

Anthropometric Relation between Height and Arm Length in Adult Male Population of Faridabad, Haryana

Maheshwar Chawla¹, Munish Khanna²

^{1,2}Department of Anatomy, GFIMSR, Faridabad, Haryana, India

Abstract: *Determining height of an individual from the skeletal remains is one of most important task of an anthropologist. Numerous studies have done to estimate height from the arm span but few have focused on arm length. Our study has established a correlation between the arm length and the height of subjects; the study subjects were adult males in Faridabad, Haryana. Arm length and height of the subjects were measured anthropometrically. The results of this study provide a regression formula between arm length and height of an individual and are statistically significant.*

Keywords: Anthropology, Anthropometry, Height, Arm length, Adult male, Haryana

1. Introduction

Biological, evolutionary and demographic aspects of human race are studied under Physical anthropology which is one of the subbranches of Anthropology[1]. Physical anthropology involves measurement of various physical parameters, referred to as anthropometric parameters. Knowledge of these parameters is helpful in the process of identification. Height or stature is one such anthropometric parameter[2,3].

Estimation of height from the skeletal remains like amputated limbs has obvious significance in medicolegal cases, accidents or natural disasters[4,5]. In such cases, limb length is measured and it has been observed this represents a certain relationship in form of proportion to the total height[6].

It has also been observed that arm length is less affected than height by the aging process, hence it provides a more accurate reflection of height while performing nutritional assessment in the elderly[7].

In India various ethnic groups inhabit different climate and ecological conditions; hence no single formula is suitable for calculating height. It is for this reason; different formulae are required for different ethnic groups[6]. The present study was conducted in northern Indian state, Haryana as no such data is available for this region. The study focused on measuring arm length and tried establish a relationship between arm length and height.

2. Objectives

The present study was conducted in the department of Anatomy, GFIMSR, Faridabad with following objectives

1. To establish the relationship of arm length with the height of an individual.
2. Finding a formula to estimate height from arm length

3. Material and methods

Procedure was adopted from Singh and Bhasin (1968)[8]. Anthropometer was used to measure arm length and height

of 100 adult males of Faridabad, Haryana, between the age group of 18 to 25yrs. Anthropometer is the most commonly used instrument for anthropometry and is used to measure height as well as transverse breadths and limb lengths.

3.1 Inclusion & Exclusion Criterion:

Male population of age group 18-25 years who were born and brought up in Haryana were included and individuals with apparent physical deformities/growth and developmental defect were excluded.

Landmarks for Anthropometric Measurements

3.2 Acromion

It is lateral most point on the lateral margin of the acromial process when subject stands in normal position with his arm hanging by sides.

3.3 Stylium

It is the deepest point on the styloid process of radius while the arm is hanging by the side of the subject (stylium radiale). Stylium ulnare is the most distal point on the styloid process of ulna. It is located on the little finger side of the wrist.

3.4 Vertex

It is the highest point on head when the head is in eye ear plane
Bony land marks were marked with a marker and then measurement were taken.

Measurements

3.5 Height

It measures the vertical distance from the vertex to floor. During these measurements subjects were asked to stand erect barefoot on a level floor against the wall with their back and hip touching the wall. The feet were parallel to each other and their heels were touching the wall. The anthropometer was kept in the median saggital plane of the subject and the reading was taken at the upper border of

movable socket when the point of the cross bar was touching the vertex.

3.6 Arm Length without Hand (AL)

It is the straight distance between acromion and styloid. All the measurements were taken on both sides and measured in millimeters

4. Statistical Analysis

The obtained data was analysed statistically with the help of SPSS/PC + Version 11.0

5. Results

In the present study, data on arm length and height of 100 adult males of Faridabad, Haryana, between age group of 18 to 25 yrs, was collected (Tables 1&2). Findings were subjected to statistical computation and results have been presented in the form of tables as given below.

Table 1: Height and arm lengths (left & right side) with mean and standard deviation

Measurements	Mean \pm SD (mm)	N
Height	1752.16 \pm 64.41	100
Arm Length (L)	558.95 \pm 32.69	100
Arm Length (R)	558.49 \pm 32.91	100

Table 2: Coefficient of correlation of different anthropometric parameters

Para-meter	Height	Arm length (L)	Arm length (R)
Height	1	0.752**	0.756**
Arm length (L)		1	0.997**
Arm length (R)			1

** Highly significant ($p < 0.01$).

5.1 Height

Refer to tables 3 & 4

Table 3: Regression equation for height (in mm)

Equations (in mm)	'r' value	'p' value	SE of estimate
$922.92 + 1.48$ (AL Left Side)	0.752	0.00	42.06
$925.08 + 1.48$ (AL Right Side)	0.756	0.00	42.31

AL: Arm length

SE: Standard Error

Table 4(a) Mean, Standard Deviation and Range of Height (mm) .

Subject	HEIGHT (mm)		Range (mm)	
	Mean	SD	Minimum	Maximum
100 males	1752.16	64.41	1640	1950

Table 4 (b) Correlation of Height with different parameters. Arm length is also correlated having r values 0.752 and 0.756 for left and right respectively.

Parameters	'r' values	'p' values
Arm Length (L)	0.752	HS
Arm Length (R)	0.756	HS

HS(Highly significant $p < 0.01$)

5.2 Arm length of left side:

Refer to table 5.

Table 5(a): Mean, standard deviation and range of arm length of left side (mm). Mean arm length of left side is 558.95 mm with a SD of 32.69. Range of Arm Length of Left side is 494-536mm.

Side	Arm Length (mm)		Range (mm)	
	Mean	SD	Minimum	Maximum
Left Side	558.95	32.69	494	536

Table 5(b): Correlation of arm length of left side with other parameters. Arm Length of Left side is correlated to Height having ($r = 0.752$). it is also correlated with arm length of right side having r value of 0.997.

Parameters	'r' values	'p' values
Height	0.752	HS
Arm Length (R)	0.997	HS

HS (Highly significant $p < 0.01$)

Regression equation of Height (mm) from arm length of Left side in male students of Faridabad of Haryana origin
 Height (mm) = $922.92 + 1.48$ (arm length of Left side in mm)

5.3 Arm length of right side: Refer to table 6

Table 6: Mean, standard deviation and range of arm length of right side (mm). Mean Arm Length of Right side is 558.49 mm with SD of 32.91. Range of Arm length of Right side is 490-637.

Side	Arm length (mm)		Range (mm)	
	Mean	SD	Minimum	Maximum
Right Side	558.49	32.91	490	637

Table 7: Correlation of Arm length of Right side with other parameters. Arm length of Right side is correlated to Height having ($r = 0.756$), it also correlation with arm length of left side having r value of 0.997.

Parameters	'r' values	'p' values
Height	0.756	HS
Arm Length (L)	0.997	HS

HS(Highly significant $p < 0.01$)

Regression equation of Height (mm) from arm length of right side in male Population of Faridabad, Haryana.
 Height (mm) = $925.08 + 1.48$ (Arm Length of Right side in mm)

6. Discussion

Studies correlating arm length and height have been done earlier[9]. However, no such data has been found for adult males of Haryana. The present study was aimed at establishing the relationship of arm length with height; the aim achieved as detailed hereunder. It is a study on unbiased mixed homogenous male population of Haryana, though racial and ethnic factors are known to influence the measurements, no such grouping was done in the present study because it is beyond the scope of the present work. The present study included 100 male population of Faridabad, Haryana, aged between 18-25 years.

6.1 Height vs. Arm length (left side)

The present study has found that

- a. arm length of left side is correlated to height by a coefficient correlation as 0.752 (Table 3).
- b. height can be estimated from arm length of left side using a regression equation (Table 4) which is as follows
 $Height (mm) = 922.92 + 1.48 (AL \text{ of Left Side in mm})$ (1)
- c. mean arm length of left side is 558.95 (table 2).

6.2 Height vs. Arm length (right side)

The present study has found that

- a. arm length of right side is correlated to height by coefficient of correlation 0.756 (Table 3).
- b. height can be estimated from arm length of right side using a regression equation (Table 4) which is as follows:
 $Height (mm) = 925.08 + 1.48 (AL \text{ of right side in mm})$ (2)
- c. mean arm length in the present study is 558.49 mm (Table 2) for right side

7. Summary and Conclusions

This study has established a baseline data for adult Haryana males, which was not available in accessible literature. This data can be very useful for Anthropologists and medico-legal experts in identification of habitual criminals. Estimation of Height of an individual from skeletal material or from mutilated or amputated limbs or parts of limbs has obvious significance in personal identification in the events of the murders, accidents or natural disasters.

This work will also be important for dieticians for nutritional assessment. This will be useful for health care providers for calculation of body surface area, for drug dosages, vital capacity, basal metabolic rate, renal clearance and body mass index and to standardize measures of physical capacity. The present study will also be useful to recognize certain growth abnormalities.

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Author Profile

Dr Maheshwar Chawla (First author), received his MBBS degree from KMC, Mangalore and MS (Anatomy) degree from GMC, Patiala. He is presently working as Associate Professor in Department of Anatomy, Goldfeild Institute of Medical Sciences & Research, Faridabad.

Dr Munish Khanna (corresponding author) received his MBBS degree from Maulana Azad Medical College, New Delhi and MD (Anatomy) degree from AIIMS, New Delhi. He is presently working as Assistant Professor in Department of Anatomy, Goldfeild Institute of Medical Sciences & Research, Faridabad.