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Nutritional status of rural adolescent girls of Cooch Behar District, India
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ABSTRACT

Background: Adolescent period (10-19 years) can be described as growing up years, as this phase is the middle phase between childhood and adulthood and this phase is the phase of many correlated biological, psychological and social changes. The problem of both undernutrition and over nutrition spreads in a large scale among adolescents and may generate continual consequences in their adulthood. That's why assessing nutritional status among adolescents is very much needed.

Method: A community-based cross-sectional study was conducted among (n= 385) Bengalee Hindu (10 -18) years old adolescent girls of rural Guriahati I Panchayat areas of Cooch Behar district, West Bengal, India. To assess nutritional status, five Anthropometric measurements of Height, weight, Mid Upper Arm Circumference, Waist Circumference, and Hip Circumference were recorded using standard procedures, after informing school authorities, students and parents about the details and purpose of the study. Height for age and BMI for age were calculated using age-specific WHO Charts for height and BMI. One-way ANOVA was used to assess age-specific mean differences of anthropometric variables. Statistical analysis was done using Chi-square test to find out the association between anthropometric data and age groups. The p-value <0.05 was considered as significant.

Result: Overall prevalence of stunting and thinness among the studied population were 32.72% and 11.16% respectively. Some socio demographic variables were found significantly associated with stunting and thinness (p<0.05).

Conclusion: Moderate prevalence of stunting and thinness were found in present study. Nutritional programs among rural areas can change this undernutrition scenario.

Keywords: *Adolescence, undernutrition, nutritional, BMI, WHO.*

INTRODUCTION

Adolescent period (10-19 years) can be described as growing up years (Nair et al. 2017), as this phase is the middle phase between childhood and adulthood and this phase is the phase of many correlated biological, psychological and social changes (Mala et al. 2007; Nair et al 2017). So, adolescent phase is the delicate phase of human life cycle with prompt growth and so many psychological and physiological changes (NNMB 2000; Nair et al 2017). According to the studies (Kumar et al.2014; Nair et al.2017), adolescent period can be divided in to three groups, i.e. the early adolescent groups of 10 to 13 years, the middle adolescent groups of 14 to 16 years and the late adolescent groups of 17 to 19 years.

During few decades, there were a concerning situation of co-existence of prevalence of both undernutrition (stunting, thinness, under-weight) and over nutrition (overweight and obesity) can be observed in Low and Middle Income Countries, which were called as Double Burden ofMalnutrition (Doak et al. 2005; Shrimpton and Rokx 2012; Debnath et al. 2019).

Stunting or Low height-for-age is an indicator of chronic undernutrition and one of the important indicators of nutritional assessment among children and adolescents. In rural and sub urban areas of India, Stunting has become matter of concern (Deshmukh et al. 2006; Medhi et al. 2006, 2007; Das et al. 2007; Mondal and Sen 2010a, b; Banerjee et al. 2011; Sil et al. 2011; Rengma et al. 2016; Debnath et al. 2019). Thinness or Low BMI-for-age also is an indicator of chronic undernutrition. Different studies (Deshmukh et al. 2006; Medhi et al. 2007; Das and Biswas 2005, Prashant and Shaw 2009) significantly found high prevalence of thinness among Indian adolescents. Prevalence of thinness among adolescents were reported 48.75% in India (Pal et al.2017), 59% in Bangladesh (Sahabudin et al. 2000), 18.9% in Nigeria (Omigbodun et al. 2010), 10.3% in Malayasia (Baharudin 2013), 58.3% Ethiopia (Mulugeta et al. 2009) respectively. Prevalence of stunting among adolescents were reported 53.57% in India (Pal et al. 2017), 11% in China (Hong et al.1999), 51.65 in Nepal (Sherpa et al. 2019), 26.5% in Ethiopia (Mulugeta et al. 2019). Prevalence of overweight were reported 7.60% in India (Tomar et al. 2018), 5.7% in Nepal (Sherpa et al. 2019, 4.3% in Bangladesh (Ghosh et al. 2021), 7.1% in Bhutan (Norbu et al. 2016).

The problem of both undernutrition and over nutrition spreads in a large scale among adolescents and may generate continual consequences in their adulthood (Faizi et al. 2016). That's why assessing nutritional status among adolescents is very much needed. Though there were few studies were conducted among adolescents, still no nutritional status assessment was conducted among present study area. Present study is an attempt to assess nutritional status among rural Bengalee Hindu adolescent girls and find out possible association of different socio demographic factors with malnutrition.

MATERIALS AND METHODS:

A community-based cross-sectional study was conducted from April to September 2023 among 385 Bengalee Hindu (10 -18) years old adolescent girls of rural Guriahati I Panchayat areas of Cooch Behar district, West Bengal, India. Cooch Behar (Latitude 26º22´N, Longitude

89º29´E) is a small city with a 74.06% majority of Bengalee Hindus (according to the census 2011).

The studied population was selected using a simple random sampling technique. Data were collected after informing the purpose of the present study to the school authorities, students and their parents of Guriahati I Gram Panchayat areas, using pre-tested and pre-designed schedules. Age was recorded based on their birth certificates. Five Anthropometric measurements of Height (cm), weight (kg), Mid Upper Arm Circumference (cm), Waist Circumference (cm), and Hip Circumference (cm) were recorded using standard procedures.

Body Mass Index were calculated using following formula: BMI= Weight (kg)/ Height ²(m²). Waist Hip Ratio were calculated using following formula = Waist Circumference in cm / Hip Circumference in cm. Height for age and BMI for age were calculated using on age specific WHO Charts for height and BMI (Abraham and Rehna 2022) in WHO AnthroPlus sofware. The BMI for age z score values evaluated as obese (above 3SD), overweight (between 2SD to 3 SD), Normal (between -1SD to 2SD), moderate thinness (between -2SD to -3SD) and severe thinness (values below -3SD) (De Onis 2015, WHO growth reference 2007 Anthroplus, Abraham and Rehna 2022). Height-for -age zscore evaluated as, tall (above 2SD), Normal (between -1SD to 2SD), moderate stunting (between -2SD to -3SD) and severe stunting (values below -3SD) (WHO Growth reference 2007 Anthroplus, WHO growth curve 2006, WHO 1995, Abraham and Rehna 2022).

 The studied population was divided into three groups, i.e., the early adolescent group (10-13 years), the mid Adolescent group (14-16 years) and the late adolescent group (17-18 years). This classification was based on biological basis, developmental and psychological basis (Kumar et al. 2014; Nair et al. 2017).

 All statistical analyses were done using Statistical Package for Social Science (SPSS Inc., Chicago, IL, version 20.0) and WHO Anthro Plus software. Data were first entered into MS Excel and have been checked, and then data were imported into SPSS version 20. Descriptive statistics were done regarding mean and standard deviation (±SD). One-way ANOVA was used to assess age-specific mean differences of anthropometric variables. Statistical analysis was done using Chi-square test to find out the association between anthropometric data and age groups. The p-value <0.05 was considered as significant.

RESULTS

Table 1 shows the Age-specific distribution of means and standard deviations of anthropometric variables. Among early adolescent rural girls, the mean values of height, weight, BMI, MUAC, Waist Circumference, Hip Circumference and WHR were 141.23 cm, 37.80kg, 18.77kg/m2, 19.31cm, 60.43cm, 75.31cm, and 0.08 respectively. Among mid-adolescent rural girls, the mean values of height, weight, BMI, MUAC, Waist Circumference, Hip Circumference and WHR were 149.06cm, 47.90kg, 21.45kg/m2, 21.64cm, 65.57cm, 82.77cm and 0.79 respectively.

Among late adolescent rural girls, the mean values of height, weight, BMI, MUAC, Waist Circumference, Hip Circumference and WHR were 151.53cm, 55.62kg, 24.09kg/m2, 23.46cm, 72.93cm, 89.49cm and 0.81 respectively. There was a gradual increase in the mean values of height, weight, BMI, MUAC, Waist Circumference and Hip Circumference with age (except WHR) can be observed. One-way ANOVA was done to find out age-specific mean differences of anthropometric variables and the results showed statistically significant (p<0.05) differences between age-specific anthropometric mean values among the studied population.

TABLE 1: Descriptive statistics (Mean±SD) of the anthropometric variables

Adolescence groups	Sample size	Age (years)	Ht (cm)	Wt(kg)	BMI(kg/m^2)	MUAC(cm)	WC(cm)	HC(cm)	WHR
Early (10-13 yr)	183	11.37 ±1.11	141.23 ±1.13	37.80 ± 9.63	18.77 ±3.70	19.31 ±2.36	60.43 ±7.63	75.31 ±8.33	0.80 ±0.04
Mid (14-16 yr)	131	15.13 ±0.808	149.06 ±6.39	47.90 ±11.31	21.45 ±4.32	21.64 ±2.44	65.57 ±8.40	82.77 ±10.25	0.79 ±0.03
Late (17-18 yr)	71	17.56 ±0.499	151.53 ±7.26	55.62 ±12.99	24.09 ±4.54	23.46 ±2.48	72.93 ±8.36	89.49 ±9.39	0.81 ±0.03
Total	385	13.79 ±2.62	145. 80 ±8.32	44.53± 12.89	20.66 ±4.54	20.86 ±2.89	64.49 ±9.26	80.46 ±10.68	0.80 ±0.04
F value			37.46	24.20	14.41	25.81	16.86	21.63	7.97
P value			P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05

Table 2 shows Height for age, where the prevalence of overall stunting among rural early adolescent, mid adolescent and late adolescent Bengalee Hindu girls were 23.49%, 36.64% and 49.29% respectively. Prevalence of severe stunting among rural early adolescents, mid adolescents and late adolescents was 6%, 12.2% and 14.1%, respectively. Prevalence of Moderate stunting among rural early adolescent, mid adolescent and late adolescent Bengalee Hindu girls were 17.5%, 24.4% and 35.2% respectively. Overall 32.72% of rural Bengalee Hindu adolescent girls were found stunted.

Table 3 shows BMI for age, where the prevalence of overall thinness among rural early, mid and late adolescent Bengalee Hindu girls was 11.47%, 15.26% and 2.8% respectively. Prevalence of severe thinness among rural early adolescent, mid adolescent Bengalee Hindu girls was 4.9% and 6.1%. No late adolescent girls in the present study were found severely thin. Prevalence of moderate thinness among rural early adolescent, mid adolescent and late adolescent Bengalee Hindu girls were 6.6%, 9.2% and 2.8%, respectively. The overall prevalence of thinness was 11.16% among rural Bengalee Hindu adolescent girls. Prevalence of overweight among rural early adolescent, mid adolescent and late adolescent Bengalee Hindu girls were 9.3%, 8.4% and 8.5% respectively. The overall prevalence of overweight and obesity among the studied population was 8.8% and 1.6%, respectively.

Table 2: Height/Age in Early, Mid and Late adolescent groups

Adolescence groups	Normal	Severe stunting	Moderate stunting	Overall stunting	Total	Chi-square	p-value
Early (10-13 yr)	140(76.5)	11(6.0)	32(17.5)	43(23.49)	183(100)		
Mid (14-16 yr)	83(63.4)	16(12.2)	32(24.4)	48(36.64)	131(100)		
Late (17-18 yr)	36(50.7)	10(14.1)	25(35.2)	35(49.29)	71(100)	48.86	P<0.05
total	259(67.3)	37(9.6)	89(23.1)	126(32.72)	385(100)		

*Values are parenthesis indicates percentage.

TABLE 3: BMI/AGE in Early, Mid and Late adolescent groups

Adolescence groups	BMI/age							Chi-square	P value
	Severe thinness	Moderate thinness	Normal	Overall thinness	Overweight	Obese	Total		
Early (10-13 yr)	9 (4.9)	12 (6.6)	145 (79.2)	21 (11.47)	17 (9.3)	-	183 (100)		
Mid (14-16 yr)	8 (6.1)	12 (9.2)	100 (76.3)	20 (15.26)	11 (8.4)	-	131 (100)	80.82	P<0.05
Late (17-18 yr)	-	2 (2.8)	57 (80.3)	2 (2.8)	6 (8.5)	6 (8.5)	71 (100)		
total	15 (7.5)	26 (6.8)	302 (78.4)	43 (11.16)	24 (8.8)	6 (1.6)	385 (100)		

*Values are parenthesis indicates percentage.

DISCUSSION

In the present study, 183 girls belonged to the early adolescent group, 131 belonged to the mid-adolescent group and 71 belonged to the late adolescent group (table 1)

In the studied population, the prevalence of overall stunting among early adolescent girls, mid-adolescent girls and late adolescent girls was 23.49%, 36.64% and 49.29% respectively. Overall 32.72% of Bengalee Hindu adolescent girls were found to be stunted and this result was similar to some other studies (Das and Biswas 2005; Maiti et al.2011; Pramanik et al. 2015).

In the studied population, the prevalence of stunting gradually increased with age group and there was a statistically significant difference between the three groups in the present study (p-value <0.05). Similar studies conducted by Bisai et al. 2011; Abraham and Rehna 2022 also concluded that the prevalence of stunting was higher among late adolescents as compared to early adolescents. In the present study, the prevalence of stunting was significantly associated with age groups, monthly income, drinking water and birth order (p<0.05) (table 4).

In the studied population, the prevalence of overall thinness among early adolescent girls, mid-adolescent girls and late adolescent girls was 11.47%, 15.26% and 2.8% respectively. The overall prevalence of thinness among the Bengalee Hindu adolescent girls was 11.16%. Among the studied population, the prevalence of thinness was very low among late adolescent groups and there was a statistically significant difference between the three age groups (p-value < 0.05).

Different studies (Mondal 2014; Maiti et al. 2011; Kebede et al. 2021; Abraham and Rehna 2022) found that the prevalence of thinness was less among late adolescents. In the present study, the prevalence of thinness was significantly associated with age at menarche, Monthly income, drinking water and father's occupation (p<0.05). (Table 5)

Conclusion: A moderate prevalence of stunting and thinness was found in the present study. Only 1.6% of girls were found to be obese. Prevalence of stunting increased with age groups. The late adolescent age group showed a higher prevalence of stunting and a lower prevalence of thinness. Prevalence of stunting and thinness were significantly associated with some factors, which can be preventable. Nutritional programs in rural areas can change this undernutrition scenario.

Table 4: Association between some socio demographic variables and stunting among Bengalee Hindu adolescent girls

Variables	Stunting		Total	Chi-square, degree of freedom and p value
	PRESENT	ABSENT		
Adolescence groups Early (10-13 yr)	43(23.49)	140(76.50)	183(47.53)	χ^2=18.32,df=2,p<0.05
Mid (14-16 yr)	48(36.64)	83(65.85)	131(34.02)	
Late (17-18 yr)	36(50.70)	35(49.29)	71(18.44)	
Types of family Nuclear	73(31.20)	161(68.80)	234(60.77)	χ^2=.865,df=1,p=.325
Joint/extended/broken	54(35.76)	97(64.23)	151(39.22)	
Age at menarche Yet not started	31(39.24)	48(61.53)	79(20.52)	χ^2=1.85,df=2,p=.395
10-11 years	54(32.14)	114(67.85)	168(43.63)	
12-14 years	42(30.43)	96(69.56)	138(35.84)	
Earning head 1	92(33.21)	185(66.78)	277(71.94)	χ^2=.023,df=1,p=.880
2 or more	35(32.40)	73(67.59)	108(28.05)	
Monthly income Below Rs. 7000	87(44.61)	108(55.38)	195(50.64)	χ^2=26.97,df=2,p<0.05
More than Rs. 7000	40(23.15)	150(78.74)	190(49.35)	
Drinking water				

Tubewell	45(46.87)	51(53.12)	96(24.96)	$\chi 2$ =15.59,df=2,p<0.05
Tapwater	64(32.32)	134(67.67)	198(51.42)	
Others	18(19.78)	73(80.21)	91(23.63)	
Father's occupation				
Deseased father	8(44.44)	10(55.55)	18(4.6)	
Labour/farmer	62(37.34)	104(62.65)	166(43.11)	$\chi 2$=8.41,df=3,p=.038
Service	13(19.11)	55(80.88)	68(17.66)	
Business	44(33.08)	89(66.91)	133(34.56)	
Birth order				
1	46(21.69)	166(78.80)	212(4.6)	
2	73(51.77)	68(48.22)	141(36.62)	$\chi 2$ =36.94,df=3,p<0.05
3	6(21.42)	22(78.57)	28(7.27)	
4	2(50.00)	2(50.00)	4(1.03)	

*Values are parenthesis indicates percentage

Table 5: **Association between some socio demographic variables and thinness among Bengalee Hindu adolescent girls**

Variables	Thinness		Total	Chi-square, degree of freedom and p value
	PRESENT	ABSENT		
Adolescence groups				
Early (10-13 yr)	22(12.02)	161(87.97)	183(47.53)	
Mid (14-16 yr)	20(15.26)	111(84.73)	131(34.02)	$\chi 2$=7.17,df=2,p=.028
Late (17-18 yr)	2(2.81)	69(97.18)	71(18.44)	
Types of family				
Nuclear family	21(8.97)	213(91.02)	234(60.77)	$\chi 2$=3.55,df=1,p=.060
Joint/extended/broken	23(15.23)	128(84.76)	151(39.22)	
Age at menarche				
Yet not started	19(24.05)	60(75.94)	79(20.51)	$\chi 2$=16.03,df=2,p<0.05
10-11 years	12(7.14)	156(92.85)	168(43.63)	
12-14 years	13(9.42)	125(90.57)	138(35.84)	
Earning head				
1	31(11.19)	246(88.80)	277(71.94)	$\chi 2$=.055,df=1,p=.815
2 or more	13(12.03)	95(87.96)	108(28.05)	
Monthly income				
Below Rs. 7000	32(16.32)	164(83.67)	196(50.64)	$\chi 2$=7.79,df=1,p<0.05
More than Rs. 7000	12(6.34)	177(93.65)	189(49.35)	
Drinking water				
Tube well	21(21.87)	75(78.12)	96(24.93)	$\chi 2$=15.43,df=2,p<0.05
Tap water	19(9.59)	179(90.40)	198(51.42)	
Others	4(4.39)	87(95.60)	91(21.63)	

Father's occupation				
Deseased father	0	18(100.00)	18(4.67)	
Labour/farmer	35(21.08)	131(78.91)	166(41.11)	$\chi2=27.44,df=3,p<0.05$
Service	2(2.94)	66(97.06)	68(17.66)	
Business	7(5.26)	126(94.73)	133(34.54)	
Birth order				
1	18(8.50)	194(91.50)	212(55.06)	
2	25(17.73)	116(82.28)	141(36.72)	$\chi2=9.56,df=3,p=.023$
3	1(3.57)	27(96.42)	28(7.29)	
4	-	4(100.00)	4(1.03)	

*Values are parenthesis indicates percentage

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