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Assessment of Adolescents' Under Nutrition Level among School Students in Eastern Tigray, Ethiopia: A Cross-Sectional Study

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Abstract

Background: Adolescence is the most important period of life where growth and development are accompanied, leading to increased demand for nutrients which could pose a greater risk of under nutrition. Little emphasis is given to reveal the evidence of level of under nutrition in this age group. So, this study assessed the magnitude of adolescents' under nutrition and its associated factors among primary and secondary public school in Eastern Tigray, Ethiopia.

Methods: Cross-sectional study design was conducted in April 2013, Tigray, Ethiopia. A sample of 411 primary and secondary adolescent students was selected using two stage stratified cluster sampling technique. The 2007 growth reference was used to assess prevalence of under nutrition. Data were analyzed using SPSS 20 for windows and logistic regression was used to declare the independent predictors considering p-value <0.05 was used as a cutoff point.

Results: The prevalence of stunting, wasting and underweight were 25.5%, 44% and 55% respectively. Stunting, wasting and underweight were more prevalent among males and early adolescents. The most important predictors identified for wasting were early adolescents' age (AOR=4.68, 95% CI=1.81-12.13), being male (AOR=5.31, 95% CI=1.73-16.32) and menarche (AOR=2.65, 95% CI=1.006-6.978). Adolescent girls who did not experience menarche were 5.5 times more likely to be under weight than those who had experienced menarche (AOR=5.47, 95% CI=2.91-10.26) none of them were found statistically significant predictors for stunting.

Conclusion: The prevalence of under nutrition among adolescents was higher. Thus, integrated nutritional intervention and related school health services should be done for intervening the under nutrition and adolescent's health, in general.

Introduction

Adolescence (10-19 years) is the most important period of life where growth and development are accompanied by various physical, physiological, behavioral and social changes. This leads to increased demand for nutrients that in turn could pose a greater risk of under-nutrition [1-3]. Globally, hundreds of millions of people are estimated to be affected by emergency situations all over the world; therefore, a high number of adolescents may present an increased risk of being exposed to under-nutrition. Under-nutrition starts before birth, goes into adolescence and adult life and can span into generations [4,5]. Adolescence under-nutrition is an important determinant of health outcome. Adolescents have different needs and have diverse problems. Under-nutrition in adolescents results in short stature and lean body mass, and is associated with deficiencies in muscular strength and working capacities [6]. This results in problem of low birth weight, which is more common in the offspring of adolescent mothers and is associated with fewer chances for survival and higher infant death rates [6]. Adolescents living in developing countries are suffering by under-nutrition. Especially, in Asia and Africa, the prevalence is higher with magnitude of 32%-65% and 4%-30% restrictively [4,6,7]. In Sub Sahara Africa, the prevalence of adolescence under-nutrition is 15%-58%, which is higher from other African countries [4,6,7]. According to EDHS 2011, the prevalence of stunting, wasting and underweight among under five children in Ethiopia were 44%, 10% and 29% respectively [8]. Rice consumption, family size, Family radio, infection, vaccination and latrine availability were among the factors associated with under-nutrition [9]. Adolescents remain a neglected age group, because they are considered as difficult to measure and interpret their data, low risk to under-nutrition and hard reaching population or otherwise simply neglected. Hence, information regarding adolescence under-nutrition is inadequate except very few population based studies stated that there is high prevalence of adolescent's under-nutrition [2]. In light of this, our study aimed to point out the magnitude and determinant factors of adolescent's under-nutrition among primary and secondary school children. The evidence from this study would help programmers and stakeholders in developing and intervening the high prevalence of under-nutrition among adolescents and generally make evidence based decisions.

Materials and Methods

Study design

Cross-sectional study design was conducted to point out the magnitude and determine the associated factors with under-nutrition.

Population and sampling

Data were collected from adolescents in primary and secondary school of Eastern zone of Tigray, 821 kms north to Addis Ababa, the capital city of Ethiopia. Sample size was calculated by Open epi software version 2.3 using the single population proportion formula. The population estimate of under nutrition used to calculate the sample size were 27.5% for underweight, 58.3% for wasting and 26.5% for stunting [1]. With the assumption of these population parameters, maximum sample size was obtained for wasting. Considering additional parameters like 95% CI, 5% of marginal error and 10% non-response rate, the sample size computed was 411. The sample size was allocated using probability proportional sampling for the primary and secondary schools. Two stage stratified cluster sampling was used to select the students from each cluster. Firstly, the classrooms were considered as clusters with the assumptions that students within secondary school were homogenous and so were the students in the primary school. One and three classes were taken from the secondary and primary schools respectively. Secondly to have a control in the sample size, a simple random sampling was used to select the individual students for the study from each school based on the students' roster.

Data collection process

For collecting information about under-nutrition, pretested structured questionnaire was used. The questions were prepared in English, translated into the local language and back translated to English by another person to maintain its consistency. Data collectors were considered from diploma nurses who had experiences in anthropometric measurements. These data collectors were well trained on how to fill the questionnaire and measure the anthropometric measurements. Adolescents were considered as individuals between the ages of 10 and 19 years. Primary school was considered as institutional school having students from grades 1-8 while secondary school was institutional school having students from grade 9-10. To exclude students whose age is out of the defined domain, age was ascertained from the school registers. Measurements were taken once each for weight and height. The measurements were read to the nearest 0.1 kg and 0.1 cm respectively.

Statistical analysis

Data were entered into a computer using Epi-Info and Exported into SPSS 16 for windows. The data were explored for errors and assumption fulfillments. The prevalence of the different indicators for under-nutrition and other characteristics of the students were analyzed using descriptive statistics. Logistic regression was used to estimate the effect size of the independent factors to under-nutrition using adjusted odds ratio. For both the descriptive and inferential statistics, the population estimates were reported using 95% confidence interval. For all the statistics, P-value less than 0.05 were considered statistically significant in the final model. The body mass index (BMI) was computed by the conventional formula-the quotient of weight (kg) to height (m) squared. Nutritional status was evaluated using anthropometric indicators recommended by 2007 NCHS/ WHO growth reference. Height -for- age (HFA) below -2Z score of 2007 NCHS/WHO reference values were classified as stunting. Wasting was assessed using BMI-for-age below 5th percentile and underweight was assessed using BMI percentile for age for sex.

Ethical consideration

Ethical clearance was obtained from the ethical board of College of Health Sciences, Mekelle University. Support letters were obtained from the Tigray Regional Education Bureau, Tigray Regional Health Bureau and respective district offices. For respondents less than 18 years old, consent was obtained from their parents or care givers and assents from the students. For the 19 years old students, consent was obtained from the students themselves. The aim of the study and the procedures were explained to the students in private before interview and anthropometry measurements. Moreover, they were informed that they had the right to withdraw from the study at any stage of the data acquisition. They were assured that the data they provided would be kept confidential and no any student identifying attributes would be encoded and reported in any report.

Results

Socio-demographic and economic characteristics

A total of 411 respondents participated making a response rate of 100%. Half (50.6%) of the students were females, and majority of them (55.7%) were aged between 15-19 years. Almost all (91.2%) were living with their parents (father and Mother). The occupational distribution of the students' fathers showed that 258(81.4%) were farmers and 31 (9.8%) were governmental employees. In terms of education, 30% of the respondents' fathers and 58.4% of mothers were illiterate. More than half (72.5%) of the respondents did not have a nearby garden and 79.1% of the respondents had used hand pump water for drinking. As to the family size distribution of respondents, 76.4% of them were with greater than five family members. Over half of the respondents, 154 (53.7%), possessed at least five cattle whereas 19(6.6%) of the parents owned sixteen and more (Table 1). The mean age, height, weight, BMI and HFA of the respondent were 14.23 yrs, 149 cm, 38 kg, 16.74 kg/m² and -1.346 Z score respectively.

Prevalence of under-nutrition

Under-nutrition was indicated by stunting, wasting and underweight. The prevalence of stunting, wasting and underweight was 25.5%, 44% and 55% respectively. Males were more affected by under-nutrition than females. However, the difference was more prevalent in wasting and underweight which exceeds by 21% in males as compare to females (Figure 1). The early age adolescents were more affected by wasting and underweight (Figure 2).

Factors associated with stunting

The prevalence of stunting was 25.5% and this was higher in males than females. Adolescents who did not start menarche were more stunted than who started with the prevalence of 21.9% and 24.10% respectively. However, no any factor was determined to affect the studying among the attributes collected in this study in the final model (Table 2).

Factors associated with wasting

The prevalence of wasting among the students in the study area was 44%. Higher number of early adolescents, 101(55%), were wasted than late adolescents. More males were wasted than females contributing 54.7% versus 45.3% respectively. Adolescent girls who did not start menarche were more wasted than who have started with prevalence

Variables	Categories	Frequency	%
Sex	Males	203	49.4
	Females	208	50.6
Age	Early adolescents	182	44.28
	Late adolescents	229	55.71
Ethnic groups	Tigrians	411	100
Religion	Orthodox	333	81
	Muslim	78	19
	Grade 4	79	19.21
	Grade 5	58	14.1
Grade level	Grade 8	83	20.2
	Grade 10	191	46.5
Family size	42009	90	22.27
	>5	314	76.4
	Parents	375	91.2
	Relatives	34	8.3
Care takers	orphan committee	1	0.2
	others	1	0.2
	Illiterate	96	30.9
	Only read and write	58	18.6
Fathers' educational level	Grad1-4	63	20.3
	Grad 5-8	57	18.3
	Grad 9-12	23	7.4
	>12 Grad	14	4.5
	Illiterate	220	58.4
	Only read and write	13	3.4
Mothers' educational level	Grad1-4	65	17.2
	Grad 5-8	56	14.9
	Grad 9-12	16	4.2
	>12 Grad	7	1.9
	Illiterate	19	57.6
	Only read and write	1	3
Care giver educational level	Grad1-4	2	6.1
	Grad 5-8	5	15.2
	Grad 9-12	3	9.1
	>12 Grad	5	9.1
	Governmental employee	31	9.8
	Private (company employee	13	4.1
Fathers' occupation	Labor (farmer)	258	81.4
	Un employee	10	3.2
	Others	5	1.6
	Elder one	134	32.6
	one year	10	2.4
Age difference between elder brother/ sister	Two years	69	16.8
	Three years	120	29.2
	≥four years	78	19
	Youngest one	68	16.5
	one year	15	3.6
Age difference between younger brother/sister	Two years	64	15.6
	Three years	149	36.3
	≥four years	115	28
	River	7	1.7
Source of water for drinking	Lake	79	19.2
	Hand pump	325	79.1
Garden at near your home	Yes	113	27.5
	No	298	72.5

Access to fruits and vegetables	Yes	326	79.3
	No	85	20.7
Condition of breakfast	Yes	404	98.3
	No	7	1.7
Hand washing practice	Yes	411	100
	42009	154	53.7
Number of cattle's	42165	85	29.6
	42323	29	10.1
	>15	19	6.6

Table 1: Socio demographic and Economic Characteristics of Studies Subjects at Agulea village Primary and Secondary School, April 2013 (n=411).

of 53.6% and 16.7% respectively. In the multiple logistic regression analysis models, being late adolescent, male and those who experienced menarche were independent predictors for wasting. Early adolescents were 4.6 times more likely to get wasted as compare to late adolescents (AOR=4.68, 95% CI=1.81-12.13). Males were 5.3 times more likely to get wasted compared to females (AOR=5.31, 95% CI=1.73-16.32) and adolescent girls who did not start menarche were 2.6 times more likely to be wasted than girls who started menarche (AOR=2.65, 95% CI=1.006-6.978) (Table 3).

Factors associated with underweight

The prevalence of underweight was 55% and it was high among the early adolescents and male adolescents. Adolescent girls who did experience menarche were more underweight, 72(64.35%), than their counterparts, 27(28.1%). Although age and sex were significant in the bivariate logistic regression, multivariable logistic regression revealed that only experiencing menarche was the predictor for underweight. Adolescent girls who did not experience menarche were 5.5 times more likely to be under weight than those who had experienced menarche (AOR=5.47 95% CI=2.91-10.26) (Table 4).

Discussion

The overall prevalence of stunting, wasting and underweight was 25.5%, 44%, and 55% respectively. Each of these magnitudes was higher compared with studies conducted in India, Africa, and sub-Sahara countries [10,11] but consistent with study done in West Bank [6]. This study revealed that stunting was higher among males than females and this is in congruent with the studies conducted in Tanzania, Senegal, West Bank and India [5,6,11]. This is because in rural Ethiopia adolescent females preferred to cook food, stay at home (they will have less energy expenditure) and they are expected to consume more than male adolescents who prefer to pass their time more of out of home to work the external works, like farming activities with their father. But males are encouraged to be autonomous than female adolescents; as a result, they are more likely to exposed to infection that predispose them to stunting. Adolescent girls who didn't start menses were more likely to be stunted than those who did. This is consistent with studies conducted in Kenya and Senegal stated that adolescent girls with low Height-for-age z-score are delay to see their menses [6,12]. Generally, adolescents' girls late to see their menarche are undernourished; it is their low nutritional status makes their menarche to delay. The age of menarche is affected with educational status, economical status and nutritional status [10]. The prevalence of wasting was as high as 44% among the study participants with 54.7% in males and 33.7% in females. This shows that males were more affected by wasting than females. This was consistent with study done in Tunisia and India [2,13]. The possible reasons might be adolescent males have larger skeleton, gain weight at faster rate more muscular and deposit less fat than adolescent females
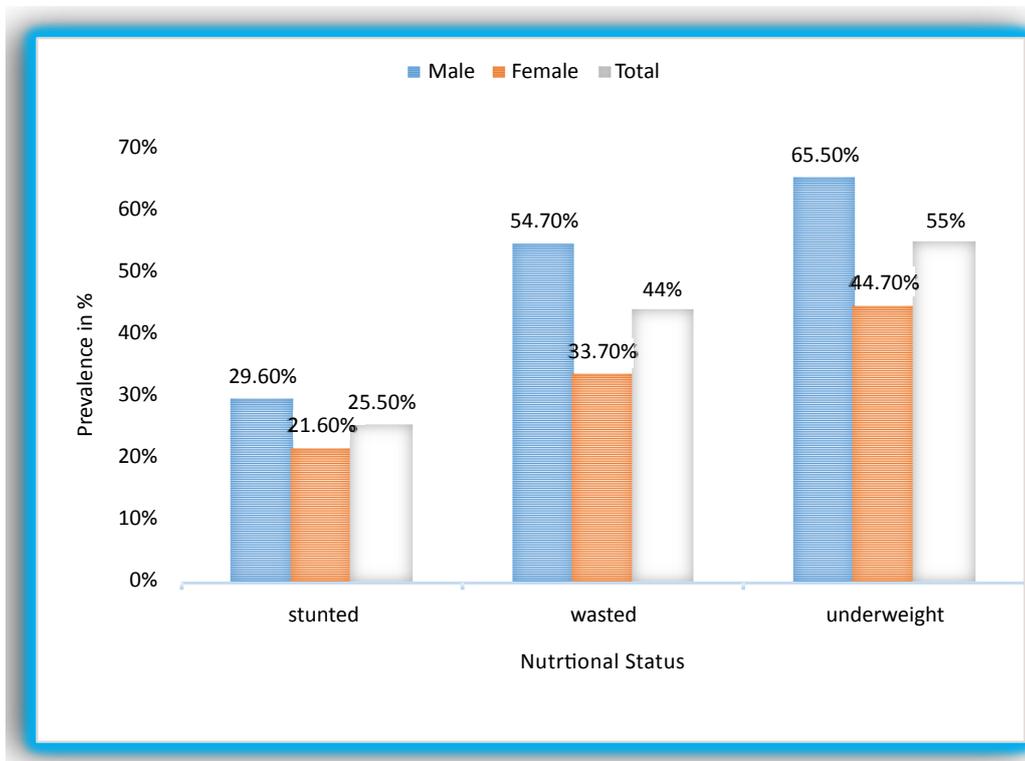
Figure 1: Prevalence of Stunting, Wasting and Underweight by Sex at Eastern zone of Tigray among primary and secondary school students, April, 2013(n=411).
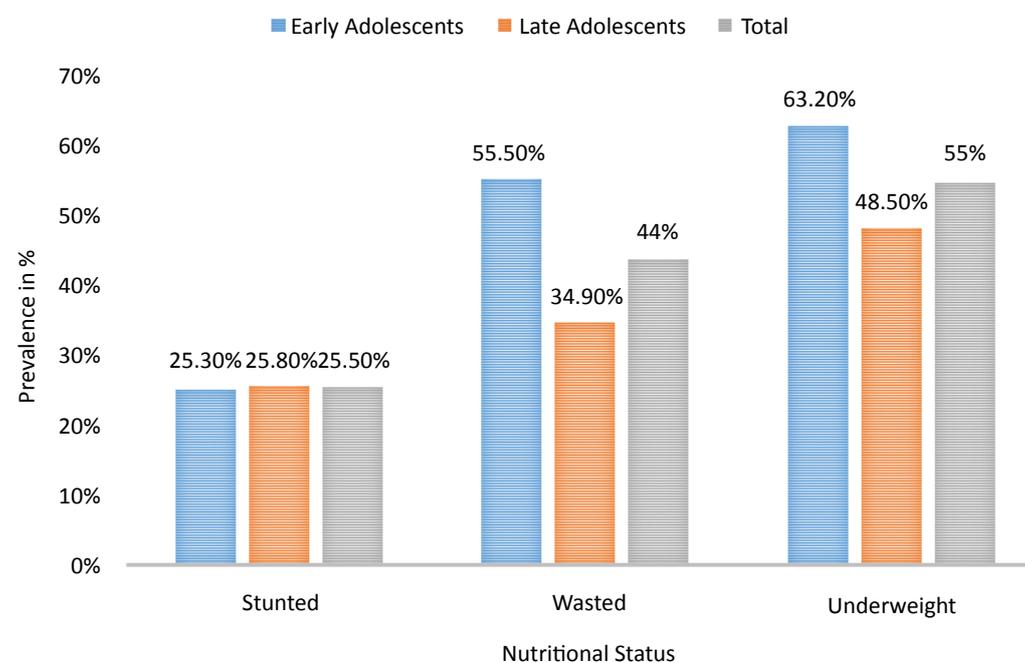

Figure 2: Prevalence of Stunting Wasting and Underweight by A great Eastern zone of Tigray among primary and secondary school students, April, 2013(N=411).

Variable	Height for Age				
	Category	Stuntingn (%)	Normal n (%)	COR (95% CI)	AOR (95% CI)
Age	42291	46(25.3%)	136(74.7%)	1	1
	15-19	59(25.8%)	170(74.2%)	0.975 (0.624,1.523)	0.839 (0.177,3.976)
Sex	Male	60(29.6%)	143(70.4%)	1.520 (0.972,2.376)	0.960 (0.197,2.417)
	Female	45(21.60%)	163(78.4%)	1	1
Age Difference(young)	I'm youngest	16(23.5%)	52(76.5%)	0.462 (0.143,1.495)	2.430 (0.814,7.251)
	One year	6(40.0%)	9(60.0%)	0.729 (0.336,1.583)	0.299 (0.056,1.586)
	Two years	19(29.70%)	45(70.3%)	1.082 (0.548,2.137)	1.236 (0.429,3.558)
	Three years	33(22.1%)	116(77.9%)	0.834 (0.416,1.671)	2.211 (0.931,5.252)
	Four years & above	31(27.0%)	84(73.0%)	1	1
Started Menarche	Yes	21(21.9%)	75(78.1%)	1	1
	No	27(24.10%)	85(75.9%)	1.134 (0.593,2.172)	2.120 (0.799,5.683)
Grade level	4th	18(22.8%)	61(77.2%)	1.416 (0.599,3.349)	0.264 (0.445,19.334)
	5th	10(17.2%)	48(82.8%)	0.549 (0.275,1.099)	0.126 (0.645,34.774)
	8th	29(34.9%)	54(65.1%)	0.879 (0.473,1.633)	0.863 (0.267,4.839)
	10th	48(25.1%)	143(74.9%)	1	1

*P value < 0.05, **P value <0.01 and ***P value<0.001, COR; Crude odds ratio; AOR, Adjusted odds ratio.

Table 2: Factors Associated with Adolescents Stunting at Agulae Primary and Secondary School, April, 2013 (n=411).

Variable	Category	BMI for Age		COR (95% CI)	AOR (95% CI)
		Wastedn (%)	Normaln (%)		
Age	10-14	101(55.5%)	81(44.5%)	2.322 (1.558 ,3.461)***	4.686 (1.810, 12.130)***
	15-19	80(34.9%)	149(65.1%)	1	1
Sex	Male	111(54.7%)	92(45.3%)	2.379 (1.596 , 3.544)***	5.319 (1.733, 16.327)***
	Female	70(33.7%)	138(66.3%)	1.00	1.00
Age Difference(young)	I'm youngest	24(35.3%)	44(64.7%)	2.145 (1.156, 3.978)*	1.018 (0.184, 5.647)
	One year	8(53.3%)	7(46.7%)	1.024 (0.348, 3.010)	0.696 (0.222, 2.182)
	Two years	33(51.6%)	31(48.4%)	1.099 (0.596, 2.027)	0.574 (0.222, 1.483)
	Three years	54(36.2%)	95(63.8%)	2.058 (1.253, 3.380)	0.494 (0.188, 1.300)
	Four years & above	62(53.9%)	53(46.1%)	1.00	1.00
Started Menarche	Yes	16(16.7%)	80(83.3%)	1.00	1.00
	No	60(53.6%)	52(46.4%)	5.769 (3.004, 11.081)***	2.650 (1.006, 6.978)*
Grade level	4th	46(58.2%)	33(41.8%)	1.214 (0.613, 2.403)	1.048 (0.386, 2.844)
	5th	31(53.4%)	27(46.6%)	1.214 (0.632, 2.192)	1.699 (0.627, 4.602)
	8th	45(54.2%)	38(45.8%)	3.119 (1.813, 5.364)***	4.447 (0.781, 25.335)
	10th	59(30.9%)	132(69.1%)	1.00	1.00

*P value < 0.05, **P value <0.01 and ***P value<0.001, COR; Crude odds ratio; AOR, Adjusted odds ratio.

Table 3: Factors Associated with Adolescents Wasting at Agulae Primary and Secondary School, April, 2013(n=411).

Variable	Category	BMI		COR (95% CI)	AOR (95% CI)
		Underweight n (%)	Normal n (%)		
Age	10-14	115(63.2)	67(36.8%)	1.825 (1.226, 2.715)**	1.660 (0.698, 3.948)
	15-19	111(48.5%)	118(51.5%)	1.00	1.00
Sex	Male	133(65.5)	70(34.5%)	2.349 (1.578, 3.498)***	2.750 (0.972, 7.774)
	Female	93(44.7)	115(55.3%)	1.00	1.00
Age difference (youngest)	I'm youngest	27(39.7%)	41(60.3%)	2.362 (1.279,4.362)**	0.902 (0.170, 4.784)
	One year	10(66.7%)	5(33.3%)	0.778 (0.250,2.425)	0.574 (0.195, 1.684)
	Two years	41(64.1%)	23(35.9%)	0.873 (0.063,1.644)	0.610 (0.251, 1.483)
	Three years	78(52.3%)	71(47.7%)	1.416 (0.864,2.320)	0.550 (0.219, 1.382)
	Four & above	70(60.9%)	45(39.1%)	1.00	1.00
Started Menarche	Yes	27(28.1%)	69(71.9%)	1.00	1.00
	No	72(64.35)	40(35.7%)	4.600 (2.552, 8.293)***	5.467 (2.912, 10.264)***
Grade level	4th	50(63.3%)	29(36.7%)	0.475 (0.277,0.814)	0.488 (0.167, 1.423)
	5th	37(63.8%)	21(36.2%)	0.465 (0.253,0.853)	0.899 (0.329, 2.457)
	8th	53(63.9%)	30(36.1%)	0.464 (0.273,0.788)**	0.792 (0.153, 4.097)
	10th	86(45.0%)	105(55.0%)	1.00	1.00

*P value<0.05, ¨P value<0.01 and ***P value<0.001, COR; Crude odds ratio; AOR, Adjusted odds ratio.

Table 4: Factors Associated with Adolescents Underweight at Agulae Primary and Secondary School, April, 2013(n=411).

[2]. But as compared to the previous research done among adolescent girls in Tigray it showed decrement by 24% in the last eight years [14]. This decrement could be due to substantial human development and increased awareness of the community. It is important to mention, this study relieved that early adolescents have high proportion of wasting as compare to late adolescents, which is consistent with previous study done in Kenya and India [6,11]. These differences were statically significant with early age category where 4.6 times more likely to be wasted than the referent groups (AOR=4.68, 95% CI=1.81-12.13). This study revealed that adolescent males were 5.3 times more likely to be wasted than their female counterparts (AOR=5.31, 95% CI=1.73-16.32). This is consistent with the studies done in Tunisia, Kenya and India [3,6,13]. Adolescents who had attained grade 4 constituted higher proportion of wasting than the other random selected class levels. Adolescent girls who did not start their menses were more wasted than who started. Similar result was found study conducted in Kenya [6]. Similar to wasting, early adolescents and male`s had higher proportion of underweight. Adolescent males were 2.7 times more likely to be underweight than the referents (AOR=2.75, 95% CI=.972-7.71) and adolescent girls who did not start menarche were 5.5 times more likely to be underweight than the referent groups (AOR=5.5, 95% CI=2.912-10.264). Similarly, study from Tanzania and Ambo of Ethiopia also stated that the difference in sex and onset of menarche significantly associated [5]. According to their grade level, grades 8th were more underweight. This study shows that under nutrition is persistent problem of future adults. A 100% of response rate can be strength of the study. But, as it is institutional based, the study had not included adolescents out of schools and it lacks a qualitative method.

Conclusion

Based on the finding, the prevalence of adolescents' under nutrition is higher in the study area. Male adolescents are more affected by stunting, wasting and underweight than female adolescents. Similarly, early adolescents are more affected by stunting, wasting and underweight than were late adolescents. However, none of these determinate factors was show an association with stunting. But early adolescents, sex and onset of menarche were associated with being wasting. In addition, beginning of menarche was also associated with being underweight. Thus, an integrated nutritional intervention and health related services that meet the needs of adolescents in the school community were recommended for better future adolescents' health. NGOs should not only focus on under five children's under nutrition; it is also better to focus on adolescents' under nutrition and researchers should also conduct further studies adding qualitative method and multicenter and longitudinal study.

Conflict of Interest

The authors don't have any conflict of interest.

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