
Assessment of nutritional status and associated factors among school going adolescents of Mekelle City, Northern Ethiopia

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Abstract: Adolescence is a period of rapid growth and maturation in human development, and that extra nutrients are needed to support their growth spurt. Adolescence is commonly regarded as a relatively healthy period of the life cycle. Indeed, adolescents are possibly less vulnerable to infection than they were at a younger age. This may contribute to their being neglected, And the reason for focusing on adolescents' nutritional status is this period of life is a unique opportunity to break a range of vicious cycles of problems caused by malnutrition can be passed from one generation to the next. So this study aims to assess adolescent nutritional status and associated factors in secondary and preparatory school students of Mekelle city, northern Ethiopia. Institution based cross sectional study design was conducted in February 2013. Six schools were selected randomly from the total 23 and then 572 adolescents were selected using systematic random sampling. Data related socio-demographic and other determinants of adolescent nutritional status were collected using self administered questionnaire but, anthropometric measurements were conducted by trained data collectors. WHO Anthro-plus software was used to analyze Anthropometric measurements and Nutritional statuses of adolescents were determined using the CDC cut of point body mass index for age. Finally Biavriate and multivariate analyses were done to determine factors affecting the nutritional statuses of adolescents. A total of 555 adolescents were participated with a response rate of 97%. The overall prevalence of wasting (thinness), overweight and obesity were 37.8%, 2%, and 0.4% respectively. Multivariate logistic regression analysis was done, being male at AOR 2.322 and 95% CI 1.58-3.39, adolescent's father education AOR 2.43 and 95% CI 1.23-4.78, adolescents who works besides education at AOR 1.94 and 95% CI 1.071-2.371, respondents who consumed food contain pulse, legumes and lentils at AOR.635 and 95% CI .435-.925 were significantly associated with thinness. In general more than one third of schools going adolescents are thinner but, the prevalence of over nutrition is very low. Being male, father education, work beside education and consuming food containing pulse, legumes and Lentils are factors determine adolescent thinness. Based on the finding; there must be intersectoral collaboration among health sectors and education sectors to address adolescent nutrition problems, intervening nutrition related education and assessments targeting male adolescents in schools and community.

Keywords: Adolescents, Nutritional Status, Associated Factors

1. Introduction

Adolescence is a period of rapid growth and maturation in human development, and that extra nutrients are needed to support their growth spurt. In other words Adolescence is an intense anabolic period when requirements for all nutrients increase. During adolescence, 20% of final adult height and 50% of adult weight are attained and bone mass also

increases by 45% [1,2].

Healthy eating patterns in childhood and adolescence promote optimal childhood health, growth, and intellectual development, as well as prevent health problems later in adulthood and old age. Most studies show an inverse association between the consumption of healthy foods, such as fruits and vegetables, and risk of cardiovascular disease and all-cause mortality. Adolescent food habits are an

important concern in the recent accelerated nutrition transition. Food habits established in childhood and adolescence tend to be stable in to adulthood. Nutritional deficiencies and poor eating habits established during adolescence can have long-term consequences, including delayed sexual maturation and lower final adult height [3, 4].

Adolescents' nutritional problems may cause a heavy health burden; mainly take account of nutritional deficiencies among pre-school and pregnant women. Up to recently, little was known about nutrition of adolescents, particularly in low-and middle-income countries. Nutritional status of adolescents in order to guide the formulation of policies and program there is a shortages of data on adolescents' nutritional status in developing countries. This was underlined in the South-East Asia Region, and especially for non-school attending, non-pregnant adolescent girls aged 12 to 16 years, called the 'grey area'. The overall nutritional status is better assessed with anthropometry, in adolescence as well as at other stages of the life cycle [5, 6,7].

Poor nutritional status during adolescence is an important determinant of health outcome. Moreover, adolescents have different needs and have diverse problems. Chronic energy deficiency in adolescents results in short stature and lean body mass and is associated with deficiencies in muscular strength and working capacities. In girls, short stature persisting into adulthood increases the risk of adverse reproductive outcomes. In many Western countries, children and adolescents increasingly seem to adopt lifestyles that negatively affect their nutritional and health status and is substantially increase risk of premature development of chronic diseases like cardiovascular diseases, metabolic syndrome, osteoporosis and certain cancers. Particularly poor dietary habits, sedentary leisure time spending and a lack of physical activity are lifestyles that once installed have a strong tendency to track from childhood in to adulthood and then become extremely resistant to modification [7,8,9].

A study conducted in Addis Ababa (the capital town of Ethiopia) elementary school for child and Adolescent Obesity showed that, the overall prevalence of underweight, overweight and obesity were 13.0%, 7.6% and 0.9% respectively. The prevalence of underweight, overweight and obesity among girls were: 9.0%, 9.4% and 0.8%, respectively, while those prevalences among boys were: 18.1%, 5.4% and 1.1% respectively. The prevalence of Obesity for Adolescents (BMI for age 95th percentile and above) was 0.9%, 95 CI (0.027%, 1.53%).the sex specific prevalence slightly higher proportion of obesity was observed among boys (1.1%) than girls (0.8%) [10,11].

A study conducted in elementary and secondary school of ambo town, Ethiopia, The prevalence of obesity, overweight, normal, and underweight is 1.7%, 2.6%, 68.2%, and 27.5%, respectively. The prevalence by sex is female 1.1%, 3.8%, 70.5%, and 24.6%, obesity, overweight, normal and underweight respectively. The prevalence of obesity overweight, normal and underweight 2.1%, 1.7%, 66.5%, 29.8 respectively [12,13,].

Many studies have shown that educational achievement of

parents, both fathers and mothers, is associated with their children's nutritional status. The educational attainment of parents most leads to higher income and may imply a higher availability of food and household resources. On the other hand, it might be positively associated with higher nutritional awareness as well as better caring of children. But also the mother's educational level to be associated positively with the adolescent's BMI. It could be explained by the assumption that mothers' education is one of the income determinants in families. Furthermore, in the studied population, mothers are responsible for shopping and cooking, therefore the educational level of mothers may affect the purchased food items and method of cooking [14,15].

Adolescents are the best human resources. But for many years, their health has been neglected because they were considered to be less vulnerable to disease than the young children or the very old. Their health attracted global attention in the last decade only. Unfortunately assessment of nutritional status of adolescent girls has been the latest explored area of research in the world [16, 17, 18, 19]. The same true in Ethiopia and in the study area. Standing from this the objective of the study was to assess adolescent nutritional status and associated factors among school going adolescents in Mekelle city, Tigray region, North Ethiopia 2013. The findings of this study provide policy makers, stake holders, health care providers and other concerned bodies about adolescent nutritional status and associated factors among school going adolescents, in order to understand the most important factors for the improvement of their life.

2. Methods and Materials

2.1. Study Area and Period

The study was conducted in Mekelle town, which is located 784 kms Northern of national capital Addis Ababa. There are twenty three secondary and preparatory schools in the city, with the total of 19,195 government and private school students. The Study was conducted in February, 2013.

2.2. Study Design

Institutional based cross-sectional study design was used.

2.3. Study Population

All secondary and preparatory school adolescent students (age group 12-19) were the source population, where as sampled or selected students were study population of this study.

2.4. Sample Size Determination

The sample size was determined using a single population formula, the standard normal deviate, usually set at 1.96 which correspond to the 95% Confidence interval, degree of freedom desired set at 4% Prevalence of Adolescent underweight in Ethiopia 13% was used and based on this the

required sample size was calculated to be 572 including 10% contingency.

2.5. Sampling Procedure

Of the total, eighteen schools were governmental and the rest five were private schools. Of the total students of the town; 9650 student were enrolled in governmental schools, and 9545 students were enrolled in private schools. The schools were stratified in two; governmental and none governmental schools. Using a lottery method three schools from each stratum was selected. That is a total of six schools were selected. In the selected schools, by using a lottery method one section per grade was selected. To take the exact sample size per class in one section there were fifty two students. Using systematic random sampling every 2nd student was considered to take twenty six students per section for all twenty two sections, twenty six students per class was taken then, two hundred eighty six students each from government and private was taken and a total of five hundred seventy two samples were considered.

2.6. Data Collection and Data Quality Control

Quantitative data were collected using structured self administered questionnaire. The questionnaire was first developed in English and translated to Tigrigna (local language) and back translated to English by language experts to check its consistency. Anthropometric data were collected by trained data collectors who were grade twelve completed. And the overall activity was coordinated by the investigator. Data collection tool is fixed weighing and height measuring tool which were calibrated every five adolescents and taken three times and consider the average measurement. The height was taken by considering to the nearest of 0.1cm , during measurement foot and head wear removed, head in correct plain subject in erect position knees bent or feet not on ground and board firmly against head. Weight measured with nearest of 100gms and was calibrated to zero, wearing heavy closes was avoided.

Data quality was insured by training data collectors & supervisors as well as providing day to day supervision during the whole period of data collection. Pre-test and modified questionnaire was used. Every day, all collected data was checked for their completeness, clarity and consistency by supervisors and principal investigator.

2.7. Data Analysis and Statistical Test

Socio-demographic and economic data were entered, sorted, cleaned, and edited using statistical package SPSS for window version 16, whereas, Anthropometric data were entered and analyzed using WHO Anthro-plus software.

Descriptive summary (Frequency distribution, proportion, mean & standard deviation) was used to summarize the variable. Bivariate & multivariate logistic regression was done to assess the association of factors with adolescent thinness, by calculating odds ratios, their 95% confidence limits and P-value less than or equal to 5% was taken as

statistically significant. Before inclusion of predictors, multi collinearity was checked using the cutoff point VIF <10 and tolerance test greater than 0.1. The goodness of fit of the final logistic model was tested by using Hosmer and Lemshow test at a value of > 0.05. And Omnibus test < 0.05 to assess the relative effects of explanatory variables on the outcome of interest using.

2.8. Ethical Considerations

Ethical Approval was obtained from Mekelle University College of Health Science Ethical Review Committee with reference number ERC0162/2013. Supporting letter was also obtained from Department of public health to zonal education bureau and the zonal education bureau wrote to each high school. The purpose and importance of the study was explained to the participants during the measurement of weight and height, their Autonomy and dignity is kept if they do have inconvenience during the measurement they can interrupt. All the findings were kept in secret and not be to transferred to any body without his permission, to keep the privacy of the participant. The names and address of the participants was not recorded in the questionnaire, the overall data were collected after full informed verbal consent is obtained.

3. Result

3.1. Participants Characteristics

A total of 555 school going Adolescents were participated in the study, with a response rate of 97%. Of the total study subjects 290(52.3%) were females and the rest 265(47.7%) were males. Regarding the age of respondents, majority 475(85.6%) were 15-19 years old and the mean (SD) age was 16.2 ± 1.44. Majority, 545(98.2%) and 520 (93.7%) of respondents were Tgrians in ethnicity and Orthodox Christian in religion. As to the family of the respondents 276(49.7%) were from large family (>5 members). Around half, 273 (49.2%) were from governmental and the rest 282 (50.8 %) were from private schools. Regarding to the education level of respondents father; only 206 (37.1%) were College and University completed. Regarding monthly income of the family; of respondents 203 (94%) had monthly income greater than 1000 Ethiopian birr (Table-1).

Table 1. Socio demographic and economic characteristics of respondents among secondary and preparatory School Students in Mekelle city February, 2013.

Variable N=555	Level	N(%)
School type	Government	273(49.2%)
	Private	282(50.8%)
Age in year	10-14	80(14.4%)
	15-19	475(85.6%)
Religion	orthodox	520(93.7%)
	Muslim	31(5.6%)
	catholic	(3).5%
	protestant	1(.2%)
Ethnic group	Tigraian	545(98.2%)
	Amhara	8(1.4%)
	Erob	2(.4%)

Variable N=555	Level	N(%)
Residential house	rented/privet	138(24.9%)
	owned	399(71.9%)
	rented/government	18(3.2%)
	No formal education	128(23.1%)
Father's education	1-4grade	18(3.2%)
	5-8grade	80(14.4%)
	9-10grade	65(11.7%)
	11-12grade	58(10.5%)
	College and university	206(37.1%)
	No formal education	153(27.6%)
Mother's education	1-4grade	32(5.8%)
	5-8grade	90(16.2%)
	9-10grade	79(14.2%)
	11-12grade	56(10.1%)
Family size	College and university	145(26.1%)
	<5	279(50.3%)
Father's job	>5	276(49.7%)
	employee	193(34.8%)
Mother's job	Merchant	262(47.2%)
	No job	17(3.1%)
	Employee(govt. and non-govt.	135(24.3%)
Family monthly income	Merchant	154(27.7%)
	No job	7(1.3%)
	House wife	259(46.7%)
	<300	3(.5%)
Family monthly income	301-500	3(.5%)
	501-1000	11(2%)
	>1000	203(36.6%)

3.2. Nutritional Status of the Respondents

Distribution of nutritional status of respondent's was determined using the CDC cut of point BMI for age accordingly as follows; ($< -3SD$), 1750 (37.8%) thin ($\geq -3SD$ and $< -2SD$), 335(60.4%), with the normal range ($> -2SD$), overweight ($+1SD$ and $+2SD$), 11(2%), and 2(.4%)of them were obese ($> +2SD$) (Figure 5.2.1)

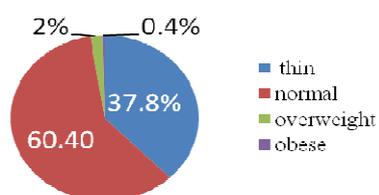


Figure 1. Distribution of nutritional status of respondents in secondary and preparatory school in Mekelle city February, 2013(N=555).

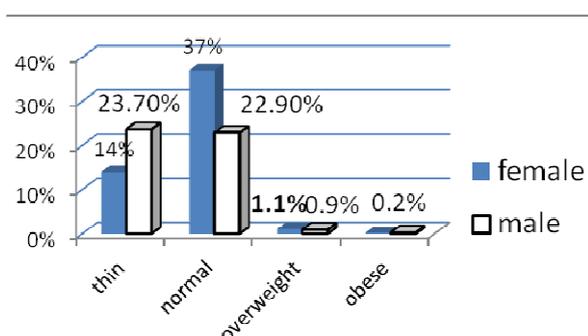


Figure 2. Distribution of nutritional status by sex of respondents secondary school and preparatory Students in Mekelle February, 2013(N=555).

3.3. Food Frequency of the Study Participants

The respondents dietary habit shows that, 346 (62.3%) which accounts the majority of respondents consumed fruit in a week. On the other hand 277(49.9%), 25(4.5%) of respondents consumed fruit once and three times a day respectively. Likewise more than half 333(60%) of respondents had an experience of meat eating and 224(40.4%) had practice of eating once a week. About, 318(57.8%) of respondents respond that, they did not consume vegetables the whole week prior to the study. On the other side 510 (91.9%) of the respondents conformed that they did not consumed food containing pulse, legume and lentils in the last week (Table 2)

The data concerning respondents meal frequency and dietary habits shows that, 491(88.5%) of the respondents had an experience of consuming three regular meals per day. Out of the total respondents 511(92.1%) had a habit of eating snacks once a day. And about 408(73.5%) of respondents ate carbohydrate (biscuit roasted cereal, Honey) as a snack.

Table 2. Dietary habit (food frequency) of respondents among secondary and Preparatory School Students in Mekelle city February 2013.

Variable N=555	Level	sex		Total
		Female	Male	
Fruit per week	Yes	191(34.4%)	155(27.9%)	346(62.3%)
	No	99(17.8%)	110(19.9%)	209(37.7%)
Fruit per day	Once	126(22.7%)	277(49.9%)	277(49.9%)
	Twice	15(2.7%)	17(3.1%)	32(5.8%)
	Three times	13(2.3%)	12(2.2%)	25(4.5%)
	Non	111(20%)	110(19.8%)	221(39.8%)
Meat per week	Yes	170(30.6%)	163(29.4%)	333(60.0%)
	No	120(21.6%)	102(18.4%)	222(40.0%)
Meat per day	Once	117(21.1%)	107(19.3%)	224(40.4%)
	Twice	42(7.7%)	51(9.2%)	93(16.8%)
	Three times	11(2%)	5(.9%)	16(2.9%)
Vegetable per week	Yes	123(22.2%)	114(20.5%)	237(42.7%)
	No	167(30.1%)	151(27.2%)	318(57.3%)
Vegetable per days	Once	104(18.7%)	98(17.7%)	202(36.4%)
	Twice	19(3.4%)	17(3.1%)	36(6.5%)
	Non	167(30.1%)	150(27%)	317(57.1%)

3.4. Factors Associated with Nutritional Status in the Results of Bivariate and Multivariate Analysis

In a bivariate logistic regression some variables were associated with the prevalence of thinness at p -value < 0.05 . That are being male, father education, father job, fruits taken in a week, foods like oilseeds, foods such as (pulse, legume and lentils), eating of snack foods and work beside education. Finally those variables were taken to multivariate logistic regression to compare the independent associations for solving cofounding effects of the variables. In multivariate logistic regression; being male, father education, foods like (pulse, legume, and lentils) and work besides education became significantly associated with thinness. This study showed us female adolescents at (AOR= 2.322 95%CI 1.58-3.39) were 2.3 times more likely prone to thinness than males. The study similarly this study revealed that those adolescents whose fathers education was 9-10 grade [AOR= 2.433 95% CI 1.237- 4.783] had 2.4 times higher risk of thinness than

those adolescents whose fathers education was collage and above. Those adolescents who consumed foods such as (pulse, legume, and lentils) were 36% prone to thinness than those who did not. Those adolescents who had work besides

education are at (AOR=1.594 95% CI 1.071-2.371), indicating that adolescents work besides education are at higher risk of thinness by 1.5 than those who do not work beside education (Table 3)

Table 3. Logistic regression showing factors affecting adolescent thinness in Mekelle Secondary schools from February 2013.

Variables	Response	Nutritional status		C OR 95%CI	AOR 95%CI
		Thinness	Normal		
Sex	Female	130	129	1	1
	Male	77	204	2.691	(1.8903.831)
Father's education	No formal education	42	81	1.719	(1.085-2.721)
	1-4grade	6	12	1.679	(.607- 4.644)
	5-8grade	29	50	1.476	(.867-2.512)
	9-10grade	17	47	2.191	(1.192-4.027)
	11-12grade	23	32	1.277	(.706-2.311)
	College and university	90	111	1	1
Father's job	Employee (gov. and N/gov.)	77	112	.499	(.282-.885)
	businessman	101	153	.506	(.291- .881)
	No job	8	8	.381	(.130-1.115)
Fruit eating week	Farmer	21	60	1	1
	Yes	129	207	1.005	(.706-1.432)
Protein (meat, egg ,fish)	No	78	129	1	1
	yes	181	274	.763	(.471-1.235)
Oil seeds	no	26	59	1	1
	Yes	3	9	2.092	(.569-7.690)
Pulse, legumes and lentils	No	204	324	1	1
	Yes	104	145	.705	(.500-.995)
Foods you eat for snacks	No	103	185	1	1
	carbohydrate/ biscuit roasted cereal, honey,	144	258	.869	(.214-3.526)
	protein/egg, meat /	28	25	.482	(.109-2.125)
	Milk and milk products	28	30	.589	(.135-2.575)
Work besides your education	Fruits	4	14	2.250	(.387-13.067)
	Vegetables	3	6	1	1
Work besides your education	Yes	64	152	1.889	(1.318-2.708)
	No	143	181	1	1

Key Significant at P < 0.05 = ****

4. Discussion

This study have been identified that Problems related nutritional states of Adolescents is an important concern for public health in Ethiopia. Nutritionally adolescents are critical period, this because, Firstly: adolescent is a transitional period between childhood and adulthood, targeting adolescence can provide an opportunity to prevent the onset of nutrition related chronic diseases in adults life, addressing adolescence specific nutrition issues and possibly also correcting some nutritional problems originating in the past. Secondly, many adolescents are in school which provides an effective and efficient opportunity for reaching large portion of the population, beyond students themselves they can influence their peers, family and community members so that adolescents an ideal target for nutrition education.

This study relived that, slightly above one therid (37.8%), of school adolescents were thin. Which is greater than the prevalence reported few years back in Addis Ababa (13 %

and Ambo (27.5%) cities of Ethiopia [8,9]. The difference is mainly may be due to socioeconomic back ground, in particularly between Mekelle and Addis Ababa. The present study relived that only 2%, school going adolescents was overweight. The same is true study conducted in Ambo city, 2.6 % of adolescents were overweight. Unlike this, study conducted in Addis Ababa, 7.6% of adolescents were overweight, which was higher than the present study and study conducted in Ambo. This is may be due to the difference in socioeconomic status [8, 9]. About obesity, below one percent (0.4) of school adolescents were obese in the present study, which is slightly lower than study conducted in Addis Ababa (2.6%) and Ambo (1.7%) city.

This study also reveals that the prevalence of thinness, normal, over weight and obese among girls was 14%, 37.1, 1.1%, and 0.2%, while among boys were 23.8%, 22.9, 0.9% and 0.2 % respectively. The same study in Addis and Ambo the prevalence of thinness, overweight and obesity among girls were: 9.0%, 9.4% and 0.8%, respectively, while among boys were: 18.1%, 5.4% and 1.1% respectively. In Ambo thinness, overweight and obesity for female were 24.6%

3.8%, 1.1%, respectively. For boys were 29.8 2.1%, 1.7%, for boys [9]. As it is indicated in the study the prevalence of thinness in boy and girls in Mekelle is greater than study conducted in Addis and Ambo. Still the main reason probability due to Socio-economic states difference.

In the same spoken the present study showed that, prevalence of overweight and obesity less than studies conducted other African countries (less than 10%) and in Americans and Europe above 20%[17]. This is due to the reason; Ethiopia is highly affected by persistent drought for centuries and is the poorest countries of the world. So under nutrition is the most common problem than over nutrition. The other reason may be due to the food habit difference between the study area and other part of the world. Unlike western diet, staple foods of the study area are unprocessed cereals and grains which are rich in many anti-nutritional factors. However currently, Ethiopia is the fastest growing countries of the world and relating with this over nutrition is emerging problem, in particularly in major cities of the countries.

In this study factors that are associated with thinness are significant associated, Adolescent's parent education has significant association with thinness; Adolescents whose father's education was 9-10 grade had 2.4 times higher risk of thinness than those adolescents whose fathers education was collage and above. This is so, the educational attainment of father could lead to higher income and may imply a higher availability of food and household resources. And it might be positively associated with higher nutritional awareness as well as better caring of children.

This study showed that those adolescents who fed foods like (pulse, legume, and lentils) were 36% prone to thinness. Which is may be due to this foods are highly rich in many anti nutritional factors and they consumes without any treatment that helps to reduce anti nutritional factors like de-healing, fermentation and soaking.

Adolescent those who had work besides education were at risk of developing thinness 1.5 times more than adolescents not working beside education. A study conducted in Northern Tigray showed that student's working beside education there was 49.1% thinness. In this regard there could be different reasons like adolescent age needs nutritious foods because of fast growing time and being physically active also needs additional nutritional requirement. So not getting the addition requirement leads to thin [1].

In the bivariate and multivariate analysis overweight and obesity had no significantly associated with factors that can have impact on overweight and obesity. This is because the present study showed that, both prevalence were below ten, in this case the statistical analysis tests don't make association below ten percent prevalence. However, the study conducted in united Arab emirate which says Adolescent overweight and obesity are one of the major global health challenges of the 21st century [15].

About sex difference, being male is 2.3 times more likely prone to thinness. This study is in line with the study conducted in Africa which conforms that, males were

affected in thinness than girls it was explain that for boys being thin was that in Africa, boys are encouraged to be autonomous at a younger age than girls, meaning that they are more likely to be exposed to infection which creates nutritional problem [3].

5. Conclusion and Recommendation

The findings of the study revealed that slightly above one third (37.8%), (2%) and (0.4%) school going adolescents of Mekelle city were thin, overweight and obese respectively. Being male, adolescent's father education being grade ten than college and university graduate, adolescents who works besides education than who don't work beside education and adolescents who consume foods such as plus, legumes, and lentils were statically significant association with thinness.

Based on the finding; there must be collaboration among health sectors and education sectors of the city to address adolescent under nutrition problems of the City. As an intervention the scoters could do school based nutrition education.

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