

## Estimation of Stature from Hand Length in Gujarati Population

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### Abstract

*Background:* Identification is the major load in every department of forensic medicine. Stature of an individual is primary data of identification. Identification of an individual from dismembered body parts will help in solving crime as well as in various mass disasters like earth quake, floods and bomb explosion. *Objective:* In this study an attempt is made to estimate stature from hand length. *Study Design:* This is cross sectional descriptive study. *Material and Method:* Stature and Hand length are taken from 100 randomly selected students of M. P. Shah Medical College Jamnagar, out of them 50 were male and 50 were female. They aged between 18-26 years. *Result:* Correlation coefficient and simple linear regression equations are derived to estimate stature from hand length. Hand length in both the sexes exhibit strong and statistically significant relationship.

**Keywords:** Identification; Stature; Hand Length.

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### Introduction

Identification is the main objective in every forensic investigation. Age, sex and stature are known as primary data of identification. Stature of an individual is inherent characteristics. Adult height is commonly attained during teens to twenty. There is an established relationship between stature and various body parts like head, trunk, upper and lower extremities. In cases of mass disasters, accidents and at crime scenes we often find dismembered body parts. Positive identification from such dismembered body parts is a prime challenge. Estimation of stature from such parts will help in narrowing down the list of possible matching persons.

As there is difference in genetic and environmental factors like nutrition, habitat, climate and life style, body proportion of one population varies from other, so different regression equations are needed to be derived for different populations. In this study an

attempt is made to statistically analyse the hand measurements and derive regression equations to calculate stature in Gujarati population.

### Material and Methods

#### (A) Subject

Study sample consists of 100 medical students (Males=50, Females=50), ageing more than 18 years of M. P. Shah Medical college, Jamnagar as subjects. Necessary permission from institutional ethical committee was taken. Subjects were fully explained regarding study design and their voluntariness in participation of study. Only healthy subjects without any disease or deformity that affects stature or Hand length participated in the study.

#### (B) Stature

Stature was measured by stadiometer. Subjects were asked to stand barefooted on platform of stadiometer. Each subject was asked to stand erect with head in horizontal Frankfort plane. Heels of both feet should be in approximation with each other and head, scapula, back, buttocks and heels should touch the back of the board. Horizontal sliding bar was lowered and stature was recorded in cms to nearest mm.

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*(C) Hand Length*

Hand length is defined as distance between midpoint of distal transverse wrist crease to the most anterior part of middle finger. Hand length was taken from each hand using sliding vernier calliper. Hand length was taken when hand was placed in supine position on flat horizontal surface with thumb abducted and all fingers were adducted and extended. Hand length is measured in cms to nearest mms.

*(D) Statistical Analysis*

Statistical analysis was performed on measured data using statistical programme for social sciences. Descriptive statistics for both sexes were calculated. Correlation coefficient and Simple linear regression equations between stature and hand length were derived to estimate stature from hand length in both the sexes. Accuracy of each regression equation is determined by SEE (standard error of estimate).

stature from hand length in both the sexes was found stronger with RHL(Right hand length) >LHL(Left hand length) i.e in male ( $r=0.683>0.583$ ); in female ( $r=0.610>0.534$ ). Correlation to estimate stature from hand lengths in both the sexes from both the sides are statistically significant as p-value is <0.001. Simple linear regression equations to estimate stature from hand measurements were derived as shown in Table 3. Separate regression equations were derived so that stature can be calculated if any right or left hand length is present. From derived equations stature in male can be calculated with an accuracy of  $\pm 4.98$  cms from RHL and  $\pm 5.36$  cms from LHL, in females it can be calculated with accuracy of  $\pm 3.471$  cms from RHL and  $\pm 4.321$  cms from LHL. When mean hand length is used there is no significant difference in actual stature and stature estimated using derived equations (Table 4). At both upper and lower limits actual values of stature differs from calculated values but they were within limits of SEE (Standard error of estimate).

**Result**

Descriptive statistics of age, stature and hand lengths of both the sexes are shown in Table-1. On comparison, stature and hand length showed statistically significant relationship. Mean height of male was found to be  $170.26 \pm 6.38$  cms and for female  $159.36 \pm 6.11$  cms. All measurements are higher on right side than on left side which may be due to dominant right handed subjects in the study group. Correlation coefficient indicating the strength of association between both the variables was calculated in both the sexes for both hand lengths as shown in Table 2. Correlation coefficient to estimate

**Discussion**

Stature is an inherent characteristic of an individual. It is affected by genetic and environmental factors, so it is necessary to have different equations for estimation of stature in different races. In this study we have found significant correlation between stature and hand lengths in both sexes. Correlation coefficient and regression equations were derived. We have found similar findings in various studies carried out on different races at state, national and international levels, findings of which are tabulated below.

**Table 1(A):** Descriptive statistics for stature and hand measurements in male

Variables	Minimum	Maximum	Mean	Standard Deviation
Age (yrs)	19	26	22.52	2.2
Stature (cms)	149.72	186.15	170.26	6.38
Right hand length (cms)	14.68	21.58	18.48	1.304
Left hand length (cms)	14.26	21.04	18.24	1.261

**Table 1(B):** Descriptive statistics for stature and hand measurements in Females

Variable	Male		Female	
	PCC	P-value	PCC	P-value
RHL	0.680*	<0.001	0.610*	<0.001
LHL	0.583*	<0.001	0.534*	<0.001

\*Indicates significant at p-value of 0.001

**Table 2:** Pearson’s correlation coefficient and p-values for estimation of stature from Anthropometric measurement

Variable	Male		Female	
	Linear Regression Equation	SEE	Linear Regression Equation	SEE
RHL	$S=110.27+3.2429 \times RHL$	4.98	$S=85.94+4.021 \times RHL$	3.471
LHL	$S=107.477+3.44 \times LHL$	5.36	$S=83.56+4.25 \times LHL$	4.312

**Table 3:** Linear regression equations to derive stature from Anthropometric measurements

Variable from which stature is estimated.	Minimum	Maximum	Mean
RHL	157.87	181.48	170.19
LHL	155.04	177.67	169.62
Actual stature	149.72	186.15	170.20

**Table 4(A):** Comparison of actual stature and stature estimated from hand measurements in males

Variable from which stature is estimated.	Minimum	Maximum	Mean
RHL	142.55	169.94	156.39
LHL	138.75	168.40	156.40
Actual stature	136.00	170.18	156.39

**Table 4(B):** Comparison of actual stature and stature estimated from hand measurements in Females

Variable from which stature is estimated.	Minimum	Maximum	Mean
RHL	142.55	169.94	156.39
LHL	138.75	168.40	156.40
Actual stature	136.00	170.18	156.39

**Table 5:** Comparison of results of present study with results of other studies carried out at state, national and international level on different races

Sr. No	Author, Year, Population, Area, Age Group	Sex	Sample size	Regression Equation	SEE	PCC
01	Present study; 2016 Gujarati; Jamnagar; 18-26 years	M	50	$S=110.27+3.24 \times RHL$	4.98	0.680
		F	50	$S=107.47+3.44 \times LHL$	5.36	0.583
02	Patel SV, Jethva N; 2013; Gujarati; Bhavnagar; 18-25 years	M	258	$S=85.94+4.012 \times RHL$	3.47	0.610
		F	252	$S=83.56+4.25 \times LHL$	4.31	0.534
03	Patel JP, Patel BG; Gujarati; Ahmedabad; 18-22 years	M	72	$S=76.737+4.917 \times RHL$		0.741
		F	252	$S=74.797+5.004 \times LHL$		0.762
04	Dr. Sunil <sup>3</sup> 2005, North Indian Students, Delhi 18-22 yrs	M	75	$S=72.763+4.865 \times RHL$	4.35	0.7
		F	75	$S=75.030+4.721 \times LHL$	4.26	0.6
05	Jasuja OP <sup>4</sup> 2004, Jat Sikhs, Punjab, 18-60 yrs	M	30	$S=125.15+2.69 \times RHL$	4.57	0.7
		F	30	$S=125.67+2.67 \times LHL$	4.63	0.7
06	Pandey N, Ujwal NS <sup>5</sup> ; 2015; Medical students; Mumbai; 18-23 years	M	100	$S=110.64+2.95 \times RHL$	4.003	0.502
		F	100	$S=110.69+2.95 \times LHL$	5.127	0.452
07	Ilayperuma <sup>6</sup> , 2009 Medical students, Galle, Sri Lanka, 20-23 yrs	M	140	$S=86.93+4.25 \times RHL$	4.78	0.383
		F	118	$S=85.84+4.32 \times LHL$	5.01	0.367
08	Adel Kamel <sup>7</sup> , Abdel-Malek; 1990; Egyptians, Assiut, Upper Egypt	M	140	$S=77.42+4.56 \times RHL$	5.29	0.573
		F	118	$S=80.94+4.40 \times LHL$	5.48	0.533
		C	T=166	$S=130.954+1.612 \times RHL$	5.22	0.58
				$S=130.035+1.660 \times LHL$	5.75	0.59
				$S=134.240+1.1996 \times RHL$		
				$S=134.926+1.1954 \times LHL$		
				$S=94.857+3.681 \times RHL$		
				$S=98.945+3.415 \times LHL$		
				$S=103.732+3.493 \times HL$		
				$S=93.689+3.625 \times HL$		
				$S=34.5+5.77 \times HL+2.7 \times HB$	5.10	

## Conclusion

This study will add in the pool of database to calculate stature from hand length in Gujarati population. There is strong correlation between

stature and hand length. Regression equations were derived to estimate stature from Hand length. Similar findings were observed by other authors.

This study will help in medicolegal investigation and to the scientists of various specialities.

*Abbreviations*

S= Stature,

RHL= Right hand length,

LHL= Left hand length,

M= Male,

F=Female,

C= Common for male and female,

SEE= Standard error of estimate,

PCC= Pearson's correlation coefficient.

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