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# Hand Length and Hand Breadth: A Study of Correlation Statistics among Human Population

**Sangeeta Dey[1], A. K. Kapoor[2]**

[1]Department of Anthropology, University of Delhi, Delhi – 110007, India

**Abstract:** ***Hand Length (HL) and Hand Breadth (HB) have been extensively used in research to estimate stature of individuals for identification. The relationship of Hand Length and Hand Breadth in relation to various body measurements was studied but the correlation between these two variables has not yet been studied. Aim: The present study made an attempt to find out possible correlations or association between hand length and hand breadth and to provide a standard table for prediction of hand dimension among males and females. Methodology: The present research was conducted in Rajasthan with sample size 147 with 73 males and 74 females in the age group 18 above. Hand Length and Hand breadth was measured in cm using anthropometric instrument – sliding caliper. Measurements was taken from both right and left side of the hand from each individual. The results were computed and analyzed using computer software IBM SPSS version 20.0. Results: The results depict significant male – female differences between the variables. Pearson's correlation analysis shows statistically significant and positive correlation between Hand length and Hand Breadth. Conclusion: It can be concluded that if hand length was known, hand breadth can be estimated as they are positively correlated hence this study will prove helpful in situation where the trace evidence was recovered and from that complete evidence can be derived by forensic expert which will aid in forensic investigation.***

**Keywords:** Forensic Anthropologists, Hand Length, Hand Breadth, Correlation Statistics.

## 1. Introduction

Hand Length (HL) and Hand Breadth (HB) have been extensively used in research to estimate stature of individuals for identification and have received scant attention from forensic anthropologists. This is due to the established strong correlation between stature and hand dimension. Ilayperuma, Nanayakkara and Palahepitiya estimated personal stature of incomplete skeletal and decomposing human remains from hand length and showed 0.58 and 0.59 correlation coefficient for males and females respectively [1]. Jasuja and Singh in their study demonstrate that hand length have a positive as well as statistically significant correlation with the stature [2]. Sangeeta and Kapoor performed stature estimation from the dimension recovered from hand outlines and it was revealed that Pearson's correlation was statistically significant between stature and hand dimensions [3]. Literature review suggests that many studies have been undertaken to demonstrate that it is possible to calculate stature through regression equation from hand length & Hand breadth. [1]-[9]. Amirsheybani, et al. [10] demonstrate hand length as good predictor of body surface area. Thus it can be extracted that relationship of hand length & Hand breadth with various measurements of the human body have been studied but none of the studies provide information regarding the correlation between two of them. The objective of the present study is to investigate the association or correlation between hand length and hand breadth and to provide a standard table for prediction of hand dimension.

## 2. Materials & Methods

The present research was conducted in Rajasthan with sample size 147 with 73 males and 74 females in the age group 18 above. Hand Length and Hand breadth was measured in cm using anthropometric instrument – sliding caliper. Measurements was taken from both right and left side of the hand from each individual. Individual with no any history of hand deformity were included in the study.

### 2.1 Anthropometric Measurements

Hand Length and Hand Breadth was obtained from each individual according to the standard techniques described by Singh and Bhasin, 1968 [11].

- Hand Length – It measures the straight distance between the mid-point of a line joining the two stylion (sty) and dactylion (daIII) of the middle finger.
- Hand Breadth – It measures the straight distance between metacarpal radialis (mr) and metacarpal ulnare (mu).

### 2.2 Statistical Analysis

The data obtained was analyzed with IBM SPSS computer software. Descriptive statistics were derived for all the measurements. Pearson's correlation coefficient was calculated between hand length and hand breadth. Predicted standard range for hand dimension was calculated by deriving regression equation keeping hand breadth as a dependent variable and hand length as independent variable. Maximum and Minimum value of Hand Length was determined through carefully observing the frequency statistics in both males and females and range was determined for Hand Length. These values were tested in regression equations to derive predicted range for Hand Breadth. Further, the range was tested to the actual dimension of hands and it was recovered that range can predict within the standard error of estimate thus can be used as a reference for future perspective.

## 3. Results & Discussion

Descriptive statistics of Hand Length and Hand Breadth in males and females are shown in Table 1. It is well established

that bilateral symmetry exist in human population i.e. the difference between the measurements of the left and right side of the human body thus both the measurements was considered for the present study. All the variables shows statistically significant male-female differences at $p < 0.001$ by student's t-test. Pearson's correlation analysis showed positive & statistically significant correlation between Hand length & hand Breadth depicted in Table 2. These depicts that the relationship between Hand Length and Hand Breadth was significant. The data obtained was computed for providing a predicted range for hand dimensions so that if one variable is known the other can be predicted within the possible range. The predicted possible standard range for hand variables for males and females are depicted in Table 3 and Table 4 respectively. The range can predict hand dimension within the standard error of estimate thus can be used as a reference for future perspective in forensic domain.

**Table 1**: Descriptive Statistics for hand variables in males and females

| *Variables (cm)* | *MALES (n = 73)* | | | *FEMALES ( n = 74)* | | |
|---|---|---|---|---|---|---|
| | *Mean* | *S.D.* | *Range* | *Mean* | *S.D.* | *Range* |
| *RHL* | 19.23* | 1.20 | 16.9-22.5 | 17.37* | 1.09 | 14.3-19.8 |
| *LHL* | 19.08* | 1.17 | 16.5-22.3 | 17.22* | 1.04 | 13.9-19.6 |
| *RHB* | 8.30* | 0.40 | 7.3-9.2 | 7.57* | 0.35 | 6.9-8.5 |
| *LHB* | 8.18* | 0.38 | 7.1-9.0 | 7.45* | 0.35 | 6.8-8.3 |

RHL - Right hand length, LHL - Left hand length, RHB - Right hand breadth, LHB - Left hand breadth, S.D. – Standard Deviation,* - $p < 0.001$.

**Table 2**: Correlation Statistics between Hand Length & Hand Breadth

| *Variables (cm)* | *MALES (n = 73)* | | *FEMALES ( n = 74)* | |
|---|---|---|---|---|
| | *RHB* | *LHB* | *RHB* | *LHB* |
| *RHL* | 0.477** | 0.502** | 0.364** | 0.381** |
| *LHL* | 0.485** | 0.521** | 0.322** | 0.381** |

RHL - Right Hand Length, LHL - Left Hand Length, RHB - Right Hand Breadth, LHB - Left Hand Breadth , **- Correlation is significant at 0.01 level.

**Table 3**: Predicted possible standard range for correlated variables in males.

| *MALES (n = 73)* | | |
|---|---|---|
| *HL* | *RHB* | *LHB* |
| 14 – 15 | 7.47 - 7.63 | 7.31 - 7.49 |
| 15 – 16 | 7.63 - 7.79 | 7.49 - 7.65 |
| 16 – 17 | 7.79 - 7.95 | 7.65 - 7.82 |
| 17 – 18 | 7.95 - 8.11 | 7.82 - 7.99 |
| 18 – 19 | 8.11 - 8.27 | 7.99 - 8.16 |
| 19 – 20 | 8.27 - 8.43 | 8.16 - 8.34 |
| 20 – 21 | 8.43 - 8.60 | 8.34 - 8.50 |
| 21 – 22 | 8.60 - 8.76 | 8.50 - 8.68 |
| 22 – 23 | 8.76 - 8.92 | 8.68 - 8.85 |

HL – Hand Length, RHB – Right Hand Breadth, LHB – Left Hand Breadth.

**Table 4**: Predicted possible standard range for correlated variables in females.

| *FEMALES (n = 74)* | | |
|---|---|---|
| *HL* | *RHB* | *LHB* |
| 14 – 15 | 7.18 - 7.30 | 7.03 - 7.16 |
| 15 – 16 | 7.30 - 7.42 | 7.16 - 7.29 |
| 16 – 17 | 7.42 - 7.53 | 7.29 - 7.41 |
| 17 – 18 | 7.53 - 7.65 | 7.41 - 7.54 |
| 18 – 19 | 7.65 - 7.77 | 7.54 - 7.67 |
| 19 – 20 | 7.77 - 7.88 | 7.67 - 7.79 |
| 20 – 21 | 7.88 - 8.00 | 7.79 - 7.92 |
| 21 – 22 | 8.00 - 8.12 | 7.92 - 8.05 |
| 22 – 23 | 8.12 - 8.23 | 8.05 - 8.17 |

## 4. Conclusions

Hand Length and Hand Breadth has been studied extensively in relation to various body measurements but the correlation between these two variables has not yet been studied. The present study was thus conducted to derive the correlation between the hand Length & hand Breadth and the results demonstrate that there is significant correlation between them. The predicted standard range derived in the study can be used to predict hand dimension if one of the two variable is known. Therefore if hand length was known, Hand breadth can be estimated and if hand breadth is known, hand length can be determined. It is well established that bilateral symmetry exist in human population i.e. the difference between the measurements of the left and right side of the human body thus standard range was predicted for both the sides of the hand. This study will prove helpful in situation where the trace evidence was recovered and from that complete evidence has to be derived by forensic experts.

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## Author Profile

**Ms. Sangeeta Dey** received M.Sc degree from Department of Anthropology, University of Delhi, Delhi – 110007 and achieved University First Rank Award in M.Sc (F) Anthropology. Presently enrolled in Ph.D. Research Areas of Interest**:** Anthropology, Forensic Science, Forensic Anthropology, Dermatoglyphics, Physiology, Human Rights, Statistics, Computer Science. Paper presented in National seminar on Expanding Horizons of Anthropological Research: Issues of Methodology, Department of Anthropology, University of Delhi, on 27th August 2013. Attended 102th Indian Science Congress Association, 3-7th January 2015, Mumbai, India. Paper presented in National seminar under UGC-SAP III, DRS II on "Anthropological Perspectives on Environment, Development, Public Policy and Health" in Department of Anthropology, University of Delhi on 27th – 28th February, 2015. Publications**:** Sangeeta, Dey, and A.K. Kapoor. "Hand Outlines: A New Dimension in Forensic Examination." *International Journal of Advanced Research* 3, no. 1 (2015): 193-199.

**Prof. (Dr) Anup Kumar Kapoor** received M. Sc and Ph. D in Anthropology from university of Delhi, Delhi – 110007. Appointed as a vice chancellor at Jiwaji University from Feb, 2007 – June, 2009. Presently working as Professor at Department of Anthropology, University of Delhi, Delhi – 110007, INDIA; supervised many students for Masters, M.phil and Ph.D degrees; Published Several research papers in International Journals. Research Areas of Interest: Human Population Biology, Health Anthropology, Biological Gerontology, Forensic Anthropology, Anthropology of NGO'S, Cultural Biology, Tribal and Himalayan Studies and Human Rights.