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Age Variations in Anthropometric and Body Composition Characteristics and Underweight Among Male Bathudis – A Tribal Population of Keonjhar District, Orissa, India

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A B S T R A C T

A cross-sectional study of 226 male Bathudis, a tribal population of Keonjhar District, Orissa, India, was undertaken to investigate age variations in anthropometric and body composition characteristics and the frequency of underweight. The subjects were categorized into three age groups: Group I: < 30 years, Group II: 30–49 years, Group III: ≥ 50 years. Height, weight, circumferences and skinfolds data were collected. Body mass index (BMI) and several body composition variables and indices were derived using standard equations. Results revealed that there existed significant negative age variations for most of the anthropometric and body composition variables and indices. Correlation studies of age with these variables and indices revealed significant negative correlations. Linear regression analyses revealed that for all these variables, age had a significant negative impact. It was also observed that with increasing age, there was an increase in the frequency of underweight individuals. In conclusion, this study showed that among Bathudi men, age was significantly negatively related with anthropometric and body composition variables and indices. Furthermore, with increasing age, the frequency of underweight individuals increased.

Key words: *India, Bathudis, age variations, anthropometry, body composition, underweight*

Introduction

Several recent studies worldwide have focused on age variations in anthropometric characteristics and nutritional status of among men of different ethnic groups[1–3]. Most studies on age variations in anthropometric and body composition parameters from India tend to focus on non-tribal populations[4–5]. Very scanty data are available on anthropometric and body composition characteristics and the frequency of underweight of tribal populations of India[6].

The tribes of India comprise about 8% of the total population of the country having probably the largest number of tribal communities in the world[7]. Bathudis are one such tribe whose mother tongue is Panchapargania, an Indo-Aryan language. They are inhabitants of three eastern provinces of India: Orissa, Bihar and Jharkhand. Majority of the Bathudis are found in three districts of Orissa, namely, Keonjhar, Mayurbhanj and Sundargarh[6]. Information on Bathudis is very limited[6,8]. The importance of the present study is that there is no published data dealing with age variations in anthropometric and body composition characteristics and the frequency of underweight among adult Bathudi males[6].

The present study was undertaken to examine age variations in anthropometric and body composition indicators and the frequency of underweight individuals among male adult Bathudi tribals of Keonjhar District, Orissa, India. It presents unique data that can be used for comparative studies with other tribal and non-tribal ethnic minorities, both from India as well as abroad. It must be stressed here that the study design was cross-sectional and thus this report deals with age variations and not age changes which can be studied only by longitudinal investigations.

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Materials and Methods

Area of study and subjects

The present investigation was conducted in collaboration of Associated Social Service Agency (ASSA), a non-governmental organization based at Sailongchhak, Anandapur, Keonjhar District, Orissa, India. Prior permission and ethical approval was obtained from local community leaders as well as relevant authorities before commencement of the study. Information on ethnicity, age, occupation and educational status were obtained from all subjects with the help of a questionnaire. The data were collected from three villages, Gahira, Kalora Gadira and Pathurkundi in Anandapur region of Keonjhar district of Orissa, India. These villages are located approximately 150 kms from Bhubaneswar, the provincial capital of Orissa. The residents of all houses (number of houses = 152) in the three villages were contacted and a total of 226 adult (>18 years) women were included in the study. The response (participation) rate was 76 %. The vast majority of the subjects were illiterate and very low-wage earning manual labourers. Thus, they belonged to the low socio-economic class. Subjects were grouped into three age groups: Group I: < 30 years (n = 72); Group II: 30–49 years (n = 104) and Group III: ≥ 50 years (n = 50).

Anthropometric measurements

Trained investigators, using internationally accepted standard protocol[9], made anthropometric measurements. Anthropometric variables included height, weight, sitting height (STHT), mid upper arm circumference (MUAC), and biceps (BSF), triceps (TSF), subscapular (SUBSF) and suprailiac (SUPSF) skinfold thicknesses. Technical errors of measurements (TEM) were computed and they were found to be within acceptable limits[10]. Thus, TEM was not incorporated in statistical analyses. Body mass index (BMI) was computed using the following standard equation:

$$\text{BMI} = \text{Weight (kg)} / \text{height (m}^2\text{)}.$$

Underweight was evaluated using internationally accepted World Health Organization BMI guidelines[11]. The following cut-off points were used:

Underweight: BMI < 18.5

Normal: BMI = 18.5–24.9

Overweight: BMI ≥ 25.0.

Body composition

Percent body fat (PBF) was calculated using Siri's equation[12]. The equation is:

$$\text{PBF} = (4.95/\text{density} - 4.50) \times 100.$$

Density was derived following Durnin & Womersley's equation[13] using the sum of BSF, TSF, SUBSF and SUPSF.

Fat mass (FM), fat free mass (FFM), fat mass index (FMI) and fat free mass index (FFMI) were computed using following standard equations:

$$\text{FM (kg)} = (\text{PBF}/100) \times \text{Weight (kg)}$$

$$\text{FFM (kg)} = \text{Weight (kg)} - \text{FM (kg)}$$

$$\text{FMI (kg/m}^2\text{)} = \text{FM (kg)} / \text{height}^2 \text{ (m}^2\text{)}$$

$$\text{FFMI (kg/m}^2\text{)} = \text{FFM (kg)} / \text{height}^2 \text{ (m}^2\text{)}.$$

Total body water (TBW) was calculated using Humes-Weyers formula[14].

$$\text{TBW} = (0.194789 \times \text{Height}) + (0.296785 \times \text{Weight}) - 14.012934$$

where height in is cm and weight is in kg.

The distributions of anthropometric and body composition variables were not significantly skewed. Oneway ANOVA (Scheffes' post-hoc Procedure) was performed to test for age group differences in mean anthropometric and body composition characteristics. Pearson correlation coefficients (r) were utilised to study the association of age with these characteristics. Linear regression analyses were used to study the impact of age on these anthropometric and body composition characteristics. In linear regression analyses, age was used as an independent variable. All statistical analyses were undertaken using the Statistical Package for Social Sciences (SPSS) Package. Statistical significance was set at $p < 0.05$.

Results

The mean age of the subjects was 38.0 years (SD= 14.4 years) years. Table 1 presents the age group differences in mean anthropometric and body composition characteristics. There were significant age group differences in means of most of the variables and indices. Among anthropometric variables, there existed significant age group differences in mean height ($F=3.6943$, $p<0.05$), weight ($F=6.9869$, $p<0.005$), BMI ($F=3.5032$, $p<0.05$), STHT ($F=10.9306$, $p<0.005$), BSF ($F=6.1170$, $p<0.005$), TSF ($F=3.4375$, $p<0.05$) and SUBSF ($F=3.4375$, $p<0.05$). There was a trend of decreasing mean from Group I to Group III. In all instances, Group I had the highest mean while Group III had the lowest mean. Among body composition variables and indices, there existed significant age group differences in mean PBF ($F=6.250$, $p<0.005$), FFM ($F=5.151$, $p<0.05$), FM ($F=5.899$, $p<0.005$), FMI ($F=5.050$, $p<0.05$) and TBW (6.834, $p<0.005$) with Group I having the highest mean while Group III had the lowest mean. There was a trend of decreasing mean from Group I to Group III.

Correlation studies of age with these anthropometric and body composition variables and indices were undertaken and results (results not shown) revealed that age was significantly negatively correlated with them.

Linear regression analyses were undertaken with age as the independent variable. Results revealed that (Table 2), for all these variables, age had a significant negative impact. A significant negative impact existed for height ($t=-3.197$), weight ($t=-3.516$), BMI ($t=-2.000$), STHT ($t=-5.435$), BSF ($t=-3.627$), TSF ($t=-2.708$), PBF ($t=-3.240$), FFM ($t=-2.966$), FM ($t=-3.162$), FMI ($t=-2.947$) and TBW ($t=-3.781$). The amount of variation explained by age ranged from 1.3% (BMI) to 11.2 % (STHT).

TABLE 1
AGE VARIATIONS IN MEAN ANTHROPOMETRIC CHARACTERISTICS OF BATHUDI MEN OF KEONJHAR DISTRICT, ORISSA, INDIA

Variable	< 30 years (n = 72)	30–49 years (n = 104)	≥ 50 years (n = 50)	F
Height (cm)	160.2 (6.3)	159.4 (5.8)	157.4 (7.3)	3.694*
Weight (kg)	48.2 (6.2)	47.4 (6.3)	44.2 (5.7)	6.987**
BMI (kg/m^2)	18.7 (1.6)	18.6 (2.2)	17.8 (1.7)	3.503*
STHT (cm)	81.2 (3.7)	79.9 (3.2)	77.3 (7.3)	10.931**
MUAC (cm)	23.8 (3.2)	23.6 (2.3)	22.9 (2.9)	1.907
Skin fold thickness (mm):				
BSF	4.1 (1.4)	3.5 (1.7)	3.1 (1.5)	6.117**
TSF	6.2 (1.8)	5.5 (2.3)	5.2 (2.3)	3.438*
SUBSF	8.4 (2.2)	7.9 (2.9)	7.0 (2.3)	4.455*
SUPSF	7.5 (2.8)	7.4 (3.2)	6.7 (2.7)	1.222
Body composition:				
PBF (%)	11.8 (3.4)	10.4 (4.6)	9.0 (4.8)	6.250**
FFM (kg)	42.5 (4.9)	42.2 (4.3)	40.0 (4.1)	5.151*
FFMI (kg/m^2)	16.4 (1.2)	16.6 (1.4)	16.2 (1.3)	1.709
FM (kg)	5.8 (2.2)	5.1 (2.3)	4.1 (2.6)	5.899**
FMI (kg/m^2)	2.2 (0.8)	2.0 (1.1)	1.7 (0.9)	5.050*
TBW (kg)	31.6 (2.9)	31.1 (2.6)	29.7 (2.8)	6.834 **

Standard deviations are presented in parentheses. *p<0.05, **p<0.005, BMI – Body mass index, STHT – Sitting height, MUAC – Mid upper arm circumference, BSF – Biceps skinfold, TSF – Triceps skinfold, SUBSF – Subscapular skinfold, SUPSF – Suprailiac skinfold, PBF – Percent body fat, FFM – Fat free mass, FFMI – Fat free mass index, FM – Fat mass, FMI – Fat mass index, TBW – Total body water

TABLE 2
LINEAR REGRESSION ANALYSES OF AGE WITH ANTHROPOMETRIC AND BODY COMPOSITION CHARACTERISTICS AMONG BATHUDI MEN

Variable	B	seB	Beta	Adj. R^2	T
Height	–0.0939	0.029	–0.209	0.039	– 3.197**
Weight	–0.1001	0.028	–0.229	0.048	– 3.516**
BMI	–0.0179	0.009	–0.013	0.013	– 2.000*
STHT	–0.1130	0.021	–0.341	0.112	– 5.435**
Skin fold thickness:					
BSF	–0.0258	0.007	–0.236	0.051	– 3.627**
TSF	–0.0268	0.010	–0.178	0.027	– 2.708*
SUBSF	–0.0295	0.012	–0.161	0.021	– 2.438*
Body composition:					
PBF	–0.0671	0.020	–0.212	0.041	– 3.240**
FFM	–0.0618	0.021	–0.194	0.033	– 2.966**
FM	–0.0382	0.012	–0.207	0.038	– 3.162**
FMI	–0.0135	0.005	–0.193	0.033	– 2.947**
TBW	–0.0478	0.013	–0.245	0.056	– 3.781**

*p<0.05, **p<0.005, BMI – Body mass index, STHT – Sitting height, MUAC – Mid upper arm circumference, BSF – Biceps skinfold, TSF – Triceps skinfold, SUBSF – Subscapular skinfold, PBF – Percent body fat, FFM – Fat free mass, FM – Fat mass FMI – Fat mass index, TBW – Total body water

Studies on the underweight status of Bathudi men revealed that (Figure 1) there was a consistent increasing frequency of underweight (BMI<18.5) from Group I (45.8 %) to Group III (64.0 %). Bathudi men in Group II had intermediate frequency (52.4 %) of underweight.

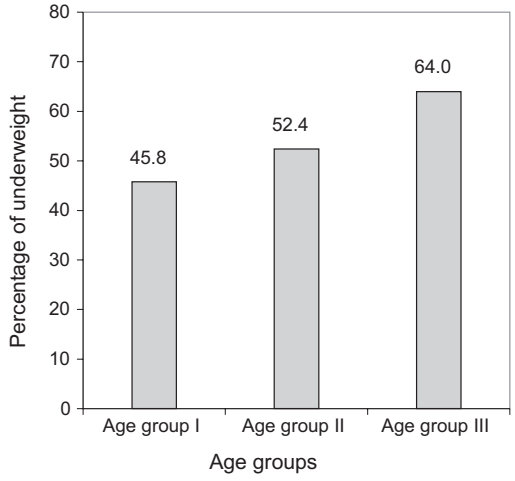

Fig. 1. Percentage of underweight among Bathudi men by age group category.

Discussion

Anthropometry has also been extremely useful in identifying changes in body size and composition that occur with old age[3–5,15–17]. Anthropometric measurements provide an indirect assessment of body composition and are easy and economical to undertake making them ideally suited for field surveys[3,5,11]. Many studies worldwide[1–3] have already reported on the effects of age on anthropometry and body composition from different parts of the world. However, only a few studies from India[4–5] have dealt with age variations in anthropometric and body composition characteristics. Moreover, to date, no detailed investigation has been undertaken on to study age variations in anthropometric and body composition characteristics among any tribal population of India. The present study provides unique data on age variations of anthropometric and body composition profile and the prevalence of underweight of adult male Bathudis, a tribal population of Orissa, Eastern India.

The results of the present study demonstrated that a significant decreasing age variation existed in anthropometric and body composition variables among Bathudi males. These results are in concordance with studies from other parts of the world on different ethnic groups[1, 18–20] which have also reported a similar inverse age varia-

tion in various anthropometric and body composition characteristics. In the Indian context, the significant negative age variation in anthropometric and body composition profile of Bathudi males was similar to that reported among older and elderly Bengalee Hindus by two recent studies[5,21] from Kolkata, India.

It has been documented that undernutrition is more common in elderly persons than in younger adults[22]. Older people, especially those residing in rural areas, are at a greater risk of undernutrition[23]. High prevalence of underweight among older Bathudi men is the noteworthy feature of the present study. According to WHO classification[11] based on BMI values, the prevalence of underweight was 45.8 %, 52.4 % and 64.0%, in Group I, Group II and Group III, respectively. This clearly indicated that there was a consistent increase in the frequency of underweight with increasing age. These rates of underweight were much higher than those reported among other rural populations in developing countries[16, 19, 23–24] including India[5]. These results clearly suggested that underweight is a serious problem among Bathudi men that becomes amplified with age.

In conclusion, the two key points of this study were:

1) Among Bathudi tribal men, age was significantly inversely related with anthropometric and body composition variables and indices.
2) Underweight (BMI < 18.5 kg/m^2) was a serious problem among this group, especially among the older individuals.

Moreover, it should be noted that since prevention of underweight among Bathudi males, especially among the elderly, is essential, the roles of nutritional screening and assessment are of paramount importance. Since undernutrition in elderly people is a consequence of somatic, psychic or social problems[22], the interrelationships between these factors should be further investigated among this ethnic group. Furthermore, it is essential that older and elderly Bathudi men be included in nutrition and health programmes and policy. Since underweight is serious problem in this group, recognition of social and health factors associated with the poor nutrition status will allow appropriate intervention to enhance the quality of the life, particularly among older and elderly males.

A recent study from India[25] has suggested that there exists ethnic variation in age-related anthropometric and body composition variations. It should also be pointed out that India is a home to a very large number of tribal populations[26]. Therefore, studies similar to the present one should be undertaken among various tribes in India so as to highlight ethnic variations in the ageing process.

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DOBNE PROMJENE ANTROPOMETRIJSKIH MJERA, SASTAVA TIJELA I PODHRANJENOST KOD MUŠKE POPULACIJE BATHUDIS: PLEMENSKE POPULACIJE KEONJHARSKE REGIJE, ORISSA, INDIA

S A Ž E T A K

Cilj presječne studije koja je napravljena na uzorku od 226 muških Bathudisa, plemenske populacije Keonjharske regije, Orissa, India, bio je istražiti dobne promjene antropometrijskih mjera, sastava tijela te odrediti frekvenciju podhranjenosti. Ispitanici su bili kategorizirani u tri grupe; grupa I: < 30 godina, grupa II: 30–49 godina, grupa III: > 50 godina. Bila je vidljiva korelacija između visine, težine, obujma i kožnih nabora. BMI i nekoliko varijabli tjelesne kompozicije dobivene su upotrebom standardnih jednadžbi. Rezultati su pokazali postojanje značajnih negativnih razlika u dobi između varijabla i indeksa antropometrijskih mjera i tjelesne kompozicije. Uzajamna zavisnost godina sa varijablama i indeksima pokazuje značajno negativan međuodnos. Analiza linearne regresije pokazuje da za sve varijable, godine imaju značajno negativan učinak. Također je ustanovljeno da starenjem raste frekvencija podhranjenosti individua. Zaključak ove studije ukazuje na značajno negativnu relaciju antropometrijskih varijabli i indeksa sa varijablama i indeksima sastava tijela.