



Correlation of Human height with dimensions of hand. A study in Young Population of Northern India

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Abstract

Background: Anthropometry has continuously been used in forensic examinations of unknown commingled human remains. Forensic Anthropology is concerned with the building of ante mortem histories of individuals from skeletonized remains. The aim and objective is to find out the bilateral and bisexual variations from the percutaneous measurement of length of hand and middle and little fingers of both hands of males to reconstruct the stature. **Material & Methods:** 100 male undergraduate students were taken up for the study. The stature was measured by a stadiometer. The hand length and finger length were measured by the measuring scale and vernier calipers. The prediction of estimation of stature from the length of both hands, middle finger length and little finger length of both hands was determined. **Results:** The mean height in males is 174.3690 ± 6.18 cm. The mean hand length in males is 19.74 ± 0.87 cm in right hand and 19.65 ± 0.83 cm in left hand. The mean length of right middle finger length is 8.32 ± 0.45 cm and left middle finger length in males is 8.28 ± 0.49 cm. The mean length of right little finger length is 6.38 ± 0.43 cm and left little finger length in males is 6.27 ± 0.52 cm. **Conclusions:** Positive and statistically significant correlation can be observed among the different variables taken up in the present study. Pearson's correlation was used which can predict a significant relationship between the height and the length of hand and middle finger of male.

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INTRODUCTION

In Forensic Science, Anthropometry as well as medicine dates back to year 1882 when a French police expert, Alphonse Bertillon, invented a criminal identification system which was based on anthropometric measurements.^[1] Since then, anthropometry has continuously been used in forensic examinations of unknown commingled human remains.^[2] Forensic Anthropology is concerned

with the building of ante mortem histories of individuals from skeletonized remains.^[3] Estimation of stature from amputated limbs has obvious significance in the personal identification in the events of murders, accidents and natural disasters.^[4]

In 1956 Fully, reintroduced anatomical method with mild variation and named as Fully's procedure. The main disadvantage of anatomical method of stature estimation is that

nearly a complete skeleton is needed.^[5] The mathematical method uses regression formulae (or ratios) based on the correlation of individual skeletal elements to living stature.^[6] Hands are one the most preferable part of the body for anthropometric measurements, comprising hand dimension (hand length and breadth). Hand index which is acquired from hand dimensions could be used to assess variation concerning sex, age and race in forensic and legal sciences.^[7]

Another importance of assessing hand length and determining bilateral and bisexual variations is attributed towards increased demand among professional hand tools used to have economic lead designed products. The assessment of the physical dimension of the human hand provides a metric description to a certain human-machine compatibility in the design of manual systems for the bare and gloved hand (e.g. design of the hand tools, knobs and controls, personal equipments, consumer appliances in the home and industry).^[8]

Aims and Objectives

The present cross-sectional study was conducted in the Department of Forensic Medicine and Toxicology, Government Medical College, Amritsar to find out the bilateral and bisexual variations from the percutaneous measurement of length of hand and middle and little fingers of both hands of males to reconstruct the stature.

MATERIAL AND METHODS

Inclusion Criteria

100 healthy male undergraduate students were taken up for the study with age group 18 years to 25 years valid age proof (Birth certificate/High school/Certificate/Ration card/Bank passbook/Voter ID/ Driving license) were included in the present study. Before performing any measuremental procedure, written informed consent was obtained from the students.

Exclusion Criteria

Cases with any pathology, congenital anomaly/amputation (surgical or accidental) of the hand or any finger were excluded from the study.

Methodology

The stature was measured by a stadiometer. The hand length and finger length were measured by the measuring scale and vernier calipers. The data was collected and analysed. The data was then analysed by the statistical analysis using Statistical Package for Social Sciences (SPSS) to calculate the stature with length of both hand, middle finger length and little finger length. The prediction of estimation of stature from the length of both hands, middle finger length and little finger length of both hands was determined with the help of 'P' value, SEE, r, r square, Pearson's correlation and regression equations individually in all the 100 male subjects.

RESULTS

Table 1: Regression Equation to predict the height from the different finger lengths.

Variable	Constant (B0)	Regression Coefficient (B1)
RHL	77.427	4.911
RMFL	97.626	9.219
RLFL	135.561	6.084
LHL	73.836	5.116
LMFL	107.894	8.027
LLFL	144.815	4.715

RHL: Right hand length, RMFL: Right middle finger length, RLFL: Right little finger length, LHL: Left hand length, LMFL: Left middle finger length, LLFL: Left little finger length

Table 2: Different variables in comparison of left side and right side

Variables	Min	Max	Mean	SD	N	Correlationr	P value
Height(cm)	156.10	188.10	174.3690	6.17811	100	-	-
RHL (cm)	17.70	22.10	19.7400	.87027	100	0.839	P<0.01 HS
LHL (cm)	17.80	22.20	19.6501	.83158	100	0.847	P<0.01 HS
Linear Regression Equation	Y = 77.427 + 4.911 * X (Right Hand Length)						
Linear Regression Equation	Y = 73.836 + 5.116 * X (Left Hand Length)						

Table 3: Correlation of hand length and stature

	N	Mean	Std. Deviation	Std. Error Mean
Height	100	174.3690	6.17811	.61781
RHL	100	19.7400	.87027	.08703
RMFL	100	8.3242	.45458	.04546
RLFL	100	6.3791	.43483	.04348
LHL	100	19.6501	.83158	.08316
LMFL	100	8.2819	.48635	.04864
LLFL	100	6.2681	.52335	.05233

DISCUSSION

The multiple linear regression model was considered. The length of middle finger and little finger have significant correlation with height in male population and can be used a

good tool for estimation of height. Moreover, the Pearson's correlation was used which can predict a significant relationship between the height and the length of hand and middle finger of male. All the paramters including Pearson's correlation coefficient, 't' test and

ANOVA test and were used in calculating the height from the variables were highly significant. ($P < 0.001$)

In the present study, the mean height in males is 174.3690 ± 6.18 cm that correlates with the study by Patel et al (2014),^[9] who observed that the mean and standard deviation of stature was 175.95 ± 5.92 cm in males. Jasuja et al (2004),^[10] who concluded that the mean height (171.6 cm) of men in the similar region. The present study correlates with study of Bardale BV et al (2013),^[11] Nishita et al (2013),^[12] Aggarwal et al (2013),^[13] Tandon et al (2016),^[14] and Kumar R et al (2016),^[15] who observed that the mean height of males was in similar range. This present study also differs from the studies carried out by Krishan et al (2012),^[16] conducted in North India between the age group of 17 years to 20 years where the mean height was found 168.2cm in males. Probable reason for difference is the different age group of study. This present study is different from the study of Suseelamma D et al (2014),^[17] where the mean height in males was 165cm and Pournima et al (2019),^[18] where the mean height was 162cm, the probable reason being the different geographical region of study.

The mean hand length in males is 19.74 ± 0.87 cm in right hand and 19.65 ± 0.83 cm in left hand. The present study correlates with the study conducted by Patel et al (2015),^[9] who observed that the mean and standard deviation of hand length was 18.41 ± 1.04 cm in males and also correlates with the study of Rastogi et al (2009),^[19] where the mean height in right hand of males is 18.89 cm while in left hand of males is 18.87. The present study was similar with the

study conducted by Jasuja et al (2004),^[10] in his study concluded that the mean hand length in males is 19.8 on right side while 19.79cm in left hand while in females is 17.51 cm of right hand and 17.47 cm of left hand. Similarity of results is observed because the study is conducted in the same region. Another study by Pal et al (2016),^[7] conducted in Bengalee population, West Bengal was different from the present study due to the different region in which the study has been conducted as the mean hand length in Bengalee population was found out to be 16.30 ± 0.86 cm. The mean hand length in Bengalee population is found less as compared to the mean hand length in the present study conducted in Punjabi population.

CONCLUSIONS

The hand lengths and finger lengths were highly significant on both left and right side. Positive and statistically significant correlation can be observed among the different variables taken up in the present study. Pearson's correlation was used which can predict a significant relationship between the height and the length of hand and middle finger of male. The data is of significance for epidemiological, anthropometric and forensic studies. The limitations can be the limited sample size and only healthy students were taken up for the study thus data may not be applicable with cases with any pathology, congenital anomaly/amputation (surgical or accidental) of the hand or any finger. Applicability among the living and dead of these anthropometric measurements can practically differ. More studies should be encouraged so as to address these limitations.



REFERENCES

1. Krogman WM. The human skeleton in forensic medicine. I. Postgrad Med. 1955;17(2):A-48.
2. Iscan MY. Rise of forensic anthropology. Yearbook Phys Anthropol. 2008;31:203-30.
3. Stanojevich V. The Role of a Forensic Anthropologist in a Death Investigation. J Forensic Res. 2012;3(6):1-2.
4. Athawale NC. Estimation of height from length of forearm bones-A study of one hundred Maharashtrian male adults of ages between 25-30 years. Am J PhysAnthropol. 1963;21:105-12.
5. Fully G. New method of determination of the height. Ann Med Leg Criminol Police Sci Toxicol. 1956;36(5):266-273.
6. Lundy JK. The mathematical versus anatomical methods of stature estimate from long bones. Am J Forensic Med Pathol. 1985; 6(1):73-76.
7. Pandeya A, Atreya A. Estimation of Stature from Percutaneous Hand Length Among the Students of A Medical College. JNMA J Nepal Med Assoc. 2018;56(211):687-690.
8. Krishan K, Sharma A. Estimation of stature from dimensions of hands and feet in a North Indian population. J Forensic Leg Med. 2007;14(6):327-32. doi: 10.1016/j.jcfm.2006.10.008.
9. Rastogi P, Nagesh KR, Yoganarasimha K. Estimation of stature from hand dimensions of north and south Indians. Leg Med (Tokyo). 2008;10(4):185-9. doi: 10.1016/j.legalmed.2008.01.001.
10. Jasuja OP, Singh G. Estimation of stature from hand and phalange length. J Indian Acad Forensic Med. 2004;26(3):100-6.
11. Bardale RV, Dahodwala TM, Sonar VD, Estimation of Stature from Index and Ring Finger. Indian Acad Forensic Med. 2013;35(4):353.
12. Nishita J, Patel SV, Patel SM, Rakesh V, Gaurang P. Estimation of stature from hand length in living subjects of Gujarat Region. Natl J Integr Res Med. 2013;4(4):57-60.
13. Agrawal J, Raichandani L, Kataria SK, Raichandani S. Estimation of stature from hand length and length of phalanges. J Evol Med Dent Sci. 2013;2(50):9651-7.
14. Tandon R, Yunus SM, Faruqi NA, Asghar A. Measurements of hand and foot A Predictor of stature in adult human population of Uttar Pradesh. Int J Anat Radiol Sur. 2016;(5):12-15.
15. Kumar R, Sharma N, Jain SK, Budhiraja V, Rastogi R, Garg R, et al. morphometric study of estimation of stature from index finger length in Indian population. Ann. Int. Med Den Res. 2016;2(4):232-36.
16. Krishan K. Determination of stature from foot and its segments in a north Indian population. Am J Forensic Med Pathol. 2008;29(4):297-303.
17. Suseelamma D, Gayathri P, Deepthi S, Chandra mohan M, Amarnath study of correlation between stature and length of fingers. Sch J App Med Sci. 2014;2 (2D):773-784.
18. Pournima, Rajesh JJ, Kumar KM, Reddy BS, Feula A. Stature estimation from length of fingers in South Indian population - A cross sectional study. J Indian Acad Forensic Med. 2019 Oct-Dec; 41(4): 226-228.
19. Rastogi P, Kanchan T, Menezes RG, Yoganarasimha. Middle finger length- a predictor of stature in the Indian population. Med Sci Law. 2009;49(2):123-126

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