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Methods and procedure: An institution based cross sectional study design was employed. A total of 598 adolescent school girls were selected using simple random sampling methods. Data were collected using interviewer administered questionnaire and anthropometric measurements. Anthro-metric measurements were converted to height-for age z-scores and BMI-for-age z-scores using WHO Anthroplus software. The nutritional status of the study subjects were classified as stunted ($HAZ < =2SD$) and thin ($BAZ < -2 SDD$). Data were Analyzed using SPSS version 20.0. Descriptive statistics was done. Binary logistic regression was used to identify factors associated with stunting and thinness.

Keywords: *adolescents girls, nutritional status, stunting, thinness.*

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NUTRITIONALSTATUSANDASSOCIATEDFACTORSOFADELESCENTSCHOOLGIRLSGOBATOWNSOUTHEASTETHIOPIA

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Abstract- Background: Despite the fact that, Having adequate information on the nutritional status of adolescent girls do have paramount importance to foster a healthy transition from childhood to adulthood and to broken the intergenerational cycle of malnutrition, in Ethiopia particularly in the study area information regarding the nutritional status of adolescents is lacking.

Methods and procedure: An institution based cross sectional study design was employed. A total of 598 adolescent school girls were selected using simple random sampling methods. Data were collected using interviewer administered questionnaire and anthropometric measurements. Anthropometric measurements were converted to height-for age z-scores and BMI-for-age z-scores using WHO Anthroplus software. The nutritional status of the study subjects were classified as stunted (HAZ < =2SD) and thin (BAZ < -2 SDD). Data were Analyzed using SPSS version 20.0. Descriptive statistics was done. Binary logistic regression was used to identify factors associated with stunting and thinness. Then the variables found significantly associated were included in multiple logistic regressions to identify the independent predictors of thinness and stunting. Finally, P value of ≤ 0.05 used to declare significance.

Results: The overall prevalence of thinness and stunting among school adolescent girls was 11.9% and 20.9 % respectively. Early adolescent girls (age ≤14) were 1.7 (AOR =1.7, 95% CI: 2.2 – 19.1) times more likely to become thinner as compared to late adolescent girls (age >=14). Adolescent girls whose mothers had no formal education were 9.6 (AOR=9.6 CI: 2.6-23.3), mothers who can read and write were 7.6 (AOR =7.6, 95% CI: 2.2 – 19.1) and mothers who had primary education were 5.2 (AOR= 5.2, 95%CI: 1.4 – 17.4) times more likely to be thin as compared to those mothers who had college and above education level. Adolescent girls with inadequate dietary diversity score were 2.7 (AOR =2.7, 95% CI: 1.5-5.04) times more likely to be stunted as compared to their counterparts.

Conclusion and recommendation: The overall prevalence of thinness and stunting in the study area is high. Age of respondent's, educational status of mother and dietary diversity scores were factors associated with thinness and stunting. School-based nutrition program that focus on

diversified diet consumption and promotion of women education is highly recommended.

Keywords: adolescents girls, nutritional status, stunting, thinness.

I. BACKGROUND

World Health Organization (WHO) defined adolescent as the period of life from 10 to 19 years. Adolescents constitute 20% of the world population and about 25% of the populations of Ethiopia are adolescent.

This period is very crucial since it is the formative years in the life of an individual when major physical, psychological and behavioral changes take place (1, 2, and 3). During this period, adolescents gain up to 50% of their adult weight, 20% or more than that of their adult height and 50% of their adult skeletal mass. Owing to these, nutritional requirements at this period are maximal, combined with poor eating habits and other considerations, e.g. menstruation, contribute to accentuating the potential risk for adolescents under nutrition (4, 5).

Malnutrition is associated with significant morbidity, mortality, and affects the reproductive outcome in adolescent girls. Moreover, undernourished adolescents tend to be ultimately malnourished adults, give birth to small babies, and transmitting under nutrition to future generation (6).

In general adolescent girls are the worst sufferers of the ravages of various forms of malnutrition because of their increased nutritional needs and low social power (7).

Like other developing countries of the world, under nutrition remains a major public health problem in Ethiopia. Among the women, 17 % had chronic energy deficiency (BMI < 18.5), 6 % had experiencing night-blindness in their most recent pregnancy, 27 % had anemia. This clearly reflects that rate of malnutrition in Ethiopia is high (8).

Despite the fact that, Having adequate evidences and information on the prevalence of stunting and thinness and associated factors among adolescent girls do have paramount important for planning, initiating and implementing of intervention programs to broken the intergenerational cycle of malnutrition and to to foster a healthy transition from childhood to adulthood,

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information regarding the nutritional status of adolescents in the study area is lacking.

Therefore, the study sets out to address the issues related to prevalence rate of underweight and stunting and its associated factors among adolescent girls in Goba town, south East Ethiopia.

II. METHODS

a) Study design and period

Institution-Based Cross-sectional Study was employed from March to June 2015.

b) Study Area

This study was conducted in Goba town, South East Ethiopia. Goba town is situated at 445km south east from the capital Addis Ababa. In the town, currently there are 21 schools of which 11 are governmental and 10 are privates. In the town there are One Referral Hospital and two health centres.

c) Sample size determination and sampling Methods

The sample size was calculated using single population proportion formula by considering the following assumptions. Proportion of adolescents with thinness ($p = 58.3\%$) from previous study done among rural adolescent girls in Tigray, Margin of error as 5%, confidence level at 95 %, non response rate of 10 % and design effect 1.5. The final sample size for this study was 617.

A total of 617 adolescent girls were selected from both governmental and private schools. Subjects were selected by stratifying the total schools into governmental and nongovernmental schools. Then, two primary and one high school from governmental schools and two primary school from private schools were selected using lottery method. Then the study subjects were stratified per study classes and determined sample size was allocated proportionally. Finally, Simple Random Sampling was used to selected study subjects from respective classes using the registrar record as the sampling frame.

d) Study variable

Dependent variables: Thinness and Stunting are Dependent variables of this study.

Independent variables: Independent variables includes Demographic and Socio –Economic Characteristics, Health and Household Environment related characteristics and Meal pattern and Dietary diversity score related characteristics

e) Operational definition

Adolescents: Individuals in the age group of 10-19 years of age (1).

Thinness: BMI-for-age below the 5th percentile of the 2007 WHO reference population (18).

Stunting: Height-for-age below -2Z scores of the 2007 WHO Reference population (18).

Adequate Dietary Diversity: Proportion of adolescent girls who received mean values or above of foods from nine food groups (20).

Inadequate Dietary Diversity: Proportion of adolescent girls who received less than mean values of foods from nine food groups (20).

f) Data collection methods and Measurement

Data were collected using a questionnaire adopted from Ethiopian Demographic Health Survey, different literatures and FAO food grouping method, which were designed to assess Demographic and Socio –Economic Characteristics, Health and Household Environment related characteristics and Meal pattern and Dietary diversity score related characteristics. Weight was measured to the nearest 0.1kg using calibrated digital weight scales in standing position with light cloths and bare foot. Height was measured to the nearest 0.1cm using height measuring Stadiometer in standing position. Data were collected by six diploma nurses working in the study area.

g) Data Quality Control

Training was given for data collectors on aim of the study, sampling methods and Anthropometric Measurements. Questionnaires were pretested on adolescent school girls found outside the sampled schools. Scales were carefully handled and periodically calibrated by placing standard calibration weights of 2 kg iron bars on the scale to ascertain accuracy.

h) Data analysis

Data were Analysis using SPSS version 20.0. Descriptive statistics was used to describe the study population in relation to relevant variables. Anthropometric measurements were converted to height-for age z-scores and BMI-for-age z-scores using WHO Anthro-plus software. The nutritional status of the study subjects were classified as stunted ($HAZ < =2SD$) and thin ($BAZ < -2 SD$) (9).

Binary logistic regression was used to identify factors associated with stunting and thinness. Then the variables found significantly associated with the study outcomes were included in multiple logistic regressions to identify the independent predictors of thinness and stunting. Finally, P value of less than 0.05 was used to declare significance.

i) Ethical considerations

Letter of Ethical approval was received from Madda Walabu University ethical clearance committee. Official letter of co-operation was also obtained from Goba town education office and from each school directors. Individual assent and parental consent for those participants <18 years and consent (> 18 years) was secured after a brief explanation about the procedure. The participants were also assured about the Confidentiality data.

III. RESULTS

a) Demographic and Socio-Economic Characteristics

A total of 598 adolescent girls aged 10–19 years were included in the final analysis among 617 which make a response rate 97.2 %. The mean (\pm SD) age of study subjects were 13.5 (\pm 1.9) years.

Three Hundred sixty four (60.9%) of the respondent were orthodox Christians. Majority of the respondent were from Grade four 133 (22.2 %). Majority of the respondents were urban dwellers 573 (95.8%).

Regarding the Educational level of mothers of the respondents, 200 (33.4%) were attended secondary school, 73 (12.2%) were illiterate, 188 (31.4%) can only read and write and only 49 (8.2%) were attended college and university.

Governmental employment and House wife were the predominant occupation of the father and mothers, 204 (44.1) and 347 (58%) respectively (Table 1).

b) Health and Household Environment related characteristics of Adolescent girls

The common sources of drinking water for most adolescent girls were Private Water pipe 506 (84.5%). Almost all of the adolescent girls, 589 (98.5 %) reported that they have home latrine. Nearly half the respondent reported that home gardening was available in their home. Of the respondents 283 (47.3 %) had begins their menstruation (Table 2).

c) Meal pattern and Dietary diversity score related characteristics

Five hundred seventy four (96 %) of the study subjects reported that they were consumed the three regular meal in the preceding day. About 115 (19.2 %) skips their regular meals in the previous week.

Two Hundred seventh one (45.3%) of the respondents practiced adequate dietary diversity (Table 3).

d) Prevalence of thinness and stunting among adolescent girls

The overall prevalence of thinness, low body mass index-for-age Z score less than $\leq -2SD$ among school adolescent girls found were 125 (20.9 %) while the prevalence of stunting, height-for-age Z Scores less than $-2SD$ were 71 (11.9 %) (Table 4).

e) Factors associated with thinness and stunting among school adolescent girls

i. Factors associated with Thinness

Thinness, low body mass index-for-age Z score less than $< -2SD$ was significantly associated with Age of the respondent and educational status of mother.

Early adolescent girls (age ≤ 14) were 1.7 (AOR =1.7, 95% CI: 2.2 – 19.1) times more likely to become thinner as compared to late adolescent girls (age ≥ 14).

Adolescent girls whose mothers had no formal education were 9.6 (AOR=9.6 CI: 2.6 -23.3), mothers who can read and write were 7.6 (AOR =7.6, 95% CI: 2.2 – 19.1) and mothers who had primary education were 5.2 (AOR= 5.2, 95%CI: 1.4 – 17.4) times more likely to be thin as compared to those mothers who are above college and education level (Table 5).

ii. Factors associated with stunting

Stunting, height-for-age Z Scores less than $-2SD$ was significantly associated with dietary diversity practice and Menstruation status of adolescent girls.

Adolescent girls with inadequate dietary diversity were 2.7 (AOR =2.7, 95% CI: 1.5-5.04) times more likely to be stunted as compared their counterpart. Adolescent girls who begin menstruation were 8 (AOR =.20, 95% CI: 0.03 – 0.401) times less likely to be stunted as compared to those who didn't begin their menstruation yet (5).

IV. DISCUSSION

In recent year, Ethiopia has made progress in reducing maternal mortality, while these achievements are encouraging, sustainable results are not expected if the nutritional status of adolescent girls is neglected.

This study found that the prevalence of thinness was 11.9%. This finding is relatively similar with the national nutrition baseline survey report for the NNP of Ethiopia (14%) (8), studies done in Agarfa Ethiopia (13.6) (10) and Hyryana, India 13.7% (11). However this prevalence is higher than the finding of previous study done in Addis Ababa Ethiopia (6.2 %) (12). Moreover, this prevalence is lower than a previous study done in Kenya (15.6 %) (13), Bangladesh (26%) (14) and Tigray region in northern Ethiopia (58.3%) (7). This difference may be due to the differences in socioeconomic, culture, feeding habits, environmental factors, and public service utilization of the community in the study area.

The current study found that prevalence of stunting, height-for-age Z Scores less than $-2SD$ was 20.9%. It was lower than the findings of previous study done in Tigray region, Northern Ethiopia (7). This may be due to time gap and set up differences. In this study majority of the respondents were urban dwellers but in the previous study the respondents were from rural community. Similarly it also lower than the prevalence reported from Bangladesh and Nigeria (32% and 57.8%) (11, 15). The possible reasons for the difference could be due to cultural difference and dietary intake. But the finding of this study is higher than the finding of previous study done in Kenya (12.1%). This may be due to time gap and socio- economical differences.

As can be noted multivariate logistic regression the likelihood of being thin was found to be significant among early adolescent (age ≤ 14) compared to late (age ≥ 14) adolescent girls. The finding of this study is

comparable with the study done in Amhara Regional State, north western part of Ethiopia (17). This could be because of the early growth spurt seen in the girls with sudden increase in height in early age group.

In the present study Educational status of mother was important socio- demographic factor which showed significant association with thinness. Adolescent girls whose mothers had no formal education were 9.6 (AOR 9.6 (95% CI 2.6 -23.3), mothers who can read and write were 7.6 (AOR 7.6 (95% 2.2 – 19.1) and mothers who had primary education were 5.2 (AOR 5.2 (1.4 – 17.4) times more likely to be thin as compared to those mothers who are college and above education level. This finding is supported by previous study conducted in Bangladesh (11). This can be explained as educated mother adopt better caring practices for better allocate family resources for nutrition and have health decision-making power which ultimately affect the nutritional status of the children

This study reveals that Adolescent girls who begun menstruation early were 8 times less likely to be stunted than their counterpart. This finding is in line with the finding of study done in Kenya (13). This may be explained by the fact that delay in bagging of menstruation of respondents may be a sign of malnutrition, as nutritional status of adolescent girls deteriorate, they start menstruation late.

Adolescent girls who practice adequate dietary diversity were 2.7 times more likely to be stunted as compared their counterpart in the past 24 hours. This may be explained by the fact that intake of divers diet increase likelihood of meeting the nutritional requirement of adolescent

The major limitation of this study was, it relay only on anthropometric measurements to determine the nutritional status of adolescent girls. .

V. CONCLUSION

The overall prevalence of thinness and stunting in the study area is high. The risk of thinness and stunting is high among early adolescent girls, adolescent girls with less educated mothers and adolescent girls who had inadequate dietary diversity practice.

School-based nutrition program that focus on diversified diet consumption and promote education of women is highly recommended.

Abbreviations

BMI – Body Mass Index,
CDC – Center for Disease Control,
CM – Centimeter,
DDS –Dietary Diversity Score,
EDHS –Ethiopian Demographic and Health survey,
FAO –Food and Agriculture Organization,
HIV - Human Immunodeficiency Virus,

IDDS –Individual Dietary Diversity Score,
IUGR –Intra Uterine Growth Retardation,
YCN –Infant and Young Child Nutrition,
KG – Kilogram,
LBW –Low Birth Weight,
OR –Odds Ratio,
SPSS-Statistical Package for Social Sciences,
SRS-Simple Random Sampling,
WHO –World Health Organization

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The authors' responsibilities were as follows. MT conceived and designed the study, performed analysis and interpretation of data and drafted the manuscript. SS Participated in the design of the study and performed the statistical analysis. TA Participated in the design of the study, writing of results and discussion and has been involved in drafting the manuscript. All authors read and approved the final manuscript. AK wrote the paper.

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LISTS OF TABLES

Table 1 : Scio-demographic characteristics of school adolescent girls Goba town, South East Ethiopia, June 2015

	Category	Frequency	percent
Age	10-14	417	69.7
	15-19	181	30.3
Religion	orthodox	364	60.9
	Muslim	167	27.9
	catholic	17	2.8
	Protestant	50	8.4
Place of residence	Urban	573	95.8
	Rural	25	4.2
Type of school	Governmental school	380	63.5
	Private school	218	36.5
Educational status of father	Illiterate	36	6
	Read and write	14	24.9
	Primary school	98	16.6
	Secondary school	170	28.4
	Collage and above	144	24.1
Occupation of father	Governmental employee	204	44.1
	Farmer	126	21.1
	Daily labourer	84	14.0
	Merchant	121	20.2
	Other	3	0.5
Educational status of mother	Illiterate	73	12.2
	Read and write	188	31.4
	Primary school	88	14.7
	Secondary school	200	33.4
	Collage and above	49	8.2
Occupation of mother	House wife	347	58
	Governmental employee	101	16.9
	Daily labourer	39	6.5
	Merchant	111	18.6
Family size	1-3 Family	33	5.5
	4-6 Family	430	71.9
	> =7Family	135	22.6

Table 2 : Health and Household environment related characteristics of school adolescent girls Goba town, South East Ethiopia, June 2015

Variables	Category	Frequency	Percent
Source of drinking water	Private Water pipe	506	84.8
	Public tap water	87	14.6
	Protected well	5	0.8
Availability of latrine facility	Yes	589	98.5
	No	9	1.5
Availability of home gardening	Yes	386	64.5
	No	212	35.5
Use of home gardening	For home consumption	346	57.9
	For sale	5	.8
	For sale and home consumption	37	6.2
What do you grow	fruit	7	1.2
	vegetable	243	40.6
	fruit and vegetable	137	22.9
Menstruation status	yes	283	47.3

	No	316	52.7
Age at first menstruation	10	5	0.8
	11	22	3.7
	12	78	13
	13	71	11.9
	14	67	11.2
	15	39	6.5

Table 3 : Meal pattern and Dietary diversity score related characteristics of school adolescent girls Goba town, South East Ethiopia, June 2015

Variables	Category	Frequency	Percent
The three regular meal during the previous day	Yes	574	96.0
	No	24	4.0
skip any regular meals during the previous week	Yes	115	19.2
	No	483	80.8
Reason for skipping meals	Shortage of food	6	1.0
	Lack of appetite	85	14.2
	sickness	19	3.2
	Others	1	.2
From the children who is served first	female	38	6.4
	male	69	11.5
	together	491	82.1
Dietary diversity score	Adequate	271	45.3
	Inadequate	327	54.7

Table 4 : Prevalence of Thinness among adolescent school girls Goba town, South East Ethiopia, June 2015

	Frequency	Percent
Thinness	71	11.9
No thinness	527	88.1
Total	598	100

Table 5 : Prevalence of stunting among school adolescent girls Goba town, South East Ethiopia, June 2015

	Frequency	Percent
Stunted	125	20.9
Not stunted	473	79.1
Total	598	100

Table 6 : Factors associated with thinness of school adolescent girls Goba town, South East Ethiopia, June 2015

		Thinness		COR 95 % CI	AOR 95 % CI
Factors		Yes	No		
Age	<=14	112	305	0.211 (0.115- 0.386)	1.7 (1.5 – 2.6)
	>=14	13	168		
Educational status of mother	Illiterate	30	43	0.093(0.027 – 3.25)	9.6 (2.6 -23.3)
	Can read and write	62	1`26		
	Primary school	22	66		
	Secondary school	8	195		
	Collage and above	3	46	1	1
Age at first menstruation	11	1	21	10.9 (5.4 -28.15)	3.18 (0.26-18.5)
	12	3	75	12.9 (4.0 -24.1)	2.1 (0.23-17.6)

	13	6	65	5.6 (2.3- 13.3)	2.9(0.3-16.6)
	14	4	63	8.17(2.8 – 23.0)	1.2(0.23-16.72)
	15	3	36	1	1
DDS	Adequate	53	218		
	Inadequate	72	255	0.46 (0.57 – 0.82)	1.75 (0.76 – 1.79)

Table 7 : Factors associated with stunting of school adolescent girls Goba town, South East Ethiopia, June 2015

Factors	Stunting		COR 95 % CI	AOR 95 % CI	
	Yes	No			
Educational status of mother	Can t read and write	24	33	0.56 (0.012 - 0.254)	13 (2.7 - 18.08)
	Can read and write	22	180	0.334(.076-1.46)	2.4 (0.5- 11.01)
	Primary education	10	79	0.322(.068-1.53)	2.2 (0.45 – 11.29)
	Secondary education	13	186	0.58(0.128-2.67)	1.4 (0.30- 6.78)
Menstruation	Above secondary	2	199	1	
	Yes	23	260		
Individual dietary diversity score	No	48	267	0.49 (0.29 – 0.83)	.201 (0.03 – 0.40)
	Adequately diversified	54	17		
	Not adequately diversified	273	254	2.9 (1.6-5.2)	2.7 (1.5-5.04)

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