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Comparison of anthropometric characteristics and body composition among rural and urban young boys

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Abstract

The present study aimed to assess and compare the anthropometric characteristics and body composition components of the 17-year-old young boys from Punjab. 60 young boys were selected to participate in the study. The height of the participants was measured with the stadiometer. Body mass was assessed by using the portable weighing machine. Widths and diameters of body parts of the participants were measured by using a digital caliper. Circumferences and lengths were taken with the flexible steel tape. Harpenden skinfold caliper was used to measure the skinfold thicknesses of the participants. The t-test showed that the rural boys were significantly heavier ($p < 0.05$) than their urban counterparts. The rural boys had significantly greater total leg length ($p < 0.01$), upper leg length ($p < 0.05$) and lower leg length ($p < 0.05$) than the urban boys. Rural boys were also found to have significantly greater wrist ($t = 3.07, p < 0.05$), abdominal ($t = 3.47, p < 0.05$), hip ($t = 2.97, p < 0.05$) and thigh ($t = 2.61, p < 0.05$) circumferences and Hand diameter ($t = 2.58, p < 0.05$) and hip diameter ($t = 2.02, p < 0.05$) as compared to their urban counterparts. Rural boys also had significantly greater lean body mass ($p < 0.05$), as compared to urban boys. In conclusion, it is evident from the results that the rural young boys possessed better anthropometric characteristics.

Keywords: Anthropometric characteristics, rural, urban, body mass index, body composition

Introduction

Anthropometric and body composition are important indicators of health status in children and adolescents. Anthropometry is the sub-branch of the human sciences that deals with body measurements specifically with body size, shape, strength and working capacity ^[1]. It also deals with some other body dimensions: bone, muscle and adipose tissue. Measurement of subcutaneous adipose tissue is important because an individual with a large amount of this tissue has the risk for hypertension, diabetes, cardiovascular disease, arthritis and different forms of cancer ^[2].

Body composition refers to the relative percentage of fat, muscle and bone. If any type of changes in body composition, it reflects changes in the metabolism of energy and protein within the body. It is determined by the complex interaction of genes and environment which modulates the functional and structural adaptations to maintain homeostasis ^[3]. The anthropometric and body composition indicators are useful for determining nutritional status and the risk of future disease. The children's growth and development indicate the health and quality of nutrition in a populace. The variation in anthropometrical characteristics is influenced by the time, ethnicity, socio-economic, political, and environmental aspects.

There are few studies available in the literature that are conducted on the anthropometric and body composition of the children. Such a study was conducted by Chaves *et al.* ^[4] on the rural Portuguese children and adolescents and reported that the percentage of body fat among studied subjects was more than their international peers. Gharib *et al.* ^[5] showed that BMI as well as skin fold thicknesses suggest an increased trend toward adiposity among adolescents, especially in girls, which puts this age group at a high risk of adult obesity. Singh *et al.* ^[6] concluded that the place of residence has a clear impact on the body composition of children as the children residing in urban areas were reported to have a high percentage of body fat as compared to their rural counterparts. Tan *et al.* ^[7] compared the body composition and fat distribution of Australian women from urban and rural areas and concluded that measurement of fat distribution, waist circumference and waist-to-hip ratio were significantly higher in rural residents than urban residents. The cross-sectional study conducted on 565 Ghanaian adults by Agyapong *et al.* ^[8] concluded that there was no difference in the prevalence of obesity among rural and urban participants.

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Visceral and body fat cut-offs showed a higher prevalence of obesity in urban compared to rural participants. Katanic *et al.* [9] conducted a cross-sectional study to compare the anthropometric parameters among participants based on urban-rural status and within regional divisions and reported that urban girls have better height and low BMI as compared to rural girls. Urban boys also have lower BMI as compared to their rural counterparts. A study of Asian Indian origin found low body weights, detrimental age-related changes in body composition and several other health-related concerns among [10]. Saleh [11] conducted a study on 600 students and reported that there were statistically significant differences between rural and urban adolescents in most anthropometric characteristics and body composition variables. Sofi *et al.* [12] conducted a study on the children of government schools of the Kashmir region and concluded that the children's anthropometric measurements were influenced by their diet and place of residence. It is evident from the existing available literature that there is an association between anthropometric characteristics and body composition. Among the other factors, they are also influenced by the place of residing among the children. Therefore, the present study has been designed to assess the anthropometric parameters and body composition among rural and urban boys from Punjab.

Methodology

For the present study, total 60 male young boys of age group 17 years, from the various districts of Majha region of Punjab were purposively selected to participate in the study. Out of sixty male boys, 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.

Results

Table 1: Comparison of anthropometric measurements between rural and urban young boys

Variables	Rural (N=30)		Urban (N=30)		t- Value
	Mean	SD	Mean	SD	
Height (cm)	165.83	6.90	163.73	7.15	1.15
Weight (kg)	63.10	7.35	55.72	6.742	4.05*
Body Mass Index (BMI) (Kg/m ²)	22.93	2.15	20.84	2.77	3.25*
Total Arm Length (cm)	76.13	3.66	74.50	2.87	1.92
Upper Arm Length (cm)	32.20	2.57	31.03	2.02	1.94
Lower Arm Length (cm)	44.33	2.38	43.86	2.28	0.77
Total Leg Length (cm)	94.06	5.66	88.93	6.59	3.23*
Upper Leg Length (cm)	44.40	4.37	41.16	3.50	3.15*
Lower Leg Length (cm)	49.83	2.39	47.76	3.58	2.62*
Upper Arm Circumference (cm)	22.80	2.51	21.86	2.11	1.55
Forearm Circumference (cm)	23.30	2.05	22.36	1.69	1.92
Wrist Circumference (cm)	16.36	0.96	15.60	0.96	3.07*
Chest Circumference (cm)	78.90	5.04	77.06	5.27	1.37
Abdominal Circumference (cm)	70.36	5.99	65.60	4.53	3.47*
Hip Circumference (cm)	83.10	5.24	79.60	3.69	2.98*
Thigh Circumference (cm)	47.36	4.86	44.40	3.84	2.61*
Calf Circumference (cm)	32.13	2.99	31.20	3.20	1.16
Bicondylar Humerus Diameter (cm)	6.77	0.41	6.78	0.35	0.03
Wrist Diameter (cm)	5.41	0.37	5.27	0.24	1.76
Hand Diameter (cm)	8.01	0.55	7.70	0.352	2.58*
Biacromial Diameter (cm)	38.84	2.51	38.50	1.53	0.64
Hip Diameter (cm)	29.56	2.00	28.52	1.96	2.02*
Bicondylar Femur Diameter (cm)	9.46	0.59	9.24	0.48	1.57

* Indicates $p < 0.05$

Anthropometry: Standing height was measured to the nearest 0.5 cm using a stadiometer. Body mass was assessed by using the portable weighing machine. Lengths of the body parts were measured with the help of anthropometric rod. Widths and diameters of body parts were measured by using digital caliper. Circumferences of the various body parts of the subjects 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.

$$\text{BMI (Kg/m}^2\text{)} = (\text{Body mass in Kg}) / (\text{Stature in Meters})^2 \text{ [10].}$$

Percent Body Fat

Percentage body fat as estimated from the sum of skinfolds was calculated using equations of Slaughter *et al* [11].

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

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

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

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

Statistical Analysis

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

Anthropometric measurements of rural and urban young boys are presented in Table 1. The rural boys were significantly heavier ($t=4.05$, $p<0.05$) than the urban young boys. The body mass index ($t=3.25$, $p<0.05$) was also significantly higher in the rural boys as compared to their urban counterparts. Similarly, the rural boys were reported to have significantly longer total leg ($t=3.23$, $p<0.05$), upper leg ($t=3.15$, $p<0.05$) and lower leg ($t=2.62$, $p<0.05$) lengths than urban boys. Rural boys were also found to have significantly greater wrist ($t=3.07$, $p<0.05$), abdominal ($t=3.47$, $p<0.05$), hip ($t=2.97$, $p<0.05$) and thigh ($t=2.61$, $p<0.05$) circumferences as compared to their urban counterparts. Hand diameter ($t=2.58$, $p<0.05$) and hip diameter ($t=2.02$, $p<0.05$) were also significantly greater in rural boys as compared to their urban counterparts.

Table 2: Comparison of skinfold thicknesses and different components of body composition between rural and urban boys

Variables	Rural (N=30)		Urban (N=30)		t-Value
	Mean	SD	Mean	SD	
Biceps Skinfold (mm)	3.30	0.95	3.53	0.81	1.01
Triceps Skinfold (mm)	5.80	1.93	6.96	2.15	2.20*
Subscapular Skinfold (mm)	7.40	2.04	7.73	2.05	0.63
Supra-iliac Skinfold (mm)	9.46	3.49	8.56	2.45	1.15
Percent Body Fat (%)	14.06	3.94	15.85	4.61	1.61
Total Body Fat (kg)	8.91	2.94	8.95	3.10	0.04
Lean Body Mass (kg)	54.18	6.36	46.76	5.44	4.85*

* Indicates $p<0.05$

Table 2 presents the skinfold thicknesses and various components of body composition of rural and urban boys. The urban boys had significantly greater triceps ($t=2.27$, $p<0.05$) skinfold measurement than the rural boys. The rural boys were found to have significantly greater lean body mass ($t=2.53$, $p<0.05$) as compared to the urban boys.

Discussion

The aim of the current study was to examine differences in anthropometric measurements and body composition of Punjabi boys living in either urban or rural settings. The main findings were that rural boys had significantly higher values on most of the parameters than their urban counterparts. In 17 years 17-year-old age group, the results revealed that the rural boys were found to have significantly greater body weight and body mass index than their urban counterparts. The result of the study was in line with the study conducted by Saleh^[11] who reported rural adolescents were better than their urban counterparts in most of the anthropometric characteristics and body composition variables. Whereas in contrary to the present results, Sofi *et al.*^[12] reported that urban boys were better than rural boys in most of the anthropometric characteristics. Das *et al.* (2010) also reported no significant differences between urban and rural Bengali children in anthropometric characteristics. However, the boys of the present study have higher height, weight and body mass index compared to Bengali boys. The leg length, upper leg length and lower leg length were significantly greater in rural boys when compared to urban boys. Whereas, there were no significant differences in arm length, upper arm length and lower arm length between the rural and urban boys. In the case of various circumferences of the body parts, the rural boys reported significantly greater wrist, abdominal, hip and

thigh circumferences than the urban boys. Kaur *et al.*^[13] also reported superior anthropometric characteristics among the rural girls as compared their urban counterparts. On the other hand, no significant difference was observed in upper arm, forearm, chest and calf circumference between the rural and urban boys. The rural boys were found to have significantly greater hand and hip diameters as compared to urban boys. However, there were no significant differences in the bicondylar humerus, wrist, biacromial and bicondylar femur diameter between rural and urban boys. The urban boys had significantly higher triceps skinfold thickness than the rural boys. No statistically significant differences were noticed in biceps, subscapular and supra-iliac skinfold thicknesses between the two groups. The analysis of body composition showed that the lean body mass of the rural boys was significantly higher than those of the urban boys. No significant difference was observed in percent body fat and total body fat between the two groups.

Conclusion

It is established that the differences exist in anthropometric characteristics and body composition of young boys based on place of residence as studied herein. The lifestyle and food habits, work oriented environment in rural settings as compared to cities might be the contributing factors in the differences among young boys.

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