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Sexual dimorphism of Socio-economic status, Nutritional status and hypertension among the Oraon tribe of Paschim Medinipur, West Bengal, India

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KEYWORDS

Socio economic status, Nutritional status, Hypertension, Oraon tribe

ABSTRACT

The nutritional status and socio-economic profile of tribal people is an important issue in India due to their marginalization from main stream population with respect to various facilities. This paper deals with the assessment of socio-economic status and health status among adult males and females of Oraon tribes. A community based cross sectional study was conducted among Oraon tribal people (N=100) from Oraon Para of Tantigeria, Paschim Medinipur, West Bengal, India. The overall prevalence of under nutrition (BMI < 18.5) was very high (56%). The prevalence was significantly higher in male than the female (72.0% vs. 40.0%; p <0.001). Sex wise mean differences was found in all anthropometric indicators (p= <0.001 & P= <0.01) except weight. The mean SBP, DBP and MAP increased with increasing BMI level. BMI category wise differences found between SBP, DBP& MAP among male and female (p=<0.001). Pearson correlation coefficient shows that very high significant association between all anthropometric and physiological variables (p= <0.01) except height wise SBP, DBP & MAP. This population was facing severe nutritional stress.

Introduction

The term Oraons comes from the Oraon word of Chota Nagpur Plateau "to roam" which means vagabond (Ali and Basak, 2018). According to 2011 census, the total population of Oraons tribe's estimates is about 3.5 million to 4.5 million in India. Socio economic condition are often discussed in broad term as satisfaction of needs, feelings of well-being, good or bad working conditions, and other indicators (Pal et al., 2015).

Under nutrition is one of the major causes of morbidity and mortality in a developing country (Calder and Jackson, 2000). More than half of the world's undernourished populations live in India (Krishnaswami, 2000). The prevalence of chronic energy deficiency (CED) measured through BMI is generally considered a good indicator of not only the nutritional status but also the poor demographic, socio-economic and environmental conditions of the population, especially adult population of developing countries (Ferro-Luzzi et al., 1992; Khongsidier, 2002; Mosha, 2003; Pryer and Rogers, 2006). BMI<18.5 kg/m2 is widely used as a practical measure of chronic energy or hunger deficiency (CED), i.e. a "steady" underweight (Khongsdier, 2005). Such a "steady" underweight or chronic under-nutrition reduces physical capacity (James et al., 1994), increases mortality (Harris et al., 1993) and morbidity (Khongsdier, 2002).

In developing countries, high blood pressure is one of the risk factors for cardiovascular diseases,

and the estimated 7.1 million deaths especially among middle, and old-age adults is due to high BP (WHO, 2002). Hypertension (HTN) is the third 'killer' disease, accounting for one in every eight deaths worldwide. It has been expected that the number of hypertensives may rise from 118 million in 2000 to 214 million in 2025 (Kearney et al., 2005). Study carried out by the National Nutrition Monitoring Bureau (NNMB) during (2008-09) on diet and nutritional status of tribal population estimated the prevalence of hypertension among man and women was 25% and 23% respectively. Hypertension is also directly responsible for 57% of all stroke and 24% of all coronary heart disease (CHD) related deaths in India (Tandon, 2006).

According to Census (2011), Indian tribe contributes a population of 104.3 million out of the total population of 1.21 billion. India has more than 104 million tribal people who constitute 8.6 % of the total population. India probably has the largest number of tribal communities in the world (Topal and Samal, 2001). There are 705 Scheduled Tribes (ST) and 75 (approx) Particularly Vulnerable Tribal Groups (PVTG) with diverse cultural and socio-economic developmental stages (Census, 2011). According to Article 342 of the Indian Constitution, at present, there exist 697 tribes recognised by the central government. The tribes in India are undisputedly considered to be the weakest sections of the population in view of common socio-economic and socio-demographic factors such as poverty, illiteracy, lack of developmental facilities and lack of adequate primary health facilities (Basu, 1994; Thakur et al., 1991). Tribal populations of our country are at different transitional stages of social, cultural and economic development. The socio-cultural pattern varies from region to region and from tribe to tribe. The economy of the tribes is explicit in character. The majority of tribal populations reside in the rural areas of the country. The tribal populations of India are recognized as socially and economically vulnerable group (Ghosh and Bharati, 2006).

In West Bengal, they constitute 14% of the total tribal population, the second largest tribe after Santal mainly settled in the districts of Paschim Medinipur, Bankura, Jalpaiguri, South 24 Parganas (Census, 2011).The Oraon are an agricultural tribe found mainly in Bihar, Jharkhand, Orissa and West Bengal. They are also distributed in Tripura, Assam, Maharashtra, some parts of Madhya Pradesh. They have a distinctive cultural identity of their own, with a language, which belongs to the Dravidian language family. Their technology is crude and their economy is primitive. The Oraons call themselves as the 'Kurukh' people while other people term them as the Oraon. Land is their main economic resource; they are settled cultivators. But during lean seasons they depend on forest produce. A number of Oraons work as daily wage labourers and industrial workers and some of them are employed in government and private organizations.

Tribal development is a vast and complex issue, which is multidimensional. Some of the important aspects of tribal development are education, occupation, socio-economic development, food security and health awareness, health and nutrition facilities. Any singular policy cannot fulfill their needs for such diversified Indian tribes having specific and distinct needs. Thus, it is necessary to understand their needs, Socio economic conditions, cultural norms, traditions, food habits, life style, associated physiological variables, their health and nutritional status. The tribal dwellers of such region are deprived from basic necessities of life. Most of them are facing the problem of unemployment making their survival difficult. They could not maintain their livelihood due to their low incomes. They are stressed with education, economic and social backwardness. It is very important to explore the socio-economic status of Oraon tribe with respect to their occupation, lifestyle, income, education and food habits etc. Therefore, in this paper an attempt has been made to analyse the socio-economic conditions of Oraon tribe in Tantigeria of Paschim Medinipur district, assessing the sex wise nutritional status by indices of nutritional anthropometry and studying the association of BMI with hypertension, among

tribal population. CED comparison to other tribes of west Bengal and Oraon tribe of India has also been done.

Materials and methods

Our Community based cross-sectional study was undertaken among Oraon tribes of Medinipur town, Paschim Medinipur district, West Bengal, India. Oraon respondents were selected from Oraon para, Tantigeria town colony area of Medinipur town, Paschim Medinipur district, respectively. A predesigned pretested and structured schedule was used for the data collection. Each participant was interviewed and measured by trained investigators (BM&JD). A total of 100samples (50 male & 50 female) were collect aged from 18 years to 59 years were measured. Sample is selected through simple random sampling. The participants were classified into three age groups, that is Group I: - <25 years, Group II: - 25-40 years and Group III: ->40 years. The study was carried out during the period of February to July, 2014. All the individuals in the age group of 18- 59 years age is willing to participate in the study, while those less than 18 years of age and >60 years of age, not willing to participate and pregnant women were excluded from the study.

The study covers two aspects viz., socioeconomic profile of the people, and assessment of anthropometric characteristics with physiological variables of the people. Ethical approval and prior permission were obtained from Vidyasagar University and local community leaders, respectively, before commencement of the study. Informed oral consent was also obtained from each participant. Information on ethnicity, age, occupation, and educational status was obtained from all subjects with the help of a questionnaire schedule. The socioeconomic status is assessed by modified Kuppuswamy socioeconomic classification scale (Singh et al., 2017). Usually needed three components viz. education, occupation of head of the family and monthly family income of the study participants and asses the socio-economic status.

The Oraon tribe came from the western part of Bengal and Chota Nagpur area of Bihar, and during this period a few batches of Oraons were brought over to this area of Midnapore. The total population of the Oraon in West Bengal was (5,36,919) as per the 1991 census. Their old traditional occupation,was agriculture. In recent years, with the easy communication system the Oraons are coming into closer contact not only with the local caste people but also with advanced groups of the urban and semi urban populations and due to this, remarkable changes in their culture has been taken place. What one can visualize is the change in their language, economy and material culture. In present time of Midnapore, Oraon's main occupation is Rajmistri and Day labour. The Oraons here at present, speak the 'Sadri' language, a mixture of Bengali and Hindi dialect. Many of them have almost forgotten their own mother toungue 'Kurukh'. They also speak in the local Bengali dialect. All people belong to Hindu religion. Oraons are nuclear families in their society. Their house is usually made up of mud wall with thatched, tin, tali and asbestos. These show the presence of many local Hindu cultural traits.

Anthropometric measurements and assessment of socio-economic status, nutritional status and hypertension

The anthropometric measurements height (cm) and weight (kg) were taken according to standard procedures (Lohman et al., 1988). Body Mass Index (BMI) was calculated following international formulae (Lohman et al., 1988; WHO, 1995). Blood pressure data was measured using mercury sphygmomanometer and stethoscope following AHA standards; data includes systolic (SBP) and diastolic (DBP) blood pressure. Nutritional status of the participants was assessed by BMI (18-40-years

age using WHO, 1995) cut-off values. The BMI is a measure of overall adiposity. It is calculated by weight in kg divided by height in mt^2.

Nutritional status can be assessed by dietary, anthropometric, biochemical and clinical Methods. Body mass index (BMI) is widely accepted as one of the best indicators of nutritional status in adults. A suitable cut-off value was also proposed for identification of chronic energy deficiency (CED) in relation to self-reported illness among the adult Oraon males of West Bengal state in India. Although nutritional status in adults can be evaluated in many ways, the BMI is most widely used because its use is inexpensive, non-invasive and suitable for large-scale surveys (Lee and Nieman, 2007; Pirlich and Lochs, 2001). BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially the adult population of developing countries (Khongsdier, 2002, Adak et al., 2006).

Nutritional status was evaluated using internationally accepted BMI guidelines (WHO, 1995). CED: BMI<18.5 kg/m^2; Normal: BMI=18.5-24.99 kg/m^2 and Overweight: BMI≥25.0 kg/m^2. We followed the World Health Organization's classification (1995) of the public health problem of low BMI, based on adult populations worldwide. This classification categorizes prevalence according to percentage of a population with BMI< 18.5 kg/m^2. According to this classification, a low prevalence (5%–9%) of low BMI is considered a warning sign requiring monitoring, a medium prevalence (10%–19%) as indicating a poor situation, a high prevalence (20%–39%) as indicating a serious situation, and a very high prevalence (≥ 40%) as indicating a critical situation. Blood pressure data were classified as normal (SBP<120 and DBP<80mmHg), prehypertensive (SBP 120–139 or DBP 80–89mmHg) and hypertensive (SBP >140 and DBP >90mmHg) according to JNC-7 blood pressure classification (JNC-7).

Statistical analysis

Data was analysed using Statistical Package for Social Sciences (SPSS version 16.0). The data was analyzed for various aspects in terms of frequencies, percentages and means. To know the association between the groups through chi square test (χ^2). Mean SBP, DBP and MAP was calculated among different BMI categories. Independent Sample t test was used to test group differences in mean height, weight, BMI, SBP, DBP and MAP. Pearson's Correlation matrix was utilized to investigate the relation of the variables. The statistical analyses were undertaken using the SPSS Statistical Package (Version 16.0) and statistical significance was set at $p = <0.05$.

Results

Table 1 shows the socio-economic status of the studied participants. The educations of the studied participants are 34% male and 50% female are illiterate and overall, 42% people are illiterate. Most of their head of the family are illiterate. Most of the tribal female are house wife (52%) in occupation but Daily labour, construction labour and domestic worker are also found. 54% tribal male and 28% tribal female are daily wage labour. 14% males are Rickshaw driver of the study participants. Overall, 26% people's monthly family income is <3000 rupees and 70% people's monthly family income is between 3000- 6000 rupees. 94% and 6% tribal male belong to upper lower, lower middle socio-economic status (according to modified Kappuswami scale, 2017) and 26%, 72% and 2% tribal female belongs to lower, upper lower and lower middle socio-economic status respectively. Significant group difference (tribal male & female) found in occupation and socio-economic status ($p<0.001$).

Table 2& 3 shows the prevalence of nutritional status and hypertension of the studied participants.

The high frequency of CED (BMI≤18.5 kg/m2) among the Oraons (56%) indicates that the adult male and female population is suffering from severe under nutrition. Male tribal people suffer high percent CED (72%) than the female (40%). According to the WHO classification of the public health problem of low BMI, the prevalence of CED was very high (≥40%) in both these groups, indicating a critical situation. Sex differences in under-nutrition between the two groups were statistically significant (χ^2= 10.71, p=<0.005). 18% male and 54% female suffer in pre hypertension and hypertension of the studied people. Sex wise statistically significant association found among the Oraon people (χ^2= 14.10, p= <0.001).

Table 4 and Figure 1 show the mean value of systolic, diastolic and mean arterial blood pressure in different BMI categories. Minimum mean SBP, DBP and MAP were found in underweight category and the maximum were found among overweight category. It showed that mean SBP, DBP and MAP increased with increasing BMI level. BMI category wise statistically significant difference found in both sexes (p= <0.001). But sex wise difference is not found except DBP (p= <0.01) and MAP (p= <0.05) of under nutrition.

Age-group and sex wise differences in mean anthropometric characteristics of studied samples are present in Table 5. Significant age-group differences are not found among the adult male and female, except the weight (F=4.21, p<0.05 and BMI (F=4.22, p<0.05) of studied female. Sex wise differences found (p= <0.001, <0.01 &<0.05) in height (all age group), BMI (AG I& II), SBP (only AG II), DBP (AG I& II) and MAP (AG I& II). Age group wise mean SBP, DBP and MAP are increased among male and female with increasing age (figure 2).

The anthropometric characteristics (mean & SD) of the male and female tribes are presented in Table 6. Males had significantly higher mean height (p= <0.001) but females had significantly higher mean BMI (p= <0.001), SBP (p= <0.01), DBP (p= <0.001) and MAP (p= <0.001). Mean weight of the studied male and female are almost same and statistically not significant differences.

Table 7 shows association of anthropometric factors with chronic energy deficiency. The non CED had increased mean height (p= <0.05), weight, BMI, SBP, DBP and MAP compared to CED and *non CED* (p < 0.001). So, all variables found significant association with CED.

Table 8 shows association of anthropometric factors with hypertension (Normotensive & hypertensive). But in case of Height there is no significant association with the hypertension; t-value is not significant. Except height all variables (weight, BMI, SBP, DBP and MAP) had significant association with hypertension (p < 0.001).

Table 9 presents the correlation matrix of age, height, weight, BMI, SBP, DBP and MAP. These results reveal significantly negative correlations between height and BMI of the studied participants. There were significant (*P*=<0.01) positive correlations of age, weight, BMI, SBP, DBP and MAP, r-value is significant (p<0.01). But in case of height there is no significant correlation with the Blood Pressure (SBP, DBP & MAP), r-value is not significant. So, in BMI mainly weight is responsible for the Blood Pressure other than height.

Discussion

The present study aims to investigate the differences in Socio economic variables and health status

between two groups (male and female). This paper deals with the assessment of socio-economic status through socio economic and demographic variables, nutritional status through body mass index (BMI) and hypertension through blood pressure among adult males and females of Oraon tribes. They live in unique physical, socio-economic and cultural environment, isolated from general population. In view of their habitat and food habits, they form a distinct group compared to other populations. Their food intake is influenced by vagaries of nature, with large seasonal variations, depending upon availability of agricultural and forest produce. Several studies have documented a close relationship between the tribal ecosystem and their health and nutritional status (Rao et al., 1996; 1994).

It is well established that health is influenced by social background (Mackenbach et al., 1997). Several recent studies worldwide have established that low socio- economic status is associated with low mean BMI and high rates of chronic energy deficiency among adult (Clausen et al., 2006; Eneobong et al., 2001; Pryer et al., 2003; Pryer and Rogers, 2006) in different populations. Same results found in our study. Education is one of the most important indirect variables affecting socio-economic behaviour as well as labour force participation of a population (Gogoi, 2016). Table 1 shows the percentage of literate population (58%) is very low and there is huge deviation from national literacy rate (74.04%), state literacy rate (76.26%) and district literacy rate (79.04%). Education is supposed to be the spine of any community and it is such a process which help to learn or acquisition knowledge, skills and habits etc. The development of any villages depends on the literacy rate of dwellers (Mandal and Sengupta, 2016).

Another study carried out socio economic condition of Oraon tribe in Jalpaiguri district, West Bengal found the monthly family income (in Rupees)<3000 is 9.3%, 3000- 5999 is 29.6%, 6000-9999 is 40.7%, 10000- 14999 is 13% and above 15000 is 3.7% (Ali and Basak, 2018). So, our studied community show the poor condition in monthly family income. And also lack of work for their livelihood. Their main occupation is daily wage labour (Construction labour, rice meal labour, etc) and Riksha driver but there is no fixed work. They are ready to do any work of the peripheral region of Medinipur town. But they forgot their traditional occupation 'agriculture' because they are situated near the town area, so lack of agricultural land. Similar study carried out on Oraon people of Paschim Medinipur district by (Dey and Mahapatra, 2020) found 13.3%, 85% and 1.7% tribal female belongs to lower, upper lower and lower middle socio-economic status respectively. So, our study show the low socio economic status than the others study.

Table 2, observed that the overall prevalence of CED was very high (56%). The chi square analysis revealed statistically significant association ($p < 0.01$) between nutritional status and sex groups. According to the WHO classification of public health problem of low BMI, the prevalence of CED was very high (≥40%) in both these groups, indicating a critical situation. In another study on the Oraon population of Jalpaiguri of West Bengal the prevalence of hypertension and underweight (based on BMI classification) both were higher in male than the female (Mittal and Srivastava, 2006). In the present study, the overall prevalence of prehypertension and hypertension was 27% (male 14%, female 40%) and 9% (male 4%, female 14%) respectively. It shows prevalence of hypertension was higher among female as compared to male. However, a study conducted among three tribal people of west Bengal by Kshatriya and Acharya, (2016) reported the high BP among female (23.4%) than the male (8.5%) in Oraon tribes.

Table 4 displays the value of systolic and diastolic BP in different BMI categories. It showed that mean systolic, diastolic and mean BP increased with increasing BMI level. Same results found in another tribal male of Northest India (Mungreiphy et al., 2011) and same results show a study

conducted among Punjabi girls of Delhi (Kapoor, 2000). Correlation analyses between age, BMI and BP showed significant positive correlations between them. In a study conducted among Punjabi girls of Delhi, a significant correlation of BMI with blood pressure was also found (Kapoor, 2000). Positive associations between BMI and BP have also been reported in other Indian populations (Gupta et al., 1995; Tandon, 2006; Mungreiphy et al., 2011). Height is not significant correlation with SBP, DBP & MAP. So, height is not responsible for blood pressure and same results found in another study carried out among adult Bengalee male of North 24 Parganas, West Bengal by Kundu and Biswas, 2014.

Several studies shows (table 10) high chronic energy under-nutrition among Oraon tribes across India (Mittal and Srivastava, 2006; Chakraborty and Bose, 2007; Banik, 2008, 2011; Bose et al., 2011; Das et al., 2013a; Roy and Chowdhury, 2013; Jerath el al., 2018) and many studies shows (table 11) high CED among different tribal people across West Bengal in different district such as (Ghosh and Bharati, 2004; Bose et al., 2006a; 2006b; Ghosh and Malik, 2007; Banik et al., 2007; Bose et al., 2008; Bisai and Bose, 2009; Das and Bose, 2010; Mukhopadhaya, 2010; Bose et al., 2011; Das et al., 2013a; 2013b; 2020; Ghosh and Bose, 2015; Ghosh et al., 2018). But the degree of prevalence differs from one community to other and same community of different regions. Thus, there is an urgent need to evaluate the nutritional status of various tribes of West Bengal as well as India.

Table10 compares the mean BMI and the levels of CED (among males & females) of the Oraon tribal populations of India. From this table it can be inferred that, in general, the mean BMI of the Oraon tribes of India was in the range of 17.9- 19.7 Kg/m2. Moreover, the rates of CED varied between 30.7% and 63.9%. These results clearly conclude that level of under nutrition (CED) varies region to region. Under-nutrition remains to be a significant health problem of different tribe of West Bengal. Table 11 compares the mean BMI and the levels of CED (among males) of the various tribal populations of West Bengal. From this table it can be inferred that, the mean BMI of the tribes of West Bengal was in the range 17.7-20.5 kg/m2. Moreover, the rates of CED varied between 19.4% and 67.9%. These rates were in the category high (20–39%) to very high (≥40%). These results clearly indicated that males and females of these tribes were under serious or critical nutritional stress. Prevalence of underweight of present study are very high in male participants (72%) than the all previous investigations in table (10& 11) of the Oraon tribal people in India and various tribal people in West Bengal. Most of the previous studies of table 10 and 11 including present study revealed very high (≥40%) prevalence of CED.

Our findings suggest that we can use BMI and HTN in identifying individuals who are experiencing nutritional stress. It had been clear that using BMI the prevalence of under nutrition was very high (critical situation), both among male and female. On the other hand, using HTN it showed that (18.0%) Male and (54.0%) female Oraons had suffer prehypertension. The mean blood pressures of the studied population reveal that, the lowest blood pressure is present among the individuals who belong to the lower BMI category as well as increases BMI parallelly increase the blood pressure, which indicate that high body mass or weight is an important factor for high blood pressure. This study again shows that a significant positive correlation is present between age, BMI and blood pressure among the adult Oraon male and female of Paschim Medinipur, West Bengal, India. However, it must be mentioned here that some limitations of the present study were the small sample size and the no availability of data on dietary intake.

Conclusion

In conclusion, this study provided strong evidence that, tribal males and females of West Bengal were experiencing serious or critical nutritional stress. CED &hypertension is a major public health problem among tribal population and appropriate nutritional intervention strategies are needed for prevention and control this situation such as increasing awareness, promoting physical activity by improving income and socio-economic condition, job opportunity and food security etc.

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Tables

Table No: 1. Socio economic variables of the studied tribal people

Category	Male (n= 50)		Female (n= 50)		Sex combined		Chi square value (χ^2)
	f	%	f	%	f	%	
	Education Status of the studied tribal people						
Illiterate	17	34	25	50	42	42	χ^2= 6.04^{NS} df=3, p= .110
Primary (I- V)	11	22	7	14	18	18	
Secondary (VI- X)	11	22	14	28	25	25	
Above (XI- Graduate)	11	22	4	8	15	15	
	Occupation of the studied participants						
Daily wage labour	27	54	14	28	41	41	χ^2= 38.89*** df=4, p= .000
House wife	-	-	26	52	26	26	
Student	11	22	8	16	19	19	
Rikshaw driver	7	14	-	-	7	7	
Others work	5	10	2	4	7	7	
	Monthly family income (Rupees)						
<3000 Rupees	12	24	14	28	26	26	χ^2= 4.21^{NS} df=2, p= .122
3001-6000 Rupees	34	68	36	72	70	70	
>6000 Rupees	4	8	-	-	4	4	
	Socio economic Status (Modified Kuppuswamy scale, 2017)						
Lower	-	-	13	26	13	13	χ^2= 15.46*** df=2, p= .000
Upper lower	47	94	36	72	83	83	
Lower middle	3	6	1	2	4	4	
Upper middle	-	-	-	-	-	-	
Upper	-	-	-	-	-	-	

***means p <0.001, NS= Not significant

Table No: 2. Body Mass Index of the studied community (WHO,1995)

Category	Male		Female		Sex combined		Chi square value (χ^2)
	f	%	f	%	f	%	
Underweight	36	72.0	20	40.0	56	56.0	χ^2= 10.71** df=2, p= .005
Normal	13	26.0	26	52.0	39	39.0	
Overweight	1	2.0	4	8.0	5	5.0	

***means p <0.001

Table No: 3. Prevalence of hypertension among the tribal people (JNC, 7)

Category	Male		Female		Sex combined		Chi square value (χ^2)
	f	%	f	%	f	%	
Normal	41	82.0	23	46.0	64	64.0	χ^2= 14.10*** df=2, p= .001
Prehypertension	7	14.0	20	40.0	27	27.0	
Hypertension	2	4.0	7	14.0	9	9.0	

****means p <0.001*

Table No: 4. BMI category wise differences of mean Systolic Pressure, Diastolic pressure and mean arterial pressure among male and female of Oraon tribes

BMI category	SBP			DBP			MAP		
	Male	Female	t test	Male	Female	t test	Male	Female	t test
Under nutrition	111.7 (5.4)	113.0 (8.0)	0.63^{NS}	70.2 (5.1)	74.9 (7.4)	2.50**	84.0 (4.9)	87.6 (7.0)	2.21*
Normal	118.1 (9.3)	122.6 (8.0)	1.48 ^{NS}	76.6 (6.7)	79.4 (7.6)	1.16 ^{NS}	90.5 (7.4)	93.8 (6.8)	1.37 ^{NS}
Over weight	144.0 (7.6)	131.0 (7.6)	1.54 ^{NS}	92.0 (1.0)	90.5 (1.0_)	1.34 ^{NS}	109.3 (2.9)	104.0 (2.9)	1.66 ^{NS}
F=	14.78***	12.81***		12.74***	8.09***		14.59***	11.75***	

** means p <0.05, **means p <0.01, ***means p <0.001, NS= Not significant*

Table No: 5. Age group and sex wise descriptive statistics (mean & SD) of anthropometric variables

Variables	Sex	AG: I (<25y)	AG: II (25-40y)	AG: III (>40)	F test
Height	Male	160.86 (5.85)	160.22 (5.14)	157.83 (5.94)	.949 ^{NS}
	Female	149.59 (7.10)	151.44(4.88)	149.74(7.20)	.362 ^{NS}
	t test	6.212 ***	4.775 ***	2.682 *	
Weight	Male	45.21 (4.52)	45.82 (5.73)	47.11 (8.47)	0.356 ^{NS}
	Female	42.0(7.04)	49.77 (9.64)	47.20 (9.85)	4.208 *
	t test	1.957 ^{NS}	1.310 ^{NS}	.021 ^{NS}	
Body Mass Index	Male	17.45 (1.34)	17.88 (2.42)	18.84 (2.68)	1.535 ^{NS}
	Female	18.73 (2.52)	21.70 (4.11)	21.04 (4.01)	4.221*
	t test	2.275*	2.967**	1.414 ^{NS}	
Systolic blood pressure	Male	112.50 (6.85)	114.35 (9.17)	117.56 (9.98)	1.237 ^{NS}
	Female	117.11(9.740	122.00 (8.40)	122.40 (10.40)	1.749 ^{NS}
	t test	1.971 ^{NS}	2.373 *	1.035 ^{NS}	
Diastolic blood pressure	Male	71.25 (6.12)	72.00 (7.24)	75.78 (7.03)	1.535 ^{NS}
	Female	76.37 (8.30)	80.92 (8.230	81.00 (7.26)	1.994 ^{NS}
	t test	2.524*	3.097**	1.592 ^{NS}	
Mean arterial pressure	Male	85.00 (6.05)	86.11 (7.82)	89.70 (7.72)	1.482 ^{NS}
	Female	89.95 (7.98)	94.61 (7.98)	94.80 (6.96)	2.300 ^{NS}
	t test	2.510*	2.914**	1.504 ^{NS}	

** means p <0.05, **means p <0.01, ***means p <0.001, NS= Not significant*

Table No: 6. Sex wise mean differences of anthropometric variables

Anthropometric indicators	Male		Female		t test	p value
	Mean	SD	Mean	SD		
Height	160.1	5.63	150.1	6.54	-8.20***	.000
Weight	45.76	5.71	45.06	8.88	-0.47 NS	.640
Body Mass Index	17.85	2.05	19.96	3.51	3.66***	.000
Systolic blood pressure	114.04	8.32	119.44	9.70	2.99**	.004
Diastolic blood pressure	72.32	6.75	78.48	8.26	4.08***	.000
Mean arterial pressure	86.23	7.06	92.13	8.00	3.91***	.000

***means p <0.01, ***means p <0.001, NS= Not significant*

Table No: 7. Association of anthropometric factors with chronic energy deficiency by CED and non CED

Anthropometric variables	CED (n= 56)		Non CED (n= 44)		t test	
	Mean	SD	Mean	SD	t value	p value
Height	156.82	7.57	152.91	7.80	2.52*	.014
Weight	41.34	4.76	50.59	7.01	7.50***	.000
Body Mass Index	16.77	1.07	21.62	2.54	11.85***	.000
Systolic blood pressure	112.18	6.45	122.55	9.39	6.25***	.000
Diastolic blood pressure	71.89	6.38	79.86	7.95	5.42***	.000
Mean arterial pressure	85.32	5.94	94.09	7.80	6.18***	.000

** means p <0.05, ***means p <0.001*

Table No: 8. Association of anthropometric factors (Mean & SD) with hypertension by normotensive and hypertensive subjects

Anthropometric variables	Normotensive (n= 64)		Hypertensive (n= 36)		t test	
	Mean	SD	Mean	SD	t value	p value
Height	155.12	8.78	155.07	7.23	.031NS	.975
Weight	42.58	5.23	50.44	8.15	5.22***	.000
Body Mass Index	17.72	2.02	21.02	3.43	5.28***	.000
Systolic blood pressure	111.38	5.32	126.28	7.24	10.82***	.000
Diastolic blood pressure	70.59	4.78	83.94	5.29	12.54***	.000
Mean arterial pressure	84.19	4.39	98.06	4.82	14.26***	.000

****means p <0.001, NS= Not significant*

Table No: 9. Correlation of coefficient between BMI, blood pressure and anthropometric variables

Anthropometric indicators	Age	Height	Weight	BMI	SBP	DBP	MAP
Age	1	-.029NS	.219*	.246*	.211*	.221*	.230*
Height		1	.359**	-.260**	.116 NS	-.070NS	-.002NS
Weight			1	.805**	.651**	.540**	.614**
Body Mass Index				1	.597**	.605**	.637**

Systolic blood pressure					1	.771**	.904**
Diastolic blood pressure						1	.969**
Mean arterial pressure							1

***. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).*

Table No.10. Mean BMI and prevalence of CED (based on BMI) among Oraon tribes across India.

Studied Community	Study area	Sample size	Mean BMI (Kg/ m^2)	CED (%)	References
Oraon (M & F)	Jalpaiguri, WB	350	18.8(M), 19.7(F)	47.0(M), 30.7(F)	Mittal & Srivastava (2006)
Oraon (M)	Gumla, JH	205	18.0	63.9	Chakraborty & Bose (2007)
Oraon (M)	Ranchi, JH	290	18.5	53.1	Banik SD (2008)
Oraon (F)	Ranchi, JH	216	18.1	62.5	Banik SD (2011)
Oraon (M)	Paschim Medinipur	104	19.4	37.5	Bose et al. (2011)
Oraon (M)	Paschim Medinipur, WB	104	18.6	46.2	Das *et al*. (2013a)
Oraon (M & F)	Jalpaiguri, WB	357	AL-18.2(M)&17.9(F); BL-18.3(M)&18.3(F)	-	Roy & Chowdhury (2013)
Oraon (F)	Gumla, JH	143	-	39.2	Jerath *et al*. (2018)
Oraon (M& F)	Paschim Medinipur, WB	100	M-17.85, F-19.96	M-72, F-40	Present study

WB: West Bengal; JH: Jharkhand; AL: Agricultural Labour; BL: Brickfield Labour; M: Male; F: Female

Table No: 11. Mean BMI and prevalence of CED (based on BMI) among various tribes of West Bengal.

Tribal name	Study area	Sample size	Mean BMI (Kg/ m^2)	CED (%)	References
Munda (F)	Kolkata	234	17.7	67.9	Ghosh & Bharati (2006)
Santal (M& F)	Paschim Medinipur	410	20.0(M), 19.3(F)	31.5(M), 41.8(F)	Bose et al. (2006a)
Kora-mudi (M& F)	Bankura	500	18.6(M), 18.2(F)	48.0(M), 56.4 (F)	Bose et al (2006b)
Santal (M& F)	Bankura	800	-	55(M), 52.5(F)	Ghosh & Malik (2007)
Dhimal (M&F)	Siliguri	305	19.5(M), 19.1(F)	27.0(M), 46.4(F)	Banik et al. (2007)
Lodhas (M)	Paschim Medinipur	157	19.5	45.2	Bose et al. (2008)
Bhumij (M)	Paschim Medinipur	161	18.6	48.4	Bose et al. (2008)
Kora-mudi (F)	Bankura	123	18.3	55.3	Bisai & Bose (2009)
Santal (M&F)	Purulia	513	19.5(M), 18.1(F)	30.6(M), 63.4(F)	Das & Bose (2010)
Santal (M& F)	Birbhum	251	20.5(M), 19.5(F)	30.5(M), 38.5(F)	Mukhopadhyay A (2010)
Munda (M)	Paschim Medinipur	106	19.3	35.8	Bose et al. (2011)
Munda (M)	Paschim Medinipur	106	18.4	50.0	Das et al. (2013a)
Birhor (M)	Purulia	72	20.5	19.4	Das et al. (2013b)

Bhumij (M)	Paschim Medinipur	195	18.6	52.3	Ghosh & Bose (2015)
Sabar (M& F)	Bankura	226	19.8(M), 18.4(F)	46.8(M), 56.5(F)	Ghosh et al. (2018)
Sabar (M)	Purulia	307	19.0	47.2	Das et al. (2020)
Oraon (M& F)	Paschim Medinipur, WB	100	M-17.85, F-19.96	M-72, F-40	Present study

M: Male; F: Female

Figures

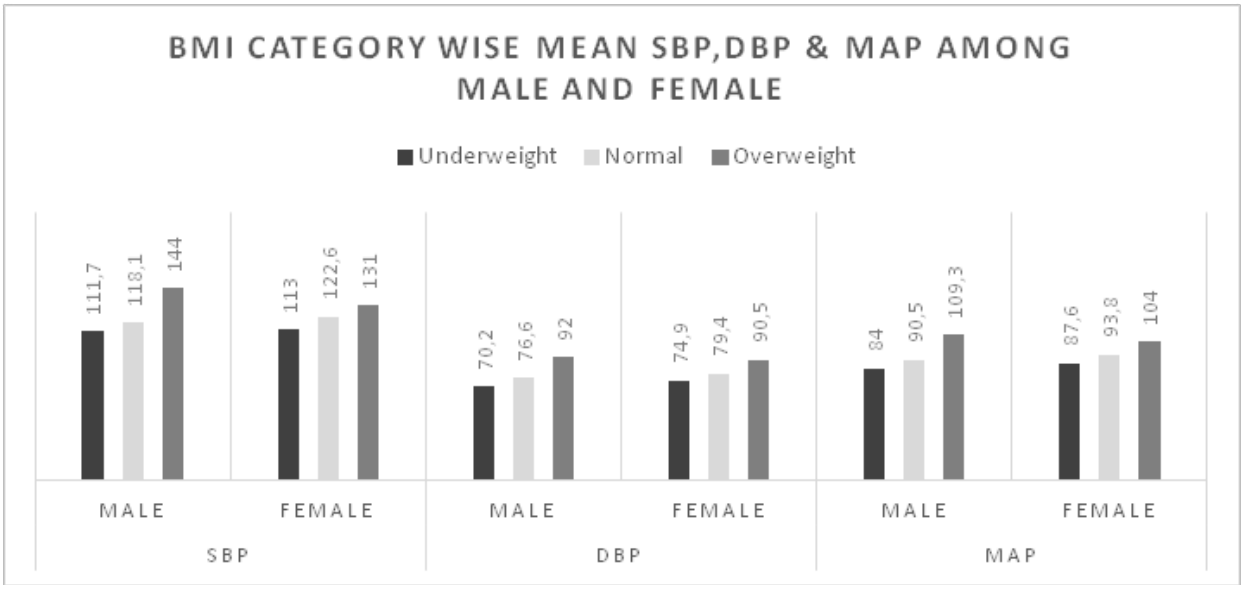

Figure 1: BMI category wise mean SBP, DBP & MAP differences among Oraon male and female

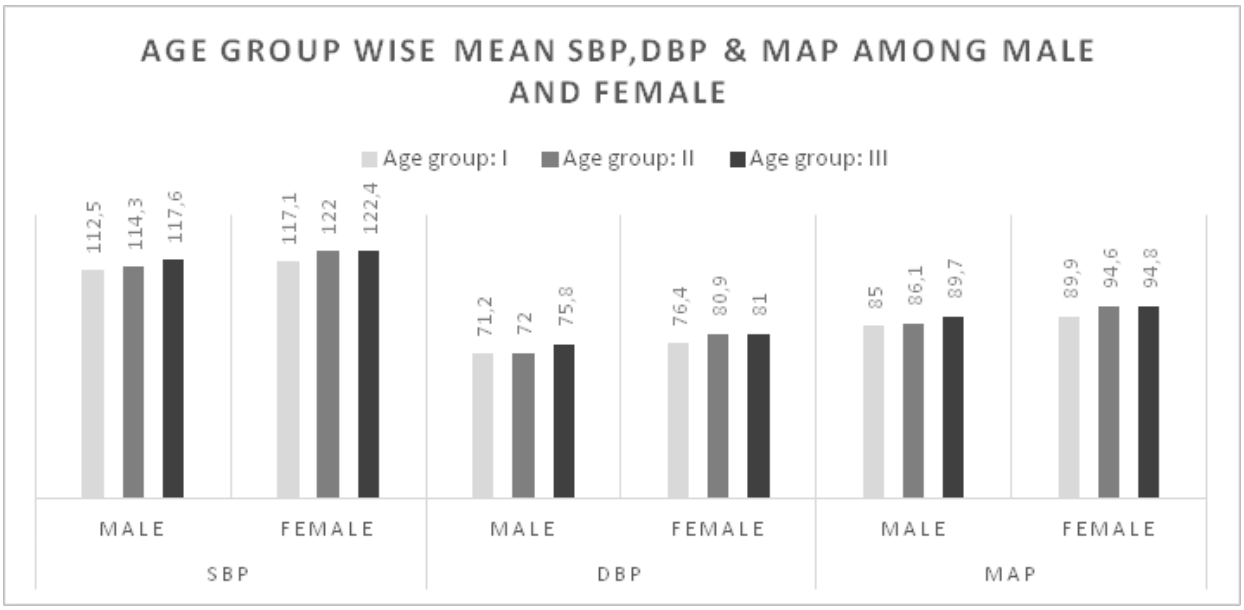

Figure 2: Age group wise mean SBP, DBP & MAP differences among Oraon male and female