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## ASSESSMENT OF NUTRITIONAL STATUS AND ASSOCIATED FACTORS AMONG ADOLESCENT POPULATION IN RURAL AREAS OF BIRBHUM DISTRICT, WEST BENGAL

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### ABSTRACT

**Background:** A body of evidences showed that adolescent undernutrition is a serious public health problem in developing countries including India. Adolescent have typically been considered as low risk for poor health and often receive few health care resource and attention. However, their approach ignores the fact that many health problems later in life can be improved by adopting health life style habits in adolescents. This study aimed to assess prevalence of nutritional status and associated factors among adolescent population in rural areas of Birbhum district, West Bengal. **Methods:** A cross-sectional study was carried out among 630 sample population of Birbhum district, age ranging from 10 to 19 years, with 327 men and 303 women adolescents during March 2023 to September 2023 in 2 blocks of Birbhum district, West Bengal. Parameters of height and weight were measured and recorded. Following the completion of questionnaire, the results were compared against the body mass index and abnormal risk factors. Nominal variables were described in terms of frequency and odd's ratio (OR) (with 95% confidence interval) as test of association. **Results:** Study subjects comprised 327 males (51.90%) and 303 females (48.10%) with overall mean age of 14.63(± 2.77) years. The mean body mass index (BMI) for boys and girls was 16.88 and 15.54 respectively. Most of the participants were students. Overall, 70.79% of the adolescents were belonging to undernutrition (body mass index (BMI) < 18.5 kg/m<sup>2</sup>), 25.56% were normal (18.50 to 22.99 kg/m<sup>2</sup>) and 3.65% were overweight or obese (BMI ≥ 23 kg/m<sup>2</sup>). **Conclusion:** The study showed that malnutrition, and especially undernutrition, is still a problem in adolescents, with a higher prevalence in boys. Nutrition education, through an improved school curriculum, healthy policies and adolescent-directed messages through the various mass media, could be employed to address adolescent undernutrition in the study area.

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## INTRODUCTION

The United Nations Sustainable Development Goal 2 calls for an end to all forms of malnutrition by 2030 United Nations (2015). In recent years, the adolescent period (defined by the WHO as between the ages of 10 and 19 years) has gained recognition as a potential second window of opportunity for achieving targeted gains in growth and development, with long-term nutrition and health benefits for current and future generations (Prentice, AM et al., 2013, Dorn, LD, et al. 2019, Das, JK, 2018, Patton, GC et al. 2018). Adolescence is a period of rapid growth and development by which up to 45% of skeletal growth takes place, and 15 to 25% of adult height is achieved (Gebregyorgis T et al., 2016). Adolescence is a period of rapid growth and development, second only to infancy, with dramatic biological, psychological changes often shaped by socio-cultural

factors. It is usually divided into two phases: early adolescence (10–14 years) and late adolescence (15–19 years) (Patton GC, et al., 2016). The nutritional transition that is occurring in some low-middle income countries is resulting in a double burden of overweight and obesity in some population groups, along with the existing high proportion of undernutrition in others (Kapoor sk e al, 2002, Lukito W et al., 2006, Popkin BM et al., 1994). One way to break the intergenerational cycle of malnutrition is to improve the nutrition of adolescent girls prior to conception. The vicious cycle of malnutrition, if not broken, will go on resulting in more and more severe consequences (Afework Mulugeta et al; 2009). Adolescence is a period of physical growth, cognitive transformation, and reproductive maturation in the life cycle which lead to the high requirements of macro or micronutrients or both (Engidaw MT, 2019). Generally nutritional status is better assessed with anthropometry in adolescence, as well as at other stages of the life

cycle. Anthropometry is the single most inexpensive, noninvasive and universally applicable method of assessing body composition, size and proportion (De Onis M *et al.*, 1997). In general, the adolescent lives in India appear to be threatened by their own risky actions more than by germs, viruses, genetic abnormalities, degenerative diseases and the like (Verma and Saraswathi, 2002). Overall the situation of adolescents is quite alarming but systematic understanding of adolescent life style issues is almost nonexistent (Hans, 1994; Kaila, 2003). Finally, developmental stages being one of determining characteristics of lifestyle due to degree of varying peer group contact (Ganguli, 2003); it was expected that young, middle and late adolescents would differ in lifestyle behaviours.

## MATERIALS AND METHODS

**Study subjects:** Most of the School going adolescent boys and girls of age group 10-19 yrs. from government schools of 2 blocks (Suri-1 & Md Bazar) of Birbhum district was included in study.

### Inclusion Criteria

- Age group 10 to 19 years, it was divided into 3 parts, 10 to 12 years, 13 to 15 years and 16 years and above.
- Those who have given written consent and agreed to provide anthropometric measurements.

### Exclusion Criteria

- The students having systemic illnesses.
- The students having congenital malformations.

**Sample Size:** 630 students [boys: 327, girls: 303].

### Material Used:

- Weighing machine
- Measuring tape (metallic)

### Socioeconomic Characteristics

**Religion and Caste:** Religion was coded as Hindu, Muslim and Christian. Caste was recoded as Scheduled Tribes, Scheduled Castes, Other Backward Classes, and others. The Scheduled Castes include a group of the population that is socially segregated and financially/economically by their low status as per Hindu caste hierarchy. The Scheduled Castes and Scheduled Tribes are among the most disadvantaged socioeconomic groups in India. The Other Backward Classes are considered low in the traditional caste hierarchy, but include the intermediate socioeconomic groups. The "others" caste category is identified as those having higher social status.

**Education Level:** For simplicity, we categorized such variables into six education levels: illiterate, read and write primary (1 to 4 years), middle school (5 to 8 years), Secondary school (9 to 10 years), Higher secondary level (11 years & above).

**Type of House :** Houses made from mud, thatch, or other low-quality materials are called kuccha houses, houses that use partly low-quality and partly high quality materials are called semi-pucca houses, and houses made with high quality materials throughout, including the floor, roof, and exterior walls, are called pucca house.

**Sanitary Latrine Used:** In the study, sanitary latrine has been divided into no toilet, pit latrine and sanitary latrine. Open defecation is identified as no toilet.

**Type of Fuel Used:** Type of fuel used has been divided into firewood, biogas, LPG, electricity and others. Among category others Gul/coal, dung cake were included.

**Type of occupation:** The type of occupation has been categorized into non-agricultural labour, non-earning household activities, self-employed, student, unemployed, physically challenged and other.

**Physical Activity:** In physical activity, sedentary activity includes landlord, service, business, housewife, postman, teacher and white collar workers. Moderate activity includes labourer, other labourer, cultivator, artisan, mason, servant maid, tailor, rickshaw –puller, etc. Heavy activity includes blacksmith, stone cutter, railway gagman, wood cutter, mine worker etc.

**Wealth Index:** In the formation of wealth index five groups have been created such as poor, poor middle, middle, upper middle and upper. Wealth index was calculated on the basis of type of house, type of fuel materials used for cooking, type of sanitation facility availed and household assets through principal components analysis (PCA) guidelines.

### Data Analysis

A cross-sectional study was carried out among 630 sample population of Birbhum district, age ranging from 10 to 19 years, during March 2023 to September 2023 in 2 (Sainthia & Suri-1) blocks of Birbhum district, West Bengal. None of the variables in this study had missing values. The data were analyzed using STATA software and the significance level of the statistics was set to  $p < 0.05$ . Multinomial logistic regression analysis was performed to identify the factors affecting obesity in rural areas, and the significance level was set to  $p < 0.05$ . Exclusion criteria for this study were students who have any physical deformities were excluded from this study.

## RESULTS

**Table 1. Nutritional Status of adolescents (Undernutrition, normal, overweight/ obese) according to socioeconomic status**

Variable	Undernutrition (446)	Normal(161)	Overweight /Obese(23)
Gender			
Male	236(52.91)	80(49.69)	11(47.83)
Female	210(47.09)	81(50.31)	12(52.17)
Age Group			
10-12 Years	160(35.87)	6(3.73)	1(4.35)
13 to 15 years	154(34.53)	46(28.57)	5(21.74)
16 Years & above	132(29.60)	109(67.70)	17(73.91)
Religion			
Hindu	279(62.56)	91(56.52)	8(34.78)
Muslim	163(36.55)	70 (43.48)	15(65.22)
Christian	4(0.90)	0	0
Caste			
Scheduled tribe	46(10.31)	18(11.18)	0
Scheduled Caste	172(38.57)	45(27.95)	6 (26.09)
Other Backward Classes	77(17.26)	29(18.01)	7 (30.43)
Other	151(33.86)	69(42.86)	10(43.48)
Physical Activity			
Sedentary	311 (69.73)	114(70.81)	18(78.26)
Moderate	131(29.37)	45 (27.95)	5 (21.74)
Severe	4(0.90)	2(1.24)	0
Quintile			
Lower	92(20.63)	33 (20.50)	3 (13.04)
Lower Middle	107(23.99)	32 (19.88)	5(21.74)
Middle	83 (18.61)	28 (17.39)	5(21.74)
Upper Middle	85(19.06)	34(21.12)	7(30.43)
Upper	79(17.71)	34 (21.12)	3 (13.04)

Findings of the present study showed that the prevalence of underweight in the total study population was 70.79 %. The prevalence of overweight and obesity was 1.90% and 1.75%, respectively whereas 25.56 % of the study population was a normal weight (Table 1). The highest prevalence of overweight and obesity was in the age of 16 years and above however underweight was seen within the age of 10 to 12 years of the study population.

Table 2. Nutritional Status of adolescents (Undernutrition, normal, overweight/ obese)

Variable	Undernutrition (446)	Normal(161)	Overweight/Obese (23)
Education Level			
No education	22(4.93)	4(2.48)	0
1 to 4	52(11.66)	21(13.04)	6( 26.09)
5 to 8	291(65.25)	114(70.81)	11(47.83)
9 to 10	80(17.94)	22(13.66)	5(21.74)
11 and above	1(0.22)	0	1(4.35)
Toilet facility used			
No toilet	229(51.35)	76(24.13)	10(43.48)
Pit latrine	17(3.81)	8(29.63)	2(8.70)
Sanitary Latrine	200(69.44)	77(44.84)	11(47.83)
Type of fuel used			
Biogas	3(0.67)	0	0
Coal/gul	6(1.35)	5(3.11)	0
Dung cakes	90(20.18)	34(21.12)	6(26.09)
Electricity	5(1.12)	3(1.86)	0
LPG	97(21.75)	39(24.22)	4(17.39)
Straw/shrubs/ grass	104(23.32)	37(22.98)	8(34.78)
Wood	141(31.61)	43(26.71)	5(21.74)
Type of House			
Floor			
Pucca	172(38.67)	72(44.72)	12(52.17)
Sempucca	6(1.35)	4(2.48)	0
mud	268(60.09)	85(52.80)	11(47.83)
Wall			
Pucca	142(31.84)	64(39.75)	10(43.48)
Semipucca	52(11.66)	15(9.32)	3(13.04)
mud	252(56.50)	82(50.93)	10(43.48)
Roof			
Pucca	115(25.78)	52(32.30)	6(26.09)
Semipucca	208(46.64)	69(42.86)	8(34.78)
mud	123(27.58)	40(24.84)	9(39.13)

Table 3. The Association between nutritional status and its determinants among adolescents in rural areas of Birbhum district, West Bengal

Variables	Underweight		Overweight/Obese	
	AOR( 95% CI)	p-value	AOR( 95% CI)	p-value
Gender				
Male	Ref.		Ref.	
Female	0.89(.63 1.266)	0.535	1.09( .471 2.53)	0.835
Age Group				
10-12 Years	Ref.		Ref.	
13 to 15 years	0.13(.056 .293)	0.00*	4.56(.52 39.76)	0.169
16 Years & above	0.045(.020 .101)	0.00*	11.88( 1.55 90.85)	0.017*
Toilet facility used				
No toilet	Ref.		Ref.	
Pit latrine	.72( .314 1.65)	0.44	1.81(.369 8.92)	0.463
Sanitary Latrine	.94 ( .647 1.356)	0.736	1.08( .439 2.68)	0.86
Type of fuel used				
LPG	Ref.		Ref.	
Wood	1.18(.72 1.95)	0.508	1.038(.267 4.028)	0.957
Dung cakes	.948(.557 1.61)	0.846	1.656(.44 6.19)	0.453
Coal/gul	.55( .159 1.92)	0.354		
Straw/shrubs/ grass	.99( .581 1.69)	0.982	1.67( .46 6.10)	0.434
Electricity	.80( .178 3.61)	0.774		
Type of House				
Floor				
Pucca	Ref.		Ref.	
Semipucca	.70(.191 2.57)	0.593		
mud	1.245(.86 1.80)	0.243	.716( .30 1.70)	0.45
Wall				
Pucca	Ref.		Ref.	
Semipucca	1.49( .808 2.75)	0.2	.86(.228 3.27)	0.832
mud	1.32( .89 1.93)	0.161	.68( .273 1.72)	0.42
Roof				
Pucca	Ref.		Ref.	
Semipucca	1.29(.85 1.97)	0.228	.83( .279 2.48)	0.743
mud	1.134( .70 1.83)	0.605	1.82(.613 5.40)	0.28
Physical Activity				
Sedentary	Ref.		Ref.	
Moderate	1.04( .70 1.546)	0.839	.70(.25 1.95)	0.499
Severe	.87( .155 4.89)	0.876		
Quintile				
Lower	Ref		Ref	
Lower Middle	1.20(.70 2.07)	0.501	1.33(.31 5.74)	0.701
Middle	1.04(.59 1.84)	0.883	1.826( .42 7.97)	0.423
Upper Middle	.92( .53 1.62)	0.787	2.06(.501 8.51)	0.315
Upper	.98(.55 1.75)	0.954	.89( .17 4.72)	0.898

AOR adjusted odds ratio, CI confidence interval ; \*Statistically significant association

The prevalence of undernutrition percentage was higher among male population whereas overweight & obese percentage was higher among female population. Study participant's responses to physical activity revealed that most of the study participant did not exercise regularly (70.32 %) and have higher BMI than those who spend some time in outdoor games and take part in sports activity but no significant difference was found. The percentage of undernutrition was higher among lower, lower middle and middle quintile population whereas the percentage of overweight and obese was higher among upper middle and upper quintile population. Among participants having education middle school and above was 83.33%, percentage of illiterate 4.13% in study area (Table-2). Concerning latrine utilization 229(51.35%) of the participants do not use latrine those who belong to undernutrition. Again, the type of pucca house (floor and wall) was comparatively higher among overweight and obese participants in study area. Around 31.61% of households used wood as type of fuel in study area for the participants who were belonging to undernutrition. The risk factors associated with nutritional status in relation to socio-economic characteristics among these communities were analyzed by multivariate logistic regression method. In Table-3, a multinomial logistic regression was used to assess the impact of different socio-economic and demographic variables on underweight and overweight/obese. Adjusted for underweight, age group 13 to 15 years (odds ratio: 0.13; 95% confidence interval: .056 .293), 16 years & above (odds ratio: 0.045; 95% confidence interval: 0.020 .101), type of house (floor with mud) (odds ratio: 1.245; 95% confidence interval: .86 1.80), type of house (wall with mud) (odds ratio: 1.32; 95% confidence interval: .89 1.93), moderate physical activity (odds ratio: 1.04; 95% confidence interval: .70 1.546), type of fuel used as wood (odds ratio: 1.18 ; 95% confidence interval: .72 1.95), sanitary latrine (odds ratio: .94; 95% confidence interval: .647 1.356) and lower middle quintile (odds ratio: 1.20; 95% confidence interval : .70 2.07). Again in Table-3, adjusted for overweight/ obese, age group 16 years and above (odds ratio: 11.88; 95% confidence interval: 1.55 90.85), sanitary latrine (odds ratio: 1.08; 95% confidence interval: .439 2.68), moderate physical activity (odds ratio: .70; 95% confidence interval: .25 1.95), upper middle quintile (odds ratio: 2.06; 95% confidence interval: .501 8.51) and upper quintile (odds ratio: .89; 95% confidence interval: .17 4.72). None of these OR are statistically significant except age group 16 years and above among study population.

## DISCUSSION

The study was conducted where most of the participants were students of government schools in rural areas of 2 blocks (Suri-1 and Md bazar). 630 participants from 10 to 19 years of the age group were assessed for nutritional status. Socio economic determinants were also among study subjects. In the present study, religion –wise analysis of nutritional status showed that 62.56 % of Hindu participants were belonging to underweight as compared to 36.55% of Muslim participants. Among undernutrition participants 51.35% used no toilet in field area. Physical activity did not have level of significance for this study. This may reflect reverse causality, owing to cross-sectional approach, as obesity might have motivated individuals to start physical activities or yet because of limitations on sample collection. The risk of underweight was, on average, significantly higher for adolescent males than adolescent females. This may be because of the fact that biological, behavioral, and sociocultural mechanisms have been proposed for the gender differences in morbidity and mortality. In addition, the difference in morbidity and mortality between boys and girls is further related to individual lifestyle, the use of health care, and health and illness behaviors and practices. For example, adolescent boys are more likely to smoke and have higher propensities of taking greater risks that expose them to injury. The type of housing is an important factor affecting nutrition. The type of one's housing will decide the chances of coming in contact with diseases, rodents, parasites and insects. It is also an indirect indicator of the socioeconomic status of the parents, thus pointing to the income, personal and environmental hygiene, sanitary facilities, accessibility and affordability of potable water, nutritional and health

care services. The present study showed that adolescents living in pucca houses had a better nutritional status than those living in mud or semi pucca houses. Results are comparable to the observations of K Venkaiah *et al* where the prevalence of undernutrition was higher in children living in mud (Venkaiah K *et al.* 2002). In our study, the prevalence of overweight / obesity was 52.17% for female population which was lower for male population (47.83%). In a study conducted by Laxmaiah *et al.*, on rural adolescents, the prevalence of overweight was 7.2%, which was higher in the girls (6.6%) than the boys (5.1%) (Laxmaiah A *et al.* 2007).

## CONCLUSION

Adolescent obesity is a global health issue that is distributed unevenly between and within regions is likely to have a dynamic causative network. Health care professionals and policy-makers need to be mindful of new adolescent issues that are developing. They may have the opportunity to initiate behavioral counseling, participate in multidisciplinary teams that care for overweight and obese adolescents, and advocate for community programs to prevent obesity. School-based health intervention programs to promote healthy lifestyles among adolescents for maintaining healthy weight status are suggested.

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