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Health and nutritional status of three adult male populations of Eastern India: an anthropometric appraisal

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Abstract

Background: Tribes constitute a considerable proportion (8.2%) of the Indian population. Most of them are underprivileged. In general, data are scarce on the nutritional status of the various tribal and rural populations of India. The principal aim of this study was to understand the age-trend and ethnic variations in anthropometric characteristics and nutritional status in three adult male populations (Oraon, Sarak and Dhimal) of eastern India. This report is significant because of the new and empirical data on these communities. Oraon is an age-old tribe while Dhimal is a much less known small community and Sarak is also a less studied group.

Methods: A cross-sectional study in the perspective of anthropometric assessment of health and nutritional status has been undertaken among the adult male samples (aged 18 years and above) of three endogamous and tribal communities of eastern India, viz., Oraons (n=290), Saraks (n=158) and Dhimals (n=159). The major objective of the present study was to report nutritional status, based on Body Mass Index (BMI), Mid Upper Arm Circumference (MUAC), Waist-Hip Ratio (WHR) and Rohrer Index (RI) of the adult males of the Oraon and Sarak communities of the district of Ranchi in Jharkhand and among the Dhimals of Darjeeling district in West Bengal.

Results: Results describing the situation of the Oraons was worse (53.10%) followed by the Saraks (27.85%) and the Dhimals (27.04%) with respect to low Body Mass Index (BMI) and high degree of undernutrition (BMI < 18.49 kg/mt^2). Health profile of the adult males evaluated by Rohrer Index (RI) documented that 66.89% of the Oraons had subnormal health the condition (RI ≤ 1.19). In addition, 51.57% of Dhimals and 39.87% of the Saraks also exhibited to have subnormal state of health in this appraisal. Sizeable proportion of each of these populations was observed to have poor nutrition, as evaluated by the standard cut-off values of MUAC.

Conclusions: Results displayed prevalence of high level of undernutrition and considerable percentages of non-obesity in these populations. Age variation of anthropometric characteristics and nutritional status grossly showed conspicuous negative trend of the parameters with the advancement of age with a few minor exceptions.

Key words: undernutrition, adult, male, communities, Body Mass Index, Rohrer Index.

Introduction

Anthropometry is of substantial interest to the public health professionals, dieticians, scientists and policy makers. It has long been well established that the use of anthropometry is an efficient indicator of nutritional and health status of adults [1]. Nutrition research in anthropometric assessment of nutritional status in anthropology and biological subjects including health and medicine is therefore, gaining importance in the present days. Low Body Mass Index (BMI) and high levels of undernutrition (based on BMI) are the major public health problems especially among rural underprivileged adults of developing countries [1]. Although adult nutritional status 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 [2-8]. Therefore, BMI is the most established anthropometric indicator used for assessment of adult nutritional status [9]. BMI is generally considered a good indicator of not only the nutritional status but also the socio-economic condition of a population, especially adult populations of developing countries [3,10-12].

Studies worldwide have investigated the anthropometric characteristics and nutritional status of the adults of different ethnic groups [13-

25]. Wide ranging geographical and regional climatic variations, diversity of populations and their multifarious ethnic identities, endogamous tribes and castes and social, economic, cultural and political pluralism are the few characteristics through which we can identify India [26,27]. In general, data are scarce on the anthropometric and nutritional status of various tribal populations of India [28, 5-8, 29]. It has been recently suggested [28, 30, 31, 5-8] that there is urgent need to evaluate the nutritional status of various tribes of India. According to the Census in India 2001, more than 84 million tribal people comprise 8.2% of the total population [32], claiming to have one of the largest numbers of tribal communities in the world [33]. The tribals reside in the interior rural areas of forest, plateau, hills and mountains of the country.

The Jharkhand State in eastern India is bounded by states like Bihar in the north, Uttar Pradesh and Chhattisgarh in the north-west and west respectively, Orissa in the south and West Bengal in the east. Jharkhand includes a major parts of the Chhotanagpur plateau which is studded with a range of residual hills [34]. The Scheduled Tribes constitute around 26.30% of the total population of the state of Jharkhand [35]. There are about 30 major tribal communities in the state. Among them the Santals, Oraons, Mundas, Hos, Loharas, Kharwars, Kharias and the Bhumijs are the predominant tribal groups.

The Oraon is the second largest tribal community, next to the Santal in the state of Jharkhand. They constitute around 19.6% of the total Scheduled Tribe population of the State [35]. The total population of the Oraon tribe in this State is 966,413 out of which 749,073 are settled in Ranchi district. They were originally the inhabitants of the Chhotanagpur region (Hazaribagh district). They are also distributed in Bihar, West Bengal, Tripura, Assam, Maharashtra, some parts of Madhya Pradesh and Orissa. They are settled cultivators.

The Sarak or Sarawak, a small endogamous caste of Chhotanagpur seems to be a Hinduised remnant of early Jain people [36]. The Saraks are a peasant community spread over different regions of eastern India in West Bengal, Bihar and Orissa. In West Bengal, they live in the districts of Purulia, Burdwan, Bankura and Midnapur in varying strength. In Bihar, they are found in the Santhal Parganas, Ranchi, Bokaro, Singbhum and Dhanbad district.

The Dhimal is a less known small community and a Tibeto-Burman language speaking Indo-Mongoloid tribe of Darjeeling district in West Bengal. Dhimals live beside the river Mechi in the bordering areas of India and Nepal at Naxalbari. In Census of India 1931, Dhimal population was 621. Since the Census of India 1941, a separate enumeration for Dhimals had been excluded. According to a report [37], it was 1,060 in 2001. Dhimals have their own unique language, dress preferences and culture. In spite of having indigenous cultural practices and folk traditions over the centuries, Dhimals have not yet been enlisted in the Scheduled Tribe (ST) category. They are enlisted in Other Backward Class or OBC category in West Bengal. In a comprehensive survey conducted by the author in May-June 2009, the total Dhimal population has been estimated to be 970 (male - 492 and female - 478). Most of the Dhimals are land less and marginal laborers. They are exceptionally poor in socio-economic and literacy status.

The studied samples of the Oraons and Saraks in Ranchi district have sex-ratio (Female to Male Ratio or FMR) 955 and 822 respectively, little fewer women compared to the males. Literacy rate in Oraon is very poor - 42% males and 56% females cannot sign. But significant proportions of the Sarak males (41.14%) and females (31%) can sign. The FMR of Dhimal community is 972. The Mean Household Size among the Dhimal is 5.66 and 17% of males and 41% of females cannot sign. Most of the Oraon, Sarak and Dhimal families are of medium sized and are land less. They work as agricultural laborers.

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 [8]. In view of this, the objective of the present study was to report nutritional status, based on Body Mass Index (BMI), Mid Upper Arm Circumference (MUAC), Waist-Hip Ratio (WHR) and Rohrer Index (RI) of the adult (age 18 years and above) males of the Oraon and Sarak communities of south-eastern parts of Chhotanagpur plateau region in the district of Ranchi (around 700 feet above sea level) in Jharkhand and among the Dhimals of Sub-Himalayan 'Terai' region at Naxalbari and adjoining regions (around 600 feet above sea level) of Darjeeling district in West Bengal. Further, understanding of age-differences and ethnic variations in anthropometric characteristics and nutritional status of the three adult male samples were the other aims of this particular study.

Methods

The present cross-sectional study in three adult

male sections of the Saraks (n= 158), Oraons (n= 290) both aged 18-75 years and Dhimals (n=159) aged 18-82 years was conducted in two phases, in June 2007 and during July – September 2008. The area of study among the Saraks was located in five villages in and around Bundu (police station, block and sub-division), about 45 kilometers away towards south from the city of Ranchi, the provincial capital of the state of Jharkhand. The anthropometric data of the adult male Oraons were collected from five different villages, viz., Amanburu, Ulidih, Nahelgara and Nawadi and Manjhituli near Bundu. The study among the Dhimals was conducted in three villages (Maniram, Hatighisa, and Buraganj) in the Mallabari area of the Naxalbari region of West Bengal. These villages are located around 45 kilometers from Siliguri town, which is approximately 580 kilometers from Kolkata, the provincial capital of West Bengal. The total male population of the Oraons in the Ranchi district is 391,401. However, the separate enumerations of the Sarak or Dhimal communities are not available. As mentioned earlier, in Darjeeling district, the total male Dhimal population is 492 (estimated by the author). Altogether the sample size for this present study includes 607 adult males. The other social and cultural aspects like ethnicity, endogamy, clan exogamy, marriage distance and direction etc were also observed in order to restore the purity of data of a particular community under study. All the available male subjects of the three communities in the villages who were not affected by any acute or chronic diseases in last six months (self-reported) were included in the study. Since the Oraon is a big tribal community, the sample size for the population was higher compared to the two other ethnic groups under study. For the Dhimals, a maximum number of adult healthy male individuals were incorporated for the study.

All Anthropometric measurements were taken using standard techniques [38, 2]. The samples were free from any selection bias. The available adult male individuals of these communities were included in this study. Subjects were not chosen on the basis of bodily structure and proportion. Subjects were apparently healthy, between the ages of 18 years and above and were not severely ill during last three months (self-reported). Height and weight were taken to the nearest 0.1 cm and 0.5 kg, using standard Martin's anthropometer and standard weighing scale respectively. Technical errors of measurements (TEM) were found to be within acceptable limits. Most of the equations were computed following standard formulae [1, 2, 39]. Derived anthropometric Indices and ratios were computed following standard equations and classifications were presented following international standards [1- 3, 9]. Prevalence of chronic energy deficiency and undernutrition has been evaluated by body mass index (BMI ≤18.49 kg/m^2). BMI has been computed by the standard formula, BMI = Weight (kg) / Height (m^2). Health status with respect to nutritional state of individuals of the three communities has been appraised by Rohrer Index [RI = (Body Weight in gm. / Stature in cm^3) x 100] or Index of Corpulence (RI ≤1.19 gm/cm^3) (according to Pignet) [40]. Ethical approval was obtained from Vidyasagar University Ethics Committee before commencement of the study. Informed consent was also obtained from local community leaders and subjects. Conicity Index (CI) has been computed (m. = meter) following the formula [9, 41]:

$$\text{Conicity Index (CI)} = \frac{\text{Minimum Waist Circumference (m.)}}{0.109 \times \frac{\sqrt{\text{Weight (kg)}}}{\sqrt{\text{Height (m)}}}}$$

The distributions of anthropometric variables were not significantly skewed. One-way analyses - Scheffe's procedure [42, 43] were used to test for differences in mean anthropometric characteristics between the populations and also age-group differences. Pearson correlation coefficients (r) and linear regression analyses were used to study the interrelationship between age and anthropometric characteristics and nutritional status. In linear regression analyses, age was used as a continuous independent variable. All statistical analyses were undertaken using the SPSS Statistical Package (version 11.00). Statistical significance was set at $p < 0.05$.

Results

Table 1 presents the descriptive statistics (mean± standard error) with range of age and 9 other anthropometric characteristics, derived indices and ratios measuring nutritional status of three adult male populations, the Oraons (n=290), the Saraks (n=158) and the Dhimals (n=159). The three male samples represent adulthood of their respective communities and their age ranges are 18-75 years for both Oraons and the Saraks. The age range for the Dhimals is 18-82 years. Mean ages of the Oraons (37.43 ± 0.81) and the Dhimals (35.93 ± 1.14) represent comparatively younger mean adult age than the Saraks (42.92± 1.23). One-way ANOVA (Scheffe's procedure) states that mean ages of the three adult male samples vary

Table 1. Descriptive statistics (Mean ± Standard Error) and range of values of the anthropometric characteristics among the male Oraon (n=290), Sarak (n=158) and Dhimal (n=159) communities.

VARIABLES	POPULATIONS	RANGE	MEAN ± SE	F	p-VALUE
AGE (Years)	ORAON	18-75	37.43 ± 0.81	10.745	0.0001
	SARAK	18-75	42.92 ± 1.23		
	DHIMAL	18-82	35.93 ± 1.14		
HEIGHT / STATURE (HT in cm)	ORAON	138.50-179.50	160.65 ± 0.35	10.154	0.0001
	SARAK	144.60-177.60	161.46 ± 0.49		
	DHIMAL	142.50-182.70	163.34 ± 0.49		
BW (kg)	ORAON	31.00-72.00	47.49 ± 0.38	32.210	0.0001
	SARAK	38.00-85.00	52.97 ± 1.73		
	DHIMAL	31.50-74.50	52.25 ± 0.56		
BMI (kg/m^2)	ORAON	12.95-26.90	18.48 ± 0.11	33.502	0.0001
	SARAK	13.96-29.59	20.07 ± 0.24		
	DHIMAL	13.04-27.36	19.54 ± 0.16		
MUAC (cm)	ORAON	23.20-44.00	23.50 ± 0.17	7.392	0.001
	SARAK	19.50-33.00	24.43 ± 0.18		
	DHIMAL	15.00-33.50	24.06 ± 0.17		
WC (cm)	ORAON	52.40-88.10	68.03 ± 0.36	23.587	0.0001
	SARAK	57.50-102.00	27.71 ± 0.68		
	DHIMAL	56.50-97.00	69.25 ± 0.51		
HC (cm)	ORAON	63.00-94.50	79.03 ± 0.28	27.102	0.0001
	SARAK	71.50-103.00	82.99 ± 0.50		
	DHIMAL	37.00-96.00	80.28 ± 0.44		
WHR	ORAON	0.65-1.13	0.86 ± 3.39	1.773	0.171
	SARAK	0.74-1.06	0.87 ± 4.19		
	DHIMAL	0.73-1.99	0.87 ± 8.56		
CI	ORAON	0.86-1.48	1.15 ± 4.39	12.328	0.0001
	SARAK	0.91-1.49	1.17 ± 6.37		
	DHIMAL	0.95-1.44	1.13 ± 5.51		
RI (gm/cm^3)	ORAON	0.76-1.69	1.15 ± 7.27	27.782	0.0001
	SARAK	0.85-1.80	1.26 ± 1.47		
	DHIMAL	0.79-1.66	1.20 ± 10.01		

significantly (F=10.745, p =0.0001). The results reveal a consistent record of minimum mean anthropometric characteristics among the adult Oraons and the maximum mean values among Saraks with respective intermediate mean values among the Dhimals along with however, a few exceptions. This trend exists in cases of body weight, BMI, MUAC, Hip Circumference (HC), Waist-Hip Ratio (WHR), and Rohrer Index (RI).

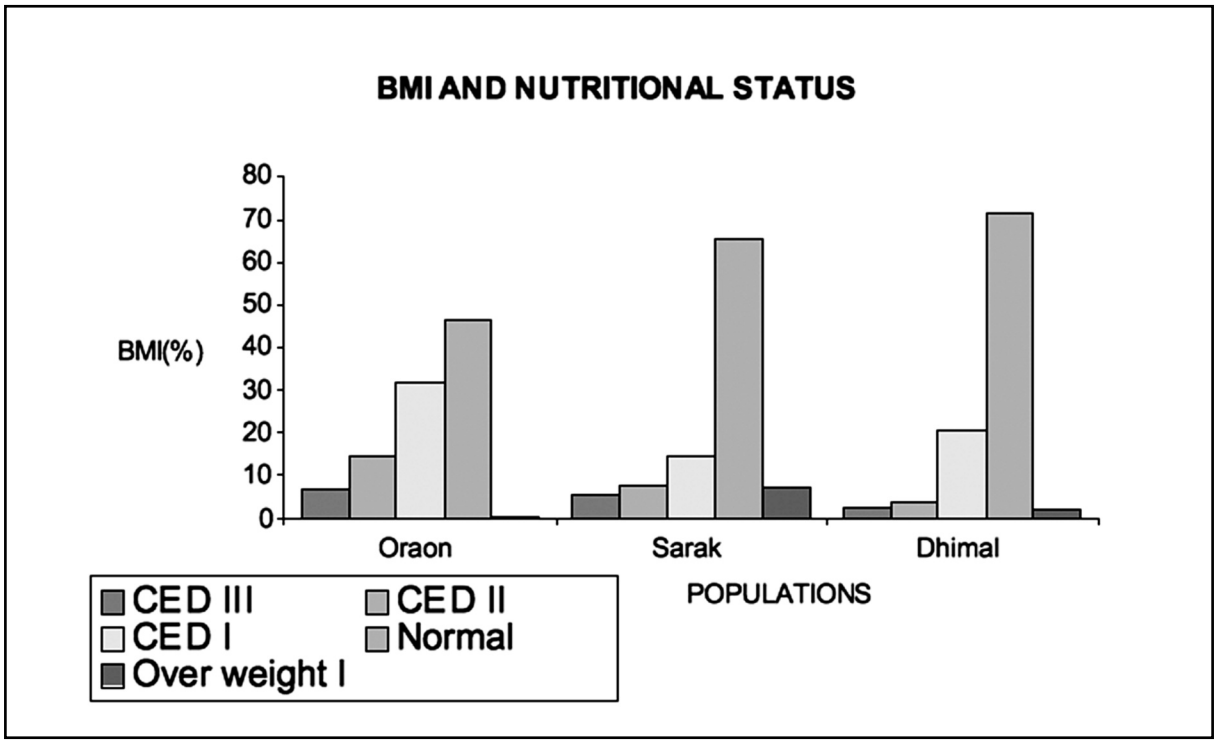
Significant variation (one-way ANOVA – Scheffe's procedure) in anthropometric parameters are observed in three adult samples with respect to stature (F=10.154, p = 0.0001), BW (F= 32.210, p = 0.0001), BMI (F= 33.502, p = 0.0001), Mid Upper Arm Circumference or MUAC (F= 7.392, p = 0.001), Conicity Index or CI (F=12.328, p= 0.0001), Waist Circumference or WC (F= 23.587, p = 0.0001), HC (F= 27.102, p = 0.0001) and RI (F= 27.782, p = 0.0001).

In Table 2, nutritional and / or health status of the adult male populations, as evaluated by anthropometric indices are presented. The frequency of undernutrition, measured by Body Mass Index (BMI) in three different ethnic groups exhibit highest prevalence of chronic energy deficiency or CED (BMI≤18.49Kg/m2) among the Oraons (53.10%). The frequencies of CED among the Saraks (27.85%) and the Dhimals (27.04%) are also very high (Figure 1). The health status measured by Rohrer Index / Index of Corpulence (RI) in the three adult male samples reveals that the Oraons (66.89%), Dhimals (51.57%) and the Saraks (39.87%) exhibit to have subnormal state of health (RI ≤ 1.19). Further, it is recorded that 38.62% of the Oraons, 20.89% of the Saraks, 24.53% of the Dhimals are suffering from undernutrition (<23.0 cm) as assessed by the values of MUAC. Nutritional status measured by the cut off values of WHR reveals that over 90% of the adult of three populations, the Oraon (93.79%), the Dhimals (93.71%) and the Saraks (90.51%) are not centrally obese (Figure 2).

Table 2. Nutritional and health status measured by BMI, RI, AND MUAC among the adult male Oraon, Sarak and Dhimal communities.

ANTHROP-OMETRIC VARIABLES	NUTRITIONAL / HEALTH STATUS	CUT-OFF VALUE	POPULATIONS		
			Oraon (n=290)	Sarak (n=158)	Dhimal (n=159)
BMI (kg/m^2)	CED III	< 16.00	6.55%	5.70%	2.52%
	CED II	16.00-16.99	14.48%	7.59%	3.77%
	CED I	17.00 – 18.49	32.07%	14.56%	20.75%
	Total CED	< 18.49	53.10%	27.85%	27.04%
	Normal	18.50 = 24.99	46.55%	65.19%	71.07%
	Over weight I	25.00 – 29.99	0.34%	6.96%	1.89%
RI (gm/cm^3)	VE RY LOW	≤1.12	42.41%	24.05%	23.27%
	LOW	1.13 – 1.19	24.48%	15.82%	28.30%
	MIDDLE	1.20 – 1.25	16.21%	13.29%	23.27%
	UPPER MIDDLE	1.26 – 1.32	8.97%	17.09%	13.84%
	HIGH	1.33 – 1.39	4.14%	8.29%	3.77%
	VERY HIGH	≥ 1.40	3.79%	21.52%	7.55%
MUAC (cm)	NORMAL	≥23.00	61.38%	79.11%	75.47%
	UNDERNUTRITION	<23.00	38.62%	20.89%	24.53%

Figure 1. BMI and nutritional status among the male Oraon, Sarak and Dhimal communities.



Correlation matrix of anthropometric measurements, derived ratios and indices show significantly negative correlations of most of the variables with age in cases of the three adult male samples. In Table 3, results of above and left of the diagonal represent Oraon, above and right of the diagonal stand for Sarak and below and left of diagonal characterize Dhimal samples. Stature is also found to have negative correlations (not significant) with variables viz. RI and CI in all the three male samples. Significant Correlations (p=0.01) are observed in most cases of BMI, CI,

Figure 2. Nutritional status measured by cut-off points of Waist-Hip Ratio (WHR) among the adult male Oraons, Saraks and Dhimals.

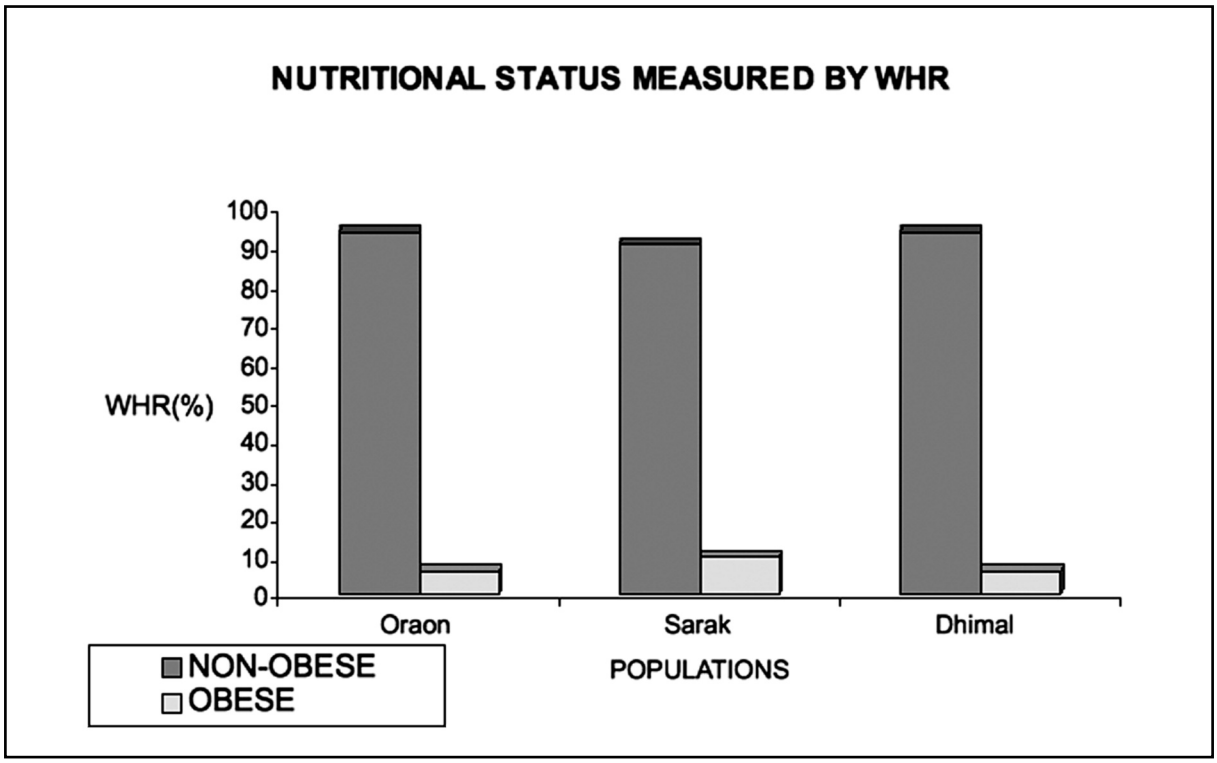


Table 3. Correlation matrix of variables in three endogamous adult male populations of eastern India.

POPULATION	VARIABLES	AGE	BMI	BW	CI	HT	HC	MUAC	RI	WC	WHR	POPULATION
ORAON (n=290)	AGE	1.00	0.0.53	-0114	0.306**	-0.367**	0.028	-0.089	0.144	0.136	0.230**	SARAK (n=158)
	BMI	-0.157**	1.00	0.896**	0.291**	0.090	0.810**	0.786**	0.965**	0.817**	0.545**	
	BW	-0.187**	0.839**	1.00	0.232**	0.519**	0.835**	0.771**	0.748**	0.784**	0.449**	
	CI	0.333**	0.097	0.032	1.00	-0.023	0.535**	0.348**	0.297**	0.764**	0.797**	
	HT	-0.113	0.093	0.617**	-0.079	1.00	0.336**	0.230**	-0.171*	0.201*	0.037	
	HC	-0.123*	0.715**	0.790**	0.225**	0.417**	1.00	0.754**	0.716**	0883**	0.438**	
	MUAC	-0.127*	0.579**	0.586**	0.081	0.225**	0.462**	1.00	0.718**	0.742**	0.472**	
	RI	-0.113	0.940**	0.603**	0.124*	-0.251**	0.554**	0.483**	1.00	0.757**	0.549**	
	WC	0.126*	0.676**	0.639**	0.771**	0.198**	0.669**	0.447**	0.590**	1.00	0.807**	
	WHR	0.280**	0.250**	0.135*	0.830**	0.111	-0.019	0.173**	0.281**	0.729**	1.00	
DHIMAL (n=159)	AGE	1.00										
	BMI	-0.152	1.00									
	BW	-0.275**	0.830**	1.00								
	CI	0.317**	0.219**	0.139	1.00							
	HT	-0.300**	0.117	0.648**	-0.062	1.00						
	HC	0.175*	0.558**	0.691**	0.089	0.470**	1.00					
	MUAC	0.221**	0.710**	0.712**	0.133	0.307**	0.550**	1.00				
	RI	-0.041	0.935**	0.579**	0.235**	-0.241**	0.387**	0.584**	1.00			
	WC	0.057	0.754**	0.711**	0.772**	0.233**	0.483**	0.566**	0.563**	1.00		
	WHR	0.167*	0.199*	0.080	0.603**	0.136	-0.489**	0.064	0.241	0.484**	1.00	

**Correlation is significant at the 0.01 level (2 tailed);

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

MUAC, RI, with all other variables. WHR displays positive and significant correlation (p=0.01) with BMI, MUAC, CI and RI among the Oraons and Saraks and with BMI (p=0.05) and CI (p=0.01) in Dhimal sample.

The age trend of mean anthropometric characteristics of the nutritional status of three adult male samples representing Oraon, Sarak and Dhimal populations are presented in Table 4. The age differences and variations of nine anthropometric parameters were tested by one-way ANOVA (Scheffe's procedure). Significant age group differences of variables are found to exist with respect to stature of the Saraks (F=9.970, p = 0.0001) and the Dhimals (F=9.653, p = 0.0001); body weight, BMI, and MUAC among the Oraons and the Dhimals; WHR of the Oraons and the Saraks; WC, and HC of the Oraons, and CI in the three communities.

A declining trend of mean anthropometric

Table 4. Distribution and age-trend of variables among the adult male Oraon, Sarak and Dhimal communities.

VARIABLES	POPULATIONS	AGE GROUPS (YEARS)						F	p-VALUE
		n	18-39	n	40-59	n	60+		
AGE	ORAON	174	28.14 ± 0.50	87	46.82 ± 0.58	29	65.00 ± 0.80	614.204	0.0001
	SARAK	78	29.71 ± 0.68	45	48.40 ± 0.81	35	65.31 ± 0.84	512.282	0.0001
	DHIMAL	99	26.46 ± 0.63	46	47.30 ± 0.85	14	65.50 ± 1.63	364.579	0.0001
HEIGHT	ORAON	174	160.93 ± 0.44	87	160.86 ± 0.64	29	158.32 ± 1.19	2.495	0.084
	SARAK	78	163.55 ± 0.69	45	159.89 ± 0.83	35	158.84 ± 0.98	9.970	0.0001
	DHIMAL	99	164.50 ± 0.61	46	162.68 ± 0.70	14	157.33 ± 1.99	9.653	0.0001
BW	ORAON	174	48.44 ± 0.49	87	47.93 ± 0.72	29	43.48 ± 0.82	7.535	0.001
	SARAK	78	54.08 ± 0.97	45	51.38 ± 1.27	35	52.57 ± 1.92	1.269	0.284
	DHIMAL	99	53.49 ± 0.66	46	51.93 ± 1.00	14	44.54 ± 1.58	11.390	0.0001
BMI	ORAON	174	18.66 ± 0.14	87	18.49 ± 0.23	29	17.34 ± 0.25	5.843	0.003
	SARAK	78	20.17 ± 0.30	45	20.08 ± 0.45	35	20.74 ± 0.63	0.570	0.567
	DHIMAL	99	19.72 ± 0.18	46	19.62 ± 0.35	14	17.96 ± 0.50	4.962	0.008
MUAC	ORAON	174	23.75 ± 0.20	87	23.50 ± 0.34	29	21.99 ± 0.33	4.986	0.007
	SARAK	78	24.66 ± 0.23	45	24.17 ± 0.33	35	24.29 ± 0.51	0.728	0.484
	DHIMAL	99	24.27 ± 0.18	46	24.21 ± 0.36	14	22.37 ± 0.68	7.007	0.001
WC	ORAON	174	67.18 ± 0.44	87	70.22 ± 0.72	29	66.57 ± 0.86	8.447	0.0001
	SARAK	78	71.72 ± 0.89	45	72.42 ± 1.28	35	75.29 ± 1.63	2.151	0.120
	DHIMAL	99	69.01 ± 0.60	46	70.20 ± 0.98	14	67.89 ± 2.22	0.894	0.411
HIP	ORAON	174	79.23 ± 0.37	87	79.43 ± 0.53	29	76.63 ± 0.62	4.099	0.018
	SARAK	78	83.06 ± 0.67	45	81.90 ± 0.88	35	84.24 ± 1.27	1.368	0.258
	DHIMAL	99	80.93 ± 0.45	46	79.39 ± 1.09	14	78.61 ± 1.20	1.951	0.146
WHR	ORAON	174	0.85 ± 4.18	87	0.88 ± 5.89	29	0.87 ± 1.11	12.260	0.0001
	SARAK	78	0.86 ± 5.56	45	0.88 ± 7.82	35	0.89 ± 9.34	4.650	0.011
	DHIMAL	99	0.85 ± 5.76	46	0.90 ± 2.60	14	0.86 ± 1.70	2.711	0.070
CI	ORAON	174	1.13 ± 5.28	87	1.18 ± 7.95	29	1.17 ± 1.17	19.625	0.0001
	SARAK	78	1.15 ± 7.73	45	1.17 ± 1.03	35	1.21 ± 1.69	8.200	0.0001
	DHIMAL	99	1.11 ± 5.62	46	1.14 ± 1.16	14	1.17 ± 2.53	6.823	0.007
RI	ORAON	174	1.16 ± 9.07	87	1.15 ± 1.43	29	1.10 ± 2.01	3.207	0.042
	SARAK	78	1.23 ± 1.85	45	1.26 ± 2.83	35	1.31 ± 3.84	1.757	0.176
	DHIMAL	99	1.20 ± 1.11	46	1.21 ± 1.27	14	1.14 ± 3.67	1.418	0.245

Table 5. Regression analysis: impact of age (independent variable) on anthropometric characteristics among the adult male Oraons, Saraks and Dhimals.

Dependent Variables	Populations	B	SeB	Beta	t	p-VALUE	R	R^2	Adjusted R^2
BMI	ORAON	-2.25	0.001	-0.157	2.617	0.009	-0.157	0.025	0.021
	SARAK	1.027	0.016	0.053	0.662	0.509	0.053	0.003	-0.004
	DHIMAL	-2.120	0.011	-0.152	-1.921	0.057	-0.152	0.023	0.017
BW	ORAON	-8.870	0.028	-0.187	-3.126	0.002	-0.187	0.035	0.031
	SARAK	-6.810	0.048	-0.114	-1.433	0.154	-0.114	0.013	0.007
	DHIMAL	-0.134	0.037	-0.275	-3.586	0.0001	-0.275	0.076	0.070
CI	ORAON	1.832	0.000	0.333	5.811	0.0001	0.333	0.111	0.108
	SARAK	1.586	0.000	0.306	4.015	0.0001	0.306	0.094	0.088
	DHIMAL	1.525	0.000	0.317	4.181	0.0001	0.317	0.100	0.094
HEIGHT	ORAON	-4.880	0.026	-0.113	-1.862	0.064	-0.113	0.013	0.009
	SARAK	-0.148	-0.030	-0.367	-4.929	0.0001	-0.367	0.135	0.129
	DHIMAL	-0.128	0.032	0.300	-3.946	0.0001	-0.300	0.090	0.084
MUAC	ORAON	-2.370	0.011	-0.127	-2.108	0.036	-0.127	0.016	0.013
	SARAK	-1.330	0.012	-0.089	-1.117	0.266	-0.089	0.008	0.002
	DHIMAL	-3.310	0.012	-0.221	-2.839	0.005	-0.221	0.049	0.043
RI	ORAON	-1.030	0.001	-0.113	-1.863	0.064	-0.113	0.013	0.009
	SARAK	1.747	0.001	0.144	1.818	0.071	0.144	0.021	0.014
	DHIMAL	-3.640	0.001	-0.041	-0.519	0.605	-0.041	0.002	-0.005
WC	ORAON	5.665	0.027	0.126	2.079	0.039	0.126	0.016	0.012
	SARAK	7.590	0.004	0.136	1.721	0.087	0.136	0.019	0.012
	DHIMAL	2.537	0.035	0.057	0.720	0.427	0.057	0.003	-0.003
HIP	ORAON	-4.340	0.021	-0.123	-2.039	0.042	0.123	0.015	0.012
	SARAK	1.161	0.033	0.028	0.354	0.724	0.028	0.001	-0.006
	DHIMAL	-6.700	0.030	-0.175	-2.223	0.028	-0.175	0.031	0.024
WHR	ORAON	1.178	0.000	0.280	4.784	0.0001	0.280	0.078	0.075
	SARAK	7.854	0.000	0.230	02.957	0.004	0.230	0.053	0.047
	DHIMAL	1.249	0.001	0.167	2.121	0.036	0.167	0.028	0.022

B refers to regression coefficient; SeB refers to standard error of B; Beta refers to the estimated regression coefficient.

characteristics and nutritional status in three successive age groups among three adult male samples is observed from the results of Table 4. In some cases, a marginal rise of variables is observed from the age group of 18-39 years to its next age group (40-59 years). Consistent and clear negative age trend of variables is observed in cases of stature, body weight, BMI and MUAC.

Impact of age on anthropometric characteristics was also examined through linear regression analysis (Table 5), considering age as an independent variable. The evidence of Negative impact of age on these parameters is revealed from the results of Table 4 and 5 that clearly indicate negative age trend and negative correlations of age with anthropometric variables.

Discussion

Data from India with respect to anthropometric characteristics and nutritional status among the adults are quite few, especially from rural sectors. The reports in the perspectives of tribal populations are still scantly in India [5-8]. In such a context, the present study contributes some new series of data and results of the Oraon, an age-old tribal community and a very less known endogamous caste group, Sarak, both from very remote areas of Ranchi district of the state of Jharkhand in eastern India. The data from another interesting small community, the Dhimals of Darjeeling district in West Bengal also enrich this present report.

Bio-anthropological reports on Sarak [44] and Dhimal [30] communities were recorded less often. These data add further importance to this present work. Apart from the results of negative age trend of various anthropometric characters, the data of this present study also compare the anthropometric parameters of similar dimension within and between three ethnic groups. Results have shown that the adult male sections of these communities are suffering from severe undernutrition as measured by Body Mass Index (BMI) and Rohrer Index (RI) and the situation of the Oraons is worse compared to the other two communities under study. The overall results therefore, may be used as the recommendations for any community health and intervention program for the adult populations of this region.

Recent investigations [5-7,30,31] have reported the anthropometric characteristics and states of nutrition in some other endogamous populations of eastern India. These studies have dealt with Bathudis [8,29] and Savars [6] of Keonjhar in Orissa, and Kora Mudis [7], Santals [5] and Telagas [31] of Paschim Medinipur district in West Bengal. Results of the present study (p.s.) have also been compared with the rates of CED in five other adult populations. All the communities were found to have very remarkable rates of undernutrition. Wide range of ethnic differences in rates of undernutrition were observed among the males of these communities– highest CED was observed among the Oraon (53.10%) in the present study, followed by Bathudi (52.7%), Kora Mudi (48.0%), Savar (38.00%), Santal (31.50%), Sarak [p.s.] (27.85%), Telaga [(27.45%) and Dhimal [p.s.] (27.04%). Oraon, Bathudis and Kora Mudi males had shown very high (≥40%) rates of undernutrition and the situation was extremely critical. Savar, Santal, Sarak and Telaga 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 in these communities of eastern India were remarkably high and their situation is critical.

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