ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Arm Span as Predictor of Stature among Indian Population.

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ABSTRACT

Stature can be easily measured and widely used as anthropometric parameter in clinical medicine and in field of scientific research, such as calculation of body mass index, basal metabolic rate, and Creatinine Height index and for assessing pulmonary function tests. Anthropometric parameters show variations in different populations according to sex, genetics, geography, race, religion, nutrition, and socioeconomic condition of local population. The sample size taken was 350 students. Study group involved 20-22yrs of age group, 163 were males and 187 females. Anthropometric measurements of armspan and standing height were conducted and recorded in centimetres scale nearing to 0.1cms. The relationships between body height and arm span were determined using correlation coefficients**.** The mean difference in south females is 2.5cm, north females is 2.5 cms while In south males it is 2.7cm and north males it is 3.0 cms.The relationships between body height and arm span are high and significant in the sample, regardless of sex. The high values of the regression coefficient signify that arm span significantly predicts body height in both sexes.

Keywords: Armspan, Stature, Standing height, Anthropometric measurements.

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INTRODUCTION

Stature can be easily measured and widely used as anthropometric parameter in clinical medicine and in field of scientific research, such as calculation of body mass index, basal metabolic rate, and Creatinine. Height index and for assessing pulmonary function tests. It is also used as an indicator of nutritional status during growth in childhood and to assess body surface area for drug usage and renal clearance [1, 2]. Anthropometric parameters show variations in different populations according to sex, genetics, geography, race, religion, nutrition, and socioeconomic condition of local population [3].

Measurement of the height of patients is required for determination of basic energy requirements, standardization of measures of physical capacity and for adjusting drug dosage [4]. Standing height is an essential variable in most of the regression equations for deriving predicted normal lung function values.

However, in some situation the exact height cannot be determined directly because of deformities of the limbs due to neuromuscular diseases or in patients who have undergone amputations. Then, an estimate of the height can be computed by taking other body parameters. Arm span is the most reliable body parameter for predicting the height of an individual. This difficulty may be encountered also in critically ill patients who are monitored in ICU where many indexes are calculated using height. Arm span and sitting height have separately been proposed as surrogate variables, and they generally provide relatively good correlation with Standard height [5]. Inter and intra population variations may be observed in relation to anthropometry due to factors such as genetic makeup, age, gender and ethnicity [1]. The objective of the study was to see the correlation between height and arm span in north and south Indians.

MATERIAL AND METHODS

The study group involved the students of first year medical, dental and nursing courses, studying at Sree Siddhartha University, Tumkuru, Karnataka. Ethical approval was obtained from the Ethical clearance Committee. Informed consent was obtained from the candidates. The demographic data collected from the subjects included age in years, name, place of dwelling, was completed in a questionnaire. Totally the sample size taken was 350 students. Study group involved 20-22yrs of age group, 163 were males and 187 females. Anthropometric measurements of armspan and standing height were conducted and recorded in centimetres scale nearing to 0.1cms. Stature is measured as the maximum distance from the point where the heel touches the floor to the highest point of the head while the person is in erect position.

Standing height was measured with the individual standing barefoot on the platform of the stadiometer with the upper back buttock and heels pressed against the upright position of the instrument. The subject's head was placed in the Frankfurt horizontal plane, and the head plate was brought into firm contact with the vertex. Arm span was measured with a flexible steel tape with measurements nearing to 0.1cms, from the tip of the middle finger on one hand to the tip of the middle finger on the other hand with the individual standing with her back to the wall with both arms abducted to 90 degrees, the elbows and wrists extended and the palms facing directly forward. To minimise intra-observer error, all measurements were obtained in duplicate. Students with physical deformities that could affect body height or armspan were excluded.

Statistical Analysis

Data collected was entered in Microsoft Excel 2007 and analysed using Epi Info version 3.4.3. Descriptive statistics such as, Mean, range and standard deviation was calculated. Correlation coefficient was calculated to determine the degree of association between height and arm span. Linear Regression analysis was done to predict the height using arm span measurement.

RESULTS

Totally sample size taken included 46.57% of males and 53.43% of females as shown in table1. In both genders mean arm span is higher than the mean stature as shown in table 2. The mean difference in south females is 2.53cm, north females is 2.49 cms, while In south males it is 2.7cm and north males it is 3.06 cms. A highly significant correlation between stature and armspan was observed in both genders as elicited in table 3. The relationships between body height and arm span are high and significant in the sample, regardless of sex.

These relationships were plotted as scattered diagram (Fig 1 and Fig 2). The high values of the regression coefficient signify that arm span significantly predicts body height in both sexes.

Table 1: Distribution of study subjects according to sex and age.

Sex	South		North		Total	
	Frequency	%	Frequency	%	Frequency	%
Male	122	45.52	41	50	163	46.57
Female	146	54.48	41	50	187	53.43
Total	268	100	82	100	350	100

Table 2: Anthropmetric measurements of the study subjects.

		Height		Arm span	
		Range	Mean ±SD	Range	Mean ±SD
South	Male	155.8-189	171.60±6.94	156.4-193	174.30±7.31
	Female	139-177	159.01±6.38	141-179	161.54±6.56
North	Male	158.4-179	168.66±5.46	159.3-183.5	171.66±5.83
	Female	145-175	158.33±5.56	146.3-177	160.82±5.58
	Total	139-189	164.47±8.79	141-193	167.11±9.05

Table 3: Correlation between Height and Arm Span.

		Correlation coefficient (r)	95% confidence interval	P value
South	Male	0.98	.97 to .99	<0.000***
	Female	0.97	.96 to .98	<0.000***
North	Male	0.96	0.93 to.98	<0.000***
	Female	0.95	0.90 to .97	<0.000***

*** Highly significant

Results of linear regression analysis where the arm span predicts the body height.

North female

Height = 6.34 + 0.945 Arm span ± 8.198

North male

Height = 13.73 + 0.902 Arm span ± 6.914

South female

Height = 6.92 + 0.942 Arm span ± 3.30

South male

Height = 9.64 + 0.929 Arm span ± 3.104

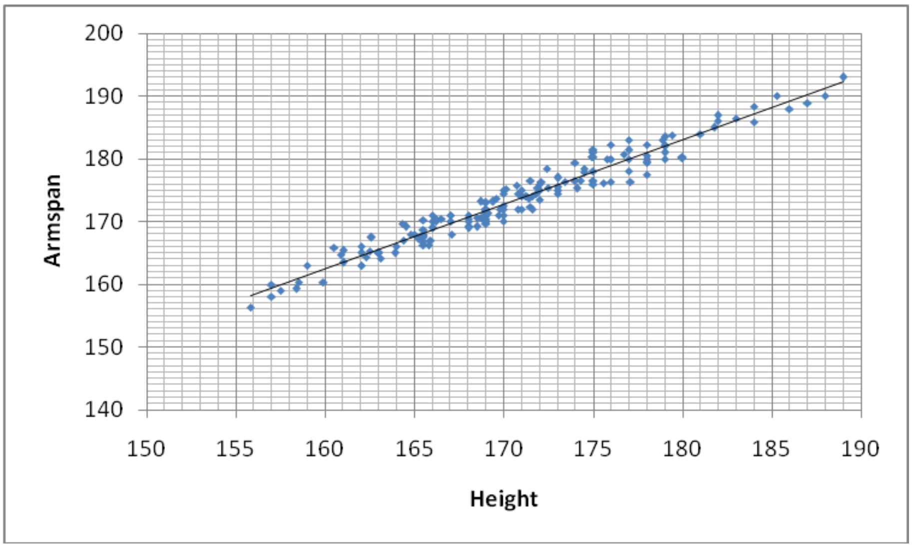

Figure 1: Scatter Diagram showing relation between Height and Arm Span in males.

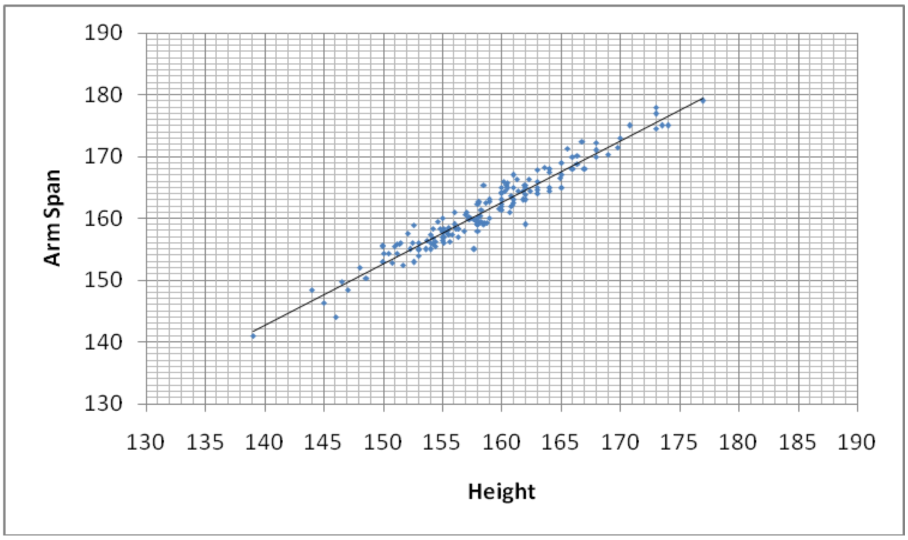

Figure 2: Scatter Diagram showing relation between Height and Arm Span in Females.

DISCUSSION

Stature is one of the most important elements of identification of an individual. Establishment of the identity of an individual is essential in cases when only fragmentary remains of human body found during mass disasters like bomb blasts, aeroplane crash, Stampede, tsunami, earthquake, flood, Cyclones, Terrorist attack, close Compartment fire, wars, public vehicle(train, bus, ship, plane *etc*)[3].

Anthropometric measurements provide simple, non-invasive methods to assess the nutritional status of populations. When measurements for stature cannot be taken accurately, other anthropometric measurements which play a important role are arm span, knee height, foot length, hand length and so on. This study analyses the correlation coefficients of stature and arm span of students aged 20 -22 years. Regression equations are hence developed to predict stature. Many authors have estimated body height from various anthropometric measurements, but it is noted that arm span is the most reliable body indicator for Predicting body height of an individual [4, 6].

A study by Mohanty *et al* on 505 healthy women of 20-29 years shows significant correlation between arm span and height of individual. He also noted in their study that the arm span was nearly 2.5 cm more than the body height in South Indian females [4]. Similar observations were made by patel et al where they found highest correlation between stature and Arm span (r=0.908) in study [3]. The one variable that proved to be consistently reliable in estimating height was the arm span. In Steele and Chenier's study [7] the arm span was nearly 8.3 cm more than the body height for black population, whereas for white population this difference was only 3.3 cm. In Ter Goon et al., study, arm span was 5.8 cm more than body height for Nigerian males whereas for Nigerian females this difference was only 4 cm [8]. In study by Bjelica et al., the arm span was 2.5 cm more than body height for Montenegrin males, whereas for Montenegrin females this difference was only 0.24 cm but in favour of body height [9]. it is known that the values of arm span and height varies from race to race, and also in different ethnic groups. Different studies thus show that height models framed are separate in different population group. In present study, the mean difference obtained was 2.5 cms in both south and north females .in males it varied from 2.7cms in south and 3cms in north population. Intersexual measurements illustrated that Males were taller and had longer arm spans than females. Similar observations were noted in study done by Sudip Datta Banik [10].

Armspan is considered a useful alternative to height, particularly in the elderly, since armspan does not vary significantly with age. Several studies demonstrated that armspan measurements exceeded height measurements in all the ethnic groups and in both sexes [11-13].

Other studies have found that armspan correlates better with height than do other long bone measurements such as knee height [12, 14]. Moreover, it is an inexpensive and simple measurement to obtain in a field setting. The arm span was 5%-6% greater than the height. The difference increased with increasing height. Among several methods of estimating height from the arm span, prediction by regression is most appropriate as it gives least errors in interpretation of spirometric data [15]. In the present study also regression analysis shows significant values for the anthropometric measurements.The results of present study would have been more accurate if north Indian population sample size was more.

CONCLUSION

Arm span was found to be an effective surrogate measure for BMI. Armspan is useful in predicting age-related loss in stature, disproportionate growth abnormalities, skeletal dysplasias and also progressive deformities of the spine or changes following surgical correction of spinal or thoracic cage abnormalities. In this study we have tried to establish arm span as an alternative measure for computing height. Statistical analysis reveals that arm span can be used as a better measurement in assessment of height.

ACKNOWLEDGEMENT

I thankfully acknowledge the help and cooperation extended by the subjects who took part in the investigation. I would like to appreciate specially Dr Raveesh PM, and Dr Mahesh SH , Asst Professor, Dept of Community Medicine, Sri Siddhartha medical college Tumakuru Karnataka for their kind help and support.

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