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Research Article

Nutritional Status Assessment among Adult Santals of East Singhbhum District in Jharkhand State, India

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ABSTRACT

Currently, malnutrition and undernutrition are comprehensible health issues for adults in India. This condition also affects children. The prevalence of such situations developed in India is primarily due to socio-economic variation, especially in the case of socio-economically disadvantaged communities like Scheduled Tribes (STs) and Scheduled Castes (SCs) over others. For the last two to three decades, there has been no inspiring progress regarding the nutritional status of such a population. Studies on the assessment of nutritional status among both male and female Santals are almost lacking, hence the importance of conducting such a study. The present study tries to determine nutritional status prevalence among Santal adults in East Singhbhum District, Jharkhand, India. It was a community-based cross-sectional study carried out in tribal areas of East Singhbhum District, Jharkhand, India. A total of 211 adult (male = 101 and female = 110) schedule tribes (Santals) aged over 20 years in those village areas (Bela, Malua, Dighi Mura, Majhipara, Teghori and Raj bandh) were included in this study. Body Mass Index (BMI) and Mid Upper Arm Circumference (MUAC) were the major indicators used here to assess the studied participants' nutritional status. It was observed that most young adults, age group 20-40 years, are mainly affected. Further study revealed that 5.9 % of males, 8.1 % of females, and 7.1% of the total population were suffering from Chronic Energy Deficiency (CED), and 52.5 % of males, 58.1 % of females and 55.5 % of the total population became overweight. The overall sex-combined prevalence of undernutrition was 7.1%. The prevalence of undernutrition was significantly ($p < 0.05$) higher (8.1%) in females compared to males (5.9%). Nutritional status assessment through MUAC also revealed more or less similar results. It may be suggested that nearly three fourth of the population (69.67 %) was nutritionally normal, whereas the rest (30.33 %) was found to be underweight and malnourished. So, from this study, it may be concluded that females were in the more concerning situation for undernutrition according to MUAC and overweight according to BMI.

Keywords: *Santal adults, undernutrition, Body Mass Index (BMI), Mid Upper Arm Circumference (MUAC), Chronic Energy Deficiency (CED), nutritional status.*

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Santals are the largest ones which are mostly found in the states of West Bengal, Bihar, Orissa, Jharkhand and Assam. In number, this community reaches up to two million (Mukhopadhyay, 2010). However, data on malnutrition as well as the nutritional status of this tribal community across India, is still very limited in understanding the nutritional aspect of this particular community. Malnutrition is prevalent in different populations in different parts of the world in different forms and rates. Since it is mostly regulated by the socio-economic condition of a state as well as a population, it is mostly seen in the form of overnutrition in some countries, especially in developed countries, and in some underdeveloped countries, it mostly occurs in the form of undernutrition causing Chronic Energy Deficiency (CED). But in India, both the forms, overnutrition and undernutrition, are running parallel at almost similar rates. Some studies indicate the need to enhance the health and nutritional status of the tribes by providing job opportunities and food security. Since the prevalence of CED (chronic energy deficiency) was higher (critical to the serious situation) in tribal populations, concerted efforts should also be made to improve the health status and nutrition uptake among them. Obesity caused by overnutrition has been an epidemic in the strong economic section of India, whereas undernutrition, mostly affecting the people of low-income sections, has become a burden of public health in India (Adhikari et al., 2018). From this perspective, it is important to assess India's nutritional status to find out how to reduce the burden of public health and to reach the people of India in a safe zone of the nutritional condition by identifying the most probable causes of malnutrition.

Nutritional status is that kind of criteria which is not only dependent on the biological profile of an individual as well as the population but also is driven by the socio-economic condition, environment and food habits of the population. Therefore, nutritional status is a population-based assessment, which is why it needs to be assessed in different world populations. It is well known that anthropometry study (body mass index and Circumference) is an important method for understanding the nutritional status of a population. The measurement of body mass index [BMI (kg/m^2)] and circumferences of different body parts are very effective and useful indicators for obesity and CED assessment. Moreover, these indicators are inexpensive, noninvasive and suitable for large-scale populations (Bose et al., 2006). Most of the studies conducted on the Santal population of different states of India show a similar trend in the case of the nutritional aspect of adult Santals. Dash and Adhikari (2018) conducted their research on 173 Santal women of Purba Medinipur, Purulia, and Bankura districts, and they observed that the Santal population (mainly women) are primarily suffering from malnutrition; 89 % of them were in the underweight category, whereas only 11% were in the normal weight category. In that study, women's average age was 27.5±1.8 years, mean height was 155.6±3.01cm and mean weight was 43.0 ±2.3 kg. The mean BMI in such women was 17.8 ±0.72 kg/mt^2, but the range was maintained from 15.2 kg/mt^2 to 19.5 kg/mt^2. So, the study suggested that inadequate food and nutritional elements are the prime reason for malnutrition. This study also supports the investigations of Mukhopadhyay (2010). Where he took his subjects 400 adults (200 males and 200 females with age range from 19–75 years) in two villages under the Bolpur Sriniketan block of Birbhum district. According to this study, it was evident that the population was in a critical situation for the high prevalence of low BMI as well as undernutrition. At the same time, it was also found that 34.5% of the studied population were in poor nutritional condition (BMI<18.5); among them, 38.5% of females and 30.5% of males were found to be under the low BMI category, but all the results were insignificant (chi square= 2.832, P = 0.092).

An earlier (2006) cross-sectional study conducted by Bose et al. on 332 male Santal villagers of the Keonjhar district of Orissa

found a high prevalence of undernutrition. This study was conducted among the five villages of the Anandapur Region of Keonjhar district. Here in relation to BMI, the percentage of undernutrition people was 26.2 %. As per MUAC, it was also observed that 33.7% of the population came under the category of undernutrition. Six years later, Das and Bose (2012a) conducted another study only on MUAC among the Santal adult population (N= 520) of the Purulia district of West Bengal. This study revealed that females (MUAC 64.7% and BMI 59.4%) were more affected by undernourished than males (MUAC 54.4 % and BMI 34.6) % in terms of MUAC and BMI. In both cases, significant sex differences were noticed for MUAC ($t=2.378$, $p<0.05$) and BMI ($t=4.971$, $p<0.001$). From the above data, it was concluded that a lack of nutrition threatened both the sexes of the studied population. Previously Bose and Bisai, in 2007, conducted another study among 332 male Santal individuals from Orissa and 197 male Santals from West Bengal and found that both the population were in serious situations with a high prevalence of CED (Orissa=26.2%, West Bengal=31.5%). Among them, the mean BMI was found to be 19.6±1.8 kg/mt^2 in Santals of Orissa and 20.0±2.6 kg/mt^2 in West Bengal Santals. But in the case of mean MUAC, no such alterations were found between these two populations (23.7± 2.1 cm and 23.8± 2.3 cm for Orissa and West Bengal, respectively). In their study, Mahajan et al. (2019) revealed that the males and females of the Santal population (N=101) of Jharkhand State had mean BMI of 20.40±2.75 and 19.85±3.08 respectively. Females (35.7%) of that study population were observed to be more undernourished than their male (17.8%) counterparts based on BMI. Here according to mid-upper arm circumference [MUAC (cm)], 17.8% of males were observed to be undernourished, whereas, unlike BMI, 42.9% of females were found to be highly undernourished. So, the findings of the study enlighten the higher prevalence of undernourishment in adult males and females of the Santal population in relation to mean MUAC (t-value=2.88, $p<0.05$).

It was already announced in 2005 the nutritional status of the Santals population of several regions of Eastern India from different points of view. Still, very few studies were performed on specific ST populations in the light of nutritional assessment for the border area of West Bengal like Baharagora Block, Jharkhand. So, in this study, a little effort has been made to explore the nutritional prominence of the Santal population of Jharkhand State of India. The present study aims to determine the nutritional status and determine the prevalence of nutritional status among Santal adults of East Singhbhum District, Jharkhand, India.

MATERIALS AND METHODS

The present cross-sectional study was designed to find the nutritional status of the reference population, which was conducted in March 2022 and followed. The data were collected from some of the tribal areas (Bela, Malua, Dighi Mura, Majhipara, Teghori and Raj bandh) under Baharagora block, East-Singhbhum district, predominantly inhabited by Santals of Jharkhand, India. A totalof 211 Santal adults were selected randomly to collect qualitative as well as quantitative data to assess the nutritional condition of the studied villagers. Among them, 101 individuals were males, and 110 were females. Individuals with the age of below 20 years and above 60 years and any skeletal and other deformities like physically handicapped were excluded. Only Santal adult people, both male and female, were included in this study. Before the commencement of the study, prior permission and ethical approval were obtained from local community leaders as well as relevant authorities. The district level and local administrative relevant authorities and the community leaders were informed about the objective of the fieldwork. Verbal and written consent was obtained from each participant in their own language prior to each interview and measurement procedure. All the measurements and data were collected during daylight between 9 am and 4 pm. All the necessary

official approval from the local authority and ethical consent from the individual participants were taken well before the study.

Anthropometric measurements such as height [cm (vertex to standing platform)], Mid Upper Arm Circumference [cm (MUAC)], Medial Calf Circumference (centimetre), and morphological facial height (in cm) were recorded to the nearest 0.1 centimetres. Each individual's body weight [kg] was also recorded to the nearest 0.5 kg. All the measurements were taken following standard procedures recommended by Lohman et al. (1988). Among all the collected anthropometric variables, some specific variables such as height, weight, and MUAC were used here to compute the nutritional condition of the population, which could better assess the same.

All data were compiled and then transferred to SPSS (16.0) for statistical analysis. To establish the nutritional condition of the population, two standard methods were used here: Body Mass Index (BMI) and Mid Upper Arm Circumference (MUAC). By using the Worldwide accepted standard formula, BMI was calculated and evaluated using internationally accepted BMI guidelines (WHO, 1995, p. 854) that fixed the cut-off value for every category of nutritional state of an individual (Table 1).

Table 1: BMI category and cut-off values according to WHO, 1995

BMI category	Cut off value
CED or Underweight	<18.5
Normal	18.5-24.9
Overweight	≥25.0

The classification of WHO categorized the prevalence of undernutrition based on the percentage of a population with a BMI less than 18.5 (Das & Bose, 2012). The classification of the problem of public health of low BMI provided by the World Health Organization (WHO, 1995 p. 854) was followed here to understand the prevalence of undernutrition in the studied population **(**table 2).

Table 2: Low BMI classification of WHO, 1995

Prevalence category	Cut off percentage	Remarks
Low prevalence	5-9 %	Warning and monitoring required
Medium prevalence	10-19 %	Poor situation
High prevalence	20-39%	Serious situation
Very high prevalence	≥40 %	Critical situation

It is now globally accepted that MUAC is another reliable method for evaluating the nutritional status of a population. The standard cut-off value of MUAC for the undernutrition category of the nutritional condition is established as <23 cm for males and <22 cm for females. Individuals with MUAC ≥23 and ≥22 for males and females, respectively, fall under the normal category of nutritional condition (Das & Bose, 2012a).

RESULTS

A descriptive statistical analysis of all the studied anthropometric variables with age and BMI has been exhibited in *Table 3*. Age of both the sexes shows equal mean values (male- 40.05 years. and female- 41.73 years). It was observed that the studied population had an average height of 159.6 cm in the case of males and 151.6 cm in the case of females, which suggests that it is a medium-statured

population. But weight indicates lower values for both sexes. The mean weight of males and females was calculated to be 58.1 kg and 52.9 Kg, respectively. It indicates that the population may have a chance of CED. In the case of BMI, males show a mean value of 22.7 kg/m^2 ($p<0.05$), whereas females have a mean BMI of 22.9 kg/m^2. MUAC of males with a mean value of 23.9 cm, whereas the mean MUAC of females is a little higher, which is 24.2cm, as compared to males. A little gender asymmetry was observed for all the anthropometric aids.

By statistical analysis of the BMI of every individual, the nutritional status of the studied population has been exhibited in Table 4. All the individuals were classified under three broad categories of nutritional classification based on their BMI values following the standard classification of BMI provided by WHO, 1990. The table shows a prevalence of CED among both sexes, 5.9% for males and 8.1% for females. The prevalence of CED was higher in females. Further classification of CED has not been performed here because of the small sample size. According to the low BMI classification of public health problems provided by WHO, males were in the poor situation (10-19 %) for the prevalence of undernutrition. In contrast, females were in the critical situation of undernutrition as per the cutoff point (≥40%). Most of the males were nutritionally normal (41.6 %), whereas 33.6 % of females had normal nutritional status. The prevalence of overweight was very among the studied participants; 52.5 % of males and 58.1 % of females were overweight. For both the sexes 41-50 years age group shows the maximum contribution to all the nutritional status categories. Most of the CED and overweight individuals were from this age group. Figure no. 1 also presents the above-mentioned scenario in graphical form.

The population's nutritional status through MUAC has been represented in Table 5 and graphically portrayed in Figure no. 2. It shows a more or less similar trend to BMI analysis. MUAC of the individuals suggests that 24.8 % of males were under the undernutrition category, whereas 35.5 % of females were in this category. Both sexes were included under the higher range of prevalence (20-39%) provided by WHO, indicating a serious situation for the studied individuals. Moreover, it exhibits that 30.3% of the total sample population is undernourished, which also indicates that the total population is seriously undernourished.

DISCUSSION

Malnutrition has been a global burden in public health which causes CED and adiposity across the world. Adiposity is mostly found in high economic groups of people, whereas undernutrition and CED are widely evident in low-earning tribals. A wide number of tribes from different parts of the worldwere studied to understand their nutritional status and its trend in tribals. Several recent studies in India (Yadav et al., 1999; Gogoi & Sengupta, 2002; Khongsdier, 2002; 2005; Sahani, 2003; Dash Sharma, 2004; Bose & Chakraborty, 2005; & Bose et al., 2006) have utilized BMI to study nutritional status of tribal populations. These studies have indicated that the utilization of BMI and WHO (1995) BMI-based cut-off points for the evaluation of CED are valid for use among tribal populations of India. The Santal population of the present study exhibits the highest mean BMI value for both sexes in comparison with all the tribal populations considered from the different states of eastern India, though almost all of them belong to the normal nutritional category. Females of the present studied population also show higher BMI values than that of male studied populations.

All these studies used BMI and MUAC as a primary indicator to assess nutritional status and found that a high rate of undernutrition belonged to their studied tribal population. The present study has shown a more or less similar trend. Although it has found higher mean BMI value and MUAC in females than males, which was not similar in previous studies mentioned, also it has exhibited that almost one-third of the

population is underweight (7.1%) and half a little more is of normal weight (37.4%). Overweight people are also present in this population but in higher (55.5%). It is also evident that females (8.1%) of the studied population are much ahead of males (5.9 %) in terms of undernourishment, and males have shown a greater percentage than females in terms of the normal weight category. In the case of overweight, both sexes have more than 50% of the total population. MUAC has also shown higher than normal. According to MUAC, 30.33% of the population falls in the undernutrition category, which is comparatively higher than the BMI-based CED category.

To sum up all these studies, it may be said that the Santal tribal population of different regions of India are nutritionally in poor condition; they have mostly been found to have nutritional conditions which can lead the population towards severe CED.

Table 3: Sex differences in mean height, weight, BMI and MUAC in adult Santals

Variables	Male (N = 101)			Female (N = 110)			"t" value
	Mean	SD	SEM (±)	Mean	SD	SEM (±)	
Age (Years)	40.05	11.85	1.18	41.73	11.33	1.06	1.060
HT (cm)	159.6	10.8	1.07	151.6	12.0	1.15	3.575***
WT (kg)	58.1	10.4	1.03	52.9	10.3	0.99	5.051***
BMI (kg/m^2)	22.7	3.6	0.35	22.9	4.4	0.42	0.658
MUAC (cm)	23.9	2.8	0.28	24.2	3.9	0.56	0.377

All the data are expressed in terms of Mean ± SEM. Significant level at ***= p <0.001

Table 4: Nutritional status of adult Santal population from BMI

Sex	BMI (kg/m^2) Category	Age Group (Years)				Total	% Within sex	Chi-square (χ^2)
		20-30	31-40	41-50	51-60			
Male (101)	CED	1(4%)	2(6.9%)	2(8%)	1(4.5%)	6	5.9	χ^2= 81.72
	Normal	9(36%)	10(34.5%)	9(36%)	14(63.6%)	42	41.6	
	Overweight and/or Obesity	15(60%)	17(58.6%)	14(56%)	7(31.9%)	53	52.5	
Female (101)	CED	1(4.4%)	2(6.7%)	4(10.5%)	2(7.6%)	9	8.1	χ^2= 93.83*
	Normal	7(30.4%)	8(26.6%)	14(36.8%)	15(57.8%)	37	33.6	
	Overweight and/or Obesity	15(65.2%)	20(66.7%)	20(52.7%)	9(34.6%)	64	58.1	
Total (211)	CED	2(4.2%)	4(6.8%)	6 (9.5%)	3(6.2%)	15	7.1	χ^2=4.99**
	Normal	16(33.3%)	18(30.5%)	23(36.6%)	29(60.4%)	79	37.4	
	Overweight and/or obesity	30(62.5%)	37(62.7%)	34(53.9%)	16(33.4%)	117	55.5	

Significant level at, *=p < 0.05, **= p<0.01

Table 5: MUAC-based nutritional status of the studied adult Santal population

Sex	MUAC category	Age Group (Years)				
		20-30	31-40	41-50	51-60	Total
Male (101)	Undernutrition	6(23.1%)	6(28.6%)	8(24.2%)	5(23.8%)	25(24.8%)
	Normal	20(76.9%)	15(71.4%)	25(75.8%)	16(76.2%)	76(75.2%)
Female (110)	Undernutrition	8(25.8%)	12(33.3%)	9(39.1%)	10 (50%)	39(35.5%)
	Normal	23(74.2%)	24(66.7%)	14(60.9%)	10(50%)	71(64.5%)
Total (211)	Undernutrition	14(24.6%)	18((31.6%)	17(30.4%)	15(36.6%)	64(30.3%)
	Normal	43(75.4%)	39(68.4%)	39(69.6%)	26(63.4%)	147(69.7%)

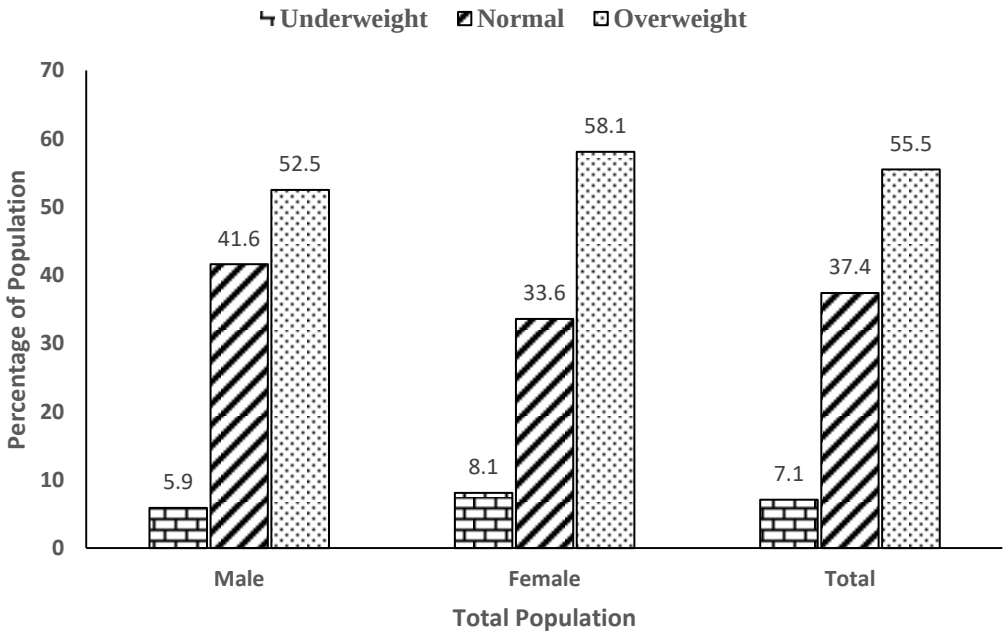

Figure 1: Nutritional status based on BMI

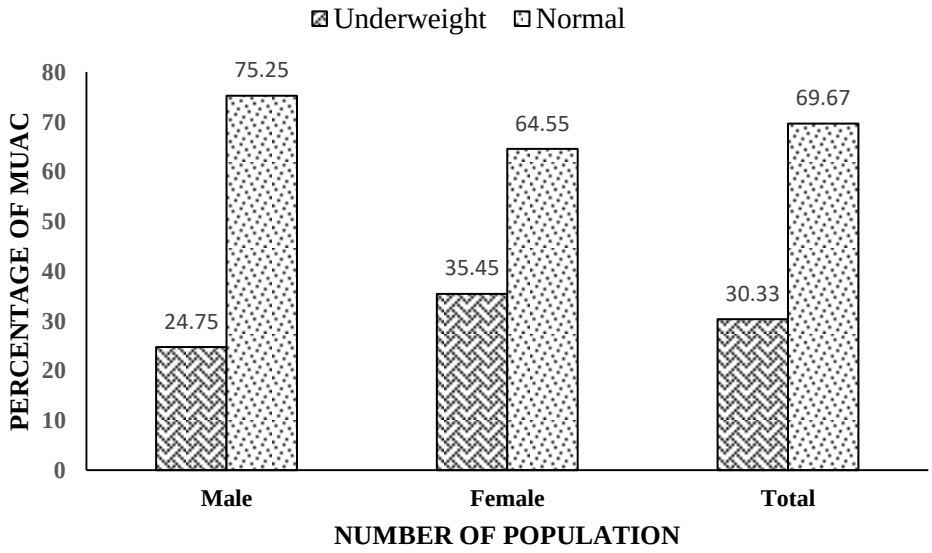

Figure 2: Nutritional status based on MUAC

CONCLUSION

From this study, it could be concluded that female Santal populations were more concerned for undernutrition according to MUAC and overweight according to BMI. Females of this population were more susceptible to conditions than males, which was justified by both the anthropometric indicators (BMI and MUAC). Adiposity was also found more in females than in males. Obesity was present in females more than in males. So, it is recommended that immediate interventional nutritional programs are needed in this population. Further study will be required to find out the genuine cause behind the situation of the population. It should be required to understand the situation's probable consequences and take immediate effective action to make the population come out of it.

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Authors Contribution:
All the authors are directly involved in this survey work, and supervisors are constantly monitored about the progress of this field study and contribute their thoughts.

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