



SUDIP DATTA BANIK, RAJ KUMAR BARMAN, SHRABANTI MAITY, TANWI SUKUL, VIVEKANANDA ROY

ETHNIC VARIATION IN ANTHROPOMETRIC CHARACTERISTICS AND NUTRITIONAL STATUS – A COMPARATIVE STUDY AMONG ADULT MALE ORAONS AND SARAOKS OF RANCHI DISTRICT, JHARKHAND, INDIA

ABSTRACT: A cross-sectional study was undertaken to investigate the ethnic variation and age-related changes in anthropometric characteristics and nutritional status among the adult males (18 years and above) of two endogamous populations, the Oraon tribe ($n=290$), and the Saraks ($n=158$), a comparatively less known caste group in the Ranchi District of the state of Jharkhand in India. The anthropometric characteristics (stature, body weight, mid-upper arm circumference or MUAC, waist circumference and hip circumference), derived index (body mass index or BMI) and ratio (waist-hip ratio or WHR) were categorized in three different age groups (18–39 years, 40–59 years and 60 years and above). Significant differences ($p<0.0001$) were observed (measured by student *t*-test) in mean values of anthropometric variables viz. body weight, BMI and hip circumference between the two studied samples. However, results displayed no significant difference in stature and a moderately significant difference in WHR ($p<0.01$) between the two sections. This particular investigation recorded high frequency of undernutrition (chronic energy deficiency or CED 53.10% among the Oraons and 27.85% among the Saraks), as measured by the WHO (1995) recommended values of BMI for the adults. It has been noted that 38.28% of the adult Oraons and 20.89% of the adult Saraks suffer from undernutrition when the nutritional status of the two communities is evaluated by the standard cut-off points of MUAC. Pearson correlations of BMI and MUAC with age exhibited significantly ($p<0.01$) negative correlations among the Oraons and not significant among the Saraks. However, WHR showed highly significant ($p<0.0001$) and positive correlations with age among the Oraons, which is moderately significant ($p<0.01$) among the Saraks. In most of the cases (except between MUAC and WHR), correlations between BMI, MUAC and WHR in both the populations showed high significance ($p<0.0001$). Significant age-related variations (tested by one-way ANOVA) in anthropometric parameters were observed in both the populations. Linear regression analyses revealed more or less significant negative impact of age on BMI and MUAC in both the populations. However, age appears to have significantly positive influence on WHR in these two ethnic groups.

Very high rates of undernutrition at all ages and even a worse situation of the nutritional status declining with age are recorded for both the Oraons and the Saraks. Immediate attention to adequate food and nutrient supplementation is required for these two populations.

KEY WORDS: Body mass index – Chronic energy deficiency – Mid-upper arm circumference – Waist-hip ratio – Age trend

INTRODUCTION

The present paper is a preliminary report of a bio-anthropological investigation undertaken among the adult

male sections of two endogamous populations, the Oraon tribe, and the Saraks, a Hindu caste in Ranchi district of the state of Jharkhand in Eastern India. It is the first report dealing with the levels of anthropometric characteristics and

nutritional status of the Saraks. An anthropometric assessment of nutritional status of the two communities with respect to body mass index (BMI), mid-upper arm circumference (MUAC) and waist-hip ratio (WHR) records a comparative account between the two populations. Data and results of the pooled sample (both Oraons and Saraks combined) also project the nutritional status of underprivileged populations in this region. Ethnic variation in anthropometric characteristics of nutrition is further observed with comparative statements made between the recently studied eight endogamous populations of Eastern India including the Oraons and Saraks. Age-trend along with age-wise ethnic variation of anthropometric measurements, derived ratios and indices in two populations were also studied. BMI is extensively used to evaluate the nutritional status of adults because its exercise is suitable for large-scale surveys (Lohman *et al.* 1998, Ferro-Luzzi *et al.* 1992, James *et al.* 1988). Therefore, BMI is the most recognized anthropometric marker used for the assessment of nutritional status of adults (Lee, Nieman 2007, Bose 1996, Pirlich, Lochs 2001), especially for the populations of developing countries (Shetty *et al.* 1994, Khongsdier 2002, Adak *et al.* 2006). The studies in different corners of the globe have investigated the anthropometric characteristics and nutritional status of the adults of different ethnic groups (Strickland, Ulijaszek 1993, Delaure *et al.* 1994, Chiu *et al.* 2000, Kuczmariski *et al.* 2000, Bose 2002, Perissinotto *et al.* 2002, Suzana *et al.* 2002, Corish, Kennedy 2003, Davidson, Getz 2004, Santos *et al.* 2004, McLorg 2005, Kikafunda, Lukwago 2005).

In general, data are scarce on the anthropometric and nutritional status of various tribal populations of India (Bose *et al.* 2005, 2006a, b, c, d, Singh 1994 a, b, Singh *et al.* 1994). It has been recently suggested (Ferro-Luzzi *et al.* 1992, Bose *et al.* 2006b, Datta Banik 2007, 2008, Datta Banik and Sain 2007, Datta Banik *et al.* 2005, 2007) that there is urgent need to evaluate the nutritional status of various tribes of India.

The Oraons of Jharkhand

Jharkhand includes the foremost part of the Chhotanagpur plateau which is studded with a whole range of hills, and more than 27% of the land lies under forest cover, which provides a unique habitat to tribal communities (Mandal *et al.* 2002). The Scheduled Tribes constitute around 26.3% of the total population of the state of Jharkhand (Census of India 2001). There are about 30 major tribal communities in the state. Among them, the Santals, Oraons, Mundas, Hos, Loharas, Kharwars, Kharias and the Bhumijis are the predominant tribal groups. The Oraons are the second largest tribal community, next to the Santals in the state of Jharkhand. They are also distributed in Bihar, West Bengal, Tripura, Assam, Maharashtra, some parts of Madhya Pradesh and Orissa. 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 wage laborers and industrial workers and some of them are employed in government and private organizations.

The Saraks of Ranchi District, Jharkhand

Sarak or Sarawak, a small caste of Chhotanagpur seems to be a Hinduised remnant of early Jain people (Risley 1891). Saraks of Manbhum, while retaining the tradition that their ancestors were Jains, appear themselves to have completely adopted Hinduism. They worship the ordinary Hindu Gods and Goddesses. In the descriptive ethnological accounts (Hunter 1877, O'Mally 1910, Coupland 1911) one gets casual references of the community. During the last two decades also local literatures depicting the exclusive nature of this community began to appear in regional and national languages (Bijoyjee 1985, Chakrabarti 1981, Chakrabarty 1984, Bhattacharya 1986, Bhattacharya 1997, Singh 1998, Chakrabarti, Bhattacharya 2000). The Saraks are skillful agriculturists and pure vegetarians.

MATERIALS AND METHODS

Several studies have focused on age variations in anthropometric characteristics and nutritional status of adult men and women of different ethnic groups of both tribal and non-tribal populations (Bose, Chakraborty 2005, Bose *et al.* 2006a, b, c, d). In view of this, the objective of the present study was to report nutritional status, based on BMI, of the adult (aged 18 years and above) male Oraons and Saraks in the Ranchi district in the state of Jharkhand, India. This cross-sectional study focuses on anthropometric variations and also evaluates nutritional status of the adult male Oraons and Saraks in Ranchi district of Jharkhand, India.

The present cross-sectional study among the adult (aged 18 years and above) Saraks (158 males) and Oraons (290 males) was conducted during July 2007. The area of study was located in five villages in and around Bundu (police station, block and sub-division), about 45 kilometers south from the city of Ranchi, the provincial capital of the state of Jharkhand.

Collection of data and information on other social and cultural factors like ethnicity, endogamy, clan exogamy, marriage distance and direction etc. were also kept in mind in order to restore the purity of data of a particular community, either a tribe (the Oraons) or caste (the Saraks).

All anthropometric measurements of lightly-clothed subjects were taken by trained investigators (SDB, RKB, SM, TS and VR) using standard anthropometric techniques (Weiner, Lourie 1969, Lohman *et al.* 1988, Lee, Nieman 2007). Stature or body height (cm) is the vertical distance from floor to vertex of the head. The subject's head is held with the Frankfurt plane and bare footed. Mid-upper arm circumference (MUAC) is an indicator of the amount of fat and muscle in the upper arm. In population level, a reasonable correlation exists between MUAC and BMI in adults (Harries *et al.* 1984, Bray *et al.* 1978, Collins *et al.* 2000). A scheme using a combination of MUAC and BMI has been proposed to categorize the degree of undernutrition in adults (Woodruff, Duffield 2000).

The body height and weight were taken to the nearest 0.1 cm and 0.5 kg, using standard Martin's anthropometer and

weighing scale (Libra, New Delhi, India), respectively. Technical errors of measurements (TEM) were within acceptable limits. Derived anthropometric indices and ratios were computed using the following standard equations, and classifications were presented according to following international standards (Lohman *et al.* 1988, WHO 1971, 1995).

Abbreviations of the anthropometric measurements, indices and ratios used (in alphabetical order):

BMI (kg/m²) = Body Mass Index

BW (kg) = Body Weight

HC (cm) = Hip Circumference

MUAC (cm) = Mid-Upper Arm Circumference

ST (cm) = Stature or Height

WC (cm) = Waist Circumference

WHR = Waist-Hip Ratio

BMI may be appropriate for population-level assessments of chronic undernutrition. The classification of BMI provides a useful framework for the analysis of height and weight data from chronically undernourished adult populations. Standard protocols (Ferro-Luzzi *et al.* 1992, WHO 1995) were followed to calculate the formula of BMI [BMI = Weight (kg)/Height (m²)] and to estimate the different categories of chronic undernutrition as per BMI.

MUAC measurement was made using a flexible non-stretch steel tape. The subject stood erect and sideways to the measurer (Lee, Nieman 2007) with the head in the Frankfurt plane, arms relaxed and legs apart. The measurement was taken at the midpoint of the upper right arm between the acromion process and the tip of the olecranon. After locating the midpoint, the right arm was relaxed so that it was hanging loosely by the side, with the palms facing inwards. The tape was wrapped gently but firmly around the arm at the mid point. Measurement was taken to the nearest 0.1 cm.

The cut-off values of mid-upper arm circumference (MUAC) in males to determine the nutritional status were estimated following standard references (Pitanga and Lessa 2005, Lee and Nieman 2007).

The standard formula and the cut-off points of waist-hip ratio (WHR) in males to determine the nutritional status were computed following standard formulae (WHO 1995, Van'tallie *et al.* 1990, Lohman *et al.* 1981).

Student t-test was performed to test for differences in mean anthropometric characteristics between the two different samples. The one-way analyses of variance – Scheffe's procedure (Mascie-Taylor 1994a, b) were used to test for age-group differences in mean anthropometric characteristics. Pearson correlation coefficients (r) and linear regression analyses were used to study the interrelationship between age and anthropometric characteristics. In linear regression analyses, age was used as a continuous independent variable. All statistical analyses were done using the SPSS Statistical Package. Statistical significance was set at p<0.05. Ethical approval was obtained from Vidyasagar University Ethics Committee

before commencement of the study. Informed consent was also obtained from local community leaders and each participant.

RESULTS AND DISCUSSION

The mean (\pm standard errors) age (range of 18–75 years) of adult males of the two investigated ethnic groups (the Oraons, n=290; the Saraks n=158) vary (*Table 1*). The Oraons (37.43 \pm 0.81 years) represent a much younger adult population compared to the Saraks (42.92 \pm 1.23 years) with significant difference (t=3.851, p<0.0001). The group statistics (mean \pm standard errors) with range (minimum and maximum values) of anthropometric measurements, derived index (BMI) and ratio (WHR) are presented in *Table 1*. The mean (\pm se) values of anthropometric parameters (BW, BMI, MUAC, WC and HC) of the adult Saraks significantly vary (Student t-test p<0.001) from those of the Oraons. The adult Saraks (161.46 \pm 0.50 cm) are taller than the Oraons (160.05 \pm 0.35 cm), however, with no significant ethnic difference. The mean Body Mass Index (BMI) of the Oraons (18.48 \pm 0.12 kg/m²) marginally equals to the standard WHO (1995) recommended value of CED Grade I thinness (18.49 kg/m²) and significantly vary (p<0.001) from the values observed among the Saraks (20.27 \pm 0.24 kg/m²), whose mean BMI falls within the normal range of nutritional status. Mean waist-hip ratio (WHR) also appears to significantly vary (t=-2.59, p<0.01) between the adult samples of the two ethnic groups (0.86 \pm 0.20 for the Oraons and 0.87 \pm 0.33 for the Saraks).

Table 1 also displays the mean age and other anthropometric characteristics of the pooled sample (combined n=448) of both the male Oraons and Saraks. This is meant for exhibiting the anthropometric characteristics and nutritional status of a mixed or heterogeneous sample represented by two neighboring ethnic groups, the Oraons and the Saraks. The Oraon is an age-old Dravidian tribe of Chhotanagpur plateau and the Sarak is a caste group, who are said to be the Jains (the Saraks, however, claim themselves belonging to the Hindus). People of these two communities reside side by side in different villages in the district of Ranchi. The pooled sample represents a moderately young adult population with mean age of 39.39 years (\pm 0.70). Mean Body Mass Index (BMI) (19.11 \pm 0.12 kg/m²) and mean waist-hip ratio (0.80 \pm 0.26) and MUAC (23.83 \pm 0.13 cm) indicate normal health and nutritional status.

Table 2 exhibits the prevalence of chronic energy deficiency (CED) and nutritional status of the adult male Oraons (n=290), the Saraks (n=158) and the combined sample (n=448) as measured by the WHO (1995) recommended cut-off values of BMI. The high frequency of CED (BMI \leq 18.49 kg/m²) among the Oraons (53.10%) indicates that the adult male population is suffering from severe undernutrition. The adult Saraks, on the other hand, also appear to have high degree (27.85%) of undernutrition. The overall situation (combined sample n=448) of the adult male population in this particular region also exhibits high frequency of undernutrition (44.20%) (*Figure 1*).

TABLE 1. Descriptive statistics of anthropometric measurements, derived indices and ratios among adult male Oraons and Saraks in Ranchi District, Jharkhand.

SL. NO.	Variables		Oraons (n=290)	Saraks (n=158)	t Value	Oraons + Saraks (n=448)
1	Age (years)	Range	18–75	18–75	-3.851***	18.0–75.0
		Mean ± se	37.43±0.81	42.92±1.23		39.39±0.70
2	Stature (cm)	Range	138.50–179.50	144.60–177.60	-1.366	138.5–179.50
		Mean ± se	160.65±0.35	161.46±0.50		160.93±0.29
3	Body wt. (kg)	Range	31.0–72.0	38.0–85.0	-6.916***	31.00–85.00
		Mean ± se	47.79±0.38	52.97±0.73		49.62±0.38
4	BMI (kg/m ²)	Range	12.95–24.90	13.96–29.59	-7.636***	12.95–29.59
		Mean ± se	18.48±0.12	20.27±0.24		19.11±0.12
5	MUAC (cm)	Range	23.20–44.40	19.50–33.00	-3.554***	23.20–44.40
		Mean ± se	23.50±0.17	24.43±0.18		23.83±0.13
6	Waist Circumference (cm)	Range	52.40–88.10	57.50–102.00	-6.660***	52.40–102.0
		Mean ± se	68.03±0.36	72.71±0.68		69.68±0.35
7	Hip Circumference (cm)	Range	63.00–94.50	71.50–103.00	-7.399***	63.0–103.0
		Mean ± se	79.03±0.28	82.99±0.50		80.43±0.27
8	Waist-Hip Ratio	Range	0.65–1.13	1.74–1.06	-2.59**	0.65–1.13
		Mean ± se	0.86±0.20	0.87±0.33		0.86±0.26

Level of significance p<0.0001****; p<0.01 **

TABLE 2. Frequency of nutritional status based on the body mass index (BMI) (WHO 1995) among adult male Oraons and Saraks.

BMI Range	Nutritional status	Oraons (n=290)	Saraks (n=158)	Total (n=448)
<16.0	Grade III thinness (CED III)	19 (6.55%)	9 (5.70%)	28 (6.25%)
16.0–16.99	Grade II thinness (CED II)	42 (14.42%)	12 (7.59%)	54 (12.05%)
17.0–18.49	Grade I thinness (CED I)	93 (32.07%)	23 (14.56%)	116 (25.89%)
Total	Undernutrition (16.0–18.49)	154 (53.10%)	44 (27.85%)	198 (44.20%)
18.50–24.99	Normal	135 (46.90%)	103 (65.19%)	147 (32.81%)
25.00–29.99	Overweight	0.00 (0.00%)	11 (6.96%)	11 (2.46%)

TABLE 3. A comparison of BMI in some populations of Eastern India.

VARIABLE	Bathudi (n=183)	Kora Mudi (n=250)	Savar (n=300)	Santal (n=213)	Telega (n=102)	Dhimal (n=159)	Oraons ^{a,b} (n=290)	Saraks ^a (n=158)
BMI (kg/m ²)	18.40 (0.14)	18.70 (0.11)	19.30 (0.12)	20.00 (0.18)	20.30 (0.36)	19.5 (0.16)	18.48 (0.12)	20.27 (0.24)

Standard errors are presented in parentheses.

^a Present study; ^b Datta Banik 2008

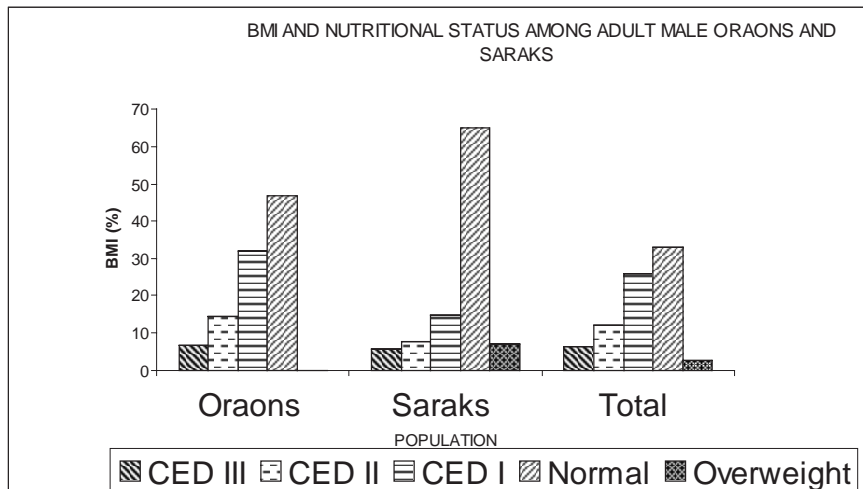
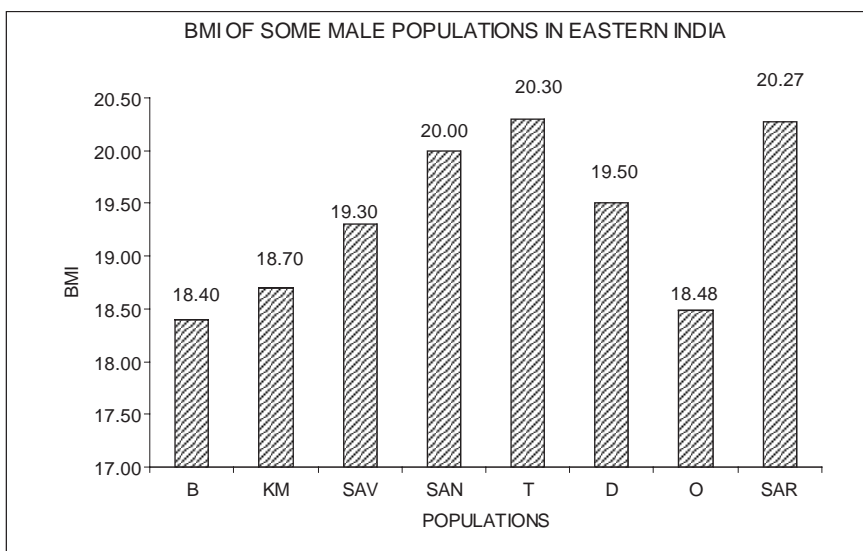


FIGURE 1. Frequency of nutritional status based on the body mass index (BMI) (WHO 1995) among adult male Oraons and Saraks.



FFIGURE 2. A comparison of BMI in some populations of Eastern India.
 B = Bathudi (Bose, Chakraborty 2005b)
 K = Kora Mudi (Bose *et al.* 2006d)
 SAV = Savar (Bose *et al.* 2006c)
 SAN = Santal (Bose *et al.* 2006a)
 T = Telega (Datta Banik 2007, Datta Banik, Sain 2007)
 D = Dhimial (Datta Banik 2005, 2007)
 O = Oraon (Present study, Datta Banik 2008)
 SAR = Sarak (Present study)

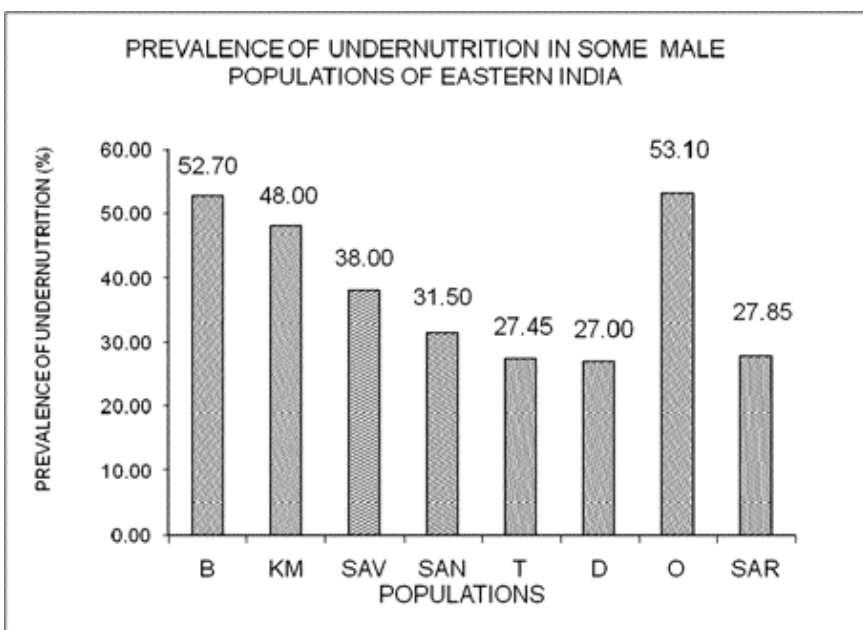


FIGURE 3. A comparative statement on prevalence of undernutrition based on BMI in some populations of Eastern India.
 B = Bathudi (Bose, Chakraborty 2005b)
 K = Kora Mudi (Bose *et al.* 2006d)
 SAV = Savar (Bose *et al.* 2006c)
 SAN = Santal (Bose *et al.* 2006a)
 T = Telega (Datta Banik 2007, Datta Banik, Sain 2007)
 D = Dhimial (Datta Banik 2005, 2007)
 O = Oraon (Present study, Datta Banik 2008)
 SAR = Sarak (Present study)

TABLE 4. Assessment of nutritional status based on MUAC among adult male Oraons and Saraks.

Cut-off points of MUAC	Nutritional status	Oraons (n=290)	Saraks (n=158)	Total (n=448)
≥23.0	Normal	179 (61.72%)	125 (79.11%)	304 (67.86%)
<23.0	Undernutrition	111 (38.28%)	33 (20.89%)	144 (32.14%)

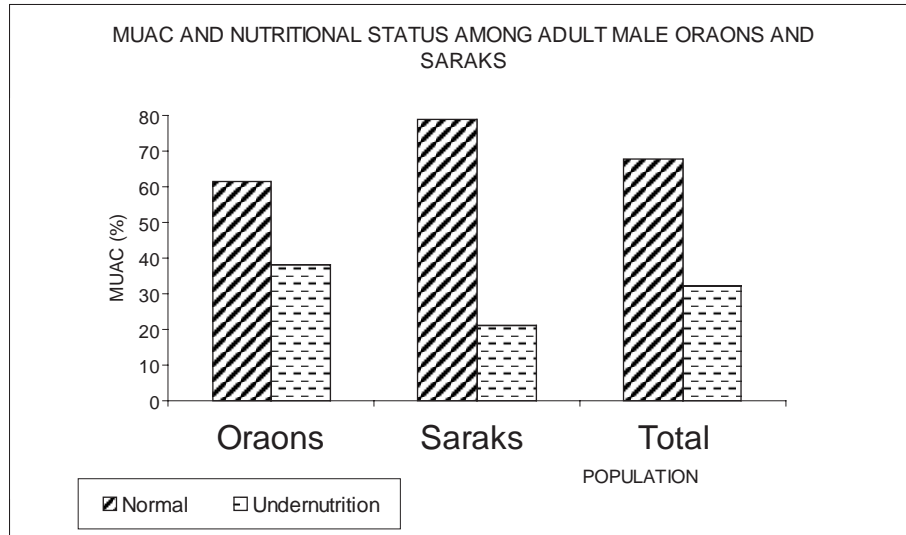


FIGURE 4. Assessment of nutritional status based on MUAC among adult male Oraons and Saraks.

TABLE 5. Assessment of nutritional status based on WHR among adult male Oraons and Saraks.

Cut-off points of WHR	Nutritional status	Oraons (n=290)	Saraks (n=158)	Total (n=448)
<0.95	Normal	272 (93.79%)	143 (90.51%)	415 (92.63%)
≥0.95	Centrally obese	18 (6.21%)	15 (9.49%)	33 (7.37%)

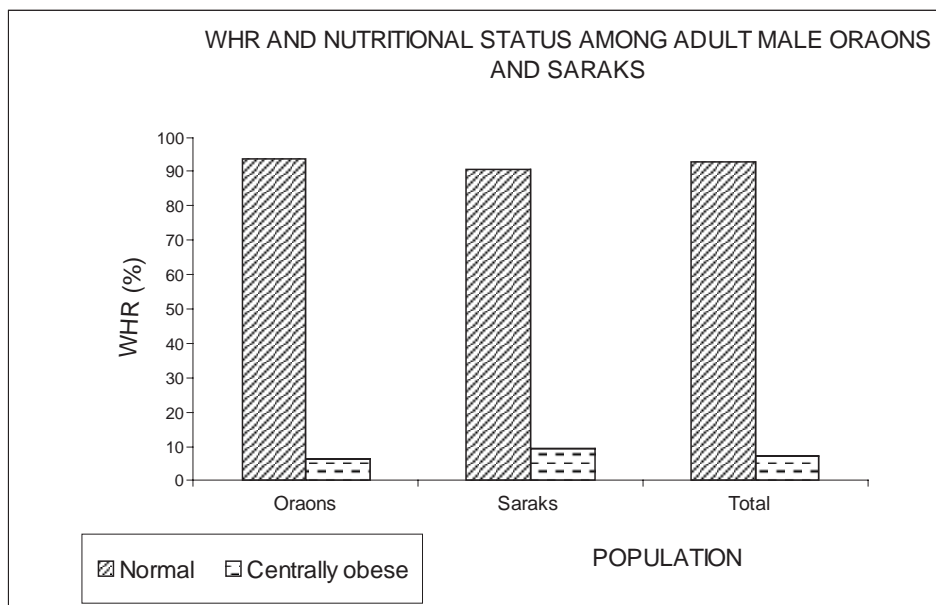


FIGURE 5. Assessment of nutritional status based on WHR among adult male Oraons and Saraks.

Moreover, recent investigations (Bose and Chakraborty 2005, Bose *et al.* 2006a, c, Datta Banik 2007, 2008, Datta Banik and Sain 2007, Datta Banik *et al.* 2005, 2007) have studied the anthropometric characteristics and states of nutrition among six other endogamous populations of Eastern India (Table 3). These studies have dealt with Bathudis (Bose and Chakraborty 2005) and Savars (Bose *et al.* 2006c) of Orissa, Kora Mudis (Bose *et al.* 2006d), Santals (Bose *et al.* 2006a), Telugu-speaking Telegas (Datta Banik 2007, Datta Banik and Sain 2007) and Dhimals (Datta Banik *et al.* 2005, 2007) of West Bengal. Comparative statement of the prevalence of undernutrition based on BMI of adult males of these six other populations of Eastern India along with the Oraons and Saraks of the present study revealed considerable ethnic differences (Figures 2, 3). Least BMI (18.40 kg/m²) recorded among the Bathudis is followed by that of the Oraons (18.48 kg/m²). Highest BMI, compared to other samples, is observed among the Telegas (20.30 kg/m²).

Figure 3 compares the rates of CED among the eight populations of Eastern India. All the eight tribal populations are found to have very high rates of undernutrition. The highest frequency of undernutrition among males was found among Bathudis (52.70%) followed by Oraons (53.10%), Kora Mudis (48.00%), Savars (38.00%), Santals (31.50%), Saraks (27.85%), Telegas (27.45%) and Dhimals (27.00%). Bathudis, Oraons and Kora Mudis also had very high ($\geq 40\%$) rates of undernutrition and the situation was thus critical. The Savar, Santal, Telega, Dhimal and Sarak males had high (20–39%) rates of undernutrition with the situation being serious. Using the WHO (1995) classification of public health problem of low BMI, based on adult populations worldwide, it was observed that the rates of undernutrition and the situation were critical.

Table 4 presents the results of the assessment of nutritional status based on the cut-off points of MUAC (Pitanga and Lessa 2005, Lee and Nieman 2007). Data shows that 38.28% of the adult Oraons compared to 20.89% of the adult Saraks suffer from undernutrition. The pooled sample shows high frequency (32.14%) of undernutrition of the adult males in this region. Hence, the overall situation of undernutrition (as measured by the cut-off values of both BMI and MUAC) among the adult males is quite alarming in the study region in Ranchi district (Figure 4).

Table 5 displays the results of the evaluation of nutritional status based on the recommended cut-off values of WHR, which is essentially a search for prevalence of central obesity in any population. However, the values in the present study among the adult males indicate 93.79% of the adult Oraons and 90.51% of the Saraks are within the normal range (not centrally obese) of WHR (< 0.95) (Figure 5).

Table 6 presents the age-group wise variation of anthropometric characteristics and nutritional status of the male adult sections of the Oraons (n=290), Saraks (n=158) and the pooled sample (both Oraons and Saraks combined, n=448). Ethnic variation in 3 different age groups is also exhibited in this table. In 18–39 years (mean age of the Oraons is 28.14 \pm 0.50 and of the Saraks 29.71 \pm 0.68), all the

anthropometric parameters display significant difference with respect to stature, BW, BMI, MUAC, WC, HC and WHR.

In the age-group of 40–59 years (mean age 46.82 \pm 0.58 for the Oraons and 48.40 \pm 0.81 for the Saraks), except BMI (t=-3.543, p<0.001), BW (t=-2.550, p<0.012) and HC (t=-2.546, p<0.012) no significant difference in anthropometric characteristics viz. MUAC, waist circumference and WHR between the two adult samples are observed.

In the age-group of older adults (60 years and above), except for mean stature and WHR, other anthropometric parameters exhibit significant difference of mean values between the two samples, viz. BW, BMI, MUAC, WC and HC.

Age-group wise differences in mean anthropometric characteristics in two adult male samples are shown in Table 7. Significant age-group differences except stature in all anthropometric characteristics, viz. BW, BMI, MUAC, WC, HC and WHR are observed among the adult male Oraons (n=290). On the other hand, among the adult male Saraks (n=158), except the stature (F=9.970, p<0.0001) and WHR (F=4.654, p<0.011), no significant variation in anthropometric characteristics with age is observed in cases of BW, BMI, MUAC, WC and HC.

In both the populations, mean stature exhibits a trend of decline with age. Among the Oraons, mean BW, BMI and MUAC show a similar trend of decline with age with significant variation as mentioned above. For other anthropometric parameters, e.g. body weight, height and WHR among the Oraons, and BW, BMI, MUAC and height among the Saraks show an initial rise of mean values from young adults aged 18–39 years to the next age group of 40–59 years which ultimately declines with further advancement of older adulthood (60 years and above). In case of WC (n. s.) and WHR (F=4.654, p<0.01) among the Saraks, a trend of rise of mean with age is observed. These age-group wise differences were found to be significant among the Oraons, but they were found not to vary significantly among the adult Saraks except for the WHR.

The results of Pearson correlation (Table 8) of variables show a negative correlation of anthropometric parameters with age, which conforms to the results of Table 6, indicating gradual decline of mean values of the variables with the advancement of age. Significant correlation of anthropometric parameters with age is recorded in BMI (r=-0.174, p<0.003) and MUAC (r=-0.162, p<0.006) among the Oraons, and in WHR (r=0.279, p<0.0001 of the Oraons; r=0.230, p<0.004 of the Saraks) in both the adult samples. Correlation of BMI with MUAC (r=0.554 of the Oraons and r=0.786 of the Saraks) and BMI with WHR (r=0.236 of the Oraons and r=0.545 of the Saraks) displays high significance (p<0.0001) for both the adult samples. MUAC with WHR also show significant correlation among the Oraons (r=0.161, p<0.006) and the Saraks (r=0.472, p<0.0001). The positive and significant correlation between BMI, MUAC and WHR in both the samples along with the pooled section indicates the fact of close interrelatedness between these anthropometric parameters irrespective of ethnicity and age. Hence, these three parameters can be

TABLE 6. Age trend of anthropometric characteristics among adult male Oraons and Saraks of Ranchi District.

Age groups (years)	Variables	Oraons (n=290)	Saraks (n=158)	t	Sig	Total (n=448)
		174	78			252
	n	Mean ± se	Mean ± se			Mean ± se
18-39	Mean age	28.14±0.50	29.71±0.68	-1.796	0.074	28.63±6.41
	Stature	160.93±0.44	163.55±0.69	-3.240	0.001	161.74±0.38
	Body weight	48.44±0.49	54.08±0.90	-5.774	0.001	50.18±0.48
	BMI	18.66±0.14	20.17±0.30	-5.138	0.001	19.12±0.14
	MUAC	23.75±0.20	24.66±0.23	-2.639	0.009	24.03±0.16
	Waist circumference	67.18±0.44	71.72±0.90	-5.109	0.001	68.59±0.43
	Hip circumference	79.23±0.37	83.06±0.67	-5.337	0.001	80.42±0.35
	WHR	0.85±0.42	0.86±0.55	-1.953	0.052	0.85±0.34
40-59	n	87	45	df=130		132
	Mean age	46.82±0.58	48.40±0.81	-1.590	0.012	47.36±0.48
	Stature	160.86±0.63	159.89±0.83	0.906	0.366	160.53±0.50
	Body weight	47.93±0.72	51.38±1.27	-2.550	0.012	49.11±0.65
	BMI	18.49±0.23	20.08±0.45	-3.543	0.001	19.03±0.22
	MUAC	23.50±0.34	24.17±0.33	-1.251	0.213	23.73±0.25
	Waist circumference	70.22±0.72	72.42±1.28	-1.612	0.109	70.97±0.65
	Hip circumference	79.43±0.53	81.90±0.88	-2.546	0.012	80.27±0.47
WHR	0.88±0.59	0.88±0.78	0.147	0.884	0.88±0.47	
60+	n	29	35	df=62		64
	Mean age	65.00±0.80	65.31±0.84	-0.267	0.790	65.17±0.58
	Stature	158.32±1.19	158.84±0.98	-0.342	0.734	158.60±0.75
	Body weight	43.48±0.82	52.57±1.92	-4.063	0.001	48.45±1.24
	BMI	17.34±0.25	20.74±0.63	-4.648	0.001	19.20±0.42
	MUAC	22.00±0.33	24.29±0.51	-3.620	0.001	23.25±0.34
	Waist circumference	66.57±0.86	75.29±1.63	-4.447	0.001	71.33±1.11
	Hip circumference	76.63±1.13	84.24±1.27	-5.068	0.001	80.79±0.88
WHR	0.87±1.13	0.89±0.93	-1.556	0.125	0.88±0.72	

considered to be good indicators for understanding the public health nutrition of any population.

The impact of age on anthropometric characteristics in these two samples is examined through linear regression analysis considering the age as an independent variable and taking all the other anthropometric parameters, viz. BMI, MUAC and WHR, separately as dependent variables (Table 9). Significant impact of age is recorded on BMI ($t=-3.00$, $p<0.003$), MUAC ($t= 2.781$, $p<0.006$) and WHR ($t=4.927$,

$p<0.0001$) among the Oraons. Regression analysis exhibits influence of age without significance, with respect to the variables including BMI and MUAC except WHR among the adult Saraks. These studies show negative impact of age on most of the anthropometric parameters. These results further confirm the negative correlation with age in cases of most of the variables as shown in Table 7. Hence, it is evident that age has negative impact on most of the anthropometric characteristics.

TABLE 7. Age variations in anthropometric characteristics of adult male Oraons and Saraks of Ranchi District, Jharkhand.

Populatio n	n	Variables	Age-groups (years)			F	Sig		
			18-39	40-59	60+				
Oraons	290	n	174	87	29	614.20	0.000		
		Mean age	28.14±0.50	46.82±0.58	65.00±0.80				
		Stature	160.93±0.44	160.86±0.63	158.32±1.19			2.495	0.084
		Body weight	48.44±0.49	47.93±0.72	43.48±0.82			7.54	0.001
		BMI	18.66±0.14	18.49±0.23	17.34±0.25			5.843	0.003
		MUAC	23.75±0.20	23.50±0.34	22.00±0.33			4.986	0.007
		Waist circumference	67.18±0.44	70.22±0.72	66.57±0.86			8.427	0.000
		Hip circumference	79.23±0.37	79.43±0.53	76.63±1.13			4.099	0.018
		WHR	0.85±0.42	0.88±0.59	0.87±0.93			12.260	0.0001
		Saraks	158	n	78			45	35
Mean age	29.71±0.68			48.40±0.81	65.31±0.84				
Stature	163.55±0.69			159.89±0.83	159.84±0.98	9.970	0.000		
Body weight	54.08±0.90			51.38±1.27	52.57±1.92	1.27	0.284		
BMI	20.17±0.30			20.08±0.45	20.74±0.63	0.570	0.567		
MUAC	24.66±0.23			24.17±0.33	24.29±0.51	0.728	0.484		
Waist circumference	71.72±0.90			72.42±1.28	75.29±1.63	2.151	0.120		
Hip circumference	83.06±0.67			81.90±0.88	84.24±1.27	1.37	0.258		
WHR	0.86±0.55			0.88±0.78	0.89±0.93	4.654	0.011		

TABLE 8. Correlation of anthropometric characteristics among adult male Oraons and Saraks.

Variables	Correlations with	Oraons (n=290)		Saraks (n=158)		Total (n=448)	
		r	Sig	r	Sig	r	Sig
Age	BMI	-0.174	0.003	0.053	0.503 (n.s)	0.002	0.966 (n.s)
	MUAC	-0.162	0.006	-0.089	0.266 (n.s)	-0.102	0.030
	WHR	0.279	0.0001	0.230	0.004	0.281	0.0001
BMI	MUAC	0.554	0.0001	0.786	0.0001	0.630	0.0001
	WHR	0.236	0.0001	0.545	0.0001	0.382	0.0001
MUAC	WHR	0.161	0.006	0.472	0.0001	0.270	0.0001

TABLE 9. Simple linear regression with age of anthropometric characteristics among adult male Oraons and Saraks. B – regression coefficient; SeB – standard error of B; Beta – estimated regression coefficient

Dependent Variables	Population	B	SeB	Beta	t	Sig	R	R ²	Adjusted R ²
BMI	Oraons (n=290)	-2.47	0.008	-0.174	-3.00	0.003	-0.174	0.030	0.027
	Saraks (n=158)	-1.027	0.016	0.053	0.662	0.509	0.053	0.003	-0.004
MUAC	Oraons (n=290)	-3.29	0.012	-0.162	-2.781	0.006	-0.162	0.26	0.023
	Saraks (n=158)	-1.33	0.12	-0.089	-1.117	0.266	-0.089	0.008	0.002
WHR	Oraons (n=290)	1.164	0.004	0.279	4.927	0.0001	0.279	0.078	0.075
	Saraks (n=158)	7.854	0.000	0.230	2.957	0.004	0.230	0.053	0.047

CONCLUSION

This study is a sort of preliminary record of data and information on anthropometric characteristics and nutritional status of the adult males of the Oraon tribe, and the Saraks, a caste in Ranchi district of Jharkhand. Anthropometric appraisal of nutritional status of the adult male sections of the two samples indicates that remarkable sections of both the populations are suffering from undernutrition. Low economic status and living below the subsistence level, non-availability of proper nutrition and lack of other supports (as reported by the subjects and informants) from the state government and non-government agencies are the major causes behind the poor nutritional situation of both the communities. Immediate attention to adequate food and nutrient supplementation is required for both the Oraons and the Saraks. Significant ethnic variations are observed between the adult male Oraons and the Saraks in Ranchi district of the state of Jharkhand in Eastern India with respect to the anthropometric criteria, viz. body weight, BMI, WC, WHR and MUAC. From the above results, it is revealed that both the adult male populations are suffering from severe undernutrition, as measured by BMI and MUAC. The nutritional status is even worse in the case of the Oraons, compared to the Saraks.

The data and results of negative age trend of anthropometric parameters are further verified and substantiated by the results of significant negative correlations with age as evaluated by Pearson correlation analysis, and negative impact of age on anthropometric variables in regression analyses. Significant decline of nutritional status with age, as measured and evaluated by anthropometric parameters, is observed to be more pronounced in Oraons. The aspect of ethnic variation in anthropometric appraisal of nutritional status needs further verifications and refinements in future studies.

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Sudip Datta Banik
Department of Anthropology
Vidyasagar University
Midnapore – 721 102 West Bengal, India

Departamento de Ecología Humana
Centro de Investigación y de Estudios Avanzados
(CINVESTAV) del Instituto Politécnico
Nacional (IPN)
Carretera Antigua a Progreso Km. 6, A.P. 73
Cordemex 97310, Merida, Yucatan, Mexico
E-mail: sdbanik72@yahoo.co.in
sdbanik@vidyasagar.ac.in
sdbanik@hotmail.com