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Original Research Article

ESTIMATION OF STATURE FROM DIFFERENT PARAMETERS OF THUMB AND LITTLE FINGER

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Abstract

Introduction: The human hand is one of the essential part of the body for investigators in the field of anthropometry, forensic pathology, orthopedic surgery and ergonomics. Stature is one of the important parameter for identification. Stature estimation is based on a principle that every body part has some constant relationship with height of an individual.

Study design: descriptive cross sectional study. **Place of Study**: Department of Anatomy, Index Medical College, Hospital & Research Centre, Indore.

Material: 510 adult Indian population was collected from Department of Anatomy, Index Medical College, Hospital & Research Centre, Indore.

Method: The hands were placed on a scanner connected to a computer through Photoshop software and scanned both hands separately. The image of the hand were saved along with the ruler in the software. Measurements of the hand were done on the scanned pictures after calibrating the scale of the software

Result: The present study showed significant (p=0.001) positive correlation with stature and all the parameters of thumb & little finger.

Key Words: Stature, Thumb length, Little finger length and anthropometry

1. Introduction

The human hand is one of the essential part of the body for investigators in the field of anthropometry, forensic pathology, orthopedic surgery and ergonomics. Stature is one of the important parameter for identification. Stature estimation is based on a principle that every body part has some constant relationship with height of an individual [1]. There is an established relationship between stature and various body parts like head, trunk, upper and lower extremities. Estimation of stature of an individual from the skeletal material or from the mutilated or from amputated limbs or from the parts of the limbs has obvious significance in the personal identification in the events of murders, accidents or natural calamities [2]. These parameters have been correlated with each other for forensic purposes like

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determination of the size of an individual from human remains [3]. Till date, there is a dearth of literature on these parameters in different ethnic groups of India. Sizes of different parts of the hand and its skeleton have been of help in tracing human remains, although literature on this topic is scanty. Some workers have correlated the height of the individual with the size of the hand in small fraction of the population [4-8]. The available literature is inadequate to infer any correlation between the height, and the hand. The degree of access to nutrition and health services may have an effect on the stature of the different ethnic groups around the world, since genetic is a factor in human development [9]. Many of them have correlated the dimensions of hand with the stature. But very few studies of stature estimation are reported based on digits and phalanges of hand. Even more limited are the studies taking into account all the digits and phalanges of hand. This study is designed to measure the hand in adult groups and correlating it with the height of the individual.

Keeping this in view, present study was carried out to derive regression formula and multiplication factor to determine stature from Hand dimensions for adult population. This present study is an effort to improve the Morphometric data in Indian population.

Study Design

The present study will be conducted as a cross sectional community based study done over a period of time. All the data needed will be collected in a single visit. The data collected will be analyzed later.

Materials

The study was conducted in Department of Anatomy, Index Medical College, Hospital & Research Centre, Indore & Katuri Medical College & Hospital, Guntur.

Sample: The study was conducted on 510 adult individuals including both male and females aged between 21 to 60 years. All males and females with no history of fracture or malformation were included. Only Indian population was taken. Subjects with history of fracture, Bony deformities & Anomalies that affects hand dimensions or stature were excluded.

2. Methodology

- The hands were placed on a scanner connected to a computer through Photoshop software and scanned both hands separately.

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Image.1a

Image.1b

- The image of the hand were saved along with the ruler in the software.
- Measurements of the hand were done on the scanned pictures after calibrating the scale of the software (Image.2 calibration of the scale of the scanner).

Image.2

Before proceeding with this methodology we cross checked it with other standard methods. Following measurements were taken.

1. **Total Finger Length of Right & Left Thumb (RTTHL), (LTTHL) & Little Finger (RTLIL), (LTLIL) were measured.** Total finger length was measured from proximal flexion crease of the finger to the tip of the respective finger. Image.3 showing the measurement of total finger length of thumb & little finger.

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Image .3

2. **Length of Proximal Phalanx of Right & Left Thumb (RTTHPL), (LTTHPL) & Little Finger (RTLIPL), (LTLIPL) were measured**. Length of Proximal phalanx was measured from proximal interphalangeal joint crease to the proximal flexion crease of each finger. Image.4 showing the measurement of proximal phalynx of thumb & little finger.

Image.4

3. **Length of Middle Phalanx of Right & Left Little Finger (RTLIML), (LTLIML) were measured.** Length of middle phalanx was measured from proximal interphalangeal joint crease to the distal interphalangeal joint crease of each finger. Image.5 showing the measurement of middle phalynx of little finger.

Image.5

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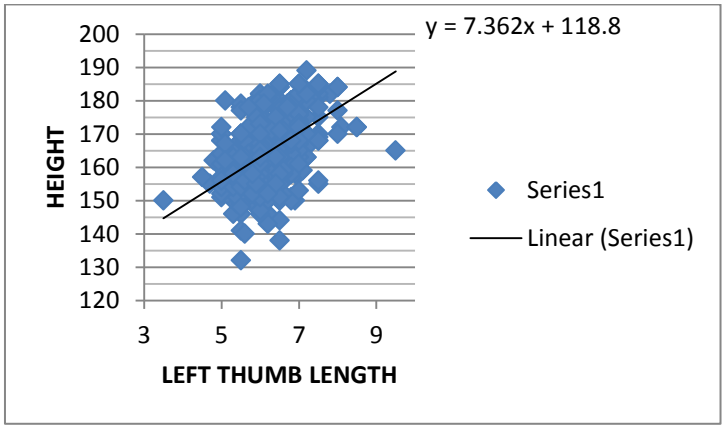
4. **Length of Distal Phalanx of Right & Left Thumb (RTHDL), (LTHDL) & Little Finger (RTLIDL), (LTLIDL) will be measured**. Length of middle phalanx will be measured from distal interphalangeal joint crease to the tip of each finger. Image.6 showing the measurement of distal phalynx of thumb & little finger.

Image.6

5. **Stature (Height):** Stature of the person will be measured from vertex to the floor while the subject is standing in anatomical position.

3. Results:



Graph.1 Showing Correlation Between Height & Left Thumb Length.

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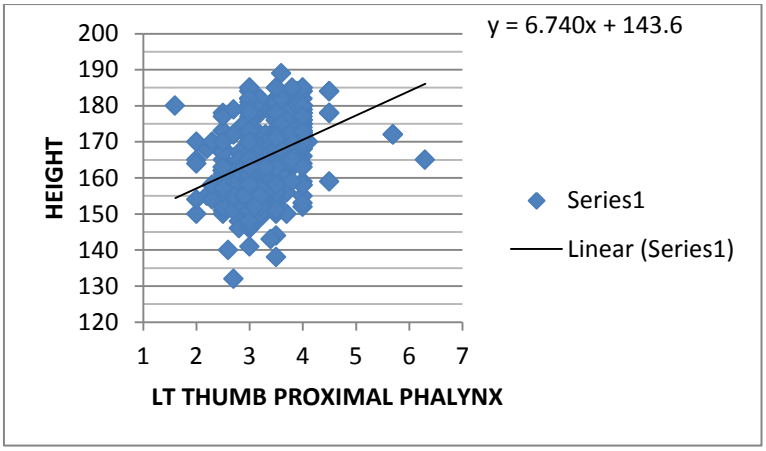
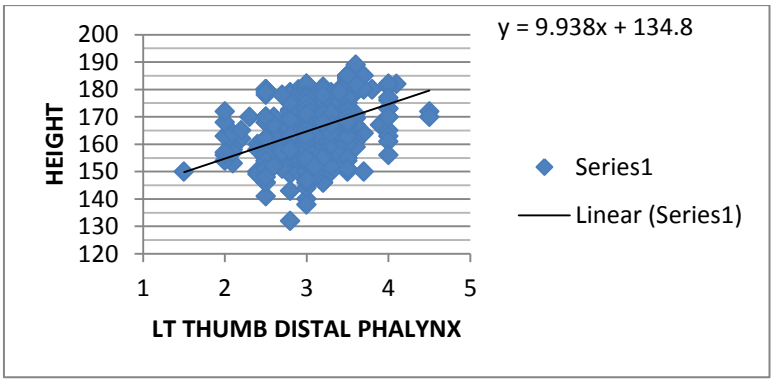
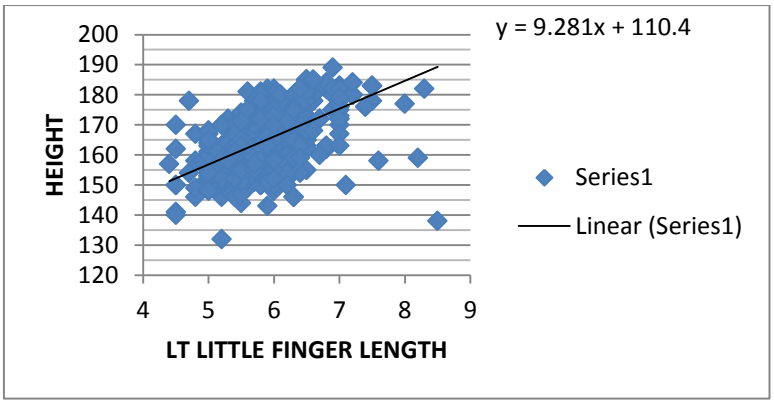


Graph.2 Showing Correlation Between Height & Left Thumb Proximal Phalynx Length.



Graph.3 Showing Correlation Between Height & Left Thumb Distal Phalynx Length.



Graph.4 Showing Correlation Between Height & Left Little Finger Length.

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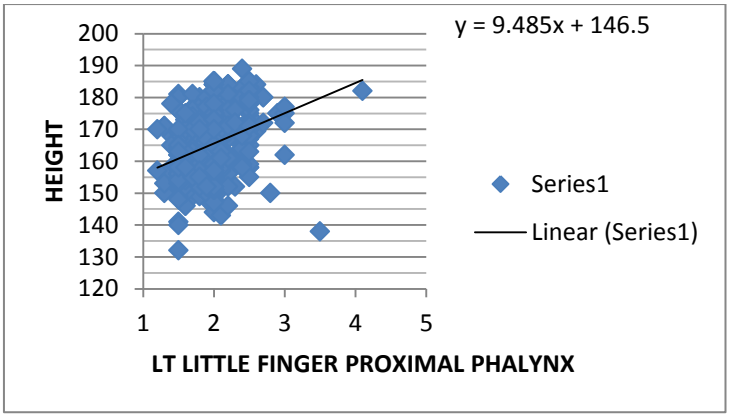
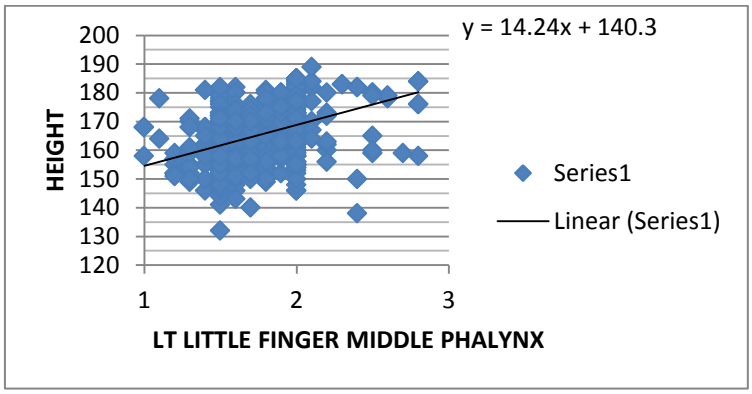
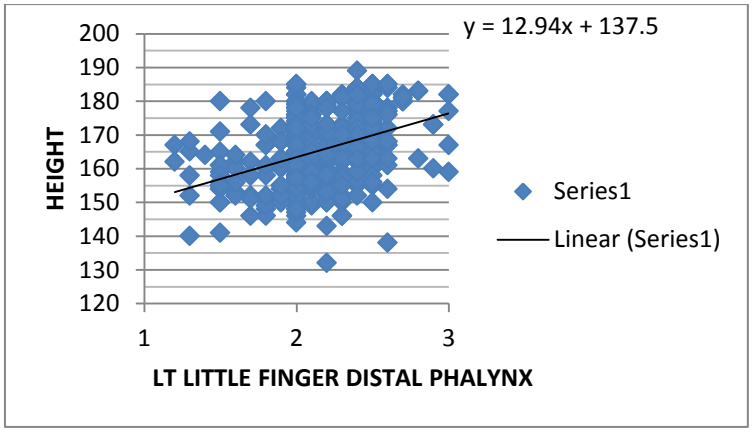


Graph.5 Showing Correlation Between Height & Left Littele finger Proximal Phalynx Length.



Graph.6 Showing Correlation Between Height & Left Littele finger Middle Phalynx Length.



Graph.7 Showing Correlation Between Height & Left Littele finger Distal Phalynx Length.

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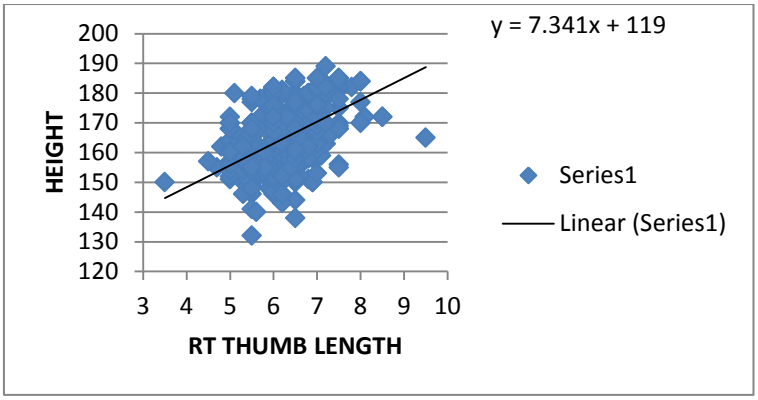
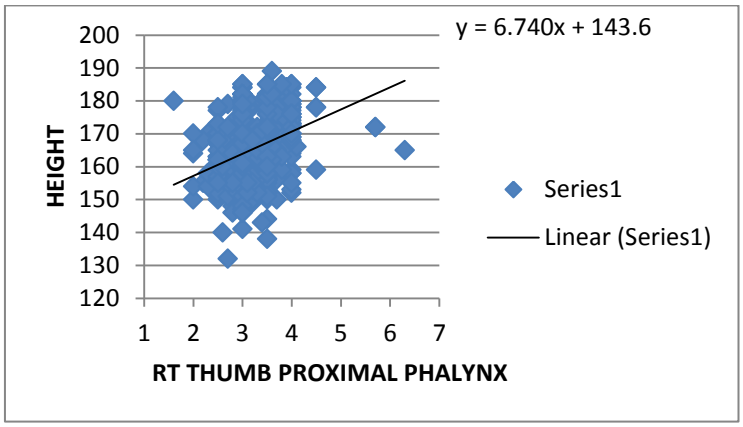
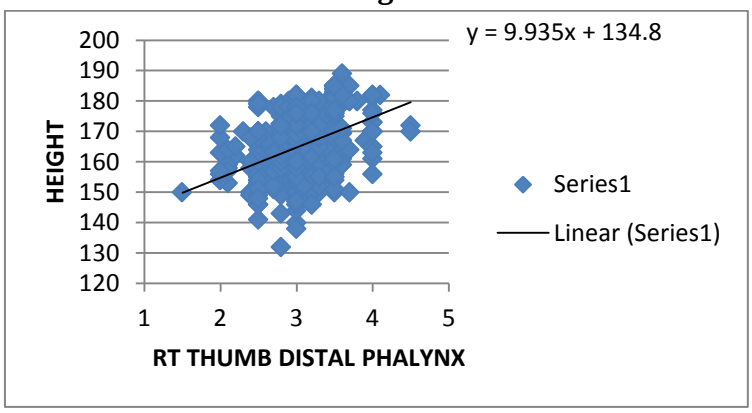


Graph.8 Showing Correlation Between Height & Right Thumb Length.



Graph.9 Showing Correlation Between Height & Right Thumb Proximal Phalynx Length.



Graph.10 Showing Correlation Between Height & Right Thumb Distal Phalynx Length.

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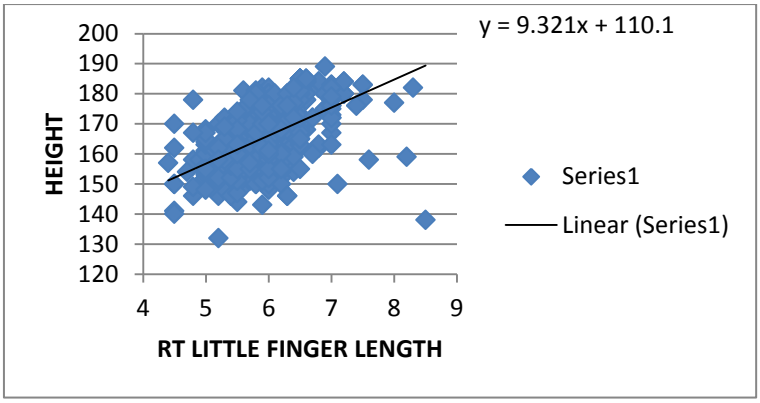
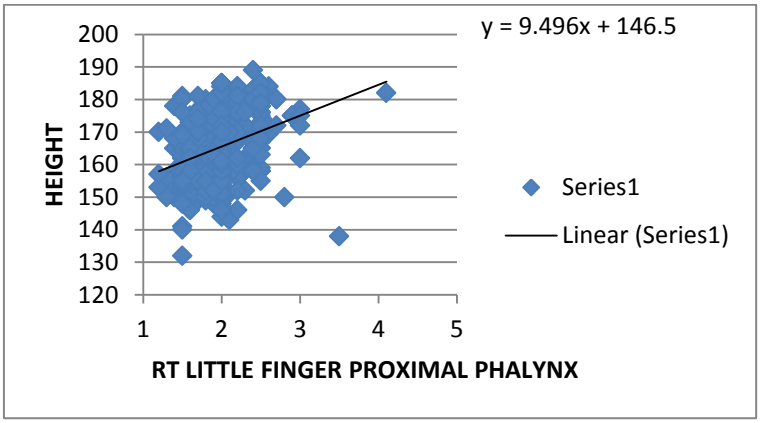
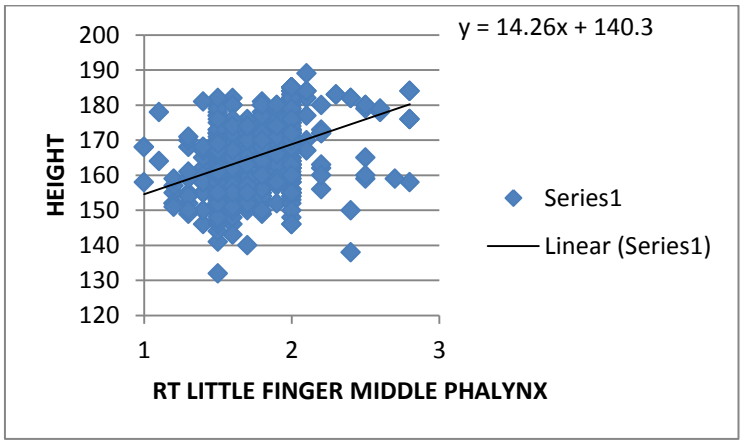


Graph.11 Showing Correlation Between Height & Right Little Finger Length.



Graph.12 Showing Correlation Between Height & Right Little Finger Proximal Phalynx Length.



Graph.13 Showing Correlation Between Height & Right Little Finger Middle Phalynx Length.

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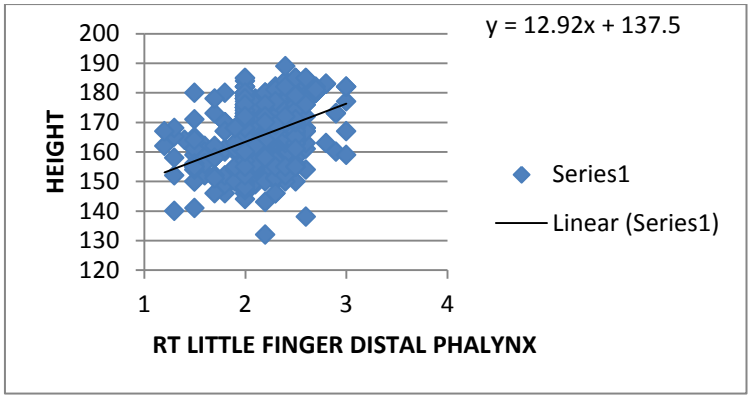

Graph.14 Showing Correlation Between Height & Right Little Finger Distal Phalynx Length.

	HEIGHT	LTTHUMBLENGTH	LTTHUMBPROXIMALPHALANXLENGTH	LTTHUMBDISTALPHALANXLENGTH	LTLITTLEFINGERLENGTH	LTLITTLEFINGERPROXIMALPHALANXLENGTH	LTLITTLEFINGERMIDDLEPHALANXLENGTH	LTLITTLEFINGERDISTALPHALANXLENGTH	RTTHUMBLENGTH	RTTHUMBPROXIMALPHALANXLENGTH	RTTHUMBDISTALPHALANXLENGTH	RTLITTLEFINGERLENGTH	RTLITTLEFINGERPROXIMALPHALANXLENGTH	RTLITTLEFINGERMIDDLEPHALANXLENGTH	RTLITTLEFINGERDISTALPHALANXLENGTH
MEAN	165.6	6.4	3.3	3.1	5.9	2	1.8	2.2	6.4	3.3	3.1	5.9	2	1.8	2.2
MAXIMUM	189	9.5	6.3	4.5	8.5	4.1	2.8	3	9.5	6.3	4.5	8.5	4.1	2.8	3
MINIMUM	132	3.5	1.6	1.5	4.4	1.2	1	1.2	3.5	1.6	1.5	4.4	1.2	1	1.2
STANDARD	10.2	0.7	0.5	0.4	0.6	0.3	0.3	0.3	0.7	0.5	0.4	0.6	0.3	0.3	0.3

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DEVIATION															
CORRELATION COEFFICIENT		0.486	0.331	0.396	0.562	0.317	0.406	0.392	0.485	0.331	0.397	0.564	0.318	0.406	0.392

Table.1 Showing Statistical evaluation of Stature & Different parameters of the present study.

In this present study total 510 subjects participated among them 236 were male and 274 were female, their height ranges from 132centimeters to 189 centimeters whereas the mean height is 165.5 centimeters. Length of the thumb ranges from3.5 centimeters to 9.5 centimeters in both right and left hands whereas the mean thumb length is 6.4 centimeters. Length of little finger ranges from 4.4 to 8.5 centimeters in both right and left hands whereas the mean little finger length is 5.9 centimeters. The data obtained during this study was analyzed and formulated equations to find out stature from length of Thumb, Little finger and their fragments. We also found that all the parameters obtained are showing positive correlation with stature among them right hand little finger length will give more accurate value when compared to all other parameters with correlation coefficient value of 0.564. Left hand little finger length will be 2nd accurate value to find out the stature when compared to other parameters with correlation coefficient value of 0.562. When we observed the correlation between Thumb length Left thumb length is a bit more positive with correlation coefficient value of 0.486 when compared with its counterpart Right thumb length with correlation coefficient value of 0.485. When we observed the correlation between the phalanges of Thumb distal phalanx of both right and left hand thumbs are showing more positive correlation with correlation coefficient value 0.396 for left and 0.397 for right hand compared to proximal phalanx. When we observed the correlation between the phalanges of Little finger middle phalanx of both right and left hand Little fingers are showing more positive correlation compared to other phalanges with a correlation coefficient value of 0.406. Proximal phalanx of little finger is showing least correlation with stature where the correlation coefficient values are 0.317 for left and 0.318 for right hand.

When we find the remnants of any dead body if we found Thumb & Little finger separated from hand total length of the little finger will give more accurate value for estimation of stature. If we find fragments of those fingers distal phalanx of Thumb & middle phalanx of little finger will give more accurate value for estimation of stature.

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4. Discussion:

Few researchers studied the correlation between the stature and hand dimensions by using different methodologies. Vijeta et al studied the Estimation of Stature from Hand Length and Hand Breadth among Population Groups of Himachal Pradesh. Hand measurements (direct) gives better prediction of stature than that of indirect in both sexes and stature prediction is more reliable in case of females than in males. Regression equations were derived. Ilsun Rhi, et al studied the Estimation of stature from finger and phalange lengths in a Korean adolescent. The results of this study showed that there is a statistically significant relationship between the length of the fingers and the phalanges of adolescents and the stature. According to current studies, estimating stature from the length of the fingers and phalanges is reasonably accurate. Dr. O.P.Jasuja et al studied estimation of stature from hand and phalange length. It was found that no significant difference exists between hand length and palm print length. The difference between measured phalangeal length from hand and print also is not significant. Statistically significant correlation is present among the stature and these measurements. The regression equations have been derived. Katwal, et al studied the Estimation of stature from length of middle finger among nepalese medical student of Nepal Medical College and Teaching Hospital. Pearson correlation coefficient (0.422) obtained showed high significant correlation between right middle finger length and the height. Nuranis-Raihan Zulkiflya, etal studied the Estimation of stature from hand and handprint measurements in Iban population in Sarawak, Malaysia and its applications in forensic investigation. Results revealed that lengths of hand and handprint are the more reliable traits for estimating stature in both the male and female Iban subjects. Suseelamma. D, et al studied Correlation between Stature and Length of Fingers Though height and length of the fingers of the hand were significantly more in males compared to females, a direct relationship was observed in both sexes. The difference in right and left side measurements are minimal and statistically insignificance in derivation of regression equation. Chikhalkar Bhalchandra G, et al studied Estimation of Stature from Measurements of Hand Dimensions. Rajesh Ban Goswami et al studied Estimation of stature from anthropometry of hand by autopsy based study in Madhya Pradesh. The mean age of the male and female study subjects was38.472±13.28 years and 34.728±10.33 years respectively. Male to female ratio was 1:1. Mean stature in male subjects was 163.5±5.21 cm. Mean stature in female subjects was 155.69±10.12 cm. In male study subjects, mean hand length on right side was more than mean hand length on left side. In female study subjects, mean hand length on right side was more than on left side. In male study subjects, hand breadth (HB) on right side was more than on left side. Average HB in male subjects was 8.39±0.203 cm. In female study subjects, hand breadth on right side was more than on left side.

This present study will help in several doubtful medico legal cases where only a few body parts of the victim can be retrieved, as well as in mass disasters to identify body parts for adequate disposal as per religious customs.

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5. Conclusion:

In this present study all the parameters of thumb and little finger are showing positive correlation with stature. Statistical evaluation of the parameters compared from left side to right side showing very minimal differences between them which is statistically insignificant. This study do not exhibit sexual dimorphism as it is difficult to identify the gender of the finger without artifacts. Higher sample number and involvement of other fingers also can be done in further studies for improvising the results and for more accuracy.

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Conflict of interest: Nil

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