected data were entered in to Epi Info version 3.5.3 and exported to SPSS version 20.0 software packages for further statistical analysis. The data were analyzed using bivariate and multivariate logistic regression. The degree of association between dependent and independent variables were assessed using odds ratio with 95 % confidence interval and variables with p-value ≤ 0.05 were considered significant.

Result: The prevalence of girls with BMI-for-age Z-score < -2 were 13.6 % and height-for-age Z-score < -2 were 31.5 %. Being in the age group 10–14 years (AOR = 5.83, 95 % CI: 3.26, 10.44), being in the age group 15–17 years (AOR = 2.06, 95 % CI: 1.09, 3.89), with poor dietary diversity score (AOR = 2.48, 95 % CI: 1.60, 3.84), utilizing community based nutrition service (AOR = 0.67, 95 % CI: 0.47, 0.95) were factors significantly associated with thinness in adolescent girls. Being on the age group 10–14 years (AOR = 6.07, 95 % CI: 4.00, 9.22), being on the age group 15–17 (AOR = 1.39, 95 % CI: 1.93, 2.09), had nutrition and health information (AOR = 1.94, 95 % CI: 1.46, 2.57), living in food secured households (AOR: 0.65, 95 % CI: 0.50, 0.84) were factors affecting low height-for-age in study subjects.

Conclusion: Finding of this study indicated that prevalence of adolescents with low BMI-for-age and low height-for-age Z-score < -2 were high. Age, dietary diversity score and community based nutrition service utilization were factors affecting low BMI-for-Age in adolescent girls. Age, food insecurity and Nutrition and health information were factors affecting low height-for- age in adolescent girls. Improving community based nutrition service utilization, food security specially in young adolescents is highly recommended.

Keywords: Adolescent girls, Prevalence, BMI-for-age, Height-for-age, Northwest Ethiopia

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Background

According to WHO Adolescents ranged from 10–19 years and they account about 18 % of the global population. They are under physiological, cognitive, and psychosocial changes but remain neglected from many health and nutrition services [1, 2].

The burden of energy, protein and micronutrient deficiencies is high in adolescents of developing countries. The subsequent social, economic, health, and development impact of under nutrition in adolescents is expected to be high in this countries [2, 3].

Malnutrition is one of the major public health issue affecting many women in Ethiopia. Twenty seven percent of women had chronic energy deficiency (BMI < 18.5), 17 % of women were anemic, and 6 % of rural women were experiencing night-blindness in their most recent pregnancy [3]. Undernutrition throughout the human life cycle usually starts in uterus and spans generation [4]. Malnutrition that occurs during childhood, adolescence, and pregnancy has an additive negative impact on the birth outcome of the newborn and it will have inter-generational effect. Malnourished adolescents tend to be ultimately malnourished adults and give birth to small babies [3, 5–7]. Moreover Infants with low birth weight are more vulnerable to adult-onset chronic diseases than children born at normal weight [7].

Malnutrition in adolescents may be genetically inherited, however, the vast majority of cases are linked with food insecurity, poor care and poor socioeconomic status [3]. Prematurity, short maternal stature, infections, cigarette smoking, alcohol and drug use, very young maternal age, indoor air pollution, domestic violence, closely spaced pregnancies, hypertension, stress, and malaria are all important predictors for the intergenerational effect of undernutrition [8].

The adolescent growth spurt offers a chance to compensate for earlier growth failure, although such potential is very limited [3]. Adolescence is a pivotal stage of the life cycle, and in turn, provides a unique opportunity to foster a healthy transition from childhood to adulthood and halting generational effect of malnutrition [5].

Large-scale community-based health and nutrition interventions showed promising results in improving nutritional status of adolescents in different countries [9]. In Ethiopia there are community based interventions mainly to prevent malnutrition in women and children, however there is limited effort to address malnutrition in adolescents. The current study aimed to assess the prevalence and associated factors of undernutrition in adolescent girls in Amhara region, Ethiopia. The study will be a base line for other future studies and will guide policy makers to design proper nutrition interventions for adolescents.

Methods

Study design and period

Quantitative cross sectional study was employed in December 2013.

Study area

The study was conducted at Amhara National Regional State which is located in the northwestern part of Ethiopia between 9° 20' and 14° 20' North latitude and 36° 20' and 40° 20' East longitude. Its land area is about 170,000 square kilometers [10]. The region is divided into 11 zones and 140 Weredas. There are about 3429 Kebeles (the smallest administrative units) in the region. During the study period, the community based nutrition(CBN) program was implemented in 10 Zones and 47 Woredas in Amhara region. The study was conducted in 5 major CBN implementing woredas namely Wogera, Ebnat, Wadla, Chilga and Dembecha [11].

Source and study population

All adolescent girls in all CBN sites in Amhara Region were the sources population. All adolescent girls in selected CBN sites in Amhara region were the study population. Those adolescent girls who were seriously ill at time of data collection were excluded in this study.

Sample size

The sample size of the Study was calculated using single population proportion formula by considering the following assumptions: Proportion of adolescents with stunting as 50 %, margin of error as 4 %, confidence level at 95 %, non response rate of 10 % and design effect of 2. The final sample size for this study was 1320.

Sampling procedure

Multistage cluster sampling was employed to select adolescent girls. There were 11 zones in the region and we have selected 4 zones by simple random sampling, then we have selected 5 woredas where CBN service implemented in 4 different phases. We have selected 15 kebeles by simple random sampling technique, three kebele in each woreda. All adolescents from selected kebeles have been incorporated in the study.

Variables of the study

Stunting and thinness in adolescent girls were considered as dependent variables in this study. Adolescent girls with height-for-age Z-score < -2 from the median value of WHO's 2006 reference data were considered as stunted and those with BMI-for-age Z-score < -2 were considered as thin. Those adolescent girls with height-for-age or BMI-for-age Z-score < -3 from the median value of 2006 WHO's reference data were considered as severely stunted or severely thin respectively [12]. Socio

demographic variables, economic status, nutrition and health related characteristics were considered as independent variables.

Data collection instruments and procedure

A cross-sectional quantitative study design was employed. Structured questionnaire was used for data collection. The questionnaire was prepared in English first and then translated to Amharic and back to English by language experts to check for consistency. Twenty Nurse data collectors and 7 health officer supervisors were trained for data collection and supervision.

Weight of adolescent girls was measured using beam balance with light closing, and was measured to the nearest 0.1 kg, and height of adolescent girls was measured to the nearest 0.1 cm on standing position without shoes. Checking accuracy of the scale and frequent calibrating of the scale was done.

The categories for dietary diversity were determined by first asking if the adolescent girl had eaten a particular type of food in the previous 24 h prior to date of data collection. These were then combined in to different food groups. Dietary diversity score(DDS) of adolescents was assessed and scored as “poor” for 0–3 food group, as “medium” for 4–5 food group and as “high” for greater than 6 food group.

Food security was assessed using 6-item module and the sum of affirmative responses to the six questions in the module was taken. The food security status of households with raw score 0–1 was described as food secure and the two categories “low food security” and “very low food security” in combination were referred to as food insecure [13].

Data quality control

Data quality was controlled via conducting a pre-test on 5 % of the samples and through supervision during data collection. The completeness of the questionnaire was also checked before data entry. Anthropometric measurements of subjects were done by trained data collectors using standard procedures.

Data processing and analysis

First code was given to the completed questionnaire and then data were entered and analyzed using SPSS version 20 statistical package. Data cleaning was performed to check for accuracy, consistencies and missed values. Any error identified has been corrected. Frequencies, proportion and summary statistics was used to describe the study population in relation to relevant variables. Anthropometric measurements were converted to height-for-age z-scores and BMI-for-age z-scores using WHO Anthroplus software [14]. The levels of undernutrition (thinness and stunting) were regressed against the

demographic, socio-economic, health and nutrition related factors. Binary logistic regression model was fitted to identify factors associated with thinness and stunting. The two outcome variables were coded as “1” for having thinness and stunting where as “0” for not having thinness and stunting. Bivariate analysis was performed and variables with p-value < 0.2 in the bivariate analysis were exported to multivariate logistic regression analysis in order to screen strong predictors of undernutrition. Significance was obtained at 95 % CI and $p < 0.05$.

Ethical considerations

Ethical approval has been obtained from the University of Gondar and permission letter was obtained from Amhara Regional Health Bureau and from zonal and woreda health offices. The questions from the questionnaire has proved not to affect the moral and personality of study subjects. Informed consent was obtained from each study subject after explanation of why they take part in research. They were also informed participation is volunteer based. Confidentiality has been ensured from all the data collectors, supervisors and investigators side using code numbers than names and keeping questionnaires locked.

Result

Socio demographic and economic characteristics of study subjects

A total of 1281 adolescent girls aged 10–19 years included in the final analysis among 1320 which make a response rate 97.2 %. Among this 499(39 %) were early adolescents, 425(33 %) were middle adolescents. while 357(27 %) of them were late adolescents. Majority of adolescents (83.8 %) were single in marital status. Around 65 % of them attended primary education and 1013(79.1 %) of them were students (Table 1).

Nutrition and health related characteristics of adolescent girls

Around 20 % of all adolescents were consuming less than three meals per day. The mean Dietary Diversity Score(DDS) was 5.6 (SD 2.04). Among all study subjects, 664(53 %) were practiced bellow the mean score of dietary diversity. About 33 % of adolescent girls had consumed 3 or less food groups (poor dietary diversity) in the previous day, 45 % had consumed 4 to 5 different food groups and 21.8 % consumed 6 or more food groups. Food insecurity status was determined at household level. The research revealed that 556(44.4 %) of adolescents lived in food insecure households. Adolescents were asked to list any sickness a month prior to the survey and 241(19.2 %) of adolescents reported sickness. Based on current physiologic state of adolescents, 27 were pregnant, 58 were lactating and the rest 91.6 % were non- pregnant and non-lactating (Table 2).

Table 1 Socio demographic characteristics of adolescent girls, Amhara region, Northwest Ethiopia, December, 2013 (N = 1281)

Variables	Frequency	Percent (%)
Age		
10 to 14	499	39.0
15 to 17	425	33.2
18 to 19	357	27.9
Woreda		
Dabat	256	20.0
Aykel	256	20.0
Ebnat	258	20.1
Wadila	253	19.8
Dembecha	258	20.1
Marital status		
Single	1073	83.8
Married	193	15.1
Divorced	12	0.9
Separated	3	0.2
Newlywed	126	9.8
Religion		
Orthodox Christian	1261	98.4
Muslim	20	1.6
Ethnic group		
Amhara	1134	88.5
Other ^a	147	11.5
Educational status		
Can't read/write	71	5.5
Can read/write	32	2.5
Primary (1 to 8)	831	64.9
Secondary (9 to 12)	315	24.6
College/university	32	2.5
Occupation		
Housewife	145	11.3
Farmer	27	2.1
Daily laborer	6	0.5
Private/government employee	2	0.2
Student	1013	79.1
Jobless (unemployed)	67	5.2
Other ^b	21	1.6
Family size		
< or equal to 5	587	45.8
Greater than 5	694	54.2
Staple cereal		
Teff	484	37.8
Wheat	398	31.1

Table 1 Socio demographic characteristics of adolescent girls, Amhara region, Northwest Ethiopia, December, 2013 (N = 1281) (Continued)

Maize	184	14.4
Sorghum	123	9.6
Others ^c	82	7.1

^aTigrie, oromo^bMerchant, house made, shepherd (cow keeper)^cBarely, millet

Prevalence and associated factors of malnutrition in adolescent girls

Prevalence of malnutrition in adolescent girls

Overall the prevalence of girls with a low body mass index-for-age Z score less than $< -2SD$ were 13.6 % while 4 % were with less than $-3 SD$. The overall prevalence of height-for-age Z-score less than $-2 SD$ were 31.5 % while 14.7 % were with less than $-3 SD$.

Factors affecting low BMI-for-Age in adolescent girls

Those adolescents aged 10–14 years were 5.8 times more likely to be thin than those aged 18–19 years [AOR = 5.83, 95 % CI: 3.26, 10.44] where as those aged 15–17 were 2 times more likely to be thin than those aged 18–19 years [AOR = 2.06, 95 % CI: 1.09, 3.89]. Adolescents with poor dietary diversity score were 2.5 times more likely to develop thinness than those having high dietary diversity score [AOR = 2.48, 95 % CI: 1.60, 3.84]. CBN service utilization was also other contributory factor for good nutritional status. Those who utilized CBN service were 33 % less likely to be thin than those not utilizing CBN service [AOR = 0.67, 95 % CI: 0.47, 0.95] (Table 3).

Factors affecting low height-for-age in adolescent girls

Those adolescents aged 10–14 years were 6 times more likely to be stunted than those aged 18–19 years [AOR = 6.07, 95 % CI: 4.00, 9.22] where as those aged 15–17 were 1.4 times more likely to be thin than those aged 18–19 years [AOR = 1.40, 95 % CI: 1.93, 2.09]. In this study adolescents who had nutrition and health information were 2 times more likely to be stunted than those who had no information [AOR = 1.94, 95 % CI: 1.46, 2.57]. Adolescents living in food secured households were 35 % times less likely to be stunted than those living in food in secured household. (AOR:0.65, 95 % CI: 0.50, 0.84) (Table 4).

Discussion

This cross sectional nutritional survey was conducted at five CBN implementing woredas of Amhara region. The study determined prevalence and associated factors of undernutrition in adolescent girls. Despite the fact that community based nutrition program will improve the nutritional status of women and children, prevalence of low BMI-for-age and Low height-for-age in adolescent

Table 2 Nutrition and health related characteristics of adolescent girls in Amhara region, Northwest Ethiopia, December, 2013 (N = 1281)

Variable	Frequency	Percent
Physiological state		
Not pregnant/lactating	1174	91.6
Pregnant	27	2.1
Lactating	58	4.5
Pregnant and lactating	2	.2
Don't know	20	1.6
Dietary Diversity Score		
Poor(0–3 food group)	417	32.6
Medium(4–5 food group)	585	45.7
High(6+ food group)	279	21.8
Meal frequency total		
Less than 3 meal	266	20.8
3 plus meal	1015	79.2
Meal frequency (non pregnant) (N = 1252)		
Once	11	0.9
Twice	247	19.7
Three and more times	994	79.4
Food security		
Food insecure	556	44.4
Food secure	696	55.6
Knowledge on vitamin A rich foods		
Green vegetable and other vegetable, fruits egg, meat, milk	163	12.7
I don't know	1118	87.3
Knowledge on iron rich foods		
Teff, meat	286	22.3
I don't know	995	77.7
Availability of home garden		
Yes	785	61.3
No	496	38.7
Disease reported in last one month(N = 1252)		
Yes	241	19.2
No	1011	80.8
Access to health and nutrition information from health extension workers		
No information	478	37.3
Growth monitoring	97	7.6
Adolescent girls nutrition	88	6.9
Maternal nutrition	75	5.9
Exclusive breast feeding	82	6.4
Complementary feeding	85	6.6

Table 2 Nutrition and health related characteristics of adolescent girls in Amhara region, Northwest Ethiopia, December, 2013 (N = 1281) (Continued)

Variable	Frequency	Percent
Family planning	93	7.3
Child care	53	4.1
Nutrition during pregnancy	67	5.2
Nutrition during lactation	163	12.7

girls were found to be high in the study setting which were 13.6 % and 31.5 % respectively.

The prevalence of low BMI-for-age is comparable with the national nutrition baseline survey report for the NNP of Ethiopia which was 14% [15] and lower than a study done in northern part of Ethiopia (58.3 %) [16] and Varanasi rural India (26.6 %) [17]. However, the prevalence is higher than a study in Addis Abeba Ethiopia (6.2 %) [18]. The variation in prevalence could be explained in socio-economic and urban–rural difference between the study subjects and settings. Low prevalence as compared to the study in northern Ethiopia may be due to the current study was conducted after the introduction of community based program in Ethiopia.

The prevalence of low Height-for-age is higher than the national base line survey which was 23 % [15], northern part of Ethiopia [16] and Addis Abeba town [18]. The reason could be our survey is done in Amhara region in which adolescents may have a different feeding habit. High levels of stunting in the study setting may be due to early marriage and early pregnancy which is high in the region. The other possible reason could be the others were conducted in the age group of 13–19 in which the most vulnerable groups were not included.

In this survey, variation in development of thinness was observed across different age groups. Young adolescent girls were more likely to be thin than older adolescent girls in this study (Table 3). The findings of this study was in line with a study in Northern Ethiopia and Ambo town [16, 19]. This may be due to the fact that age 10–14 is the time of adolescent growth spurt in which there is an increased demand of essential nutrients. Hence, if the requirement for achieving their maximum need is not fulfilled they will be prone to malnutrition.

The DDS is one of best indicators of both macronutrient and micronutrient intake. The current study revealed that adolescent girls with higher DDS were more likely to have normal BMI-for-age Z scores as compared to those having low DDS (Table 3). This is because when the DDS is high, adolescents will get adequate energy, and other important nutrients having role in growth and development.

Age of adolescent girls was also important predictor of stunting in adolescent girls in which early adolescents aged 10–14 years were more likely to be stunted as

Table 3 Both bivariate and multivariate result of factors affecting body mass index-for-age of adolescent girls, Amhara region, Northwest Ethiopia, 2013

Variable	Low body mass index -for -age		OR(95 % CI)	
	Yes	No	Crude OR(95 % CI)	Adjusted OR(95 % CI)
Age				
10 to 14	118	381	7.08(3.99, 12.56)	5.83 (3.26, 10.44)
15 to 17	38	381	2.28(1.21, 4.28)	2.06 (1.09, 3.89)
18 to 19	14	320	1	1
DDS				
Low	53	134	3.48(2.30,5.27)	2.48(1.60, 3.84)
Medium	57	420	1.19(0.81, 1.75)	0.96 (0.64, 1.44)
High	60	528	1	1
Community based nutrition service utilization				
Yes	65	595	0.51(0.36, 0.71)	0.67(0.47,0.95)
No	105	487	1	1

compared with those 18–19 years old (Table 4). This finding is consistent with the baseline national nutrition survey and a study in northern Ethiopia [15, 16]. Those early adolescents are at the greatest gain in height as compared to late adolescents. Hence, Failing to achieve their nutrient needs for this period will make early adolescents more susceptible for developing chronic malnutrition.

Adolescents living in food secure households were 35 % times less likely to be stunted than those living in food insecure household (Table 4). This finding is consistent with a study in Jimma Zone, southwest Ethiopia [20]. This is because food security is one of the important determinant of chronic nutritional insult in adolescent girls.

In this study adolescents who had no nutrition and health information were 2 times more likely to be stunted

than those who had information (Table 4). This is because adolescents getting nutrition information will change their dietary habit which can improve their nutritional status.

Even though the study is conducted in wider coverage it may not address cause and effect relationship between variables since it is a cross sectional study. There may be recall and social desirability bias in listing food items eaten in the past 24 h. More over DDS did not measure quantity of food eaten by this adolescents.

Conclusion

Prevalence of adolescents with low BMI for age and Height for age Z score less than $< -2SD$ were high. Age, dietary diversity score and CBN service utilization were factors affecting low BMI for Age in adolescent girls. Age, food

Table 4 Both bivariate and multivariate result of factors affecting low height-for-age in adolescent girls, Amhara region, Northwest Ethiopia, 2013

Variable	Low height for age		OR	
	Yes	No	Crude OR(95 % CI)	Adjusted OR(95 % CI)
Age				
10 to 14	262	237	6.34(4.51, 8.91)	6.07(4.00,9.22)
15 to 17	89	336	1.52(1.05, 2.21)	1.39(1.93,2.09)
18 to 19	53	304	1	1
Nutrition and health information				
No information	122	356	1.58(1.23,2.03)	1.94(1.46, 2.57)
Had information	282	521	1	1
Food insecurity				
Yes	153	467	0.54(0.42,0 .68)	0.65(0.50, 0.84)
No	251	410	1	1
Home gardening				
Yes	241	544	1	1
No	163	333	1.11(0.87, 1.41)	1.27(0.96, 1.67)

insecurity and access to Nutrition and health information were factors affecting low height for age in adolescent girls. Considering adolescents as one of major target groups for CBN and give training to health extension workers and Women development army about nutrition services to be delivered to adolescents is recommended.

Abbreviations

AOR: Adjusted odds ratio; BMI: Body mass index; CBN: Community based nutrition; COR: crude odds ratio; DDS: Dietary diversity score; NNP: National Nutrition Program; SD: Standard deviation; SPSS: Statistical packages for social sciences.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The authors' responsibilities were as follows-MM, AA, ME, GD, TM and AB: designed and supervised the study and ensured quality of the data and made a substantial contribution to the local implementation of the study. MM did the analysis and interpretation of the data. MM, the corresponding author wrote the manuscript and had the final responsibility to submit it for publication. All authors read and approved the final manuscript.

Authors' information

Not applicable.

Availability of data and materials

Not applicable.

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