

Nutritional Status and Its Associated Factors among School Adolescent Girls in Adama City, Central Ethiopia

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Abstract

Adolescence is a period of rapid growth and maturation in human development that demands extra nutrients and energy to support growth. Focusing on adolescents' nutrition, especially girls, provides a unique opportunity to break the intergenerational cycles of malnutrition. But, there is little information about nutritional status of school going adolescent girls in central Ethiopia.

Methods: Institutional based cross-sectional quantitative study was employed among school going adolescent girls in Adama city. Survey was conducted among 726 samples which were selected by using stratified cluster random sampling procedures. Data was entered into Epi Data and transferred to SPSS (version 16) for analysis. WHO Anthro plus software was used to calculate body mass index for age z-score and height for age z-score. Multivariable logistic regression was used to measure the association between the dependent variable and independent variables with 95% confidence interval.

Results: This study found that 21.3% of adolescent girls were underweight, 3.3% were overweight, 1.0% was obese and 15.6% were stunted. Of the adolescents, 41.2% of them received minimum dietary diversity (MDD), but 73.0% of the underweight adolescent's did not receive minimum dietary diversity in 24 h before the survey. The proportions of wasting, stunting and low dietary diversity were higher among subjects from government schools compared to those from private schools. The predictors of under-nutrition among adolescent girls were: being born from uneducated parents (father and mother), their fathers' occupation of being a merchant, adolescents with low dietary diversity, monotonous diet and adolescents attending government schools.

Conclusion: Malnutrition affects one out of five female adolescent in this community and was associated with poor dietary diversity and parent demography which demands appropriate health information disseminations to the target groups.

Keywords: Adolescent; Wasting; Thinness; Ethiopia

Introduction

Adolescence is the age between 10-19 years old, and it is the transition from dependent childhood to independent adulthood, that comprises 20% of the global population, and with approximately 80% of them live in developing countries [1,2]. This age is a stage of growth and development in the lifespan that needs adequate and proper quality food to meet the nutrient requirement for their physical, mental growth and development in addition to reproductive maturity [3].

Nutritional needs during adolescence are influenced mainly by the onset of puberty with its associated increased growth rate and changes in body composition and organ systems [4]. In this period adolescents gain 15% of their final adult height, 45% of increments in bone mass and 50% of adult weight is attained together with changes in body shape and composition [5-7].

Adolescents in all income and ethnic groups can be at risk for dietary excesses and deficiencies. Many boys and girls in developing countries enter adolescence undernourished, making them more vulnerable to disease and early death [8]. In addition, adolescents have

a low rate of infection and chronic diseases compared to children under 5 years old and old age that makes them receive little attention, except reproductive health. Inadequate diet during this time can result in decreased learning ability, delayed sexual maturity, a lack of concentration, impaired school performance and slow growth. Pregnancy, lactation, physical activity and sports participation further increase nutrient requirements during this age [9]. Therefore, malnourished adolescent girls are at risk of being stunted mothers who are likely to suffer obstetric complications and to deliver low birth weight babies that could lead to intergenerational cycle of malnutrition. Thus, adequate nutrition and healthy eating habits at this age are foundations for good health in adulthood.

In Ethiopia, children and adolescent constitutes about 48% of Ethiopian population and about 25 percent of this age group is girls [10] but studies among this age group were insufficient. Few Studies in Ethiopia showed that under nutrition was common problem among adolescent girls. Of which, a study in the rural community of Tigray indicated that 25.5% and 58.3% of adolescent girls were stunted and thin respectively [11], 37.8% were wasting (thinness), 2.0% overweight and 0.4% had obesity [12]. Similarly, in Jimma, 53.2% were underweight [13], Hawassa, 12.9% were overweighted and 2.7% had obesity [14] but no study was reported among adolescent girls in

Adama city, the biggest city in south east Ethiopia. Therefore, this study aimed at identifying the level of malnutrition and associated factors among high school adolescent girls in Adama city, south eastern Ethiopia.

Materials and Method

Study area

This study was conducted in Adama city which is located 100 km away on eastern direction of Addis Ababa. This city is among the biggest cities in Ethiopia and the biggest in the Oromia region. The livelihoods of this city are predominantly trade followed by civil servants. This study was conducted in April 2015 GC among school going adolescent girls. The schools were categorized as private who are providing education by collecting fee from students and Government schools, provides educational services for free to all citizen by acquiring funding from government. No gender based schools were available in Adama city. There are five government and four private schools that render education for grade nine and above in Adama city.

This study employed quantitative institution based cross study design. The study populations were adolescent girls who were selected from four randomly selected schools. The sample size was determined using the formula for single population proportion with the assumption of 0.05% marginal error, 95% confidence interval ($Z_{\alpha/2}=1.96$). Using on the prevalence (P) of 37.8% stunting in the study conducted in Tigray [12] (due to similarity of the population) and with design effect of 2, the final sample size was 726.

Sampling technique

A stratified cluster random sampling technique was used according to the following procedures. First the secondary schools grade 9 and grade 10 were identified by name and then the schools were stratified by ownership into government and non-government schools. Then, two government and two non-government schools were randomly selected by lottery method and sample size for each school was assigned based on proportionality to the number of adolescent girls in each school. Finally the study participants were selected by using Probability proportional to population size (PPS) from the total size in to grades 9 and 10. Then estimated sample size for each grade was distributed proportionally to each section and final samples were drawn using systematic random sampling method from student registry after identifying a list of female students. Adolescent girls suspected of pregnancy during screening, severe illness/history of admission to hospital in last months were excluded from the study.

Data collectors

Eight data collectors that have diplomas in nursing that monitor data collection filling and completeness of data on spot and provides necessary assistance for participants and two more supervisors with degrees who had experience of collecting similar data and were able speak the local language were recruited. Two days training was given to data collectors on how to approach the adolescent girls during data collections and pre-test was also conducted for standardization. After data collection each questionnaire was checked for completeness of information by immediate supervisors and the principal investigator.

Data collection

Data were collected using a structured, self-administered questionnaire under strict supervision of female supervisors and the overall quality control was conducted by the first author. The questionnaire was prepared based on the nutrition baseline survey report for the national nutrition program of Ethiopia, (Ethiopian Health and Nutrition Research Institute 2009/2010) and relevant literature. The questionnaire was pretested in similar setting out of sample schools and comments and suggestion identified in pretest was included in the final version. The questionnaire developed in English, was translated into Amharic and Afan Oromo language then back to English by another person to ensure consistency and contextualization.

Data collection tools were designing in logical sequenced and free of scientific terms and non-leading. The pre-test was conducted on 5% of the study population other than the selected schools in the town, but in schools other than study sites before the actual data collection begins and amendment was made on the questionnaires if necessary. Questionnaires were checked each day by principal investigator for any incompleteness and/or inconsistency and feedback was given every morning before commencement of the next day's work.

A household wealth index was calculated by principal component analysis based on household assets and housing quality was used as a proxy indicator for socioeconomic status of households. An absolute measure of household wealth (wealth index) used in this study is based on an earlier concept developed by Garenne and Hohmann [15], whereby the sum of dummy variables are created from information collected on housing quality (floor, walls, and roof material), availability of potable water in the compound and type of toilet facility, and ownership of household durable goods (e.g. bicycle, television, radio, motorcycle, telephone, cars, refrigerator, mattress, bed). These facilities or durable goods are often regarded as modern goods that have been shown to reflect household wealth. The scores were thus added up to give the proxy household wealth index. The index varied from 0 to 18. Similar classification was used in previous study [16].

Anthropometric data

Nutritional status of study participants was assessed based on the anthropometric measurements used to assess the physical development of adolescent girls. Height was measured once with a Portable Height Scale to the nearest 0.1 cm. The Body weight was measured using the platform (digital scale) weighing Scale (770 alpha; SECA, Hamburg, Germany) to the nearest 0.1 kg that has the capacity to measure 0-140 kg. Weight and height were measured by two different measurers and with any variation the final validations was made by supervisors immediately on site. The subjects were weighed with minimum of clothing. Body mass for age z-score was used to classify level of malnutrition in the study subjects and those who have less than -2 z-score were categorised as thin, between >-2 and <+1 as normal weight, overweight between +1 and <+2 and above +2 were categorized as obese (WHO, 2007). Having height for age z-score less than -2 was categorized as stunted [17].

Dietary diversity data were collected using a questionnaire developed by Food and nutrition technical assistance [18]. The questionnaire asked adolescents the types of food consumed in the home or outside the compound in the last 24 h. The information collected on dietary consumption was used to calculate the dietary diversity score (DDS) and additionally seven day food frequency was also noted to their household dietary diversity and regular access to

food. The seven day food frequency was used to determine frequency of accessing to animals sources foods and phytates (that inhibits absorption of Iron and zinc from food). Each food group was counted only once resulting in a possible score of 0 to 9. The DDS was categorized into low/inadequate dietary diversity (<4 food groups), adequate dietary diversity (≥ 4 food groups) [19]. The recall was randomly made on week days or on weekend days, since weekends do not have any special significance in the context of our study. We took care not to include atypical days (local feasts or celebrations) in the recall.

The dependent variable was nutritional status of adolescent girls. The independent variables derived from socio-demographic and socioeconomic characteristics of the family, and dietary habits of the adolescents. The socio-demographic variables used in this study were age, sex, marital status, ethnicity and religion. The socio-economic variables were level of education of parents, type of last school attended, occupation, family size, income, water and sanitation. Adolescents were also asked about their lifestyles, source of income, pocket money, how spare time was spent in addition to their dietary diversity, meal pattern and habits of eating fast foods.

Data processing and analysis

Data were double entered into Epi Data 3.1 version and was checked for completeness and consistency, followed by data cleaning and editing. Then the data was analysed by using Statistical Package for Social Sciences, Version 16 (SPSS for Windows, SPSS Inc., and Chicago, IL, USA) software's and WHO Anthro Plus software for assessing growth of the adolescents was used [20]. Descriptive statistics using frequencies, proportions and correlation was used to present the study results. Odds ratio with 95% confidence interval was used for checking the strength of associations between dependent and independent variables. Bivariate analysis was used to identify candidate variables for multivariable logistic regression in determining factors associated with nutritional status and only variables with p-values <0.2 in bivariate analysis were entered into the final multivariable logistic regression model to adjust for confounders.

Ethical consideration

Prior to the commencement of the actual data collection process, the study proposal protocol was approved by Rift Valley University College Institutional Research Ethics Review Committee. Official letters of co-operation were written to all secondary school and concerned bodies in the city and to the schools. After getting permission from the schools, the principal investigator set dates and times of data collections with the school administrations. Students and their parents were notified and necessary explanations were also given about the purposes, procedure and all the confidentiality issues. Consent was collected from the parents of study subjects by sending letter to parent/guardians for each study subject less than 18 years old and oral assent was obtained from study subjects in the school. The respondents' confidentiality of information was assured by excluding names and identifiers from in the questionnaire and they were informed that they can refuse participation at any time.

Results

Socio-demographic characteristics of study participants

From calculated sample size of 726, 700 adolescent girls provided complete questionnaire making a response rate 97.2%. All of them were urban residents, 60.7% were from governmental schools and 56.3% of them were grade 9 students. Of the participants, 66.7% belonged to 15-19 years of age groups, 52.7 % of them were followers of Orthodox Christianity by religion (Table 1).

Variables	Categories	Number (n)	%
Age	15-17	236	34
	17-19	474	66
Religion	Muslim	229	33
	Orthodox	369	53
	Protestant	90	13
	Other	12	1.7
Grade	Grade 9	394	56
	Grade 10	306	44
Type of Schools	Private School	276	39
	Public School	424	61
Father Education	No formal Education	140	20
	Primary and Secondary	275	39
	Grade 12 and College	285	41
Mother Education	No formal Education	188	27
	Primary and secondary	302	43
	Grade 12 and College	210	30
Father occupation	Daily laborer	148	21
	Government	275	39
	Merchant	277	40
Mother occupation	House wife	163	23
	Government	261	37
	Merchant	276	39
Wealth Index	Poor	219	31
	Middle	264	38
	Rich	217	31

Table 1: Socio-demographic characteristics study participants in Adama city, south eastern Ethiopia, 2015.

Of the participants, 37.7% were among middle wealth class group while the rest were categorized among lower and upper class wealth index. Regarding the educational status parents, about 40.7% of their fathers attended some college/university while only 30% their mothers did so. As to the occupation of parents of the study subjects, 39.6% of

the respondents' fathers were merchants and 39.3 % were government-employed (Table 1).

Diet/Dietary habit of school adolescent girls

Based on the 24 h dietary recalls the mean Dietary Diversity Score (DDS) was 4.2 (SD 2.01). The proportion of adolescents with minimum dietary diversity (at least consumed from four food groups out of nine food groups) was 41.2%. Among the participants, the all (100 %) of them consumed grains or other starchy roots and tubers (staples), followed by dark green vegetables (80.0%), others fruits and vegetables (79.3%) and legumes (66.7%). Consumption of animal source foods like, organ and flesh meat, dairy product and egg were relatively low (Table 2).

Food Type or Group	Categories	Frequency (n)	%
Grains or other starchy roots and tubers	Yes	700	100
Vitamin A rich fruits and vegetables	Yes	430	61
	No	270	39
Dark Green Leafy Vegetables	Yes	560	80
	No	140	20
Organ Meat	Yes	80	11
	No	620	89
Flesh foods	Yes	226	32
	No	474	68
Other fruits and vegetables	Yes	555	79
	No	145	21
Eggs	Yes	218	31
	No	482	69
Legumes and nuts	Yes	467	67
	No	233	33
Dairy products (milk, yogurt, cheese)	Yes	317	45
	No	383	55

Table 2: Adolescent's 24 h dietary diversity recall in Adama city, South Eastern Ethiopia 2015.

Food frequency of the study participants

A seven day food frequency questionnaire of major foods and beverages consumed by adolescents indicated that 73.3% of them consumed milk and milk products 1-2 times per week, 50% ate pasta/ rice/bread/potatoes more than three times a week, but only 32.9% of the respondents reported they did not eat meat at least once per week (Table 3).

Nutritional status of the adolescent school girls

Under nutrition or thinness (BMI for age z score <-2) was observed among 21.3% respondents, while 3.3 % of them were overweight and 1.0% had obesity. Similarly 15.6% of the adolescents were stunted (have

short stature for their age) (Table 4). Among 21.3% of adolescents with malnutrition, 59.1% and 42.5% of them were born from mothers and fathers who attended school respectively. Of the malnourished adolescents, 47% do not eat egg in weeks, 47.1% had monotonous diet pattern and only 26.8% of them took adequate dietary diversity as reported from 24 hrs before the survey (Table 5).

Consumption Frequency	Food items	Frequency	%
Cereals	>3 times in a week	700	100
	Never	66	9.4
Pasta and rice	1-2 times/week	280	40
	>3 times	354	51
Milk and milk products	Never	11	1.6
	1-2 times/week	513	73
	>3times	176	25
Meat	Never	230	33
	1-2 times/week	277	40
	>3times	193	28
Egg	Never	239	34
	1-2 times/week	235	34
	>3 times	226	32
Sweets	Never	272	39
	1-2 times/wk	214	31
	>3 times	214	31
Cheese	Never	483	69
	1-2 times/week	141	20
	>3 times	76	11
Legumes	Never	222	32
	1-2 times/wk	295	42
	>3 times	183	26
Fast food	Never	324	46
	1-2 times/week	189	27
	>3 times	186	27

Table 3: Seven day food frequency of some food stuffs among school adolescent consumed in Adama city, South East of Ethiopia, 2015.

Variables	Total	Types of school		X ² test values (p-values)
	N (%)	Government	Private	
BMI for age z score				
<-2 z score (thin)	149 (21.3)	124	35	20.5 (<0.001)

>-2 to<0.99 (Normal)	521 (74.4)	297	214	1
1.00 to 1.99 (Overweight)	23 (3.3)	3	20	3.2 (0.07)
≥ +2 Obese	7 (1.0)	0 (0.0)	7	NA
Height for age z score				
<-2 z score (stunted)	109 (15.6)	81 (19.1)	25 (9)	0.7 (0.4)
≥ -2 (normal)	591 (84.4)	343 (80.9)	251 (91)	
Minimum Dietary Diversity				
Yes	289 (41.2)	195 (45.8)	94 (34.1)	9.4 (0.002)
No	411 (58.7)	231 (54.2)	182 (65.9)	

Table 4: Nutritional status of adolescent school girls in Adama City, South Eastern Ethiopia.

Factors associated with nutritional status of the school adolescents

Among socio-demographic and economic factors, age of mothers and fathers of adolescent girls, their households wealth index, religion, grade, , family income, were not significant at binary logistic regression (p values>0.2) and were removed from multivariable logistic regression

models. Among dietary habits eating meat, cheese, fast foods predominantly diets eating vegetables and most other variables in seven day food frequency were not significant and then removed from further analyses. Finally, educational status of adolescent girls mothers and fathers, their fathers occupation, dietary diversity, frequency of eating egg, sweets and legumes in a week, perceptions of their dietary diversity, lifestyle's in their free time and types of schools they are attending fulfilled the criteria and were included in multivariable analysis.

In multivariable logistic regression analysis, adolescent girls' father and mother education level, occupation of their fathers, their DDS and pattern of meal diversity were significantly associated with under nutrition. Adolescent girls who were from an illiterate father were more likely to develop under nutrition (thinness) compared to those born from fathers of college level training (AOR=3.06, 95% CI=1.67-5.63). In addition, those adolescent girls from daily laborer fathers were twice more likely to be undernourished compared to those adolescent girls from merchant fathers (AOR=2.67, 95%, CI: 1.48-4.8). Adolescent girls who had low DDS were more likely to be thin (AOR: 2.1 95% CI: (1.54-3.89) than those adolescents with high DDS. Similarly, regarding meal diversity perception, those adolescent girls who perceived their diet was monotonous were more likely to develop wasting (AOR=2.52, 95%, CI=1.51-4.19) compared to those who had diversified food on daily bases. Adolescents from uneducated mothers and mothers who attended primary school were more likely to have undernourishment compared to mothers who attended some formal college training (Table 5).

Variables		Nutritional Status			
		Thin N (%)	Normal N (%)	COR (95% CI)	AOR (95% CI)
Mother education level	Illiterate	85 (57.1)	95 (18.2)	7.5 (4.3-13.6)	5.4 (4.71-9.1)*
	Primary	43 (28.9)	248 (47.6)	1.5 (0.82-2.7)	1.69 (0.91-3.17)*
	Secondary/College	21 (14.0)	178 (34.2)	1	
Father education level	Illiterate	44 (29.5)	78 (15.0)	3.2 (1.9-5.4)	3.06 (1.67-5.63)*
	Primary	63 (42.3)	206 (39.5)	1.73 (1.12-2.7)	2.40 (1.43-4.04)*
	Secondary/College	42 (28.2)	237 (45.5)	1	
Father occupation	Daily labor	53 (35.6)	97(18.6)	2.62 (1.59-4.3)	2.67 (1.48-4.8)*
	Government	54 (36.2)	222 (42.6)	1.16(0.73-1.87)	1.20 (0.74-2.05)
	Merchant	42 (28.3)	202 (38.8)	1	
DDS	Low	109 (73.1)	282 (54.1)	2.31 (1.5-3.5)	2.1 (1.54-3.89)*
	Adequate	40 (26.8)	239 (45.9)	1	
Sweets/week	Never	74 (49.7)	168 (32.2)	2.1 (1.3- 3.4)	1.24 (0.701-2.18)
	1-2 times/week	38 (25.5)	176 (33.8)	1.033 (0.3-1.7)	0.81(0.45-1.48)
	>3 times/week	37 (24.8)	177 (34.0)	1	
Legumes/week	Never	30 (20.1)	153 (29.4)	0.6 (0.36-1.0)	1.35 (0.74-2.47)
	1-2 times/week	54 (36.2)	167 (32.0)	0.99 (0.6-1.5)	1.42 (0.79-2.53)

	>3 times/week	65 (43.6)	201 (38.6)	1	
Pattern of eating diversified meal	Monotones diet	85 (57.1)	203 (39.0)	3.1 (1.7-5.5)	2.52 (1.51-4.19)*
	Sometimes	44 (29.5)	175 (34.0)	1.8(0.98-3.4)	1.8 (0.98-3.4)
	Always Different	20 (13.4)	143 (27.0)	1	
Free time practice	Watching TV/computer using	52 (35.0)	278 (53.4)	0.46 (0.31-0.70)	0.88 (0.49-1.58)
	Walking/sport	97 (65.1)	243 (46.6)	1	
Types of school	Private	35 (23.4)	214 (41.0)	1	
	Government	124 (83.2)	297 (57.0)	0.39 (0.25-0.60)	0.42 (0.21-0.75)*

Table 5: Determinant of nutritional status of school Adolescent girls in Adama city, South Eastern Ethiopia. NB: Adolescents who were overweight were removed from multivariate analysis. *percentage is calculated for column in this data.

Discussion

This study showed that 21.3% of the adolescents were underweight, 3.3% of them were overweight and 1.0% had obesity. Of the adolescents, 15.6% were stunted and 41.2% of them received minimum dietary diversity (MDD) recalled from a 24 h before the survey. The predictors of under-nutrition among adolescent girls were: adolescents from mothers and fathers who did not attend formal education, from daily laborer and government employee fathers, adolescents with low dietary diversity, and adolescents who perceived their diet was monotonous.

Problems related to nutrition have been identified as important concerns for public health in Ethiopia. Many studies have been carried out to identify the extent and consequence of malnutrition in different population groups. Thus, adolescents demonstrate the vulnerability of those who have not received appropriate attention to ensure that their nutritional needs are met. This study is important indicators for nutritional status of “tomorrow mothers” where all stakeholders should work hand in hand to cut the intergenerational cycle of malnutrition. It is worth to notices that this study is conducted in urban area where majority of the household have better exposure to health information and awareness through different media as well as the relative suffer of adolescent girls in city are assumed to be better than rural in fetching water, collecting fire wood and assisting families in farm activities. Therefore the magnitude of this study could be an indicative of public health importance of this study which may require different interventions.

This study revealed that prevalence of under-nutrition among adolescent students was 21.3% and this finding is lower than the study in Ambo (27.5%, [21], higher than study conducted in Addis Ababa city (13%) [22]. This might be due to the difference in socioeconomic background between the cities. Other studies in Ethiopia indicated that 37.8% were wasted in Tigray region [12]. These findings indicated that under-nutrition is a major public health problem in majority of Ethiopian communities including urban and rural adolescents. The differences in prevalence could be associated with the socio-demographic and economic characteristics of household.

The prevalence of overweight was 3.3%, which is another form of malnutrition that may be associated with nutritional transition among adolescents. The finding of this study is relatively low compared to the study conducted in Hawassa (12.9) [14], but higher than Mekelle (2%) [12], and Ambo (2.6) [21]. This finding can alert policy makers about

the presence of double burden (under and over nutrition) in the same community. In addition, about 1.0% of adolescents were obese and this is lower compared to the findings from Ambo (1.7%) [21] and Addis (2.6) [22]. So, this study calls for a need to give health information about the impact of over nutrition in addition to teaching about endemic under-nutrition in Ethiopia. Among children with overweight and obesity, the majority of them were from private schools that may be associated with the welfare of the households and related reduced outdoor physical activities. The magnitude of overweight adolescents girls was higher among private school girls compared to government schools ($p=0.07$) and all of the obese adolescents were from private schools that could be due to the fact that private schools are mainly attended by students from better socioeconomic status.

The prevalence of stunting in this study was 15.6% which is due to a prolonged shortage of balanced meals, especially amongst children from poor families. This finding is similar to the study conducted in Babile, but higher than the previous study conducted among children in Adama (12.6%) [23] And Kersa district of eastern Ethiopia (8.9%) [24]. Similar to wasting, stunting is also relatively higher in government schools than in the private schools, even though the difference was not significant. It is know that short stature is associated is cephalopelvic disproportion and increased risk of maternal complications during child birth. In addition studies showed that stunted mothers will give birth of stunted child which indicate that international cycle of malnutrition. Studies showed that stunting was associated with delayed school entry, repetition and dropout rates, as well as decreased graduation rates from primary and secondary school, and lower school performance [25]. Similarly, early childhood stunting was associated with lower adult body-mass index (BMI) but higher risk of developing central adiposity [26].

The proportion of children, who received at least from four more food group out of nine, is 41.2%. This finding is lower than the study conducted in Bale zone (80.7%) [27] and chiro town (74.2%) [28], but higher than Libo Kemkem and Fogera Districts adolescents (5%) [29] and the study by Wassie et al. (15%) [30]. 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 IDDS is high, adolescents will get adequate energy and other important nutrients having role in growth and development. Even though the magnitude of adequate dietary diversity is varied across the regions, the proportion of adolescents with low

dietary diversity is common in Ethiopia. This needs great attention to curb its long lasting consequences.

Dietary diversity has been used as proxy indicators for food quality and security [31], which may be due to its ability to capture consumption of both macro and micronutrients or a more balanced diet in the general sense without the need of measuring the quantity of food consumed, which may in turn be difficult in certain contexts. Malnutrition found in these school-aged adolescents living in Adama city is associated with a low DD together with other socio-demographic factors of the household. In this study, we also found that 42.9% of adolescents expressed their diet as monotonous which is mainly based on low energy and low nutrient foods, such as cereals or tubers and is low in animal source foods. Of the children with wasting, 57.1% perceived that their diet is mostly monotonous. With regard to growth spurts in adolescents, even though the actual need of energy at this time may vary greatly with physical activity level, basal metabolic rate (BMR) and body composition, inadequate intake of energy leads to malnutrition. Studies also showed that meal pattern of the adolescent may follow pattern of their family as they grew up, they are influenced by their family feeding/dietary diversity behaviors [32].

Studies in Ethiopia indicated that food consumption patterns are very diverse and their food basket consists of a wide variety of grains and other staples, which are varied across agro-ecology, socioeconomic levels, and livelihood strategies [33] as well as affected by tradition of the societies and food preferences [34]. In addition, differences and inequalities in dietary diversity among urban and rural areas was reported previously [35,36].

This study found that adolescents of fathers from lower levels of education had a significantly higher risk of being underweight than those of fathers who attended above grade 12 or higher level of education. This finding is consistent with the study done in western Ethiopia [12]. This indicated that the educational attainment of the father could lead to a higher income and may imply a higher availability of food and household resources as well as being positively associated with higher nutritional awareness.

This study showed that being adolescents from mothers having non-formal education were significantly associated with under-nutrition. This study is in agreement with the study done in urban slums of Dibrugarh which showed that the prevalence of both stunting (41.80) and thinness (44.26%) was much higher among girls who came from families whose mothers were illiterate [37]. Similarly studies from different parties of the world indicted that maternal education are closely related to child health measured either by nutritional status or by infant and child mortality but the effect of father's education appears to be about one half that of mother's education [38,39].

Another striking finding of this study was that adolescents from private schools were less likely to acquire wasting compared to government school adolescents, which indicate that the causes of malnutrition are associated with household income. This difference is observed because most of the students going to private schools were from the families who are able to afford school fees while the government school is free of any charge. Another studies in Ethiopia indicated that higher prevalence of under nutrition among adolescents from lower family income or those adolescents born from lower income fathers was undernourished compared to counterparts [13].

A limitation of this study is that most of the data was collected from self-administered forms and therefore social desirability bias may be present. But during data collection adequate information was given to

participants about the importance and confidentiality of information and were seat in separate chair and not able to see/read the response of each other's. Other limitation of this study was that this study was conducted in urban and do not generalize to rural adolescent girl population.

Conclusion

This study revealed that under-nutrition was relatively high among urban adolescent girls and adolescent's parent education, adolescent's meal pattern and dietary diversity were predictors of the observed under-nutrition. Recognizing the intergenerational effect of malnutrition and high prevalence of under-nutrition in the city, there is a clear need for carefully designing interventions that reduces the risks of malnutrition among adolescent girls in Adama city.

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