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Thinness and its association with socio-economic and demographic factors among rural tribal adolescent girls of Kharagpur, West Bengal, India

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ABSTRACT
Undernutrition is one of the major problems especially among the tribal adolescent girls. Thus, the objective of the present study was to evaluate the prevalence of thinness and its association with socio-economic and demographic aspects among adolescent girls. This study was conducted among 418 tribal adolescent girls, aged 10-17 years of Kharagpur Development Block II, West Bengal, India. Assessment of nutritional status was measured by thinness (Low BMI for age) following standard cut offs as proposed by Cole and co-workers. Logistic regression was applied to evaluate the dependence of thinness on various socio-economic factors of the participants. The overall prevalence of thinness was 43.5%. When age specific prevalence are taken into account, the highest (67.5%) prevalence was found among the participants of the age group of 10 years, followed by age group 12 (54.7%) and in case of 17 years (49.0%). Prevalence of thinness was highly ($p < 0.001$) dependent on mothers' education (Wald = 10.3481) and physical activity (Wald = 6.8404) of the participants. Higher the mother's education, lower the prevalence of thinness. The prevalence of thinness was very high. Future nutritional and health intervention programmes should focus on these factors.

Keywords : *Thinness, tribal adolescent girls, socio-economic aspects, West Bengal, India.*

INTRODUCTION:

Adolescence is considered from 10-19 years aged by WHO (1995) and an important stage of growth and development in the lifespan of an individual. It is the phase which is marked by the beginning of signs of emergence of secondary sexual characters and continues up to the morphological and physiological maturation to move to the adulthood (WHO, 1995). These are the formative years in the life of an individual (Patil et al., 2009). Adolescent is an age of opportunity for making our future generation healthy (Puwar and Saxena, 2016**)**. Adolescent girls

constituting nearly 1/10th of the Indian Population form a crucial segment of the society (Planning Commission, 2001), with much lower sex ratio (898) than India's average sex ratio (943) (Census of India, 2011). They are traditionally married at an early age and are exposed to greater risk of reproductive morbidity and mortality which make them more vulnerable group especially in the developing countries. They also suffer from various forms of malnutrition due to their increased nutritional needs and low social power (Chowdhury et al., 2009). Recently conducted survey by Ministry of Women and Child Development, Government of India, Rapid Survey of Children 2013-143 has also measured BMI for adolescent girls (Rapid Survey of Children, 2015).

According to the Census of Govt. of India (2011), the tribal population constitute 8.6% of India's total population. The tribal populations are among the most underprivileged and undernourished people in India. 93.0% of this population resides in rural areas which are significantly underdeveloped areas, thus having disadvantage than other categories of the population in terms of economy, education, health, medical facilities etc. (Dutta Chowdhury et al., 2008). West Bengal is inhabited by substantial number of scheduled tribe population, having 40 schedule tribes like Santhal, Munda, Bhumij, Oraon, Mahali, Mech, Sabar and others (Dutta Chowdhury et al., 2008).

Undernutrition is one of the major problems especially among the adolescent girls. Undernurished girls are likely to give birth to undernourished children which transmitting to the future generations (Mulugeta et al., 2009). Malnutrition delays puberty which causes the growth of the stature to be slowed, causing stunting. Stunting is associated in women with small pelvis and a higher risk of obstructed labour, which is major cause of maternal deaths in developing countries (WHO, 1989). Malnourished adolescent girls if give birth to babies at a young age are more likely to give birth to Low Birth Weight (LBW) babies, perpetuating a cycle of health problems which pass from one generation to the next (Pramanik et al., 2015). Thus, assessing the nutritional status of adolescent girls, especially in rural India is essential (Pramanik et al., 2015).

Anthropometry is an area of study which involves the systematic and scientific measurement of humans. It is a very useful tool which not only helps to understand body composition but also provides insights into the relationship between biological and social factors. Several anthropometric indicators are used to assess nutritional status. They provide information on nutritional deficiency, thus giving insight to the cause of undernutrition of the population (WHO, 1995). The NFHS -3 and NFHS-4 data clearly showed that there was a clear

socioeconomic gradient. There were higher prevalence of thinness and stunting in rural areas (Bhargava et al., 2020).

Although nutritional status of adolescent girls, the future mothers, contributes significantly to the nutritional status of the community, assessment of nutritional status of adolescent girls has been the least investigated area of research particularly in rural and tribal areas of India. Hitherto, to the best of our knowledge, there are no previous studies dealing with thinness among adolescent tribal girls of Kharagpur region, Paschim Medinipur, West Bengal. This is the uniqueness of our study. The results of our study could help initiate appropriate intervention programmes for the amelioration of nutritional status of the adolescent girls.

Objective : Considering the above, the objective of the present study was to evaluate the prevalence of thinness (low BMI for age) and its association with socio-economic and demographic aspects among the tribal adolescent girls.

MATERIALS AND METHODS :

The area :

The present cross-sectional study was conducted in Higher Secondary Schools of 10 villages (Changual, Gangarampur, Benapur, Balarampur, Sankoa, Gopinathpur, Chakmakrampur, Mawa, Amlatoria, Chakturia) of Kharagpur Community Development Block II, West Midnapore, West Bengal, India and is situated 10 km. south from Midnapore District Head Quarters. There were several schools in this Block, but only those which had a sizable number of tribal students were considered for the present study. Tribal groups constitute 25.6% of the total population of the Block (Census of Govt. of India, 2011).

The participants :

Measurements as well as other information were collected from 418 tribal adolescent girls, aged 10-17 years. The students were randomly selected from who were present on the days of work. The various tribal communities like Santhal, Bhumij, Munda, Mahali, Sabar live in these villages. The living *amenities* like house types, drinking water resources, sanitary systems and types of food consumed were more or less same for all the groups. Hence we considered them as a homogenous population and used the term ‘tribals’ to define the participants. Age of the participants was calculated from the DOB recorded in the school registration books. Children and adolescents of non-tribal origin were excluded from our study.

Anthropometric measurements :

Height (kg) and weight (cm) were measured following standard method (Lohman et al., 1988) by the first author. BMI (kg / m^2) was calculated following standard equation (WHO, 1995). The technical error of measurements (TEM) was calculated for height and weight and they were found to be within reference values as given by Ulijaszek & Kerr (1999). Thus, TEM were not incorporated in any analyses.

Assessment of thinness :

Assessment of nutritional status as measured by thinness (Low BMI for age) was done following age and sex specific internationally accepted standard cut offs (Table 1) as proposed by Cole and others (2007). All the undernourished adolescents were categorized as Grade I, II, and III for severity of thinness.

Table 1.The age specific BMI cut-off points (girls) for thinness (Cole et al., 2007)

Age (years)	Grade III	Grade II	Grade I
10	12.64	13.43	14.61
11	12.95	13.79	15.05
12	13.39	14.28	15.62
13	13.92	14.85	16.26
14	14.48	15.43	16.88
15	15.01	15.98	17.45
16	15.46	16.44	17.91
17	15.78	16.77	18.25

Socio-economic and demographic information :

Socio-economic and demographic aspects i.e. ethnicity, literacy, economic aspects of family, number of family members, physical activities performed by the respondents were collected through structured questionnaire. The fathers' and mother's education were categorized as (1 = illiterate, 2, = primary, 3= secondary, 4= higher secondary and above). Father's occupation was categorized as 1 = manual worker (daily worker, mason, carpenter, driver etc.), non-manual worker (Service, business etc.), 3 = land holder. Mother's occupation was coded as: 1 = house work, 2 = manual worker and 3 = non-manual worker. *In* case of physical activity, it was

categorized as 1= yes and 2 = no. Number of family members had been coded as up to 5 individuals as 1, 6 to 10 individuals as 2 and 3 for more number of individuals.

Statistical analysis :

All essential descriptive and inferential statistics were done by Statistical Package for Social Sciences (SPSS) version 16.0. Descriptive statistics (mean, standard deviation) for the continuous variable were computed. For comparing the mean of the variables between age-groups one way analysis of variance (ANOVA) was computed. Logistic regression was applied to evaluate the dependence of thinness on various socio-economic factors of the participants. Statistical significance was set as $p < 0.05$.

Ethical approval :

Ethical approval was taken from the Ethical and Research Committee of Department of Anthropology, Vidyasagar University. Permission for conducting the study was also obtained from each school authority. Informed consent was obtained from each participant as well.

RESULTS :

Table 2. Mean (SD) of height, weight and BMI of the participants.

Variables	Age groups (years)								Total (N=418)	F
	10 (N=40)	11 (N=48)	12 (N=64)	13 (N=58)	14 (N=50)	15 (N=57)	16 (N=52)	17 (N=49)		
Height (cm)	133.7 (8.3)	139.1 (6.6)	144.2 (7.2)	145.9 (6.5)	148.7 (5.7)	149.9 (4.6)	150.4 (5.3)	150.9 (5.2)	145.7 (8.2)	43.91*
Weight (Kg)	25.8 (5.3)	29.1 (5.7)	32.9 (6.0)	36.0 (6.0)	40.2 (6.5)	41.1 (4.1)	42.3 (6.2)	41.5 (5.1)	36.4 (7.9)	57.86*
BMI	14.31 (1.93)	14.96 (2.15)	15.71 (1.89)	16.82 (2.10)	18.13 (2.43)	18.32 (1.86)	18.68 (2.18)	18.19 (2.0)	16.95 (2.56)	32.55*

* = $p < 0.001$

Table 2 presents the mean (SD) and the age trends of the variables among the studied adolescent tribal girls. Mean height among them was 145.7 cm (8.2) and weight was 36.4 kg (7.9). In case of BMI it was 16.95 (2.56). The highest mean value of height (150.8 cm) was noticed at 17 years of age and lowest mean value of height (133.7 cm) was noticed at 10 years of age. The

highest mean weight (42.3 kg) was noticed at 16 years of age and lowest mean weight (25.8 kg) was noticed at 10 years of age. It is also evident from this table that the values of the variables were increasing with the increase of the age of the participants and this gradual increase was highly significant when evaluated through ANOVA ($p < 0.001$). The maximum increase in height was found at age group 10-12 years, reflecting girl's adolescent growth spurt.

Table 3. Prevalence of thinness (Grades –I, II and III) among the participants.

Age (years)	Thinness			Total	Normal
	Grade - III	Grade – II	Grade - I		
10 (N=40)	6	8	13	27 (67.5)	13 (32.5)
11 (N=48)	11	4	8	23 (47.9)	25 (52.1)
12 (N=64)	10	8	17	35 (54.7)	29 (45.3)
13 (N=58)	4	8	7	19 (32.8)	39 (67.2)
14 (N=50)	1	3	10	14 (28.0)	36 (72.0)
15 (N=57)	2	2	17	21 (36.8)	36 (63.2)
16 (N=52)	1	5	13	19 (36.5)	33 (63.5)
17 (N=49)	6	8	10	24 (49.0)	25 (51.0)
Total (N=418)	41 (9.8)	46 (11.0)	95 (22.7)	182 (43.5)	236 (56.5)

Percentages are presented in the parentheses

Table 3 presents the prevalence of thinness (low BMI for age) using cut off (Table 1) as proposed by Cole and others (2007) along with the three Grades. From the table, it is evident that the overall prevalence of thinness was 43.5%. The highest frequency was noticed in case of Grade I category (22.7%) followed by moderate (Grade II, 11.0%) and severe thin (Grade III) adolescents were 9.8%. When age specific prevalence are taken into account, the highest (67.5%) prevalence was found among the participants of the age group of 10 years, followed by age group 12 (54.7%) and in case of 17 years (49.0%). The lowest prevalence (28.0%) was found in the age group of 14 years.

Table 4. Logistic regression analysis: Effect of socio-economic and demographic factors on thinness

Independent Variables	**Thinness (%)**	**B**	**SeB**	**95% CI**	**Wald**	**p**	**Remarks**
Fathers' education		0.1713	0.1006	0.9745-1.4455	3.0381	0.0813	Not Significant
Non-literate	21.3						
Primary	8.6						
Secondary	12.6						
HS and above	1.0						
Fathers' occupation		-0.0551	0.1075	0.7666-1.1682	0.2632	0.6079	Not significant
Manual	26.5						
Non-manual	3.8						
Own land	3.2						
Mothers' education		0.3703	0.1151	1.1556-1.8148	10.3418	0.0013	**Significant**
Non-literate	31.						
Primary	6.6						
Secondary	4.8						
HS and above	1.0						
Mothers' occupation		-0.2627	0.1821	0.5381-1.0988	2.0810	0.1491	Not significant
Manual	22.9						
Non-manual	19.4						
Own land	1.2						
No. of family members		0.0196	0.1946	0.6963-1.4934	0.0101	0.9199	Not significant
Up to 5	30.6						
6-10	12.2						
10+	0.7						
Physical activity		0.9922	0.3794	1.2823-5.6730	6.8404	0.0089	**Significant**
Yes	41.1						
No	2.4						
No. of earning member(s)		0.0587	0.1831	0.7407-1.5183	0.1029	0.7484	Not significant
One member	27.7						
Two members	15.8						

The results of the logistic regression analysis and the association of socio-economic and demographic variables like fathers' and mothers' education and occupations; number of family members and earning members; physical activities performed by the participants on the prevalence of thinness are presented in Table 4. It is evident that out of these seven, prevalence of thinness was highly ($p < 0.001$) associated and dependent on mothers' education (Wald = 10.3481) and physical activity (Wald = 6.8404).

DISCUSSION

India has a unique opportunity to improve the health and nutritional status of its citizens as a result of its tremendous economic development in the past two to three decades. There have been impressive improvements in some health indicators in the past two decades, including a drop in the fertility rate and reduction in infant mortality rate, but improvements in nutritional status have been less impressive (*Datta* Banik et al., 2016; Dey et al., 2011). More than half of the world's undernourished population lives in India (Roy et al., 2016). Apart from overall poverty, the health status of the rural population reflects inequitable distribution of health resources, low purchasing capacity of foods and unequal food sharing pattern in the families making them socially and biologically vulnerable. Undernutrition is an indicator of poor nutrition and poor health of a population. However, very little information is available on the nutritional status of adolescents from rural areas of West Bengal. This lack of useful epidemiological data is the reason why we have attempted to investigate the nutritional status of adolescents from the rural areas of West Bengal state (Pal et al., 2017).

Our study area Kharagpur Community Development Block II is a rural based habitation and the tribal groups constitute 25.6% of the total population of the Block. Various tribal communities live in this area and their living conditions are similar. Hence, they were considered as a common community and mentioned here as 'tribal group'. All children and adolescents study in schools in and around their villages.

Mean height (145.7cm) of the present adolescent girls was much higher than the Santhal adolescent girls (142.8cm) from Purulia, West Bengal. But the mean weight (36.4 kg and 36.12 kg) as well as BMI (16.95 and 17.4) were more or less same between these two populations (Das and Bose, 2011a). Among the Rajbanshi adolescent girls from North Bengal, the three anthropometric variables show similar mean values (Roy et al., 2016). However, in comparison of the rural adolescent girls of West Bengal studied by Pal and others (2017) the mean values of the present adolescent girls were slightly higher in all three variables.

The overall prevalence of thinness was 43.5%. The prevalence was found to be higher among girls of lower age group and showed a gradual decrease with increased age. Similarly high prevalence were observed among the tribal adolescents from Paschim Medinipur (45.0%) (Chowdhury et al., 2008) and 45.1% (Maiti et al., 2012). Santal girls (44.6%) and Hill Kheria girls

(53.8%) of Purulia district of West Bengal also showed over severe thinness (Das and Bose, 2011a; Das, 2011b). Much higher prevalence had been observed among the Birhor children and adolescents (75.0%) of the same district (Das et al., 2012).

Comparing with tribal adolescents of other states, similarly high prevalence of thinness (42.0%) has been observed among tribal adolescents of 9 states consisting of Andhra Pradesh, Gujrat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, West Bengal, Tamil Nadu, Orissa (Rao et al., 2006), higher prevalence was found among the Kolam tribe (64.9%) of Andhra Pradesh (Karri et al., 2017) and Sabar adolescents (54.4%) of Orissa (Chakraborty and Bharati, 2008), while tribal children and adolescents of Tripura (Sil et al., 2011) showed much lower (28.5%) prevalence (Table 5).

Table 5: Prevalence of thinness among tribal populations of India

Studied Population	Studied area	Age group	No of participants	Prevalence of thinness (%)	Reference
Tribal Girls					
Mixed Scheduled Tribes	9 states of India	10-17	12789	42.0	Rao et al., 2006
Sabar	Orissa	10-18	328	35.8	Chakrabarty and Bharati, 2008
Santals	Purulia, West Bengal	7-17	421	44.6	Das and Bose, 2011a
Hill Kheria	Purulia, West Bengal	4-18	136	53.8	Das & Bose, 2011b
Mixed Scheduled Tribes	Tripura	6-15	608	28.5	Sil et al., 2011
Birhor	Purulia, West Bengal	2-18	88	75.7	Das et al., 2012
Mixed Scheduled Tribes	Paschim Medinipur, West Bengal	9-19	277	45.1	Maiti et al., 2012
Kolam	Andhra Pradesh	6-18	414	64.9	Karri et al., 2017
Mixed Scheduled Tribes	**West Bengal**	**10-17**	**418**	**43.5**	***Present study***

Several socio-economic and demographic aspects of these tribal adolescent girls have been considered to evaluate the effect on thinness. In case of father's occupation, 26.5% of the total

participants were undernourished whose father was engaged as manual work force, followed by non-manual work force having 3.8% thin adolescents and fathers having own agricultural land showed 13.2% undernourished children. Whereas, in case of mother's occupation, 22.7% participants were thin whose mothers were engaged in household works, followed by manual work and non-manual work having 19.4% and 1.2% undernourished girls respectively. Coming to the case of fathers' education, we categorized as non-literate, primary, secondary and higher secondary and above and the prevalence of thinness were 21.3%, 8.6%, 12.7%, and 1.0% respectively. The prevalence of thin adolescent girls were 31.1%, 6.6%, 4.8% and 1.0% respectively, for the same categories as of fathers. Mothers' educational status showed a significant association with thinness. Overall, 30.5% were thin who belonged to a family consisting of up to 5 members, whereas, 6-10 member families and more than 10 member family showed 12.2% and 0.7%, respectively, thinness rates. Physical activities was another factor which had significant effect on thinness. Girls who were involved in physical activities showed much higher prevalence of thinness of 41.1%. Participants who did not engage in any physical activity displayed had a very low level (2.4%) of thinness. This difference was also highly significant. It was also observed that 27.7% and 15.8% were undernourished, respectively, corresponding with one and two earning member(s) of the family.

Out of these socio-economic and demographic aspects of the studied tribal adolescent girls, there were three aspects such as, Mother's educational level and physical activity performed by the adolescents which had significant impact on thinness. Girls whose fathers and or mothers were non literate had higher prevalence (21.3% and 31.1%, respectively) of thinness, whereas, the prevalence was 1.0% in both the cases where they were having at least higher secondary or higher level of education. An earlier study had also reported similar results among the rural adolescents from West Bengal (Pal et al., 2017). A recent study from Purba Medinipur, West Bengal, India (Khanra et al, 2020) has also reported that mothers' educational attainment had a significant impact on the nutritional status of the child. Adolescents with higher educated parents were less likely to be undernourished. Women not having higher education resulting in less exposure to the outside world, are not aware of personal hygiene and wellbeing of the children. Educational exposure enables mothers to have greater access to household resources that are important for nutritional aspects (Das and Sahoo, 2011). Tesfaye (2009) reported that some of the predictors of children nutritional status were maternal education, occupation of mother. Sapkota and Gurung (2009)

studied the nutritional status of the Nigerian children and concluded that the significant association of mother's education and undernutrion Importance of mother's education was also informed. Adolescent Girls Attending Governmental Schools in Aksum Town, Northern Ethiopia also revealed the significant association of mother's educational status and thinness (Amha and Girum, 2018).

The other socio-economic and demographic aspect which influenced the rate of thinness was physical activities of the girls. Out of total 43.5% thin adolescents, 41.1% were those who engaged in physical activities. This indicates that, due to the inadequate amount of food consumed by the adolescents which could not supplement the energy lost by the physical activities.

Conclusion

The prevalence of thinness of the studied adolescent girls was very high. There were several factors like mother's education, as well as physical activity level which significantly influenced this prevalence rate. Future nutritional and health intervention programmes should focus on these factors. Amelioration of their nutritional status may be achieved by addressing these confounding covariates.

Conflict of interest : None

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