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Investigation of Somatotyping in 6 to 14 year old boys of Chandauli and Mirzapur Districts of Uttar Pradesh - A Pilot Survey

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ABSTRACT

Aim: *The major aim of this cross-sectional pilot survey is to determine the somatotype characteristics using Heath and Carter method in 6 to 14 year - old boys in the rural regions of the districts Chandauli and Mirzapur.*

Materials & Methods: *The sample consists of 136 male children in the age span 6 to 14 years from the Chandauli and Mirzapur districts in Uttar Pradesh. The study was carried out in February and March 2014. Somatotyping of the subjects was determined with the help of the Heath–Carter formula. Mean and standard deviation were used to characterize the somatotyping of the male children. Socioeconomic conditions, nutritional inadequacies and geographical factors may have had an influence on the physical growth of the research population along with their genetic constitution.*

Results: *(1) The maximum value for endomorphy 3.2 was found in the age group 11 years and minimum 2.7 was in 13year age groups. (2) The maximum value for mesomorphy (4) was found in the age group 6 years and minimum (2.7) in the 11 years. (3) The maximum value for ectomorphy (5) was found in 12 years and min (3.1) in the age group 6 years.*

Conclusions: *In the age group 6 years, the mesomorphic component was dominant, but with age, that position went to the ectomorphic component in the 12 year's age group. The endomorphic value was constant for the 8 to 10years age groups and was found to slowly fluctuate for higher age groups.*

Keywords: *Somatotype, Anthropometry, Height, Weight, ICMR*

INTRODUCTION

Somatotype is the study of the structure or build of a person, especially the extent to which it exhibits the characteristics of an ectomorph, an endomorph, or a mesomorph (according to Stedman's Medical Dictionary). The children were somatotyped by the Heath-Carter anthropometric method (Heath and Carter, 1967) which defines an individual's somatotype as a composite of the contributions of three components: endomorphy (relative body fatness), mesomorphy (relative musculoskeletal development) and ectomorphy (relative body linearity).

There are various factors that affect somatotyping of an individual such as age, gender, socio-economic status (Carter and Parizkova, 1978; Gakhar and Malik, 2002; Bhasin and Jain, 2007; Kaur, 2009, De Garay et al., 1974; Heath et al., 1961; Prakash and Malik, 1989; Kalichman and Kobliansky, 2006, Rahmawati et al., 2004; Dibamani Singh, 2011, etc.).

There are several methods to estimate somatotype, but the Heath-Carter anthropometric method, which quantifies the present shape and composition of the entire human physique, is most commonly used (Carter and Heath, 1990). However, it has now been established beyond doubt that the somatotype ratings do change, especially during adolescence (Barton and Hunt, 1962; Heath and Carter, 1971; Hunt and Barton, 1959; Parizkova and Carter, 1976; Walker, 1978; Zuk, 1958). Previous research has shown that changes in somatotype in children can provide valuable information for understanding their growth and maturity. For instance, Parizkova and Carter (1976) stressed the importance of assessing patterns of growth in individual children rather than relying on group means. This is based on the finding that while some children changed in one direction, others changed in another direction, thereby concealing individual changes in the group. The aim of the present study was to investigate the somatotyping of children in the 6 to 14 year age span in the cross-sectional sample of the male children from Chandauli and Mirzapur districts of Uttar Pradesh.

MATERIALS AND METHODS

This cross-sectional sample consists of 136 school-going male students selected through non probability sampling approach and the data obtained were classified into 9 groups in the age span 6 to 14 years as follows:- 6 years (n=19); 7 years (n=19); 8 years (n=15); 9 years (n=14); 10 years (n=14); 11 years (n=13); 12 years (n=13); 13 years (n=13); and 14 years (n= 16). The ages

of the subjects were determined from their dates of birth in their school registers. Voluntary data were collected from the subjects; and prior to the collecting of the data, permission was taken from the heads of the institutions and the parents of the subjects. The study was approved by the Research Ethics Committee of the Pondicherry University.

The following measurements were obtained according to the International Society for Advancement of Kianthropometry (ISAK) guidelines. All measurements were taken only for the right-hand side of the body parts. Height was measured with an anthropometric rod to the nearest 1 mm. Weight was measured in kilograms using an electronic weighing machine to the nearest 0.1 kg. All skinfold measurements (triceps, subscapular, supraspinal and medial calf) were taken with the Harpenden skinfold caliper which had a min accuracy of 1 mm. All measurements were taken just after 2 seconds. Biepicondylar humerus width and biepicondylar femur width were measured using a small sliding caliper to the nearest 1 mm. Flexed arm and maximum calf girth were measured with the help of Lufkin tape. All measurements were taken using cross-hand technique with 1 mm graduation. The corrections were done as proposed by Hebbelinck et al. (1973). The following descriptions are adapted from Carter and Heath (1990). Further details are given in Ross and Marfell-Jones (1991), Carter (1996), Ross, Carr and Carter (1999), Duquet and Carter (2001) and the ISAK Manual (2001). The formulae for calculating the somatotype were taken from Carter and Heath (**1990).**

1. **Endomorphy** = –0.7182 + 0.1451(X) – 0.00068(X^2) + 0.0000014(X^3), where X = (sum of triceps, subscapular and supraspinal skinfolds) multiplied by 170.18 (height in cm). This is called height-corrected endomorphy.
2. **Mesomorphy** = (0.858 x humerus breadth) + (0.601 x femur breadth) + (0.188 x corrected arm girth) + (0.161 x corrected calf girth) – (0.131 x height) + 4.5.
   (Corrected arm girth = flexed arm girth - triceps skinfold/10; Corrected calf girth= (maximal calf girth - calf skinfold)/10.)
3. **Ectomorphy.** Three different equations are used to calculate ectomorphy according to the height–weight ratio (HWR).
   (i) If HWR is greater than or equal to 40.75, then **Ectomorphy** = 0.732 HWR – 28.58.
   (ii) If HWR is less than 40.75 but greater than 38.25, then **Ectomorphy** = 0.463 HWR – 17.63.

(iii) If HWR is equal to or less than 38.25, then **Ectomorphy** = 0.1.

Mean, Standard Deviation and somatotype was calculated using Excel sheet Windows 2007.

RESULTS

Table: 1. Mean and Standard deviation of Somatotyping distribution of the boys in the age span 6 to 14 years

Age	Endomorphy	Mesomorphy	Ectomorphy
6+	2.9±0.2	4.0±0.8	3.1±0.58
7+	3.1±0.4	2.8±0.72	4.2±1.4
8+	2.9±0.3	3.6±0.79	3.6±1.6
9+	2.9±0.34	3.8±0.0.55	3.4±0.98
10+	2.9±0.4	3.2±0.6	4.3±0.62
11+	3.2±0.53	3.2±0.56	4.2±1
12+	3.0±0.32	2.7±0.3	5.0±0.67
13+	2.7±0.33	2.9±1.2	4.5±0.77
14+	3.1±0.72	2.8±53	4.4±0.89

The Mean Somatotype rating for the 6 year age group was (2.9, 4, and 3.1) and for the 14 year age group was (3.1, 2.8, and 4.4). Therefore the component of somatotype changed (fluctuated) with the age.

The minimum value for endomorphic component of the 13 year age group is 2.7 and maximum value is 3.2 obtained in the age group 11 years. Therefore I found that the overall increment in endomorphy component is 0.5 units. The maximum value of mesomorphy (4.0) is found in the age group 6 years and minimum value (2.7) is recorded in the age group 12 years. Observation shows that a 1.3 unit decrement is found in mesomorphic component in the age group 12 years. The maximum value of ectomorphy (5.0) is in the 12+ year age group and minimum value (3.1) is recorded in 6 year age group. Therefore a 1.9 unit increment is found in ectomorphy in the age group from 6 years to 12 years. The Mesomorphic component is dominant (4.0) in the age group 6 years. While in the 12 year age group ectomorphic component is dominant but the minimum value (3.1) is found in the 6 year age group and, ectomorphy component increases in value along with age up to the 12 year group. Afterwards there is a tendency for a decrease in the ectomorphic component. Similar, though not exactly the same, results were found according to

Singh and Sidhu (1980) . There were irregular fluctuations found in somatotyping of Mirzapur and Chandauli districts in the age span 6 to 14 years.

The standard deviation shows that the minimum variability (0.2) is found in the 6 years age group and maximum variability in the age group 14 years in relation to endomorphic component. The results I obtained were opposite to those obtained by Singh and Sidhu (1980 in relation to year variations; similarly the minimum variability (0.58) is found in the 6 years age group and

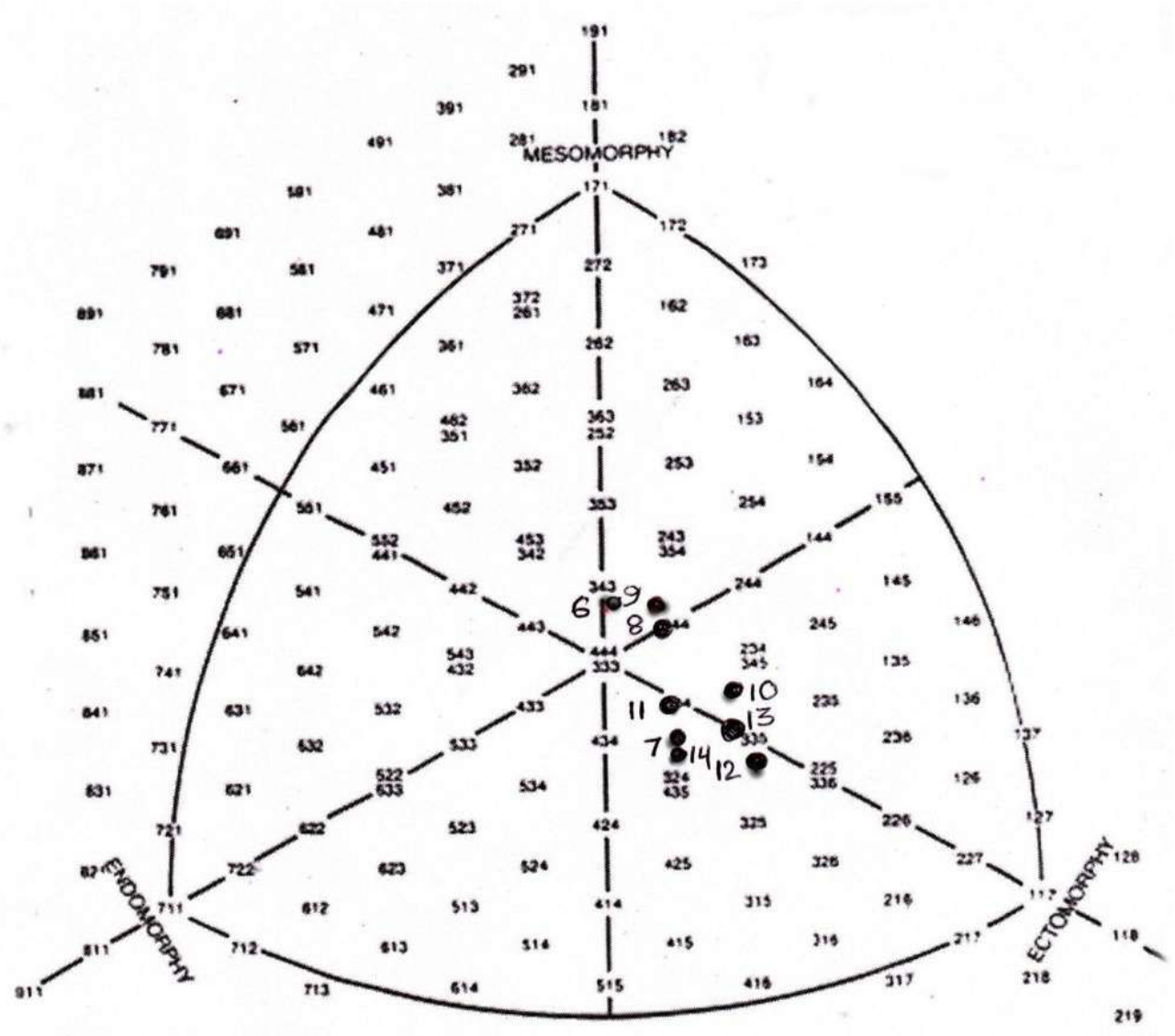

Fig. 1. Graphical Representation of the Mean Somatotype of boys from 6 to 14 years in Chandauli and Mirzapur districts.

maximum variability (1.6) is found in the 8 years age group of male children in the Mirzapur and Chandauli districts. However the results did agree more with those of Ventrella et al., 2008.

This somatochart shows that the mean values of the age groups of 6 and 9 year-old children come under Ectomorphic – Mesomorph, and mean of 8-year age group comes under Mesomorph– Ectomorph. The mean values of age groups 7, 12 and 14 years come under Endomorphic- Ectomorph category. Therefore the mean values of age groups 10 and 13 years come under Mesomorphic - Ectomorph. Mean of 11-year age group children comes under balance Ectomorph. This chart clearly shows that the values of somatotype rating changed according to the age of the children.

Table: 2. Comparison of mean height and weight of boys in Chandauli and Mirzapur districts with recommended values of ICMR height-weight chart

Age group	**Chandauli and Mirzapur districts**		**ICMR height weight chart**	
Years	Height	Weight	Height	Weight
6	113.9	18.1	116.1	20.7
7	122.4	21.4	121.7	22.9
8	125.5	23.6	127.0	25.3
9	125.9	24.1	132.2	28.1
10	133.5	26.4	137.5	31.4
11	134.0	27.1	140.0	32.2
12	140.0	28.5	147.0	37.0
13	140.7	30.5	153.0	40.9
14	145.2	34.0	160.0	47.0

DISCUSSION

The maximum growth spurt in the height of the male children in the Chandauli and Mirzapur districts was found to be 8.5 cm which was in the age groups of 6 to 7 years and 8 to 10 years. Also, the minimum values were recorded in the age groups 11 and 13 years. Similarly, the maximum weight progressions were measured in the age groups 14 years and 7 years as 3.5 and 3.3 respectively.

Therefore, when the mean height and weight of the research population were compared with the ICMR height–weight chart, the researchers found lower values for height and weight. This clearly shows that there was shunting in relation to the height and weight of the research

population. The growth pattern is influenced by many factors such as nutritional status, socioeconomic conditions and environmental and genetic factors. The survey was conducted among the agricultural population of the hilly areas of the districts; therefore their underprivileged backgrounds could be one of the main factors which could have contributed to the shunting in their height and weight.

CONCLUSIONS

In the age group 6 years the mesomorphy component was dominant but with the rise in age that position was taken by the Ectomorphy component in the age group 12 years. The Endomorphic value was constant for 8 to 10 years age groups and then found to slowly fluctuate for the higher age groups.

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