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Anthropometric Characteristics and Body Composition of the Rural and Urban Children

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ABSTRACT

Aim: The purpose of the present study was to evaluate the anthropometric characteristics and body composition components of the rural and urban children from Punjab.

Methodology: Total 360 children (180 rural and 180 urban) of age between 12 to 18 years 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.

Results: The results revealed that the rural children were significantly taller ($p<0.01$) and heavier ($p<0.01$) than the urban children. Body mass index was significantly higher ($p<0.05$) in rural children as compared to urban children. The rural children also had significantly greater length measurements ($p<0.01$), circumferences ($p<0.01$) and diameters ($p<0.01$) in comparison to urban children. The rural children possessed significantly higher lean body mass ($p<0.01$) than the urban children.

Conclusion: In conclusion, it is evident from the results that place of residence had impact on the anthropometric characteristics among the children.

Key Words: Anthropometric Measurements, Rural, Urban, Children, Percent body Fat

INTRODUCTION

Human settlements are categorized as rural or urban areas on the basis of the density of population and human formed structures in a particular area. Urban areas consist of towns and cities while rural areas contain villages and hamlets. Rural areas may develop randomly on the foundation of natural vegetation and fauna available in a region, whereas urban settlements are proper, suitable and planned settlements developed according to a process called urbanization. The urbanization process takes place in various countries under different circumstances in recent times (Valladares and Coelho, 1993). 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. Many studies have reported that physical parameters related to growth and development in urban children was at higher level than in rural children (ICMR, 1972; Phadake, 1968; Sahoo et al, 2011). 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

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countries (Bielicki, 1986). 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 (Eveleth and Tanner, 1990). There is little agreement from published comparisons of urban and rural children with regard to anthropometric measurements. A study of children in Crete (Mamalakis et al, 2000) found higher skinfolds among urban children, while higher levels of body fat have been reported in rural Belgian (Guillaume et al, 1997) and North American (McMurray et al, 1999) youth. A Polish study (Wilczewski et al, 1996) reported lower skinfolds in rural boys compared with urban boys but no differences for girls. Booth et al (1999) found no differences between urban and rural children with regard to body mass index and skinfolds in New South Wales. Henneberg and Louw (1998) reported that urban South African children had greater height, weight and skinfold thickness than their rural counterparts. Arm muscle area and waist/hip ratio were higher among rural adolescents compared to urban adolescents in the Cameroon (Dapi et al, 2005). Aberle et al (2009) found no differences in anthropometric characteristics between rural and urban children in Croatia. Greater height and lower body mass index were reported among rural Vietnamese children compared to their urban counterparts (Dang et al, 2010). Mesa et al (1996) reported no significant differences in percent body fat, lean body mass and sum of skinfolds between rural and urban children in central Spain. In a study on Kenyan children, Adamo et al (2010) reported that none of rural children were overweight or obese and they had lower body mass index, waist circumference and triceps skinfold than urban children. Body mass index and skinfolds thickness were higher among urban children in Turkey (Ozdirenc et al, 2005; Tinazci and Emiroglu, 2008; Tinazci Emiroglu, 2009). Urban children in Oman had higher percentage of body fat and body mass index compared to their rural counterparts (Albarwani et al, 2009; Al-Shamli, 2010).

Genetic endowments influence the growth and maturation process can better evident under better environmental conditions. In the growth studies, the effects of socioeconomic factors and rural and urban environment are related. In the present study, the attempt has been made to study the differences (if any) in anthropometric characteristics and body composition with regard to place of residence among children from Punjab, India.

METHODOLOGY

The subjects of the present study were selected from the camps organized under "Catch Them Young Programme" by Department of Physical Education (AT), Guru Nanak Dev University, Amritsar. A total 360 children, aged 12-17 years, from the various districts of Punjab viz. Amritsar, Jalandhar, Tarn-taran, Kapurthala, Nawashehar and Gurdaspur were purposively selected to participate in the study. Out of 360 male children, 180 children were from rural areas and 180 children were belonged to the urban areas. The meaning and definition of rural and urban residence is differing in different studies and countries according to their country norms. 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 tn the present study.

Anthropometry

Standing height of the subjects was measured using a Stadiometer, with the subject's shoes off and head in the Frankfort horizontal plane. Body mass of the subjects was assessed by using the portable weighing machine. Diameters of body parts of the subjects were measured by using digital sliding caliper. Circumferences and length measurements of body parts of the subjects were taken with the flexible steel tape. Skinfold thicknesses of the subjects 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

(Meltzer et al., 1988)

Percent Body Fat

Percentage body fat as estimated from the sum of skinfolds was calculated using equations of Slaughter et al (1988).

Percent Body Fat = 1.21 (triceps + subscapular) x 0.00 8 (triceps + subscapular) x 2-1.7

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 boys. Significance levels were set at p<0.05.

RESULTS

The height, weight and body mass index of the rural and urban children is given in table 1. The rural children were significantly taller (t = 3.48, p < 0.01) as compared to their urban counterparts. The rural boys children also significantly heavier (t = 4.02, p < 0.01) than the urban children. Similarly, the rural children were reported to have significantly greater body mass index (t = 2.29, p < 0.05) as compared to children residing in the urban areas.

Table 1: Comparison of height, weight and body mass index of rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean	SD	Mean	SD	
Height (cm)	156.32	11.87	151.80	12.70	3.48**
Weight (kg)	48.39	13.21	43.48	9.69	4.02**
Body Mass Index (kg/m²)	19.51	3.60	18.73	2.75	2.29*

* indicates p<0.05, ** indicates p<0.01

Table 2: Comparison of length measurements of body parts of the rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean (cm)	SD	Mean (cm)	SD	
Total Arm Length	71.29	6.48	67.75	6.32	5.24**
Upper Arm Length	29.31	3.29	27.22	3.29	6.02**
Lower Arm Length	41.99	3.81	40.57	3.96	3.46**
Total Leg Length	86.58	8.77	83.41	7.28	3.73**
Upper Leg Length	40.52	5.22	38.47	4.32	4.05**
Lower Leg Length	46.31	4.15	44.78	4.04	3.54**

** indicates p<0.01

The table 2 presents the length measurements of body parts of the rural and urban children. The rural children were found to have significantly greater total arm length (t = 5.24, p < 0.01) when compared to their urban counterparts. The rural children were also reported to have significantly greater upper arm length (t = 6.02, p < 0.01) and lower arm length (t = 3.46, p < 0.01) than the children living in urban areas. Similarly, the children from rural areas had significantly greater total leg length (t = 3.73, p < 0.01), upper leg length (t = 4.05, p < 0.01) and lower leg length (t = 3.54, p < 0.01) than the children residing in urban areas.

Table 3: Comparison of circumferences of the body parts of the rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean (cm)	SD	Mean (cm)	SD	
Upper Arm Circumference	21.11	2.88	20.24	2.37	3.11**
Forearm Circumference	21.50	2.38	20.39	2.08	4.68**
Wrist Circumference	15.31	1.39	14.56	1.21	5.43**
Chest Circumference	73.30	7.59	70.75	6.74	3.37**
Abdominal Circumference	66.38	7.54	62.54	6.74	5.09**
Hip Circumference	77.36	7.85	72.69	8.12	5.54**
Thigh Circumference	43.67	6.20	41.59	4.88	3.53**
Calf Circumference	29.71	3.32	28.36	3.35	3.83**

** indicates p<0.01

The table 3 presents the various circumferences of body parts of the rural and urban children. The rural children were found to have significantly greater upper arm circumference (t = 3.11, p < 0.01), forearm circumference (t = 4.68, p < 0.01) and wrist circumference (t = 5.43, p < 0.01) when compared to their urban counterparts. The rural children were also reported to have significantly greater chest (t = 3.37, p < 0.01), abdominal (t = 5.09, p < 0.01) and hip (t = 5.54, p < 0.01) circumferences than the children living in urban areas. Similarly, the children from rural areas had significantly greater thigh (t = 3.53, p < 0.01) and calf (t = 3.83, p < 0.01) circumferences than the children residing in urban areas.

Table: 4 Comparison of diameters of the various body parts of the rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean (cm)	SD	Mean (cm)	SD	
Bicondylar Humerus Diameter	6.48	0.58	6.30	0.49	3.14**
Wrist Diameter	5.07	0.45	4.92	0.39	3.32**
Hand Diameter	7.54	0.67	7.16	0.57	5.75**
Biacromial Diameter	36.49	2.94	35.37	2.87	3.63**
Hip Diameter	27.45	2.93	26.47	2.55	3.40**
Bicondylar Femur Diameter	9.06	0.67	8.87	0.59	2.95**

** indicates p<0.01

The various diameters of body parts of the rural and urban children are given in table 4. The rural children were found to have significantly greater bicondylar humerus diameter ($t = 3.14$, $p < 0.01$) as compared to their urban counterparts. The rural children were also reported to have significantly greater wrist ($t = 3.32$, $p < 0.01$), hand ($t = 5.75$, $p < 0.01$) and biacromial ($t = 3.63$, $p < 0.01$) diameters than the children living in urban areas. Similarly, the children from rural areas had significantly greater hip ($t = 3.40$, $p < 0.01$) and bicondylar femur ($t = 2.95$, $p < 0.01$) diameters than the children residing in urban areas.

Table 5: Comparison of skinfold thickness of body parts of the rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean (mm)	SD	Mean (mm)	SD	
Biceps Skinfold	3.52	1.69	3.87	1.82	1.88
Triceps Skinfold	6.42	3.23	7.20	3.04	2.35*
Subscapular Skinfold	6.84	3.98	6.78	3.32	0.15
Supra-iliac Skinfold	8.20	5.64	8.05	4.70	0.28

* indicates p<0.05,

The table 5 depicts the skinfold thicknesses of the body parts of the rural and urban children. There was no significant difference in relation to biceps skinfod thickness between the rural and urban children. The urban children were found to have significantly greater triceps skinfold thickness ($t = 2.35$, $p < 0.05$) as compared to their rural counterparts. Whereas, in case of subscapular and supra-iliac skinfold thicknesses, there were no significant differences between rural and urban children.

Table 6: Comparison of various components of body composition of the rural and urban children

Variables	Rural (N=180)		Urban (N=180)		t-Value
	Mean	SD	Mean	SD	
Percent Body Fat (%)	14.14	8.11	15.00	7.16	1.06
Total Body Fat (kg)	7.06	5.84	6.74	4.00	0.61
Lean Body Mass (kg)	41.11	10.58	36.74	7.94	4.43**

** indicates p<0.01

The various components of body composition of the body parts of the rural and urban children are shown in table 6. There was no significant difference in relation to percent body fat and total body fat between the rural and urban children. On the other hand, the rural children were found to have significantly greater lean body mass ($t = 4.43$, $p < 0.01$) as compared to their urban counterparts.

DISCUSSION

The principle aim of the current study was to examine potential differences in anthropometric measurements and body composition of Punjabi boys living in either urban or rural settings. The main findings were that rural children had significantly higher values on the most of the parameters than their urban counterparts. The rural children were significantly heavier and taller than urban children. These results are in conformity with various studies published on the children of the Punjab (Kaur and Singh, 2010). Matsuura et al, (1974) reported similar findings on Thai and Indonesian children. But the present data do not agree with the reports published on children in other states of India which reported greater height and weight among the urban children than the rural children (Bharati et al, 2005; Kolekar and Sawant, 2013; Khan et al, 1990; Adak et al, 2002). Similarly the findings of the present study are not in line with various studies reported on children in other countries. It has been found that Hungarian, Brazilian, Spanish, Greek and Mexico urban children have greater height and weight than their rural counterparts (Mazzuco et al. 2006, Eiben et al. 2005, Pena Reyes et al. 2003; Chillon et al. 2011; Mesa et al, 1996; Tambalis et al, 2010). In line with the previously published reports on Indian children (Mukhopadhyay et al. 2005, Venkaiah et al. 2002) the present data demonstrated that children of Punjab from both rural and urban areas have higher height and body weight than the rural Indian boys and urban Bengalese boys. In the present study the rural children had significantly greater body mass index as compared to urban children. These results are in conformity with the results reported by Ramachandran et al (2009) on Kerala boys and Tambalis et al (2010) on Greek children. But the findings of the present study are not in agreement with studies reported on children in many countries (Booth et al, 1999; Aberle et al, 2009; Adamo et al, 2010; Ozdirenc et al, 2005; Tinazci and Emiroglu, 2008; Tinazci and Emiroglu, 2009; Albarwani et al, 2009; Pena Reyes et al. 2003; Dana et al, 2011; Ujevic et al, 2013). The body mass index of children in present study was higher than those among urban children of Kolkata reported by de Onis et al (2001) and Bengalese boys studied by Chatterjee et al (2006). But the subjects in the present study have lower body mass index than the Swedish children (Orjan et al. 2005). The rural boys were reported to have significantly greater length measurements of body parts than the urban boys. The results are in conformity with those of reported by Singh and Bhola (2012) on rural and urban children in Haryana. But these findings are not in agreement with those of Henneberg and Louw (1998) who reported that the urban children had better length of body segments than the rural children in Cape Town. Masturra et al (1974) also reported that Japanese, Thai and Indonesian urban boys had greater leg length than the rural boys. The results revealed that the rural boys had significantly greater circumferences

and diameters of the body parts than the urban boys. Similar findings are reported by many studies in literature (Adak et al, 2002; Singh and Bhola, 2012). In contrast, Booth et al (1999) reported that there were no differences in rural and urban New South Wales children. Bharati et al (2005) reported better circumferences in the urban children from Raichur region of India. Eiben et al (2005) compared the Hungarian Children from rural and urban settings and reported that urban children had better diameters of body parts than their rural counterparts. Adamo et al (2010) also found that the urban children had greater circumferences than the rural children from Kenya. There were no significant differences in skinfold thicknesses between rural and urban boys except for triceps skinfold thickness. Similar results are reported by Ozdirenc et al, (2005) and Tinazci and Emiroglu (2008) on Turkish children, Dollman et al (2002) on Australian children, Ramachandran et al (2009) on Kerala children. In body composition, no significant differences were reported for percent body fat and total body fat among the rural and urban boys. Similar findings are reported by Ujevic et al (2013) on the Croatian children. But Kangane and More (2013) reported contrasting findings on Maharashtra children in which rural boys had significantly higher percent body fat than the urban boys. Vyas et al (2012) also reported that rural boys had higher percent body fat than the city boys in Gandhinagar. However, the urban children showed higher percent body fat than their rural counterparts in Greece, Oman, Turkey and Bengal (Tsimeas et al, 2005; Al-Shamli, 2010; Saha and Haldar, 2012; Ozdirenc et al, 2005). The rural boys were possessed significantly greater muscle mass than their urban counterparts. This might be due to fact that the rural boys have more activity oriented environment and more physical workload due to engagement in agriculture related works. The results of present study are not in line with those reported by Mesa et al (1996) on the Spanish children with regard to the body composition which showed no significant differences in lean body mass between rural and urban children.

CONCLUSION

It is concluded that the place of residence has clear impact on anthropometric measurements and body composition of children as studied herein. The way of life and food habits and the constituents of food might have played significant role in the differences among children from different settings.

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