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ANTHROPOMETRIC MEASUREMENTS AND SEXUAL DIMORPHISM IN SCHOOL CHILDREN AND ADOLESCENTS IN ENUGU-NIGERIA

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ABSTRACT

Actual stature, weight and body measurements are useful for the purpose of assessing growth, body fat distribution and for provision of reference data The aim of this study was to provide data for economic planning and health use and to determine presence of sex difference in the parameters. The study was a cross sectional survey of 1489 subjects (807 males and 691 females) within the age of 5-18 years selected from University of Nigeria primary and secondary school and Command day secondary school. The height (Ht), weight (Wt), biacromial diameter (BAD), bi-iliac diameter (BID) and waist circumference (Wc) were measured and analyzed. At 9 to 13 years, the females were taller and weighed more than the males though statistically significant at 12 and 9 years respectively, while the males were significantly taller and weighed more than the females at 14 to 18years. At 5 to 8, the values for the males were greater but not significant. The BAD were significantly greater in males at 5, 6, 8 and 15 to 18 years while at 9 to 11 years, it was greater in females. Generally, the females had higher values of BID and Wc than the males except at 18years where the males recorded significantly higher values. There were significant positive correlations among the parameters measured. Presented here are the anthropometric measures and existence of sexual dimorphism in school children and adolescents in Enugu with males having larger BAD, being taller and weighing more than the females. These differences were most significant at 14 to 18 years old. In contrast, females had larger BID and Wc. Females also tend to have higher values at 9 to 13 year age group in other parameters due to the obvious reason of early adolescent

KEYWORDS: Anthropometric measures, sex determination, school children and adolescent, Enugu-Nigeria

INTRODUCTION

Anthropometric measurements are not only important in establishment of reference standards for body proportions and dimensions but also in clinical medicine and in the assessment of genetic, environmental and nutritional statures of children. It is used by companies for proper and adequate production and management of goods and resources (Igiri et al 2009). It also serves as biomarkers for disease conditions (Opert et al 2002, Yan et al 2006), sex determination and estimation of stature from skeletal remains (Joyce et al 1991, Owen 2000, Krishan et al 2007). Though, ascertaining sex and estimation of stature from incomplete skeleton and decomposing bodies is a re-occurring theme in physical anthropology and forensic science (Agnihotri et al. 2007, El-meligy et al. 2006, Ozaslan et al. 2003 Ozden et al. 2005). Such parameters like bi-acromial diameter (BAD), bi-iliac diameter (BID), waist circumference (Wc), height (Ht) and weight (Wt) are very important makers to determine gender difference and disease conditions in medical anthropology (Igiri et al 2009, Han et al 1995, Wahrenberg et al 2005) .

Masculinity is said to be positively correlated with BAD and negatively with BID (Tanner 1957). There is an association between body weight and various health related conditions such as diabetes mellitus, cardiovascular disease, sleep apnea, hepatic steatosis and psychological stress of social discrimination (Dietz 1998).

There is paucity of data on anthropometry and sexual dimorphism in school children and adolescents in Nigeria. The objectives of the study were therefore to obtain Anthropometric Measures (Actual stature, weight and body measurements), and detect Sexual Dimorphism in school children and adolescent in the University of Nigeria primary and secondary school and Command day secondary school, to provide data for the purpose of assessing growth, body fat distribution and for provision of reference data, to provide the above data for economic planning and health use and to determine presence of sex difference in the measured parameters.

MATERIALS AND METHODS

Subjects

The study was a cross sectional survey of one thousand four hundred and ninety eight subjects (807 males and 691 females) within the age range of 5 to 18 years. The subjects were selected by simple random sampling from the University of Nigeria Primary and Secondary Schools and Command Day Secondary School.

Anthropometry

Measurements were taken as follows: body weight; measured to the nearest 0.1kg with a portable scale with minimal clothing. Height; was measured to the nearest 0.1cm with the subject on bare feet. Waist circumference; was measured to the nearest 0.1cm with non stretchable tape at the midway between the iliac crest and the subcostal margin. Biacromial and bi-iliac diameters were measured with a sliding caliper as the distance between the most lateral margins of the acromial processes of the scapulae and the distance between the iliac tuberosities respectively.

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Statistical analysis

The statistical analysis of the sample data was carried out using SPSS computer software version 17.The data were expressed as mean and standard deviation (SD), and the student t-test was used to compare differences in the body proportions of males and females. Pearson correlation was used to study relationships between the various anthropometric characteristics.

RESULTS

Height - Table 1 shows the mean height of males and females by age. At 9 to 13 years, the values of the mean height were higher in females, though only statistically significant at the age of 12 while the males had significant higher mean values at 14 to 18 years.

Weight - Table 2 highlights the mean weight of males and females by age. The mean weights of males were higher than those of the females at 5 to 8 years and 15 to 18 years but statistically significant only at 15 to 18 years. At 9 to 14 years, the mean values were higher in girls but significant at 9 years.

Table 1. Mean, standard deviation and P - value of height of males and females by age

	Males		Females		
Age	N	Mean±SD(cm)	N	Mean±SD(cm)	P-Value
5	56	115.16±4.92	61	114.5±5.29	0.46
6	65	121.24±4.49	67	121.14±4.69	0·09
7	46	126.25±4.69	58	124.46±5.54	0.08
8	42	133.47±6.88	61	132.26±6.25	0.36
9	72	136.58±5.64	61	137.52±6.68	0·38
10	57	143.66±6.8	41	144.98±6.72	0.34
11	45	150.09±7	61	151.87±6.74	0.19
12	76	152.7±6.91	61	155.61±5.61	0·01
13	67	158.01±6.95	45	157.58±6.1	0.74
14	41	166.56±6.76	20	162.7±4.7	0.03
15	48	172.46±6.96	40	163.81±6.22	0·00
16	41	173.04±6.84	43	162.24±6.56	0·00
17	55	172.62±6.53	38	164.34±6.54	0·00
18	94	176.2±6.94	34	163.16±5.66	0·00

Table 2. Mean, standard deviation and P - value of weight of males and females by age

	Males		Females		
Age	N	Mean±SD(cm)	N	Mean±SD(cm)	P-Value
5	56	21.46±3.22	61	20.57±3.17	0.14
6	65	23.29±2.78	67	22.69±2.81	0.22
7	46	25.68±3.73	58	25.02±3.58	0.36
8	42	30.37±6.85	61	29.35±6.81	0.46
9	72	30.53±4.06	61	34.08±8.15	0·00
10	57	35.48±5.9	41	37.5±5.95	0·10
11	45	39.87±6.88	61	43.01±8.86	0.05
12	76	43.85±12.88	61	46.81±10.16	0.15
13	67	47.91±10.4	45	51.39±6.67	0.05
14	41	56.22±10.51	20	59.53±6.5	0·20
15	48	63.41±10.59	40	58±8.78	0.01
16	41	64.95±10.39	43	57.36±23.56	0.01
17	55	63.09±9.52	38	56.61±6.21	0·00
18	94	65.94±8.8	34	57.72±9.8	0·00

Biacromial diameter (BAD) - Table 3 highlights the mean biacromial diameter of males and females by age. Males had significant higher values at 5, 6, 8 and 15 to 18 years while at 9 to 11 years, it was greater in females but not statistically significant.

Bi-iliac diameter (BID) - Table 4 shows the mean bi-iliac diameter of males and females by age. Females had greater values than the males, and this was statistically significant at 9 and 10 years.

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Waist circumference (WC) - Table 5 highlights the mean waist circumference of males and females by age. This study

Table 3: Mean, standard deviation and P - value of biacromial diameter for males and females by age.

	Males		Females		
Age	N	Mean±SD(cm)	N	Mean±SD(cm)	P-Value
5	56	25.2±1.9	61	24.5±1.36	0.02
6	65	26.38±1.54	67	25.76±1.32	0.01
7	46	27.66±1.54	58	27.36±1.76	0.36
8	42	29.83±2.19	61	28.48±1.94	0·00
9	72	29.85±1.91	61	30.03±2.16	0·61
10	57	31.29±1.67	41	31.91±1.83	0.09
11	45	32.76±2.22	61	33±1.81	0.54
12	76	33.64±2.57	61	33.53±1.82	0.78
13	67	34.84±2.57	45	34.76±1.77	0.86
14	41	37.07±2.36	20	36.13±1.74	0.12
15	48	37.95±3.65	40	35.67±1.73	0·00
16	41	38.55±2.03	43	35.43±2.19	0·00
17	55	39.25±2.51	38	36.07±1.56	0·00
18	94	39.91±2.24	34	36.34±1.98	0·00

Table 4. Mean, standard deviation and P - value of bi-iliac diameter for males and females by age.

	Males		Females		
Age	N	Mean±SD(cm)	N	Mean±SD(cm)	P-Value
5	56	17.36±1.15	61	16.97±0.93	0.05
6	65	17.73±1.07	67	17.64±1.11	0.64
7	46	18.31±0.98	58	18.24±1.36	0.77
8	42	19.51±1.4	61	19.23±1.49	0.34
9	72	19.66±1.06	61	20.38±1.66	0·00
10	57	20.69±1.5	41	21.47±1.33	0.01
11	45	21.73±1.53	61	21.86±1.58	0.67
12	76	22.39±1.83	61	22.8±1.74	0.19
13	67	23.33±1.8	45	23.71±1.46	0.24
14	41	24.31±1.65	20	24.67±1.75	0.44
15	48	24.82±1.77	40	25.5±1.4	0.05
16	41	25.1±1.53	43	25.36±2.42	0.56
17	55	25.18±1.49	38	25.38±1.52	0.53
18	94	25.65±1.72	34	25.57±3.23	0.86

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Table 5. Mean, standard deviation and P-value of waist circumference of males and females by age.

	Males		Females		
Age	N	Mean±SD(cm)	N	Mean±SD(cm)	P-Value
5	56	53.39±3.49	61	52.98±2.96	0.51
6	65	54.77±2.76	67	54.2±3.42	0.27
7	46	56.29±3.72	58	54.73±3.96	0.04
8	42	58.56±4.93	61	58.53±6.54	0.86
9	72	59.09±4.02	61	62.24±7.77	0·00
10	57	60.83±6.13	41	63.11±5.86	0.06
11	45	61.87±5.08	61	64.62±6.35	0.02
12	76	64.18±8.3	61	65.38±6.83	0.36
13	67	66.47±6.25	45	69.05±4.37	0.02
14	41	69.15±5.49	20	71.34±6	0.18
15	48	69.16±6.61	40	71.15±5.91	0.14
16	41	69.72±7.08	43	72.64±8.96	0.11
17	55	69.86±4.57	38	70.61±5.74	0.52
18	94	72.65±4.87	34	68.91±6.15	0·00

Table 6. Correlations among the different anthropometric characteristics of male subjects in the study

	age	ht	wt	BAD	BID	WC
age	1	0.945	0.877	0.903	0.879	0.76
ht	0.945	10	0.918	0.94	0.927	0.81
wt	0.877	0.918	1	0.914	0.924	0.91
BAD	0.903	0.94	0.914	1	0.912	0.82
BID	0.879	0.927	0.924	0.912	1	0.86
WC	0.76	0.81	0.909	0.815	0.861	1

Table 7. Correlations among the different anthropometric characteristics of female subjects in the study.

	age	ht	wt	BAD	BID	WC
age	1	0.906	0.855	0.881	0.861	0.687
ht	0.906	1	0.899	0.94	0.899	0.76
wt	0.855	0.899	1	0.919	0.92	0.884
BAD	0.881	0.94	0.919	1	0.91	0.81
BID	0.861	0.899	0.92	0.91	1	0.832
WC	0.687	0.76	0.884	0.81	0.832	1

DISCUSSION

The first index of adolescence was shown in height. From the age of 14, the males were taller and weighed more than the females. This observation is in keeping with the findings of De Koning et al. (2007), and Okosun et al. (1998). However at 9 to 13 years of age, the females were taller and weighed more than the males but difference was significant at age 12 ($P<0.05$).This is similar to the results obtained by Nwokoro et al. (2006) and Obikili (1991). The probable reason for the female ascendancy could be attributed to the fact that on the average, females begin their adolescent growth spurts, which shoot up their growth rate at an earlier age than the males, (Shmssain 1991, Didia et al. 1986). Males had statistically significant larger values of BAD than the females, at 15 to 18 years of age. This was due to the fact that males tend to develop broader shoulder from puberty compared to the females (Stein et al. 1982). This was in consistent with the result obtained by (Igiri et al. 2009)

Females generally had wider BID and WC than the males. This was statistically significant at the age of 9 to 14 years. This result was in line with other works done in Nigeria by (Okosun et al. 1998) in Ibadan and (Igiri et al. 2009) in Calabar. They noted that WC measurements were significantly higher in females than the males. This lower

BID and WC in males may be due to their narrow pelvis and less accumulation of adipose tissues around the midsection at this young age.

This study showed very strong correlation between the different parameters measured.

CONCLUSIONS

This study has presented the anthropometric measures and existence of sexual dimorphism in school children and adolescents in Enugu state with males having larger biacromial diameter, being taller and weighing more than the females. These differences were most significant at 14 to 18 years old. In contrast, females had larger bi-iliac diameter and waist circumference. Females also tend to have higher values at 9 to 13 year age group in other parameters due to the obvious reason of early adolescent There is strong positive correlation between the difference anthropometric characteristics.

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