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Correlation between ARM Span and Height in Age Group of 21-23 Years

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ABSTRACT

Objectives: The height of an individual is an important parameter in a person's identity. However, in some situations like lower limb deformities, amputations, or in accidents or mass disasters, where mutilated parts of the body are available, measurement of height in the upright position is not possible and here the anthropometry becomes an important aid.

Method: In the present study, we included 200 young, healthy medical students of 21-23 years. Out of these 100 were male and 100 were female students. Their height and arm span were calculated in cms using standard procedures.

Observation: The data were subjected to statistical analysis. The mean, standard deviation, and standard error of the mean were calculated and the regression equation was derived for the height of males and females separately as **Male: $Ht=78.233+(0.534)As$; R-value=0.702** **Female: $Ht=18.802+(0.861)As$; R-value=0.878**

Conclusion: Thus It can be concluded that there is a correlation between height and arm span of an individual. And the arm span becomes one of the important and most accurate measures to find the height of a person.

Key Words: Height, Arm span, Correlation, Regression Equation, Mutilated Body parts

INTRODUCTION

Identity of a person may be defined as a distinctive characteristic belonging to any given individual. It is the birthright of every individual. An individual is identified by his age, sex and stature. These three are the most primary characteristics for the identification of any individual.¹

Height of an individual is not only an important parameter in the determination of basic energy requirement, but also in measurement of physical capacity and for adjusting the drug doses. Apart from this, height is, also important in predicting age-related loss in stature, identifying the person with disproportionate growth abnormalities and skeletal dysplasia or height loss during a surgical procedure on spine. Also, it is important in normalizing pulmonary functions in Scoliosis.²

However in some situations height cannot be determined directly in standing upright position, because of Limb deformities or amputations. Or in medico-legal cases like decomposed bodies, mutilated bodies, in cases of mass disasters earth quacks, aircraft crashes etc, where the whole body is

not available. To measure the height of such a person, anthropometry becomes an important aid.^{2,3}

In such cases estimation of height is done by using various body parameters such as arm span, hand length, foot length, demi span etc. Among all the parameters for estimating the height of an individual, total arm span is the most accurate one.

The present study has been carried out to find the correlation between the height and the arms span, in the age group of 21 to 23 years and to derive the regression equation for the same.

MATERIAL AND METHODS

This study has included 200 healthy, young medical students of our Institute ageing 21-23 year, without any gross skeletal abnormality. Out of 200 students, 100 were male and 100 were female students. Students with any Orthopedic problems such as Scoliosis, Kyphosis, deformities of limb, joints or muscle pathology, and students with medi-

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cal conditions like Osteoporosis, Metabolic diseases and cancer were excluded from this study.

After the ethical committee clearance and after getting the informed consent from the students, the height of each student was calculated using Stadiometer to the nearest 0.1 cm.

The height was measured from Vertex(it is the highest point of the skull cap on Sagittal suture) up to the floor in standing upright position with feet together and heels, buttocks and back touching the Stadiometer. Head was kept in Frankfort's horizontal plane. Two such readings were taken for each student and average of both the readings was considered as final height in cms.¹

The arm span was also measured from the tip of the middle finger of the left hand up to the tip of the middle finger of the right hand, when arms were raised parallel to the ground at shoulder height, at 180degrees, when standing at the leveled concrete floor with heels, buttocks and back touching to the wall and palms facing forward. This length was measured twice with calibrated steel tape to the nearest 0.1 cm and then the average was taken as the final arm span in cms.

The mean, standard deviation and standard error of mean were calculated for height and arm span of males and females."t" test for significance was applied and the regression equation was calculated for both the sexes.

OBSERVATION

In this study, a total of 200 young healthy medical students of age group 21-23 years were studied for the correlation between height and arm span. Out of 200 students, 100 were male and 100 were female students.

In males the maximum height in cm was 180 and minimum 145 with a mean of 172.167, while in females maximum height was 170, minimum height was 145 and the mean height was 157.190.

Figure 1 and 2 shows the frequency diagram of height in 100 males and 100 females respectively.

The mean arm span in cm was 175.906 in males and 160.730 in females. Figure 3 and 4 shows a frequency diagram for the arm span in males and females respectively.

Figure 1: Frequency Diagram of Height in Male.

Figure 2: Frequency Diagram of Height in Female.

Figure 3: Frequency Diagram of Arm Span in Male.

Figure 4: Frequency Diagram of Arm Span in Female.

Table 1: Shows values of mean, standard deviation and standard error of the mean for height and arm the span in both the sexes.

	Sex	Number	Mean	S.D.	Standard Error of Mean
HEIGHT	F	100	157.190	6.3172	0.8934
	M	100	172.167	5.5709	0.8041
ARM SPAN	F	100	160.730	6.4406	0.9108
	M	100	175.906	7.3185	1.0563

T-test for significance was applied for the above data.

Table 2: Shows the results of the T-test

	F-Value	Significance (P-value)	95% confidence interval
HEIGHT	0.424	0.000	-17.3687 to -12.5846
ARM SPAN	2.261	0.000	-17.9377 to -12.4148

Table 2 T-test for significance

From the above data, the regression equation was derived as under.

Total: $Ht = 21.607 + (0.850)As$; $R\text{-value} = 0.909$

Male: $Ht = 78.233 + (0.534)As$; $R\text{-value} = 0.702$

Female: $Ht = 18.802 + (0.861)As$; $R\text{-value} = 0.878$

DISCUSSION

Anthropometry is the scientific study of measurements and proportions of the human body.³ After birth the physical growth occurs in terms of increase in height and weight. However, once the epiphyseal plates in the bones fuse a person generally will not grow any taller. Most females reach their adult height between the age of 16 to 18 and most males reach their full height by the age of 17 to 19. It is very unusual for a person to grow after the age of 19.¹

Growth including height and weight can be affected by nutritional factors, environmental factors and genetic factors. A significant role is played by genetic factors especially the HMGA2 gene. Correlation between mother and son, father and daughter has been stated by genetic studies. On an average adult males are taller than adult females. The tallest race of humans is Nilotic people of Sudan. Where most of the males' average height is 1.9 m (6 feet and 3 inches) and females are about 1.8 m (5 feet 11 inches). It has been found that the length of certain long bones is proportionate to the height of a person. Once the skeletal maturity is complete the proportion does not alter with age. Thus after skeletal maturity, along with age and sex, the height of a person becomes an important parameter in an individual's identity.^{4,5}

Several studies have been carried out for co-relation of height with different parameters like arm span, demispan, hand length, knee-length, or foot length.

Pinki Rai et al.(2015)³ have studied co-relation of arm span with height in different age groups .where as

LG KithminiKasunka and colleagues (2015)⁴ studied the correlation between height and arm span in young adults of 20-25 yrs age group. Both have concluded that the arm span is the most reliable indicator for estimation of height and can be used to predict the height changes due to abnormal conditions in the skeletal system.

Amandeep Singh and his colleagues (2012)⁶ studied the use of arm span and foot length for height estimation in 400 medical students of the age 21-24 yrs from the northern part of India whereas Monika S.Malli(2015)⁷ used arm span and

hand length for estimation of height both have concluded that these parameters are very well correlated with the height of a person and can be used in the estimation of it.^{6,7}

SP Mohanty (2001)² worked to estimate the height of south Indian women by using arm span. He found that the mean arm span in females was 159.14 cms and mean height was 156.88 cm these findings are quite comparable with a present study which shows the mean arm span in females, of 160.730 cm and mean height of 157.190 cms. The R-Value estimated by SP Mohanty and colleagues was 0.8743 which is comparable with present study where R-Value is 0.878.1

Table 3: Shows that the values of height and arm span of females are coinciding in both the studies.

	S.P.MOHANTY (mean in cms)	PRESENT STUDY (mean in cms)
ARM SPAN		
FEMALE	159.14	160.730
HEIGHT		
FEMALE	156.88	157.190
R-value	0.8743	0.878

Ritesh K Shah (2013)⁸ studied co-relation between stature and arm span in the Gujarat region. In his study of 150 MBBS students, he derived the regression equation for the height of males and females.with the R-value of 0.7061 and 0.8661 respectively. These values are quite comparable with the present study, where the R-value was 0.702 in males and 0.878 in females.

Table 4: Shows the comparison between the findings of R.K shah and colleagues and the present study

	R.K.shah (mean in cms)	PRESENT STUDY (mean in cms)
ARM SPAN		
MALE	178.1764	175.906
FEMALE	162.3090	160.730
HEIGHT		
MALE	175.9472	172.167
FEMALE	161.1141	157.190
R-value	M:0.7061 F:0.8661	M:0.702 F:0.878

CONCLUSION

Height is an important parameter for the identification of an individual and it can be concluded that arm span is one of the most reliable anthropometric measurements by which we

can estimate the total height of any individual using regression equations.

Also in medicolegal cases, in mass disasters where the whole body is not available, and in cases of skeletal abnormalities, arm span measurement can help us to estimate the height of a person, thereby helping us to move one step forward in the identification of any individual.

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