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Anthropometric Characteristics and Nutritional Status of Adult Sabars of Bankura District, West Bengal

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ABSTRACT:

Aim: *The tribes of India constitute approximately 8.6% of the total population of the country. Undernutrition among tribal populations is a significant public health problem in India. The present study was carried out to assess age trends in anthropometric characteristics and nutritional status among adult Sabars.*

Methods: *It was a community-based cross-sectional study, carried out in tribal areas of Bankura District, West Bengal, India. These were located approximately 60 km radius from Bankura, 233 km from Kolkata, the state capital of West Bengal. A total 226 adult (male = 111 and female = 115) Sabar tribals, aged over 18 years in those village areas were included in the study.*

Results: *The mean values of height (HT), weight (WT), mid-upper arm (MUAC), neck (NC), and waist circumferences (WC), body mass index (BMI) and total body water (TBW) were significantly higher ($p < 0.001$) among males than females. Among females, mean values of biceps (BSF) and triceps skinfold (TSF) and percent body fat (PBF) were significantly higher ($p < 0.001$). Age trends were statistically significant ($p < 0.01$, $p < 0.05$) in WT, MUAC, and TBW in all categories (male, female and combined sex). Among females (as well as sex-combined) statistical significant age trends were observed in HT, BMI and PBF. The overall sex-combined prevalence of undernutrition was 51.8%. The prevalence of undernutrition was significantly (chi square = 6.530, df = 2, $p < 0.05$) higher (56.5%) in females than males (46.8%). The prevalence of undernutrition increased with increase in age.*

Conclusion: *Undernutrition is a major health problem among this tribal population. Their nutritional status was unsatisfactory. The nutritional stress was critical and this condition increased with the increase in age.*

Key Words: Age trends, Body Mass Index, Sabar, Chronic Energy Deficiency.

INTRODUCTION:

Both undernutrition and overnutrition play a major role in morbidity and mortality, therefore assessment of nutritional status is a cornerstone of efforts to improve the health of individual and population throughout the world. Undernutrition occurs when net nutrient intake is less than requirements. Undernutrition leads to a succession of metabolic abnormalities, physiological changes, reduce organ and tissue function and loss of body mass.

In general, tribal populations of India are recognized as socially and economically vulnerable (Ghosh and Bharati, 2006). As per latest census, India has more than 88 million tribals who constitute 8.6% of the total population (Census of India 2011). India probably has the largest number of tribal communities in the world (Topal and Samal, 2001). The vast majority of the tribal populations reside in rural areas of the country.

The body mass index (BMI) is the most established anthropometric indicator used for assessment of adult nutrition status (Lohman et al., 1988; Ferro-Luzzi et al., 1992; James et al., 1994; Lee and Nieman, 2003). In general, data are limited on the nutritional status of the various tribal populations of India (Tanuja et al., 1995; Yadav et al., 1999; Yadu et al., 2000; Khongsdier, 2001, 2002, 2005; Gogoi and Sengupta, 2002; Sahani, 2003; Dash Sharma, 2004; Gusain, 2004; Bose and Chakraborty, 2005, Das et al 2013, *Ghosh and Bose 2015).* Low BMI and high levels of undernutrition (based on BMI) is a major public health problem especially among rural underprivileged adults of developing countries (WHO, 1995).

The situation in India is not only different but often very complex due to regional disparities and rural-urban divide. Despite rapid strides in socio-economic development, health and education, the widening economic, regional and gender disparities are posing challenges for the health sector. (Das 2012). There is direct relationship between health and development (Sharma 2012).

The Sabars (also Shabar, Savar or Saora) are one of the scheduled tribes in India who live mainly in Jharkhand, Chhattisgarh, Madhya Pradesh, Odisha and West Bengal. During the British Raj, they were classed as one of the 'criminal tribes' under Criminal Tribes Act 1871, and still suffer from social stigma and ostracism in modern times. According to 2001 census the

total population of Sabars in West Bengal was 43,599. Sabars are the 10th largest group in West Bengal, comprising 1% of the total ST's population.

The traditionally forest-dwelling tribe lack experience in agriculture, and rely on the forests for their livelihood. In recent years, with the spread of the Naxalite rebellion in the area, the police often restrict their access to the forest. They lack educational opportunities and health consciousness.

In view of this, the objective of the present study was to report the anthropometric characteristics and the nutritional status, based on BMI, of adult Sabars of Bankura, West Bengal, India.

METHODS AND MATERIALS:

Prior permission and ethical approval were obtained from local community leaders as well as relevant authorities before commencement of the study. Information on ethnicity, age, occupation, and educational status were obtained from all subjects with the help of a questionnaire. The present cross-sectional studies were conducted at villages Bethuala, Maula, Kotro, Botdanga, Sagardanga, Katiyam under Ranibandh block of Bankura district of West Bengal. These are located approximately 60 km radius from Bankura, located 233 km from Kolkata, the state capital of West Bengal. A total 226 adult (males = 111; females = 115) Sabar individuals aged above 18 years in those village areas were included in the study. The vast majority of the subjects were illiterate and very low-waged manual laborers belonging to low socio-economic status. All anthropometric measurements were made by trained investigators using the standard techniques of Lohman et al. (1988). Height, circumferences, weight, and skinfolds were recorded to the nearest 0.1 cm, 0.5 kg, and 0.2 mm, respectively. Circumferences and skinfolds were measured using measuring tape and Holtain skinfold callipers, respectively. Technical errors of measurements (TEM) were computed and were found to be within acceptable limits (Ulijaszek and Kerr, 1999).

Body mass index (BMI) was computed using the following standard equation: BMI = weight (kg)/height (m2).

The CED (Chronic Energy Deficiency) status was defined as BMI < 18.5 kg/m^2. The WHO classification (WHO, 1995) of the public health problem of low BMI, based on adult populations worldwide, was followed. This classification categorizes prevalence according to percentage of a population with BMI < 18.5.

1) Low (5-9%)	Warning sign, monitoring required
2) Medium (10-19%)	Poor situation
3) High (20-39%)	Serious situation
4) Very high (≥ 40%)	Critical situation

Total Body Water was calculated using the Watson's Formula (Watson et al.1980).

Total Body Water in male =
2.447- (0.09156 x Age in year) + (0.1074 x Height in cm) + (0.3362 x Body Weight in kg).

Total body water in female =
-2.097+ (0.1069×height in cm) + (0.2466×weight in kg)
Percent Body Fat (PBF):

Percent Body Fat (PBF) was calculated using four skin folds with the following standard equations [Durnin and Womersley, 1974]:

PBF = (4.95 / density-4.5) x 100

Medians of all anthropometric variables and BMI were computed for each sex separately. The distribution of BMI in both sexes was not significantly different from normal according to Cox's skewness test. Thus t-tests were performed to test for sex differences as well as differences in mean BMI with other ethnic groups. The chi-square test (Fischer's exact test) was utilized to compute sex differences in nutritional status. All statistical analyses were undertaken using the Statistical Package for Social Science (SPSS 16) program.

RESULTS:

Table 1 presents the mean, standard deviation, t and significance (p) values of the following anthropometric measurements: height (HT), weight (WT), mid-upper arm circumference (MUAC), neck circumference (NC), waist circumference (WC), hip circumference (HC), biceps skinfold (BSF), triceps skinfold (TSF), Subscapular skinfold

(SCSF), suprailiac skinfold (SISK), body mass index (BMI), total body water (TBW) and percent of body fat (PBF). The mean values of HT, WT, MUAC, NC, WC, BMI and TBW were significantly higher ($p < 0.001$) among males. Among females the mean values of BSF, TSF and PBF were significantly higher ($p < 0.001$).

Table 2 demonstrates the age trends of anthropometric characteristic of the following measurements: HT, WT, MUAC, NC, WC, HC, BSF, TSF, SCSF, SISF, BMI, TBW and PBF. Statistical significant age trends ($p < 0.01$, $p < 0.05$) were found in WT, MUAC, and TBW in all categories (male, female and combined sex). Among females (as well as sex-combined) statistical significant age trends were observed in HT, BMI and PBF.

Table 3 presents the age and sex specific nutritional status based on BMI. The overall sex-combined prevalence of undernutrition was 51.8%. The prevalence of undernutrition was significantly (chi square = 6.530, df = 2, $p < 0.05$) higher (56.5%) in females than males (46.8%). The prevalence of undernutrition increased with increase in age (except 31 – 40 years). Similar trends were observed in both sexes. From our study it is clearly evident that the nutritional status of Sabars was unsatisfactory. They were experiencing critical nutritional stress. This condition increased with the increase in age.

DISCUSSION:

For thousands of years, the so-called "primitive" tribes resided in forests and hills without having more than causal contacts with the populations of the open plains and the centre's of civilization. There are wide variations among these tribal groups in nutritional status and access to utilization of nutrition and health services. From ***Table 4*** and ***Figure 1*** it is clear that among males from West Bengal, Santals of Birbhum (Mukhopadhyay 2009) and Birhors of Purulia (Das et al 2013) have the highest mean value of BMI (20.5 kg/m^2) followed by Mahalis of Bankura (19.9 kg/m^2) (Ghosh and Bose 2017), Sabars (present study) (19.8 kg/m^2), Santals of Purulia (19.5 kg/m^2) (Das and Bose 2010), Kora Mudis of Bankura (Bisai et al 2008) and Bhumijs of Paschim Medinipur) (Ghosh and Bose 2015) (18.6 kg/m^2). Similarly, among females of West Bengal, the mean value of BMI was highest among Birhors of Purulia (20.2 kg/m^2) (Purulia) (Das et al 2013), followed by Santals (19.5 kg/m^2) (Birbhum) (Mukhopadhyay 2009), Sabars (present study) (18.4 kg/m^2), Kora Mudis of Bankura (18.3 kg/m^2) (Bisai et al 2008), Santals of

Purulia (18.1 kg/m^2) (Das and Bose 2010). The least mean BMI was observed among Mahali females (17.9 kg/m^2) of Bankura (Ghosh and Bose 2017).

Table 4 also shows the prevalence of CED among the various tribes of West Bengal. The highest frequency of CED was found among Santals of Purulia (55.0%) (Das and Bose 2010), followed by Bhumijs of Paschim Medinipur (52.3%) (Ghosh and Bose 2015), Kora Mudis of Bankura (48.6%) (Bisai et al 2008), Sabar (46.8%) (present study), Mahalis of Bankura (42.2%) (Ghosh and Bose 2017), Santals of Birbhum (30.5%) (Mukhopadhyay 2009). The lowest frequency of CED was found among Birhors (19.4%) of Purulia (Das et al 2013). Among females, the highest frequency of CED was found in Mahalis of Bankura (63.6%) (Ghosh and Bose 2017), followed by Sabars (56.5%) (present study), Kora Mudis of Bankura (56.4%) (Bisai et al 2008), Santals (52.5%) of Purulia (Das and Bose 2010), Santals of Birbhum (38.5%) Mukhopadhyay 2009). As with males, the lowest frequency of CED was found among Birhors of Purulia (33.3%) (Das et al 2013). Thus, from these research investigations, it is clearly evident that the nutritional status of tribal populations of West Bengal was unsatisfactory. They were experiencing serious to critical nutritional stress.

According to National Family Health Statistics -3 Report the prevalence of undernutrition in India is 33.0% in males and 28.1% in females. The Government of India has been implementing several nutritional intervention and developmental programmes under tribal sub-plan approach for the betterment of health and nutritional status of tribal populations. However, as can be seen from the results of these anthropometric surveys, undernutrition is still an important public health problem among various tribal populations of West Bengal. This may be associated with low literacy, poor socio-economic conditions and other associated factors. Therefore, appropriate intervention programmes are required to improve socio-economic conditions by income generating activities such as an employment guarantee scheme. To enhance their nutritional status, food security in the form of food for work programmes alongwith increased dietary intake of calories and proteins are imperative. Other important efforts needed to ameliorate this problem include improved education along with health promotion, better sanitation and provision of safe drinking water for prevention of diarrhoeal and other infections. One of the limitations of our study was that it did not investigate the role of socio-demographic and socio-economic concomitants of undernutrition. In view of this, future

studies on the prevalence of CED among tribal populations should investigate these variables in detail. Hitherto, such studies are scanty not only from West Bengal but also from India. The manifestations of undernutrition are manifold with serious implications for morbidity and mortality.

***Conclusion**:*

From our study it can be concluded that the nutritional status of Sabars was unsatisfactory. They were experiencing critical nutritional stress.

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Table 1: Anthropometric characteristics of the subjects.

Variables	**Male (N = 111)**		**Female (N = 115)**		"t" value
	Mean	**SD**	**Mean**	**SD**	
HT (cm)	159.9	5.9	149.0	5.0	14.838***
WT (kg)	49.7	7.4	40.1	5.9	10.717***
MUAC (cm)	25.2	3.9	22.9	2.3	5.530***
NC (cm)	33.4	2.0	29.1	2.2	15.03***
WC (cm)	75.2	6.4	68.9	9.3	5.972***
HC (cm)	84.6	9.1	83.1	9.2	1.202
BSF (mm)	3.1	1.6	4.1	2.3	-3.845***
TSF (mm)	5.6	3.1	7.9	3.3	-5.533***
SCSF (mm)	10.3	4.7	9.9	3.5	0.874
SISF (mm)	9.3	4.3	8.5	3.1	1.861
BMI (kg/m^2)	19.4	2.6	18.1	2.3	4.226***
TBW (lt)	32.9	3.4	23.7	1.8	25.199***
PBF (%)	12.3	5.2	20.4	5.2	-11.641***

Level of Significance: *** $p < 0.001$.

Table 2: Age trends in anthropometric characteristics.

Variables	Sex	Age Group (Years)				F	P
		(18-30) Mean (SD)	(31-40) Mean (SD)	(41-50) Mean (SD)	(>50) Mean(SD)		
HT (cm)	Male	159.2 (5.6)	159.9 (5.4)	162.1 (6.1)	159.5 (6.1)	1.204	0.312
	Female	149.7 (5.1)	150.0(4.9)	150.7(3.0)	146.0 (4.8)	4.455	0.005
	combined sex	154.3 (7.2)	153.9(7.0)	157.8 (7.9)	152.5 (8.7)	3.224	0.023
WT (kg)	Male	50.2 (6.9)	51.1 (7.3)	51.9 (10.2)	45.9 (4.4)	3.064	0.031
	Female	41.1 (4.9)	41.7 (6.2)	39.6 (5.3)	36.9 (6.8)	4.041	0.009
	combined sex	45.6 (7.5)	45.5 (8.0)	47.3 (10.5)	41.2 (7.3)	4.734	0.003
MUAC (cm)	Male	26.1 (4.9)	25.4 (2.0)	25.1 (2.7)	23.4 (2.0)	2.722	0.048
	Female	23.4 (2.0)	23.2 (2.3)	22.0 (2.0)	21.9 (2.9)	3.498	0.018
	combined sex	24.7 (3.9)	24.2 (2.4)	24.0 (2.9)	22.6 (206)	4.483	0.004
NC (cm)	Male	33.3 (2.1)	34.2 (2.4)	33.1 (2.0)	33.5 (1.7)	0.877	0.456
	Female	29.3 (1.9)	29.6 (2.3)	28.3 (2.2)	29.0 (2.9)	0.977	0.406
	combined sex	31.2 (2.8)	31.4 (3.2)	31.2 (3.1)	31.1 (3.3)	0.047	0.987
WC (cm)	Male	74.6 (6.4)	75.0 (6.9)	76.7 (6.0)	75.5 (6.4)	0.532	0.661
	Female	69.0 (6.9)	69.8 (7.2)	68.5 (4.9)	68.3 (15.4)	0.096	0.962
	combined sex	71.7 (7.2)	71.8 (7.5)	73.7 (6.9)	71.8 (12.4)	0.445	0.721
HC (cm)	Male	84.8 (9.3)	86.4 (5.3)	86.9 (6.6)	81.3 (11.4)	1.648	0.183
	Female	84.3 (4.9)	84.9 (6.5)	76.9 (22.0)	82.1 (7.8)	2.580	0.057
	combined sex	84.5 (7.4)	85.5 (6.0)	83.2 (14.9)	81.7 (9.6)	1.496	0.217
BSF(mm)	Male	3.1 (1.5)	3.4 (1.9)	3.1 (1.7)	2.8 (1.3)	0.391	0.760
	Female	4.4 (2.4)	4.3 (1.9)	2.8 (1.7)	3.8 (2.4)	1.803	0.151
	combined sex	3.7 (2.1)	3.9 (2.0)	3.0 (1.7)	3.3 (2.0)	1.793	0.149
TSF (mm)	Male	5.2 (2.7)	7.1 (4.3)	6.3 (3.6)	4.9 (2.2)	2.269	0.085
	Female	8.4 (2.4)	8.3 (1.9)	5.9 (1.7)	7.5 (2.4)	2.215	0.090
	combined sex	6.9 (3.2)	7.8 (3.5)	6.2 (3.3)	6.2 (3.8)	1.882	0.133
SCSF (mm)	Male	10.3 (3.9)	11.1 (3.7)	11.8 (7.0)	8.8 (4.2)	1.653	0.182
	Female	10.1 (2.9)	10.8 (3.6)	8.3 (3.2)	9.2 (4.5)	1.702	0.171
	combined sex	10.2 (3.4)	10.9 (3.6)	10.5 (6.0)	9.0 (4.3)	1.744	0.159
SISF (mm)	Male	9.7 (4.2)	9.0 (3.9)	10.1 (5.3)	8.1 (3.6)	1.033	0.381
	Female	8.7 (2.9)	9.2 (2.9)	7.5 (2.9)	7.9 (3.8)	1.182	0.320
	combined sex	9.2 (3.6)	9.1 (3.3)	9.1 (4.7)	8.0 (3.7)	1.290	0.279
BMI (kg/m^2)	Male	19.8 (2.6)	19.9 (2.2)	19.7 (3.4)	18.1 (1.5)	3.037	0.032
	Female	18.4 (2.0)	18.5 (2.2)	17.4 (2.0)	17.3 (3.0)	1.938	0.128
	combined sex	19.1 (2.4)	19.1 (2.3)	18.6 (3.1)	17.7 (2.4)	4.006	0.008
TBW (lt)	Male	34.2 (2.6)	33.7 (3.0)	33.1 (3.9)	29.3 (2.2)	16.907	0.000
	Female	24.1 (1.5)	24.2 (1.9)	23.8 (1.5)	22.6 (1.9)	5.089	0.002
	combined sex	29.0 (5.5)	27.9 (5.2)	29.6 (5.6)	25.8 (3.9)	5.228	0.002
PBF (%)	Male	12.5 (4.7)	13.7 (4.6)	13.3 (6.2)	10.4 (5.4)	1.708	0.170
	Female	21.3 (4.3)	21.7 (3.9)	17.5 (4.8)	18.7 (7.0)	3.260	0.024
	combined sex	17.0 (6.3)	18.5 (5.7)	14.9 (6.0)	14.7 (7.5)	3.243	0.023

Table 3: Nutritional status based on BMI. .

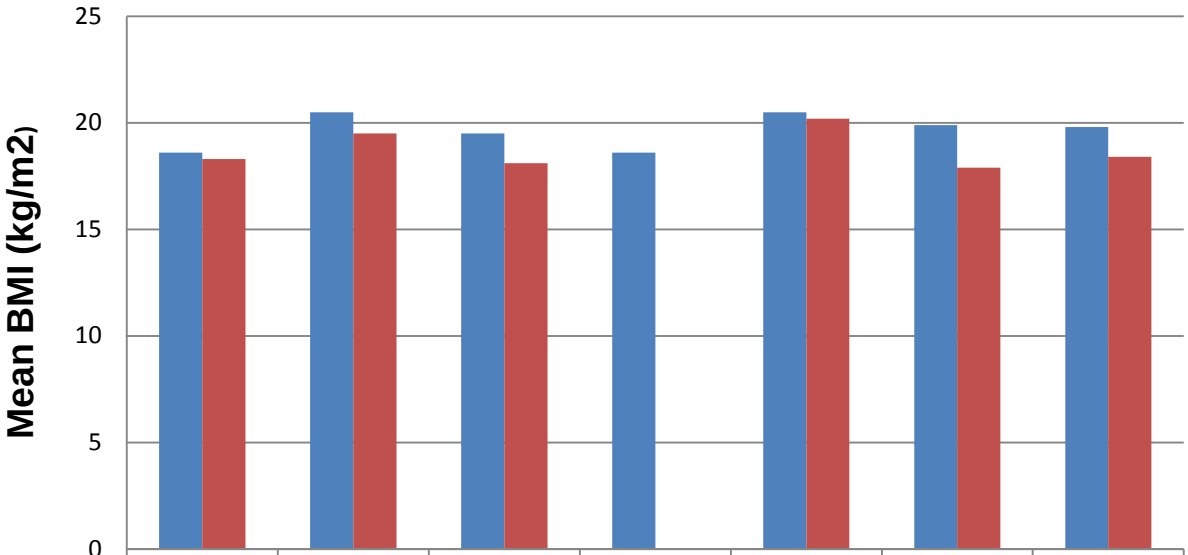
Nutritional Category	Age Group (Years)										Age and sex Combined
	Male (N= 111)					Female (N = 115)					
	18-30 (N=54)	31-40 (N=13)	41-50 (N=20)	>50 (N=24)	Age Combined	18-30 (N=57)	31-40 (N=20)	41-50 (N=12)	>50 (N=26)	Age Combined	
Under-nutrition	40.7 %	30.8 %	55.0 %	62.5 %	46.8%	50.9%	50.0 %	66.7 %	69.2 %	56.5%	51.8%
Normal	57.4 %	61.5 %	30.0 %	37.5 %	48.6%	49.1%	50.0 %	33.3 %	30.8 %	43.5%	46.0%
over-weight	1.9%	7.7%	15.0 %	0.0	4.5%	0.0	0.0	0.0	0.0	0.0	2.2%
Chi-square	13.133, p<0.05, df=6					N.S					17.922, p<0.01, df=6

Sex difference: chi-square = 6.530, p < 0.05, df = 2.

Table 4: Comparison of mean BMI kg/m^2 and prevalence of CED among various tribal populations of West Bengal.

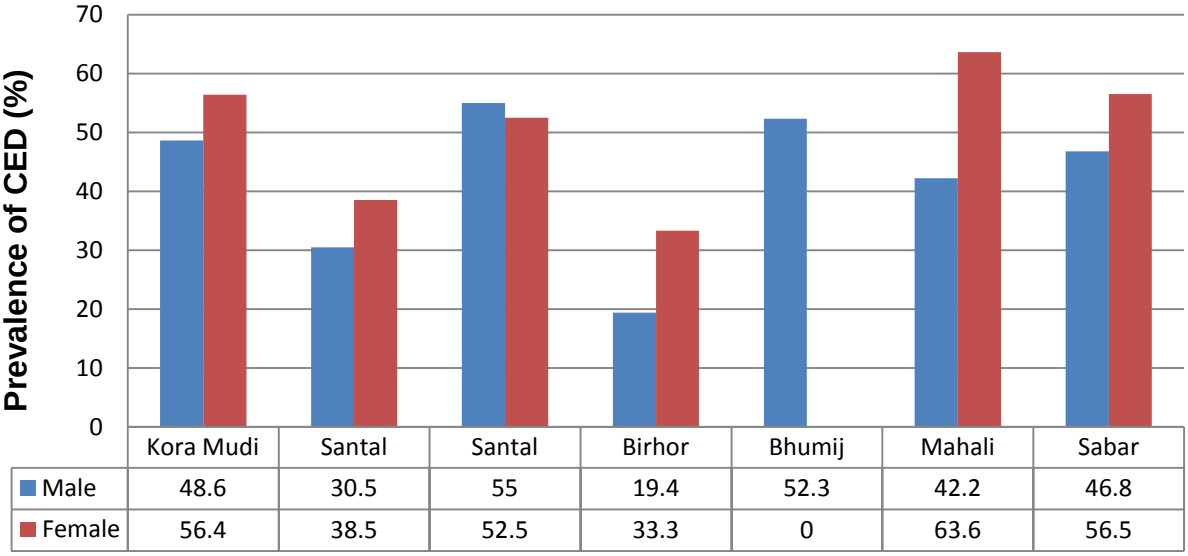
Community	Mean BMI (kg/m^2)		CED Prevalence (%)		Study area (District)	Reference
	Male	Female	Male	Female		
Kora Mudi	18.6	18.3	48.6	56.4	Bankura	Bisai et al 2008
Santal	20.5	19.5	30.5	38.5	Birbhum	Mukhopadhyay 2009
Santal	19.5	18.1	55.0	52.5	Purulia	Das & Bose 2010
Birhor	20.5	20.2	19.4	33.3	Purulia	Das et al 2013
Bhumij	18.6	---	52.3	----	Paschim Medinipur	Ghosh & Bose 2015
Mahali	19.9	17.9	42.2	63.6	Bankura	Ghosh & Bose 2017
Sabar	***19.8***	***18.4***	***46.8***	***56.5***	**Bankura**	**Present Study**

Figure 1: Mean BMI: community and sex wise



	Kora Mudi	Santal	Santal	Bhumij	Birhor	Mahali	Sabar
Male	18.6	20.5	19.5	18.6	20.5	19.9	19.8
Female	18.3	19.5	18.1	0	20.2	17.9	18.4

Figure 2: Prevalence of CED: community and sex wise



	Kora Mudi	Santal	Santal	Birhor	Bhumij	Mahali	Sabar
Male	48.6	30.5	55	19.4	52.3	42.2	46.8
Female	56.4	38.5	52.5	33.3	0	63.6	56.5