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## INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/17519

DOI URL: <http://dx.doi.org/10.21474/IJAR01/17519>



### RESEARCH ARTICLE

#### ARM SPAN TO HEIGHT RELATIONSHIP AMONG ADULT POPULATION IN JOS METROPOLIS, NIGERIA

Mosugu O.O., Nyam, J.C. and Mohammed B.M.

Department of Human Anatomy, Faculty of Basic Medical Sciences, University of Jos.

#### Manuscript Info

##### Manuscript History

Received: 10 July 2023

Final Accepted: 14 August 2023

Published: September 2023

##### Key words:-

Anthropometry, Variation, Height, Arm Span, Regression

#### Abstract

Anthropometric characteristics differ from one population to another due to genetic variation. Height, one of the big fours of anthropometry may be difficult to determine in some clinical and forensic conditions. Thus, the goal of this study was to ascertain the nature of the relationship between adult arm Span and height in Jos and to derive equations that can determine one parameter from the other. In this cross sectional study, standing height and arm spam measurements were taken from 378 randomly selected, consenting adult students who fit the inclusion criteria and analyzed using NCSS/ PASS 2006 Dawson Edition, USA. Mean age of the subjects was 24 + 4 years with minimum age being 18 years and maximum 55 years. Also, there exists positive relationship between adult height and arm span. Regression analyses yielded equations that could predict height from arm span by 99.99% and arm span from height by 99.79% among adults in Jos. These findings will contribute significantly to improving health care delivery and forensic investigations for crime solving in Nigeria.

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#### Introduction:-

Anthropometry is that branch of anthropology that deals with measurable parameters of humans to determine their characteristics. However, these characteristics are not homogeneous; they change from one geographical location to another based on the principle of variation. Height is an essential clinically measured parameter along with body mass index (BMI) and body surface area computation. These measurements play an unavoidable part in drug dose modification, nutrition assessment and requirements, as well as for risk stratification (Kyle, Kossovsky, Karsegard & Pichard, 2006; Browning, Hsieh & Ashwell, 2010). Developing nations like Nigeria are faced with environmental, nutritional and socio-economic challenges that affect optimal growth and development (Sede & Ohemeng, 2015; Morakinyo, Adebawale, Obembe & Oloruntoba, 2020). Thus, it is important to have health standards and references from locally generated data to work with rather than rely wholly on those from international survey standards. It is equally important to note that the field of forensic science, for human identification and crime investigation in Nigeria in view of the current understanding of global best practices concerning medico-legal investigation of death resulting from mass disasters, appears to lag behind. The resultant effect is a huge gap in knowledge and practice of forensic science in Nigeria (Alisigwe & Oluwafemi, 2019; Ladapo, 2011; Obafunwa, Faduyile, Soyemi, Eze, Nwana & Odesanmi, 2015).

This study aims to determine the nature of the relationship between adult arm Span and height in Jos and to derive equations that can predict the height of n adult from arm span and vice versa. The results of this study will in turn

**Corresponding Author:- Mosugu Ovayoza Omolara**

Address:- Department of Human Anatomy, Faculty of Basic Medical Sciences, University of Jos.

provide more reliable tools for references for both the health and judiciary sectors in Nigeria, improving health care delivery and forensic investigations for crime solving.

### Materials and Methods:-

This was a descriptive cross-sectional study carried out on 378 randomly selected, consenting students of the university of Jos, Nigeria aged between 18 and 55 years. Subjects with physical deformities involving the vertebral column and the limbs were excluded from the study. Subjects that were below 18 years of age were also excluded due to ongoing growth processes, so also were those above 55 years of age since they are likely to have degenerative disorders of the joints. The age of subjects was based on the ages they indicated while obtaining consent. Every subject was measured and included only once so that a pure cross-sectional set of data was constructed. For each subject the age, sex, arm span and height were recorded. Age was calculated in completed years at the moment of the data collection.

The height of the subject was measured between the vertex and the floor, when the person is standing erect, in an anatomical position and the head in Frankfort plane, using a stadiometer to the nearest 0.1cm. The arm span was measured with a non-stretchable measuring tape from the tip of the middle finger of the right hand to the sternal notch (half arm span). This measurement was taken with the subject standing with the back to the wall and both arms abducted to 90 degrees, and with the elbows and wrists extended and the palms facing directly forward. Readings were taken twice to the nearest 0.1 cm, the average obtained and then multiplied by two (2) to obtain the total arm span.

These measurements were taken according to International Society for the Advancement of Kinanthropometry (ISAK) 2001 guidelines. Statistical analyses were 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 on the parameters measured.

### Results:-

A total of 378 adults were studied for the relationship between height and arm span. The mean age of the subjects was 24 + 4 years with minimum age being 18 years and maximum 55 years. Table 1 shows the grouped frequency table for height and mean arm span of study sample. Regression modeling of height data plotted against mean arm span demonstrated that the best-fitted regression model (figure 1) to describe the relationship between arm span and height was the linear regression equation  $y = 0.9423x - 3.0552$  with a correlation of determination of  $R^2 = 0.9979$  ( $p < 0.05$ ) 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 adults in Jos by 99.99% percent ( $R^2 = 0.9999$ ) in 378 subjects in this study. When arm span is plotted against height (figure 2), the equation is  $y = 1.059x + 3.6164$  with  $R^2 = 0.9979$  meaning height could predict arm span of adults in Jos by 99.79% in 378 subjects.

**Table 1:-** Grouped Frequency Table for Height and Mean arm span of Study Sample.

Height (cm)	Frequency	Mean arm span (cm)	Standard deviation	Standard error
150 – 154	20	163.8	3.8	0.8
155 – 159	34	170.4	5.4	0.9
160 – 164	69	175.7	5.2	0.6
165 – 169	86	180.6	5.1	0.6
170 – 174	85	185.1	8.1	0.9
175 – 179	48	191.9	4.7	0.7
180 – 184	22	196.1	6.6	1.4
185 – 189	14	201.4	2.7	0.7
Total	378			

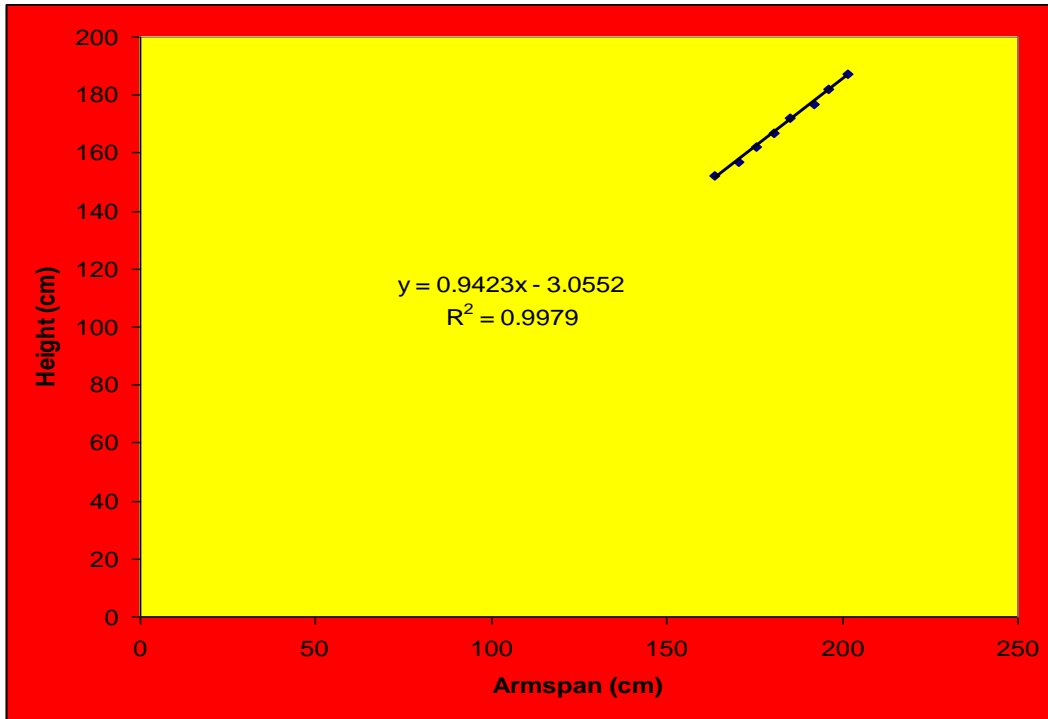


Figure 1:- Correlation and regression graph showing height of total study sample plotted against arm span.

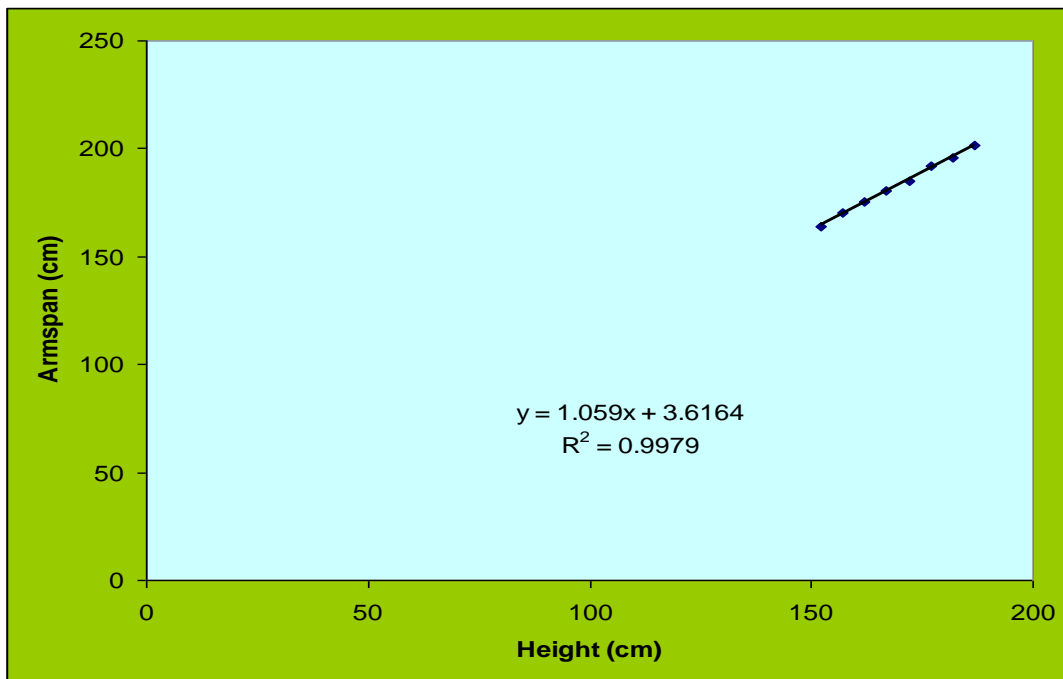


Figure 2:- Correlation and regression graph showing arm span of total study sample plotted against height.

**Discussion:-**

The positive correlation of adult arm span with height found in this study is consistent with previous studies from other parts of Nigeria (Anibor, Ogbor-Omorie, & Nwagbara, 2014; Iteire, Anibor, & Akpo, 2015; Ugbem, Godfrey, Ojim, & Ejuiwa, 2016) as well as internationally (Gerver, Gkourogianni, Dauber, Nilsson, & Wit, 2020; Lahner, Kassier & Veldman, 2016). However, the variation in the degree of positivity of correlation further emphasizes the

fact that there is need for locally generated information on anthropometric indices for use in both clinical settings and forensic investigation of crimes involving human identification in Nigeria.

Furthermore, the findings of the present study have confirmed what several other investigators (Tanase, 2015; Tetteh, Darko, Abaidoo, & Diby, 2021) reported, that arm span can be used to predict height confidently. However, the regression equations generated from this research were found to have higher predictive values and as such yield more accurate and reliable results than those of the afore mentioned investigators.

### **Conclusion:-**

There is a positive relationship between adult armspan and height in Jos. Also, armspan can be used to predict height and vice-versa among adults in Jos, Nigeria with high levels of precision using regression equations. These are vital tools necessary for appropriate health care delivery crime investigation in Jos metropolis, Nigeria. These findings will also be useful in updating and modifying governing policies.

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