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Association between Birth Order, Father's Occupation, House Type and Thinness among Adolescent Girls of Darjeeling District, West Bengal, India

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***Abstract*:** Thinness among adolescent girls happens to be a serious health hazard in many low and middle-income countries including India. The main objectives of this cross-sectional study are twofold: (i) to measure the frequency of thinness among 292 adolescent girls between 11-14 years of age residing in the Darjeeling district of West Bengal, India and also (ii) to find out the association of different socio-economic and demographic variables with thinness. Assessment of thinness was done by using the proposed international BMI-for-age cut-off values of Cole et al. (2007). For that purpose, anthropometric measurements of height and weight were taken to calculate Body Mass Index (BMI). In order to find the association of socio-economic and demographic variables with thinness binary logistic regression (BLR) was used. The frequency of overall thinness in the sample was estimated to be 31.51%. The BLR analysis revealed variables such as birth order ($p<0.01$), father's occupation ($p<0.05$) and house type ($p<0.05$) are significantly associated with thinness. Appropriate nutritional programmes and interventions are required to minimise the prevalence of thinness in the study area. Preventive strategies focusing on adolescent girls of different socio-economic status could aid in addressing the issue of thinness.

***Keywords**:* Thinness, Adolescent girls, BMI-for-age, Anthropometry, West Bengal

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Introduction

As per UNICEF, there are 1.3 billion adolescents in 2023 which comes to 16 per cent of the world's total population (https://data.unicef.org). World Health Organisation (WHO, 2006) also reported that adolescents comprised around 20% of the population of the South-East-Asia (SEAR) region. Adolescence has been defined by World Health Organisation and the United Nations (UN) as the phase between childhood and adulthood covering generally ages between 10 to 19 years (https://www.who.int/health-topics/adolescent-health). There is no denying that this happens to be an extremely vital stage of human development as it is the stepping stone for a future lifetime of good health. At this stage, adolescents undergo rapid biological or physical, cognitive and psycho-social growth.

During this phase, individuals gain around 50 per cent of adult body weight and height growth besides developing a unique pattern of sexual dimorphism. Due to increased nutritional needs and low social power, adolescents fall under the ravages of various forms of malnutrition (Chaudhary et al., 2003: 53-61). Persistent under-nutrition is associated with slower cognitive development and serious health impairments later in life that eventually reduce the quality of life (Scrimshaw, 1995).

Among the adolescents, girls constitute a vulnerable group in many counts across the world. (Dasgupta et al., 2008, 33(2):77–80; Upashe et al., 2015). For adolescent girls, sufficient nutrition is vital not only for optimal physical and cognitive development but also for pregnancy either during adolescence or in later life. Poor nutrition of adolescent girls can lead to poor intergenerational effects as adolescent girls with poor nutritional status are more likely to give birth to low-birth-weight newborns (Guilloteau et al., 2009, 17-35). Priority should be kept in mind to assess the nutritional status of vulnerable segments of any community not only for identifying nutritional risks, but also for improving current health problems.

Scholars are unanimous in considering body mass index (BMI) as one of the most cost-effective, and non-invasive appropriate tool for the assessment of the nutritional status of adolescents and adults (WHO, 1995). BMI also happens to be the best indicator for assessing thinness amongst adolescents (de Onis et al., 2001; cf Bisai et al., 2012).

The BMI, which is considered as an index of chronic energy deficiency (CED), is actually not constant in growing children and adolescents' group. There are three commonly used indicators of under nutrition among children and adolescents viz., stunting (low height for age), thinness (low BMI-for-age) and underweight (low weight for age). Thinness is an indicator of acute under nutrition. Numerous studies have advocated that the prevalence of under nutrition is better assessed as thinness compared to other indicators (WHO, 1995; Cole et al., 2007). Moreover, thinness has also been adopted as a more appropriate indicator of relatively recent nutritional deprivation, such as insufficient dietary intakes of energy, protein, or several micronutrients, than underweight in older children (WHO, 1995). BMI-for-age best defines the extent of thinness among children and adolescents from 5-19 years (de Onis et al., 2004). The BMI cut-off values proposed by Cole et al. (2007) are considered to be the best anthropometric measures of thinness (low-BMI-for-age) among children and adolescents.

Patton et al. (2018) delineated the crucial period of adolescence into two phases: early (10-14 years) and late (15-19 years); and it has been well established that our body demands more nutrition during early adolescence than at any other phase of life. Unfortunately, girls are exposed to risk factors beginning in early adolescence (Lassi et al., 2017). Studies have reported that the prevalence of thinness was significantly higher in early adolescence than in late adolescence (Bose & Bisai, 2008a; Das et al., 2007; Deshmukh et al., 2006; Kumar et al., 2021; Malhotra & Passi, 2007; Sethi et al., 2019). Shahabuddin et al. (2000) reported that as age increases, thinness tends to decrease. A survey by National Nutrition Monitoring Bureau (NNMB 2002) revealed that thinness decreased from 78% in 10-13 years to 66% in 14-17 years.

A number of studies addressing different countries and ethnic groups have found thinness to be prevalent in adolescent girls of low and middle income countries (WHO, 2005; Meleku et al., 2015; Zhang et al., 2016; Candler et al., 2017; Kumar et al., 2021). Existing evidences acknowledge several socio-economic and demographic factors influencing the nutritional status of the adolescent population (Tigga et al., 2015; Pal et al., 2017; Roy et al., 2020; Biswas et al., 2021; Kumar et al., 2021). A study comparing two groups of adolescent boys and girls having a common ethnicity but living in two different countries (viz. India and United Arabs Emirates) revealed that the prevalence of thinness was statistically higher among the subjects of India (Haboubi & Shaikh, 2009). Factors typical to low and middle income countries seem to contribute to moderate and/ or high prevalence of thinness among adolescents.

Speaking in terms of region, earlier studies have investigated nutritional status (in terms of thinness) among adolescents from rural (Das & Biswas, 2005; Bose et al., 2007; Das et al., 2007; Bose & Bisai, 2008a; Bose & Bisai, 2008b; Mondal & Sen, 2010; Dey et al., 2011; Maiti et al., 2011; Pal et al., 2017) and urban (Das

& Bisai, 2009; Ghosh & Bandhopadyay, 2009; Bhattacharya et al., 2015) areas in West Bengal as well as different parts of India (Anand et al., 1999; Deshmukh et al., 2006; Malhotra & Passi, 2007; Medhi et al., 2007; Haboubi & Saikh, 2009; Chandar et al., 2018; Bhargava et al., 2020; Kumar et al., 2021). However, there is a paucity of data on the prevalence of thinness among urban adolescents in West Bengal state of India (Das & Bisai, 2009; Ghosh & Bandhopadyay, 2009; Pal et al., 2017).

Therefore, based on review of literature in the previous paragraphs, it could be conjectured that the nutritional status (here, in terms of thinness) of the aforementioned group are related to several socio-economic and demographic parameters. Over and above, early adolescent groups are subjected to poorer nutritional status compared to late adolescent groups. However, reports on thinness among early adolescent girls of urban areas involving socio-economic and demographic factors are scarce. Keeping all the issues in mind, the present study had the following objectives:

(i) To estimate the prevalence of thinness among adolescent girls of Siliguri, Darjeeling district using the proposed international BMI-for-age cut-offs of Cole et al. (2007).

(ii) To ascertain the association of different socio-economic and demographic factors with thinness of the participant girls.

Materials and Methods

Source of data: The present cross-sectional study was done among school-going adolescent girls (aged 11-14 years) studying in a government secondary school situated at the heart of Siliguri, a cosmopolitan city under Darjeeling district of West Bengal, India. The minimum number of subjects required for reliable estimation of the prevalence/effect in a health investigation was determined using the standard sample size estimation method (Naing, 2003). The calculation of sample size (N) was done using the criteria of anticipated population proportion (i.e. prevalence of thinness) of 23.77% (Debnath et al., 2016), the minimum absolute precision of marginal error was 5% and the confidence interval (i.e. the maximum amount of tolerance) of 95% was taken into consideration. The standard equation used to calculate sample size was as follows:

$$N = (z/d)^2 \times p(1-p)$$

where p = 0.238, d = 0.05 and z = 1.96

Thus, the minimum sample size was estimated to be 279 for the present investigation. If the non-response rate considered being 5% at the sample size estimation was assured, then the minimum number required to be N=292. Convenience sampling method was employed to achieve the minimum sample size estimated above.

The study was conducted in accordance with the ethical guidelines for human experiments, as enacted by the Helsinki Declaration of 2000 (Touitou et al., 2004). The study protocol was approved by the Institutional Research Board of the University. Appropriate ethical permission for human studies was obtained from all concerned authorities before the commencement of the study. Prior to the conduction of the study, necessary consent was also obtained from the school authorities after explaining clearly the nature and purpose of the present work. Informed consent from parents as well as local guardians was also obtained. Verbal assent was also obtained from each participant.

Collection of anthropometric data: Anthropometric measurements of height and weight of girls in the aforementioned age-group were collected using standard procedures (Singh & Bhasin, 1989). Measurements were taken to the nearest 0.1 cm for height and 0.5 kg for weight. BMI was subsequently calculated by the formula: BMI (kg/m^2) = weight in kilogram/(height in meter)^2. Technical Error of Measurement (TEM) was calculated on 50 randomly selected girls and the errors were found to be within reference values (Ulijaszek & Kerr, 1999). Hence, the anthropometric measurements recorded were considered to be reliable and reproducible and the TEM values were not incorporated for further statistical consideration.

Collection of socio-economic and demographic data: A semi-structured pre-designed and pre-tested interview schedule was used to acquire information on socio-economic and demographic parameters. The data recorded were on age, birth order (1-2 or ≥3), parental education (none or primary education or junior high school or senior high school or professional degrees), mother's occupation (employed or unemployed), father's occupation [low-income (such as daily wagers, mason, carpenter, driver, etc.) or middle-income (shopkeepers, small business, etc) or high-income (government employees, big business, miscellaneous)], house type [bricked (also called *pucca* house; bricked walls with a roof made of concrete) or mixed-type (also called *semi-pucca* house; bricked walls with a thatched or tiled roof) or non-bricked (also called *kutcha* house; mud walls with a thatched roof)], drinking water [treated (by boiling or through purifier) or untreated], types of family (nuclear or joint) and toilet facilities (yes or no). Later, data on parental education was omitted since the subjects were less aware of the exact information. 100% of the subjects claimed that they had toilet facilities in their homes. Moreover, we found that there were no subjects residing in non-bricked (*kutcha)* houses. Regarding mother's occupation, a majority (almost 81%) were reported as home-makers while the remaining reported working outside home. Since a very scarce number of mothers were found to work in different types of jobs, the authors decided to group them in a separate section as 'employed' and the home-makers/ housewives as 'unemployed'.

Statistical analysis: The data analysis has been done using IBM SPSS (Statistical Package for Social Science) (version 23.0, SPSS Inc., Chicago, IL). Anthropometric trait data exhibited a normal distribution (Shapiro-Wilk test, $p<0.05$) and hence required no transformation. The anthropometric measurements recorded have been described using descriptive statistics (mean ± standard deviation). One way analysis of variance (ANOVA) was utilised to identify the mean differences among the anthropometric variables with respect to different ages. Presence of thinness was evaluated using the cut-off values of international survey as suggested by Cole et al. (2007). In 2007, Cole et al. developed three grades of thinness, based on an international survey of nationally representative samples of children aged 6 to 18 years, between 1963 and 1993. The BMI values calculated in the present study were used to determine three definite grades of thinness (Grade I: mild, Grade II: moderate, Grade III: severe). Chi-square test was done to find the significance of differences in the prevalence of thinness across socioeconomic and demographic parameters.

Binary Logistic Regression analysis was fitted to estimate the crude odds ratios (ORs) and 95% confidence intervals (CIs) were associated with thinness. The analysis allows the creation of categorical depended variables and the odds were derived by comparing with the reference category. To generate dichotomous dependent variables, thinness was coded as '1' and normal was coded as '0' in regression models. The predictor variables such as age, birth order, family type, house type, drinking water, mother's occupation and father's occupation were entered as dummy variables and results were obtained by comparing with reference categories. A p-value of <0.05 was considered to be statistically significant.

Results and Discussion

The age-specific descriptive statistics (mean ± standard deviation) of the recorded anthropometric parameters and frequencies of different grades of thinness based on international cut-offs of Cole et al. (2007) is presented in *Table 1.* The overall mean height, weight and BMI of the subjects were 146.13 ± 7.00cm, 39.16 ± 8.56 kg and 18.24 ± 3.37 kg/m^2 respectively. Height of girls increased with age. Mean values of height ranged from 142.03 ± 7.11 cm (at 11 years) to 149.46± 4.57 cm (at 14 years). Body weight and BMI also increased with age except at 14 years. Mean weight ranged from 36.27± 8.40 kg (at 11 years) to 42.02±8.91 kg (at 13 years). Mean BMI ranged from 17.83± 3.21 kg/m^2 (at 11 years) to 18.97± 3.77 kg/m^2 (at 13 years). Using ANOVA, statistically significant (p< 0.0001) differences were observed in height (F-value = 20.188; df= 3, 288) and weight (F-value= 7.855; df=3, 288) with respect to age. No statistically significant difference was observed in BMI with respect to age (F-value= 2.029; df= 3, 288) (p>0.05).

Table 1: Descriptive statistics (mean ± standard deviation) of the recorded variables and prevalence of thinness (based on cut-offs proposed by Cole et al. **2007)**

Age (yrs)	*Subjects (N)*	*Height (cm)*	*Weight (kg)*	*BMI (kg/ m²)*	*Prevalence of different grades of thinness*			
					Mild (Grade-I)	*Moderate (Grade-II)*	*Severe (Grade-III)*	*Total*
11	89	142.03 ±7.11	36.27 ±8.40	17.83 ±3.21	18 (20.22%)	3 (3.37%)	4 (4.49%)	25 (28.08%)
12	89	146.53 ±6.86	38.59 ±7.86	17.89 ±3.08	16 (17.98%)	9 (10.11%)	2 (2.24%)	27 (30.33%)
13	64	148.66 ±5.88	42.02 ±8.91	18.97 ±3.77	12 (18.75%)	3 (4.68%)	4 (6.25%)	19 (29.68%)
14	50	149.46 ±4.57	41.69 ±7.91	18.66 ±3.51	10 (20.00%)	9 (18.00%)	2 (4.00%)	21 (42.00%)
Total	292	146.13 ±7.00	39.16 ±8.56	18.24 ±3.37	56 (19.18%)	24 (8.22%)	12 (4.11%)	92 (31.51%)

The prevalence of overall thinness in the sample was found to be 31.51% which was much lower than reported by other studies of West Bengal (*Figure 1*). Among the rural tribal adolescent girls of Kharagpur, the prevalence of thinness was 41.36% (Biswas et al., 2021), among rural school adolescents in Paschim Medinipur and Puruliya district, it was 38.22% (Bose & Bisai, 2008b), among tribal adolescent girls of Paschim Medinipur district, it was 38.63% (Maiti et al., 2012). The same holds true when comparing with studies outside West Bengal. Among the adolescent girls of Kolam tribe of Andhra Pradesh, it was 67.18% (Bharthi et al., 2017), among adolescent girls of tea gardens of Dibrugarh district of Assam (Medhi et al., 2007), it was 45.19%, among the pre-menarcheal and post-menarcheal girls of Barnala and Mansa districts of Punjab, it was 69.74% and 47.06% respectively (Goyal et al., 2012).

On the other hand, the prevalence of thinness in the present study was found to be much higher when compared to other studies: 18.81% and 19.02% among tribal and rural adolescent girls of Karbi Anglong district of Assam respectively (Mondal & Terangpi, 2014; Sharma & Mondal, 2014), 24.00% and 13.51% among Rajbanshi school-going adolescent girls of North Bengal (Roy et al., 2016; Bose et al., 2020), 15.23% and 10.26% among urban and rural

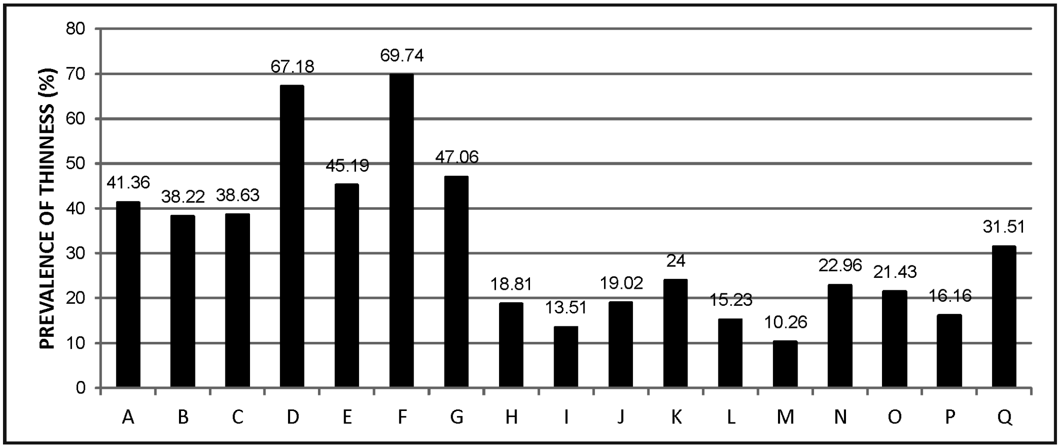

Figure 1: A Comparative Statement on Prevalence of Thinness in Some Studies from India

A= rural tribal adolescent girls of Kharagpur (Biswas et al. 2021),

B= rural school adolescents in Paschim Medinipur and Puruliya district, (Bose & Bisai 2008b)

C= tribal adolescent girls of Paschim Medinipur district (Maiti et al. 2012)

D= adolescent girls of Kolam tribe of Andhra Pradesh (Bharthi et al. 2017)

E= adolescent girls of tea gardens of Dibrugarh district of Assam (Medhi et al. 2007)

F= pre-menarcheal of Barnala and Mansa districts of Punjab (Goyal et al. 2012).

G= post-menarcheal girls of Barnala and Mansa districts of Punjab (Goyal et al. 2012)

H= tribal adolescent girls of Karbi Anglong district of Assam (Mondal & Terangpi 2014)

I= Rajbanshi school-going adolescent girls of North Bengal (Bose et al. 2020)

J= rural adolescent girls of Karbi Anglong district of Assam (Sharma & Mondal 2014)

K= Rajbanshi school-going adolescent girls of North Bengal (Roy et al. 2016)

L= urban areas under Lucknow district of Uttar Pradesh (Sachan et al. 2012)

M= rural areas under Lucknow district of Uttar Pradesh (Sachan et al. 2012)

N= Bengalee adolescent girls of Darjeeling district of West Bengal (Debnath et al. 2016)

O= rural tribal adolescent girls from Jampuijala block of West Tripura district (Sil et al. 2011)

P= adolescent girls from Haryana (Goyal et al. 2020)

Q= Present study

areas under Lucknow district of Uttar Pradesh respectively (Sachan et al., 2012), 22.96% among Bengali adolescent girls of Darjeeling district of West Bengal (Debnath et al., 2016), 21.43% among rural tribal adolescent girls from Jampuijala block of West Tripura district (Sil et al., 2011) and 16.16% among adolescent girls from Haryana (Goyal et al., 2020).

The altogether prevalence of mild (Grade-I), moderate (Grade-II) and severe (Grade-III) were found to be 19.18%, 8.22% and 4.11% respectively. Age-specific prevalence of overall thinness and different grades of thinness did not show any definite age-related trend among the subjects. The age-specific prevalence of overall thinness was found to be highest at 14 years (42%), while the lower incidences were observed at 11 years (28.08%). The prevalence of mild thinness ranged from 17.98% (at 12 years) to 20.22% (at 11 years). The prevalence of moderate thinness ranged from 3.37% (at 11 years) to 18% (at 14 years). The prevalence of severe thinness ranged from 2.24% (at 12 years) to 6.25% (at 13 years). In the present study, prevalence of mild (grade-I) thinness was found to be higher compared to other grades of thinness. This is consistent with the findings of Bovet et al. (2011), Das and Bose (2011a, 2011b), Mondal (2014) and Suder et al. (2020), Biswas et al. (2021).

The distribution of prevalence of thinness among different socio-economic parameters and chi-square test results is presented in *Table 2.* The prevalence of thinness was found to be less in adolescent girls of lower age-groups (11-12 years) compared to those of higher age-groups (13-14 years), though these differences are statistically insignificant. More subjects with higher birth order (≥3) were suffering from thinness as compared to subjects having comparatively lower birth order, which is statistically significant. Chi-square test results revealed that the prevalence of thinness was found to be statistically significant in different categories of birth order (chi-value= 10.936; $p<0.001$), father's occupation (chi-value= 10.158; $p<0.01$) and house type (chi-value= 4.340; $p<0.05$). However, it was found to be statistically insignificant among different categories of other factors such as type of family, mother's occupation and drinking water.

The results of the binary logistic regression analysis fitted to estimate the crude odds of being affected by overall thinness with the socio-economic and demographic variables are presented in *Table 3*. The results showed that adolescent girls of higher age groups (13-14 years) exhibited 1.310 times greater odds of being thin than their younger counterparts (e.g. 11-12 years) though statistically insignificant ($p>0.05$). The likelihood of thinness was significantly higher among adolescent girls of higher birth order (≥3) compared to those

Table 2: Prevalence of thinness among the studied sample

Variables		*N (%)*	*Thinness*	*Chi-square*	*p-value*
Age	11-12	178 (60.96)	52 (29.21)	1.111	0.2918
	13-14	114 (39.04)	40 (35.08)		
Birth order	1-2	220 (75.34)	58 (26.36)	10.936	0.0009
	≥3	72 (24.66)	34 (47.22)		
Family size	Nuclear	198 (67.81)	67 (33.83)	1.549	0.2132
	Joint	94 (32.19)	25 (26.60)		
Drinking water	Untreated	234 (80.14)	78 (33.33)	1.821	0.177
	Treated	58 (19.86)	14 (24.14)		
House type	Bricked (*pucca*)	181 (61.99)	49 (27.07)	4.340	0.037
	Mixed-type(*semi-pucca*)	111 (38.01)	43 (38.73)		
Father's occupation	Low-income	99 (33.90)	36 (36.36)	10.158	0.0062
	Middle-income	102 (34.93)	39 (35.25)		
	High-income	91 (31.16)	17 (18.68)		
Mother's occupation	Unemployed	235 (80.48)	69 (29.36)	2.567	0.1091
	Employed	57 (19.52)	23 (40.35)		

of lower birth order (1-2) (OR= 3.071, 95% CI: 1.151-8.193). This finding is in congruence with the findings of Debnath et al. (2016) and Debnath et al. (2018). One possible explanation could be children with higher birth order might get less attention and care compared to children with lower birth order. A previous report by Raj et al. (2015) claimed a larger number of siblings increased the odds ratio for thinness for girls but not for boys. This could be attributed to gender preferences of the child.

The odds of being thin were significantly 1.703 times higher among adolescent girls living in mixed-type (*semi-pucca)* houses than those living in bricked (*pucca*) houses. Similar observation was reported by Abraham and Anand (2017) who claimed that subjects living in bricked (*pucca*) houses had a better nutritional status than those living in non-bricked (*kutcha*) or mixed-type (*semi-pucca*) houses. A very recent study by Guin et al. (2020) found that adolescent girls of comparable age living in bricked (*pucca*) houses were on an average taller and with higher BMI when compared to those living in mixed-

Table 3: Findings on the binary logistic regression showing associations of socio-economic and demographic variables with thinness

Variables		*Binary logistic regression*		
		Walds	*ODDS*	*95% CI*
Age	11-12®		-	-
	13-14	1.109	1.310	0.793-2.169
Birth order	1-2®		-	-
	≥3	5.020	3.071**	1.151-8.193
Family size	Nuclear®		-	-
	Joint	1.542	1.412	0.819-2.432
Drinking water	Untreated	1.802	1.571	0.812-3.040
	Treated®		-	-
House type	Bricked (*pucca*)®		-	-
	Mixed-type(*semi-pucca*)	4.303	1.703*	1.030-2.818
Father's occupation	Low-income	4.102	1.888*	1.113-2.673
	Middle-income	0.391	1.171	0.713-1.923
	High-income®		-	-
Mother's occupation	Unemployed®		-	-
	Employed	2.539	1.627	0.894-2.962

Values in parentheses indicate percentages; *p<0.05; **p<0.01; ®Reference category

type (*semi-pucca*) and non-bricked (*kutcha*) houses. The type of house is claimed as an important factor affecting nutritional status since it is an indirect indicator of the socio-economic 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. However, contrary to the present study, a very recent study (Bose et al., 2020) in the same area reported adolescent girls living in *pacca* houses bear significant risks of being thin.

The odds of thinness were 1.571 times higher among adolescent girls who drank untreated water from any unimproved source as compared to adolescent girls who drank treated/ purified water. However, the association in this case was found to be insignificant in the present study. Several studies claimed source of drinking water to be a significant factor for determining nutritional status (Gebregyorgis et al., 2016; Chattopadhyay et al., 2019; Pal & Bose, 2019; Shaka et al., 2020; Usman & Gerber, 2020) since impure drinking water acts as carrier for intestinal parasites which results in loss of appetite leading to poor nutritional status. A very recent study (Singh et al., 2019) among children across 640 districts of India found improved source of drinking water has 3% contribution to generate socio-economic inequality in childhood stunting and about 4% contribution in socio-economic inequality in underweight.

With regards to mother's working status, adolescent girls of working mothers were 1.627 times more likely to be thin compared to adolescent girls of non-working mothers but, having said that, the association was found to be insignificant in the present study. Such statistically insignificant association was also reported by a recent study in the same area (Bose et al., 2020). However, studies from other areas (Selvaraj et al., 2016; Pal et al., 2017) found a significant positive association between mothers' working status and prevalence of thinness. Unlike mother's occupation, father's occupation yielded a significant association with thinness in the present study. Adolescent girls whose fathers were involved in low-income occupation had 1.888 times greater odds of thinness compared to those whose fathers were involved in high-income occupations ($p<0.05$). In many cultures of Asia, father is considered as the significant earning head who usually contributes his income to his family. Economic inequality is an independent determinant for childhood and adolescent under-nutrition and a number of studies have illustrated that the children and adolescents whose fathers are doing manual jobs e.g., daily worker, mason, carpenter, driver, etc., are at higher risk of being undernourished compared to those whose fathers are doing non-manual jobs e.g. services, business, etc. (Alom et al., 2012; Gupta et al., 2015). This could be attributed to the higher uncertainty in the manual jobs compared to non-manual jobs.

Type of family is an important determinant for thinness. Though statistically insignificant, the present study found that adolescent girls reared in joint families were 1.527 times more likely to be thin compared to those reared in nuclear families. Previous studies have confirmed that nuclear families are less likely to have undernourished children and adolescents compared to joint families (Bhattarai & Bhusal, 2019; Nath et al., 2019). Parents' education (either or both) has been shown to be positively associated with child growth and nutritional status (Biswas et al., 2021; Mishra et al., 2000) but this could not be employed in the present study. The connivance of family type, parents' occupation and parents' education imply the importance of the family characteristics in the causation or predisposition of an individual to under nutrition.

As with the majority of studies, the design of the present study is subjected to few limitations. Firstly, we employed a convenience sample which may not be a representative of the overall adolescent girl population. Secondly, the study was carried out on a small sample size (N=292). Thirdly, as in every cross sectional study, conclusions related to cause and effect could not be drawn. A longitudinal dataset would be better befitted to examine the effect of several socio-demographic factors on nutritional status of adolescent population. Fourthly, several factors acting on adolescent nutritional status such as physical activity and menstruation status of the subjects were not considered in the present study. Lastly, the study findings are based on self-reporting by the adolescent girls, and such findings are likely to suffer from over or under reporting and recall bias.

Conclusion

The nutritional status of the subjects (in terms of thinness) is not impressive. Thinness is an important overlooked phenomenon and there is a necessity to tackle the issue comprehensively. Longitudinal studies in multi-ethnic context must be encouraged in a country like India to reveal several factors associated with thinness.

Conflicts of Interest

The authors report no conflicts of interest. The authors are solely responsible for writing the content of the manuscript.

Ethical Approval

The investigation was conducted in accordance with the ethical guidelines for human experiments, as enacted in the Helsinki Declaration of 2000. Research permission to conduct the present investigation was obtained from the Department of Anthropology, University of North Bengal.

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