CORRELATION OF HEIGHT WITH ARM SPAN OF ADULT MALES IN JOS, NIGERIA

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Abstract

This research was aimed at ascertaining the existence of a relationship between the standing height of adult males in Jos and his arm span and to derive equations that will be used to predict standing height from arm span measurements and vice versa. With these equations, adult male height can be predicted in conditions where it cannot be easily measured. This descriptive, cross sectional study examined the relationship between standing height measurements and arm span measurements of 226 apparently healthy, randomly selected, consenting adult male students who fit the inclusion criteria. Measurements of standing height and their corresponding arm spans were taken using standardized methods and instruments and data collected was analysed using NCSS/ PASS 2006 Dawson Edition, USA.

Mean age of the subjects was 25± 4 years while mean standing height and mean arm span of males was 172.3± 9.7cm and 186.9 + 9.0cm respectively. Correlation regression analyses done showed that arm span could predict height in males by 98.7% i.e. R^2 = 0.987 ($P<0.05$) and height could predict arm span by 98.7% (R^2 = 0.987) using simple linear equations derived.

Key words: relationship, height, arm span, male, Jos.

Introduction

Anthropometry is the study of the science of measurement basic to physical/biological anthropology. [1] Generally, variations measured in anthropology are those regulated by multiple genetic factors. Thus, some of the easiest anthropometric parameters to measure include height and weight which vary from community to community in mean values and from tribe to tribe. While there is a wide range of variation in anatomical proportions between people, much reference has been made to body proportions that are intended to be canonical, either in art, measurement or medicine. Average height is vital to the estimation and assessment of health and wellness (standard of living and quality of life) of populations and like other phenotypic traits, it is determined by a combination of genetic and

environmental factors. [2] The evidence of the interplay of these determining factors is further elucidated in parts of Europe and especially within the egalitarian populations where proper medical care and adequate nutrition are relatively equally distributed. This could be responsible for the trend of increasing height. [3] On the contrary, under-nutrition and malnutrition as well as inadequate medical care, seen in developing countries are associated with stunted growth.

Arm span (also known as 'reach' or wingspan) refers to the length from one end of an individual's arms (measured at the fingertips) to the other, and it also varies with height. This variation may sometimes be an indicator of a health problem. The measurement of stature is important in many settings. Height measurement is vital for the estimation and evaluation of a number of health indices including growth, development and nutritional indices of children as well as adults, assessment of respiratory, metabolic and muscle function and for proper drug dosage in patients.[4] However, in some situations, the exact height cannot be determined directly because of deformities of the limbs or in patients who have undergone amputations. In such circumstances, an estimate of the height has to be computed based on measurements of other body parts. These estimations are also significant in predicting age-related loss in stature, identifying individuals who have growth abnormalities as well as conditions that affect the spine such as skeletal dysplasia or height loss secondary to surgical procedures performed on the spine.[5] Another application for the use of estimated height values is in normalizing pulmonary function in scoliosis.[6] Also, indirect measurements of stature via other anthropometric indices help in predicting age-related loss in stature, in identifying individuals with disproportionate growth abnormalities and skeletal dysplasia. It could also be utilized in sport settings in estimating the stature of wheel chair athletes or other athletes with limb disabilities or deformities.[4] This study's goal was to ascertain the existence of a relationship between arm span and height of adult males in Jos, the significance of this relationship as well as to derive equations that can predict height from arm span and vice versa.

Materials and methods

This was a descriptive cross-sectional study carried out on 266 randomly selected, consenting male students of the university of Jos aged between 18 and 55. Subjects with physical deformities involving the spine and the limbs were excluded from the study. Subjects that were below the age of 18 years were also excluded because they are still growing so also were those above 55 years of age since they are likely to have degenerative disorders of the joints. Every subject was measured and

included only once so that a pure cross-sectional set of data was constructed and for each subject, the age (calculated in completed years at the moment of the data collection), sex, measured arm span and standing height were recorded.

The height and hemi span of each subject was measured using standard methods according to International Society for the Advancement of Kinanthropometry (ISAK) 2001 guidelines, hemi span measurements were then multiplied by two (2) to obtain the total arm span. Statistical analysis was performed using Number Cruncher Statistical System (NCSS/PASS 2006 Dawson Edition, USA). Means, standard deviations and standard errors of mean were determined and regression analyses were carried out.

Results

A total of 266 young adult males were studied for estimation of height from arm span measurements. The mean age of the subjects was 25 $\pm$ 4 years with minimum age being 18 years and maximum 55 years. Table 1 shows the descriptive statistics of the measured parameters. Mean height of the sampled adult males is 173.3 ± 7.1 centimeters while their mean arm-span is 186.9 ± 9.0 centimeters.

Table 1: Distribution of arm span in males showing mean, standard deviation and standard error of mean with corresponding height in centimeter.

Height (cm)	Frequency	Mean Arm Span (cm)	Standard deviation	Standard Error
155 – 159	5	174.8	5.1	2.3
160 – 164	19	178.7	5.4	1.2
165 – 169	58	181.6	4.6	0.6
170 – 174	65	185.3	8.6	1.1
175 – 179	43	192.2	4.6	0.7
180 – 184	22	196.1	6.6	1.4
185 – 189	14	201.4	2.7	0.7
TOTAL	226			

Mathematical modelling of male height data plotted against mean arm span demonstrated that the best-fitted regression model (figure 1) to describe the relationship between male arm span and their standing height was the linear equation y = 1.104x - 34.69 with a correlation of determination R^2 =

0.987 (P < 0.05) where y is the height in centimeters and x is the arm span in centimeters. This means that arm span could predict the height of males in Jos by 98.7%.

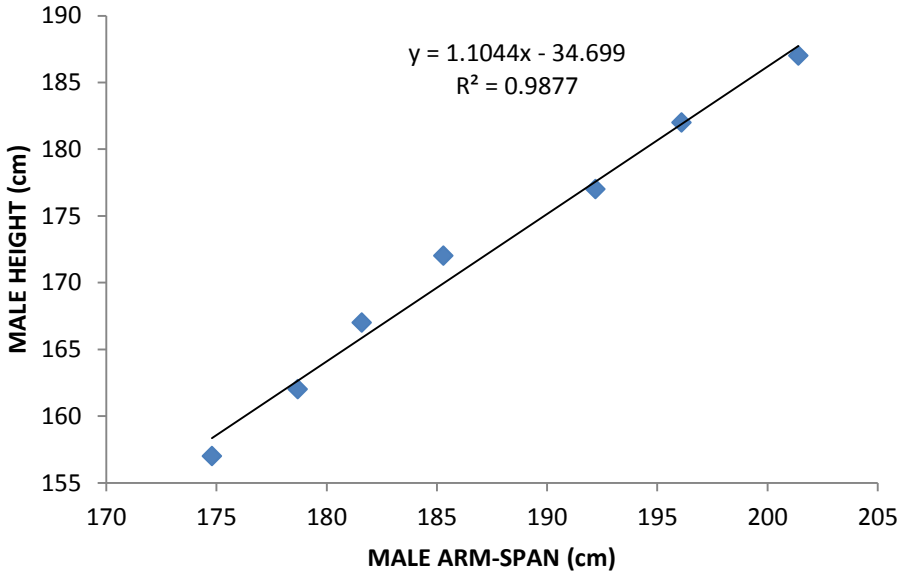

Figure1: Correlation and regression graph showing male height plotted against male arm sapn.

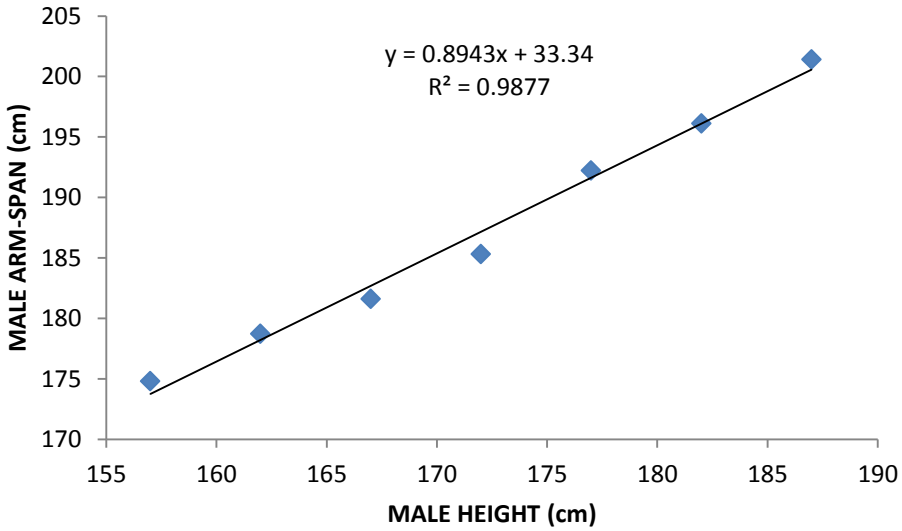

Figure 2: Correlation and regression graph showing male arm span plotted against male height.

The other way around, when arm span is plotted against height (figure 2) the best mathematical model to describe the relationship was the linear equation y = 0.894x + 33.34 with a correlation of determination of R^2 = 0.987 (P < 0.05) where y is the arm span in centimeters and x is the height in centimeters. This means that height could predict

the arm span of males in Jos by 98. 7% (R^2 = 0.987) in 226 males in this study.

Discussion

This study was specifically aimed at finding out whether there exists a relationship between the arm span and the height of male adults in Jos, Nigeria and to derive equations that can determine height from arm span and vice versa. Stature and its determination are necessary and valuable tools in art, forensic medicine and more importantly in the health care.

It is useful to health care givers for calculating drug dosage for treatment, as well as for monitoring growth and other health indices. To artists it is useful in determining body proportions. It is also crucial to forensic anatomists and morbid anatomists, to be able to determine height of victims of crime with dismembered body parts or those burnt beyond recognition, for identification when solving crimes. However, sometimes for one reason or another, height cannot be determined and must be estimated using another parameter / body index such as the arm span. This can only be done by use of an equation/formula that relates standing height and arm span. In this study, analyses were done to ascertain the existence of a relationship between standing height and arm span of adult, male Nigerians and the strength of this relationship.

The findings of the present study have confirmed what several other investigators [4,5,7,8] reported, that arm span can be used to predict height confidently. When compared with similar studies done in Benue state Nigeria [4] where stature in the men ranged between 167.2 – 167.8 cm and the mean height 172.7 – 175.8 cm, the values obtained in this study are higher but lower than those obtained from Montenegrins in a similar study. [9] However, there is an assumption that Montenegrins are still the tallest population in Europe [9] and this genetic predisposition for tallness may be responsible for the higher mean values of height in both males and females when compared to those of obtained from this study. Also, European countries are more developed than African ones (such as Nigeria) and have better nutrition and thus better/healthier growth.

In this study, regression equations that can predict the stature of a Nigerian male adult from his arm span ($y = 1.104x - 34.69$ with $R^2 = 0.987$) and arm span from the height ($y = 0.894x + 33.34$ with R^2 = 0.987) were derived. It is necessary to emphasize here that although similar work to this one has been done all around the world and documented, there is yet to be any documented report with regression equations that can predict height from arm span and vice versa, in Nigerian males.

Conclusion

Both standing height and arm span of humans are basic anthropometric indices which vary with age and population and are vital anthropometric tools that are very useful in clinical/health management. This study has demonstrated strong relationships between the standing height of adult males in Jos and their arm span and has yielded equations for the prediction of height from arm span and vice versa. These findings are of great use to the clinicians for effective delivery of health care in Nigeria and other parts of the world, forensic scientists as well as artist. The findings of this study also provide valuable information and contribute to the data base for adult males in Nigeria.

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