

ESTIMATION OF STATURE USING ARM SPAN

Running Title - Stature estimation using arm span

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ABSTRACT

INTRODUCTION

One of the most important body measurements in humans is height. Arm span was found as one of the most reliable measurements for stature estimation. It may differ from region to region, ethnicities, and races. This is very helpful for forensic investigation of dismembered bodies, amputations, stature loss, etc.

AIM

To Estimate stature using arm span.

MATERIALS AND METHOD

60 samples (29 males & 31 females) were collected within the age limit between 18-20 years. The arm span and height of the subjects was measured. The data was tabulated and analysed using the statistical software SPSS version 23.

RESULTS

A strong correlation was found between the human height and arm span.

Regression equation for male => $y = 25.22 + 0.83x$, Correlation coefficient = 0.84

Regression equation for female => $y = 27.09 + 0.81x$, Correlation coefficient = 0.81

CONCLUSION

During situations when the height cannot be determined through usual methods for deformed bodies, amputations, diseases, or fractures, etc., arm span can serve as a very helpful measurement tool to estimate height. From the present study it is determined that arm span has a very strong correlation to estimate stature of a person.

KEYWORD

Novel Stature estimation; arm span; anthropometric measurement; forensics

INTRODUCTION

One of the most important body measurements in humans is height. The distance between the feet to the head in a person standing erect is known as Stature. Human height is very important as its closely related to various health components, like life expectancy. It is useful in assessing children's longitudinal growth, body surface area calculation, and normal body function prediction. Arm span is an important anthropometric parameter for numerous predictions (1,2). There are many situations when the exact body height cannot be obtained in the usual way for example in cases of paralysis, due to amputations, scoliosis, etc (3). In situations like these, the stature can be estimated using other parameters like hands and feet (4), foot measurements, etc. during mass destruction, the forensic investigation faces difficulties in estimating the stature and gender of the dismembered body (5). During situations like these, estimation of stature using other body parameters prove effective and important.

Many body parameters can be used to estimate the stature and many studies have been conducted on these parameters like using hands and feet measurements (4), hand length and length of phalanges (6), facial measurements (7), lower limb (8), etc. Different such parameters prove to be helpful in estimating the stature. One of such parameter is arm span. There are numerous studies conducted on the stature estimation using arm span in many different ethnicities and regions. In Montenegro (9), South Indian women (1), Macedonian

adults (3). Several studies have reported various parameters. However, these measurements in correlation of arm span to height varied from race to race (1). There were differences between the correlation between the height and arm span in black and white women in the study conducted by M F Steele (10). Estimation of stature using arm span and age was preferred as it is more accurate and leads to reduced percentage of misclassifications in terms of abnormally low respiratory parameters or restrictive pattern, making this parameter more clinically useful.(11)

Difficulties faced may include the stature of the population. It is important to know that the correlation obtained from tall populations may be less accurate than the one obtained from short height populations based on the fact that sometimes arm span may not be equal (12). The extensive knowledge and experience of our research team has been translated into high quality publications (13–20),(21),(22),(23),(24,25),(26),(27),(28–32). Variations in human stature was seen between individuals and across people of various biological, genetic, and environmental factors, among others. The aim of the current study is to try to estimate stature using arm span

MATERIALS AND METHOD

This cross-sectional study was done using 60 samples. It comprised 29 male subjects and 31 female subjects. Ages were between 18-20 years. The data collection was accessible as the study was conducted among the dental students of the college. The study couldn't be performed on the subjects who have undergone arm amputations and fractures. Data collection was done using a measuring tape, the subjects were asked to stand with their arms spread as straight as possible and the measurements were taken from the tip of the middle finger of one hand to the tip of the middle finger of the other hand (Figure 1). The measurements were taken thrice in each case and taken as a mean to avoid any bias. Measurement of height was done using a standard stadiometer. The data collected was made into excel sheet and imported to SPSS. The statistical analysis was done using linear regression. The statistical software used was Statistical Package for Social Sciences, SPSS, version 23. The independent variable was arm span and the dependent variable was height.



Figure 1- Measurement of arm span

RESULTS

Table 1- Values of regression equation for estimation of height (y) from arm span (x) in males and females.

	MALE	FEMALE
n	29	31
Mean value of arm span (x in cms)	177.91	162.16
Mean value of height (y in cms)	173.24	159.32
Correlation coefficient (r)	0.84	0.81
A	25.22	27.09
B	0.83	0.81

From the data in Table 1, Regression equation was calculated using the formula

$$y = A + Bx$$

Regression equation for male $\Rightarrow y = 25.22 + 0.83x$, Correlation coefficient = 0.84

Regression equation for female $\Rightarrow y = 27.09 + 0.81x$, Correlation coefficient = 0.81

Therefore, there is a strong correlation between the arm span and the stature of the population under study in the present research.

DISCUSSION

Our study shows strong correlation between stature and arm span, several other studies also showed positive and strong correlation between them using regression analysis (33). Many

researchers have taken male gender into major consideration, the present study includes both male and female population. In the studies considering both male and female showed greater correlation in male than female agreeing with the result of the present study. The present study didn't take a wider age group into consideration since age was used as an additional predictor in earlier studies shows very little amount of variance with not much of significant correlation shown among height and age (33).

Several studies showed strong correlation between Stature and arm span. Among male the regression equations $y = 50.81 + 0.68x$ (2), and correlation coefficient were, $r = 0.87$ (3), $r = 0.82$ (9), $r = 0.89$, $r = 0.80$ (34), $r = 0.82$ (33), $r = 0.89$ (35). Among female the regression equations were $y = 40.23 + 0.73x$ (2), and correlation coefficients of $r = 0.81$ (1), $r = 0.83$ (3), $r = 0.75$ (33), $r = 0.86$ (34), and for white and black women, $r = 0.90$ and $r = 0.85$ respectively(10). Moderate correlation between arm span and stature was found in a study conducted in the region of Birgunj, Nepal where the correlation coefficient obtained for male was 0.68 and female was 0.50. This shows that different regions and other factors do show differences in the correlation between arm span and stature. This also brings about the need to develop separate height models for different populations and also different genders (36). The limitation of the study was a very small sample size of 60 taken into consideration for the. A bigger sample can be considered over a wide range in the future and more accurate results can be obtained.

CONCLUSION

During situations when the height cannot be determined through usual methods for deformed bodies, amputations, diseases, or fractures, etc., arm span can serve as a very helpful measurement tool to estimate height. From the present study it is determined that arm span has a very strong correlation to estimate stature of a person. Still it is important to develop different height models for different ethnicities, regions, races, and also genders because arm span as well as height greatly differs in different ethnicities, regions, races, and gender.

AUTHOR CONTRIBUTIONS

Vedha .R. Nair: Study Design, Data collection, Data Analysis, manuscript writing

Yuvaraj Babu K: Study Concept, Data verification, Data Analysis, manuscript drafting and correction

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CONFLICT OF INTEREST

The authors reported the conflict of interest while performing this study to be nil

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