Assessment of Nutritional Status Among School Going Adolescent Boys of Paschim Medinipur and Jhargram District, West Bengal, India

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ABSTRACT

Introduction: The transitional phase between puberty and adulthood, also known as adolescence, is a critical phase contributing to the growth and overall development of a human being. Also, most of the physical and psychological changes occurs during this period. Adolescence is an intense anabolic period when requirements for all nutrients increases.
Objectives: A cross-sectional study based on age-group (years) was undertaken to determine the prevalence of thinness and the association between thinness and socio-economic status of school going adolescent boys in Paschim Medinipur and Jhargram district.
Methods: A total of 516 adolescent school boys from three different schools (Gurguripal High School and Siramani Birsha Munda High School from Medinipur Sadar block, Paschim Medinipur district and Andharia Rajballav High School from Binpur-I block, Paschim Medinipur (now Jhargram district) district) were measured. The present study assessed their nutritional status by using BMI Z-score. Data on socio economic status like monthly income, father's occupation and mother's occupation were collected verbally.
Results: BMI distribution of present study population showed a significance difference ($t = -20.706$, $p<0.001$) and maintained a distance with age specific median value of WHO reference population. The overall (age combined) prevalence of thinness was 26.16% (135), and 73.84% (381) were normal respectively and there was no prevalence of overweight or obesity. Higher prevalence of thinness was observed among studied participants belonging to higher age groups (years) as compared to other age groups. The present investigation found that the family income, father's occupation and mother's occupation of studied subjects were associated with their nutritional status in terms of thinness.
Conclusion: From the present study we can conclude that a moderately high prevalence of thinness was present among the school going adolescent boys and this was indicative of major nutritional deficiency.

Key words: Adolescent boys, Adolescence period, Thinness, Socio-economic status

INTRODUCTION

Adolescence period is very crucial since these are formative years in the life of an individual when major physical, psychological and behavioral changes take place (Banerjee et al., 2011). The worlds adolescent population, comprising of 1200 million individuals, or 19.00% of the total population of the world are in a verge of serious nutritional challenges which is not only limited to affecting their growth and development, but also their general livelihood as adults (Kotecha et al., 2009). During this period, up to 45.00% of skeletal growth takes place, and 15.00% to 25.00% of adult height is attained (WHO, 2005). Adolescence is usually bifurcated into two phases: early adolescence (10–14 years) and late adolescence (15–19 years) (Patton et al., 2016). The early years of adolescence are physiologically dominated by pubertal changes, and sexual maturation and development of adult roles and responsibilities are predominantly seen in the later stages. The nutritional issues in this age group are similar with children and adults with some additional dimensions of puberty, psychological changes, and growth spurt that are crucial for current, future and intergeneration health (Victora et al., 2008). On one hand, poor nutrition can result in a delay or failure in achieving maturation with a stunted linear growth perpetuating the cycle of poverty and intergenerational undernutrition. There is an increased risk of non-communicable diseases (NCDs) on the other hand (Story, 1992). In some low-middle income countries, the nutritional transition that is occurring in some population groups are resulting in a double burden of overweight and obesity, along with the existing high proportion of undernutrition among other groups (Popkin, 1994; Kapoor & Anand, 2002; Lukito & Wahlqvist, 2006). Inadequate food intake, low nutrient content of the food and frequent infections results in deficiency of macro and micronutrient in the body. For measuring the nutritional status of adolescent, the World Health Organisation (WHO) has recommended the use of low height-for-age (stunting) for indication of chronic undernutrition and low BMI-for-age (thinness) for indication of acute undernutrition (WHO, 1995). Nutritional status among adolescents is a vital determining factor of health outcomes; undernutrition impacts the health status of adolescents. It increases mortality severely and creates long lasting effects on growth, development and physical fitness of survivors (Demilew & Emiru, 2018). Undernutrition is significant in gauging poor nutrition and has major impact on human health as well as social and economic development of the population (Black et al., 2003). Undernutrition still continues to be a major health problem in spite of the economic growth observed in developing countries, (Müller & Krawinkel, 2005). According to recent estimates, the prevalence of thinness among Indian adolescent was 26.70% (31.10% boys and 21.70% girls) (WHO, 2016), and the prevalence of stunting was 34.10% (Bhargava et al., 2020). Studies from two Indian eastern states (Chhattisgarh and Odisha) shows that the prevalence of thinness among adolescent girls aged 10–14 and 15–19 years was 17.10% and 9.60% respectively (Sethi et al., 2019). Another study among 5521 adolescents in rural West Bengal shows that the prevalence of stunting was 23.30% among males and 26.90% among females (Darling et al., 2020). Existing evidence acknowledges that the commonly mentioned factors that influence the nutritional status of the adolescent are socioeconomic status, age, family size, parent's education status, lack of latrine, and poor water supply (Gebregyorgis et al., 2016; Engidaw & Gebremariam, 2019). Undernutrition negatively impacts adolescents by affecting their normal growth and puberty development (Lifshitz et al., 1993) and increases the risk of infectious diseases (Dobner & Kaser, 2018). It is also associated with lower educational achievement and income status in adulthood (Victora et al.,

2008). Though adolescents are expected to be in good health, however inadequate diet and unfavorable environments in developing countries may adversely influence the growth and nutrition of the adolescents (WHO, 1995). Lower socio-economic status may cause domestic crowding, a condition that negatively impacts both adults and children, including higher psychological stress and poor health outcomes (Melki et al., 2004). Drive for thinness during the critical developmental years may exert long-term effects on adulthood eating behaviors tied to greater weight gain, potentially reflecting an important early target of intervention (Laraia et al., 2021).

There is very little work on adolescents in the southern part of West Bengal. The present study aims to evaluate the prevalence of thinness and the association between thinness and socio-economic status of school going adolescent boys in Paschim Medinipur and Jhargram districts.

MATERIALS AND METHODS

The present study was a cross-sectional study among 516 adolescent boys aged 10-17 years. All the participants were from rural area and they were selected from grades 5 to 12. The study was carried out in between November 2017 to March 2018. Among them 166 students were from tribal and rest of 350 students were from non-tribal communities. The studied area was situated almost 135 km from the capital of West Bengal, Kolkata. The study was conducted in three different schools, two of them were situated in Paschim Medinipur district and the other one was in Jhargram district. Data were collected from three higher secondary schools, Gurguripal High School, Medinipur Sadar block, Paschim Medinipur district; Siramani Birsha Munda High School, Medinipur Sadar block, Paschim Medinipur district and Andharia Rajballav High School, Binpur-I block, Paschim Medinipur (now Jhargram district) district.

Data were collected after obtaining the necessary approval from the school authorities. Parents of the adolescent boys were informed about the objectives of our study before the commencement of measurement. Information on age (years), ethnicity, socio-economic status were collected using a structured questionnaire. Age (years) of boys was documented from their school records provided by the head masters of schools and also confirmed by their parents.

Anthropometric measurements such as height (cm) and weight (kg) were measured by following the internationally accepted standard techniques (Lohman et al., 1988). Height was recorded with the studied subjects standing erect in a flat platform and head was oriented in the Frankfort horizontal plane from floor to vertex using a Martin's anthropometer rod, nearest to 0.1 cm. The weight was measured wearing minimum cloth and being bare footed with the help of a portable weight scale nearest to 0.5 kg. The BMI (kg/m^2) was computed following the standard formula: BMI = Weight (kg) / Height (m^2). Z- Score of the subjects were calculated by using WHO Anthro plus.

Father's occupation has been categorized as cultivator, Daily labour, Business, Employee and others and mother's occupation were categorized as Housewife, Daily labour, Liquor preparation and others. Based on occupation, "Others" have been classified for those who do not have any fixed occupation. They tend to change the occupation based on their skill and needs.

The statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS 16.0). Independent sample t test, One-way ANOVA and chi-square test were performed. The p-value was considered at <0.05 level**.**

RESULTS

Table 1 presents the age specific mean, standard deviation of BMIZ among the studied subjects. Results revealed that the range of mean BMIZ of all ages is -1.68 to -0.02. A clear significant increase in BMIZ with increasing age (years) was found ($F = 12.43$, $p<0.001$) in the present study. It is noteworthy that in maximum instances of all ages (years), these mean values are less than the 0 Z score or the median value of BMI (kg/m^2) of WHO reference population (WHO, 2007). Except for the 10 year old children, the mean Z scores showed a statistically highly significant ($p<0.001$) distance from 0 Z score of 11 to 17 years WHO reference population. Evidences from Figure 2 demonstrates that BMI distribution of present study population showed a significant difference ($t = -20.706$, $p<0.001$) and maintained a distance with age specific median value of WHO reference population.

Table 2 shows the overall (age combined) prevalence of thinness was 26.16% and 73.84% that were normal respectively. The highest prevalence of thinness was observed at age (years) of 16 years (45.16%) and lowest prevalence of thinness observed in the age (years) of 10 years (4.17%). Other age groups (years) show the prevalence of thinness were 8.82% (in 11 years), 28.57% (in 12 years), 30.53% (in 13 years), 20.83% (in 14 years), 43.94% (in 15 years) and 19.50% (in 17 years) respectively. It was observed that there were no prevalence of obesity and overweight among the studied participants. Higher age group (years) was significantly ($p<0.001$) associated with higher prevalence of thinness.

Table 3 presents father's and mother's educational status wise thinness among the studied subjects. The highest prevalence of thinness was observed in upper primary level of father's education (31.29%) and lowest prevalence of thinness was observed in illiterate level of father's education (20.37%). Prevalence of thinness was observed in students whose father's educational level was primary (22.22%), secondary (26.56%), higher secondary (23.60%) and graduation and above (21.62%).
In case of mother's education, the highest prevalence of thinness was observed in upper primary level of mother's education (29.24%) and lowest prevalence of thinness was observed in illiterate level of mother's education (20.22%). Prevalence of thinness was observed in students whose mother's educational level was primary (27.24%), secondary (26.14%) and higher secondary (24.39%). There was no statically significant association between father's and mother's educational status with thinness of studied subjects.

Table 4 indicates the prevalence of thinness among studied participants by their ethnic groups. The prevalence of thinness was 26.86% among non-tribal student and 24.70% among tribal students. There was no statistically significant association between caste and thinness prevalence among studied subjects.

Table 5 shows the effective role of mother's occupation, father's occupation and family income on the prevalence of thinness among studied students. The highest prevalence of thinness was observed among those subjects whose mothers were involved in liquor preparation (58.82%) and lowest prevalence observed among

those subjects whose mothers were daily laborer (22.97%). In case of mothers who were housewives none of their children showed any signs of thinness. This table shows that there was a highly significant ($p<0.001$) association between thinness and their mother's occupation.

In case of father's occupation, the highest prevalence of thinness was observed in studied subjects whose father's occupation was classified as other (100.0%) and lowest prevalence was observed in studied subjects whose father's occupation was business (13.33%). The prevalence of thinness was also observed in studied boys whose father's occupations were classified as daily laborer (25.00%), employee (27.27%) and cultivation (27.98%). There was a statistically highly significant ($p<0.001$) association between thinness and father's occupation.

In case of family income, the highest prevalence of thinness (40.16%) was observed in lowest income group (<4634.99 Rs. /month) and the lowest prevalence of thinness (9.92%) was observed in highest income group (>7396.00 Rs. /month). There was a statistically highly significant ($p<0.001$) association between thinness and family income.

DISCUSSION

Undernutrition is a significant problem and continues to be a cause of morbidity and mortality among children in developing countries like India (UNICEF, 2006). A study by Cole et al., (2007) states that undernutrition is better assessed as thinness (low BMI for age) than as wasting (low weight for height). In India, the prevalence of child undernutrition varies widely across the states and also across rural and urban areas. Malnutrition among children and adolescents is a major public health problem globally, particularly in developing countries.

The overall (age combined) prevalence of thinness was 26.16% (135), and 73.84% (381) were normal respectively and there was no prevalence of overweight or obesity. Higher prevalence of thinness was observed among studied participants belonging to higher age groups (years) as compared to other age groups. The present investigation found that the family income, father's occupation and mother's occupation of studied subjects were associated with their nutritional status in terms of thinness.

The present study reflects a severe situation of nutritional status among the studied subjects with 26.16% of thinness. A clear significant increase in BMIZ with increasing age (years) has been observed from present study. Present study shows that there was an increased thinness among higher age group (years) students. In this study, we found an association between father's and mother's occupation with thinness and also with family income. The category of 'father's education' have displayed a significant Spearman's correlation with 'mother's education' (r = 0.548, p and lt; 0.001), 'mother's occupation' (r = -0.147, p and lt;0.01) and 'income groups' (r = 0.170, p and lt;0.001). The category of 'mother's education' showed a significant correlation with 'mother's occupation' (r = -0.208, p and lt; 0.001) and 'income groups' (r = 0.216, p<0.001). Father occupation category showed a significant relation with 'mother's occupation' (r = 0.138, p and lt; 0.01) and 'income group' (r = 0.214, p and lt;0.001). Whereas, the correlation between 'mother's occupation' and 'income group' showed a negative significance (r = -0.230, p and lt; 0.001). The present study derived that the maximum prevalence of

thinness was observed among those students whose fathers were involved in occupations classified as others and minimum prevalence of thinness was observed among those students whose fathers were involved in occupation classified as Business in socio-economic status. In case of mother's occupation, the maximum prevalence of thinness was observed in those students whose mothers are involved in liquor preparation and minimum prevalence of thinness was observed among those students whose mothers are daily laborers.

The result shows that, the family income have a major impact on nutritional status (Thinness) of studied participants. The highest prevalence of thinness was observed in lowest income group (<4634.99 Rs. /month) and the lowest prevalence of thinness was observed in highest income group (>7396.00 Rs. /month).

Different previous studies described the thinness of adolescent boys from different parts of India (Bose et.al., 2009; Bisai et.al., 2010; Banerjee et.al., 2011). The comparison of prevalence of thinness among Indian children is presented in Figure 3. In comparison to the present study, most of the studies reported a higher prevalence of thinness such as school children of Bankura District, West Bengal (Bose et al., 2008, 23.1%), school children of Paschim Medinipur and Purulia district, West Bengal (Bose & Bisai, 2008, 44.54%), school children of Purba Medinipur, West Bengal (Chakraborty & Bose, 2009, 62.90%), school children of Dibrugarh district, Assam (Medhi et al., 2006, 53.90%), children of Dibrugarh district, Assam (Medhi et al., 2007, 59.45%), Kora-Mudi tribal children of Paschim Medinipur, West Bengal (Bisai et al.,2010, 67.20%), Santal tribal children of Purulia, West Bengal (Das & Bose, 2011, 41.30%), tribal children of Dibrugarh, Assam (Singh et al., 2013, 23.92%) and Karbi tribal children of Karbi Anglong district, Assam (Mondal et al., 2016, 17.15%).

CONCLUSION

The present study clearly indicates a moderately high prevalence of undernutrition in terms of thinness among school boys aged 10 - 17 years from West Bengal, India. In conclusion, the present analyses indicated that the under-nutrition of adolescent school boys still remains a significant and urgent public health issue in West Bengal. To overcome this problem there is an immediate requirement for appropriate steps such as appropriate diet, regular exercise programs, health awareness programs to develop awareness among the students as well as their parents to be taken to improve nutritional status of the adolescent school boys in West Bengal. Our investigation stated that, the family income, father's occupation and mother's occupation of the studied adolescent school boys are associated with their nutritional status in terms of thinness.

However, it needs to be mentioned here that due to the cross-sectional design of the present study, lack of information related to dietary intake, resource allocations and cultural practices, it was difficult to draw major conclusions and/or identify the actual cause(s) of such higher prevalence of thinness among the adolescent school boys.

This study would help in generating new data which can be used for national and global comparisons. Appropriate health promotion and nutritional intervention policies can be formulated based on the findings of the present study.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Table 1: Descriptive statistics on BMI for age among studied subjects

Age (Years)	N	Mean	SD	t value
10	48	-0.02	1.42	-0.081
11	68	-0.68	1.29	-4.379***
12	63	-1.22	0.98	-9.94***
13	95	-1.47	1.11	-12.845***
14	72	-1.01	1.19	-7.186***
15	66	-1.68	1.17	-11.68***
16	62	-1.66	1.18	-11.03***
17	42	-1.17	1.18	-6.443***
Total	516	-1.16	1.27	-20.706***
ANOVA	F = 12.43, p<0.001			

N= Number of studied subjects, SD= Standard Deviation, ***= p<0.001

Table 2: Age wise distribution of thinness among the studied adolescent school boys

Age (years)	Nutritional status				Total	χ^2
	Thinness	%	Normal	%		
10 years	2	4.17	46	95.83	48	
11 years	6	8.82	62	91.18	68	
12 years	18	28.57	45	71.43	63	
13 years	29	30.53	66	69.47	95	
14 years	15	20.83	57	79.17	72	48.271***
15 years	29	43.94	37	56.06	66	
16 years	28	45.16	34	54.84	62	
17 years	8	19.05	34	80.95	42	
Total	135	26.16	381	73.84	516	

***= p<0.001

Table 3: Prevalence of thinness among studied adolescents based on father's and mother's education

Education status	Nutritional status				Total	χ^2
	Thinness	%	Normal	%		
	Father's education					
Illiterate	11	20.37	43	79.63	54	4.226
Primary	10	22.22	35	77.78	45	
Upper primary	51	31.29	112	68.71	163	
Secondary	34	26.56	94	73.44	128	
Higher secondary	21	23.60	68	76.40	89	
Graduate & above	8	21.62	29	78.38	37	
Total	135	26.16	381	73.84	516	
	Mother's education					
Illiterate	18	20.22	71	79.78	89	2.58
Primary	17	27.42	45	72.58	62	
Upper primary	50	29.24	121	70.76	171	
Secondary	40	26.14	113	73.86	153	
Higher secondary	10	24.39	31	75.61	41	
Total	135	26.16	381	73.84	516	

Table 4: Prevalence of thinness among studied adolescents by their ethnic groups

Ethnicity	Nutritional status				Total	χ^2
	Thinness	%	Normal	%		
Non-tribe	94	26.86	256	73.14	350	0.272
Tribe	41	24.70	125	75.30	166	
Total	135	26.16	381	73.84	516	

Table 5: Prevalence of thinness among studied boys based on father's occupation, mother's occupation and family income

Socio-economic status	Nutritional status				Total	χ^2
	Thinness	%	Normal	%		
Father's occupation						
Cultivator	94	27.98	242	72.02	336	14.231**
Daily labour	21	25.00	63	75.00	84	
Business	8	13.33	52	86.67	60	
Employee	9	27.27	24	72.73	33	
Others	3	100.00	0	0.00	3	
Total	135	26.16	381	73.84	516	
Mother's occupation						
Housewife	108	25.96	308	74.04	416	12.975**
Daily labour	17	22.97	57	77.03	74	
Liquor preparation	10	58.82	7	41.18	17	
Others	0	0.00	9	100.00	9	
Total	135	26.16	381	73.84	516	
Family income						
<4634.99 Rs.	51	40.16	76	59.84	127	34.582***
4635.00-6260.99 Rs.	28	22.22	98	77.78	126	
6261.00-7395.99 Rs.	43	32.58	89	67.42	132	
>7396.00 Rs.	13	9.92	118	90.08	131	
Total	135	26.16	381	73.84	516	

**=p<0.01; ***=p<0.001

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Figure 1: Map of studied area

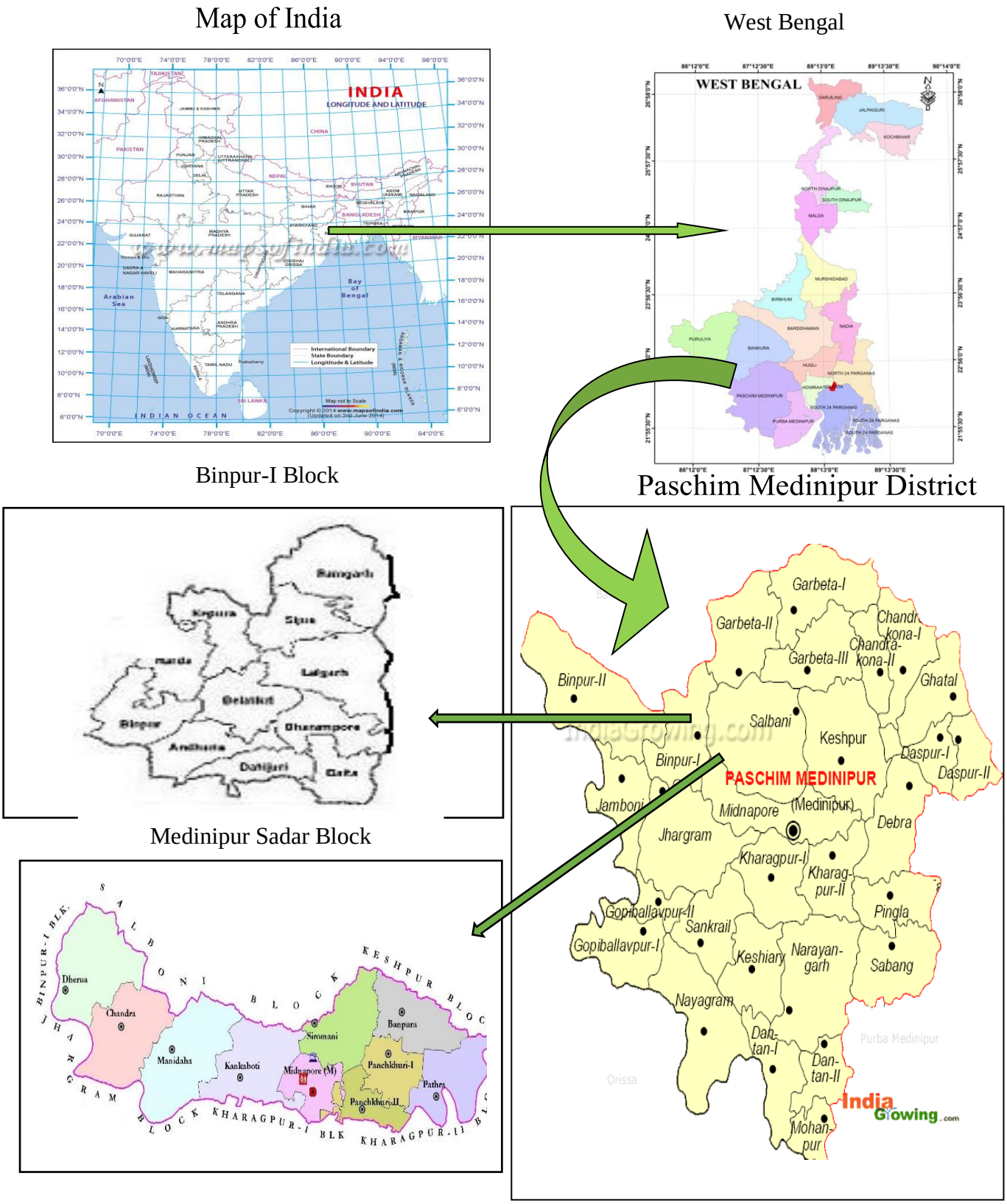

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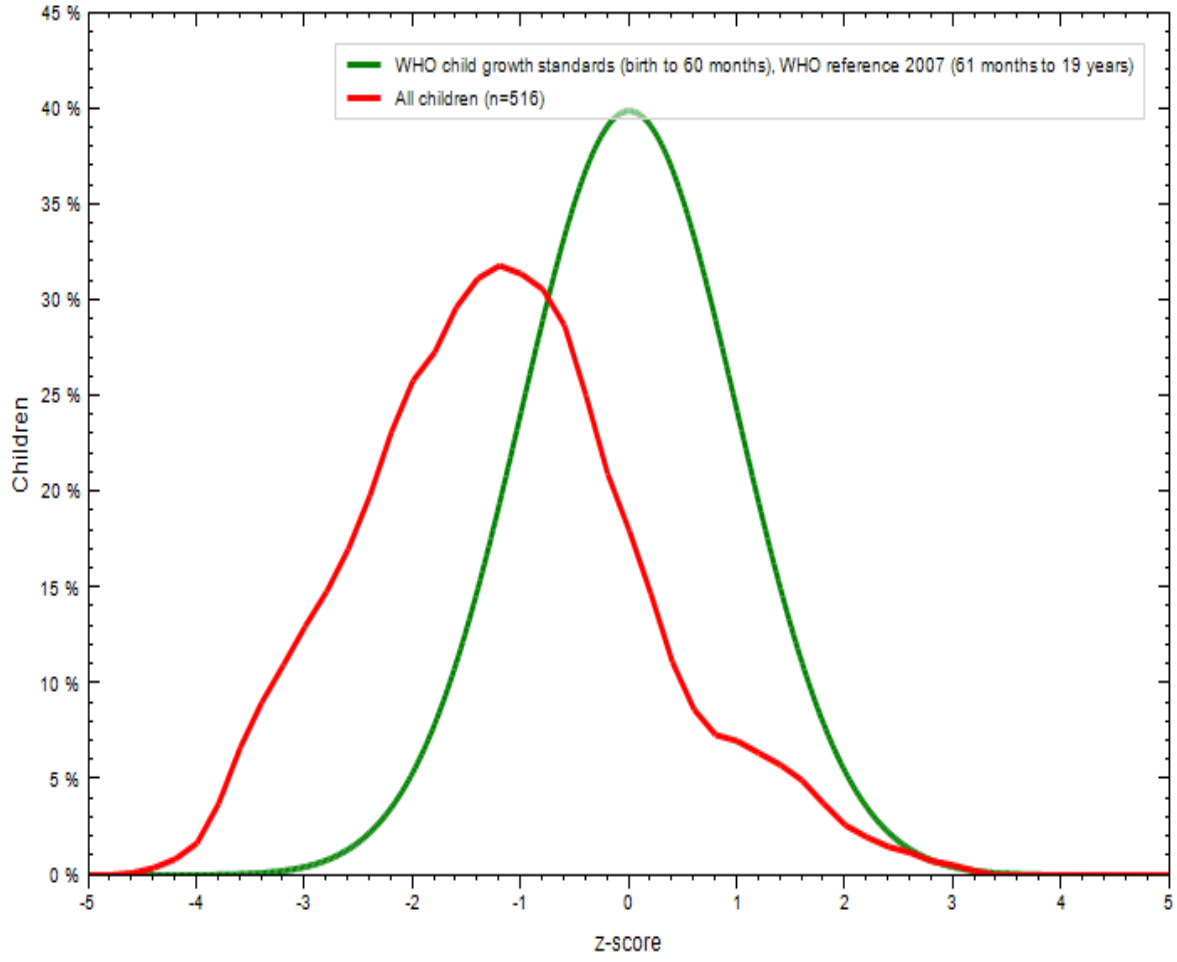
Figure 2: Density plot of WHO reference population and studied subjects



Vol.2 No.2 (2023)
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Figure 3: Comparison of the prevalence of thinness of present study with other Indian studies