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RESEARCH ARTICLE

SOMATOTYPE CHARACTERISTICS OF TWO POPULATIONS IN MANIPUR

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ABSTRACT

Somatotype is a numerical shorthand method of studying the present morphological constitution of an individual or population. Somatotypes are determined by age, genetic, dietary condition and physical exercise. The present paper aims at studying the somatotype characteristics of two different communities of Manipur. Ten anthropometric measurements were measured from amongst 339 individuals aged 18-75 years of which 174 constitute males and 165 constitute females. BMI (Body Mass Index) was computed from height and weight of each subject. Somatotype rating of each individual was assessed using standard method. One way analysis of variance indicated significance differences in all parameters among the four groups of men and women (all $P< 0.05$) level. Regarding somatotype patterns, mesomorphic-endomorph was the most common type in all four comparing groups. Comparatively, Kom and Chothe women were higher in endomorphy with 9.22 and 8.54 ratings than male counterparts; on the contrary, high mesomorphy ratings were observed in both Chothe and Kom males with 6.65 and 5.05 respectively. The highest ectomorphy rating was indicated by the Kom males (2.11) whereas the lowest was indicated by the Chothe women (0.95). Significant variations have been shown in all somatotype components of endomorphy, mesomorphy and ectomorphy among the four groups (all $P<0.05$). Further, it was found that higher the mean BMI values, the larger were the endomorphy components and it was followed by mesomorphy, but the ectomorphy rating declined among the overweight and obese individuals.

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INTRODUCTION

Somatotype provides the quantitative description of human physique. It is expressed in three numerical digits which indicates endomorphy (degree of fatness), mesomorphy (musculoskeletal development) and ectomorphy (linearity). These components correspond with the three primary germ cell layers that give rise to specific sets of tissuesthat define body composition (Biljana et al,, 2016). Koleva et al., (2002) reported that mesormorphic endomorph tend to suffer from digestive disorders, lumbo-sacral radiculitis and also arterial hypertension and liver disease. Higher value of endomorphy was associated with type 2 diabetes, hypertension and breast cancer (Buffa et al,, 2007; Herrera et al., 2007; and Ronco etal 2008).

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Briton and Fox (2011) also reported that fat is initially stored in the subcutaneous adipose tissue, but once maximum limit of this adipose tissue is reached, storage shifts to visceral depots and ectopic non- adipose sites, including skeletal muscles. This may causes larger body girths as a result of ectopic fat deposition in the skeletal muscles. Successful athletes in many sports events appear to have high mesomorphy ratings, demonstrating strong musculo-skeletal development (Cater and Heath, 1990). In general, larger muscles are able to produce higher strength outputs (Lauchbach and Caville, 1969) which can lead to superior anaerobic performance. There are ample evidences that somatotypes differ from person to person and population to population. Moreover, athletes belonging to different sports events exhibit different somatotypes. Carter (1970) reported that endomorphic mesomorph is the prerequisite for success in football, however, Devi and Singh (2007) found mostly mesomorph-endomorph somatotype pattern among the Meitei women football players of Manipur. Many scientists have taken research works on the aspects of somatotypes among the athletes of different sports events; however, data on somatotypes among the general populations

are scanty. Hence an effort has been made to study the somatotype characterictics of two different tribal communities of Kom and Chothe of Churachandpur and Chandel districts of Manipur. These two populations are listed in the recognised scheduled tribes of Manipur. The former group inhabit mostly towards the western sides of Manipur whereas the later are distributed mostly at the southern parts of the state. These two population groups occupy different habitats in different directions and claimed themselves belonging to different identity of Naga (Chothe) and Kuki (Kom). The Chothe language has affinities with the old Kukis and Grierson classified it under the Kuki chin sub group of Tibeto- Burman family of languages, but they have learned more dialects through inter marriages with the neigh boring people. The Chothe and Kom people followed Christianity. Rice is the staple food of both communities. Basically, the most common method of cooking is boiling and is also the simplest form of preparing dishes. Locally available edible leaves are used for making cuisines. Among the regularly consume meat items, pork play an important item of food in the life of Chothe and Kom tribes of Manipur.

MATERIALS AND METHODS

A cross sectional data of 339 individuals aged 18-75 years was considered in the present study of which, male constitutes 174 individuals (51.33%) and female constitutes 165 individuals (48.67%). Anthropometric measurements such as body height, body weight, triceps skinfold, supra-spinale skinfold, sub-scapular skinfold, calf skinfold, humerous bi-epicondylar diameter/ humerus width, femur bi-epi-condylar diameter/ femur width, biceps girth and calf girth were measured following the norms of Weiner and Lourie (1969). Somatotype rating of each subject was computed using standard method of Heat and Carter (1970). BMI (body mass index) was also found out from height and weight parameters and classified as per WHO (2003).

Statistical Analysis: Data obtained from the present study was cross checked and cleaning of data was also performed before analysis to minimize the rate of error. Data entry was done using MS excel. Appropriate statistical tools were also used for the analysis of the collected data. Mean and standard deviation (SD) values were computed using SPSS version 16 and Single factor ANOVA was analyzed using MS excel.

RESULTS

Mean values of ten anthropometric variables and BMI values indicate that the Kom males have the highest mean body height of 160.0 cm with lighter body weight (56.26 kg) than the Chothe males (59.14 kg) who are the heaviest of all. The shortest and lightest group is represented by the Chothe women. The largest of the triceps and sub-scapula skinfolds are found among the shortest women group of Chothe whereas the slightly shorter Kom women reveal largest mean values of supra-illiac and calf skinfold. Quite similar mean values of humerus width are observed among the same sexes, but larger among the males (6.43 cm and 6.48 cm) as compare to females (5.73cm and 5.83 cm). Such a trend is also observed in case of femur width. The largest biceps girth is among the Chothe men. As a general trend, women have smaller girth measurements than males. BMI values show that taller the height with lighter weight of the Kom males, the less is the BMI value (21.98 kg/m^2),while the remaining three groups indicate higher BMI approximately 23.70 kg/m^2. However, BMI values ranges from a minimum of 18.08kg/m^2 to a maximum of 34.54kg/m^2 for all groups. Analysis of variance shows significant difference in all anthropometric parameters among the four comparing groups (all $P<0.05$) (Table 1). Somatotype categories highlight that mesomorphic-endomorph is the most common somatotype in all four groups of men and women, however, highest among the Chothe women (95.29%) and the lowest among the Kom men (43.62%). The somatotype characteristic of mesomorphic-endomorph is that the first component (endomorphy) is the highest of all and the second component (mesomorphy) is greater than the third (ectomorphy). Mesomorph endomorph with 39.36% and 22.5% and endomorphic mesomorph (17.02% and 15%) are also found only among the males of two populations, but no woman exhibit such somatotype pattern since these classes represent male characteristics in which mesomorphy is either dominant or equal in both the cases. Since women have poor development of musculo-skeletal tissue, in general, as compare to males. On the contrary, least percentages of two different types of somatotypes that is balanced endomorphy and ectomorphic endomorph are prevalent only among the females. These somatotype patterns are characterized by predominance of endomorphy and low mesomorphy rating (Table 2, Fig. 1& 2).

Mean BMI values show that the Kom males have the lowest mean with 21.98 kg/m^2, while the remaining three groups indicate approximately 23.70 kg/m^2. Somatotype components of men and women reveal that the highest endomorphy is found among the Cho the women with a mean value of 9.22 and the Kom women (8.54) indicate the next highest in this component among the four groups. On the other, Chothe males (6.65) have higher mean endomorphy than the Kom males (5.05). In case of mesomorphy, Chothe males (5.07) dominant over the three groups, whose mean values show close among each other. Mention may be made here that the low value of mesomorphy of Kom males indicate poor musculoskeletal development, who are linear in size and have the highest ectomorphy of all with a mean of 2.11 (Table 3). Analysis of variance shows significant differences in all somatotype components among the four groups (all $P<0.05$). Table 4 indicates mean BMI values and somatotype components of overweight and obese men and women of Kom and Chothe tribes. From the BMI values of the subjects computed, whose BMI > 23.0 kg/m2 and > 27.5 kg/m2 and above are considered as overweight and obese as per WHO (2003). Hence, the BMI and somatotypes of the present study men and women indicate that mean BMI values increases from a minimum of 25.52 kg/m^2 to a maximum of 26.77 kg/m2 as compared to BMI mean values of the general Chothe and Kom men and women. As BMI increases, the results show higher endomorphy and mesomorphy components. On the other hand, decline in ectomorphy components among the overweight and obese subjects and it could be due to increase in weight since it is calculated in terms of height/ ^{3}weight (Table 4). One way analysis of variance shows significant differences in endomorphy and ectomorphy components ($F=20.96$, $P<0.05$) and $F=16.55$, $P<0.05$) level.

DISCUSSION

Body height, weight, skin fold thickness, girth and dimensional measurements vary from sex to sex and population to population.

Table 1. Mean, standard deviation and F- ratio of anthropometricvariables of two populations

		Men		Women		
		Kom (n=94)	Chothe (n=80)	Kom (n=80)	Chothe (n=85)	
Sl. No.	Variables	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	F- ratio
1.	Body height	160.0 ± 6.03	158.51 ± 5.56	151.21 ± 5.52	147.98 ± 5.52	90.89*
2.	Body weight	56.26 ± 7.64	59.14 ± 10.45	54.63 ± 8.66	52.31 ± 9.99	8.01*
3.	Triceps skinfold	9.90 ± 3.78	11.78 ± 5.22	17.05 ± 4.94	18.16 ± 5.22	58.95*
4.	Sub-scapular skf.	10.55 ± 5.51	17.16 ± 7.72	18.66 ± 5.08	23.08 ± 7.01	55.82*
5.	Supra-spinaleskf.	10.61 ±4 .03	11.52 ± 5.46	15.86 ± 5.02	15.73 ± 5.58	25.75*
6.	Calf skinfold	9.84 ± 4.55	11.31 ± 6.09	17.04 ± 5.08	15.95 ± 6.25	34.52*
7.	Humerus width	6.48 ± 0.66	6.43 ± 0.46	5.83 ± 0.65	5.73 ±0.64	34.95*
8.	Femur width	8.95±0.82	8.82±0.65	8.48±0.84	8.07±1.20	16.19*
9.	Biceps girth	25.61±2.39	27.50±3.09	25.58±2.84	26.02±3.27	9.88*
10.	Calf girth	33.59 ± 2.67	35.23 ± 3.03	32.94 ± 3.65	32.65 ± 3.15	11.0*
11.	BMI	21.98 ± 2.87	23.81 ± 3.57	23.99 ± 3.53	23.31 ± 3.12	6.99*

Note: body height, width and girth in cm, weight in kg, skinfold (skf) in mm, BMI in kg/m2, df=3,335,
F-ratio =2.63 at 0.05% level.

Table 2. Distribution of somatotypes of men and women

		Men				Women			
Sl. No		Kom (n=94)		Chothe (n=80)		Kom (n=80)		Chothe (n=85)	
	Category	f	p.c	f	p.c	f	p.c	f	p.c
1.	Mesomorphic endomorph	41	43.62	50	62.5	66	82.5	81	95.29
2.	Mesomorph endomorph	37	39.36	18	22.5	-	-	-	-
3.	Endomorphic mesomorph	16	17.02	12	15.0	-	-	-	-
4.	Balanced endomorphy	-	-	-	-	09	11.25	02	2.35
5.	Ectomorphic endomorph	-	-	-	-	05	6.25	02	2.35
	Total	94	100	80	100	80	100	85	99.99

Table 3. Mean BMI and Somatotypesof men and women

		Men		Women		
		Kom (n=94)	Chothe (n=80)	Kom (n=80)	Chothe (n=85)	
Sl. No.	Variables	Mean±SD	Mean±SD	Mean±SD	Mean±SD	F ratio
1.	BMI (kg/m2)	21.98 ± 2.87	23.81 ± 3.57	23.99 ± 3.53	23.31 ± 3.12	6.99*
2.	Endomorphy	5.05 ± 1.65	6.65 ± 2.62	8.54 ± 2.44	9.22 ± 2.47	59.18*
3.	Mesomorphy	4.46 ± 1.15	5.07 ± 1.14	4.47 ± 1.39	4.45 ± 1.48	4.62*
4.	Ectomorphy	2.11 ± 1.21	1.62 ± 0.93	1.06 ± 0.93	0.95 ± 0.62	27.98*

Note: df= 3,335, F=2.631 at 0.05% level.

Table 4. Somatotype components of overweight and obese men and women

		Overweight and obese men		Overweight and obese women		
		Kom(n= 26)	Chothe (n=42)	Kom (n=39)	Chothe (n=46)	
Sl. No.	Variables	Mean ±SD	Mean±SD	Mean±SD	Mean±SD	F ratio
1.	BMI(kg/m2)	25.52±2.21	25.82±2.06	26.77±2.79	25.56±2.71	1.91
2.	Endomorphy	5.56±1.62	8.23±2.38	9.96±2.33	10.47±2.29	20.96*
3.	Mesomorphy	5.65±1.29	5.54±0.91	5.31±1.30	5.20±1.50	0.92
4.	Ectomorphy	0.73±0.53	0.92±0.61	0.26±0.30	0.55±0.21	16.55*

Note: df= 3,145, F=2.66 at 0.05% level.

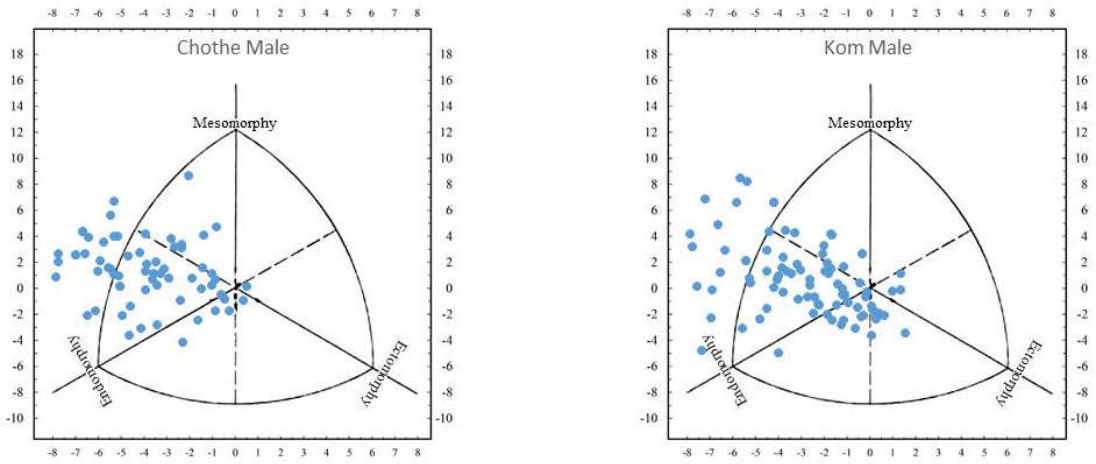

Fig. 1: Graph showing male somatotype charts

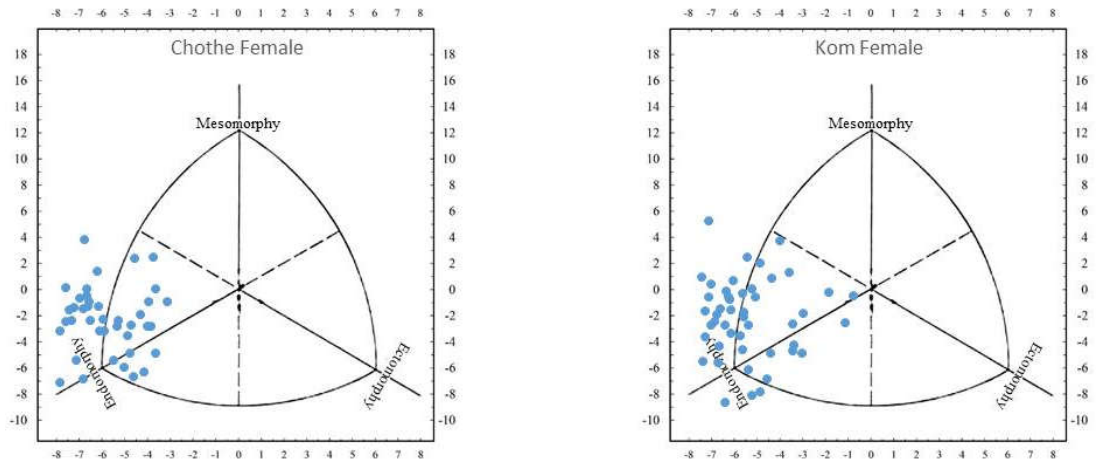

Fig. 2. Graph showing female somatotype chart

Taller heights and larger girths of the males than female counterparts are due to genetic factor, and women have more adipose cells as compare to men, in general. Least mean BMI of Kom males (21.98 kg/m^2) is because of taller height and lighter weight as compare to other groups since it is computed using weight/ (height)^2, while the remaining three groups indicate higher BMI approximately 23.70 kg/m^2(Table1). Regarding somatotypes pattern, mesomorphic - endomorph is the most common type in all four groups of men and women ranging from a minimum of 43.62% to maximum of 95.29%) in the present study. This indicates the higher ratings of endomorphy, followed by mesomorphy and ectomorphy in the three numerical digits of the subjects which represent somatotypes of individuals. In other words, large numbers of subjects indicate having more amount adipose tissue as compare to development of musculo-skeletal tissue. Among the subjects, however, other somatotypes such as mesomorph - endomorph with 39.36% and 22.5% and endomorphic - mesomorph (17.02 % and 15%) are also found only among the males of two populations, but no woman exhibit such somatotype pattern since these classes represent male characteristics in which mesomorphy is either dominant or equal in both the cases (Table 2). Comparatively, women are higher in mean endomorphy with 9.22 and 8.54 as compare to male counterparts. On the contrary, the later groups exhibit higher mesomorphy that is 6.65 for Chothe males and 5.05 for Kom males than female populations. This is due to genetic and environmental factors. The tallest population of Kom males has the highest ectomorphy mean of all. Ectomorphy is the assessment of degree of linearity (Table 3).

From the BMI values of the subjects computed, whose BMI > 23.0 kg/m2 and > 27.5 kg/m2 and above are considered as overweight and obese individuals as per WHO (2003). Hence, computed mean BMI values have been found from a minimum of 25.52 kg/m2 to a maximum of 26.77 kg/m2 among the overweight and obese groups. As BMI increases, the results show higher endomorphy and mesomorphy, but lower ectomorphy in overweight and obese subjects as compare to BMI and somatotypes of total men and women presented in table 3. Fat is stored initially in the subcutaneous adipose tissue and once the capacity of subcutaneous is reached, storage fat shifts to visceral depots and ectopic non –adipose sites, including skeletal muscles (Ukropec et al., 2008). Thus higher mesomorphy among the overweight and obese Kom and Chothe males could be the result of deposition of ectopic fat in the skeletal muscles that causes larger girths of extremities.

On the other hand, decline in ectomorphy component among the overweight and obese subjects could be due to increase in weight since it is calculated in terms of height/ $\sqrt[3]{\text{weight}}$ (Table 4). While comparing the endomorphy components of men and women of two populations, higher mean values of Chothe men (8.23) and women (10.47) indicate having more amount of body fat than the Kom men (5.56) and women (9.96). Again among the same sexes, women are more adipose as compared to males.

Conclusion

In conclusion, the present study reveals that males and females have different somatotype characteristics. Moreover, it is observed that as BMI increases there is corresponding increase in endomorphy and slight increment in mesomorphy also. BMI is an index of assessing overweight and obesity whereas obesity is the accumulation of excess body fat to the extent that it may have adverse effect to health. Since there is corresponding increase in endomorphy among the overweight and obese men and women of the present study, hence somatotype characteristics may be considered as an indicator of health.

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Consent: The authors declare that consent was obtained from the subjects under study for data collection and publication of this study.

Ethical approval: The authors hereby declare that methods have been examined and approved by institutional ethics committee as per ICMR (Indian Council of Medical Research) guidelines.

Competing interests: Authors have declared that no competing interests exist.

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