Australian Journal of Basic and Applied Sciences, 7(7): 400-403, 2013
ISSN 1991-8178

Stature Estimation From Upper Extremity Long Bones In A Southern Nigerian Population

Ebeye Oladunni. A.

Departmentof Anatomy, Delta State University, Abraka, Nigeria

Abstract: Stature estimation is an important parameter in medico-legal and forensic examinations. In cases where highly decomposed and mutilated dead bodies with fragmentary remains are brought for forensic examination, it becomes necessary to identify the diseased. The aim of this study is to obtain regression formula for estimation of stature in Urhobopopulation of southern Nigeria from length of upper extremity long bones.The stature of 338 healthy males and 296 healthy females and their upper extremity long bones were measured. All statistical dispositions were done in SPSS version 16 including description and regression analysis. The results indicate that the long bones studied strongly and positively correlated ($p<0.05$) with stature. Regression formulae with statistic significance in estimation of the stature from the sum of the length of the upper extremity long bones were established. In conclusion,regression coefficient was higher in humerus than in ulna, in males than in females.Measurement of the length of the upper extremity long bones seems to be a simple and practical method to estimate human stature in forensic practice.

Key words: STATURE, UPPER EXTREMITY, IDENTIFICATION

INTRODUCTION

No two individuals are exactly alike in all their measurable traits; no control however great can make all the cells similar. Even genetically identical twins differ in some respect(Indrayan ,2007).One of the questions when people find new remnants of skeleton is what the height of the person was when he was alive. This question forms the basis of identification, forensic anthropologist have taken interest since a long time in determining the heights of individuals from dimensions of bones.With increasing frequency of mass disasters, (wars, accident,terror events and natural disasters) identification of an isolated upper extremity long bone and the determination of the stature of individuals have created problems for investigators in identifying some victims. The earthquake in Turkey in August 1999 and the terrorist attack on world trade centre in September 2001 created great challenges to identification effort.Stature is one of the most important and useful anthropometric parameter which determines the identity of an individual. It is synonymous with height, built, physique and tallness. It is a measure of biological development of both an individual and a population (Kodak, 1996). It is the natural height of a human or animal in an upright position, it is taken from vertex to the floor, in anatomical position and Frankfort plane(Ozaslan*et al*., 2006). Stature has a definite and proportional biological relationship with each and every part of the body like leg length, arm span, foot dimension, hand measurements to mention a few. The relationship helps a forensic scientist to calculate stature from dismembered and mutilated body parts in forensic examinations (Kewal, 2007). Two methods of stature estimation have been established, mathematical method and anatomical method. The most widely used mathematical method is that of Trotter and Gleser (Trotter *et al*.,1952). Studies on stature estimation mostly from long bones have been reported by published work of (Trotter *et al*., 1952;Pearson, 1899; Athwale, 1963; Petal *et al*., 1964).Someof such have also been reported for Nigerians,Ebite *et al*., 2008and Didia *et al*., 2007. Having known the means of stature estimation are population and sex specific as reported by the following authors. Petal *et al*., 1964; Joshi *et al*., 1964;Devi and Nath2005;Jain *et al*.,2006). The present study therefore provides anthropometric correlation of some upper limb bones with stature in Urhobos of southern Nigeria.

MATERIALS AND METHODS

The data for the present study were based on a sample of 634 adult Urhobos (338 males and 296 females) ranging in age from 18 – 30 years. The subjects were randomly selected from the six local government areas of Delta State of Nigeria where Urhobos are located. The following data were thereafter taken according to landmarks and procedure recommended by (Krishan and kumar 2007)and (Bhavana and Surinder 2009).

- Stature:measurements were taken by making the subjects stand on a horizontal resisting plane bare footed with shoulder blocks and buttocks touching the wall, and with subjects standing in anatomical position. The movable band of the anthropometric rod was brought in contact with vertex in the mid sagittal plane.
- Ulna length: subjects were made to flex forearm at a 90 degree angle, the distance from the most prominent point of the olecranon process to the most distal point of the styloid processed was measured.

Corresponding Author: Ebeye Oladunni. A., Departmentof Anatomy, Delta State University, Abraka, Nigeria

- Humerus length: standing in an erect position, a straight distance from the greater tubercle to the lateral epicondyle was measured.

The data thus collected were subjected to statistics like mean, S.D., Pearson's correlation coefficients, regression analysis using SPSS version 16.

Results:

Table 1: Descriptive statistic for stature and long bones in adult Urhobos. (n= 338males and 296 females)

	Males		Females	
Measurement(in inches)	Means	SD	Means	SD
Stature	68.99	3.93	64.69	3.03
Ulna length	11.18	0.72	10.30	0.62
Humerus length	12.25	2.00	11.34	1.74

Table 2: Correlation coefficients between stature and long bones in adult Urhobos (n= 338 males and 296 females)

	Males	Females
Measurement(in inches)	Correlation coefficient (r)	Correlation coefficient (r)
Ulna length	0.390	0.481
Humerus length	0.142	0.214

Table 3: Regression equation for estimation of stature (in inches) from long bone measurements in adult Urhobos

	Males		Females	
Measurement(in inches)	Regression equation	SEE	Regression equation	SEE
Ulna length	45.19 + 2.13 (Y)	3.074	40.56 + 2.36 (Y)	2.600
Humerus length	65.57 + 0.28 (Y)	1.317	60.76 + 0.37 (Y)	1.132

Table 1presents means and standard deviations of stature and long bones of the upper limb measurements of adult male and female Urhobos. In the sample of 634, an adult Urhobo male has an average height of 68.99inches/172.47cm and an adult Urhobofemale has an average height of 64.69 inches/161.72cm.

Table 2 presents Pearson's correlation coefficient between stature and some long bones of the upper limb.The two long bone studied show significant positive correlation with stature ($p<0.05$).

Table 3 show regression equations for estimation of stature (in inches) from two long bones of the upper extremity.

Discussion:

The finding of this study confirms that long bones can be used in estimation of stature in situation when only long bones are brought for forensic examination. Various methods are used to establish the identity of unknown human remains and the reliability of each method varies. The introduction of regression formulae developed in modern population has enhanced the accuracy of stature estimation (Shalini *et al*., 2008). Utmost care must be taken while measuring the subject for stature and long bones lengths (Kewal, 2007). The findings of the study indicate that the two long bones studied are positively and significantly correlated with stature ($P<0.05$).From table 1 mean height of males are higher than the mean height of females, it was also the same for the two long bones studied. These tend to agree with studies of Ebite *et al*., 2009 done in a community in Edo state of Nigeria. ZhouXiao-Rong (2009) estimated stature from upper extremity long bone by digital radiography and found regression was higher in ulna than radius. In 2004 Izzetduyarin his study found ulna to correlate more with stature than tibia.The usefulness of regression equation is generally assessed on the basis of their standard error of estimate. In the present study, the standard error of estimate ranged from 1.13in/2.71cm to 3.07in/7.36cm for the long bone. Other studies of long bones show standard errors of estimates that are comparable. For example the study by Trotter and Glesser display values of 2.99 to 4.45cm in whites, 2.25 to 3.09cm by Dupertuis and Hadden. The standard error from other bones like skull, vertebrae columns and metacarpals are higher. This implies that long bones produce the lowest error of estimate and therefore should be used as first preference to estimate stature.

In conclusion the most accurate regression equation is indicated by formula that contains the lowest standard error of estimate. Thus in both males and females in this study,Humerus provides a lower standard error of estimate as such it is termed a more accurate predictor of stature.

ACKNOWLEDGEMENTS

The author is grateful to Professor P.S.Igbigbi of Delta State University, Abraka Nigeria for supervising this work. Am also grateful to all subjects who voluntarily participated and cooperated duringdata collection. Thanks

REFERENCES

Athwale, M.C., 1963. Estimation of height from lengths of forearm bones: a case study of one hundred Maharastrian male adults of age between 25 and 30 yrs. *Am J.Phys. Anthrop*. 21: 105-121.

Bhavna and S. Nath, 2009. Use of lower limb measurements in reconstructing stature among shiamuslims. The internet journal of biological anthropology.Vol 2 number 2.

Devi, L.S. and S. Nath, 2005. Formulation of multiplication factors for estimation of stature using upper extremity dimensions among male and female tangkhulNagas of Manipur. Pp 150-157. In forensic science and crime investigation.Remesh Chandra, SurinderNath and P.K. Janjua (Eds). Abhijeet publication, delhi (2005).

Didia, B., B.N. Jaja and S.N. Utchay, 2007. Model stature estimation formula for adult Nigerians based on metacarpal bone length. Orient journal of medicine. 19: 1-4

Ebite, L., T. Ozoko, A. Eweka, P. Otuaga, A. Oni and F. Ominiabohs, 2008. Height ulna ratio: a method of stature estimation in a rural community in Edo state, Nigeria. *The internet journal of forensic science*, 3: 1.

Indrayan, A., 2007. Biological variation and uncertainties and role of statistics in biostatistics a manual of statistical methods for use in health, nutrition and anthropology.Pp5-9, 2nd edition.Jaypee Brothers Medical Publicers. New Delhi.

Izzet, D., P. Can, Z. Ragiba, 2006. A new method of stature estimation for forensic anthropological application.J of anthropological sciences, 114: 23-27.

Jain, P., S. Singh, P. Arora, P. Majumdar, K. Kaur and S. Nath, 2006. Determination of stature using lower limb dimensions. Pp 176-185. In .modern trends in forensic science. Ramesh Chandra, SurinderNath and ParveenJanjua (Eds.) Shree Publishers and distributors, Delhi.

Joshi, N.B., M.P. Petal and A.V. Dongre, 1964. Regression equation of height on ulna length. Ind. J. Med. Res., 52: 1088-1091.

Kewal, K., 2007. Anthropometry in forensic medicine and forensic science- forensic anthropometry.*The internet journal of forensic science.*Volume 2 number 1.

Kodak, J., 1996. Stature estimation from long bones. The estimation of usefulness of some selected methods for skeletal populations from Poland. *Variability and evolution,* 5: 83-94.

Krishan, K., R. Kumar, 2007. Determination of stature from cephalo-facial dimensions in a north indian population. Leg Med (Tokyo) 9(3): 128-33.

Ozaslan, A., M.Y. Isca, I. Ozaslan, H. Tugcu and S. Koc, 2006. Estimation of stature from body parts.*Forensic SciInt.,* 132: 40-45.

Patel, M.P., N.B. Joshi and A.V. Dongre, 1964. Regression equation of height and tibia length.*Ind. J. med. Res*., 52: 531-534.

Pearson, K., 1899. Mathematical contribution to the theory of evolution.On the reconstruction of the stature of prehistoric races. Phil. Trans. R. Soc. Land. A 192: 169-244.

Shalini, K., K.S. Shwetha karthikeya P. Mahima, 2008. Stature estimation using odontometry and skull anthropometry.

Trotter, M and G.C. Gleser, 1952. Estimation of stature from long bones of American whites and Negroes.*American journal of physical anthropology*, 10: 463-514.

Xiao-Rong Zhou, Yong-Kang Shu, Yun-Feng Chang, Zhen-Hua Deng, Zhao-Hui Zhang, Xiao-Gang Chen, Jian-Qun Yu, Lin Huang pubmed, 2007. Stature estimation from upper extremity long bones by digital., 23(6): 418-423.