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Stature Proportionality: Comparison of Upper Segment-To-Lower Segment Ratio Among Different Age Groups In Urhobos of Nigeria.

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ABSTRACT

This anthropometric study was to assess stature proportionality of Urhobos in Nigeria. It was aimed at comparing the body proportion among children, adolescents ad adults, establishing if sex and age a major role in the body proportionality of an individual. 360 subjects, 120 each of different age groups, 60 males and 60 females [children 3-10 years), adolescents (11-18 years) and adults (19-35 years)] were studied in order to compare their upper-to-lower segment (US/LS) rations. The result of the study showed that in the average, the US/LS ratio and upper trunk of males are higher than those of females for each age grade while the lower extremities of females between ages 3-18 years are higher than their male counterparts but lower than their male counterparts between ages 19-35 years. Hence, it was found that age sex plays a major role in stature estimation of an individual.

Anthropometry literally means "measurement of humans". In physical anthropology, it is the measurement of an individual for the purpose of understanding human physical variation (Roberts 1998). Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are intimately linked with one another, and manifestation of the internal structure and tissue components which in turn are influenced by environmental and genetic factors (Krishnan 2008). It is a fact especially familiar not only to anatomist but also to artists that, the trunk and limbs exhibit consistent ratios among themselves and relative to the total height. These ratios are linked to age, sex and race (Soames et al 1991). The body's structure and function changes as a person grows and ages (Richard 2007). The adult male tends to be taller than the adult female. It has been observed that at the age of approximately 10years, boys and girls grow at the same rate. Around 12years, boys often start to grow faster than girls so that most males reach a greater adult height than females (Richard 2007).

Body proportion varies within a racial group due to variability in musculature, skeletal make-up and adiposity. Thus, there is variability in measurement of body segments or parts from one individual to another and from race to race. As infants grow, they change their body proportions gradually towards adult shape; these proportions diverge toward one sex at puberty. Physical measurement of various parts of the body is essential in identification of forensic cases where sex, age and race of an individual can be determined from skeletal data (Ozaslan et al 2003). The determination of body proportions is also an important part of clinical evaluation of children with short stature. The upper-to-lower segment ratio (US/LS ratio) is commonly used for this purpose US/LS ratio was calculated using the equation:

$$\frac{\text{Upper segment}}{\text{Lower segment}} = \text{height} \quad \frac{\text{Lower segment}}{\text{Lower segment}}$$

The variation in height between populations and across time is largely due to changes in leg length. The remainder of height consist of the cranium. Statistically, height is more or less normally distributed, but with heavy tails (Rother 1977). In fact, recent studies of secular change and allometry have observed differential limb proportions between sexes ad among populations (Meadows and Jantz 1996). It is also important to note that disproportionately long limbs constitute much of the increase in stature (Njolstad et al 1996). Before puberty, limbs grow more rapidly than the spine. During puberty, lengthening of the spine and increase in bone width accelerate (Pital et al 2005). Correlation of parameters with length of the upper and lower segments and with the US/LS ratio may indicate the period of critical growth, critical for

their determination (Pital et al 2005). It is been shown that at birth, US/LS ratio is 1.70 (greatest ratio) and post puberty ratio is between 0.89-0.95. This study observes the stature proportionality of urhobos of Nigerian by comparing the upper segment to lower segment ratio.

MATERIALS AND METHODS

This is an anthropometric study aimed at obtaining information on the height and US/LS ratio in Urhobo of Nigeria at difference age grade levels. The population ranged from 3years to 35years. Subjects were both male and females. Descriptive information like age, sex and tribe were obtained. Also, information about standing height, length of upper trunk and lower extremities were obtained. Standing height of subjects was measured as the distance from the top of the head (vertex) to the feet (Scott Moses 2008) using a wall-mounted calibrated measuring tape with a moveable head board. Upper trunk of subjects were measured as a distance from the sternal notch to the umbilicus using a calibrated measuring tape in centimeters, while measurement of the lower extremities was made by measuring the distance from the anterior superior iliac spine (ASIS) to the medial malleolus as real length and from the symphysis pubis to the medial malleolus as apparent length (Scott Moses 2008). The results are presented below.

RESULTS

Table 1: Showing the upper-To- Lower segment ratio for each age group

Age Group	Male Real length	Male Apparent length	Female Real length	Female Apparentlength
Group 1 (3-10)	0.75	90.782	0.690	0.701
Group 2(11-18)	0.710	0.700	0.643	0.627
Group 3(19-35)	0.663	0.684	0.659	0.659

This result shows that the difference between the US/LS ratio using real length or apparent length is negligible; hence any one can be used.

Table 2: A Summary of Height Statistics

Age Grade	Male	Female
Group 1 (3-10yrs)	114.24cm (3ft 8in)	112.26cm (3.7in)
Group 2(11-18yrs)	142.77cm (4ft 8in)	142.44cm (4ft 8in)
Group 3 (19-35yrs)	166.98cm (5ft 6in)	159.39cm (5ft 3in)

This shows that the individual in each group had normal average height as compared to individuals between ages 19-35yrs

Table 3: Showing A Summary of upper trunk, real and apparent lengths statistics

Age group	Upper trunk (cm)		Real length (cm)		Apparent length (cm)	
	Male	Female	Male	Female	Male	Female
Group 1	40.95	39.72	64.98	66.42	64.11	66.00
Group 2	49.25	49.05	83.51	86.69	84.08	87.55
Group 3	39.92	38.92	156.41	96.06	99.18	96.09

This result shows that the upper trunk of males in higher than in females for each age grade. Also, the lower extremities of females whether suing real length or apparent length measurements is higher than in males for individuals in group 1 and 2 only but lower than makes in group 3.

Table 4: Showing the estimation of US/LS ration

Age Grade	US/LS Ratio Male	US/LS Ratio Female	Proportion Estimate Male	Proportion Estimate Female
Group 1	0.75	90.690	0.670	0.64
Group 2	0.710	0.643	0.570	0.55
Group3	0.663	0.659	0.380	0.36

This result was obtained by using the formula;
As those differences statistically significance
Estimate of US/LS Ratio = Mean 2 Standard Deviation.

This shows that the US/LS ratio is higher in male than in females for each age grade. The ratio is lowest in group 3 and highest in group 1 for males, while it is lowest in group 2 and highest in group 1 for females.

DISCUSSION

From Tables 1 and 4: The US/LS ratio is higher in males than in females for each group. This was expected because as earlier stated the adult male tends to be taller than the adult female. The ratio is lowest in group 3 (adult) for males and group 2 (adolescents) for females, while it is highest in group 1 (children) for both males and females. This confirms that as infants grow, they change their body proportions which diverge towards one sex at puberty and gradually towards adult shape. It is

pertinent to note that the relationship between the trunk and the lower extremities is very useful in establishing finding racial differences, especially when only part of a diseased body is available. Also, Upper-to-Lower segment Ratio can be used for growth assessment and to determine short stature (Delayed Linear Growth).

From table 2, the results show that males and females of 11-18yrs are for the same height while males are taller than females as children and adults. This result was expected because it has been observed that at the age of approximately 10yrs, boys and girls grow at the same rate, and around 12years, boys often start to grow faster than girls so that most males reach a greater adult height than females (4). Also, it has been observed that women ordinarily reach their greatest heights at a younger age than men (4).

The result of the study shown in table 3, confirms that observation made by Mariana, et al, in 2005 (14), that humans grow fastest (other than in the womb) as infants and toddlers (birth to roughly age 3) and then during puberty growth spurt than as adults. This is shown by the difference in growth rates between man height of individuals in group 1 and 2 (28.5cm and 30.18cm respectively) for males and between group 2 and 3 (24.21cm and 16.95cm respectively) for females. Hence one can say growth does not stop until full maturity even though the growth process is reduced. (15).

Also, sexual differences in height and of course long bones exists (10) and this is shown by Pearson's correlation coefficient (1.0) in the study. This means that height increases as long bones increase at each age grade for both sexes. There is also a significant association between height and upper trunk (i.e. height increases as upper trunk increases). On one hand, and between height and lower extremities on the other (i.e. height increases as lower extremity increases) for both sexes at each age grade. Height measurement can be used to determine both length which reflects maternal genetics and nutrition (13). Table 4 shows that the upper trunk of males in higher than in females for each age grade. Also, the lower extremities of females whether using real length or apparent length measurements I higher than in males for individuals I group 1 and 2 only but lower than males in group 3. This was expected because body proportion varies within a racial group due to variability n musculature, skeletal make-up and adiposity. It has been observed that women carry

about percentage points more body fat that do men of the same age; men accumulate fat primarily in the back, chest, and abdomen; women gain fat in he buttocks, arms, and thighs, thus, there is variability in measurement of body segments or parts from one age of an individual to another and from race to race. This information is useful in sports. This is because, each body reacts differently o varying degrees of Physical Street and no two bodies react exactly the same way to the same physical stress (4). For everyone to get the maximum benefit from training, leaders must be aware of the physical differences between men and women. This difference in size affects the absolute amount of physical work that can be performed by men and women. Also, because the centre of gravity is lower in women than in men, women must overcome more resistance in activities that require movement of the lower body. In conclusion, age and sex plays a major role in the estimation stature of an individual. This work is based on contemporary times where a lot of changes have taken place compared to works done in the past.

REFERENCES

Agwu JC, Shaw NJ, Kirk J, Capman S, Ravine D, Cole TRP (1999). "Growth in Soto's Syndrome" *Achieve of disease in Childhood,* **80** (4): 339-342

Demick and Barbara (2004). "Effects of famine: Short stature evidence in North Korean generation". Los angles Time. The Seattle Time. 2004-02-14

Krishnan K (2008) "Estimation of stature from foot print and foot outline dimensions in Gujjar of North India". *Forensic Sci. Int.* **175** (2-3) 93-101

Lillian Ebite T, Ozoko A, Eweka P, Otuaga A, Oni F Om'Iniabohs (2008): Height: Ulna Ratio: A Method of stature Estimation in a Rural Community in Edo state, Nigeria. *He Internet Journal of forensic Science.* Volume 3 Number 1

Meadows L, Jantz RL (1996). "Secular changes in long bone length and proportion in the United state 1800-1970" *Am. J. Antthropol.* 1999, **110**: 57-67

Mariana Del Pion Luisa Bay Haracio Lejarrage Irina Kovalskys Enquiring Bner and Cecile Rausch Herscovic, (2005). "Archik; HK: Mvos Argentinos de Pediatria". Scielo Arghentina.

Njolstad I, Arnesen E, Lund-Larsen PG, (1996). Body height, cardiovascular risk factors, and risk of strole in middle-aged men and women: a 14 year follow-up of the Finnmark Study. *Circulation,* **94**: 2877-2882.

Netherlands Central Bureau for Statistics (1996) for average heights

Ozaslan A, Iscan MY, Ozoaslan I, Tugeu H, Koc S (2003). "Estimation of stature from body parts". *Forensic Sci. Int., 32:* 40-45

Paul Schultz (2008). Productive benefits of improving health: Evidence from low-income countries' ISO **234**: 14(23).

Pital HA, Edouard Herriot (2005). "Bone width is correlated positively with the upper to the lower segment ratio in elderly mena" The MINOS study". Vol. 40, Issue 1, pp 199

Richard, S. Snell (2007). "Clinical Anatomy only by regions" 8th ed

Robert (1998). "Manual of anthropometry-basic human body measurements for technological design". International organization for standardization, ISO 72050; No 1-3, 6-7

Rother, P. Hunger, H. Leopold, D. et al, (1977). "Zur bestimmuny des lebensalter und des geschltch aus humerusmassen". *Anat Anz,* 1977,; **142**: 243-254

Soames RW, Bannister LH, (1991). "Gray's anatomy-anatomical basis of medicine and surgery". 38th ed. Churchill Livingstone, London. Pp **433**-4434, 637,640

Scott KE, Usher R (1966): Fetal malnutrition: its incidence causes and effects. *Am.* J. Obstet. Gynecol, **94**, 951-963.

Scott Moses (2008). "Upper to Lower segment ratio" Family Practice Notebook, LLC