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Biacromial Breadth: A Tool to Measure Stature

Authors
Dr Parul[1], Dr Monica Jain[2], Dr Lovesh Shukla[3], Dr Dalbir Kaur[4]
[1]MD Anatomy, Demonstrator, Department of Anatomy, MAMC AGROHA, Hisar, Haryana
[2]MD Anatomy, Professor, Department of Anatomy, MAMC AGROHA, Hisar, Haryana
[3]MS Anatomy, Senior Professor and Head of Department, Department of Anatomy, MAMC AGROHA, Hisar, Haryana
[4]MD Anatomy, Associate Professor, Department of Anatomy, MAMC AGROHA, Hisar, Haryana

Abstract
Background: *Stature is one of the biological characteristics often used in forensic anthropology.*
Aim: *To determine the relationship of stature with bi-acromial breadth in North India and to derive regression equations for estimation of stature in males and females.*
Material and Methods: *The present study was conducted on 150 male and 150 female, in the age group of 20-40 years. Anthropometer rod was used for measurement of stature of the subject. Bi-acromial breadth was measured with the help of spreading calliper.*
Results: *Linear regression analysis was performed and regression equations for predicting stature from bi-acromial breadth were derived. Correlation coeffcient for predicting stature from bi-acromial breadth were 0.49 and 0.31 in males and females respectively.*
Conclusion: *This study provides an additional tool of stature estimation particularly in absence of other measures.*
Keywords: *Stature, Bi-acromial Breadth, Anthropometer Rod, Spreading Calliper.*

Introduction

Stature is one of the most used anthropometric dimension. Stature estimation from various measurements like foot length and breadth, hand length and breadth and length of long bones have been extensively studied in different populations by various authors.[1-4] The literature available for stature estimation from bi-acromial breadth (BAB) is scanty.[5-9] The upper part of dorsal surface of scapula has a large bony projection called spinous process or spine of scapula. Acromion process is the continuation of lateral end of spine of scapula.[10] Bi-acromial breadth is the distance between "acromiale point'' on each scapula, which is the most lateral point on the acromion process. This length was measured in subjects in an erect posture and arms hanging down by the sides of the body.[11] The present study was undertaken to estimate the correlation between stature of an individual and BAB, both in males and females.

Material and Methods

The present study was conducted after permission from Institutional Ethical Committee on 300 subjects (150 male and 150 female) between 20-40 years of age. Subjects were the willing attendant of patients attending the outpatient department of the hospital of Maharaja Agrasen Medical College, Agroha, Hisar (Haryana).

Individual with apparent physical deformity, growth and developmental defects were excluded from the study. The aims and objectives of study and procedures were explained to subjects in their own language and a written consent was obtained from them in pre-approved and predesigned format. Stature was measured using anthropometer rod (minimum count 0.5 mm) while BAB was measured using round tipped spreading caliper (minimum count 0.5 mm). Data was recorded on computer and analyzed statistically using SPSS software (version 20.0).

Measurements

- Stature was measured by making the subject to stand bare footed on a horizontal platform in erect posture, keeping the head in Frankfort horizontal plane. It was measured as a vertical distance from the vertex of the subject to the floor on which subject is standing. Movable horizontal piece of anthropometer rod was brought in contact with the vertex in mid-sagittal plane and stature was recorded. [11]
- BAB was measured by making the subject to stand erect with arms hanging down on the sides of body. By standing behind the subject, acromiale of both sides were felt and marked with the help of skin marking pencil. It was measured by placing the round tipped spreading caliper on marked points.

Observations and Results

Table 1: Showing range, Mean, SD, SE of stature and BAB in male and female

Sex	Stature (mm)				BAB(mm)			
	Range	Mean	SD	SE	Range	Mean	SD	SE
Male and female combined	1400-1800	1598.53	95.76	5.52	220-394	308.26	28.45	1.642
Male	1480-1840	1668.00	67.83	5.53	250-394	320.98	24.11	5.538
Female	1400-1720	1529.07	63.91	5.21	220-352	295.53	26.77	1.969

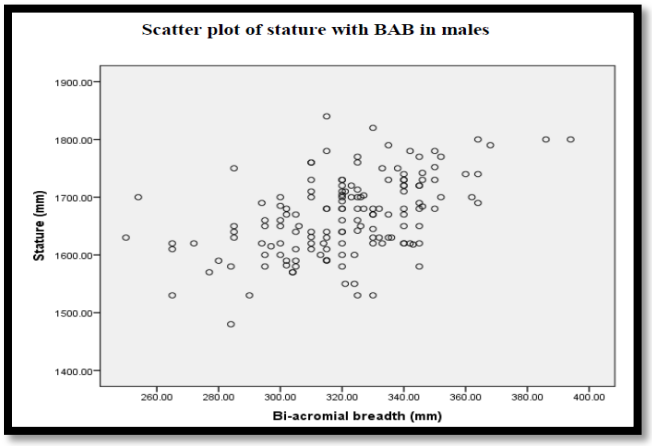
To estimate stature from BAB, regression equations were derived separately for male and female separately as well as together. [Table 2]

$Y = x \times b + c$ (Y = stature, x=BAB, b = regression coefficient, c = constant)

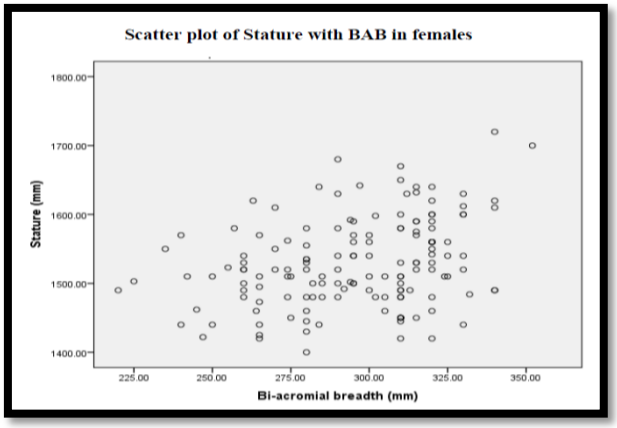
Table 2 Showing Regression equations, correlation coefficient and 95% confidence interval for stature estimation from BAB in male and female

	Regression equations	Correlation coefficient r	95% confidence interval
Male & Female combined	Stature = BAB × 1.920 + 1006.54	0.571	1.605-2.236
Male	Stature = BAB × 1.389 + 1223.744	0.492	0.986-1.782
Female	Stature = BAB × 0.746 + 1308.484	0.313	0.378-1.1150

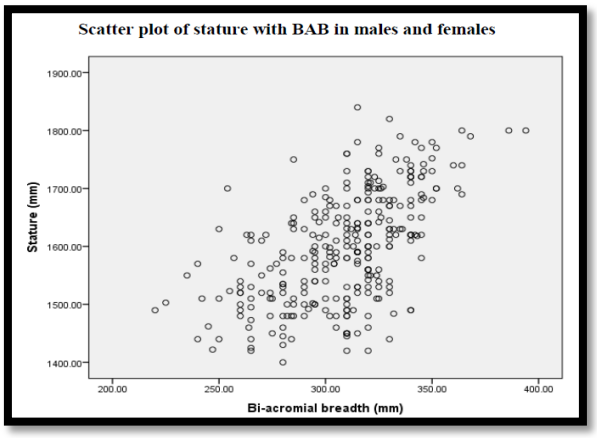
Statistically significant correlation was observed between stature and BAB in both sexes. Correlation between stature and BAB in males and females were 0.49 and 0.31 respectively. In males and females together it was 0.57. (Scatter plot 1, 2 and 3)



Scatter plot 1 showing correlation of stature with BAB in males.



Scatter plot 2 showing correlation of stature with BAB in females.



Scatter plot 3 showing correlation of stature with BAB in both males & females.

Discussion

BAB is not so frequently used tool to estimate stature. In various studies, BAB is more in males as compared to females irrespective of race, geographical area and socioeconomic status as in present study.[5-9] Males in comparison to females, tend to develop broader shoulder from onset of puberty as shoulder growth spurt is more marked in them. This may be due to fact that cartilage cells in shoulder region are specialized to respond to male sex hormone testosterone. [12]

A wide range of BAB is being measured ranging from 284.5-445 mm and 230.3-403 mm in male and female population respectively by different workers [table 3]. These findings of present study are close to the findings of Koulapur and Mestri. Genetic drift may be responsible for this type of diversity of physical anthropological variation between different populations. [13]

Table 3 Showing Comparison of range and mean of BAB in different studies

Name of Researchers	Geographical area of study group	Age group (years)	Sex	Range of BAB (mm) Min	Max	Mean of BAB (mm)
Momonchand & Devi	Imphal, India	21-86	M	350	510	445.0
			F	320	480	403.0
Koulapur & Mestri	Karnataka, India	Around 23	M	302	402	342.0
			F	256	330	299.0
Patel *et al*	Gujarat, India	22-44	M	350	489	412.0
			F	300	460	370.0
Mishra *et al*	Madhya Pardesh, India	22-27	M	262	377	319.4
			F	262	339	294.7
Ozaslan *et al*	Turkey	20-52	M	273	458	386.0
		20-49	F	273	412	349.0

Apart from India, studies have been conducted on other populations like on Turkish one by Ozaslan et al and on Sri Lankan population by Balasuriya. [14] Mean BAB of both males and females of present study are lesser than that of Turkish and Sri Lankan populations. Turksih are tall statured and well built[15] similarly Sri Lankan population is Dravidians which is better built as compared to Indo-Aryans population of present study.

Correlation coefficient of regression equations for estimation of stature from BAB in males is less as compared to the study of Shah et al (0.56), while it is comparable with the study of Koulapur and Mestri. (0.50). Whereas in females, correlation coefficient is less as compared to the study of Momonchand and Devi (0.45), Koulapur et al (0.60) and comparable with the study of Mishra et al (0.32).

Various researchers have found significant correlation between height and different parts of body. Jadhav and shah derived regression equations between head length and height in Gujarat region and correlation coefficient between height and head length came out to be 0.53 which is significant. [16] In a study done by Patel et al for estimation of stature from hand length, positive correlation was found to be significant (r=0.51 in males and r=0.50 in females. [17]The highest correlation coefficient was observed in the study done using foot length as a tool for stature estimation by Charnalia et al (r=0.95) [18] while in females it was observed by Supare et al (r=0.90) using arm span [19] as a tool for stature estimation. The correlation coefficient with clavicle in a study done by Jit and Singh came out to be 0.56 in males and 0.68 in females. [20]

Conclusion

There exists a significant correlation of stature with bi-acromial breadth of an individual in both the sexes. Stature can be estimated with bi-acromial breadth even when only upper parts of trunk are is available. The present study explores the usability of dimensions of upper trunk as predictor of stature in population of Haryana. These data can be very useful for anthropologists and medicolegal experts in identification of individuals as many times (in bomb blast/ rail accident/ airplane crashes, murders) only trunk of individual is available for identification.

Limitations

Our main limitation was small sample size and we had covering a small part of India (Northern Region)

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Conflicts of Interests: None

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