

Correlation between Index Finger and Stature in Uttarakhand Population

Lalit Kumar¹, Sandeep Agarwal², Rajesh Garg³ and Amit Pratap Dixit⁴

¹*Department of Forensic Medicine and Toxicology, Shri Guru Ram Rai Institute of
Medical & Health Science, Dehradun 248 001, Uttarakhand, India*

²*Department of Radio-diagnosis, Saraswathi Institute of Medical Sciences,
Hapur, Uttar Pradesh, India*

Telephone: ¹<+91-9358507650>, ²<+91-9717189471>, ³<+91-8410050040>,
⁴<+91-7417409084>

E-mail: ¹<dr_lalit303@yahoo.com>, ²<sandeepmdrd1@gmail.com>,
³<rajeshgarg839@gmail.com>, ⁴<mtsng733@gmail.com>

KEYWORDS Anthropometry. Forensic Science. Index Finger. Length. Regression Analysis. Stature Estimation

ABSTRACT Human beings are considered to be bilaterally symmetrical, though, there is an asymmetry in the length of the thumb and fingers of both hands irrespective of sex or handedness; estimation of stature of an individual plays an important role for medico-legal fixation of individuality. This study looks into the possibility of estimation of stature from length of index finger. In this study 200 subjects (100 males and 100 females) between the ages of 21 to 30 years were taken from Uttarakhand (India) population. Their index finger length and height were measured using the standard points mentioned by the earlier authors, and data was analyzed statistically for correlation. The outcome showed a significant correlation between length of index finger and height of the individuals in both sexes. Then linear regression equation for stature estimation was calculated. It is therefore concluded that if the index finger length is known, then height of individual can be predicted and vice versa. These results could be of help in medico-legal cases for the stature estimation for identification as well as in fixation of identity.

I. INTRODUCTION

Recognition or identification of an individual is the main objective in forensic investigation (Kanchan et al. 2008) in which mutilated or fragmented remains is always a challenge for the medico-legal experts. The stature of an individual is an important part of identity of a person and one of the “big fours” of forensic anthropology (Krishan and Sharma 2007). Opinion of stature of individual from mutilated or amputated limbs or parts of limbs play a vital role in facilitating personal identification in a variety of crime scenes like murder, accidents or natural disasters (Jasuja and Singh 2004). Although several different types of methods and formulae are available for evaluation of stature, most of them utilize bones such as femur, tibia, humerus and

radius or other bones (Holland 1998), some from foot dimensions (Krishan 2008), or some from cephalo-facial anthropometry (Krishan 2008). Very few workers had correlated height and thumb, finger length and phalange length (Shintaku and Furuya 1990; Bardale et al. 2013; Krishan et al. 2012).

Tyagi et al. studied in Delhi and found, accurate or near accurate relationship between stature and finger lengths, and suggested that index finger is best for the prediction of stature in both males and females (Tyagi et al. 1999). Verghese et al. studied in Mysore and found that best finger to predict the height in case of males was left thumb and in case of females it was the right thumb (Annie et al. 2010).

Fluctuating asymmetry is defined as the small, random deviations from symmetry that arise in otherwise bilaterally symmetrical traits as a consequence of developmental noise and developmental instability (Ludwig 1932). Therefore in researchers' study, length of both index finger was taken. In the majority of the studies, the measurement of finger or thumb was taken from tip of finger (dactylyon) to phallangion (metacarpophalangeal joint). At the crime scene or in the

Address for correspondence:

Dr. Lalit Kumar

Assistant Professor,

Department of Forensic Medicine and

Toxicology Shri Guru Ram Rai

Institute of Medical & Health Science,

Dehradun, U.K. India 248001.

Contact No.: +91-9358507650

E-mail: dr_lalit303@yahoo.com

fragmented or mutilated body remains, it is not compulsory that separation was done at joint, but it was found that when separation was done of fingers and thumbs on hand, that was at the level of proximal crease of the fingers or thumb. So investigators had taken the index finger measurement from dactylion (tip of index finger) to proximal index finger crease. So that this method will be helpful in the estimation of stature from mutilated or amputated finger in dead as well as taking measurement from prints of finger from crime scene in living personality.

Height of a person increases from intra-uterine life to 20-21 years (Nandy 2001). Trotter and Glesser found that there is a loss of height for each two decades of age over the age of 30 years (Saukko and Knight 2004). Therefore in current study the age of researchers' subjects was between 21 to 30 years.

METHODOLOGY

Participants

This was a prospective study for which random sample of 200 normal subjects from Uttarakhand, India in 2012-2013 were selected and study point was Department of Forensic Medicine and Toxicology, Shri Gururam Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand. Subjects with any physical deformities (congenital or acquired) or earlier history of trauma to the hand were excluded from the study. After taking informed consent data on age, sex and height were collected and the anthropometric measurements were taken. No special attempt was made to select patients. Patients were also chosen on the basis that they were stable and cooperative with being examined. The sample consisted of 100 males and 100 females, all were aged more than 21 years and less than 30 years and their family origin were in Uttarakhand state.

Consent: Consent was taken prior to taking measurements.

Measures

Index Finger Length: Each subject was asked to place his/ her hand on a white paper with the palm facing downwards keeping the fingers separated comfortably. To measure the length of index finger a sliding caliper was used. The proximal point, that is radial side of the proximal crease over the 2nd metacarpo-phalyngeal

joint. The distal point, that is dactylion the distal most part of the index finger. The ends of the caliper were placed over these two landmarks and distance between them gave the maximum length of index finger. The length of index finger were taken on both sides in each subject.

Height of Individual: The subject was asked to stand erect and barefoot against a wall. The feet were kept parallel to each other. The heels, buttocks and back touched the wall and the head was kept in the eye ear plane, eyes facing forwards. The anthropometer was positioned in front the subject, perpendicular to the floor. The lower horizontal bar was brought in contact with head at the vertex, in the mid sagittal plane. The distance between the floor and the horizontal bar gave the height of the person.

Measurements were taken and repeated and mean measures were recorded. The measurements were taken in nearest 0.1 centimeters according to the technique described by Vallois. The results were analyzed statistically.

RESULTS

The correlation between index finger length and stature were studied on both sides in males as well as in females. From Table 1 for male subjects, the results showed a high degree of correlation and were statically significant ($p < 0.001$) between index finger length and stature. With SPSS software linear regression equation is formulated for right and left index finger. Table 2 for female subjects, again showed a high degree of

Table 1: Result obtained for male subjects

<i>Index finger length</i>	<i>Regression equation (Height=)</i>	<i>% Explained (r^2)</i>
Right index finger	H=136.051 + 5.538 (Index Finger Rt)	0.186
Left index finger	H=134.602 + 5.571 (Index Finger Lt)	0.232

Table 2: Result obtained for female subjects

<i>Index finger length</i>	<i>Regression equation (Height=)</i>	<i>% Explained (r^2)</i>
Right index finger	H=132.910 + 3.851 (Index Finger Rt)	0.157
Left index finger	H=137.216 + 3.225 (Index Finger Lt)	0.096

correlation and were statically significant ($p < 0.001$) between index finger length of both sides and stature. Linear regression equation was formulated with the same in female subjects.

DISCUSSION

Krishan et al. (2012) found statistically significant correlation between stature, index finger length and ring finger length in right and left hands. Pearson correlation (r) was higher among males than females. Among males and females correlation coefficient was higher for the index finger length than the ring finger length. Bardale et al. (2013) found a significant correlation between index finger length and stature in a cross sectional sample of 195 adult students, out of which 100 were males and 95 were females. There was significant difference ($P < 0.001$) between stature of male and female subjects. Sen et al. (2014) showed in their study that correlation coefficient (r) between stature and finger lengths was observed to be positive and statistically significant.

The present study has shown that there is a significant correlation between index finger length and stature of the individual ($p < 0.001$). The results of this study show the similar result as reported by the other authors. The results, therefore, indicate that if the index finger length is known, stature can be predicted and if the stature is known, index finger length can be predicted and vice versa.

CONCLUSION

All the value showed a high degree of correlation and all values were statically significant (p value < 0.001). Therefore any of the index fingers can be used to calculate height for the male as well as female subjects.

For male, estimation of stature from index finger length-

$$H = 136.051 + 5.538 (\text{Index Finger Rt})$$

$$H = 134.602 + 5.571 (\text{Index Finger Lt})$$

For female, estimation of stature from index finger length-

$$H = 132.910 + 3.851 (\text{Index Finger Rt})$$

$$H = 137.216 + 3.225 (\text{Index Finger Lt})$$

RECOMMENDATIONS

This study was done on living subjects; therefore it can be used to estimation of stature of mysterious criminals by measuring their index finger length from fingerprints present at crime scene.

REFERENCES

- Annie J, Balaraj B, Kumar P 2010. A study of estimation of stature from length of fingers in mysore. *Indian Journal of Forensic Medicine Toxicology*, 4(2): 12-13.
- Bardale RV, Dahodwala TM, Sonar VD 2013. Estimation of stature from index and ring finger length. *Journal of Indian Academy of Forensic Medicine*, 35(4): 353-357.
- Holland TD 1998. Estimation of adult stature from fragmentary tibias. *J Forensic Sci*, 37: 1223-1229.
- Jasuja OP, Singh G 2004. Estimation of stature from hand and phalange length. *JIAFM*, 26(3): 0971-0973.
- Kanchan T, Menezes RG, Moudgil R, Kotian MS, Garg RK 2008. Stature estimation from foot dimensions. *Forensic Sci Int*, 179(2-3): 241.e1- 241.e5.
- Krishan K 2008. Determination of stature from foot and its segments in North Indian population. *Am J Forensic Med Pathol*, 29(4): 297-303.
- Krishan K 2008. Estimation of stature from cephalofacial anthropometry in North Indian population. *Forensic Sci Int*, 181: 52.e1- 52.e6.
- Krishan K, Kanchan T, Asha N 2012. Estimation of stature from index and ring finger length in a North Indian adolescent population. *Journal of Forensic and Legal Medicine*, 19(5): 285-290.
- Krishan K, Sharma A 2007. Estimation of stature from dimensions of hands and feet in north Indian population. *J Forensic Legal Med*, 14(6): 327-332.
- Krogman WM 1986. *The Human Skeleton in Forensic Medicine*. 2nd Edition. Springfield: Charles C Thomas, pp.153-187.
- Ludwig W 1932. *Das Rechts-links problem im tierreich und beim menschen*. Springer, Inc; Berlin, Germany.
- Nandy A 2001. *Principles of Forensic Medicine*. 2nd Edition. Calcutta: New Central Book Agency.
- Saukko P, Knight B 2004. *Knight's Forensic Pathology*. 3rd Edition. London: Arnold, pp. 114-116.
- Sen J, Kanchan T, Ghosh A, Mondal N, Krishan K 2014. Estimation of stature from lengths of index and ring fingers in a North-eastern Indian population. *J Forensic Leg Med*, 22 :10-15.
- Shintaku K, Furuya Y 1990. Estimation of stature based on the proximal phalangeal length of Japanese women's. *JUEOH*, 12(2): 215-219.
- Tyagi AK, Kohli A, Verma SK, Aggrawal BBL 1999. Correlation between stature and finger length. *International Journal of Medical Toxicology and Legal Medicine*, 1(2): 20-22.
- Vallois HV 1965. Anthropometric techniques. *Curr Anthropol*, 6: 127-144.