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Comparison of anthropometric measurements and body composition among the 12 years old rural and urban children

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Abstract

The purpose of the present study was to compare the anthropometric measurements and body composition components of the 12 years old rural and urban children from Punjab. Total 60 children (30 rural and 30 urban) were selected to participate in the study. Height of the subjects was measured with the stadiometer. Body mass was assessed by using the portable weighing machine. Widths and diameters of body parts were measured by using digital caliper. Girths and lengths were taken with the flexible steel tape. Skinfold thicknesses were measured with the help of Harpenden skinfold caliper. The results revealed that the urban children had significantly higher body mass index (BMI) ($p < 0.05$), % body fat ($p < 0.01$), total body fat ($p < 0.05$), biceps ($p < 0.05$), triceps ($p < 0.01$) and supra-iliac ($p < 0.05$) skinfold thicknesses as compared to rural children. The rural children had significantly greater upper arm length ($p < 0.01$) than the urban children. In conclusion, it is evident from the results that the urban children possessed higher amount of fat.

Keywords: Anthropometric measurements, rural, urban, children, percent body fat, lean body mass

1. Introduction

Anthropometry is defined as the study of the measurement of the human body in terms of the size of bone, muscle and adipose tissue. The area of anthropometry includes a range of human body measurements such as weight, height, skinfold thicknesses, circumferences, diameters and length measurements of the body segments [1]. Anthropometry is the measurement of physical characteristics of the human body at different ages [2]. It includes taking accurate, highly standardized measurements so that size and form of human body can be depicted objectively. Anthropometric dimensions, body composition and morphological characteristics are sensitive indicators of growth, progress and nutritional status of a population. The anthropometric measurements are used to assess the nutritional status in children and adults [3] and are effective and frequently performed child health screening procedure. The data on anthropometric measurements of children reflect general health status, and growth and development over time [1].

The anthropometric measurements such as weight and height reflect the physical growth of children. Growth is determined by biological determinants including sex, birth weight and genetic constitution. The growth of children can be measured cross-sectionally or longitudinally through the anthropometric measurements. If children are assessed once, the growth status of children for age can be evaluated by comparing this data with the suitable reference chart, if children are assessed more times, the children's growth rate data are acquired that can be more important because they reveal change in growth and development [4]. Socioeconomic and environmental factors seem to produce their effect on physical dimensions of the body in growing period of school age in the children [5]. Nowadays studies are conducted to examine the differences in anthropometric characteristics, body proportions and body composition between populations from different settings. Many research studies in the human biological literature investigated the differences in urban and rural populations and in different socio-economic strata with regard to anthropometric characteristics [6-10]. The differences among urban and rural children are reported and these are exaggerated by unending dietary problems in the rural areas and noticeable economic disparities in many African, Asian and Latin American countries [11-14].

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Area of residence and environmental factors may be related to the disparities in activity patterns, diet, eating attitudes, availability of sports facilities and chances for physical fitness activities. However, it is not clear whether such factors can affect growth patterns, anthropometric measurements and body composition. The present study, therefore, aims to evaluate the anthropometric characteristics, body composition and physical fitness among the rural and urban children of state of Punjab.

2. Methodology

A total 60 male children of age 12 years, from the various districts of Punjab were purposively selected to participate in the study. The children were from Amritsar, Jalandhar, Tarn-taran, Kapurthala, Nawashehar and Gurdaspur districts of Punjab. The data for the study was collected during the various camps conducted under “Catch Them Young Programme” organized by Department of Physical Education (AT), Guru Nanak Dev University, Amritsar under the aegis of Centre of excellence in sports sciences. Out of sixty male children, 30 children were belonged to rural areas and 30 children were from the urban areas. In different studies and countries the meaning and definition of rural and urban residence may differ according to their country norms. For the present study, an area with a minimum population of 15,000, with 75 percent of the male population is engaged in non-agricultural works is considered as urban area.

2.1 Anthropometry

Standing height was measured to the nearest 0.5 cm using a stadiometer. Body mass was assessed by using the portable weighing machine. Widths and diameters of body parts were

measured by using digital caliper. Girths and lengths were taken with the flexible steel tape to the nearest 0.5 cm. Skinfold thicknesses were measured with the help of Harpenden skinfold caliper.

Body Mass Index

Body mass index (BMI) was calculated by the following formulae

$$BMI (Kg/m^2) = (Body\ mass\ in\ Kg) / (Stature\ in\ Meters)^2 [15].$$

Percent Body Fat

Percentage body fat as estimated from the sum of skinfolds was calculated using equations of Slaughter *et al* [16].

$$Percent\ Body\ Fat = 1.21(triceps+subscapular) \times 0.008(triceps+subscapular) \times 2 - 1.7$$

$$Total\ Body\ Fat\ (kg) = (\%body\ fat/100) \times body\ mass\ (kg)$$

Lean body mass (LBM) was calculated using the % body fat value estimated from the sum of skinfolds.

$$Lean\ Body\ Mass\ (kg) = body\ mass\ (kg) - total\ body\ fat\ (kg)$$

2.3 Statistical Analysis

Statistical analysis was performed using SPSS version 16.0 for windows (SPSS Inc, Chicago, IL, USA). All descriptive data pertaining to anthropometric measurements and body composition variables was reported as mean and standard deviation. An independent sample t-test was used to compare the mean values of anthropometric measurements and body composition variables between rural and urban boys. Significance levels were set at $p < 0.05$.

3. Results

Table 1: Comparison of height, weight, BMI and length measurements between rural and urban children

Age Group	Rural (N=30)		Urban (N=30)		t- Value
	Mean	SD	Mean	SD	
Height (cm)	144.30	10.63	141.30	8.506	1.20
Weight (kg)	34.21	5.41	35.09	6.26	0.58
Body Mass Index (BMI) (Kg/m ²)	16.41	1.84	17.50	2.10	2.12*
Total Arm Length (cm)	64.16	5.51	61.56	4.52	1.99
Upper Arm Length (cm)	26.30	2.38	24.30	1.72	3.72**
Lower Arm Length (cm)	37.90	3.46	37.26	3.44	0.71
Total Leg Length (cm)	81.53	6.47	79.00	6.45	1.51
Upper Leg Length (cm)	38.20	3.46	36.40	4.67	1.69
Lower Leg Length (cm)	43.33	3.30	42.60	3.23	0.86

* Indicates $p < 0.05$, ** Indicates $p < 0.01$

The height, weight, body mass index and length measurements of the rural and urban children are shown in table-1. The results revealed that there were no significant differences in height and weight between the rural and urban children. The children from the urban areas were found to have significantly greater body mass index ($t = 2.12, p < 0.05$)

compared to the children from the rural areas. There were no significant differences in total arm length, lower arm length, total leg length upper leg length and lower leg length between the rural and urban children. However, the children from the rural areas showed significantly greater upper arm length ($t = 3.72, p < 0.05$) as compared to their urban counterparts.

Table 2: Comparison of various circumferences and diameters of body parts between rural and urban children

Age Group	Rural (N=30)		Urban (N=30)		t- Value
	Mean	SD	Mean	SD	
Upper Arm Circumference (cm)	18.70	1.76	18.73	2.24	0.06
Forearm Circumference (cm)	19.43	1.47	19.06	1.59	0.92
Wrist Circumference (cm)	14.20	1.06	14.06	1.25	0.44
Chest Circumference (cm)	66.16	5.09	66.06	6.07	0.06
Abdominal Circumference (cm)	59.96	4.94	59.46	8.49	0.27
Hip Circumference (cm)	69.60	5.27	68.40	6.60	0.77
Thigh Circumference (cm)	38.23	3.44	39.23	5.46	0.84
Calf Circumference (cm)	26.80	2.12	25.93	2.87	1.32
Bicondylar Humerus Diameter (cm)	5.88	0.46	5.93	0.42	0.49

Wrist Diameter (cm)	4.66	0.39	4.66	0.24	0.03
Hand Diameter (cm)	6.86	0.58	6.70	0.426	1.20
Biacromial Diameter (cm)	32.81	2.07	33.01	2.13	0.37
Hip Diameter (cm)	24.19	2.09	24.43	2.06	0.44
Bicondylar Femur Diameter (cm)	8.45	0.45	8.58	0.53	1.01

The various circumferences and diameters of body parts of the rural and urban children are given in table-2. The results revealed that there were no significant differences between the rural and urban children with regard to various

circumferences of the body parts. Similarly in case of diameters of body parts, there were no significant differences between the rural and urban children.

Table 3: Comparison of skinfold thicknesses and different components of body composition between rural and urban children

Age Group	Rural (N=30)		Urban (N=30)		t- Value
	Mean	SD	Mean	SD	
Biceps Skinfold (mm)	3.20	1.24	4.63	2.78	2.57*
Triceps Skinfold (mm)	5.13	1.81	7.83	3.90	3.43**
Subscapular Skinfold (mm)	5.10	2.38	6.73	4.28	1.82
Supra-iliac Skinfold (mm)	5.23	3.41	8.40	6.41	2.38*
Percent Body Fat (%)	10.51	4.20	15.69	9.22	2.79**
Total Body Fat (kg)	3.66	1.91	5.94	4.57	2.51*
Lean Body Mass (kg)	30.54	4.57	29.14	3.38	1.34

* Indicates $p < 0.05$, ** Indicates $p < 0.01$

The table-3 depicts skinfold thicknesses and different components of body composition of the rural and urban children. The children from the urban areas were found to have significantly greater biceps ($t = 2.57, p < 0.05$), triceps ($t = 3.43, p < 0.01$) and supra-iliac ($t = 2.38, p < 0.05$) skinfold thicknesses in comparison to the children from the rural areas. Similarly, the children from the urban areas were found to have significantly greater percent body fat ($t = 2.79, p < 0.01$) and total body fat ($t = 2.51, p < 0.05$) as compared to the children from the rural areas. However, no significant differences were reported for subscapular skinfold thickness and lean body mass between the two groups.

4. Discussion

The objective of the study was to examine potential differences in anthropometric measurements and body composition of Punjabi children living in either urban or rural settings. The analysis of the data indicated that no significant differences were found in height and weight between the 12 years old rural and urban children. These results are not in agreement with those of Pena Reyes *et al* [17] who reported higher values of height and weight in urban boys than the rural boys in Turkey. The height of the both rural and urban children in the present study is higher than the 12 year old children from Saudi Arabia and Turkey [17, 18]. The weight of children in present study is comparable to those of children from Saudi Arabia and Turkey [17, 18]. The urban children were found to have significantly greater body mass index than the rural children. Similar findings were reported by Pena Reyes *et al* [17] on children from Turkey. But these results are not in agreement with those reported by Tsimeas *et al* [19] on Greek children which found no significant differences in body mass index between urban and rural children. The children in the present study have lower body mass index than the Greek and Turkish children [17, 19]. There were no significant differences in leg length, upper leg length, lower leg length, arm length and lower arm length between the rural and urban children. However, the upper arm length was significantly greater in rural children when compared to their urban counterparts. No significant differences were observed for various circumferences of the body parts between the rural and urban children. The children in the present study have greater diameters than the Saudi Arabia boys studied by Al-Hazzaa

[18]. The urban children showed significantly greater mean value in biceps, triceps and supra-iliac skinfold thickness as compared to rural children. The both rural and urban children in the present study have lesser skinfold thicknesses than the Saudi Arabia boys studied by Al-Hazzaa [18]. The analysis of body composition showed that the percent body fat and total body fat of the urban children were significantly higher than those of the rural children. These findings are not in line with those reported by Tsimeas *et al* [19] on Greek children in which no differences were reported between urban and rural boys. However, the both rural and urban children in present study possessed lower fat percentage than the Greek children. No significant difference was observed in lean body mass between the two groups. These findings are in line with those reported by Mesa *et al* [20] on the Spanish children with regard to the body composition which showed no significant differences in lean body mass between rural and urban children. As the urban children showed higher levels of body fat than the rural children this might be due to the more activity oriented routine in rural areas, more open spaces and play fields compared to cities in the rural areas of Punjab.

5. Conclusion

It is concluded that the place of residence has clear impact on body composition of children as studied herein. The way of life and food habits and the constituents of food, the more activity oriented routine, more open spaces and play fields compared to cities in the rural areas of might have played significant role in the differences among children from different settings.

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