



A CROSS SECTIONAL STUDY OF NUTRITIONAL STATUS AMONG THE BOYS AND GIRLS OF MOST PRIMITIVE AND SMALLEST TRIBE IN THE NORTH-EASTERN INDIA

Anusree Sankar Sahu¹, Nirmalya Kumar Sinha^{2,3}, Arindam Dey¹, Sujata Maiti⁴, Sovanjan Sarkar⁵, Sandip Chattopadhyay*¹

¹Department of Biomedical Laboratory Science and Management, Vidyasagar University, Midnapore, West Bengal, India

²Department of Nutrition, Raja Narendra Lal Khan Women's College (Autonomous), Midnapore, West Bengal, India

³Department of NSS, Raja Narendra Lal Khan Women's College (Autonomous), Midnapore, West Bengal, India

⁴Department of Nutrition, Vivekananda Mission Mahavidyalaya, Chaitanyapur (Haldia), Purba Medinipur, West Bengal, India

⁵Department of Anthropology, Vidyasagar University, Midnapore, West Bengal, India

*Corresponding author: sandipdoc@yahoo.com

ABSTRACT

Toto tribe is the smallest tribal community in the North-Eastern India with only 1531 members. This study was conducted to determine the nutritional status of children and adolescents belonging to the Toto tribes. A total number of 228 children and adolescents (boys=120, girls=108) aged 6-17 years living in mono-ethnic Village of Totopara at West Bengal in India, which has been included in the present study. The height, weight, mid-upper arm circumference were measured and nutritional status was evaluated using internationally recognized age and sex specific BMI cut-off points. The prevalence of chronic energy deficiency (CED) and overweight among the Toto children and adolescents of the present study was 21.93% and 1.75% respectively. The girls (25.93%) were 1.559 times [OR 1.559; 0.229-2.932 & RR=1.246; 0.928-1.673] more prone to CED than the boys (18.33%). The tendency of prevalence of CED was lower among the higher ages of girls excepts the age of 11 to 13 years, the menarche associated physiological and reproductive stress may be responsible behind higher CED among the girls. The health and nutritional awareness and the up-gradation of education in this population may help them grow healthy.

Keywords: Adolescents, Children, Nutritional status, Totopara, Toto tribe.

1. INTRODUCTION

Toto, a primitive Mongoloid tribal community of West Bengal, is the smallest tribe in North-Eastern India [1, 2]. They live in a mono-ethnic village Totopara, which is a small Himalayan hamlet located in a border area of Jalpaiguri District of West Bengal and Bhutan [3]. So far as the information gathered till date on the basis of the evaluation of Indian census (2011) this endangered community is suffering from scanty existing population with only 1387 members among which the females are 649 and male are 737 [4]. The alarming condition of this group started to improve after independence to the implementation of different types of developmental schemes that resulted in better survival of this tribal community along with the growing numbers of family members [1]. In comparison with the first census of the post-independence period (1951) there was only 321 Totos and there was an increase of population 4.76 times in 2015 where the record was showing existence of 1531

members [5]. The spoken language of the Toto is originated from the Tibeto-Burman language which is announced 'critically endangered' by UNESCO in accordance to the language vitality index. This language is the local dialect which is popularly known as 'Dengaka' [5]. Till date there is a paucity of information regarding the extensive study on Toto tribes although few studies were carried out.

In a recent study on the diet and nutritional status of adolescent tribal population in nine states of India found that about 63% of adolescent boys and 42% of girls were undernourished [6]. Though, Kulkarni et al. has specified that nutritional status among tribal adolescent girls is very poor [7]. While, Rose-Clarke et al. in their descriptive cross-sectional community-based study in rural eastern India showed that the prevalence of thinness was 14% for younger girls and 6% for older girls [8].

According to the study of Sengupta there is higher numbers of underweight Toto women and Toto men are

existing [1, 2]. Actually there is a lacuna, regarding the information of nutritional status of Toto children and adolescence. It is imperative to know the actual physical and nutritional status of the Toto community. Here we have taken an effort to explore the nutritional status of the Toto children and adolescent boys and girls.

2. MATERIAL AND METHODS

2.1. Study design

The present community based cross-sectional study was carried out in Totopara of Jalpaiguri District.

2.2. Area under Study

The dwelling place of Totos is popularly known as Totopara composed of six villages (Panchayatgaon, Mandolgaon, Subbagaon, Mitrangaon, Pujagaon and Dumchigaon). Actually, it is located on twenty-two kilometer away from Madarihat having the geographical location 89°20' E and 26°50' N with an area about 8.08 km²[9]. The Totos live in the northern end of Jaldapara National Park. Totopara is surrounded by the foothills of Bhutan to the north which is connected with the rivers of Torsha, Titi and Hauri.

2.3. Human Participants

Children and adolescents aged 6-17 years belonging to Toto tribes were included in this study. The minimum estimated sample size was 146 calculated using the standard formula: $n = (z^2 pq) / d^2$

The calculation $[(1.96^2 \times 0.413 \times 0.587) / (0.08^2)]$ was based on 41.3% prevalence (p) of thinness (CED) in community-based surveys with desired precision (d) of $\pm 8\%$ [10-12]. Where, $z = 1.96$ and $q = p - 1$ [12]. A total of 228 (boys=120) children and adolescents aged 6-17 years belonging to Toto tribes were included in the present study. Age of the subject was considered to the nearest whole number. Thus, the appropriate (to the nearest whole age) cut-off values were utilized.

2.4. Study duration

This study was conducted from October 2018 to January 2019.

2.5. Ethical Issues

The current research topic had been approved by the Human ethics committee of Vidyasagar University following the guidelines of ICMR within which the study was conducted. A written consent was taken from the

respective mothers of the children before conducting the study.

2.6. Anthropometric Assessment

The questionnaire was prepared based on demographic information, anthropometric data and personal hygiene. The children and adolescents were identified by name, age and sex. The date of birth was noted from the hospital record. The anthropometric parameters including the height and weight of the children and adolescents were measured using standard techniques [13]. The reading of height and weight were recorded to the nearest 0.1 cm and 0.5 kg respectively. Body mass index (BMI) was computed using the following standard equation [14]:

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

Nutritional status was evaluated using internationally recognized age and sex specific BMI cut-off points [15, 16]. The underweight boys and girls were further divided into three group according to their severity as Chronic Energy Deficiency Grade (CED) III/ Thinness Grade-III, CED Grade II/ Thinness Grade-II, and CED Grade I/ Thinness Grade-I. MUAC of the participants was measured with a rigid measuring tape and recorded to the nearest 0.1 cm [14]. Body fat percentage (PBF) was calculated from BMI using the age specific standard equation [17].

2.7. Statistical tests

One-way ANOVA (F value) was undertaken to test for age differences in mean height, weight, BMI, MUAC and PBF. Student's 't' tests were done in the present investigation to study the difference in the said parameters among the boys and girls. Chi square tests were performed to find out the association between gender and nutritional status. Product moment correlation coefficient (r) between age level and different anthropometric parameters were determined. Data processing and statistical analyses were done using the SPSS software package (Version 16.0). The p value of <0.05 was considered statistically significant.

3. RESULTS

Mean and standard deviation of height, weight, BMI, MUAC and PBF of 6-17 years children and adolescents belong to Toto tribes was presented in Table 1. It indicated that height, weight and MUAC were gradually increased with age in both boys and girls and the ANOVA test showed a significant age difference ($P < 0.001$). But the mean height of the girls of 14 years was lower than that of in 13 years while MUAC of the girls of 12 and 13

years were lower than the MUAC of the 11 years. The study also indicated that in most of the age group the girls were taller than the boys of that age group and in the age group of 12 and 14 years the girls were significantly taller ($P<0.05$) than the boys while in the age of 17 years boys were significantly taller ($P<0.05$) than the girls. This

study also indicated that the boys were heavier in lower age group than the girls. In the age group of 8 and 11 years BMI was significantly ($P<0.05$) lower among the girls than the boys but in the age group of 17 years the opposite results was noted i.e., BMI was significantly ($P<0.05$) higher among the girls than the boys.

Table 1: Mean and standard deviation of height, weight, BMI, MUAC and PBF of 6-17 years children and adolescents belong to Toto tribes

Girls						
Age (years)	N	Height (cm)	Weight (kg)	BMI (kg/m^2)	MUAC (cm)	PBF
6	5	112.54 $\pm$ 4.55	18.20 $\pm$ 2.49	14.32 $\pm$ 1.26	15.00 $\pm$ 2.15	18.82 $\pm$ 1.90**
7	9	119.50 $\pm$ 3.71	20.06 $\pm$ 2.70	14.06 $\pm$ 1.90	16.06 $\pm$ 2.14	17.72 $\pm$ 2.87
8	5	123.36 $\pm$ 2.54	21.80 $\pm$ 1.92	14.33 $\pm$ 1.17*	16.50 $\pm$ 1.50	17.43 $\pm$ 1.77
9	10	128.51 $\pm$ 6.61	24.95 $\pm$ 3.59	15.06 $\pm$ 1.37	17.80 $\pm$ 1.55	17.84 $\pm$ 2.07**
10	12	134.00 $\pm$ 6.71	27.08 $\pm$ 3.90	15.04 $\pm$ 1.54	18.96 $\pm$ 3.90	17.11 $\pm$ 2.33***
11	7	142.31 $\pm$ 8.35	29.14 $\pm$ 3.67*	14.45 $\pm$ 1.96**	20.64 $\pm$ 2.44	15.52 $\pm$ 2.96
12	17	143.48 $\pm$ 5.34*	33.88 $\pm$ 4.74	16.43 $\pm$ 1.82	21.35 $\pm$ 3.24	17.81 $\pm$ 2.75
13	10	145.09 $\pm$ 4.65	36.75 $\pm$ 4.33	17.44 $\pm$ 1.61	21.21 $\pm$ 2.28	18.63 $\pm$ 2.43**
14	4	149.93 $\pm$ 2.52**	39.13 $\pm$ 5.75	17.36 $\pm$ 2.02	23.00 $\pm$ 1.41	17.81 $\pm$ 3.05
15	9	152.48 $\pm$ 5.64	47.06 $\pm$ 9.04	20.18 $\pm$ 3.23	24.16 $\pm$ 1.76	21.37 $\pm$ 4.88*
16	13	155.44 $\pm$ 4.36	50.27 $\pm$ 2.39	20.84 $\pm$ 1.29	24.31 $\pm$ 1.61	23.28 $\pm$ 1.55***
17	7	152.07 $\pm$ 6.65*	52.43 $\pm$ 3.21	22.70 $\pm$ 1.35**	24.43 $\pm$ 2.56	25.76 $\pm$ 1.62***
ANOVA		F=50.668; P<0.001	F=59.770; P<0.001	F=22.431; P<0.001	F=13.987; P<0.001	F=10.317; P<0.001
Boys						
Age (years)	N	Height (cm)	Weight (kg)	BMI (kg/m^2)	MUAC (cm)	PBF
6	12	113.24 $\pm$ 3.60	18.21 $\pm$ 3.16	14.11 $\pm$ 1.71	15.83 $\pm$ 1.32	14.91 $\pm$ 2.59
7	11	118.70 $\pm$ 4.74	21.23 $\pm$ 2.62	15.03 $\pm$ 1.25	16.08 $\pm$ 1.09	15.59 $\pm$ 1.89
8	10	120.51 $\pm$ 5.45	22.65 $\pm$ 1.89	15.59 $\pm$ 0.73	16.70 $\pm$ 0.79	15.74 $\pm$ 1.10
9	15	127.62 $\pm$ 3.82	25.60 $\pm$ 2.75	15.69 $\pm$ 1.25	17.87 $\pm$ 1.55	15.19 $\pm$ 1.89
10	12	132.02 $\pm$ 4.24	26.33 $\pm$ 2.57	15.12 $\pm$ 1.46	19.29 $\pm$ 2.44	13.64 $\pm$ 2.21
11	9	137.02 $\pm$ 2.82	33.61 $\pm$ 3.79	17.89 $\pm$ 1.82	20.28 $\pm$ 1.72	17.11 $\pm$ 2.75
12	11	139.01 $\pm$ 4.85	33.73 $\pm$ 5.31	17.37 $\pm$ 1.89	19.63 $\pm$ 1.55	15.62 $\pm$ 2.85
13	10	143.47 $\pm$ 6.91	34.80 $\pm$ 4.42	16.93 $\pm$ 2.04	19.57 $\pm$ 2.22	14.27 $\pm$ 3.09
14	7	140.90 $\pm$ 4.69	37.29 $\pm$ 7.09	18.67 $\pm$ 2.60	21.01 $\pm$ 2.05	16.19 $\pm$ 3.93
15	9	153.24 $\pm$ 6.97	45.44 $\pm$ 6.67	19.27 $\pm$ 1.82	22.49 $\pm$ 2.64	16.40 $\pm$ 2.76
16	6	154.50 $\pm$ 8.67	50.67 $\pm$ 8.43	21.13 $\pm$ 2.29	24.50 $\pm$ 0.77	12.84 $\pm$ 2.75
17	8	161.06 $\pm$ 7.75	52.00 $\pm$ 5.15	20.04 $\pm$ 1.27	24.50 $\pm$ 1.91	11.75 $\pm$ 1.53
ANOVA		F=74.856; P<0.001	F=57.522; P<0.001	F=15.496; P<0.001	F=24.960; P<0.001	F=3.308; P<0.001
Significant sex difference is considered as *P<0.05; **P<0.01; ***P<0.001						

Percentage distribution of nutritional status of 6-17 years children and adolescents belong to Toto tribes is presented in Table 2. It was indicated that the prevalence of CED, normal weight and overweight among the girls was 25.93%, 72.22% and 1.85% respectively, while among the boys the prevalence was

18.33%, 80.00% and 1.67%. Though this study found that boys had the higher percentage of the Normal weight individuals but no significant association was noted ($\chi^2=2.659$; $P>0.05$).

Distribution of the BMI (kg/m^2) of the children and adolescents belonging to Toto tribes according to age

and sex was presented in Fig. 1. The scatter plot diagram indicated the tendency of dispersion of the BMI was lower in the lower age group while higher in the higher age group.

Impact of different gradation of BMI on the PBF among the children and adolescents belonging to Toto tribes

was presented in Fig. 2. The mean and standard deviation of the PBF among the CED III, CED II, CED I, Normal and Overweight were 11.52 ± 1.84 , 13.86 ± 1.70 , 14.40 ± 2.18 , 17.74 ± 3.43 and 24.78 ± 7.14 respectively.

Table 2: Percentage distribution of nutritional status of 6-17 years children and adolescents belong to Toto tribes

Nutritional status	Girls	Boys	Sex Combined
CED III	6 (5.56)	5 (4.17)	11 (4.82)
CED II	7 (6.48)	3 (2.50)	10 (4.39)
CED I	15 (13.89)	14 (11.67)	29 (12.72)
Total CED	28 (25.93)	22 (18.33)	50 (21.93)
Normal	78 (72.22)	96 (80.00)	174 (76.32)
Overweight	2 (1.85)	2 (1.67)	4 (1.75)
Total	108 (100.00)	120 (100.00)	228 (100.00)

$$\chi^2=2.659; P>0.05$$

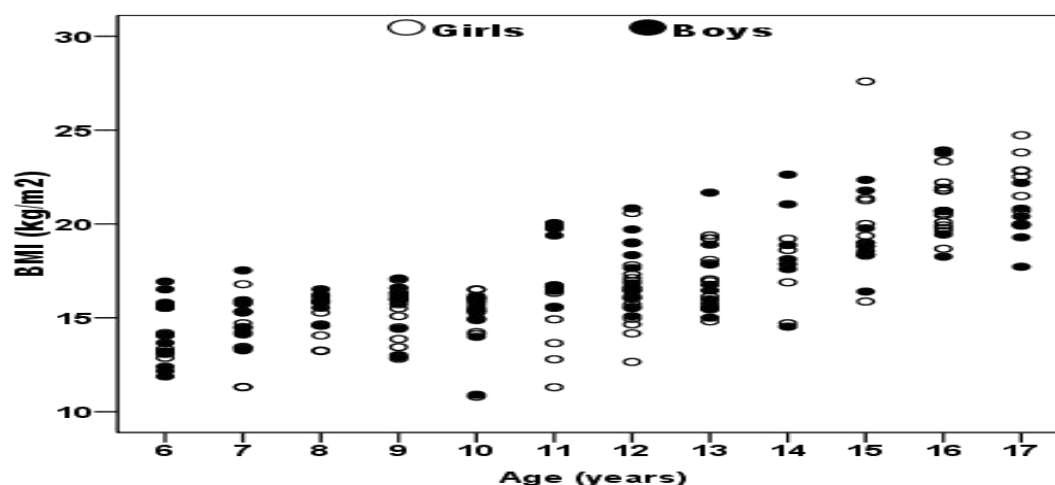


Fig. 1: Distribution of the BMI (kg/m^2) of the children and adolescents belonging to Toto tribes according to age and sex

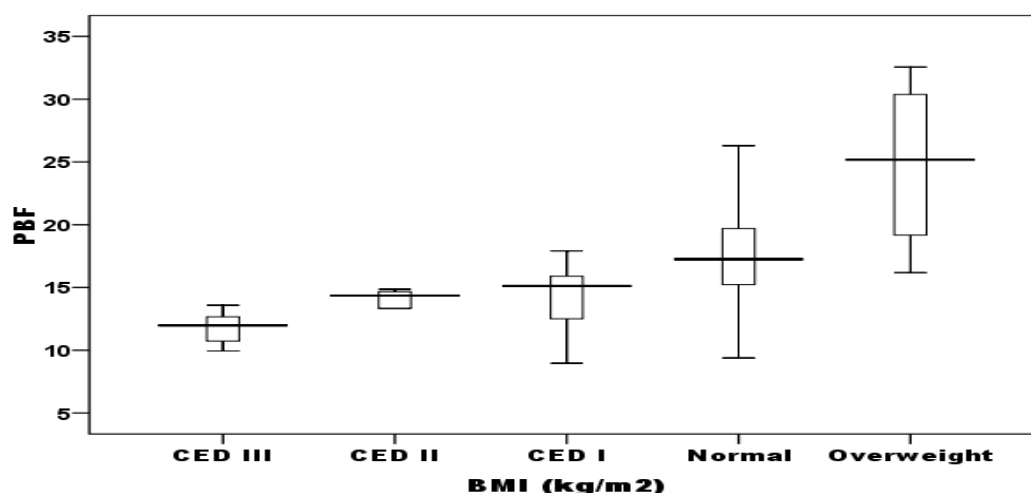


Fig. 2: Impact of different gradation of BMI on the PBF among the children and adolescents belonging to Toto tribes

The study showed that PBF was significantly higher among the overweight and normal weight group than the different CED groups ($F=22.454; P<0.001$). Similarly, the impact of different gradation of BMI on the MUAC (cm) among the children and adolescents belonging to Toto tribes was presented in Fig. 3. The mean and standard deviation of the MUAC among the CED III, CED II, CED I, Normal and Overweight were 18.77 ± 3.15 cm, 19.25 ± 4.70 cm, 17.91 ± 2.63 cm, 20.28 ± 3.49 cm and 24.13 ± 3.20 cm respectively. The study showed that PBF was significantly higher among the overweight and normal weight group than the different CED groups ($F=4.872; P<0.001$).

Prevalence of CED among the children and adolescents

belonging to Toto tribes was presented in Fig. 4. The study showed that girls had higher level of CED than boys and statistically significant at the age of 8 years ($\chi^2=4.615; P<0.05$) and 11 years ($\chi^2=6.859; P<0.01$).

The prevalence of CED and overweight among the children and adolescents belonging to Toto tribes was shown in Fig. 5. The study showed that girls had higher level of CED than boys though statistically not significant ($\chi^2=1.956; P>0.05$).

Correlation between age and different anthropometric parameters was shown in Table 3. The study showed that age was significantly ($P<0.001$) associated with the different anthropometric parameters.

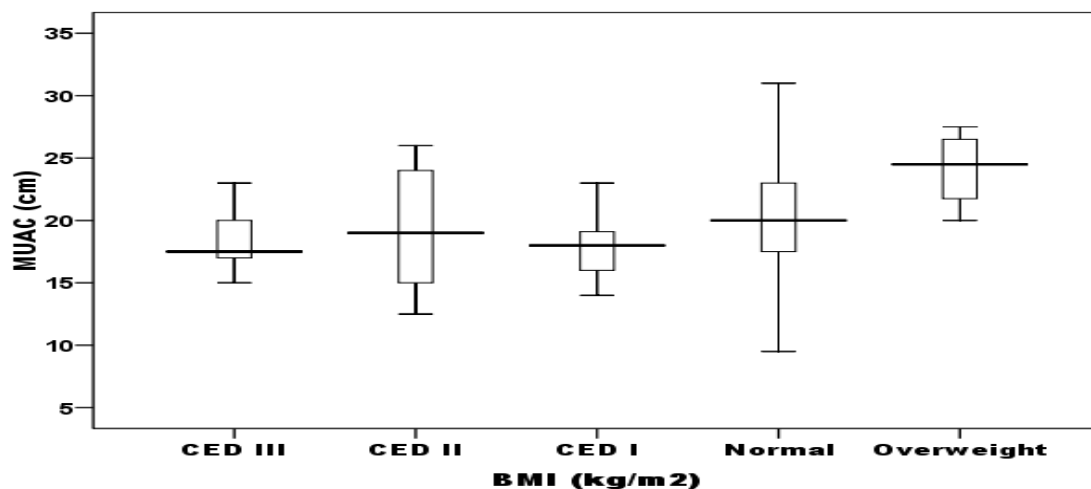


Fig. 3: Impact of different gradation of BMI on the MUAC (cm) among the children and adolescents belonging to Toto tribes

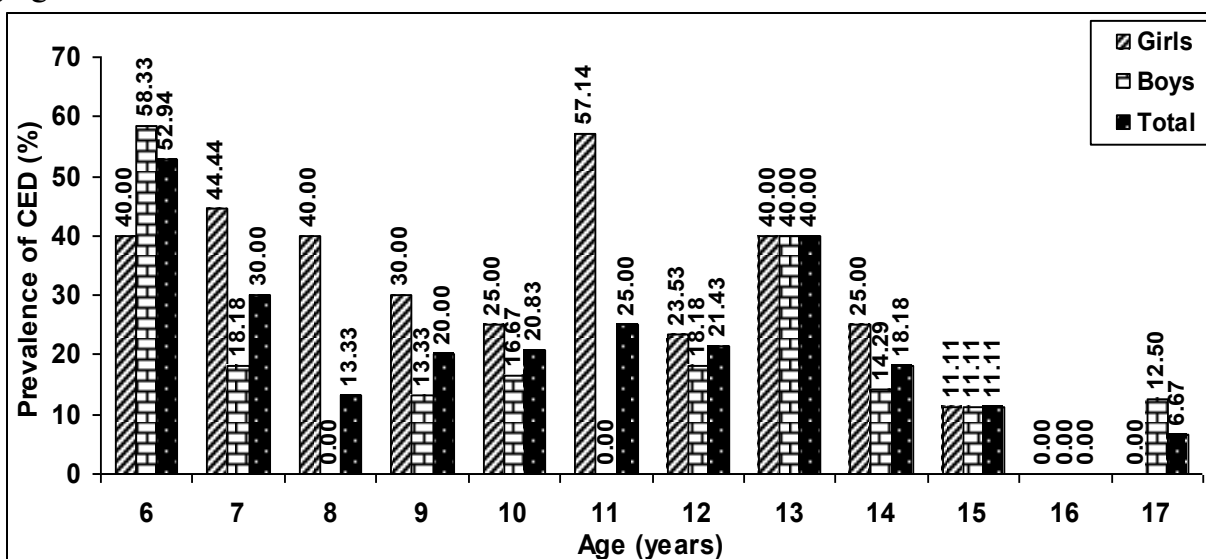


Fig. 4: Prevalence of CED among the children and adolescents belonging to Toto tribes

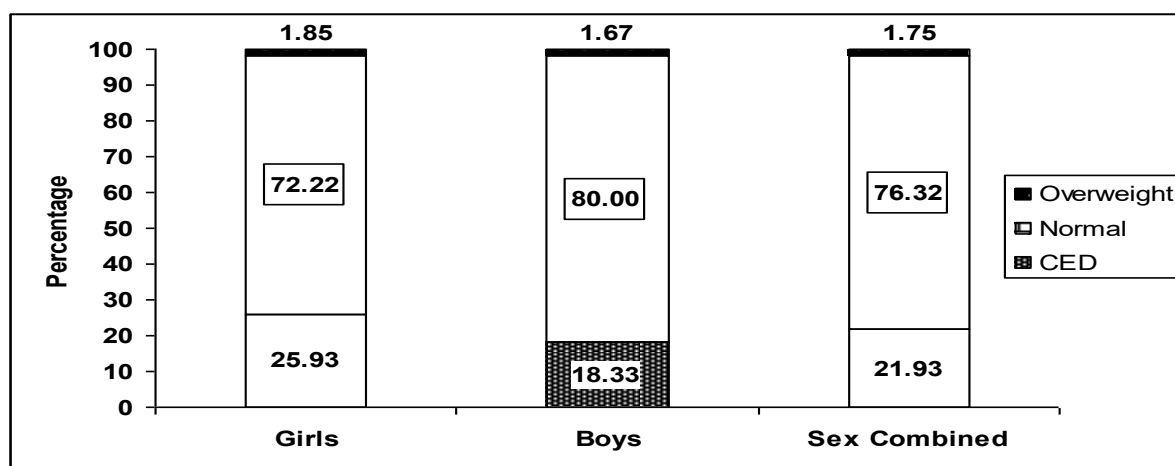


Fig. 5: Prevalence of CED and overweight among the children and adolescents belonging to Toto tribes

Table 3: Correlation between age and different anthropometric parameters

Nutritional status	Girls	Boys	Sex Combined
Height (cm)	0.897***	0.931***	0.916***
Weight (kg)	0.923***	0.906***	0.915***
BMI (kg/m ²)	0.794***	0.737***	0.757***
MUAC (cm)	0.774***	0.821***	0.796***
PBF	0.553***	-0.171	0.253***

4. DISCUSSION

The overall weight, height, BMI, MUAC and PBF of the Toto tribes aged 6-17 years were 32.86 ± 11.48 kg, 137.01 ± 14.56 cm, 16.91 ± 2.88 kg/m², 19.93 ± 3.55 cm and 16.97 ± 3.84 respectively. In a similar study the overall weight, height and BMI among the Santal tribes of West Bengal aged 7-18 years were 29.91 ± 10.75 kg, 134.7 ± 15.62 cm and 15.87 ± 2.36 kg/m² respectively [10]. In another study among 4-18-year-old Hill Kharia children and adolescents of West Bengal, the overall-weight, height, and BMI were 21.17 ± 10.0 kg, 116.3 ± 21.60 cm, and 14.76 ± 2.36 kg/m² respectively [17]. So, this study indicated that Toto children and adolescents were taller and heavier than both Santal and Hill Kharia children and adolescents of similar age groups.

The prevalence of CED and overweight among the Toto children and adolescents of the present study was 21.93% and 1.75% respectively. The prevalence of CED using new international cut-off points i.e., Cole et al. among the Santal and Hill Kharia children and adolescents of similar age group 41.3% and 52.9% respectively [10, 11, 15, 16]. This study clearly indicated that the nutritional status of the Toto tribes

were better in comparison of other tribal children and adolescents in West Bengal.

This study indicated that the prevalence of CED was higher among Toto girls (25.93%) than the Toto boys (18.33%). Similar findings were shown in the Santal population where girls (44.6%) were more prone to undernourished than boys (38.3%) and Hill Kharia population where the higher prevalence of thinness was observed among girls (53.8%) than boys (52.2%) [10, 11]. This study also noted that the prevalence of CED in Toto girls of 6-17 years children and adolescents were 7.60% more than that of the Toto boys. When the Odd ratio was employed, it was noted that the girls of the community were 1.559 times [OR=1.559; 0.229-2.932 & RR=1.246; 0.928-1.673] more prone to become underweight. It may be due to their poor dietary pattern and following poor diversification of food consumption from the angle of four basic food groups. Lack of safe drinking water and hygiene condition may also responsible for wide spread prevalence of underweight. Some social factors may also be responsible for the higher prevalence of under nutrition among the girls than the boys. The girls were more likely to be engaged in home based work and usually cover a long distance to carry water with difficulties because of rough hilly area. In another study among the Santal population, it was noted that the CED of the Santal girls were 16% more than boys while the Hill Kharia girls had only 3% more CED than boys. In Kolam tribal children CED was more in boys (8%) than girls [18]. In Khasi boys also had higher risk of CED (14%) than girls [19]. A study in northeast India documented that, the BMI of the sonoalkachi girl was significantly higher than boys [20]. In Bharia tribal boys

were more underweight (44.9%) as compared to girls (28%) [21].

It is well known that age is an important factor for the growth of the children and adolescents. In this study, it was noted that weight, height, BMI, MUAC and PBF were significantly ($P < 0.001$) increased with age as reported while studying the ANOVA (Table 1). It was further supported by the Pearson product moment correlation (Table 3). The Linear Regression Analysis showed that the weight, BMI and PBF was associated with age among the girls while height, weight, BMI and PBF was associated with age among the boys (data not shown). This indicated that age is one of the most determining factors while studying the nutritional status of the children and adolescents. But in case of girls in the age of 11 years a decreased tendency of BMI was noted (Table 1) and it was further confirmed by the high incidence of CED at the age of 11 years (Fig. 4). During these years the girls showed the highest prevalence of CED, this may be associated with the menarche and inadequate food/nutrient supply, low access of health education and improper hygienic practices which may further aggravate the physiological and reproductive stress during this time and it was depicted as highest level of under nutrition in this study. In the upper ages in this study i.e., during 15-17 years, there was a very low prevalence of under nutrition has been observed. Interestingly no case of under nutrition was observed in the age of 16 years and total 19 of the adolescent boys and girls were in normal BMI except one who belongs to the category of overweight.

5. CONCLUSIONS

One fourth of the girls and one fifth of the boys were suffering from under nutrition with respect to CED. This showed a tendency of higher CED among girls than that of boys. Our study also revealed that the prevalence of this type of under nutrition is occurred at the age of 11 years. This condition may be improved by the proper execution of awareness programme in a Knowledge, Attitude and Practice mode (KAP mode) and supplementary programme among this community.

6. REFERENCES

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