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Original Research Article

Variations in the Pattern of Stature and Sitting Height among Urban Lagos Adolescent School Children

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Abstract

Assessment of stature and sitting height is of importance when estimating the growth and development of individuals. These indices serve as markers for determining the overall nutritional, health, and general growth patterns of children and adolescents. This study aimed to determine the pattern of stature and sitting height variations in urban Lagos adolescent school children. In the study, a total of 674 students aged 10 to 17 years were used, comprising 354 males and 320 females. These were drawn from two secondary schools, one of high socio-economic status and the other of low socio-economic status. Two anthropometric parameters were measured: sitting height and stature. The results obtained were presented in tables and graphs with their means, standard deviation, and median. It was observed that boys generally had higher values of stature and sitting height compared to girls of the same age group, especially in ages 10 to 15 years, but had similar or closely related values between 16 to 17 years. Also, students of schools with high socio-economic status were observed to have higher measurements compared to those from schools with low socio-economic status. Stature was generally higher in girls of high economic status compared to boys of the same status, and was higher than both boys and girls of low economic status, and this was marked at ages 10 to 14 years.

Keywords: Anthropometry, socioeconomic status, sitting height, stature, parameters, Nigeria, Lagos.

INTRODUCTION

Anthropometry is a set of standardized techniques used for systematically measuring the body and body parts. It quantifies the dimensions of the body and uses carefully defined body landmarks and appropriate instruments for measurement (Bhattachaya *et al.,* 2019). These measurements have a direct relationship with age, sex, and shape of an individual, and are influenced by the environmental and socio-economic status of the individual (Bridger *et al.,* 2019).

WHO (1995) stated that local standards are preferred to international standards in assessing a community's nutritional and growth patterns. Nigeria and Africa are generally peculiar in body composition and stature, hence the need to generate a more specific and robust data pool for comparison with other data, both locally and from international studies (Orisanya, 2002, and Abidoye, 2001)

Therefore, this study intends to provide data on body stature and sitting heights of adolescents in Urban Lagos that will serve as a reference basis for comparison with other populations.

Anthropometric assessments are useful because they provide a simple and practical way of describing the overall nutritional status and growth of the population groups (Qiong Tand *et al.,* 2024). Their usefulness stems from anthropometry's close correlation with the multiple dimensions of individual health and development and their socioeconomic and environmental determinants (Ferreira, 2020). One common question asked when people find new remnants of the skeleton is, “What was the height of this person when he was alive?” For this information, which is one of the most important issues for identification, forensic medicine specialists and forensic anthropologists have taken an interest in determining the height from the

dimensions of bones (Masanovic *et al.,* 2019). It has been shown that lengths of the humerus, radius, ulna, femur, tibia, and fibula could be used in calculating the heights of Finnish children with acceptable accuracy (Abrahamyan *et al.,* 2008)

Anthropometric studies can help identify nutritional problems, such as undernutrition and overnutrition, and pinpoint groups with specific nutritional and health needs to be addressed in policy development and programming (Bhattacharya *et al.,* 2019). Anthropometric indicators can define the extent of the problems and can be used as one criterion in ranking areas and population groups by need, in this way allowing the targeting of appropriate interventions and informed decisions on resource allocation (Khurana *et al.,* 2024). Where interventions are expected to influence nutrition directly or indirectly, anthropometric measures may be used to evaluate progress and the outcome of an intervention (Warrier, 2023).

Variations in stature, sitting height, and other body skeletal segments have not been extensively studied in our population; hence, the need to develop a database for future reference (Colin *et al.,* 2019). Estimation of stature is important in the field of Forensic Anthropology (Grasgruber, 2019). Establishing the identity of an individual from mutilated, decomposed, and amputated body fragments has become an important necessity in recent times due to natural disasters like earthquakes, tsunamis, cyclones, floods, and man-made disasters like terror attacks, bomb blasts, mass accidents, wars, plane crashes (Charis *et al.,* 2021). This is because stature is one of the most important elements for the identification of an individual (Masaanovic *et al.,* 2020).

The lack of anthropometric data concerning our local population has created many setbacks in body identification during disasters (Abisoye and Akande, 2000)

This study is therefore aimed at studying the pattern of variation of stature and sitting height among adolescents in Urban Lagos School children.

Objective o the Study

To determine the relationship between socioeconomic status and growth patterns in Urban Lagos adolescent school children.

To compare the measurements of stature and sitting height among adolescents of private and public schools in Urban Lagos.

To estimate gender-related differences in stature and sitting height in adolescents in Urban Lagos.

MATERIALS AND METHOD

The study was carried out in two locations in Lagos: a public and a private school of low and high socio-economic status, respectively. Both schools are co-educational institutions located within Urban Lagos. A total of 674 students from the two schools participated in the cross-sectional study. This comprised 354 males and 320 females aged between 10 to 17 years. Both the parents and the volunteers were informed about the study, and consent was duly obtained.

A stratified random sampling technique was used to generate volunteers from the two schools, and students who did not freely consent to be volunteers, malformed/deformed students, and pure-breed Caucasians were excluded from the study.

Stature

This is a linear measurement of the distance from the floor or standing surface to the vertex of the skull. This was taken in an erect posture with the subject in full inspiration, and the head oriented in the Frankfurt plane. Measurements were taken without shoes and to the nearest 1mm.

Body Mass

Subjects were measured wearing light clothing, standing on the measuring beam, still and without support, and looking at the horizon. Weights were recorded to the nearest 0.1kg.

Sitting Height

This is the height while sitting. It was measured as the distance from the sitting surface to the top of the head, with the subject sitting in a standard position, with the head in the Frankfurt plane, feet flat on the floor and thighs unsupported, and the back and buttocks making contact with the stadium

Age: This is recorded in years to the nearest birth date.

Data Analysis

Means, standard deviation, and median of the measurements taken were determined and comparisons were made between ages, sexes, and the two schools.

RESULTS AND DISCUSSION

Table 1 shows the means of sitting height among boys and girls in both public and private schools.

TABLE 1: SUMMARY OF DESCRIPTIVE AND INFERENTIAL STATISTICS OF SITTING HEIGHT

AGE(years)	PRB STH (cm) Mean ± S.D Median	PUB STH (cm) Mean ± S.D (Median)	PRG STH (cm) Mean ± S.D (Median)	PUG STH (cm) Mean ± S.D Median
9-51-10.50	81.68 ± 4.69 * (81.50)	77.24 ± 5.23 (76.15)	81.11 ± 3.43 * (81.35)	76.78 ± 2.66 (76.95)
10.51-11.50	79.16 ± 2.95 * (79.10)	77.36 ± 3.90 (76.90)	83.18 ± 5.40 * (83.20)	78.06 ± 6.85 (78.20)
11.51-12.50	80.36 ± 3.97 (80.80)	79.39 ± 3.47 (77.90)	83.23 ± 4.45 * (84.10)	79.31 ± 3.44 (80.30)
12.51-13.50	85.17 ± 3.19 * (84.80)	80.39 ± 3.22 (81.00)	87.69 ± 5.08 * (88.70)	84.03 ± 6.52 83.3)
13.51-14.50	86.54 ± 4.74 * (87.10)	81.08 ± 3.90 (80.20)	89.52 ± 3.87 * (90.70)	84.86 ± 4.56 (85.10)
14.51-15.50	91.24 ± 4.44 * (91.60)	87.43 ± 4.28 (88.20)	87.88 ± 3.77 (88.15)	88.00 ± 4.38 (88.50)
15.51-16.50	88.62 ± 9.87 (87.55)	89.55 ± 4.21 (88.90)	87.78 ± 3.49 (88.65)	87.83 ± 3.66 (87.80)
16.51-17.50	87.86 ± 4.47 (89.40)	91.38 ± 7.23 * (93.20)	90.17 ± 2.16 * (90.50)	87.73 ± 3.56 (87.65)

* Significance at 0.05

KEY: PUB = Public school boys, PRB = Private school boys, PUG = Public school girls, PRG = Private school girls, SD = Standard deviation, STH = Sitting height

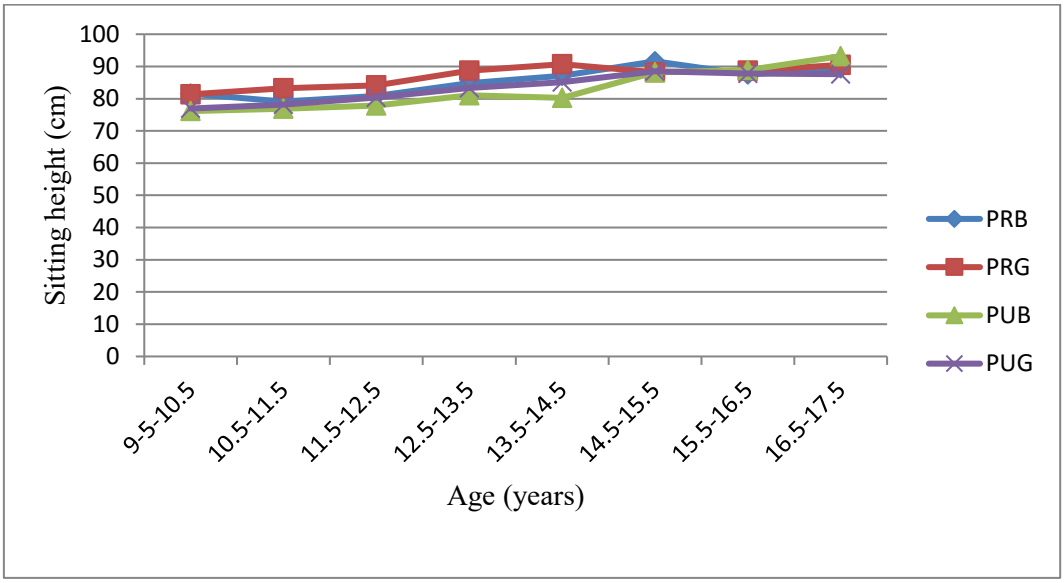

Figure 1: Comparative median curve of sitting height for boys and girls.

STH of PRB was significantly higher than in PUB at ages 10 - 15 years, except at age 12 years, and at 16 years. PUB had significantly higher STH at age 17 years. Among girls, PRG was significantly higher than PUG at all ages except 15 and 16 years, where no significant difference was observed.

Table 2 shows the means, standard deviation and median for stature in boys and girls in public and private schools.

Table 2: Summary of the Descriptive and Inferential Statistics of Stature

AGE (years)	PRB Mean ± S.D (Median)	PUB Mean ± S.D (Median)	PRG Mean ± S.D (Median)	PUG Mean ± S.D (Median)
9-51-10.50	157.29 ± 5.62**(158.10)	150.91 ± 9.51(149.95)	158.04 ± 7.79*(157.65)	149.66 ± 9.45(148.85)
10.51-11.50	156.81 ± 6.57**(156.50)	147.45 ± 10.31(145.90)	163.13 ± 7.00*(163.40)	150.03 ± 7.36(150.50)
11.51-12.50	158.98 ± 8.48**(158.40)	151.58 ± 7.10(150.50)	163.03 ± 7.99*(161.90)	153.13 ± 11.27(149.70)
12.51-13.50	169.64 ± 8.22**(170.10)	157.13 ± 10.10(155.50)	169.14 ± 7.81*168.50)	162.64 ± 14.11(159.90)
13.51-14.50	172.35 ± 8.63**(173.40)	161.05 ±1 5.59(160.20)	171.8 ± 7.59* (173.50)	167.65 ± 14.39(168.80)
14.51-15.50	179.34 ± 8.11**(181.10)	171.85 ± 10.29(172.20)	168.19 ± 6.88 (166.70)	171.90 ± 8.94*(170.25)
15.51-16.50	183.42 ± 8.69**(185.50)	171.82 ± 7.91(170.55)	170.10 ± 4.54*(169.05)	166.56 ± 5.86(166.90)
16.51-17.50	179.65 ± 10.13**(182.85)	168.68 ± 5.71(169.80)	157.48 ± 11.51(153.60)	167.56 ± 7.10*(168.85)

** Significance at 0.01 * Significance at 0.05

KEY: PUB=Public school boys, PRB=Private school boys, PUG=Public school girls, PRG=Private school girls, SD=Standard deviation

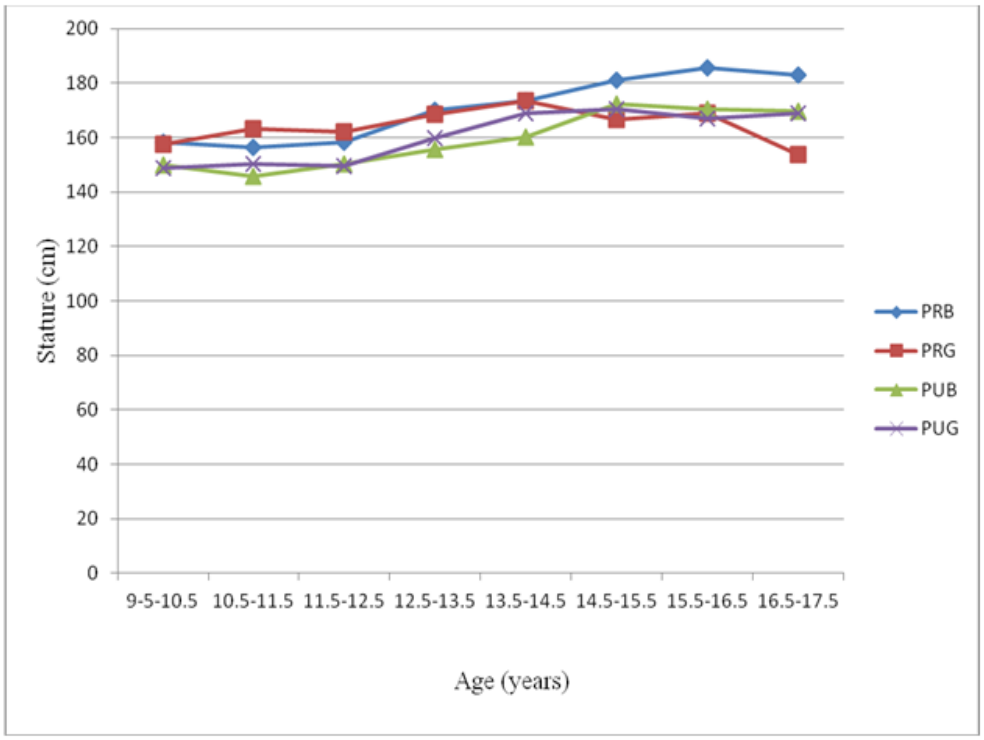

Figure 2: Comparative median curve of stature for boys and girls

Stature in PRB was significantly higher in all age groups ($p < 0.01$) compared to PUB.

PRG values were significantly higher at ($p < 0.0$) at 10 – 13 years and 16 years, while PUG values were higher at 15 and 17 years ($p < 0.05$).

Mean values for stature in PRB were between 156 – 181cm, compared to 147 – 171cm in PUB. PRG had mean values of 158 – 171cm compared to 149- 171cm in PUG.

DISCUSSION

In this study, measurement of anthropometric indices of sitting height and stature was carried out on secondary school children aged 10 – 17 years. This was done on both boys and girls in two secondary schools, one of high socio-economic status (private), and the other of low socio-economic status (public).

Sitting Height:

This refers to the height of individuals while sitting. It is measured from the sitting surface to the highest point of the head. Studies involving sitting height are yet to have large data for comparison with the local population (Balogun, 2001)

Stature minus sitting height provides an estimate of the length of the lower limb (Bogin & Varela-Silva, 2010). Lower limb length is the distance between the hip joint and the floor with the child standing erect. It can be calculated by subtracting sitting height from stature.

Sitting height in this study was observed to be higher among boys and girls of private schools compared to those of public schools (Table 1, $P<0.05$).

Values in Figure 1 also show slightly higher sitting height values for private school girls between the ages of 10 -14 years, before being joined by other groups who also had steady but lower values between 10 to 15 years. No significant difference in values was observed between 15-17years.

In comparing sitting height with stature amongst boys, it was observed that sitting height increased as stature increased at early age groups of 10 to 16 years, and then reduced at age 17 years in boys of high socio-economic status.

Among boys of low economic status, there was a nearly similar growth pattern, with a positive correlation being observed at ages 10 – 15 years and a negative correlation at ages 16 – 17 years.

Among girls, however, there was a positive correlation at ages 10 – 15 years with a negative correlation at ages 16 and 17 years in both high and low socio-economic status.

Stature

This refers to the standing height of an individual. Height directly or indirectly reflects the nutritional status of a child (Shrestha *et al.,* 2020).The measurements obtained in children aged 5 to 15 years are a direct reflection of their nutritional status, though gender factors exist (WHO, 2002).

In Table 2, the stature of boys and girls in private schools was observed to be higher than that in public schools in the same age group. This confirms studies by Akesode and the WHO above since the private school was of a higher socio-economic status. Eboh & Boye (2005) reported on the body composition of normal and malnourished children aged 3-11 years in the Niger Delta. He reported that anthropometric measurements in the malnourished children were lower compared to the normal children.

WHO/NCHS reference values for different age groups in different populations show that at age 10 years, the mean stature across different regions is between 140 – 141cm for boys and girls, respectively. The tallest boys in each region do not differ significantly, with heights between 140 –144cm. For 10-year-old girls, the maximum height in each region varies from 140cm for African American girls to 144cm for Urban Mexico.

In this study, stature for 10-year-old boys was 149cm in PUB and 157cm in PRB, indicating significantly higher stature compared to the WHO/NCHS reference values.

At age 13 years, WHO reference values for the boys is between 160cm and 164cm (tallest boys), and 159cm to 162cm in girls (tallest girls). In our study, values for boys at 13 years all met the WHO/NCHS reference mark except PUB.

At age 17 years, the tallest boy was recorded in PRB with a stature of 183cm, about 2cm higher than the tallest boy in the WHO reference values. About 50% of the boys in PRB met the WHO reference mark, and about 30% of the boys in PUB met this reference.

PRG and PUG had statures of 157cm and 167cm, respectively, at 17 years compared to the WHO reference values of 163cm for girls in all regions except Asia.

The median curve for stature (Fig. 2) shows boys of private schools with greater heights compared to those in public schools, boys also had higher heights than girls at ages 14 to 17 years hence exhibiting gender effect on growth in height.

CONCLUSION

This study has generated a database on some anthropometric parameters of growth and physical development in both males and females aged between 10-17 years in Urban Lagos.

It was observed in this study that adolescent growth and development depend so much on socioeconomic status and, to some extent, gender influence. Age also played a part in growth and development, as some parameters recorded were seen to be influenced by age, with variation at different age groups. It is, however, significant to note that growth among students of high socio-economic status was higher at ages between 10-15 years and at age 16-17 years, there was no significant change in growth patterns. This shows the effect of nutrition in an early growth spurt and the subsequent catch-up for students of low socio-economic status, similar to findings of Haris and Benedict, 2018).

These results will, however, be useful as a reference base for comparison with similar populations in other geographical locations in Nigeria and Africa.

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