Antrocom Online Journal of Anthropology vol. 16. n. 2 (2020) 213-222 – ISSN 1973 – 2880

Antrocom Journal of Anthropology

journal homepage: http://www.antrocom.net

Prevalence of Thinness among tribal preschool children of West Bengal: An assessment measured by BMI cut off points

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KEYWORDS

Anthropometry, BMI, Thinness, Tribal, Preschool children.

ABSTRACT

Thinness is a major underlying problem among tribal preschool children in the developing countries including India. To assess the prevalence of low body weight/ thinness based on age and sex specific new international BMI (proposed by Cole et al.2007) cut-off points, among 2-5 years tribal preschool children of West Bengal, India. A total 643(328 boys and 315 girls) tribal preschool children were studied from 36 villages using the stratified random sampling method. Commonly used indicators, that is, height, weight, and BMI were used to evaluate the nutritional status. The present study revealed that the nutritional status of the studied tribal preschool children was poor with a very high rate of thinness in boys and girls (69.5% and 69.2%, respectively). Significant age differences in mean height, weight and BMI (p= <0.001) among boys and girls were observed. The results of the present study clearly indicate that the nutritional status of these children is unsatisfactory. Very high prevalence of thinness was present among the pre-school children and this was indicative of major nutritional deprivation. The proposed values may be useful in evaluating growth and nutritional status of tribal preschool children. It may also be used for comparisons with other ethnic groups.

Introduction

Preschool children are one of the most nutritionally vulnerable segments of the population. Nutrition during the first five years has not only an impact on growth and morbidity during childhood, but also acts as a determinant of nutritional status in adolescent and adult life. Global comparative data indicate that contrary to common perception, the prevalence of undernutrition (a deficiency of calories or of one or more essential nutrients) is the highest in South Asian children (SCN, 2004). India has the highest occurrence of childhood malnutrition in the world (Bamji, 2003). Several types of nutritional programs are also being run in India, but the result of this progress has failed to improve the nutrition status of the children (Shahnawaz and Singh, 2014).

Preschool children are in the developmental stage (functional) of life any impairment in their growth can reduce physical, mental and intellectual potential. The prevalence of under nutrition is generally considered to be a major public health issue among tribal children and is a principal cause of ill-health condition and leads to causes premature mortality and morbidity among children of the developing countries such as India (Nandy et al., 2005; Svedberg, 2011).It has been estimated that approximately 70 percent of the world's malnourished children live in Asia, and 800 million individuals being reportedly undernourished worldwide, a little under one-third (258 million individuals) are

Please cite this article as: Biswajit Mahapatra and Kaushik Bose. Prevalence of Thinness among tribal preschool children of West Bengal: An assessment measured by BMI cut off points. *Antrocom J. of Anthropology 16-2 (2020) pp. 213-222.*

concentrated in South Asia (Ahmed et al., 2012). Many studies have shown that the tribal populations in India are experiencing a state of under nutrition especially among pre-school children and their nutritional status was assessed by using anthropometric characteristics (Mitra et al., 1993; Kumar et al., 1993; Mitra and Tiwari, 1997; Rao et al., 1994; Rao et al., 2005; Mitra et al., 2007).

Malnutrition is an abnormal physiological condition caused by inadequate, imbalanced or excessive consumption of the macronutrients (carbohydrates, protein and fats) that provide dietary energy and the micronutrients (vitamins and minerals) that are essential for physical and cognitive growth and development. Given recent statistics, undernutrition continues to be the major cause of ill-health and premature mortality and morbidity of the children in developing countries including India (Nandy et al., 2005; Black et al., 2008; Measham et al., 1999; Pelletier DL, 1998). Undernutrition among preschool children may be the result of faulty feeding practices rather than scarcity of the food. It was also assessed that the low status of women and their lack of nutritional knowledge are important determinants of high prevalence of underweight children (Antomy et al., 2008).

Several previous studies have also been undertaken to assess the prevalence rate of thinness among tribal children (Bisai et al., 2010; Das and Bose, 2011; Das et al., 2012; and Mandal and Bose, 2014) from different districts of West Bengal state utilizing the internationally accepted BMI cut offs developed by Cole et al., (2007). Numerous researchers have conducted investigations among tribal children (Sikdar, 2012; Singh and Mondal, 2013; Longkumar, 2013; Singh et al., 2014; Mondal et al., 2016; Singh et al., 2015; Das et al., 2016; Bharthi et al., 2017; and Bartwal, 2017) from different states of India to assess the nutritional status of the children using same cut-offs (Cole et al., 2007). The aim of the present study was to evaluate different grades of thinness using age- and sex specific body mass index (BMI) among tribal preschool children using international cut-off points (Cole et al.,2007).To compare the prevalence of thinness with different tribal and non-tribal preschool children of India.

Materials and Methods

The present community based cross sectional study conducted at 36 different villages of three blocks, among the 643 (328 boys; 315 girls) tribal (Santal and Bhumij)preschool children aged 2 to 5 years. Data were collected from three blocks of two districts (Dantan- I and Keshiary block from Paschim Medinipur district and Nayagram block from Jhargram district). This study was carried out from April, 2018 to February, 2019. Data were collected after obtaining the necessary approval from the village authorities. Parents of the children were informed about the objectives of our study before the commencement of measurement. Information on age, ethnicity, height and weight were collected using a pretested questionnaire by house-to-house visits following interview and anthropometric measurements. Age of children was documented from their birth certificates provided by the nearest Primary Health Centre (PHC) or polio vaccination card provided by the teachers of Anganwadi (an integrated child development program by the Government of India) and also confirmed by their parents. Formal ethical approval was obtained from Vidyasagar University and ICDS authorities before initiation of the study. Anthropometric measurements such as height and weight were made by a trained investigator (BM) following the internationally accepted standard techniques (WHO, 1995). The BMI was computed following the standard formula:

$$BMI = \text{Weight (kg)} / \text{Height (m}^2\text{)}$$

The BMI was used to evaluate the nutritional status of the subjects (Cole et al., 2007). BMI cut-off point was followed to define thinness. The cut-off values are present in Table 1.

Anthropometric Measurements and Assessment of Nutritional Status

Anthropometric measures have been widely used because of its simplicity, reliable, non-invasive, portable, inexpensive and universally accepted technique to assess child undernutrition (WHO, 1995; Bose et al., 2007). Height was recorded with the subject standing erect in a flat platform and head was oriented in the Frankfort horizontal plane from floor to vertex using an anthropometer, 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 prevalence of thinness was assessed using the recently proposed international reference and cut-offs proposed by Cole et al.,(2007). The prevalence of thinness was categories in three categories include Grade I (Mild thinness), Grade II (Moderate thinness) and Grade III (Severe thinness).

Statistical Analysis

The statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS, version, 16.0). The anthropometric variables of weight, height and BMI were depicted using descriptive statistics. Independent sample t-tests were performed to observe the age specific sex differences in mean height, weight and BMI. One-way ANOVA (F test) tests were done to see significant age variations in mean anthropometric values for both sexes. The Chi-square analysis was used to assess the age group wise sex differences in the prevalence of different grades of thinness.

Results

Table 2 and 3 shows that age and sex wise mean and standard deviation of height (cm), weight (kg), and body mass index (BMI in kg/m^2) of the 2-5 years tribal preschool children. The mean height, weight and BMI are found to be higher among boys than girls. There was a significant sex differences found in mean height (only 5years age), weight (only 3years, 5years and age combined), and BMI (only 3 years and age combined) at the level of significance <0.05. The age specific mean values of height and weight were gradually increased with age in both boys and girls. The age specific mean BMI values are gradually decrease with increasing age among boys and girls. Significant age difference was observed in mean height, weight and BMI for boys (height: F=362.50, weight: F= 149.51and BMI: F= 6.75) and as well as girls (height: F= 307.28, weight: F= 117.10and BMI: F= 5.30)at the level of significance<0.001.

Table 4 presents the age and sex wise prevalence of thinness among 2-5 years tribal preschool children of West Bengal. Results revealed that the age combined prevalence of under-nutrition (Grades I, II, III and combined) among boys and girls was 69.5% and 69.2% respectively. Overall, 30.5% boys and 30.8% girls of studied tribal children were found to belong to the normal category. The age-sex specific prevalence of overall thinness was ranged among boys from 66.2 percent (in 5 years) to 74.2 percent (in 3 years) and girls from 61.8 percent (4 years) to 77 percent (3 years). Using χ2-analysis, there is no significant association found between the sex with prevalence of thinness, except 4 years age (χ2= 9.35; p <0.01).Age wise thinness (Grades I, II, III and Overall) are presented in boys and girls separately (figure 1 and 2).

Table 5 show that statistically significant thinness wise mean differences are found in all the anthropometric variables (p <0.001) except height. So, this table clearly indicate that thinness (low BMI for age) directly or indirectly effects the others anthropometric variables of the tribal preschool children.

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).The recent study of Cole et al., (2007) has stated that undernutrition is better assessed as thinness (low BMI for age) than as wasting (low weight for height). Child growth monitoring is universally used to assess nutrition, health and development of individual children, and to estimate the overall nutritional status and health of populations (WHO, 1995). Good quality of nutrition is essential from the very early stages of life for the proper growth, development of young children, and if they do not get a proper diet, it can affect the later period of life and can have short and long-term effects (Singh and Sadhu, 2014). Between 8 to 11 million under five years of age children die each year globally (Singer et al., 2011).

In our study, the mean BMI among boys was 14.21 ± 1.25, and that among girls was 13.92 ± 1.35. The mean BMI significantly decreased with increase of age and it is statistically significant among boys ($F = 6.75, P < 0.001$) and girls ($F = 5.30, P < 0.001$). Similar trends are found in previous study on preschool children (boys and girls) such as, rural preschool children (Bose et al., 2011); Preschool children in rural area (Nayak et al., 2015); Preschool children of North Bengal (Tigga et al., 2015).

Our investigation assessed the nutritional status based on BMI cut offs among tribal preschool children of Jhargram and Paschim Medinipur Districts, West Bengal, India. It was observed from present study that overall prevalence of thinness in our study was 69.4%. The results of the present study clearly indicated that the nutritional situation of tribal preschool children was poor with high rates of thinness of 69.5% and 69.2% in boys and girls, respectively. Age and sex combined category wise high rates of thinness found from grade I (33.3%), to grade II (20.1%) and grade III (16.0%). Similar trends are found in many tribal children studies such as Santal preschool children of Purulia district (Das and Bose, 2011a); Tribal children in Assam (Singh and Mondal, 2013); Karbi tribal children (Mondal et al., 2016) and nontribal children such as Nepali speaking preschool children (Das and Banik, 2011c); Rural Bengalee children of Hooghly district (Pal and Bose, 2020).

High prevalence of thinness is reported in the present study when compared with other tribal studies in India such as Kora-Mudi tribal children of West Bengal (67.2%; Bisai et al., 2010), Santal pre-school children of West Bengal (56.4%; Das et al., 2011a), Santal children of West Bengal(41.3%; Das et al., 2011b), Tribal children in Assam (25.99%; Singh et al., 2013), Bhaina tribal preschool children of Bilaspur (45.45%; Singh et al., 2014), Karbi tribal children of Assam (18.9%; Mondal et al., 2016). Previous tribal children studies have reported high rate of thinness such as Kolam preschool children of Telangana (Bharathi et al., 2015), overall, 72.6% thinness than the present study (Table 6).Nutritional status of the children remains very poor for most of the states, especially in the tribal population and lower socioeconomic groups among urban populations.

It has also been observed that high prevalence of thinness is a major nutritional problem among both tribal and non-tribal pre-school children of the country. It has been estimated that more than half of the children in the age group of below 5 years remained nutritionally affected by thinness (Biswas et al., 2009; Bisai et al., 2010; Mandal et al., 2014) and they require immediate attention in terms of nutritional interventions. Several studies have showed that the tribal children were more vulnerable to being affected by thinness when compared with those from the caste populations (Mondal and Sen, 2010; Sen and Mondal, 2012; Som et al., 2006).

The present study shows very high (69.4%) (critical situation) levels of under-nutrition. To

overcome such problems of under-nutrition more state specific policies should be designed on a priority basis to size the level of under-nutrition among children and improve the nutritional status of children. There are many factors responsible for undernutrition of tribal preschool children. Parents have lack of awareness of their children, no idea about children health, hygiene and nutritional status, they are poor hygienic habits, insufficient food intake, lack of food availability, illiteracy, parity, socio economic and cultural factors, parents' occupation etc (Mandal and Bose, 2013). Therefore, the proper dissemination of knowledge and awareness level related to nutritional requirement, use of energy dense food, feeding practices and appropriate dietary modification among nutritionally vulnerable segments would be helpful to reduced such prevalence. Poor nutritional status among mothers has significant impact/influence on the child including low birth weight, preterm, nutritional deficiency, higher death rate, and so forth which finally contributes in shaping demographic structure of the population (Allen, 2006).

Conclusion

The present study clearly indicates that the high prevalence of undernutrition in terms of thinness among pre-school children aged 2-5 years from West Bengal, India. In conclusion, the present analyses indicated that tribal preschool children under-nutrition still remains a significant and urgent public health issue in West Bengal. The present study revealed that the nutritional status of the preschool children of tribal community of these villages was poor with very high rate of thinness of 69.5% &69.2% in boys and girls. To overcome this problem there is an immediate requirement for appropriate steps to be taken to improve nutritional status of this ethnic group in West Bengal. It is therefore recommended that nutritional supplementation programmes be initiated within this community. 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 tribal children. Our investigation stated that tribal children were experienced very high prevalence of malnutrition. Regular periodic surveillance of growth and nutritional status of children are required for early detection of malnutrition and growth faltering. This specific information is valuable for national nutrition policy planning. It can also serve as a resource and evidence base for information of future research on child health and nutrition interventions of the study area. Community specific intervention programs should be recommended to fight with the problem of malnourishment.

The results of the present study undoubtedly shall be useful for policy makers in their endeavour to formulate various developmental and healthcare programmes and appropriate nutritional interventions and proper monitoring of the ongoing intervention programmes. Priority interventions are necessary in terms of appropriate complementary feeding, supplementation with proper balance food, micronutrient, breast feeding promotion and acute undernutrition and related morbidity management.

Acknowledgements *The authors are grateful to the all study participants and CDPO and BDO authorities for their help and cooperation. The authors are thankful to the Vidyasagar University for instrumental and logistic support.*

Author's contributions *BM carried out data acquisition, dataset tabulation, statistical analysis and draft the manuscript. KB helped to designed the study, analysed the data and finalized the manuscript.*

Conflict of Interests *Authors declare no conflict of interest regarding authorship and/or publication of the manuscript.*

Source of funding *The present research is a part of the PhD work conducted under the supervision of Kaushik Bose, faculties of Department of Anthropology, Vidyasagar University. Financial and logistic support was provided by the University and Anthropological Survey of India.*

Ethical clearance *Ethical clearance was obtained from the Institutional Ethical Committee prior to conduct the research work.*

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Pictures

Figure No. 1: Prevalence of Thinness among tribal preschool children (boys).

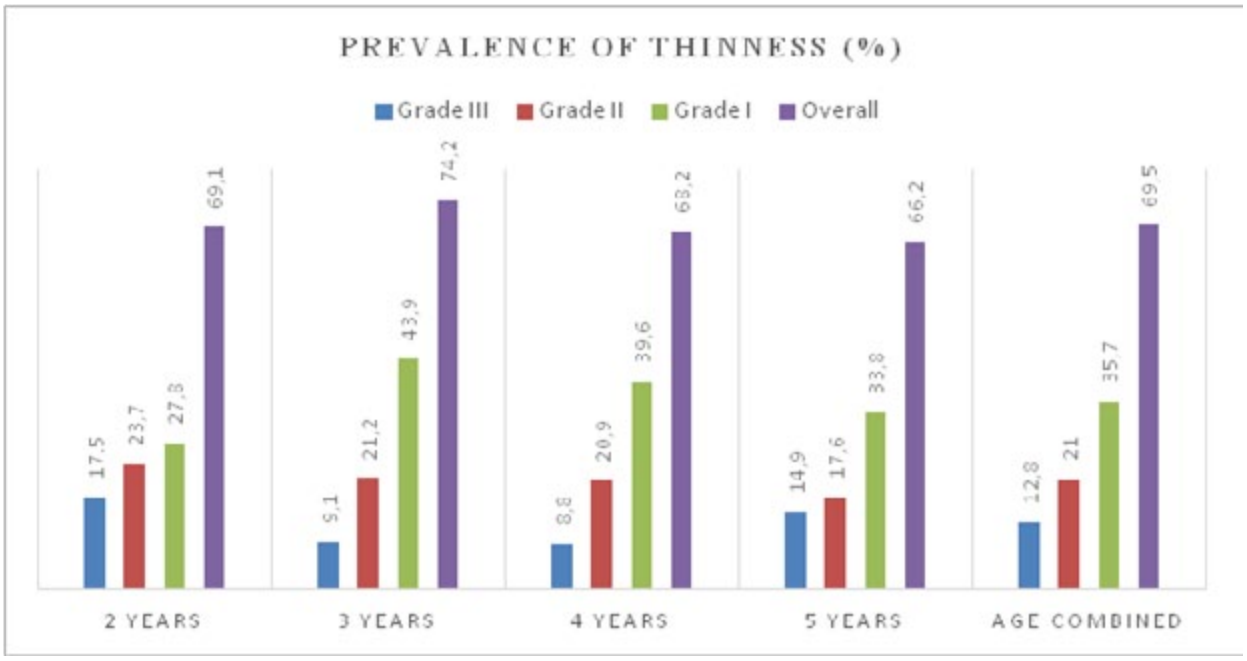

Figure No. 2: Prevalence of Thinness among tribal preschool children (girls)

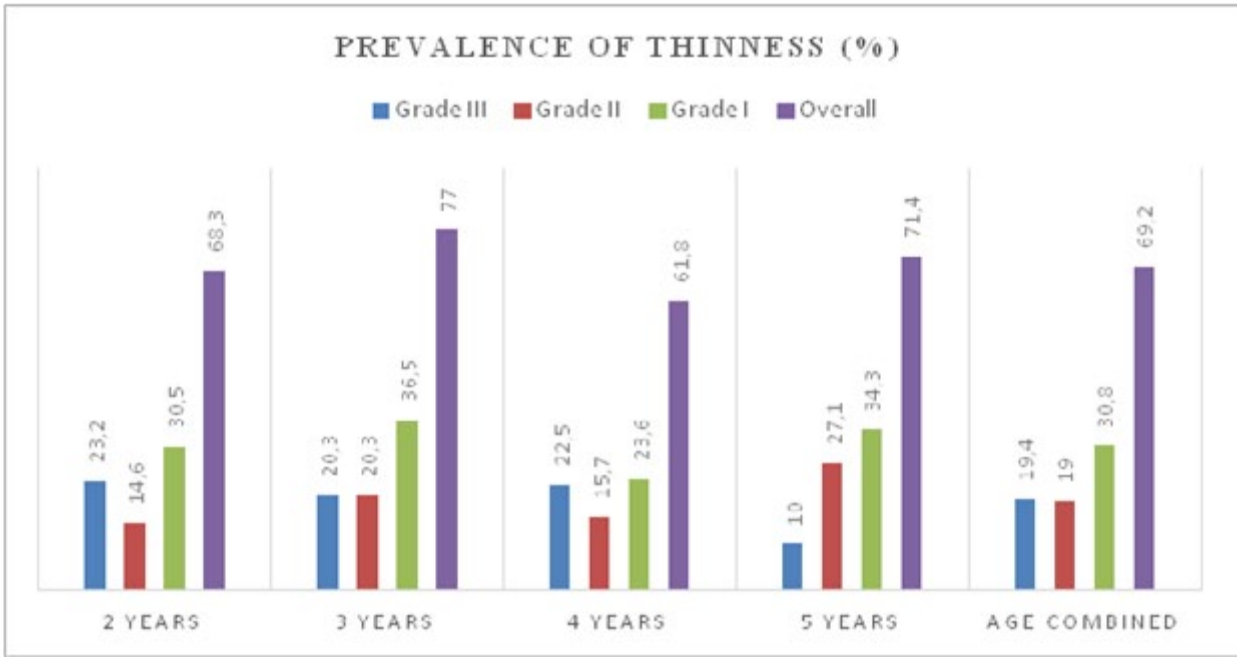

Table 1. Age and sex specific internationalCut Off points of BMI (kg/m2) for assessing thinness among children (based on Cole et al., 2007)

Age in years	Boys thinness			Girls thinness		
	Grade-III(<16.0)	Grade- II (16- 16.9)	Grade- I (17-18.5)	Grade- III (<16.0)	Grade- II (16- 16.9)	Grade- I (17-18.5)
2	13.37	14.12	15.14	13.24	13.90	14.83
3	13.09	13.79	14.74	12.98	13.60	14.47
4	12.86	13.52	14.43	12.73	13.34	14.19
5	12.66	13.31	14.21	12.50	13.09	13.94

All values are in kg/m^2.

Table 2.Age specific sex differences of Height and Weight among tribal preschool children

Age in years	Sample size Boys		Height			Weight		
			Girls	t- value Mean (SD)	Boys	Girls	t- value Mean (SD)	
	Boys	Girls	Mean (SD)			Mean (SD)		
2	97	82	84.50 ±4.39	83.36 ±3.85	1.85 ^{NS}	10.42 ±1.52	10.00 ±1.34	1.93^{NS}
3	66	74	92.52 ±4.42	91.85 ±4.94	0.85 ^{NS}	12.33 ±1.50	11.78 ±1.74	2.00 *
4	91	89	99.28 ±4.24	98.92 ±4.55	0.55 ^{NS}	13.92 ±1.60	13.53 ±1.88	1.49^{NS}
5	74	70	105.45±4.49	103.91 ±4.63	2.02 *	15.32 ±1.76	14.66 ±1.61	2.32 *
Age combined	328	315	94.94 ±9.09	94.32 ±8.90	0.88 ^{NS}	12.88 ±2.46	12.46 ±2.41	2.21 *
ANOVA (F test)			F=362.50***	F=307.28***		F=149.51***	F=117.10***	

** means p <0.05, ***means p <0.001, N.S= Not significant.*

Table 3.Age specific sex differences of BMI among tribal preschool children

Age in years	Boys			Girls			t- value
	N	Mean	SD	N	Mean	SD	
2	97	14.54	1.38	82	14.38	1.55	0.71^{NS}
3	66	14.39	1.33	74	13.92	1.37	2.05 *
4	91	14.10	1.09	89	13.78	1.22	1.82^{NS}
5	74	13.75	1.01	70	13.57	1.11	1.00^{NS}
Age combined	328	14.21	1.25	315	13.92	1.35	2.76 **
ANOVA	F=6.75***			F=5.30***			

** means p <0.05, **means p <0.01, ***means p <0.001, N.S= Not significant.*

Table 4. Prevalence of age and sex wise nutritional status/ thinness among studied tribal children according to Cole et al., (2007) cut offs of BMI

Age in years	Sex	Prevalence of thinness				Normal(%)	Sex differences (χ^2)
		Grade- III (%)	Grade- II (%)	Grade- I (%)	Overall (%)		
2	Boys	17 (17.5)	23 (23.7)	27 (27.8)	67 (69.1)	30 (30.9)	χ^2= 2.68^{NS}
	Girls	19 (23.2)	12 (14.6)	25 (30.5)	56 (68.3)	26 (31.7)	
3	Boys	06 (9.1)	14 (21.2)	29 (43.9)	49 (74.2)	17 (25.8)	χ^2= 3.38^{NS}
	Girls	15 (20.3)	15 (20.3)	27 (36.5)	57 (77.0)	17 (23.0)	
4	Boys	08 (8.8)	19 (20.9)	36 (39.6)	63 (68.2)	28 (30.8)	χ^2= 9.35**
	Girls	20 (22.5)	14 (15.7)	21 (23.6)	55(61.8)	34 (38.2)	
5	Boys	11 (14.9)	13 (17.6)	25 (33.8)	49 (66.2)	25 (33.8)	χ^2= 2.02^{NS}
	Girls	07 (10.0)	19 (27.1)	24 (34.3)	50 (71.4)	20 (28.6)	
Age combined	Boys	42 (12.8)	69 (21.0)	117 (35.7)	228 (69.5)	100 (30.5)	χ^2= 5.78^{NS}
	Girls	61 (19.4)	60 (19.0)	97 (30.8)	218 (69.2)	97 (30.8)	
Age & Sex combined		103 (16.0)	129 (20.1)	214 (33.3)	446 (69.4)	197 (30.6)	

***means p <0.01, N.S= Not significant*

Table 5.prevalence of overall thinness (Grade I, II and III) wise difference of anthropometric variables among the tribal preschool children.

Anthropometric variables	Prevalence of thinness			Normal n= 197	F value	p value
	Grade III n= 103	Grade II n= 129	Grade I n= 214			
Height	93.15 ±9.24	95.00±8.99	94.80±8.45	94.99 ±9.44	1.13 NS	.335
Weight	10.83 ±2.07	12.04 ±2.06	12.66 ±2.00	14.05 ±2.48	54.18***	.000
Head circumference	45.34 ±1.64	46.33 ±1.37	46.35 ±1.81	46.90 ±1.81	18.93***	.000
Neck circumference	21.09 ±0.93	21.61 ±1.00	21.85 ±0.95	22.32 ±1.19	33.89***	.000
Mid upper arm circumference	12.76 ±0.75	13.29 ±0.79	13.53 ±0.76	14.14 ±0.93	71.10***	.000
Chest circumference	45.66 ±2.45	46.69 ±2.83	47.64 ±2.50	48.59 ±2.76	31.75***	.000
Thigh circumference	22.69 ±2.11	23.14 ±2.13	23.69 ±2.08	24.80 ±2.26	27.54***	.000
Medial calf circumference	16.99 ±1.36	17.50 ±1.25	17.87 ±1.24	18.60 ±1.53	36.78***	.000
Biceps Skin fold	4.68 ±0.83	4.74 ±0.77	4.88 ±0.84	5.24 ±0.90	14.13***	.000
Triceps Skin fold	6.83 ±1.22	7.23 ±1.11	7.35 ±1.09	7.72 ±1.14	14.57***	.000
Sub scapular Skin fold	5.88 ±0.86	6.07 ±0.87	6.33 ±0.98	6.78 ±1.01	25.08***	.000
Supra iliac Skin fold	4.61 ±0.85	4.53 ±0.87	4.72 ±0.94	5.18 ±1.05	15.89***	.000
Medial calf Skin fold	7.56 ±1.26	7.56 ±1.20	7.80 ±1.11	8.20 ±1.02	11.58***	.000
Elbow girth	3.63 ±0.26	3.76 ±0.26	3.82 ±0.27	3.95 ±0.30	32.73***	.000
Body mass index	12.40 ±0.57	13.27 ±0.34	14.02 ±0.44	15.52 ±1.08	527.86***	.000

****means p <0.001, N.S= Not significant.*

Table 6. Comparison of the prevalence of thinness of present study with other tribal studies fromIndia (Thinness evaluation method as per Cole et al., 2007 cut-offs).

Study children	Study area	Age groups in year	Sample size (n)	Prevalence of thinness			References
				Boys	Girls	Overall	
Kora-Mudi tribal children	Paschim Medinipur, West Bengal	2-13	119	67.8	66.7	67.2	Bisai et al., 2010
Santal preschool children	Purulia, West Bengal	2-6	251	59.5	53.3	56.4	Das et al., 2011(a)
Santal tribal children	Purulia, West Bengal	7- 18	421	-	-	41.3	Das et al., 2011(b)
Tribal children in Assam	Dibrugarh, Assam	6-18	1343	28.08	23.92	25.99	Singh etal., 2013
Bhaina female tribe	Bilaspur	2-5	11	-	45.46	45.45	Singh et al., 2014
Kolam preschool children	Adilabad district, Telangana	2-5	284	72.91	72.14	72.6	Bharathi et al., 2015
Karbi tribal children	Anglong district, Assam	5- 12	480	17.15	20.75	18.9	Mondal et al., 2016
Tribal preschool children	Jhargram & Paschim Medinipur	2-5	643	69.5	69.2	69.4	Present study