Original Article

Variations of Body Physique in Adult Santhals of North Bengal, Bangladesh

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Abstract

Somatotype gives information on individual physical constitution in an easily comprehensible form. The somatotype is expressed in a three-numerical rating representing three components: endomorphy, mesomorphy and ectomorphy and influenced by age, sex, race, diet, environmental factors, occupation or physical activity. In order to assess variations of body physique in Santhals, a cross sectional sample of 200 Santhals (100 male and 100 female) age ranging from 30 to 49 years was collected from North Bengal, Bangladesh. Both group of population are agricultural labourer. In the present study, Anthropometric Somatotyping, the method forwarded by Heath and Carter is followed. Personal information and anthropometric measurements were recorded on questionnaire and datasheet following interview and examinations of the participants respectively. Data was analysed with the help of SPSS version 19.0 for windows and statistical analysis were done by unpaired student's 't' test. This type of research is rare in tribal communities, especially in Bangladesh. Somatotype category observed in Santhals male was mesomorph-endomorph (3.13-3.31-2.53) and in female was mesomorphic endomorph (3.91-3.35-2.27). Among the three components of somatotype, femalesare more endomorphic than male whereas malesare more ectomophic than female but no significant difference was observed in mesomorphy component.

Key words: Body physique, anthropometric somatotype, gender differences, Santhals.

Introduction

A somatotype is a convenient short hand descriptor of overall physique in terms of body shape and composition independent of body size.[1]In 1967, Heath and Carter devised somatotype method and recognized three basic components of physique. Endomorphy refers to relative fatness, meosomorphy refers to relative musculoskeletal-development and ectomorphy refers to relative linearity of individual physiques.[2]

Somatotype is expressed in a three-numerical rating, for example, a 3-5-2 rating is recorded in this manner where 3 indicates endomorphy, 5 indicates mesomorphy and 2 indicates ectomorphy. In 1990, Heath and Carter classified somatotype into thirteen categories: central, balanced endomorph, mesomorphic endomorph, mesomorph-endomorph, endomorphic mesomorph, balanced mesomorph, ectomorphic mesomorph, mesomorph-ectomorph, mesomorphic ectomorph, balanced ectomorph, endomorphic ectomorph, endomorph-ectomorph, ectomorphic endomorph.[3]

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It is ideal to conduct anthropological research on a homogenous population where hereditary aspects of a trait can be examined with less error and contamination. Like any tribal population, Santhal of North Bengal are close knit homogenous populations. The Santhal belong to the Proto-Australoid race. Primary occupation of the Santhal is agriculture and both men and women take part in agricultural activities.[4]

In a developing country like Bangladesh where mechanization is at minimum, human labour provides most of the power for work outputs. The requirements of strenuous laborious physical activity to sustain daily livelihood affects body composition and physique of these tribal people.[5]

In human populations, sex differences in body physique is a common phenomenon. Almost all the study examining the gender differences in body size shows that males are significantly heavier and taller than the

females, they possess broader shoulders and have bigger bone widths and circumferences than the female.[6]

A good number of researches were carried out with Santhal of West Bengal, India showing different aspects of anthropological variations. Considering the importance of understanding variation in body physique, the present study aims to study gender differences in anthropometric somatotype among Santhals of North Bengal. Particularly on mesomorphic component where each group requires high level of physical activity for their livelihood.

Materials and Methods

This cross-sectional type of analytical study was carried out in the department of anatomy of Dhaka medical college, Dhaka from July 2013 to June 2014. The sample size was 200 adult Santhals (100 male & 100 female) age ranging from 30 to 49 years. The study subjects were selected from three Santhals villages: Sundarpur and Joykrishnapur of Rajshahi districts and Bhabicha of Naogaon districts. Prior permission and informed written consent were taken from the headmanof the respective village Panchayet. Personal information and anthropometric measurements were recorded on questionnaire and datasheet following interview and examinations of the participants respectively.

With the help of stadiometer, weighing scale, vernier slide calliper, a standardized flexible ribbon tape and a skinfold calliper following ten body measurements were taken: 1. Height, 2. Body weight, 3. Skinfold at triceps, 4. Skinfold at sub-scapula, 5. Skinfold at supraspinale, 6. Skinfold at medial calf, 7. Bi-epicondylar breadth of femur, 8. Bi-epicondylar breadth of humerus, 9. Upper arm circumference & 10. Calf circumference.

Anthropometric Somatotyping was done incorporating the above ten anthropometric measurements using Heath and Carter's formula:

i. Endomorphy = - 0.7182 + 0.145(X) - 0.00068 (X)2 + 0.0000014 (X)3. Here, X = (Sum of triceps, subscapular and supraspinale skinfolds) x 170.18 / Body height in cm,

ii. Mesomorphy = (0.858 x humerus breadth) + (0.601 x femur breadth) + (0.188 x corrected arm girth) + (0.161 x corrected calf girth) - (body height x 0.131) + 4.5,

iii. Ectomorphy = 0.732 x HWR -28.58 (If HWR ≥40.75), Ectomorphy = 0.463 x HWR -17.63 (If HWR <40.75 but >38.25) &Ectomorphy = 0.1or recorded as 1/2 (If HWR ≤ 38.25).

Here, Data were analysed with the help of SPSS version 19.0 for windows and statistical analysis were done by unpaired student's 't' test.

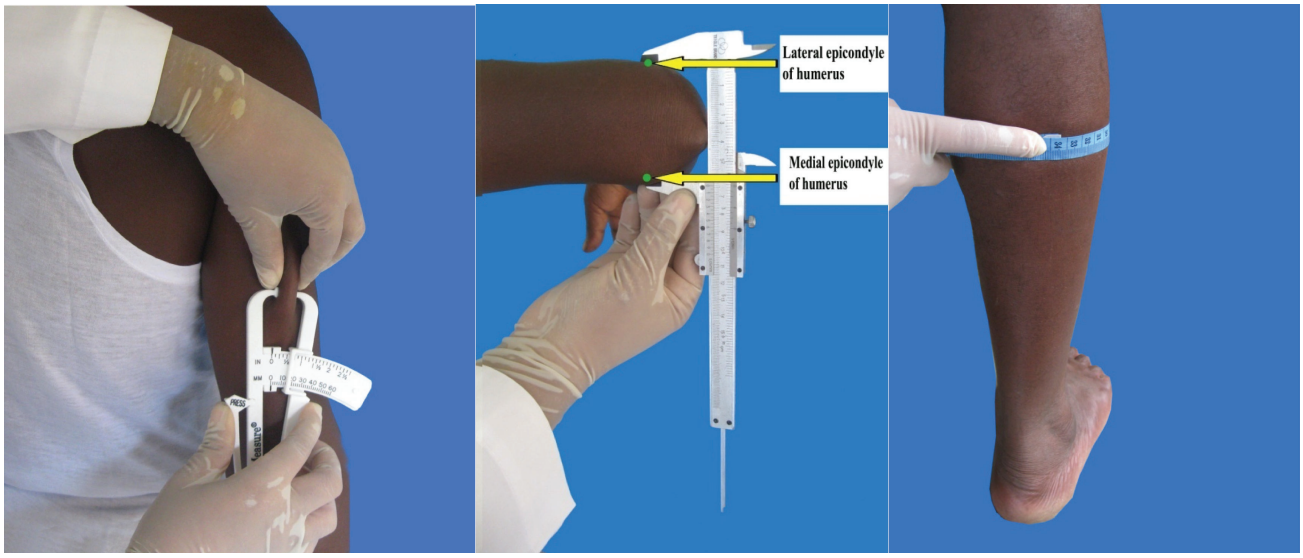

Fig: 1. a **Fig:1. b** **Fig:1.c**

Fig.-1: *Anthropometric measurements of different variables. 1.a Skinfold at triceps, 1.b Biepicondylar breadth of humerus, 1.c Calf circumference.*

Results

Results and observations of this study are described below with suitable tables & graphs. In table-1 significant difference in height & weight was observed between male and female (P< 0.001), where height & weight of male was higher than female. Mean height & weight of male was 160.69±3.91cm & 148.22±6.53 kg; whereas in female 148.22±6.53 cm & 44.82±5.30 kg respectively.

Female had higher value in all skinfold's measurements than male. In female, skinfold measurements at triceps was 11.07±1.86mm, at subscapula was 11.36±2.07mm, at supraspinale was 12.94±2.33mm & at medial calf was 10.10±2.04mm whereas in male all skinfolds measurements show lower value. Santhal male had higher value in all bone breadths and limb girths measurements than female (P< 0.001). Biepicondylar breadths of humerus & femur was 6.25±0.33 cm & 7.31±0.60cm in male & 5.94±0.36cm & 7.02±0.44 cm in female respectively. Limb girths measurements of upper arm & calf of leg was 25.03±1.11 cm & 31.26±1.49 cm in male and 23.18±1.74 cm & 28.96±1.96 cm in female respectively (Table-1).

Table 1. Gender differences in different anthropometric measurements between male and female adult Santhals of North Bengal

Anthropometric measurements	Santhal Male (100)	Santhal Female (100)	P-value
Height(cm)	160.69±3.91 (144.00176.00)	148.22±6.53 (140.00170.00)	0.0001***
Body Weight(kg)	54.54±4.06	44.82±5.30	0.0001***
Skinfold at triceps(mm)	9.60± 1.89	11.07±1.86	0.0001***
Skinfold at subscapula (mm)	10.06±1.92	11.36±2.07	0.0001***
Skinfold at supraspinale (mm)	11.10±1.91	12.94±2.33	0.0001***
Skinfold at medial calf (mm)	8.80±2.33	10.10±2.04	0.0001***
Biepicondylar breadth of humerus (cm)	6.25±0.33	5.94±0.36	0.0001***
Biepicondylar breadth of femur (cm)	7.31±0.60	7.02±0.44	0.0001***
Upper arm circumference (cm)	25.03±1.11	23.18±1.74	0.0001***
Calf circumference (cm)	31.26±1.49	28.96±1.96	0.0001****

significant at P<0.05, *** significant at P<0.001.

Table 2. Gender differences in different anthropometric somatotypes between male and female adult Santhals of North Bengal.

Sex	Endomorphy Mean±SD	Mesomorphy Mean±SD	Ectomorphy Mean±SD
Male (n=100)	3.13±0.57 (2.104.30)	3.31±0.65 (2.205.30)	2.53±0.63 (1.205.40)
Female (n=100)	3.91±0.67 (2.305.10)	3.35±0.73 (1.906.20)	2.27±0.93 (1.104.90)
P value	0.0001***	0.691ns	0.019*not

significant at P>0.05, * significant at P<0.05, *** significant at P<0.001.

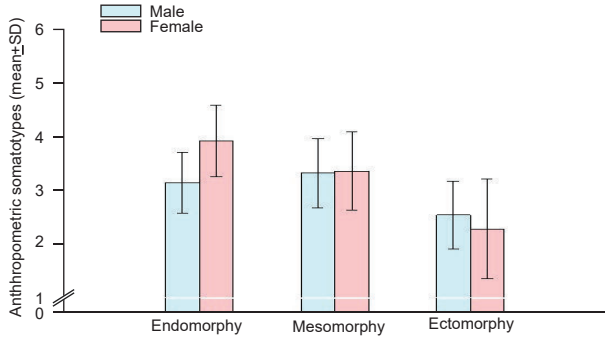

Fig. 2 Gender differences in somatotype component of adult Santhals in North Bengal, Bangladesh

Among the three components of anthropometric somatotype; endomorphy component was more in female than male (P<0.001) but ectomorphy component of somatotype was higher in male (P<0.019*). No

significant difference was observed in mesomorphy component (Table-2). Somatotype category observed in male was mesomorph-endomorph (3.13-3.31-2.53) and in female was mesomorphic endomorph (3.91-3.35-2.27).

Table 3 : Distribution of somatotype categories of Santhal male and femaleof North Bengal according to HeathCarterclassification.

Somatotype categories	Male (100) No. (%)	Female (100) No. (%)
Central	7	3
Balanced endomorph	14	17
Mesomorphic endomorph	5	27
Mesomorphendomorph	18	17
Endomorphic mesomorph	15	16
Balanced mesomorph	25	5
Ectomorphic mesomorph	0	0
Mesomorphectomorph	3	2
Mesomorphic ectomorph	1	0
Balanced ectomorph	4	0
Endomorphic ectomorph	1	2
Endomorphectomorph	4	6
Ectomorphic endomorph	3	5

Somatotype category observed in Santhal male was mesomorph-endomorph (3.13-3.31-2.53). Distribution of somatotype in categories among 30-49 years Santhal male showed that most of them was Balanced mesomorph (25%). Ectomorphic mesomorph category was absent (0%) in male adult Santhal. According to distribution of somatotype categories in Santhal male were Central (7%), Balanced endomorph (14%), Mesomorphic endomorph (5%), Mesomorph-endomorph (18%), Endomorphic-mesomorph (15%), Balanced mesomorph (25%), Mesomorph-Ectomorph (3%), Mesomorphic ectomorph (1%), Balanced ectomorph (4%), Endomorphic ectomorph (1%), Endomorph- ectomorph (4%) and Ectomorphic endomorph (3%). Somatotype category observed in Santhal female was mesomorphic endomorph (3.91-3.35-2.27). Mesomorphic endomorph (27%) somatotype category was recorded in most of Santhal female. Ectomorphic mesomorph (0%), Mesomorphic ectomorph (0%) and Balanced ectomorph (0%) category were absent in Santhal female. According to distribution of somatotype categories in Santhal female were Central (3%), Balanced endomorph (17%), Mesomorphic endomorph (27%), Mesomorph-endomorph (17%), Endomorphic mesomorph (16%), Balanced mesomorph (5%), Mesomorph-ectomorph (2%), Endomorphic ectomorph(2%), Endomorph-ectomorph(6%) and Ectomorphic endomorph (5%).

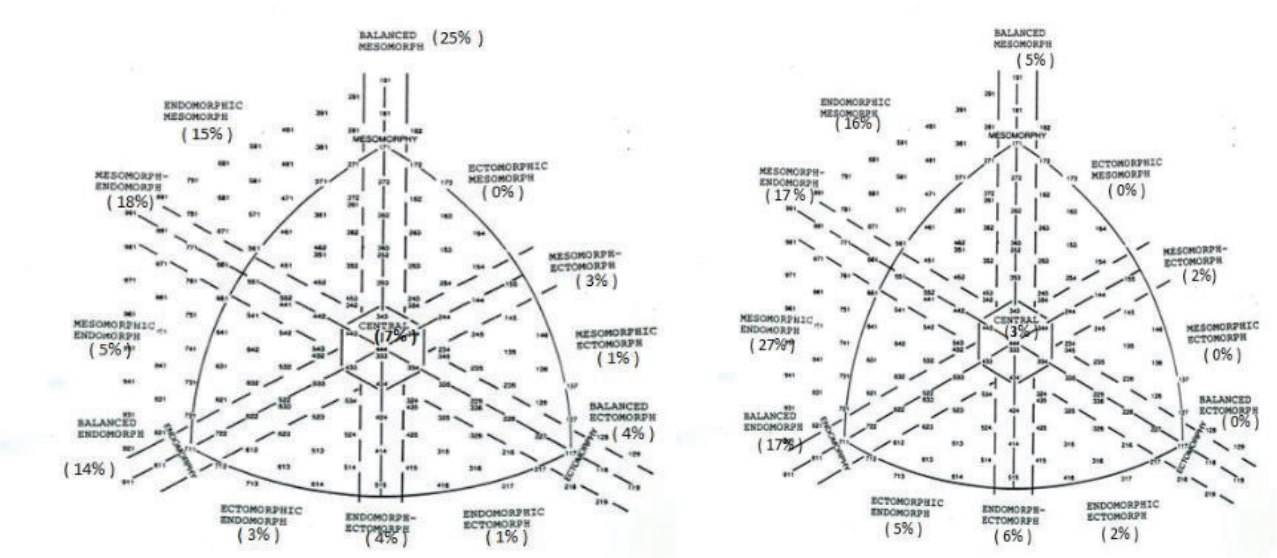

Fig:3 *Distribution of somatotype categories of male and female adult Santhals according to Heath-Carter classification*

Discussion:

The present study was carried out on middle-aged (30-49 years) Santhals and observed result shows females are more endomorphic and males are more ectomorphic than their counterpart. But no significant difference was observed in mesomorphy component. As endomorphy refers to relative fatness based on selected skinfolds measurements and females showed higher value in all skinfold thickness, so female found more endomorphic than male. Ectomorphy component related to Hight-weight ratio and as Santhal male was taller and heavier than female so male was found more ectomorphic than female. But no significant difference was observed in mesomorphy component as both requires high level of physical activity for their livelihoods. Results of different variables in this study showed some similarities with the findings of Ghosh and Malik 6 among the Santhals of West Bengal, India. Ghosh and Malik observed females are endomorphic and males were ectomorphic than their counterpart. Both male and female were found mesomorphic. Both Bangladeshi Santhals and Santhals of West Bengal, India belong to Proto-Astraloid race. Most of the Santhals both Bangladeshi and Indian were farmer. So, similarities observed between two groups may be due to same race, same dietary habit, same occupation and physical activity. Gender differences also found in similar type of study conducted by Chandel& Malik (2012) among 1008 adult (18-40 years) Kshatriya and kurmi of Uttar Pradesh, India. They found Kshatria and Kurmi male were ectomorphic-mesomorph while Kshatria and Kurmi female were balanced mesomorph[7]. So, both Kushatriya and Kurmi males have linear and muscular body physique whereas females are muscular in their body physique. The overall high mesomorphic ratings in both the populations can be attributed to the occupation of agriculture and factory works involving high physical activity. Kshatriya and Kurmi were agricultural and factory labourer and Santhals were farmer so similarities may be due to same physical activity. According to Chandel and Malik[7]Kshatryia is one of the four castes of Hinduism and Kurmi is a subcaste of Kshatryia caste and their staple food is wheat or wheat product. So, dissimilarities may be due to the racial variation, environmental factor, food habit and selection of different age group. So, Ghosh & Malik[6] and Chandel& Malik[7] revealed sexual dimorphism in anthropometric somatotype of Santhals of West Bengal and Kshatriya &Kurmi of Uttar Pradesh, India, which is consistent with this study.

Conclusion: The anthropometric somatotype, used as a descriptive method of body shape in the present study, revealed remarkable variations of body physique in Santhals of North Bengal, Bangladesh. Among the three components of somatotype, endomorphy component was higher in female than male and ectomorphy component was higher in male. But no significant difference was observed in mesomorphy component as their existence requires high level of physical activity for both male and female.

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