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Somatotype of School Going Girls at the Age of Menarche of a Peripheral District of Bangladesh

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Abstract

***Context**: Human populations consist of individuals who differ widely in body shapes and sizes. Somatotypes are morpho-phenotypic ranges along with continuation of variation, which possess constantly recognizable characteristics and are the functional end products of the whole genetic and the developmental complex. This study was conducted with the objective to find out the difference of somatotype of children at the age of menarche in the rural and the urban areas in a district of Bangladesh.*

***Materials and Methods:** Somatotypes of school going girls age ranging from 12 to 16 years were considered in a cross sectional descriptive type of study and was carried out at the department of Anatomy, Rangpur Medical College from July 2014 to June 2014. A total of 200, 100 rural and 100 urban students were included from the urban and the rural schools respectively. A pre-tested, structured, self-administered questionnaire was set for obtaining the socio-demographic data (age at menarche, number of sibling of the students and occupation and educational attainment of their parents, etc.). A series of measurements were obtained by direct measurements.*

***Results:** It was found that the urban students had a higher mean value for endomorphic and mesomorphic scores than rural students and the difference was statistically highly significant (p<0.000). On the other hand ectomorphic score was slightly higher in urban students than rural students but was not statistically significant (p>05). The endomorphic and mesomorphic scores of urban students were 4.99 ±0.73 & 2.21±1.3 and those of rural students were 4.45±0.40 & 1.48±1.0 respectively. Ectomorphic scores of urban and rural students were 2.87±1.5 & 2.82 ±0.85 respectively. The mean menarcheal age in case of urban students was 11.83±0.82 years and in case of rural students was 13.61±0.83 years.*

***Conclusion:** The findings indicated that urban girls were significantly more endomorphic and mesomorphic than rural girls.*

***Keywords :** Somatotype, menarcheal age, rural girl, urban girl*

Introduction

Somatotyping is a unique method for classification of human physique which was first invented by Sheldon in 1940[1] and was later on modified by Heath and Carter in 1967.[2] Somatotype denotes body shape as well as physique type in human and the corresponding method describes the variation between and within human groups numerically. This numerical expression of information of individual physical constitution is an easy comprehensible form compared to an array of anthropometric measurements.[3] Changes in somatotype components during the growth period can provide useful information about the growth status, timing and rate of sexual maturation.[4] Somatotype ratings are well suited for analyzing the widely recognized changes in human beings during growth, maturation and process of aging.[5,6] It is a convenient short hand descriptor of overall physique and conveys a meaning of totality of morphological features of human body.[4] The somatotype identifies a person

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as belonging to a biological group or family and describes the physical characteristics of human body. This allows defining body type through analysis of metric characters. It has proved to be a well descriptive and classification system for learning about relative shape and body composition and their variation in populations.[7]

Somatotype is expressed in a three-number rating representing endomorphy, mesomorphy and ectomorphy. Endomorphy is the relative fatness which could be determinant by measurement of the skinfold thickness, mesomorphy is the musculo-skeletal robustness measured by thickness of muscles and bone. On the other hand, ectomorphy is the relative linearity or slenderness of a physique, measured by height, weight and Body Mass Index (BMI). Endomorphy focuses on the digestive system that corresponds to viscerotonia temperament. Mesomorphy focuses on musculature and circulatory system corresponds to the somatotonia temperament. Ectomorphy focuses on nervous system that corresponds to cerebrotonia temperament. Human has all three systems in the body and no one is simply an endomorphy without having at the same time some mesomorphy and ectomorphy. But these components are present in varying degrees. Sheldon[1] evaluate the degree of existence of a component on a scale ranging from one to seven, with one was the minimum and seven was the maximum. There 7-1-1 was the most extreme endomorph with minimal mesomorphy and ectomorphy and 1-7-1 was the extreme mesomorphy and 1-1-7 was the extreme ectomorphy.

Malnutrition is still prevalent in developing countries. School children may also be at high nutritional risk, not only under-five children. However, their nutritional status is poorly documented, particularly in rural areas.[8] Childhood and adolescent stunting remains an important determinant of age of menarche. A child weight, height and age permit determination of degree of underweight, stunting or wasting and such measures are usually considered as proxies of protein energy malnutrition. The regular monitoring of child growth is now one of the major concerns for the public health policymakers and planners of Bangladesh. So, a study was conducted with the objective to find out the difference of somatotype of children at the age of menarche in rural and urban area of Rangpur district.

Materials and Methods

The present study was based on a sample of 200 girls, among them 100 were selected purposively from a school of urban area and 100 from that of a rural area of Rangpur district. All had their menarche 6±1 months prior to the date of data collection. The study was carried out from June 2014 to July 2015 at the Department of Anatomy, Rangpur Medical College. The selected girls were briefed on the objectives of the study and separate written consent was taken from the willing students for the study. A spreadsheet was used to record the information (age and time of menarche) and measurements.

A series of measurements were taken using carefully specified procedures and measuring instruments. To estimate endomorphy, triceps skinfold thickness, sub-scapular skinfold thickness and supraspinale skinfold thickness were measured with a spreading caliper and recorded to the nearest of 0.1. The calipers were zeroed before starting the procedure. For mesomorphy, mid arm circumference and calf circumference were measured with flexible measuring tape. Humerus breadth and femur breadth were measured with slide caliper. For ectomorphy, height was measured while the subject was standing without foot wear, to the nearest 0.1 cm, using a portable stadiometer. Statistical analysis was done using computer programs SPSS-16.

The protocol of the study was submitted to the Ethical Review Committee of Rangpur Medical College and required approval was taken.

Results

The observation and results of collected data are presented in table-I to IV and figure 1 to 7.

The mean (±SD) menarcheal age in case of urban students was 11.83±82 years and in case of rural students was 13.61±83 years. The mean (±SD) thicknesses of triceps, subscapular & supraspinale skin-folds were higher ($p<0.001$) at all measurements in urban students (table-I). Almost all of the rural students, 91%, 96% and 99% for triceps, subscapular and supraspinale skin-fold thicknesses were less than 1.27 cm, 1.53 cm & 1.68 cm respectively. On the other hand, 57%, 40% & 33% of urban students had measurements more than those respectively (Fig. 1-3).

Table-I

Distribution of the subjects by triceps, sub scapular and supraspinale skin-fold thicknesses

Variables (cm)	Subjects		p value
	Urban (n=100) mean±SD (range)	Rural (n=100) mean±SD (range)	
Triceps skin-fold thickness	1.38 ± .29	1.12 +.15	0.001*
	(0.85 - 2.45)	(0.7-1.6)	
Subscapular skin-fold thickness	1.52 ± .31	1.29 ± .13	0.001*
	(1.05 - 2.45)	(0.9 -1.6)	
Supraspinale skin-fold thickness	1.62 ± .34	1.41 ± .13	0.001*
	(1.15 - 2.9)	(1.15 - 1.8(	

* Difference is statistically significant.

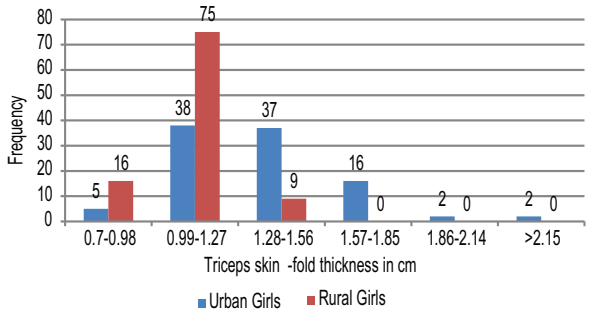

Fig.-1 : *Bar diagram showing the distribution of urban (n=100) and rural (n=100) students according to triceps skinfold thickness.*

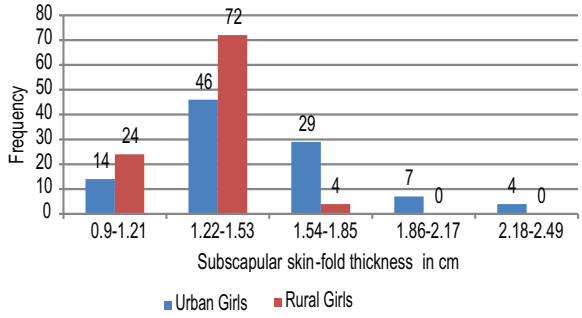

Fig.-2: *Bar diagram showing the distribution of urban and rural students according to Subscapular skin-fold thickness.*

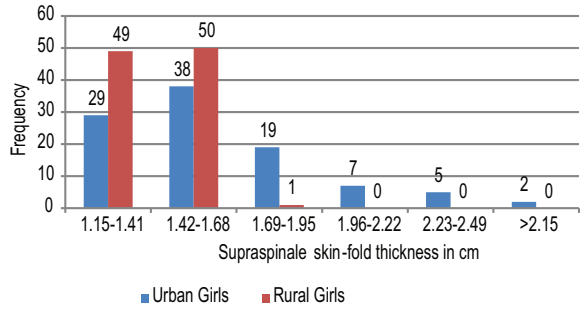

Fig.-3: *Bar diagram showing the distribution of urban and rural students according to supraspinale skin-fold thickness.*

The mid arm and calf circumferences of the urban students were 20.72 ± 2.3 cm and 28.94 ± 3.3 cm respectively (Table-II). The means are significant higher than the corresponding mean measurements of rural students (p<0.001).

Most of the rural students (70%) had mid arm circumference less than 19.55 cm, whereas 60% of the urban students had mid arm circumference more than 19.55 cm (Fig-4). The highest proportion of urban students (43%) was distributed between 26.9 and 30.2 cm for calf circumference and that for the rural students (63%) was distributed between 23.5 and 26.8 cm (Fig-5).

Table-II

Distribution of the subjects by mid arm circumference and calf circumference.

Variables	Subjects		p value
	Urban (n=100) mean±SD cm (range)	Rural (n=100) mean±SD cm (range)	
Mid arm circumference	20.72 ± 2.3 (15.8-26.2)	19.03 ± 1.4 (15.1-23.1)	0.001*
Calf circumference	28.94 ± 3.3 (22.3-38)	25.3 ± 2.3 (29.8-35.1)	0.001*

* Difference is statistically significant.

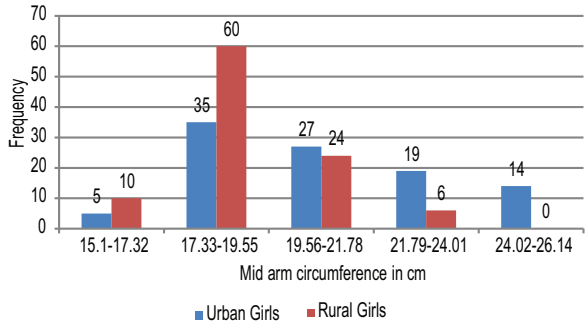

Fig.- 4: *Bar diagram showing the distribution of urban and rural students according to mid arm circumference.*

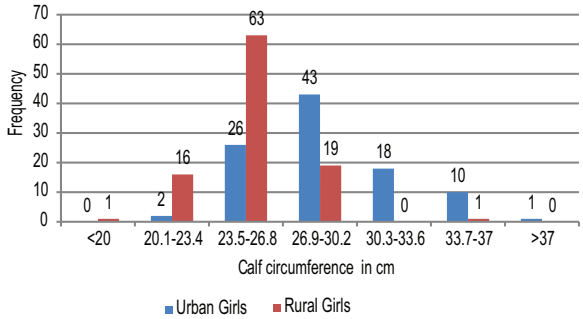

Fig.- 5: *Bar diagram showing the distribution of urban and rural students according to calf circumference.*

Table-III

Distribution of the students by humerus breadth and femur breadth

Variables	Subjects		p value
	Urban (n=100) mean±SD cm (range)	Rural (n=100) mean±SD cm (range)	
Humerus breadth	5.41 ± .43 (4.57-7.28)	4.9 ± .45 (3.16-5.93)	0.001*
Femur breadth	7.61 ± .52 (6.35 -9.25)	7.04 ± .42 (5.35 -7.92)	0.001*

* Difference is statistically significant.

Significantly (p<0.001) more humerus and femur breadths were found among the urban students (Table-III). The highest frequency of humerus and femur breadths of urban students were observed in groups 5.16 - 6.15 cm (63%) and 7.15 - 8.14 cm (67%) respectively (Fig-6) and the same of the rural students was observed in groups 4.16 - 5.15 cm (48%) and 7.15 - 8.14 cm (53%) respectively (Fig-7).

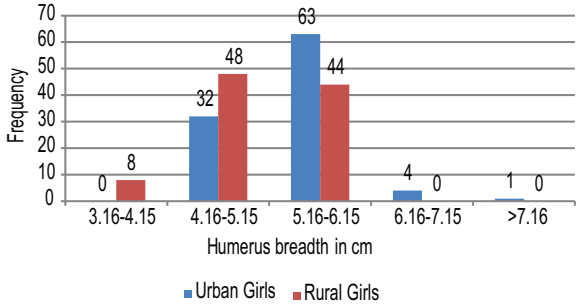

Fig.- 6: *Bar diagram showing the distribution of urban and rural students according to humerus breadth.*

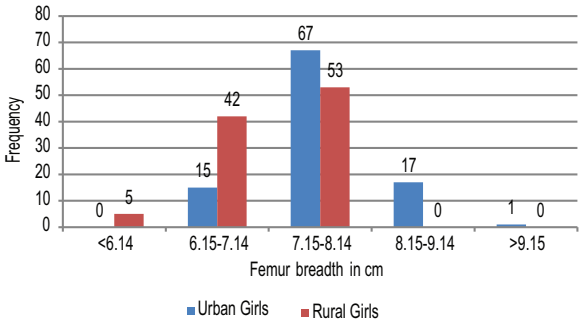

Fig.- 7: *Bar diagram showing the distribution of urban and rural students according to femur breadth.*

Table IV

Distribution of various somatotypes among urban and rural students

Variables	Subjects		p value
	Urban (n=100) mean±SD	Rural (n=100) mean±SD	
Endomorphy	4.99 ± 0.73	4.45 ± 0.40	0.001*
Mesomorphy	2.21 ± 1.3	1.48 ± 1.0	0.001*
Ectomorphy	2.87 ± 1.5	2.82 ± 0.85	0.730

* Difference is statistically significant.

Discussion

Somatotype is an effective technique for the study of anthropometric variations and body composition in subjects. It reflects an overall outlook of the body and conveys a meaning of the totality of the morphological feature of the human body.[9]

Skinfold thickness gives an idea about the endomorphy. For this purpose, skinfold thickness was measured from three areas such as triceps skinfold thickness, subscapular skinfold thickness and supraspinale skinfold thickness according to Heath and Carter[2].The present study revealed that the mean triceps skinfold, subscapular skinfold and supraspinale skinfolds were higher in urban students and the differences of mean were statistically significant (p<0.001) between two groups. Ahmed et al[10] worked on 180 Nigerian school going girls (age range 10-18years) and found the mean triceps skinfold thickness 1.3 ± 4.61 cm.

Mesomorphy has the tendency towards muscularity and refers to a body built characterized by the predominance of tissues derived from the mesoderm. So, measurement of the arm circumference and calf circumference and humerus as well as femur breadth, may be indicative of mesomorphy[1]. In this study, the mid arm circumference and calf circumference of the urban students were higher than rural students and mean differences are statistically highly significant (p<0.001).

Simondon et al[11] in France studied on 1120 girls, the age ranged from 10.3 to 17.5 years. Among them 705 were rural and 415 were migrated to the city. They found the mean upper arm circumference 20.87 1 2.1 cm in resident girls and 21.67 ± 2.1 cm in migrated girls. These means are lower than the findings of the present study. Monsma and Manila[12] in the USA conducted a study on 161 female skaters of mean age 15.7 ± 2.4 years. They found the calf circumference of girls at test stream level 33.61.4 cm, at pre-elite level 32.8 ± .3 cm and at elite stage it was 32.1 ± .4 cm. In all the cases, the measurements were higher than those of the present study. The subjects of the present study

had means (lSD) of menarcheal age 11.83 ± 82 and 13.61 ± 83 years respectively for urban and rural students and measurements were taken at about 6 months after menarche.. The subjects of the study conducted by Monsma and Manila were older.

The anthropometric measurements done to estimate ectomorphy are stature, weight and body mass.[2] A comparison of the anthropometric indices of urban and rural girls showed: weight, 46.47 ± 8.4 kg vs 40.03 ± 4.2 kg; height 153.15 ± 6.6 cm vs 146.43 ± 3.8 cm, BMI, 19.8 ± 3.2 vs 18.6 ± 1.5.In all the cases the results are significantly higher in urban girls than rural. It is expected that, urban students came from families belonging to a relatively higher level of socioeconomic and they had better nutrition and optimum living condition compare to rural students. This may be the cause of having all the scores higher than those of rural students. It is well known fact that the well-off population has higher physical growth than the poor ones.[13]

The present study showed that the endomorphic scores in urban and rural students were higher than ectomorphic and mesomorphic scores. Suryobroto et al[13]in 2011 studied on somatotype in 363 girls and 299 boys in Indonesia age ranging from 4 to 20 years. Researcher related age with somatotype and found that mesomorph-endomorph score were high at age 4 years. Thereafter it was transformed into ectomorphic endomorph in girls and mesomorph-ectomorph in boys at the age of 20 years. In girls, onset of puberty was characterized by an acceleration of endomorphy component at age 8 years. It is well known that endomorphy reflect body fat; girls augment their body fat noticeably at 7 years of age. It was found that higher age group girls (14 to 18 years) are more endomorphic than the younger ones (10-13 years).

Conclusion

This study revealed that the urban students were more endomorphic than rural students and rural students were more ectomorphic than urban students. In short it may be summarized that, ectomorph are lean & long, with difficulty building muscle, endomorph are big, high body fat, often pear-shaped, with a high tendency to store body fat and mesomorph are muscular & well-built, with a high metabolism and responsive muscle cells. This study may be a clue to nutrition planner.

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