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Stature Estimation From Hand Prints: A Study in Rajasthan.

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ABSTRACT

The Stature prediction occupies relatively central place both in identification and anthropological research, necessitated by the medico-legal experts. This paper attempts to establish identity from partial evidences to carry out further investigation in forensic and police examination. The study was conducted among Bhils of Udaipur, Rajasthan. The objective of the present study was to formulate regression equation to predict the stature from hand length and hand breadth (Direct & indirect from prints) and to find gender differences for estimation of stature among Bhil (males and females) of Rajasthan. From the present study, it has been observed that Hand length has come out as a better predictable variable to estimate the stature and the parameters are more efficient predictors in stature estimation for females than males. Thus, It can be said that more studies on various ethnic groups of India on the said topic be initiated for a proper data base and this will help in identifying the person on the basis of these measurements.

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Introduction:

The Stature prediction occupies relatively central place both in identification and anthropological research, necessitated by the medico-legal experts. Stature is one of the important aspects for establishing identity. In this new era, incidence of mass disasters, murders, accidents, or natural disasters are increasing at a tremendous rate and the analysis of the living as well as amputated body parts of decedents is required frequently. This becomes challenge to forensic experts to establish complete identity from partial evidences to carry out further investigation.

Stature estimation from various parameters based on different body parts is an integral part of criminal investigation and identification. Studies on estimation of stature from different body parameters like mutilated body parts mostly long bones or skeletal remains have been reported by Pearson (1889), Trotter and Glesser (1952). Rollet (1888) was the first to tabulate stature from long bones. Correlation of long bones to stature is said to differ with sex, race and the side of the body (Hrdlicka, 1947). There is supposed to be a progressive diminution in stature as age advances (Trotter and Gleser, 1951a). Also there is a considerable statistical difference between the lengths of fresh bones and dry bones (Brues, 1958). Authors investigated skeletal materials of Americans and Europeans to estimate stature (Breitinger, 1937; Telkka, 1950; Trotter and Gleser, 1952, 1958).

Then, the approach of estimating stature from various measurements (Hand length, hand breadth and so on) and also from different perspective like estimating stature from hand length taken from prints or from measurements taken from hand outlines or from finger prints was carried out. Kapoor (1987) estimated stature from the hand length as obtained through palm prints among Lodhas of Midnapur district, West Bengal. Earlier work done in India is limited to estimation of stature based on multiplication factor (Pan, 1924; Nat, 1981). But now, correlation coefficient and regression equations are frequently used in estimating stature (Jasuja & Singh (2004), Sanli et al. (2005), Vijeta and Kapoor (2012), Kapoor et al (2013, 2014).

It is important to remember that these parameters varies with respect to differences in environment, physical activity level, nutrition, occupation from one ethnic group to other.

Thus, the present study attempts to investigate Stature from hand length and hand breadth (Direct and Indirect) as obtained through prints among Bhil males and females of Rajasthan. Fingerprint or palm print patterns are unique and remain unchanged throughout life. If prints are recovered at the scene of crime as evidence, hand length and hand breadth can be obtained from prints and the stature of the criminals can be formulated through regression equation which can effectively help to narrow down the pool of evidences in criminal investigation and this type of study can be proved helpful in police science.

Materials and Methods:

The present research was based on hand measurements i.e. Hand length (HL) and Hand breadth (HB). Data for the present study includes 204 samples (113 Males and 91 Females) of one endogamous group- Bhil of District Udaipur, Rajasthan within the age groups 18-60 years. The method suggested by Cummins and Mildo (1961) i.e. Ink method was employed for obtaining HL and HB from prints. By using sliding caliper HL (Direct - interstylion (isty) to dactylion III (da III)) and HB (Direct- metacarpal radiale (mr) to metacarpal ulnare (mu)) were measured. HL and HB measurements were also obtained indirectly from prints with the help measuring scale. HL and HB measurements were taken on both Right and Left hand of the individual. The standard technique given by Weiner and Lourie (1981) was followed for measuring Stature of each individual using Anthropometer. SPSS (Statistical Packages for Social Sciences) have been used to analyze the result. Descriptive statistics i.e. mean, standard Deviation have been calculated. Also t-test (to observe the difference between males and females), Correlation coefficient, coefficient of determination and linear regression have been calculated to estimate the stature.

Results:

Table 1 represents the computed values of mean with standard deviation and t-test among Bhil males and females of Rajasthan of all the above listed Variables i.e. (Stature, Right & Left Hand Length direct, Right & Left Hand Length Indirect, Right & Left Hand Breadth Direct, Right & Left Hand Breadth Indirect). The mean stature of the Bhil males has been found 163.56 with standard deviation ± 5.57. Among Bhil females mean stature has been found 152.62 with standard deviation ± 6.40. Means Difference among males and females of Rajasthan have been found statistically significant for Right & Left Hand Length & Hand Breadth both for direct as well as Indirect methods.

Table: 1. represents Mean with Standard Deviation and t-test among males and females of Rajasthan.

Variable (cm)	Sex	N	Mean	S.D	t-test
Stature	Male	113	163.56	5.57	13.04**
	Female	91	152.62	6.40	
RIGHT Hand length (direct)	Male	113	19.30	1.11	11.85**
	Female	91	17.48	1.07	
LEFT Hand length (direct)	Male	113	19.24	1.10	12.59**
	Female	91	17.33	1.04	
RIGHT Hand length (indirect from hand print)	Male	113	18.77	0.96	12.41**
	Female	91	17.08	0.86	
LEFT Hand length (indirect from hand prints)	Male	113	18.77	0.86	12.63**
	Female	91	17.08	0.81	
RIGHT Hand breadth (direct)	Male	113	8.26	0.39	13.13**
	Female	91	7.58	0.39	
LEFT Hand breadth (direct)	Male	113	8.15	0.39	14.39**
	Female	91	7.47	0.38	
RIGHT Hand breadth (indirect from hand prints)	Male	113	7.71	0.43	10.26**
	Female	91	7.09	0.43	
LEFT Hand breadth (indirect from hand prints)	Male	113	7.72	0.45	10.82**
	Female	91	7.06	0.41	

S.D. = Standard Deviation, ** p<0.01

Table: 2 Representing computed value of correlation coefficient & coefficient of determination with stature with 'b' and 'beta' values among Bhil males of Rajasthan.

Variable (cm)		Unstandardized coefficient	Standardized coefficient	Coefficient of correlation(r)	Coefficient of Determination (R square)
		'b'	'beta'		
Hand length (Direct)	R	111.25	0.54	0.54**	0.29
	L	111.88	0.53	0.52**	0.28
Hand breadth (Direct)	R	122.27	0.35	0.35**	0.12
	L	124.49	0.33	0.33**	0.11
Hand length (Indirect from prints)	R	100.90	0.58	0.58**	0.33
	L	97.32	0.54	0.54**	0.30
Hand breadth (Indirect from prints)	R	138.96	0.25	0.25**	0.06
	L	140.19	0.25	0.25**	0.06

**P<0.01 R: Right Hand, L: Left Hand.

Table 2 represents the correlation coefficient (r) and Coefficient of Determination (R^2) for all the variables such as Hand length Direct (Right & left), Hand breadth Direct (Right & left), Hand length Indirect from prints (Right & left), and Hand breadth Indirect from prints (Right & left) with stature among the males of Rajasthan. The overall highest correlation has been exhibited by Hand length Indirect from prints (right hand, r = 0.58) and the least correlation was

observed for Hand breadth Indirect from prints (left hand, r = 0.25). Table 3 represents the correlation coefficient (r) and Coefficient of Determination (R^2) for all the variables with stature among the Bhil females of Rajasthan. The overall highest correlation was exhibited by Hand length direct (right hand, r = 0.69) and the least correlation was observed for hand breadth indirect from prints (left hand, r =0.41). Table 4 & Table 5 shows the Computed Regression Equation with standard error and the correlation between observed and predicted Stature among Bhil males and females of Rajasthan.

Discussion:

Determination of Partial identity of unidentified bodies and dismembered remains can be established by estimating Stature. Central tendency and standard deviation was calculated to see the deviation of the variables from the mean. 't-test' was calculated to see the difference among the Bhil males and females of Rajasthan and the difference was found statistically significant at $p < 0.01$ for all the measurements.

Our result showed that in case of hand length direct the 'b' value was found more in left hand and 'beta' value was found more in right hand among males and females whereas in case of hand breadth direct 'b' value was more in left hand & 'beta' value in right hand among males while in females 'b' value was more in Right hand & 'beta' value in left hand With respect to hand length indirect from prints, 'b' value was found more in right hand while 'beta' value in left hand both among males and females of Rajasthan.

Indirect measurement shows higher 'b' values both among males and females whereas 'beta' value is more in indirect among males but in females it is more in direct measurements.

Strength of association between stature and variables is depicted by correlation coefficient. Among males the overall highest correlation is exhibited by Hand length Indirect from prints (right hand, r = 0.575) and the least correlation is observed for Hand breadth Indirect from prints (left hand, r = 0.245). Among females, the overall highest correlation is exhibited by Hand length direct (right hand, r = 0.698) and the least correlation is observed for hand breadth indirect from prints (left hand, r =0.409).Thus, the maximum correlation was exhibited by Hand length direct.

The coefficient of determination (r^2 or R^2) is useful because it gives the proportion of the variance of one variable that is predictable from the other variable. The coefficient of determination is the ratio of the explained variation to the total variation. It also represents the percent of the data that is closest to the line of fit. 33% of stature change in study of males can be explained with right hand length indirect while in case of females, 48.7% of stature change can be explained with right hand length direct. Similar results were shown by Vijeta and Kapoor (2012) that 63% of stature change in study groups can be explained with Right Hand Length direct. The reason could be their occupation of laboring which makes skin of hands of males harder and stiffer so that they are not able to place their hands properly flattened but slightly curved.

Table: 3.Representing computed value of correlation coefficient & coefficient of determination with stature with 'b' and 'beta' values among Bhil females of Rajasthan.

Variable (cm)		Unstandarized coefficient	Standarised coefficient	Coefficient of correlation (r)	Coefficient of Determination (R square)
		'b'	'beta'		
Hand length Direct	R	79.76	0.70	0.69**	0.49
	L	80.97	0.67	0.67**	0.45
Hand breadth Direct	R	85.55	0.54	0.54**	0.27
	L	85.27	0.54	0.54**	0.29
Hand length Indirect (from prints)	R	67.83	0.66	0.66**	0.44
	L	66.26	0.64	0.64**	0.41
Hand breadth Indirect (from prints)	R	103.97	0.46	0.46**	0.22
	L	107.13	0.41	0.41**	0.17

**P<0.01 R: Right Hand, L: Left Hand.

Table: 4. Regression equation to estimate stature with correlation coefficient among Bhil males of Rajasthan.

Variable (cm)		Regression equation	SEE
Hand Length Direct (x)	R	Y=111.250+2.710(x)	4.71
	L	Y=111.884+2.686(x)	4.74
Hand Breadth Direct (x)	R	Y=122.273+5.000(x)	5.24
	L	Y=124.493+4.792(x)	5.24
Hand Length Indirect (x) (from prints)	R	Y=100.904+3.338(x)	4.58
	L	Y=97.317+3.529(x)	4.70
Hand Breadth Indirect (x) (from prints)	R	Y=138.958+3.191(x)	5.42
	L	Y=140.193+3.028(x)	5.42

Y: predicted stature, R: Right Hand, L: Left Hand.

Table: 5. Regression equation to estimate stature with correlation coefficient among Bhil females of Rajasthan.

Variable (cm)		Regression equation	SEE
Hand Length Direct (x)	R	Y=79.758+4.168(x)	4.61
	L	Y=80.971+4.134(x)	4.76
Hand Breadth Direct (x)	R	Y=85.545+8.852(x)	5.44
	L	Y=85.272+9.013(x)	5.41
Hand Length Indirect (x) (from prints)	R	Y= 67.832+4.964(x)	4.80
	L	Y=66.260+5.058(x)	4.96
Hand Breadth Indirect (x) (from prints)	R	Y=103.967+6.867(x)	5.70
	L	Y=107.130+6.445 (x)	5.88

Y: predicted stature, R: Right Hand, L: Left Hand.

Regression equations have been formulated with standard error of estimate ranging from 4.58 to 5.42 in case of males and 4.61 to 5.88 in case of females. Similar studies about regression equation for estimation of stature from hand measurements have also been reported earlier. (Jasuja, 2004; Bhatnagar et al., 1984) and these equations are also tested by the actual values and it was found that error of estimation of stature exists within the calculated range. A correlation of proximal phalange and stature for Japanese women has been reported by Shintaku and Furuya (1990). Similar results were also reported among North Indian Population and Egyptian females that prediction of stature is more reliable in females than in males (Krishan and Sharma, 2007) and (Habib and Kamal, 2010) respectively which indicates that these parameters are more efficient predictors in stature estimation for females than males.

Thus, if hand length or hand breadth is known, stature can be calculated within the standard error of estimate and this knowledge can be helpful for anthropologists, archaeologists, forensic experts, medico-legal scientists.

Conclusion:

The present research highlights that hand measurements are highly reliable for the estimation of stature in forensic examinations and stature estimation has practical use in medico-legal cases and forensic identification. Ways to establish Stature are plentiful but their significance lies in simplicity of measurement, applicability and accuracy in prediction. It can be said that stature estimation was gender specific in present study as it indicates that the parameters are more efficient predictors in stature estimation for females than males as regression equations derived indicated that the stature can be estimated with standard error of estimate ranging from 4.58 to 5.42 in case of males and 4.61 to 5.88 in case of females. Similar results were shown by Vijeta and Kapoor, 2012 with a range of +4.55 to ±7.28 for both the sexes for stature estimation. It can be concluded that Hand length has come out as a better predictable variable to estimate the stature and more studies on various ethnic groups of India on the said topic be initiated for a proper data base as this will help in identifying the person on the basis of these measurements.

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References:

1. Bretinger, E. (1937). Zur Berechnung der Korperhohe aus den langen Gliedmassenknochen. Anthrop. Anz., 14: 249-274.
2. Brues, A.M. (1958). Identification of skeletal remains. J. Crim. Law. Criminol. and Pol. Sci., 48 : 551-563.
3. Cummins, H. and Mildo, C. (1926). Palmer and planter epidermal ridge configuration in European Americans. Am. J. Phys. Anthrop., 9: 471-502.
4. Habib, R.S. and kamal, N.N. (2010). Stature estimation from hand and phalanges lengths of Egyptians. Journal of Forensic and Legal Medicine, Vol 17, Issue 3, Pages 156–160.
5. Hrdlicka, A. (1947). Practical Anthropometry. Third edition, edited by T. D. Stewart. Wistar Institute, Philadelphia, 230 pp.
6. Jasuja, O.P, and Singh, G. (2004). Estimation of stature from hand and phalange length. Journal of Indian Academy of Forensic Medicine, 26 (3) ISSN 0971-0973.
7. Kapoor, A. K., Saini, M. and Choudhary, V. (2013). Estimation of Stature from Hand Length Prints among Ladakhis of Kashmir.
8. Kapoor, A.K and choudhary, V. (2014). Estimation of stature from palm prints among Indian populations: Identification dynamics. The international research journal of social sciences and humanities. Vol.3 (2) Feb. (2014) ISSN2320-4702.
9. Kapoor, A.K. (1987). Estimation of stature from the hand length as obtained through palm prints among the Lodhas of district Midnapur, West Bengal. Indian Journal of physical anthropology and human genetics, 13 (2): 139-742.
10. Krishan, K. and Sharma, A. (2007). Estimation of stature from dimensions of hand and feet in North Indian population. Journal of forensic and legal medicine, 14 (6), 327-332.
11. Krogman, W.M. (1962). The Human Skeleton in Forensic Medicine. Springfield, Charles C. Thomas.
12. Martin, R. and K. Seller 1959. leh rbuch der Anthropology, Stultgart, Gustar Fioher rorlage.
13. Pearson, K. (1889). Mathematical contributions to the theory of evolution. V. On the reconstruction of the stature of prehistoric races. Phil. Trans. Roy. Soc. London. 192:169-244.
14. Rollet, E. (1888). De la mensuraition des os longs des members. Thesis pour le doc. en med., 1st series, 43: 1-128.
15. Sanli, G.S., Kizilkanat, D.E. , Boyan, N. , Ozsahin, E.T. ,Bozkir, G.M. , Soames, R. , Erol, H. and Oguz, O. (2005). Stature Estimation Based on Hand Length and Foot Length. Clinical Anatomy, 18:589–596.
16. Shintaku K, Furuya Y. (1990). Estimation of stature based on the proximal phalangeal length of Japanese women's. JUEOH, 12(2):215–9.
17. Telkka, A. (1950). On the prediction of human stature from the long bones. Acta Anatomiea, 9 : 103-117.
18. Trotter, M.G. and Gleser, G.C. (1951a). The effect of ageing on stature. Am. J. Phys. Anthrop., 9: 311-324.
19. Trotter, M., and Gleser, G.C. (1952). Estimation of stature from long bones of American Whites and Negroes. Am. J. Phys. Anthrop., 9: 427-440.
20. Trotter, M.G. and Gleser, G.C. (1958). A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death. Am. J. phys. Anthrop, 16: 79-123.
21. Vijeta and Kapoor, A.K. (2012). Estimation of stature from Hand length and Hand breadth among population groups of himachal Pradesh. AJSAT, Vol.1 No.1 January-June 2012.
22. Weiner, J.S and Lourie, J.A. Practicle human Biology. Academic press London (1981).