

Under nutrition and associated factors among school adolescents in Dangila Town, Northwest Ethiopia: a cross sectional study

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Abstract

Background: Under nutrition in adolescents is an important determinant of health outcomes. Yet, adolescents are not usually part of health and nutrition surveys. Therefore, this research was conducted to assess factors associated with under nutrition among school adolescents.

Method: A cross-sectional study was conducted among 424 school adolescents from November 1-15, 2015. Simple random sampling was used to select the study participants. Data were collected using structured questionnaire and analyzed by SPSS version 20 software. Both bivariate and multivariable logistic regression analyses were carried out to identify predictors of under nutrition. Furthermore, anthropometric data were calculated using Anthro-plus software.

Result: The prevalence of stunting and thinness were 24.8 % and 7.1 %, respectively. Male gender [AOR=3.2, 95 % CI: (1.7, 5.8)], infrequent food intake [AOR=4.6, 95% CI: (2.6, 8.0)], unavailability of latrine [AOR=2.7, 95 % CI: (1.2, 6.0)], and poor hand washing practice [AOR=3.9, 95 % CI: (1.9, 8.1)] were independent predictors of stunting. Factors associated with thinness were being male [AOR=11.5, 95% CI: (3.3, 39.5)], illness in the last two weeks [AOR=2.9, 95 % CI: (1.2, 7.0)], and having more than five family members [AOR=3.6, 95% CI: (1.3, 9.4)].

Conclusion: The prevalence of under nutrition was high in this study. Infrequent food intake, unavailability of a latrine, poor hand washing practice, and large family members were the factors associated with under nutrition. There is need to implement nutrition education to school adolescents by giving emphasis on environmental and personal hygiene.

Keywords: Adolescent, stunting, thinness.

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Background

The World health organization (WHO) defined adoles-

cents as individuals between the ages of 10–19 years¹. Adolescence, a period of transition from childhood to adulthood, is crucial in the life of human beings and characterized by an exceptionally rapid rate of growth^{2,3}. This period is known to be a second opportunity for growth, as it facilitates catch up growth for children experiencing nutritional deficits in their early life^{4,5}.

Due to rapid growth, during this period, the dietary requirement of adolescents is higher for most nutrients than at any other period of life². If their requirement

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is not met, at this age, they are likely to develop serious nutritional deficiency². Despite the economic growth observed in developing countries, under nutrition is still highly prevalent among school-going adolescents⁶⁻¹⁰.

Under nutrition during adolescence is an important determinant of health outcomes. Apart from causing significant mortality, it creates long-lasting effect on growth, development and physical fitness of survivors¹⁰⁻¹³. This, in turn, affects their ability to learn and work at maximal productivity^{14,15}. In girls, short stature may persist into adulthood and increase the risk of adverse reproductive outcomes¹⁶.

Therefore, nutritional support during this period of life affects not only the individual wellbeing of adolescents but also the well-being of entire societies¹⁷. Ensuring that adolescents can successfully navigate this phase of life will help to break the cycle of poverty and produce benefits for individuals, communities, and nations^{10,18}. However, Ethiopian adolescents received low priority in terms of nutrition intervention².

To address nutritional problems of adolescents, it is crucial to assess their current nutritional status. Thus, the present study was undertaken to ascertain the level of under nutrition and associated factors among school adolescents. Findings obtained from this study may assist decision makers to plan and implement nutrition intervention programs to benefit school adolescents.

Methods

Study setting

The study was conducted in Dangila town, Northwest Ethiopia. The town is located 484 km Northwest of Addis Ababa (capital city of Ethiopia). In Ethiopia, education curriculum is classified into four cycles such as the primary school with first (grade 1-4) and second (grade 5-8) cycles; and secondary school with first (grade 9-10) and second (grade 11-12) cycles. This study was conducted among secondary school first cycle (grade 9-10) students. In the town, there was one first cycle secondary school with a total of 2,867 students during the time of the study, of which 1,504 were females.

Study design and population

A school based cross-sectional study was conducted from November 1 to 15, 2015. Adolescents above fifteen years

old were included in the study. However, those who were transferred from other schools during the academic year of data collection period were excluded from our study.

Sample size, sampling procedure, and data collection

The sample size was determined using single population proportion formula, with the following assumptions: a 95% confidence level, 5% marginal error, 50% proportion of under nutrition as there was no previous study, 10% non-response rate. The sample size was 424.

The sampling frame (list of students) was obtained from school registration book. Using this registration log book, study participants were selected by simple random sampling technique (lottery method).

Data were collected using a self-administered questionnaire adapted by reviewing literature²⁰. The questionnaire was first developed in English then translated into Amharic (local language), and then back to English to check consistency. The questionnaire focused on socio-demographic characteristics (sex, age, residence, grade, father and mother education, father and mother occupation, living arrangement and the number of family members), availability of latrine, source of drinking water, frequency of food intake, type of food they took frequently, and hand washing practice.

Four diploma nurses and one public health professional were recruited as data collectors and supervisor, respectively. The data collectors and supervisor were trained for two days on the purpose of the study, data collection technique, and tools. The study participants were not allowed to discuss their responses with each other to avoid shared responses.

Anthropometric measurements were done at the school premise. Each participant was measured for weight and height. Weight was measured to the nearest 0.1kg using a digital weight scale. During weight measurement, each participant wore light clothes. Likewise, height was measured to the nearest 0.1 cm using a stadiometer. During the measurement, each participant stood on the measuring board without shoes, considering the normal anatomical position, and heels, buttocks, shoulders, and back of the head touching the board. The flat headpiece of the measuring board touched the crown of the head and formed a right angle. For both height and weight two

readings were recorded, and the computed average was used in the analysis. Body mass index was calculated as the ratio of weight in kilograms to the square of height in meters.

The z-score values for BMI-for-age and height for age were calculated using WHO Anthro-Plus software (21). Calculated z-scores of BMI-for-age and height for age were used to classify thinness and stunting using the new WHO 2007 reference value. The z-score values for BMI-for-age were interpreted as follows: adolescents who scored < -3 SD, between -2 SD to -3 SD, -2 SD to $+2$ SD, and $> +2$ SD were declared severely thin, thin, normal, and overweight, respectively. Similarly, the z-score values for height-for-age were interpreted as follows: adolescents who scored below -3 SD, between -2 SD to -3 SD, > -2 SD stated as severely stunted, stunted, and normal, respectively. Those adolescents who had stunting and/or thinness were considered as undernourished.

Data quality control

Data collectors and the supervisor were trained on the purpose of the study, data collection technique and tool before and after pretesting. The questionnaire was pre-tested among 43 students in a school where the study was not undertaken, and modifications were done accordingly. The weighing scale and height measuring stadiometer were checked after each measurement. Each day, the collected data were reviewed and errors were returned back to the data collectors for correction. Data validity and reliability was maintained through close supervision of data collection process by the supervisor and investigators.

Data processing and analysis

Data were double entered and analyzed using SPSS ver-

sion 20 software. The frequency of each variable was calculated to check for accuracy, outliers, consistency and missed values. The proportion of under nutrition was determined. Crude and adjusted Odds ratios were computed for each explanatory variable to determine the strength of association and control confounders. The p-value < 0.05 was taken as a cut-off point to select variables for the multivariable logistic regression models. The final model was built using backward elimination. The p-values less than 0.05 was considered statistically significant.

Ethical consideration

The study was approved by the Ethical Review Committee of Amhara Regional Health Bureau. Letter of permission was taken from the school administrator. Consent was obtained from school directors, and assent was taken from every participant. Privacy and confidentiality were maintained throughout the study period by excluding personal identifiers from the data collection form.

Result

Socio-demographic characteristics of the adolescents and their parents

Of 424 adolescents participated in the study, complete data were obtained among 407 participants, making the response rate 95.9 %. The mean (\pm SD) age of the respondents was $16.67 \pm (0.93)$ years. The majority, 394 (96.8%) of the participants were Orthodox Christian followers, and 350 (86%) were Amhara in ethnicity (Table1). Two hundred seventy (66.3%) of the respondents' fathers, and 287(70.5%) of their mothers, had no formal education. Whereas, only 44 (10.8%) of their fathers and 34 (8.4%) of their mothers attended beyond secondary education. About six in ten of their fathers, 251(61.7%) and their mothers, 235(57.7) were farmers and housewives in their profession (Table 1).

Table1: Socio- demographic characteristics of school adolescents and their parents in Dangila town, 2015.

Variable	Frequency(n=407)	Percentage (%)
Religion		
Orthodox	394	96.8
Muslim	7	1.7
Protestant	6	1.5
Sex		
Male	188	46.2
Female	219	53.8
Ethnicity		
Amhara	350	86
Tigrie	47	11.5
Agew	10	2.5
Respondents currently live with		
Both parents	266	65.4
Mother	50	12.3
Alone	26	6.4
Relatives	23	5.7
Friends	36	8.8
Father	6	1.5
places of residence		
Urban	185	45.5
Rural	222	54.5
Educational status of the father		
Have no formal education	270	66.3
Primary education	42	10.3
Secondary education	51	12.5
Above secondary education	44	10.8
Occupational status of the father		
Daily laborer	37	9.1
Farmer	251	61.7
Government employee	67	16.5
Merchant	41	10.1
Driver	11	2.7
Educational status of the mother		
Have no formal education	287	70.5
Primary education	39	9.6
Secondary education	47	11.5
Above secondary education	34	8.4
Occupational status of the mother		
Housewife	235	57.7
Daily laborer	40	9.8
Farmer	74	18.2
Government employee	33	8.1
Merchant	25	6.1

Eating behavior and hygienic practices of the respondents

More than half, 207(56.3 %) of the adolescents consumed “maize and millet mix injera” with “Wot” as a daily staple diet. “Injera” (Amharic: ኦጅጅ) is a sourdough-risen flatbread with a slightly spongy texture. “Wot”(Amharic: ወጥ) is an Ethiopian stew or curry that may be prepared with

chicken, beef, lamb, a variety of vegetables, legumes, and spice mixtures such as berebere (matured green pepper). Two thirds, 270(66.3 %) of the respondents often took three or more meals per day. The majority of the adolescents used piped water for drinking, 351(86.2%) and had a functional latrine at their home, 336(82.6%). More than three fourths, 318(78.1%) of the adolescents had the habit of washing their hand before eating (Table 2).

Table 2: Eating behavior and sanitation practices of adolescents, Dangila Town, Northwest Ethiopia, 2015

Variable	Frequency	Percentage
Kind of food always eaten at home		
Maize & millet injera with “wot”	207	50.9
Teffinjera with “wot”	178	43.7
Wheat, maize, millet and Teffinjera with “wot”	22	5.4
Number of feeding per day		
1-2 times	137	66.3
3-4 times	270	33.7
Use iodized salt		
Yes	250	61.4
No	157	38.6
Wash hands with soap before eating		
Yes	318	78.1
No	89	21.9
Source of drinking water		
Pipe & protected spring	351	86.2
River	56	13.8
Availability of functional latrine at home		
Yes	336	82.6
No	71	17.4

Nutritional status of school adolescents

About 101(24.8%), and 33 (8.1%) school adolescents were stunted and severely stunted, respectively. The prev-

alence of thinness was 7.1%. More boys than girls were stunted (36.1% versus 15.0%) and thin (13.8 versus 1.4%) in this study (Table 3).

Table 3: prevalence of under nutrition among school adolescents in Dangila town from November 01-05/2015.

Variable	Male	Female	Total	X ² (P-value)
Stunted				
Yes	68(36.2)	33(15.1)	101(24.8)	24.143(<0.001)
No	120(63.8)	186(45.7)	306(75.2)	
Severely stunted				
Yes	22(11.7)	11(5.0)	33(8.1)	6.057(0.014)
No	166(88.3)	208(95.0)	374(91.9)	
Thinness				
Yes	26(13.8)	3(1.4)	29(7.1)	23.732(<0.001)
No	162(86.2)	216(98.6)	378(92.9)	

Factors associated with under nutrition of adolescents

The bivariate logistic regression analysis showed that being a male, lack of possession of television and radio, being from a rural residence, taking less than three meals

per day, unavailability of latrine and lack of hand washing practice were statistically associated with stunting (Table 4). Factors associated with thinness were being a male, having illness in the last two weeks, drinking river water, and living in the household having more than five family members (Table 5).

Table 4: Factors associated with stunting among school adolescents in Dangila town, 2015.

Factor	Stunting		COR (95% C/I)	AOR (95% C/I)
	Yes	No		
Sex				
Male	68(16.7)	120(29.5)	3.1(1.9,5.1)	3.2(1.7,5.8)
Female	33(8.1)	186(45.7)	1.00	1.00
Area of parental residence				
Urban	36(8.8)	149(36.6)	1.00	
Rural	65(16.0)	157(38.6)	1.7(1.0,2.7)	
Possession of television				
Yes	20(4.9)	104(25.6)	1.00	
No	81(19.9)	202(49.6)	2.0(1.2,3.5)	
Possession of radio				
Yes	49(12.0)	207(50.9)	1.00	2.0(1.1,3.5)
No	52(12.8)	99(24.3)	2.2(1.4,3.5)	1.00
Frequency of food intake per day				
1-2 times	64(15.7)	73(17.9)	5.5(3.4,8.9)	4.6(2.6,8.0)
3-4 times	37(9.1)	233(57.3)	1.00	1.00
Wash their hand by soap and water before eating				
Yes	50(12.3)	268(65.9)	1.00	1.00
No	51(12.5)	38(9.3)	7.1(4.2,12.0)	3.9(1.9,8.1)
Availability of functional latrine at home				
Yes	59(14.5)	277(68.1)	1.00	1.00
No	42(10.3)	29(7.1)	6.8(3.9,11.7)	2.7(1.2,6.0)

COR- Crude odds ration; AOR – adjusted odds ratio, C/I- Confidence interval

Table 5: Factors associated with thinness among school adolescents in Dangila town, 2015.

Factor	Underweight		COR (95% C/I)	AOR (95% C/I)
	Yes	No		
Sex				
Male	26(6.4)	162(39.8)	11.5(3.4,38.8)	11.5(3.3,39.5)
Female	3(0.7)	216(53.1)	1.00	1.00
Source of drinking water				
Pipe and protected spring	21(5.2)	330(81.1)	1.00	
River	8(2.0)	48(11.8)	2.6(1.0,6.2)	
Illness in the last two weeks				
Yes	12(2.9)	69(17.0)	1.00	1.00
No	17(4.2)	309(75.9)	3.1(1.4,6.9)	2.9(1.2,7.0)
Family members				
≤5	6(1.5)	202(49.6)	1.00	1.00
>5	23(5.7)	176(43.2)	4.4(1.7,11.0)	3.6(1.3,9.4)

COR- Crude odds ration; AOR – adjusted odds ratio, C/I- Confidence interval

In the multivariable logistic regression analysis, a significant association was observed between stunting and sex, in which males were 3.1 times more likely to be stunted than girls [AOR=3.2, 95% CI: (1.7, 5.8)]. The frequency of food intake had association with stunting, adolescents who took food two or less times per day were 4.6 times more likely to be stunted than those who took more than two times per day [AOR=4.6, 95% CI: (2.6,8.0)].

Hand washing practice was another predictor for stunting, adolescents who did not wash their hands before eating were almost 4 times more likely to be stunted compared to those adolescents who did wash their hands [AOR =3.9, 95 % CI = 1.9, 8.1]. Unavailability of latrine had a significant association with stunting, adolescents from families who did not have latrine were 2.7 times more likely to be stunted compared with families who had latrine [AOR=2.7, 95% CI: (1.2, 6.0)]. The odds of having stunting was 2 times higher among adolescents whose family had no radio as compared to their counterparts [AOR=2.0, 95% CI: (1.1, 3.5)](Table 4).

The number of family members was one of the strongest predictors for thinness, adolescents who lived in the household with more than 5 family members were 3.6 times more likely to be thinner than those who lived in the household with five or less family size [AOR=3.6, 95% CI: (1.3, 9.4)]. Being a male gender had a significant association with thinness, male adolescents were 11.5 times more likely to be thinner compared with female adolescents [AOR=11.5, 95% CI: (3.3, 39.5)]. Having ill-

ness had also a significant association with thinness, adolescents who had illness within fifteen days prior to the study were almost three folds more likely to be thinner than their counterparts [AOR=2.9, 95% CI: (1.2, 7.0)] (Table 5).

Discussion

The aim of this study was to assess nutritional status and associated factors among school adolescents. In view of that, in this study, the prevalence of stunting was high (24.8%). More males than females were stunted (p-value, <0.001). This finding was almost comparable with the prevalence documented in Northern Ethiopia (28.5%), Southwest Nigeria (19.1%), and Northeastern Brazil (20.7%)²³⁻²⁵.

The prevalence of stunting in this study was higher than a study finding in South-Western Nigeria (15.7 %) ²⁶. This discrepancy might be due to the difference in habit of food intake, socioeconomic status and cultural variation between the study subjects. On the other hand, the prevalence of stunting in our study was lower than the study findings in West Bengal, India (44-46.6 %) ^{27,28}. The difference might be due to time gap; currently, there is an implementation of nutrition intervention programs by governmental and nongovernmental organizations especially in the first two years of life. This intervention could have a direct contribution to improving the nutritional status of adolescents because stunting is due to the effect of malnutrition starting from the first 1000 days.

In this study, 7.1% of the adolescents were thin. This prevalence was consistent with the study finding in Seychelles (6.7 %) ²⁹. However, the magnitude was lower compared to the study findings in Southeast Ethiopia (13.6%), Northern Ethiopia (26.1%), Nigeria (18.9 %) and West Bengal, India (28 %) ^{25,26,28,30}. The discrepancy might be due to the time gap between studies and current implementation of nutritional programs.

The likelihood of both stunting and thinness was higher among boys compared to girls. This result was in line with the study findings in different parts of Ethiopia and Nigeria ^{9,25,26,31-34}. The reason for high prevalence of under nutrition among males than females might be related to biological, behavioral, and socio-cultural mechanisms.

Many studies throughout the world revealed the relationship between dietary intake and nutritional status of an individual ^{30,35-38}. Similarly, in this study, adolescents who took food two or less times per day were more likely to be stunted than those who took food more than two times per day. This might be explained due to the fact that infrequent taking of food is less likely to meet the nutritional requirement.

Adolescents who did not wash their hands before eating were more likely to be stunted compared to those adolescents who did wash their hands. This finding was in line with the study findings in different parts of Ethiopia and India ³⁸⁻⁴⁰. Hand washing practice is essential to prevent diarrhea and other feco-oral diseases, which in turn may contribute to the reduction of under nutrition.

A significant association was observed between thinness and number of family members. This finding was comparable with the study finding in Northwest Ethiopia ⁴¹. This might be due to the fact that large family size hampers food security status of the household ⁴², which is an important determinant of nutritional status of the family ⁴³. The risk of being stunted was higher among adolescents from families who did not have latrine compared with families who had a latrine. A similar result was reported from previous study finding in Northwest Ethiopia ⁴¹. This might be due to the fact that poor sanitation and hygiene interventions lead to repeated bouts of diarrhea and intestinal worms, which in turn deteriorates the nu-

tritional status of adolescents ^{44,45}. The other explanation could be attributed to repeated fecal contamination that leads to environmental enteropathy, which is an inflammatory response, increases the small intestine's permeability to pathogens while reducing nutrient absorption ^{46,47}.

Adolescents who had illness within fifteen days prior to the study were more likely to be thin than their counterparts. Infection plays a major role in the etiology of under nutrition because of infection results in increased needs and high energy expenditure, lower appetite, utilization of nutrients and disruption of metabolic equilibrium and nutrient losses due to vomiting, diarrhea, poor digestion and mal-absorption ⁴⁸.

The odds of having stunting was higher in adolescents whose family had no a radio as compared to adolescents' families who possessed a radio. The result was in agreement with other studies ^{41,49}. Families who have radio are more likely to get nutrition-related message.

Random selection of participants, using well-trained sex-matched data collectors and validated data collection instruments were strengths of this study. Whereas, the cross-sectional design makes any inference of growth pattern over time difficult was the limitation of this study.

Conclusion

The prevalence of under nutrition was high in this study. Factors associated with stunting were being a male, lack of possession of a radio, unavailability of latrine, infrequent food intake and poor hand washing practice. Illness in the last two weeks, having more than five family members and being a male were positively associated with thinness. There is need to implement nutrition education to school adolescents by giving emphasis for environmental and personal hygiene.

List of abbreviations

BMI- Body Mass Index

WHO -World Health Organization

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

YM: Conceived and designed the study, conducted statistical analysis and result interpretation, prepared manuscript. The author read and approved the manuscript.

AA: assisted the study design, data analysis and result interpretation, prepared manuscript. The authors read and approved the manuscript.

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