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SEX DIFFERENCES IN ANTHROPOMETRIC CHARACTERISTICS AMONG 11–14-YEAR-OLD URBAN BENGALLEES OF NORTH 24 PARGANAS, WEST BENGAL, INDIA

ABSTRACT: A cross-sectional study was undertaken to investigate sex differences in anthropometric characteristics, including central body fat distribution, among 11–14-year-old urban Bengalees of West Bengal, India. The sample consisted of 559 (314 boys and 245 girls) randomly selected students from two schools of North 24 Parganas, West Bengal, India. Height, weight, six circumference and ten skinfold measurements were made on each subject. Waist-hip ratio (WHR) was used as a measure of central body fat distribution. Results revealed that significant sex differences existed in mean anthropometric characteristics. On average, girls were significantly taller and heavier and had greater mean waist circumference (WC) than boys until 13 years of age, after which boys had significantly greater mean height, weight and WC. Girls had significantly greater mean hip circumference and mean skinfolds at all ages, compared with boys. Mean WHR among boys was significantly greater at all ages. Of all the anthropometric measurements studied, only for mean WHR no significant age trend was observed, in both sexes. In conclusion, this study indicated that there existed sexual dimorphism in adiposity and central fat distribution among 11–14-year-old urban Bengalees. Furthermore, significant positive age trends were observed, in both sexes, for all anthropometric variables except WHR. Thus, central body fat distribution remains unchanged during this period, in both sexes.

KEY WORDS: Bengalees – Sex differences – Anthropometrics – Central body fat distribution

INTRODUCTION

Several recent studies worldwide have investigated sex differences in anthropometric characteristics among adolescents (Harsha *et al.* 1980, Corlett 1986, Musaiger *et al.* 1989, Deurenberg *et al.* 1990, Ramirez 1993, Blade *et al.* 1995, Martinez *et al.* 1995, Ohzeki *et al.* 1996, Leccia *et al.* 1999, Lopez-Blanco *et al.* 2001, Zsakai *et al.* 2001, Tahara *et al.* 2002). A recent study (Ghosh *et al.* 2001) has reported significant sex differences in adiposity and central fat distribution among elderly (> 55 years) Bengalees of Calcutta, India. However, to date, there are no studies (de Onis *et al.* 2001) which have dealt with sex differences in adiposity and central body fat distribution among adolescent Bengalees. The present investigation was undertaken to investigate sex differences

in anthropometric measurements, including central body fat distribution, of urban Bengalee children aged 11–14 years.

MATERIALS AND METHODS

The present study was carried out during the period February – October 2000, at two secondary schools (one for boys and the other for girls) in the district of North 24 Parganas, West Bengal, India. Both the schools were located within the area under the jurisdiction of Calcutta Metropolitan Development Authority (CMDA). The subjects belonged to the upper socio-economic status. Formal consents were obtained from the authorities of both schools prior to commencement of the study.

TABLE 1. Anthropometric characteristics of 11–14-year-old urban Bengalee boys and girls of North 24 Parganas, West Bengal, India.

Variable	Age (years)							
	11		12		13		14	
	Boys (n=53)	Girls (n=85)	Boys (n=87)	Girls (n=61)	Boys (n=116)	Girls (n=59)	Boys (n=58)	Girls (n=40)
Height (cm)	132.0 (8.2)	142.0 (9.0)	138.0 (8.7)	143.8 (7.9)	145.5 (8.0)	141.6 (8.1)	153.1 (8.9)	145.3 (8.6)
Weight (kg)	27.5 (5.1)	33.8 (8.7)	30.9 (5.9)	33.7 (7.8)	34.9 (7.0)	34.1 (7.5)	38.8 (7.5)	37.3 (8.1)
Body mass index (kg/m ²)	15.7 (1.9)	16.5 (2.6)	16.1 (2.0)	16.1 (2.6)	16.3 (2.2)	16.8 (2.6)	16.4 (1.9)	17.5 (2.6)
Circumferences (cm)								
Minimum waist	54.1 (4.0)	57.4 (7.3)	55.8 (4.1)	56.7 (5.7)	58.9 (5.6)	57.1 (6.7)	61.2 (5.7)	59.9 (6.9)
Maximum hip	64.4 (5.2)	74.4 (9.2)	67.5 (5.1)	74.8 (7.4)	70.9 (6.2)	75.4 (8.1)	73.6 (6.6)	78.0 (8.1)
Chest	63.3 (4.3)	68.5 (9.7)	65.5 (4.6)	68.9 (6.8)	68.7 (7.2)	68.6 (9.4)	71.0 (6.2)	72.0 (8.2)
Mid upper arm	17.6 (1.7)	18.5 (3.1)	18.4 (1.9)	18.3 (2.4)	19.4 (2.5)	18.6 (3.0)	19.6 (2.0)	19.5 (3.3)
Mid thigh	35.4 (5.0)	35.9 (7.4)	37.3 (3.7)	35.5 (5.4)	38.4 (4.7)	35.0 (6.2)	40.2 (4.0)	37.7 (6.9)
Medial calf	24.5 (2.4)	26.8 (5.1)	25.6 (2.4)	26.7 (3.5)	27.0 (3.0)	26.1 (4.1)	28.2 (2.5)	28.4 (5.7)
Skinfolds (mm)								
Subscapular	6.4 (2.2)	13.0 (6.9)	7.1 (2.2)	12.0 (5.1)	8.7 (4.2)	12.5 (5.3)	9.3 (3.7)	14.5 (6.2)
Suprailiac	7.8 (5.0)	11.3 (6.5)	8.6 (2.9)	10.8 (5.1)	9.1 (4.9)	11.5 (5.9)	9.4 (4.3)	13.3 (6.3)
Midaxillary	5.1 (1.8)	9.2 (5.2)	5.7 (1.8)	8.6 (4.3)	6.9 (3.2)	9.0 (4.5)	7.0 (2.4)	10.4 (5.2)
Chest	5.1 (2.0)	12.3 (4.3)	5.5 (1.7)	11.4 (4.0)	6.1 (3.8)	12.8 (4.1)	6.3 (3.2)	13.3 (4.6)
Abdomen	7.7 (4.5)	19.1 (8.8)	8.8 (3.4)	17.3 (6.9)	10.2 (5.8)	19.8 (7.9)	10.0 (5.1)	21.1 (7.9)
Triceps	6.6 (2.3)	12.2 (4.9)	6.6 (1.6)	11.2 (4.0)	7.2 (2.7)	11.8 (4.4)	7.2 (2.4)	13.4 (5.0)
Biceps	4.5 (1.5)	9.0 (4.4)	4.7 (1.2)	8.2 (3.3)	4.8 (1.6)	7.9 (3.0)	4.6 (1.7)	8.9 (3.8)
Forearm	4.4 (0.9)	5.9 (1.6)	4.5 (0.9)	5.5 (1.2)	5.0 (1.5)	5.5 (1.4)	5.1 (1.5)	5.8 (1.5)
Medial calf	7.5 (2.5)	14.3 (6.8)	7.5 (2.1)	13.2 (5.7)	8.3 (2.4)	13.5 (5.3)	8.3 (2.2)	15.1 (6.7)
Anterior thigh	11.3 (3.7)	24.6 (11.4)	11.8 (3.3)	22.9 (9.6)	12.1 (4.1)	23.9 (8.1)	12.1 (4.0)	25.2 (10.6)
Central body fat distribution								
Waist-hip ratio	0.84 (0.045)	0.77 (0.041)	0.83 (0.040)	0.76 (0.045)	0.83 (0.044)	0.76 (0.043)	0.83 (0.057)	0.77 (0.046)

Standard deviations are presented in parentheses.

A total of 559 Bengalee students (314 boys and 245 girls) aged 11–14 years participated in the present investigation. The study was cross-sectional in nature and the subjects were selected through random sampling procedure. All participants completed a questionnaire, which included specific questions on age and ethnicity.

A total of 18 anthropometric measurements (height, weight, six circumferences and ten skinfolds) were made by trained investigators (MB and AM) following the standard techniques recommended by Lohman *et al.* (1988). Body mass index (BMI) and waist hip ratio (WHR) were calculated using the standard equations:

$$\text{BMI (kg/m}^2\text{)} = \text{Weight (kg)} / \text{Height}^2 \text{ (m}^2\text{)}$$

$$\text{WHR} = \text{Waist circumference (cm)} / \text{Hip circumference (cm)}$$

Technical errors of measurements (TEM) were calculated and the results were found to be within reference values cited by Ulijaszek and Kerr (1999). Therefore, TEM was not incorporated in statistical analyses. All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) Version 6.

RESULTS AND DISCUSSION

The anthropometric characteristics of the sample are presented in *Table 1*. Significant sex differences existed in mean anthropometric characteristics. On average, girls were significantly taller, heavier and had greater mean waist circumference (WC) than boys until 13 years of age; after that, boys had significantly greater mean height, weight and WC. This indicated that among Bengalees, the significant sex differences which exist in adult stature and WC, with males being taller and having greater WC than females (Ghosh *et al.* 2001) begins at 13 years. Girls had significantly greater mean hip circumference at all ages.

Girls had significantly greater mean skinfolds at all sites, at all ages, compared with boys. This provided evidence that Bengalee girls aged 11–14 years had significantly greater subcutaneous adiposity.

Mean WHR among boys was significantly greater at all ages. This implied that boys had significantly greater central adiposity compared with girls during the period 11–14 years of age. Therefore, the sexual dimorphism which exists in adult central body fat distribution (males having significantly greater mean WHR than females) among Bengalees (Ghosh *et al.* 2001) is evident even at 11 years of age. It is noteworthy that of all the anthropometric measurements studied, only for mean WHR no significant age trend was observed, in both sexes. This indicated that central body fat distribution remained constant in both sexes, during this period. Thus, although overall (BMI) and subcutaneous (skinfolds) adiposity changed in both sexes during this period, central body fat distribution remained constant.

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