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Prediction of the Height of the Esan Ethnic Group of Nigeria, Using Armspan Length

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ABSTRACT

This study was carried out to determine the average value for the stature, arm span and arm span stature ratio of the Esan ethnic group. It was also carried out to determine the correlation between the stature and arm span, and to establish a formulae for estimation of height using the armspan of the adult Esan ethnic group, as well as to determine if there are sexual dimorphism in these parameters. Six hundred subjects (600 Esan's) 300 males, 300 females(between the ages 18-50years), were used for this study. The location where this study was carried out were: College of Education Igueben, Ambrose Alli University Ekpoma, Auchi Polytechnic Auchi, Ekekhen Community, Uromi Community and New Benin City. The morphological measurements were stature (height) and arm span length.The mean and standard deviation of height of the males and females were 176.19±7.09 cm and 167.36±6.92cm. It was observed that the Esan males had a significantly higher height than the Esan females ($p<0.05$). The mean and standard deviation of arm span length of the males and females were 187.30±8.41cm and 173.75±8.47 cm. It was observed that the males of the Esan males had a significantly larger arm span length than their females ($p<0.05$). The mean and standard deviation of Arm Span Stature Ratio for males was 106.31±2.18cm and; while, for females, it was 103.81±2.42cm, it was also observed that, the males had a significantly higher values than that of the females ($p<0.05$).A regression formula for estimation of stature was established from arm span length of the subjects. When comparing the result in this study and works of previous authors, there were ethnic and racial differences in these parameters. These values will be of clinical and forensic anthropological significance when dealing with the Esan people.

Key words: Arm span , Clinical,Esan, Stature.

INTRODUCTION

Anthropometry is recognized as the single most universally applicable, inexpensive and non-invasive technique for assessing the size and proportions of the human body[1]. This technique has been used by anthropologists worldwide to estimate body size and stature for many years [2,3]. Besides race, age and sex, stature is one of the vital features of identification. Thus, developing a biological profile in stature is an important step for human identification[4].Stature is usually estimated by employing either the anatomical or mathematical method. The anatomical methodis based on a summed height of skeleton or human piecescontributing to stature in human. Nevertheless, the maindisadvantage in this method is that nearly complete pieces of bones are needed for stature [5, 6].On the other hand, themathematical method makes use of either one or more bone

lengths to estimate stature. This method employs bone length, stature tables and regression formulae to estimate total skeletal height from long bones. Assessment of lung function by spirometry constitutes an important part of diagnostic work-up of a patient with respiratory disease.[7,8] Interpretation requires comparison of observed with normal values that are obtained from prediction equations. Standing height and age are the major determinant variables of forced vital capacity (FVC) and explain most of its variance.[9]
In patients unable to stand straight due to physical disability, structural defects such as kyphoscoliosis or neuromuscular weakness or leg amputation, standing height can be estimated from arm span measurements[10-16]. This may be done by direct substitution by the latter[10–12,16] or by application of a fixed correction factor based on arm span:height ratio[17] or by estimating height from arm span using regression equations.[13–15] For reasons of simplicity, direct substitution by arm span has been favored, both in children[10] and adults.[11,16] The errors introduced by such substitution in interpretation of spirometric data have been reported to be small.[10,12] The recent joint statement of the American Thoracic Society (ATS) and the European Respiratory Society

(ERS) has also recommended such substitution.[9] However, the agreement between arm span and standing height has been found to be poor.[14,18] Direct substitution of arm span for height was also questioned recently by Golshan *et al.,*[15] who found estimation from regression models to be superior in healthy subjects. As these three methods may not provide similar estimates of standing height, the predicted values will differ and could have an impact on interpretation.

Daniel et al.[19] carried out a study on the relationship between armspan and stature in Nigerian adults in Benue state. It was observed that there was a significant linear relationship between stature and armspan. Again [20] carried out a study among shia muslims in India. The aim of their study was to reconstruct stature among male and female shia muslims of Delhi using lower limb dimensions. Mohanty *et al.*[21] carried out a research on the Sitting height, standing height, arm span and leg lengths of 505 healthy women. It was observed that the correlation of arm span and leg length with standing height were good.

A research work has been carried out on arm span length and foot length of the igbo's and the Hausa ethnic group[22]. It was observed that the Hausa males and females had a significantly higher arm span length than that of the Igbos in all the sex. Samira et al.[23] has worked on the Bangladish people in india. Ogoun et al.[24] compared the armspan between the Ijaw and the Ikwerre ethnic group of Nigeria.

Despite the anthropological and forensic relevance of knowledge of stature, arms pan length and arm span stature ratio, there is scarcity of literature on these parameters for Esan ethnic group. This is the driving force behind this research. The aim of this study is to determine the average value for the stature, arm span and arm span stature ratio of the Esan ethnic group. This study also seeks to determine the correlation between the stature and arm span, and to establish a formulae for estimation of height using armspan. Finally, this study was carried out to examine if there are Sexual dimorphism, ethnic differences when comparing our result to works of other authors.

MATERIALS AND METHODS

Six hundred subjects (600 Esan's) 300 males, 300 females, were used for this study, between the age range of 18 to 50.

The location where this study was carried out were: College of Education Igueben, Ambrose Alli University Ekpoma, Auchi Polytechnic Auchi, Ekekhen Community, Uromi Community and New Benin City.

Stature (Height)

This was measured using a steel meter rule with the subjects standing in upright position with both hands by the sides. The ruler was placed on top of the subjects (the person's) vertex to indicate the upper margin, the distance between the vertex and the floor is the height recorded in centimeter (cm).

Arm span: Arm span is the physical measurement of the length from one end of an individual's arms (measured at the fingers tips) to the other when raised parallel to the ground at should height at a One-Hundred Eighty degree angle (180^{o}).

Figure1: Picture showing measurement of Arm Span

Armspan: stature ratio
The arm Span: Stature Ratio was calculated by using the length of arm span divided by stature, multiplied by one hundred. i.e. 100 x length of arm span /stature (height).

All linear measurements were in centimeters for each parameter. The data on the measured parameters were analyzed using the z-test to determine the sex differences and ($P < 0.05$) was taken as being statistically significant. The actual ranges for the male and female sexes were found out.

A correlation study was also carried out between the stature of subjects and their armspan length. A regression analysis was also carried out to predict the stature (height) of the males and females from their armspan length.

Verbal informed consent was sort from subjects before measurements were taken.

Precautions
The following precautions were taken during the measurement:
1. Measurements were taken on bare foot.
2. Each participant's measurements were taken twice to obtain accurate results.
3. Individuals with recognized deformities of either arm, thigh or foot were exempted from the study.
4. Subjects used were from 18 to 50 years.
5. The subjects were indigenes of Esan ethnic group
6. Also Their parents and grandparents where from Esan ethnic group.

RESULTS
The result of the mean and standard deviation of stature, arm span length, arm span stature ratio of the Esan ethnic group are shown in table1. The mean and standard deviation of height of the males and females were 176.19±7.09 cm and 167.36±6.92cm. It was observed that the Esan males had a significantly higher height than the Esan females ($p<0.05$). The mean and standard deviation of armspan length of the males and females were 187.30±8.41cm and 173.75±8.47 cm. It was observed that the males of the Esan ethnic group had a significantly larger arm span length than their females ($p<0.05$). The mean and standard deviation of Arm Span Stature Ratio for males was 106.31±2.18cm and; while, for females, it was 103.81±2.42cm, it was observed that, for all the parameters, the males had a significantly higher values than that of the females ($p<0.05$). it was also observed that the arm span length was significantly higher than that of the height of the Esan people.Table 2 Shows a comparison of the mean arm span length of present study and previous studies . It was observed that, there were ethnic differences in the this parameter.Table 3: Shows the Linear Regression Equation for estimation of Stature (Height) from Arm Span length. Figure 2 and 3 Shows the Pearson correlation between the Height and armspan of the Esan ethnic group. It was observed that, there was a strong positive correlation between their height and armspan ($p<0.05$).

Table 1: Table showing mean values of measured parameters for the Esan ethnic group.

Parameters	Sample Size (N)	Males Esan	Females Esan
Stature (cm)	300	176.19±7.09	167.36±6.92
Arm Span Length(cm)	300	187.30±8.41	173.75±8.47
Arm Span Stature Ratio	300	106.31±2.18	103.81±2.42

P<0.05

Table 2: Comparison of mean arm span length of present study and previous studies .

Researchers	Ethnic group	Males	Females
Fawehinmi and Paul [22]	Igbo	185.95±9.16	172.95±7.64
	Hausa	202.37±6.56	191.15±10.43
Samira et al.[23]	Banglaheshi		154.74±5.69
Ogoun et al.[24]	Ijaw	188.4± 9.48	171.7± 11.30
	Ikwerre	174.8± 10.10	166.4±8.34
Present Study	Esan	187.30±8.41	173.75±8.47

Table 3: Table showing Linear Regression Equation for Stature (Height) from Arm Span

Variable	Regression Equation
Esan Males Arm Span Length(cm)	Esan Males Height (Stature) = 35.3 + 0.752 Esan Males Arm Span Length
Esan Females Arm Span Length(cm)	Esan Females Height (Stature) = 42.0 + 0.721 Esan Females Arm Span Length

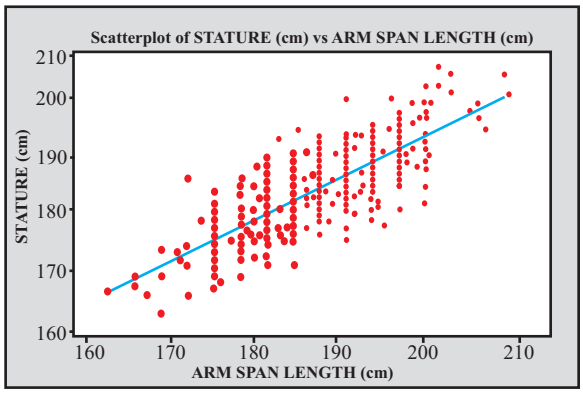

Figure 5: Pearson correlation of Stature(cm) and Arm Span Length(cm) for the Esan males. R =0.892.

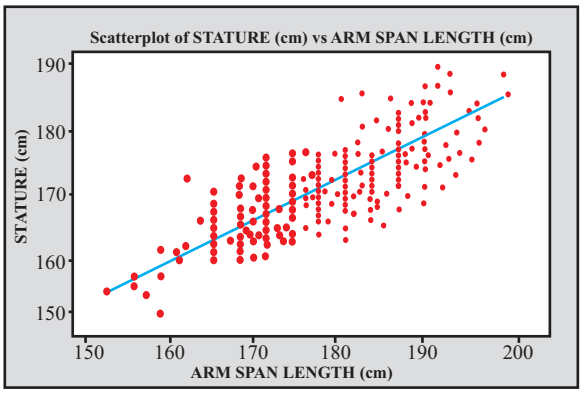

Figure 6: Pearson correlation of Stature(cm) and Arm Span Length(cm) for Esan Females. R=0.882.

DISCUSSION

Anthropometry is the external measurement and description of human body and its parts for the purpose of comparison and establishing norms for sex, age and race[22].There are biologically and statistically significant variations between human populations in body shape.

In the study of [22] the arm span length of the igbo's and the hausa ethnic group was measured. When comparing the armspan length of the Esan ethnic group with that of the Hausa's, it was observed that the Hausa's had a higher armspan length than that of the Esan people for both male and females. But the Esan males and females had a higher armspan length than that of the Igbo's and the Bangladish people of India. The armspan length of the Esan ethnic group for males was higher than that of the Ikwerre males, and that of the Esan female armspan value was also higher than that of the Ikwerre female armspan[24.]

Mohanty *et al.*[21] carried out a correlation between sitting height, arm span and leg length and observed a positive correlation between these parameters. Our study is in line with it, as there was a positive correlation between the height and all the measured parameter.

Yousafzai et al.[25]. Compared the armspan, arm length and tibia length as predictors of actual height of disabled and nondisabled children in Dharavi, Mumbai, India. It was observed that, there was a strong positive correlation between the arm span length and the height of the subjects. Our study is in line with this as there was a strong positive correlation between the armspan and the height of the Esan people.

Again[26] used arm span to derive height, and their results of the study show that arm span was about 5 to 6% greater than the standing height. our study is in line with this, as the armspan length of the Esan ethnic group was significantly higher than that of the actual height of the individuals for males and females.

In the study carried out by[27]regression models were used to establish formulae specific to Nigerians. General formulae for males and females were established. In this study, formulars for estimation of height, using armspan were established. our result compares favorably with that of [27] and can be relied upon.Igiri et al.[28] observed that the males had a larger height than the females in their research. This study is in line with their study as the heights of the Esan males were higher than their female counterparts.

In the study of [26], it was observed that height estimated from a fixed correction factor derived from the arm span:height ratio or predicted from arm span using a linear regression equation yielded a value closer to actual standing height than using the arm span as a substitute. Our study is in line with this, as a fixed correction factor derived from the arm span:height ratio or predicted from arm span using a linear regression equation yielded a value closer to actual standing height than using the arm span as a substitute for the Esan ethnic group in Nigeria.

The correlation between standing height and arm span is usually excellent [16-18,29-30] . Our study is in line with this, as there was a strong positive correlation between the armspan of the Esan ethnic group and their height. Therefore, when actual standing height cannot be measured or is affected by disease as in thoracic vertebral compression due to osteoporosis, and deformity in kyphoscoliosis, arm span has been recommended as a substitute for calculation of the predicted FVC.[14,16,17] This study has provided a data base for the Esan ethnic group as regards their armspan and their height estimation.There is a risk of wrongly labeling a normal subject as abnormal, as well as overestimating the degree of impairment in those with a true restrictive pathology. Therefore, the practice of substituting arm span for height cannot be recommended.

CONCLUSION

In patients unable to stand straight due to physical disability, structural defects such as kyphoscoliosis or neuromuscular weakness or leg amputation, standing height can be estimated from arm span using regression analysis. when predicting the height of the Esan people, the formulae given in this work should be given cognizance. Further research work should be carried out on other ethnic groups in Nigeria.

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