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Anthropometric measurements and body composition among the 16 years old adolescents

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Abstract
The purpose of the present study was to evaluate and compare the anthropometric measurements and body composition components of the 16 years old rural and urban adolescents from Punjab. For the purpose of the study, 60 adolescents (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 independent samples t-test revealed that the rural adolescents were significantly taller ($p<0.05$) than their urban counterparts. The rural children had significantly greater total arm length ($p<0.01$), total leg length, lower leg length, wrist ($p<0.05$) and thigh ($p<0.05$) circumferences, wrist ($p<0.05$), hand ($p<0.05$) and biacromial ($p<0.05$) diameters and lean body mass ($p<0.05$) than the urban adolescents. In conclusion, it is evident from the results that the rural adolescents possessed better anthropometric characteristics.

Keywords: anthropometric measurements, rural, urban, adolescent, percent body fat, lean body mass

Introduction
About 70 percent of Indian population lives in villages. There is a large variation among urban and rural areas in India. One of the most important differences that can be noticed between rural and urban areas is the dissimilarity in living standard of the people. People living in urban areas have better standard of living. There is a huge economic inequality between rural and urban areas in India. There are many people who prefer the peace and quiet of rural living. Rural areas are not as densely populated, not as polluted and certainly not as fast paced as the urban areas. Rural areas have a fresher and cleaner environment. Urban localities are classified according to number of peoples residing in an area, population density and land use. The urbanization process takes place in various countries under different circumstances in recent times [1]. The transition from rural agricultural societies to urban societies, which come with major changes, have forced to a large extent the social and biological transformation of populations throughout the world [2]. The differences in growth, body dimensions, body composition and fitness levels of children due to urban and rural environmental disparities have come into center of attention during the last few years.

Nowadays studies are conducted to examine the evolutionary importance of differences in anthropometric characteristics, body proportions and body composition between populations whose ancestors lived in different environmental 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. Height, weight and other body dimensions are differed in rural and urban children and in children from different socio-economic groups in nearly all the developed and in developing countries. There are several studies from Europe in the past 100 years show that urban children have greater body dimensions and mature earlier compared to children living in rural areas and urban and rural differences are existed among adults in many countries [3]. The greater anthropometric characteristics among urban children are attributed to advantageous transformations in health and diet and in wide-ranging living circumstances related to urbanization. The differences among urban and rural children are exaggerated by unending dietary problems in the rural areas and noticeable economic disparities in many African, Asian and Latin American countries. In the more developed countries of these continents, the greater anthropometric characteristics and earlier growth and development of children living in urban areas reveal the advantageous outcomes of urbanization related with enhanced economic status and access to facilities [4]. 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 among the rural and urban adolescents from Punjab.

Methodology
For the purpose of this study, total 60 male adolescents of age group 16 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 adolescents, 30 were belonged to rural areas and 30 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.

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 [5].

Percent Body Fat
Percentage body fat as estimated from the sum of skinfolds was calculated using equations of Slaughter *et al* [6].

Percent Body Fat =
1.21 (triceps+subscapular) x0.008
(triceps +subscapular) x2-1.7

Total Body Fat (kg) =
(%body fat/100) × 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)

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 adolescents. Significance levels were set at $p<0.05$.

Results

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

Variables	Rural (N=30)		Urban (N=30)		t- Value
	Mean	SD	Mean	SD	
Height (cm)	164.10	6.58	158.10	10.71	2.61*
Weight (kg)	51.86	8.80	47.80	8.51	1.81
Body Mass Index (BMI) (Kg/m^2)	19.14	2.16	19.03	2.12	0.18
Total Arm Length (cm)	74.43	4.51	71.80	4.27	2.31*
Upper Arm Length (cm)	30.33	3.13	29.40	2.67	1.24
Lower Arm Length (cm)	43.76	2.94	42.40	2.68	1.87
Total Leg Length (cm)	89.46	6.53	85.86	6.52	2.13*
Upper Leg Length (cm)	41.40	4.53	39.86	4.15	1.36
Lower Leg Length (cm)	47.80	2.60	46.46	3.94	2.20*

* Indicates $p<0.05$

The height, weight, body mass index and length measurements of the rural and urban adolescents are shown in table-1. Rural adolescents were significantly taller ($t=2.61$, $p<0.05$) than the urban adolescents. There were no significant differences in weight and body mass index of the rural and urban adolescents. Total arm length was significantly longer ($t=2.31$, $p<0.05$) in the rural adolescents as compared to their urban counterparts. On the other hand, there were no significant differences in relation to upper arm length, lower arm length and upper leg length between rural and urban adolescents. However, rural adolescents were found to have significantly greater total leg length ($t=2.13$, $p<0.05$) and lower leg length ($t=2.20$, $p<0.05$) than the urban adolescents.

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

Variables	Rural (N=30)		Urban (N=30)		t-Value
	Mean	SD	Mean	SD	
Upper Arm Circumference (cm)	22.06	2.49	21.63	2.09	0.73
Forearm Circumference (cm)	22.33	1.95	21.80	1.90	1.07
Wrist Circumference (cm)	15.73	0.90	14.90	1.15	3.10*
Chest Circumference (cm)	75.70	6.82	73.03	5.80	1.63
Abdominal Circumference (cm)	67.83	5.80	65.23	5.88	1.72

Hip Circumference (cm)	79.20	7.27	76.70	7.34	1.32
Thigh Circumference (cm)	46.73	6.28	43.60	4.26	2.25*
Calf Circumference (cm)	29.86	2.58	30.56	2.83	0.99
Bicondylar Humerus Diameter (cm)	6.71	0.40	6.60	0.38	1.07
Wrist Diameter (cm)	5.29	0.30	5.12	0.28	2.28*
Hand Diameter (cm)	7.91	0.39	7.50	0.491	3.57*
Biacromial Diameter (cm)	38.18	2.10	36.91	2.07	2.25*
Hip Diameter (cm)	28.95	2.55	28.11	2.00	1.41
Bicondylar Femur Diameter (cm)	9.28	0.62	8.99	0.50	1.91

* Indicates $p<0.05$

The various circumferences and diameters of body parts of the rural and urban adolescents are given in table-2. Independent samples t-test showed that there were no significant differences in upper arm, forearm, chest, abdominal, hip and calf circumferences between the rural and urban adolescents. However, rural adolescents had significantly greater wrist ($t=3.10$, $p<0.05$) and thigh ($t=2.25$, $p<0.05$) circumferences as compared to their urban counterparts. Similarly, rural adolescents were found to have significantly greater wrist ($t=2.28$, $p<0.05$), hand ($t=3.57$, $p<0.05$) and biacromial ($t=2.25$, $p<0.05$) diameters as compared to the urban adolescents. On the other hand, no significant differences were reported on bicondylar humerus, hip and bicondylar femur diameters between rural and urban adolescents.

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

Variables	Rural (N=30)		Urban (N=30)		t-Value
	Mean	SD	Mean	SD	
Biceps Skinfold (mm)	3.40	1.43	3.60	1.19	0.58
Triceps Skinfold (mm)	6.50	2.47	7.46	2.63	1.46
Subscapular Skinfold (mm)	6.70	3.32	7.33	2.69	0.81
Supra-iliac Skinfold (mm)	6.70	3.32	7.33	2.69	0.81
Percent Body Fat (%)	14.06	6.67	15.97	6.07	1.15
Total Body Fat (kg)	7.51	4.57	7.86	3.97	0.32
Lean Body Mass (kg)	44.35	7.31	39.93	6.40	2.48*

* Indicates $p<0.05$

The table-3 depicts skinfold thicknesses and different components of body composition of the rural and urban adolescents. Results revealed that there were no significant differences in biceps, triceps, subscapular and supra-iliac skinfolds, percent body fat and total body fat between the rural and urban adolescents. However, rural adolescents had significantly greater lean body mass ($t=2.48$, $p<0.05$) as compared to their urban counterparts.

Discussion

The objective of the study was to examine potential differences in anthropometric measurements and body composition of Punjabi adolescents living in either urban or rural settings. No significant differences were found in weight and body mass index between the rural and urban adolescents. There is little agreement from published comparisons of urban and rural children with regard to anthropometric measurements. Aberle *et al*. [7] found no differences in anthropometric characteristics between rural and urban children in Croatia. The rural adolescents were significantly taller than the urban adolescents. Greater height and lower body mass index were reported among rural Vietnamese children compared to their urban counterparts. [8] The adolescents in present study have lower height and weight than the adolescents from Oman and Sweden. [9, 10] The adolescents in present study have lower body mass index compared to Swedish children [10]. The rural adolescents had significantly greater mean values of arm length, leg length and lower leg length than the urban adolescents. However, there were no significant differences in upper leg length, upper arm length and lower arm length between the rural and urban adolescents. The rural adolescents were found to have significantly greater wrist and thigh circumferences as compared to urban adolescents. Whereas, no significant differences were observed for upper arm, forearm, chest, abdominal, hip and calf circumferences of the body parts between the rural and urban adolescents. The rural adolescents had significantly greater wrist, hand and biacromial diameters than the urban adolescents. However, there were no significant differences in bicondyler humerus, hip and bicondyler femur diameters of the body parts between rural and urban adolescents. There were no statistically significant difference in biceps, triceps and supra-iliac and subscapular skinfold thicknesses between the two groups. The analysis of body composition showed that the lean body mass of the rural adolescents was significantly higher than those of the urban adolescents. No significant difference was observed in percent body fat and total body fat between the two groups. Contrasting findings were reported in literature regarding body composition among rural and urban children. A study of children in Crete [11] found higher skinfolds among urban children, while higher levels of body fat have been reported in rural Belgian [12] and North American [13] youth. A Polish study [14] reported lower skinfolds in rural boys compared with urban boys but no differences for girls. Booth *et al* [15] found no differences between urban and rural children with regard to body mass index and skinfolds in New South Wales. The boys from Punjab have higher percent body fat compared to

adolescents from Oman [9].

Conclusion

It is concluded that the differences exist in anthropometric measurements and body composition of adolescents on the basis of place of residence 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 might be the major factors contributing in the differences among adolescents from different settings.

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