Nutritional Status among Adolescent Girls in Rural Areas of Tirupati – A Cross Sectional Study

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ABSTRACT

Background: Adolescent is the period of the life between the ages of 10-19 years. Adolescence is time to learn and adopt healthy habits to avoid many health and nutritional problems later in life. Objective of this study is to assess the nutritional status of adolescent girls by anthropometric measurements and to determine the association between different individual and family level factors with under nutrition.

Methods: It is a community based cross-sectional study conducted among adolescent girls of age between 10-19 years in rural areas of Tirupati. The study sample was 188. BMI for age <-2SD is considered as thinness. A pre tested semi structured questionnaire was used to collect individual and family level factors and analysed using appropriate statistical tests with SPSS26th version.

Results: Prevalence of thinness and overweight/obese among adolescent girls in this study was 17% and 17.6%. Thinness was significantly high among girls with family size is more than five (23.8% vs 8.4%), who attained menarche at >11 years (17.1% vs 0%) and who are not doing regular physical activity (22.3% vs 9.2%). Multivariate binary logistic regression showed socioeconomic status, family size and physical activity are significant predictors of thinness.

Conclusions: It can be concluded from this study that thinness was significantly high among adolescent girls with family size >5, who attained menarche at >11 years and who does not have the habit of doing regular physical activity.

Key word: Adolescent girls, Thinness, BMI for Age, Rural area

INTRODUCTION

Nutrition may be defined as the science of food and the relationship to the health. It is concerned primarily with the part played by nutrient in body growth, development and maintenance.[1] Good nutrition means "Maintaining a nutritional status that enables us to grow well and enjoy good health.[2] The association of nutrition with infection, immunity, fertility, maternal and child health and family health have engaged scientific attention. Nutrition is the cornerstone of socio-development, and the nutritional problems are not just medical problems but are multi-factorial with roots in many other secrets of development such as demography, education, agricultural and rural development.

Adolescent is the period of the life between the ages of 10-19 years. It is variously described as neither childhood nor adults or as" growing up years". The term adolescence is derived from Latin word "adolescere " meaning to grow to mature.[3] Adolescence is the transition period between childhood and adulthood where rapid physical, mental, emotional, social development and physiological changes takes place.[4] Adolescence is time to learn and adopt healthy habits to avoid many health and nutritional problems later in life.[5] It offers last opportunity to intervene and re-

cover growth faltered in childhood and also support growth spurt and skeletal development.[6]

Adolescent constitutes over 21.4% of the population in India and adolescent girls contribute about 10% of Indian population.[7] Due to such big population, the reported burden of under nutrition and anaemia is high.[8] Owing to sudden growth taking place in this phase, nutritional requirement in them, also compared to preceding years of growth. Optimum nutritional intake is essential to meet increasing demand of growing body and neurocognitive performance which is eventually related to adult productivity of the individual.[9] particularly health, nutritional knowledge and healthy habits of female adolescent will have critical role to play in maintaining future family health and nutrition. It contributes significantly to nutritional status of community. Malnutrition is associated with significant mortality and morbidity that affects the reproductive outcome in adolescent girls.[10] With this background objectives of this study are to assess the nutritional status of adolescent girls by anthropometric measurements and to determine the association between different individual and family level factors with under nutrition.

MATERIALS AND METHODS

Study design: The present study is a community based cross-sectional study conducted among adolescent girls of age between 10-19 years. The study participants were selected from rural field practice area (RHTC) of SVIMS, Sri Padmavathi Medical College for women for a period of 2 months. RHTC Mangalam which is located about 15 kms away from SVIMS-Sri Padmavathi Medical College for Women (SPMCW) which covers a population of 1,08,840. It has 12 sub centres namely Akkarampally, M.R.Palle, Mangalam I, Mangalam II, Rajeevnagar Colony, S.V.Nagar, Santhinagar, Settipalle, Tirumala (North), Tirumala (South), Tirumala (West) and BTR Nagar. Among these 12, 3 sub centres (Mangalam I, Mangalam II and BTR colony) were selected randomly and study sample was collected from these sub centres according to population proportion to size by doing door to door survey till reach the sample size.

The sample size(N) was calculated by using following formula : $N = Z_{\alpha/2}^2 P(1-P) \div E^2$ (Z=1.96 for 95% of confidence interval, P is estimated prevalence in study population(the prevalence of under nutrition using BMI for age <5th percentile using NCHS/WHO standards was 36.54% in one of the study on rural adolescent girls in India, which was taken into consideration for sample size estimation).[11] E= relative precision, here taken as 20% of prevalence. So the study sample was 188.

Inclusion criteria: Adolescent girls of age between 10-19 years who are permanent residents of the study area and willing to participate in the study.

Exclusion criteria: Individuals of age below 10 years and above 19 years, Individuals with congeni-

tal anomalies, any acute are chronic medical condition which may compromise anthropometric measurements, individuals who are not willing to participate and individuals who are staying at home irregularly (<4 days in a week). Study instruments were standard calibrated measuring tape and weighing machine for anthropometry, predesigned semi structured questionnaire.

Data collection procedure: A door to door survey was conducted in study area after explaining about aims and objectives of the study, informed consent was taken from parents or guardian. The interview was conducted at the residence of girls using predesigned and pre tested questionnaire. It included the information on socio-demographic variables, family size and type of family, menstrual history, morbidity status in last 2 weeks and habit of doing regular physical activity.

Operational definitions:

Height: Height in centimeters was marked on a wall with the help of a measuring tape. All girls were measured against the wall without foot wear and with heels together and their heads positioned so that the line of vision was perpendicular to the body. A scale was brought down to the topmost point on the head. The height was recorded to the nearest 1 cm.

Weight: A bathroom weighing scale was used. It was calibrated against known weights regularly. The zero error was checked for and removed if present, every day. Their weight was recorded to the nearest 500 grams.

BMI: BMI of each participant was computed by using the formula weight (kg)/ height (m²). Socio economic status (SES) assessed by modified BG prasad's socio economic scale.[12] Study participants were classified based on WHO BMI for age charts and classified into thinness (<-2 SD), normal (in between -2SD and +1SD) and overweight and obese (>+1SD and >+2SD respectively).[13]

Ethical Approval: This study was approved by the Institution Ethics Committee, SVIMS, Tirupati. Written consent from parent or guardian and the adolescent girls was obtained before data collection. The anonymity and confidentiality of the participants were strictly maintained.

Statistical analysis: The collected data was entered into Microsoft excel. Number and percentages was calculated for qualitative data. Mean and standard deviations was calculated for quantitative data. Chi-square test was used to test significance for qualitative data. *Shapiro–Wilk test* was used to test the normality. If the data is normally distributed Student t test was used to test significance difference between 2 means. If the data is not normally distributed Mann Whitney's U test was used. Multivariate binary logistic regression was used to predict the odds of thinness with predictors. SPSS version 26 was

used to calculate statistics. P value <0.05 will be considered as significant.

RESULTS

In the present study total 188 adolescent girls of age in between 10-19 years were included. Among them 32 (17%) were thin, 123 (65.4%) were normal weight and 33 (17.6%) were overweight and obese.

It is observed from the above table 1 that mean ages of thin, normal and overweight and obese study participants were 14.34±2.42 and 14.39±2.26 respectively. Means ages of mothers of thin, normal and overweight and obese study participants were 36.50±6.86 and 35.41±5.43 respectively. Means ages of fathers of thin, normal and overweight and obese study participants were 36.91±17.87 and 38.29±10.98 respectively.

From the table 2 it is observed that mean height of thin, normal and overweight and obese study participants was 152.14±8.79, 151.84±7.94 and 153.53±7.78 respectively. Mean weight of thin, normal and overweight and obese study participants were 33.33± 5.82, 42.24±6.57 and 61.68±11.53 respective-

ly. Mean BMI of thin, normal and overweight and obese study participants were 14.28±1.34, 18.25±2.06 and 25.99±3.57 respectively. From the table 3 it is observed that, majority of thin study participants were in the age group of 15-19 Years (18.9% vs 15.3%),

Table 1: Distribution according to adolescent, mother and father age

Variable	Thinness		P value
	Present	Absent	
Girl Age	14.34 ± 2.42	14.39 ± 2.26	0.904
Mother age	36.50 ± 6.86	35.41 ± 5.43	0.322
Father age	36.91 ± 17.87	38.29 ± 10.98	0.565

Values in Mean ±SD

Table 2: Distribution according to anthropometry

Variable	Thinness (N=32)	Normal (N=123)	Overweight & obese (N=33)
Height	152.14 ± 8.79	151.84 ± 7.94	153.53 ± 7.78
Weight	33.33 ± 5.82	42.24 ± 6.57	61.68 ± 11.53
BMI	14.28 ± 1.34	18.25 ± 2.06	25.99 ± 3.57

Table 3: Distribution according to Socio demographic factors and birth history

Variable	Thinness		Total (%)	P Value	Odds ratio (95% CI)
	Present (%)	Absent (%)			
Age group					
10-14 years	15 (15.3)	83 (84.7)	98	0.514	0.776 (0.362-1.663)
15-19 years	17 (18.9)	73 (81.1)	90		
Religion					
Hindu	30 (17.8)	139 (82.2)	169	0.472	
Muslim	2 (16.7)	10 (83.3)	12		
Christian	0 (0)	7 (100)	7		
Family size					
<5	7 (8.4)	76 (91.6)	83	**0.005**	3.393 (1.386-8.303)
≥5	25 (23.8)	80 (76.2)	105		
Type of Family					
Nuclear	28 (17.6)	131 (82.4)	159	0.539	
Joint	2 (25)	6 (75)	8		
Three Generation	2 (9.5)	19 (90.5)	21		
Socio economic status					
Upper Class	1 (11.1)	8 (88.9)	9	0.519	
Upper Middle Class	11 (18)	50 (82)	61		
Middle Class	13 (14.3)	78 (85.7)	91		
Lower Middle Class	7 (25.9)	20 (74.1)	27		
Type of adolescent					
Early	10 (15.6)	54 (84.4)	64	0.916	
Middle	16 (18.2)	72 (81.8)	88		
Late	6 (16.7)	30 (83.3)	36		
Type of Birth					
preterm	7 (26.9)	19 (73.1)	26	0.148	2.019 (0.769-5.303)
Term	25 (15.4)	137 (84.6)	162		
Birth Order					
≤2	30 (17.4)	142 (82.6)	172	0.652	0.676 (0.146-3.132)
>2	2 (12.5)	14 (87.5)	16		
Birth space(n=95)					
< 3	7 (12.5)	49 (87.5)	56	0.461	0.653 (0.029-2.038)
≥3	7 (17.9)	32 (82.1)	39		
Presence of at least one male child					
Present	16 (14.7)	93 (85.3)	109	0.315	0.677 (0.316-1.453)
Absent	16 (20.3)	63 (79.7)	79		

Table 4: Distribution according to menstrual history, morbidity status and regular physical activity

Variable	Thinness		Total	P Value	Odds ratio (95% CI)
	Present (%)	Absent (%)			
Menstruation					
Attained	22 (14.8)	127 (85.2)	149	0.108	0.502 (0.215-1.175)
Not attained	10 (25.6)	29 (74.4)	39		
Age at menarche					
<11 years	0 (0)	20 (100)	20	0.045	-
≥11 years	22 (17.1)	107 (82.9)	129		
Number of days of menstruation					
Less than 5 days	19 (14.6)	111 (85.4)	130	0.892	0.913 (0.245-3.434)
More than 5 days	3 (15.8)	16 (84.2)	19		
Regularity					
Regular	21 (25.6)	114 (84.4)	135	0.398	2.394 (0.297-19.294)
Irregular	1 (7.1)	13 (92.9)	14		
Heavy bleeding					
Yes	1 (5)	19 (95)	20	0.368	0.395 (0.049-3.188)
No	21 (16.3)	108 (83.7)	129		
Marital status					
Married	0 (0)	1 (100)	1	0.650	-
Un married	32 (17.1)	155 (82.9)	187		
Morbidity in last 2 weeks					
Present	2 (15.4)	11 (84.6)	13	0.871	0.879 (0.185-4.170)
Absent	30 (17.1)	145 (82.9)	175		
Regular physical activity					
Present	7 (9.2)	69 (90.8)	76	0.019	0.353 (0.144-0.865)
Absent	25 (22.3)	87 (77.7)	112		

Table 5: Distribution according to Education and occupation

Variable	Thinness		Total	P Value
	Present	Absent		
Education of Girl				
Primary	2 (50)	2 (50)	4	0.346
Middle	7 (12.3)	50 (87.7)	57	
High School	14 (19.2)	59 (80.8)	73	
Intermediate	7 (15.6)	38 (84.4)	45	
Graduate & Above	2 (22.2)	7 (77.8)	9	
Education of Mother				
Illiterate	8 (21.6)	29 (78.4)	37	0.286
Primary	4 (10.8)	33 (89.2)	37	
Middle	7 (17.9)	32 (82.1)	39	
High School	10 (23.8)	32 (76.2)	42	
Intermediate	0 (0)	19 (100)	19	
Graduate & above	3 (23.1)	10 (76.9)	13	
Not Applicable	0	1 (100)	1	
Occupation f Mother				
Professional	1 (25)	3 (75)	4	0.226
Semi Professional	1 (50)	1 (50)	2	
Skilled	1 (9.1)	10 (90.9)	11	
Semi-Skilled	1 (4.5)	21 (95.5)	22	
Unskilled	14 (25.9)	40 (74.1)	54	
Homemaker	14 (14.9)	80 (85.1)	94	
Not Applicable	0	1 (100)	1	
Education of Father				
Illiterate	4 (13.8)	25 (86.2)	29	0.555
Primary	4 (20)	16 (80)	20	
Middle	6 (22.2)	21 (77.8)	27	
High School	7 (15.2)	39 (84.8)	46	
Intermediate	2 (9.5)	19 (90.5)	21	
Graduate & above	4 (13.3)	26 (86.7)	30	
Not Applicable	5 (33.3)	10 (66.7)	15	
Occupation of Father				
Professional	4 (28.6)	10 (71.4)	14	0.133
Semi Professional	3 (15.8)	16 (84.2)	19	
Skilled	12 (17.9)	55 (82.1)	67	
Semi-Skilled	0 (0)	20 (100)	20.	
Unskilled	8 (15.1)	45 (84.9)	53	
Not Applicable	5 (33.3)	10 (66.7)	15	

Hindus (17.8%), followed by Muslims (16.7%), have family size was <5 (23.8% vs 8.4%), belong to joint family (25%) followed by nuclear family (17.6%) and belong to lower middle class (25.9%) followed by upper middle class (18 %). Most of the thin study participants were middle adolescent (18.2%) followed by late adolescent (16.7%), preterm (26.9% vs 15.4%) birth order of ≤2 (17.4% vs 12.5%), the birth space of more than 3 years (17.9% vs 12.5%). Majority of Thinness girl families don't have male child (20.3% vs 14.7%).

Table 4 showed that most of the thin study participants were not attained menstruation (25.6% and 14.8% respectively). Among menstruation attained most of the thin study participants were attained menarche at the age of more than 11 years (17.1% vs 0%). Number of days of menstruation for most of the thin study participants were more than 5 days (15.8% vs 14.6%), having regular menstrual cycle (25.6% vs 7.1%). Most of the thin study participants did not have morbidity in last 2 weeks (17.1% vs 15.4%) and didn't have the habit of doing regular physical activity (22.3% vs 9.2%). Among all study subjects only one girl is married.

From the table 5 it is observed that most of the thin study participants were educated status up to primary school (50%) followed by graduate and above (22.2%) and high school (50%). Most of the mothers of thin study participants were educated up to high school (23.8%) followed by illiterates (21.6%).

Most of the mother's occupation of thin study participants was semiprofessional (50%) followed by unskilled workers (25.9%). Most of the fathers of thin study participants were studied up to middle school (22.2%) followed by primary (20%).

Table 6: Multivariate binary logistic regression with thinness and individual and family level factors

Variable	Crude OR	Adjusted OR (95% CI)	P value
Age	1.010	1.171 (0.644 - 2.28)	0.605
Religion Hindu*	0.545	0.929 (0.173 - 5.000)	0.932
Family size ≥5	3.393	4.672 (1.453 - 15.021)	0.010
Type of family#			
Joint	0.641	0.316 (0.043 - 2.325)	0.258
Three generation	0.031	0.953 (0.161 - 5.641)	0.958
Socio economic status$			
Upper middle	2.800	4.785 (0.450 - 50.837)	0.194
Middle	1.591	2.479 (0.693 - 8.869)	2.163
Lower middle	2.100	3.673 (1.102 - 12.244)	0.034
Attained Menstruation	1.991	2.373 (0.907 - 6.209)	0.078
Doing Regular physical activity	0.353	0.36 (0.134 - 0.964)	0.042
Morbidity present in last 2 weeks	1.138	0.575 (0.101 - 3.282)	0.534
Education of girl- high school & below	1.215	1.223 (0.538 - 2.779)	0.631
Mother education- middle school & below	1.037	1.079 (0.470 - 2.480)	0.858
Mother occupation- skilled & above	2.025	2.042 (0.661 - 6.309)	0.215
Father education- middle school & below	0.848	0.811 (0.365 - 1.081)	0.607
Father occupation- skilled & above	0.739	0.7 (0.31 - 1.569)	0.387

OR- Odds Ration; * Reference - Muslim & Christian; # Reference – Nuclear; $Reference – Upper Socio-economic status

Most of the father's occupation of thin study participants was professional (28.6%) followed by skilled (17.9%).

From the multivariate binary logistic regression it is observed that adolescent girls with family size of more than 5 have 4.672 (1.453-15.021) times more risk of Thinness compared to family size <5. Family with middle socio-economic status have 3.673 (1.102-12.244) times more risk of Thinness than upper class. Girls who are doing regular physical activity have 0.360 (0.134-0.964) times less risk of thinness compared to who those do not. (Table 6)

DISCUSSION

The nutritional status of adolescent girls as they are the future mothers, contributes significantly to the nutritional status of the community. The nutritional requirement during adolescent period is increased compared to other age groups as it is transition period between childhood and adulthood. In this study 17% of adolescent girls were thin. This finding was less compared to the study done by Smitha Malenahalli Chandrashekarappa et al[14] (24.1% of study population were undernourished), study by Bhattacharyya and Barua [15] conducted in Dibrugarh, Assam, which showed a prevalence of 25.7%, the study by Srivastav et al.[16] conducted in Gautam Buddh Nagar in Uttar Pradesh , which showed a prevalence of 24%, the study by Bovet et al. [17] conducted in Seychelles, which showed a prevalence of 21.2%, the study by Alam et al. [18] conducted in Bangladesh, which showed a prevalence of 26%, and the study by Fokeena and Jeewon, which showed a prevalence of 27%.[19] This finding is very much less compared to studies done by **Sheloj M Joshi et al (69%)[20],** Goyle A study (72%)[21], Soumyajit Maitistudy study(71.8%)[22] and H.R. Shivaramakrishna study (73.5%).[23] This difference may be due to using of different criteria for classifying Thinness or under

nutrition and different age groups. In this study 10-19 years age group was included. The proportion of obesity in this study was 17.6% which is high compared to studies done by Smitha Malenahalli Chandrashekarappa et al (12.3%)[17] and other studies (proportion of obesity ranges from 14.2% to 29.18%).[24-27]

In this study majority of thin study participants were in the age group of 15-19 Years (18.9%), this may be due to after puberty adolescent girls require more energy compared to pre puberty this finding is differed with the studies done by Sheloj M Joshi et al[23] and Neyamul Akhter [28]study where majority of undernourished were in the age group of 10-14 years. In this study majority of thin were middle adolescents (18.2%). But in the study done by Nair A et al[29] most of the Thinness were early adolescents. In this study most of the thin were Hindus (17.8%), this is similar to study done by Nair A et al.[30]

In this study most of the thin were belong to joint families (25%), this may be due to in joint families age appropriate nutritional requirement is difficult to meet. This is contrast to study done by Smitha Malenahalli Chandrashekarappa[14] where under nutrition was common in nuclear families. In this study majority of thin were birth order of <2. This is similar to study done by Smitha Malenahalli Chandrashekarappa[14] where malnutrition was in higher proportion among those who were born second or later. This can be attributed to the economic burden after the birth of the second child especially for low socioeconomic status families. In this study under nutrition was significantly more in family size of more than 5. This is similar to study done by Bhattacharyya and Barua [15] study there was a significant association seen between family size and malnutrition.

In this study most of the thin were belong to lower middle class (25.9%) followed by upper middle class

(18%), but it is not significant. Similar findings were observed in the study done by Sheloj M Joshi et al[20], Neyamul Akhter[28] study and in the study of Seema Choudhary[30] maximum (82.54%) under nutrition was observed in subjects belonging to lower SES, followed in middle (69.92%) and then in high (54.05%) SES categories. In study of K Venkaiah[31] significant association was seen between SES and nutritional status. In the study done by Smitha Malenahalli Chandrashekarappa[14] there is no association was seen between socio-economic status and malnutrition.

In this study thin was common in educated parents compared to illiterate parents. This may be due to reason that as the educated parents the chances of both parents working is also higher. Hence there might be loss of care on the regular dietary intake of children and their eating habits. This is similar to study done by Smitha Malenahalli Chandrashekarappa.[14] The findings are different from that of Bhattacharyya and Barua [15] study conducted in Assam and by Amin et al. [32], where it is seen that most mothers of adolescents with obesity had a lower educational level. Similar findings were observed in the study done by Waseem Fatima[33] where thinness was common in educated parents. In this study thinness was common in home maker and unskilled mothers and professional and skilled work fathers. Where in the study done by Waseem Fatima[33] it is shown that under nutrition was common in-house wives and unemployed fathers. Similarly in a study done in Nigeria by Danjuma Shehu Uba[34] under nutrition was common in mother with education up to secondary school and high. In this study thinness was high among girls who are not doing regular physical activity. This finding is similar in the study done by Waseem Fatima.[33]

CONCLUSIONS

It can be concluded from this study that thinness was significantly high among adolescent girls with family size more than five, who attained menarche at more than 11 years and who does not have the habit of doing regular physical activity. Thinness was high among girls with age of 15-19 years, Hindus, joint families, lower middle-class socio-economic status, preterm birth, birth order ≤2 and birth space of more than 3 years.

It also concluded that thinness was commonly observed among who were not attained menstruation, among those who attained menstruation, thinness was high among girls with more than 5 days of menstrual bleeding and regular cycles. Thinness was common among educated and employed parents.

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