

Correlation of Hand Length and Height in the Residents of Kerala and Estimation of Height from Hand Length using Regression Equation

Mubeena Shaikh¹, Sushma², Hariharan S.³, Sateesh N.S.⁴

Abstract

Introduction: Height is one of the important factor serving as a parameter for personal identification. In natural calamities or mass explosions or fights where body parts are available it becomes important to know factors which can help in the identification of the individuals. There are several factors like race, ethnicity, nutritional status that influence the growth and development of the individual so there should be different methods and ways to be applied for identification for different population [1]. When only the segments of the bodies are available to determine the height from them becomes important to a forensic personal for identification and analysis. So estimating the height of the individual from the different body remains is utmost important as it provides this forensic anthropological value [2,3]. In this study the correlation of the height with hand length is done in the students and some volunteers in Kerala in the age group of 18 to 25. **Aim:** To study the correlation between hand length and height and to derive the equation for calculating the height from the hand length. **Methodology:** The study was conducted by taking 133 comprising of 73 girls and 60 boys ranging in the age group of 18-25 years. The medical students of first year and second year M.B.B.S were selected for the study. The subjects who were apparently normal with no obvious musculoskeletal deformities were included in the study. The height and hand length measurements were taken. The parameters were then analyzed and correlation study was done and statistical significance was studied. The regression equation is calculated for the height. **Results:** The study showed that there was significant correlation between right hand length and height. Pearson's correlation analysis was used and it showed a positive correlation between hand length and height. Regression equation was derived using S.P.S.S. software to calculate the height of the individual from hand length. **Conclusion:** There is a positive correlation between hand length and height. It is sought as the height and hand length is directly proportional. The height is nearly nine times the length of the hand.

Keywords: Height; Females; Males; Kerala; Hand Length.

Introduction

The Height is an important aspect of human personality. It forms an essential component of a

Author's Affiliation: ¹Assistant Professor, Department of Anatomy ³Assistant Professor, Department of Community Medicine, Kannur Medical College, Anjarakkandy, Kannur Kerala 670612, India. ²Assistant Professor, Srinivas Institute of Medical Sciences and Research Centre, Surathkal, Mangalore, Karnataka 575021, India. ⁴Professor, Dept of Physiology, KVG Medical College, Sullia, Karnataka 574327, India.

Corresponding Author: Mubeena Shaikh, Assistant Professor, Department of Anatomy, Kannur Medical College, Anjarakkandy, Kannur, Kerala 670612, India.
E-mail: mubeenashaikh05@gmail.com

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personal identification. The total stature of the human body is sum of length of certain bones and appendages of the body. And there is a certain relationship of the body segments with the proportion of the height of the individual [4]. Height is determined by various factors like nutrition, genes, and environmental factors. Height is also affected by the race of the population. There are several occasions which lead to mass disasters like earthquakes, tsunamis, manmade disasters like wars or even murders, suicides where we find the identification of bodies and different body segments a serious challenge [5]. Now where there is major loss of facial identification or even when only body parts like hands, legs available height of the individual forms an important parameter in identification. So height is an important key to physical anthropology and forensic science [6].

The reliability of prediction of height from foot length is as high as from long bones [7]. So establishing height from various parameters in different population has importance as same formulas and standards don't stand accurate in different population and regions [8,9]. The Identification of individual remains significant for stature reconstruction for which foot length and hand length are used as a predictor of height [10].

The hand length was found to be the most reliable alternative that can be used as a basis for estimating age related loss in height. Hand length is also the good predictor of the body surface area independent of the sex of the individual according to the study done by Amirsheybani et al. (2000)[11].

The aim of this study is to determine the correlation between the hand length and height and estimation of the height from the hand length in Kerala region.

Materials and Methods

A sample of 133 individuals which had 73 girls and 60 boys in the age group of 18-30 years is included in this study. These individuals belong to Kerala origin. Those with congenital musculoskeletal abnormalities and those who had previous fractures were excluded from the study. And Informed consent was taken from these participants. The following particulars were noted: Age, Height and Right and Left hand lengths. The height of the subjects was taken with the standing erect anatomical position and noted in centimeters. The height being measured from the highest point of the skull vertex to heel. [12,13].

The hand lengths taken by following method.

Each subject was asked to place his/her hand on a white paper with the palm facing upwards keeping the fingers close together with the thumb lying comfortably but not tightly against the radial aspect of the hand and index finger. A tracing of the hand was made with a lead pencil. The tracing proceeded from the radial styloid process to the ulnar styloid process. A line was drawn joining the two styloid tips.

The Interstyloid distance was marked on the hand and its midpoint was marked. The length of the hand was measured from the midpoint of previous line to the tip of middle finger using a ruler scale. The measurements were recorded in centimeters to the nearest 0.1 cm. [11]

Both Right hand length and left hand lengths was taken.

These measurements were taken at fixed time to eliminate diurnal variation and by the same person to avoid observer error.

Results

In the present study there are a total of 133 subjects of which there are 60 males and 73 females.

Height and hand length characteristics of subjects

In the present study, it shows that mean height of male medical students was 172.9267 ± 7.4 and female medical students was 160.33 ± 7.15 . Mean length of right hand in male medical students was $20.05 \text{ cm} \pm 1.04 \text{ cm}$. and female medical students was $18.26 \pm 0.96 \text{ cm}$.

Table 1: Showing the total number of male and female subjects and their mean ages

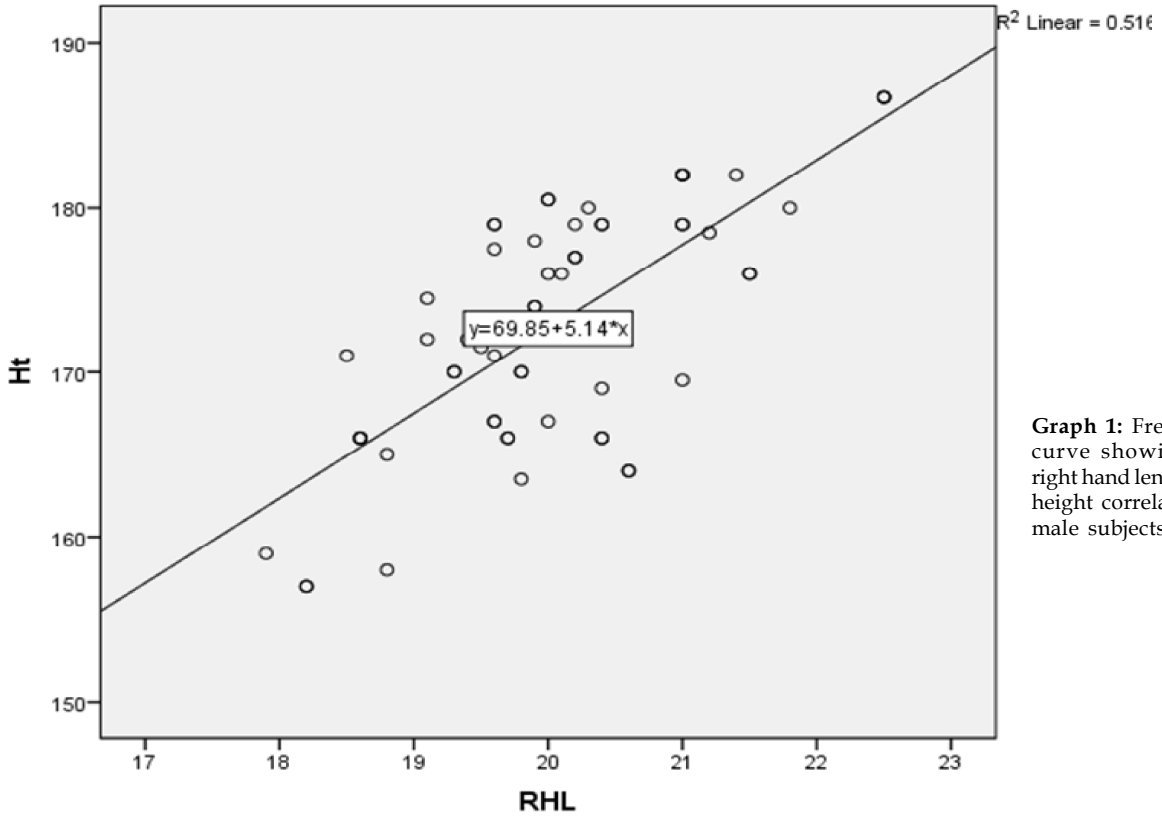
	Males	Females
Total number	60	73
Manage	20.68 ± 1.58	21.68 ± 3.78

Table 2: Showing the Height and measurements of the hand length in males, the multiplication factors for estimating height from the hand length measurements and correlation of these measurements with stature

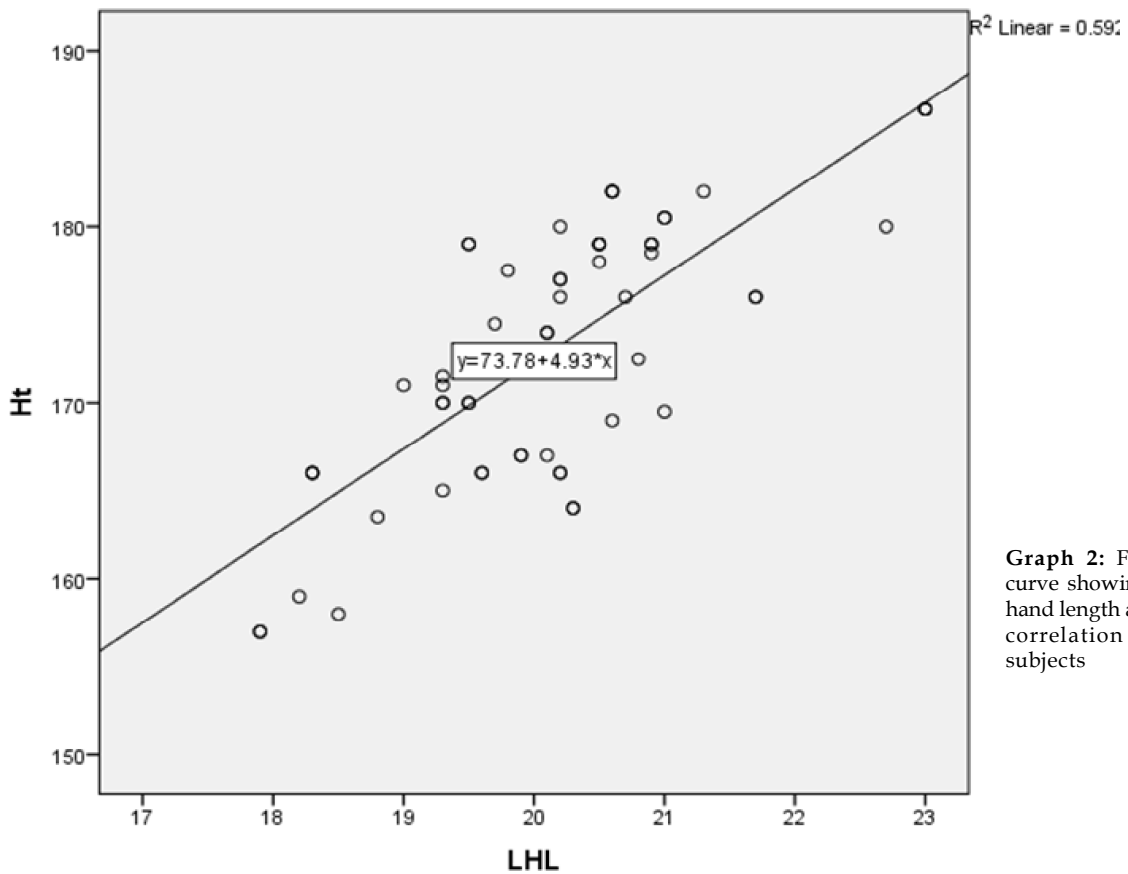
Variable	Mean \pm SD	Mean multiplication factor	Correlation of hand lengths with height r value	p value
Mean height	172.93 ± 7.45			
Right hand length	20.06 ± 1.04	8.62	0.71	<0.0001
Left hand length	20.13 ± 1.16	8.59	0.77	<0.0001

Table 3: Showing the Height and measurements of the hand length in females, the multiplication factors for estimating height from the hand length measurements and correlation of these measurements with stature.

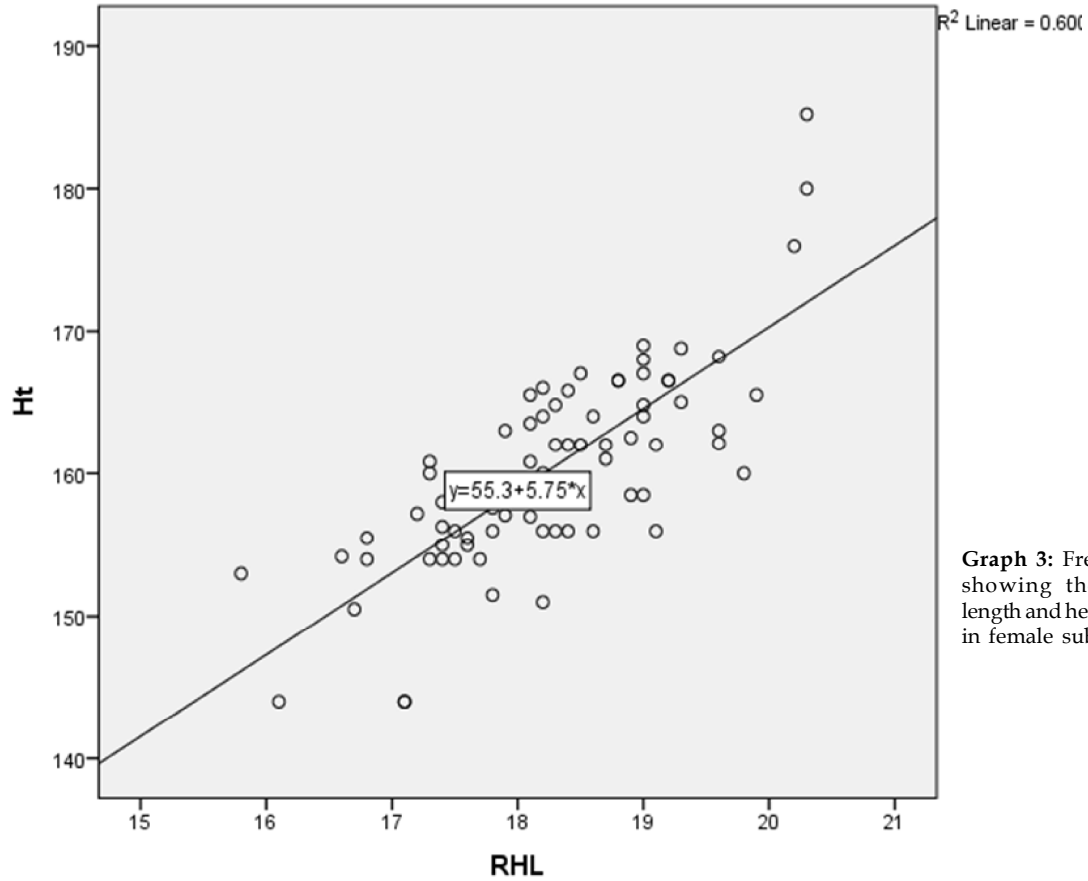
Variable	Mean \pm SD	Mean multiplication factor	Correlation of hand lengths with height r value	p value
Mean height	160.33 ± 7.16			
Right hand length	18.27 ± 0.96	8.78	0.77	<0.0001
Left hand length	18.20 ± 0.96	8.81	0.73	<0.0001



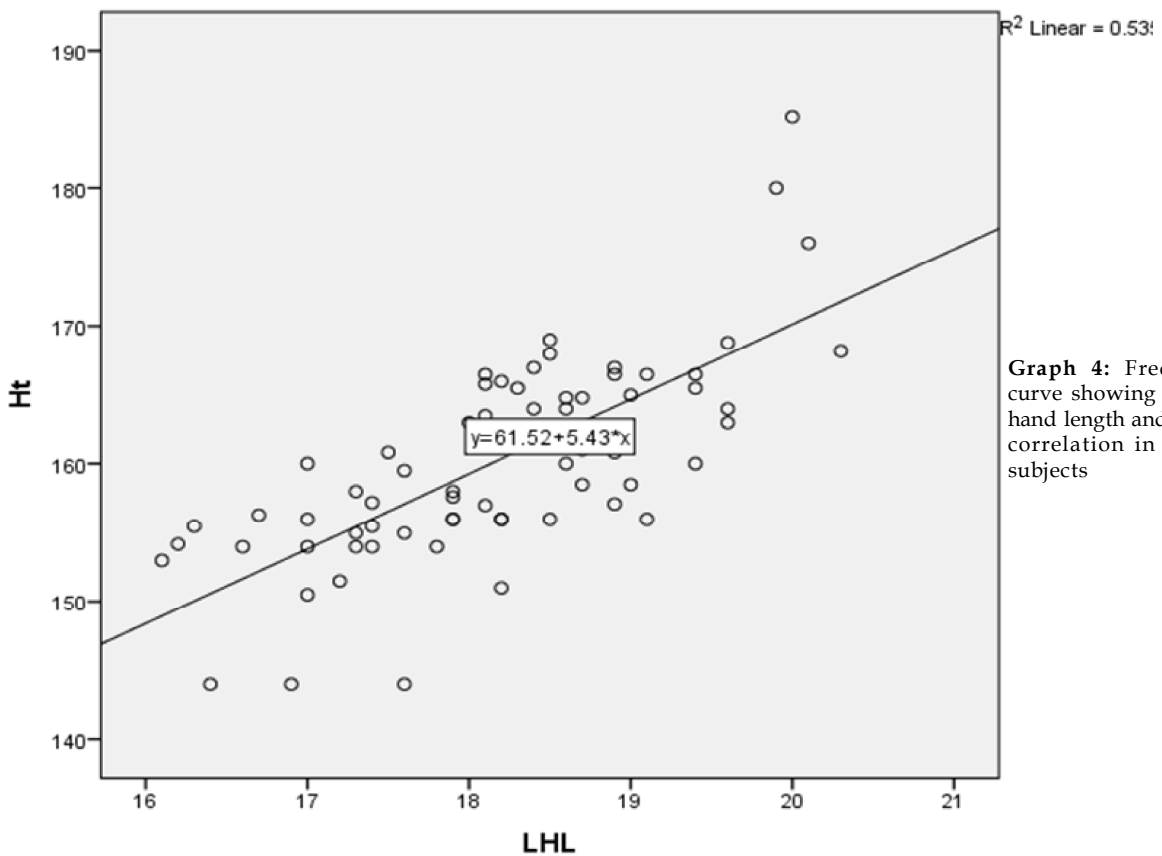
Graph 1: Frequency curve showing the right hand length and height correlation in male subjects



Graph 2: Frequency curve showing the left hand length and height correlation in male subjects



Graph 3: Frequency curve showing the right hand length and height correlation in female subjects



Graph 4: Frequency curve showing the left hand length and height correlation in female subjects

In our study age group the height is approximately 9 times more than length of hand. Pearson's correlation analysis was used to and shows a strong positive correlation, which means that high X variable scores go with high Y variable scores.

It has been shown in this study that there was a significant correlation between height and hand length. As there is increase in the hand length, height also increases in a proportional manner.

Linear regression equation was derived for estimation of height in males from hand length and similarly the estimation of height from hand length was derived for females.

The p value ($P < 0.001$) showed positive correlation between height and hand length.

Results in Male Subjects

The regression equation derived for calculating height is as follows;

In Males

Height designated as "y" and the hand length as "x"

The height is derived as for Right hand as

$$Y = a x + b$$

a = constant and b = constant

$$\text{so } y = (5.139) x + 69.852$$

$$\text{and for left hand } y = (4.93) x + 73.78$$

Results in Female subjects

The regression equation derived for calculating height is as follows;

Height designated as "y" and the hand length as "x"

For Right hand length the Height is derived as

$$Y = a x + b$$

a = constant and b = constant

$$\text{so } y = (5.75) x + 55.30$$

For Left hand length the Height is derived as

$$\text{so } y = (5.43) x + 61.52$$

Discussion

The present study is mainly done to correlate the height and hand length. As per the statistics it showed that there is a strong positive correlation between height and hand length both in males and females.

Height can be derived using the regression equation which can be useful for identifying the body by the forensic scientist in cases where only fragments of limbs or hands are available. These predictions of height are also of significance to artificial limb providers in people whose lower limbs are amputated. Since long it has been established that height can be derived from long bones of the body and so hand length serves also the same purpose [14].

Estimation of height using various physical measurements has been attempted by many researchers but the one variable that proves to be consistently reliable in the estimation of height is the hand length [15,16]. Similarly study was done to determine height from the length of clavicle [17]. There was a study showing significant correlation between foot length and the height by Charnalia in 1961 [18]. Shroff and Vare derived height from length of superior extremity and its segments [19]. Similarly a regression equation is derived by Saxena et al between hand length and height. The result from the present study shows that hand length can be used to predict height. The present study shows the parameters used to determine height can also be used to determine hand length because there was a 2-tailed significant correlation between hand length and height.

There is a study done on Nigerian population and in North Indian population showing similar results [20]. Study of height from hand in Punjabi males was done [21]. In the age group of the present study the height in males from right hand is 8.62 times and 8.59 times more than length of hand. In the age group of the present study the height in males from right hand is 8.78 times and 8.81 times more than length of hand. This shows that height in males and female of any age group is nearly 9 times more than the length of hand.

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