CORRELATION BETWEEN STANDING HEIGHT AND ARM SPAN IN YOUNG ADULTS – A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Height is a significant parameter for assessing growth and development of an individual. It can vary in different populations. There are quite a handful of studies which support using arm span to substitute height for predicting lung volumes. The associations of arm span and body height was found to vary in different ethnic and racial groups. No such studies have been carried out in Dakshina Kannada district, Karnataka, India. This study was done to show whether there is any relationship between height and arm span for young adults in Dakshina Kannada district.

Methodology: Height and arm span were measured in 34 boys and 119 girls from Alva’s Education Foundation, Moodbidri with the help of stadiometer and calibrated steel tape. The height measured was vertical distance from the vertex to floor. Arm span measured was the straight distance between tip of middle fingers right and left, when the arms are fully stretched and are parallel to the floor. For statistical analysis (Statistical Package for Social Sciences) SPSS Version 16 was used.

Result: Pearson correlation was used to correlate variables. Mean height for girls 157.38 (SD =6.96) cm and for boys 167.93 (SD=6.98) cm. Mean arm span for girls 161.63 cm and for boys 176.2 cm.

The correlation coefficient between height and arm span was 0.890 for girls and 0.826 for boys. P< 0.05 for both groups. Correlation is significant at the 0.01 level.

Conclusion: Height and arm span have strong correlation and arm span can be used as reliable parameter for predicting the height of young adult individuals.

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1. INTRODUCTION

Length of certain long bones and appendages of body represent a certain relationship in the form of proportion to height[1]. Once the skeletal maturity is complete, the proportions do not alter with age. Height is a quantitative or qualitative measurement of personality. It can be used as an indicator of growth, body size, physiological variables, physical capacities, and nutritional status of human body[2]. Adult height between populations often differs significantly.

It might be affected by nutritional factors, environmental factors and genetic factors. Significant role is played by genetic factors especially HMGA2 gene. Correlation between mother and son, father and daughter has been stated by genetic studies. On average adult males are taller than adult females. The tallest race of humans is Nilotic people of Sudan. Most of males’ average height is 1.9 m (6 feet and 3 inches) and female are about 1.8 m (5 feet 11 inches)[3]. Arm span or arm reach is physical measurement of length from one end of individuals arm (measured at the finger tips) to other, arm raised parallel to the ground at shoulder
height at hundred and eighty degree angle. Average arm span of a person depends usually on age, sex and height.

Standing height has also been calculated from anthropometric measurements of bony fragments, height of spine, face breadth, limb and foot measurements[1].

In patients who are unable to stand straight due to physical disability, structural defects such as kyphoscoliosis or neuromuscular weakness or leg amputation and osteoporosis, standing height can be estimated from arm span measurements.

This may be done by direct substitution by the latter or by application of a fixed correction factor based on arm span : height ratio or by estimating height from arm span using regression equations[8]. Despite many articles agree with statement of arm span measurements can be a good predictor of standing height, some controversy still prevails while reviewing the below mentioned articles.

The associations of arm span and body height was found to vary in different ethnic and racial groups[15]. Yet Torres et al. and Hickson and Frost, applying the Bland Altman analysis, observed a poor agreement between the arm span and height even though these correlate well. This suggests that arm-span measurements may be an inappropriate proxy for height in certain populations.

Additionally, in comparison with the young age group, the mean difference between height and arm span was the highest in the postmenopausal age group [5]

Many studies of this interest are available on western populations; very few studies explored this relation in Gujarat, West Bengal and Punjab on Indian population. None of the studies have been carried out in the region of Dakshina Kannada, Karnataka district in exploring relationship between standing height of individual and arm span.

This study was carried out in young adults in Alva’s Education Foundation, Moodbidri where students from different part of Karnataka stay, to assess the use of arm span to determine the standing height. The measurements of height and arm span and relationship between them have applied significance in forensic medicine, plastic and cosmetic surgery and other allied clinical sciences.

2. MATERIALS AND METHODS

The subjects were healthy young adults aged 20-25 years, both male and female in Alva’s Education Foundation, Moodbidri. 153 subjects volunteered to participate in this study.

2.1. Materials Used

1. Stadiometer
2. Calibrated steel tape

Healthy students were included between the age group of 20-25 years old. Both gender participated. Subjects were excluded if they had any orthopedic problems such as scoliosis, kyphosis, deformities in limbs and joint or muscle pathology. Medical conditions like osteoporosis, metabolic diseases, and cancers. Consent forms were used and Alva’s Institutional review board Committee(s) approved this study.

3. PROCEDURE

The body height is the perpendicular distance between the top of the head (the vertex) and the bottom of the feet. It was measured using stadiometer to the nearest 0.1 centimeters in bare feet with the participants standing upright against the stadiometer (Figure 1). The respondents had to put their feet together and move back until their heels touched the bottom of the stadiometer upright.

Their buttocks and upper part of their back were in contact with the stadiometer upright, but their head did not have to touch the stadiometer. The participant’s head had to be in the horizontal plane. The vertex was the highest point on their head, otherwise the participant’s had to raise or lower their chin until it was in the Frankfort horizontal plane to align their head properly (Figure 2).

The arm span is the anthropometric measurement of the length from the tip of the middle fingers of the left and right hands when raised parallel to the ground at shoulder height at a one-hundred eighty degree angle. It was measured using a calibrated steel tape to the nearest 0.1 centimeters in bare feet on a level concrete floor with their upper backs, buttocks and heels against the wall providing support.

The participant’s head was also in the Frankfort horizontal plane and the arms were outstretched at right angles to the body with palms facing forwards. The measurements were taken from one middle fingertip to the other middle fingertip, with the tape passing in front of the clavicles while two field workers supported (Figure 3). The measurements were taken twice and average was calculated.

Body height and arm span were taken according to the protocol of the International Society for the Advancement of Kinanthropometry (ISAK)
Figure 1 Measurement of height is the vertical distance from the vertex to the floor.

Figure 2 Measuring height using stadiometer

Figure 3 Arm span is the straight distance between one middle finger to other, when the arms are fully stretched and are parallel to the floor.

4. RESULTS AND DISCUSSION

SPSS 16 version was utilized. Normative test was done. Pearson correlation was used to test correlation between these measures. Table 1 describe Mean standing height of Male and female participants of this study. Table 2 describe Mean arm span of Male and female participants of this study. Table 3 describes correlation values of arm span and standing height of participants. Figure 3 explains bar diagram of gender variation of observed variables.
Table 1 Mean standing height of Male and female

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<th>Male</th>
<th>Female</th>
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<tr>
<td>Mean</td>
<td>167.93± 6.98 cm</td>
<td>157.38±6.96 cm</td>
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Table 2 Mean arm span of Male and female participants

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<th>MALE</th>
<th>FEMALE</th>
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<tr>
<td>Mean</td>
<td>176.22±8.90 cm</td>
<td>161.93±8.56cm</td>
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Figure 4 Bar diagram of gender variation of observed variables

Table 3 Correlation values of arm span and standing height of male and female participants.

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<th>Male</th>
<th>Female</th>
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<tr>
<td>Corr</td>
<td>r= 0.826</td>
<td>r= 0.890</td>
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<td></td>
<td>Correlation is significant at the 0.01 level</td>
<td>Correlation is significant at the 0.01 level</td>
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5. DISCUSSION

This study contributes to a very important update of average body heights among males and females. The mean height of male participated in this study was 167.93± 6.98 and female was 157.38±6.96. The results of the studies which were done before are also very similar to the correlation obtained in the present study (male: r=0.826; women: r=0.890). The correlation is significant at 0.01 for both male and female. This study result goes in accordance with other studies that has been done in the region of Punjab, West Bengal and Gujarat[1, 2, 13]. This study which was carried out in Dakshina Kannada district, Karnataka too reports that arm span is little longer than overall subjects standing height[13].

Even though correlation which was obtained is similar the values of height obtained are substantially different from other population. This study is on unbiased mixed homogenous young adults. Though racial and ethnic factors are known to influence the measurements, no such grouping was done in the study because it is beyond the scope of the present work. The obvious limitation of this study was composition of the measured sample consisted of only 153 subjects and all are college students. Therefore it is necessary to do a separate research for each population on account of ethnic difference and wider age range using bigger sample for prediction of body height utilizing arm spans measurement.

This study would be of special importance in certain circumstances, such as obtaining height of non-ambulatory persons. This would also be used by the anthropologist, equipment's designers, ergonomists and dress designers, etc.

6. CONCLUSION

1. Height and arm span have strong correlation in young adults.
2. Arm span can be used as reliable parameter for predicting height in young adults.
3. It can be useful for predicting height changes due to abnormal condition in skeletal system.
7. Acknowledgements
I am grateful to my parents, my teachers and friends who helped me in a different way throughout my study.

8. REFERENCES