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RESEARCH ARTICLE
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Sex Determination Based on Measurements of Hand That Are Devoid of Ridge Patterns of Skin

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ABSTRACT

Personal identification is the process of individualizing a person. Among the various parameters of identification of a personal identification sex determinaton is the most important and one of the foremost criteria in establishing the identity of an invidual. Forensic anthropologists routinely work with skeletonised and badly decomposed bodies and collect osteometric data which is very straight forward and stature estimation from various parameters. Such as hand outlines and determination of sex. The handprints of adult subjects were using metrics that are usually not measured on the human body such as the length of the hand without distal phalanx of the third finger, the length of the hand from the centre of the palm and diagonal width of the palm. The aim of the study is to determine the sex based on measurements of hand that are devoid of dermatoglyphic features. The data collected were cross verified by another examiner. The anthropometric measurements were measured with the help of the standard anthropometric instrument sliding caliper. From the present research it can be concluded that the hand dimensions can be successfully applied to determine sex. Among the hand width was identified as the more reliable predictor of sex.

Keywords: *Anthropometry; Sex determination; hand outlines; dermatoglyphics; forensic investigation*

INTRODUCTION

Personal identification is the process of individualizing a person. Among the various parameters of identification of a personal identification sex determinaton is the most important and one of the foremost criteria in establishing the identity of an invidual.

Forensic anthropologists routinely work with skeletonised and badly decomposed bodies and collect osteometric data which is very straight forward and stature estimation from various parameters (1) Such as hand outlines (2) and determination of sex. (3)

But the collection of osteometric data can be more challenging when dealing with fleshed remains as there is a need for soft tissue dissertation. Anthropometric measurements may help to by pass this requirement. Anthropometry is the best known and the earliest method of identification also known as Bertillon system of criminal identification(4). As human population exhibit some sort of sexual dimorphism which provides discrimination features regarding sex such as skeleton of male are on average larger than female thus the size of the skeleton can be used to estimate sex of the individual. Dermatoglyphics is the study of configuration of epidermal ridges on certain body parts namely palms & fingers. (5)

The unique nature of dermatoglyphic features serves as a valuable tool to suspect a crime scene in forensics but when the handprints are erased the measurements and the shape of palm and the phalanges can be taken into consideration. Measurements of hands are sexually dimorphic , they can be used as a potential tool in forensics. It differs with age, sex and race. Each race requires its own formula for stature estimation because racial and ethnic variations exist in one population cannot be entirely applicable to other populations.

(6). Previously there had been numerous studies done from our institute on bones (7) (8) (9) (10) (11) (12), researches are also done on (13) (14) (15) (6) (16) our institute have also studied technology (17) (18) (19) (20) This study attempts to discriminate between male and female on the basis of hand dimensions to investigation among the variables which can better predict sex to drive sectioning point for discriminating sex and to reflect frequent hand index category among the sexes.

MATERIALS AND METHODS

The present study was an anthropometric study. The study was approved by the Institutional Research Board. Before collecting the data informed consent was obtained from the participants. The handprints of adult subjects were collected and evaluated by measurements that are usually not considered and analysed on the human body such as the length of the hand without distal phalanx of the third finger, the length of the hand from the centre of the palm, and the diagonal width of the palm. Handprints from 24 adult subjects (12 male and 12 female) were obtained and examined for hand dimensional variations between males and females. The data collected were cross verified by another examiner. The anthropometric measurements were measured with the help of the standard anthropometric instrument sliding caliper. The necessary data like the name, age and gender was collected from subjects. Measurements like hand length parameters like the length of the hand without distal phalanx of the third finger, the length of the hand from the centre of the palm and the width of the palm were measured from subjects using a sliding caliper. The data was imported to SPSS version 20.0 and the variables were defined.

Chi-square tests were done for correlation analysis. The age, gender were the dependent variables and the height, weight, education, occupation were considered to be independent variables. The obtained data was analysed and represented graphically using bar charts.

RESULTS AND DISCUSSION

The average length of the hand without the distal phalanx of the third finger of males are found to be 222.7mm.The average length of the hand without the distal phalanx of the third finger of females are found to be 154mm. Figure-1 shows correlation between the length of the hand without the distal phalanx of the third finger in cm.

The average length of the hand from the centre of the palm of males was found to be 602.7mm.The average length of the palm of females was found to be 483mm. Figure-2 shows the correlation between the length of the hand from the centre of the palm between males and females.

The average width of the ulnar part of the palm of males was found to be 40mm. The average width of the ulnar part of the palm of females was found to be 23mm. Figure-3 shows the correlation between the width of the ulnar part of the palm between males and females. The average width of the diagonal width of the palm

of the males was found to be 23mm. The average diagonal width of the palm of a female was found to be 71mm. Figure-4 shows the correlation between the diagonal width of males and females.

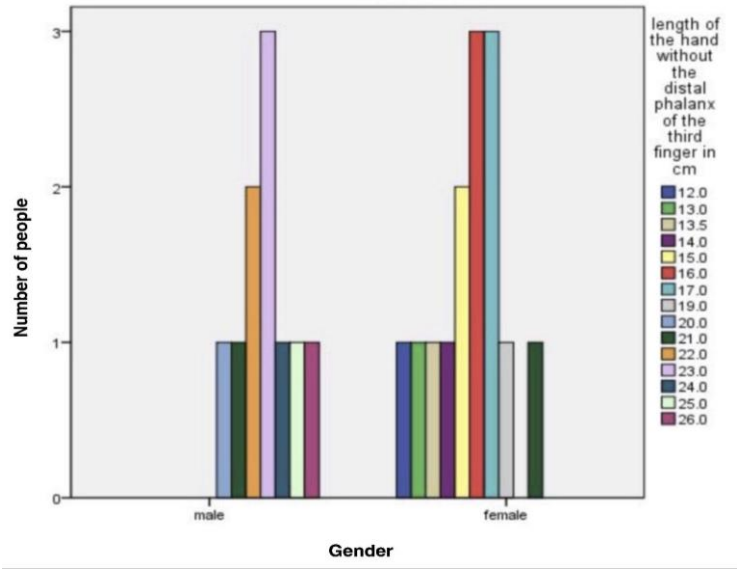

FIGURE 1: The graph shows the correlation between the length of the hand without the distal phalanx of the third finger in male and female (cm). X-axis denotes the gender (Male and female). Y-axis denotes the number of participants. There is a significant difference in the length of the hand between male and female. Chi square test showing p=0.000 (p<0.005 indicating statistically significant).

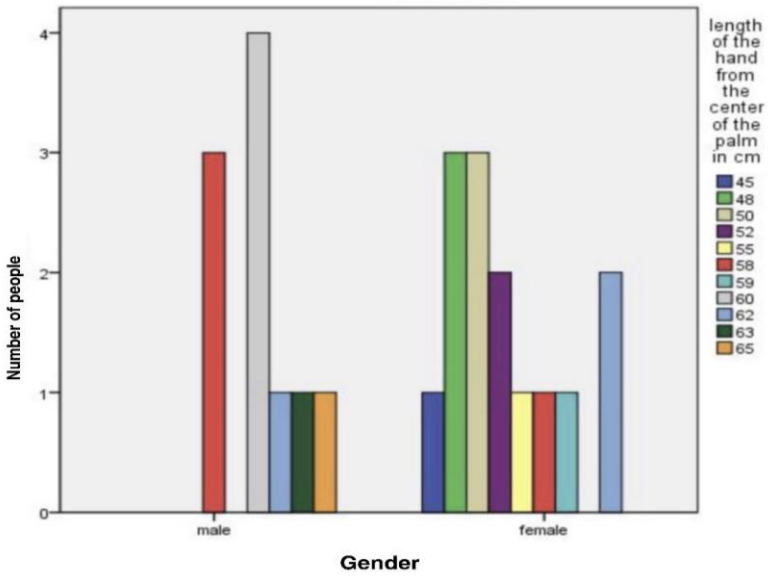

FIGURE 2: The graph shows the correlation between the length of the hand from the centre of the palm between males and females (cm). X-axis denotes the gender (Male and female). Y-axis denotes the number of participants. There is a significant difference in the length of the hand from the centre of the palm between males and females. Chi square test showing p=0.002 (p<0.005 indicating statistically significant).

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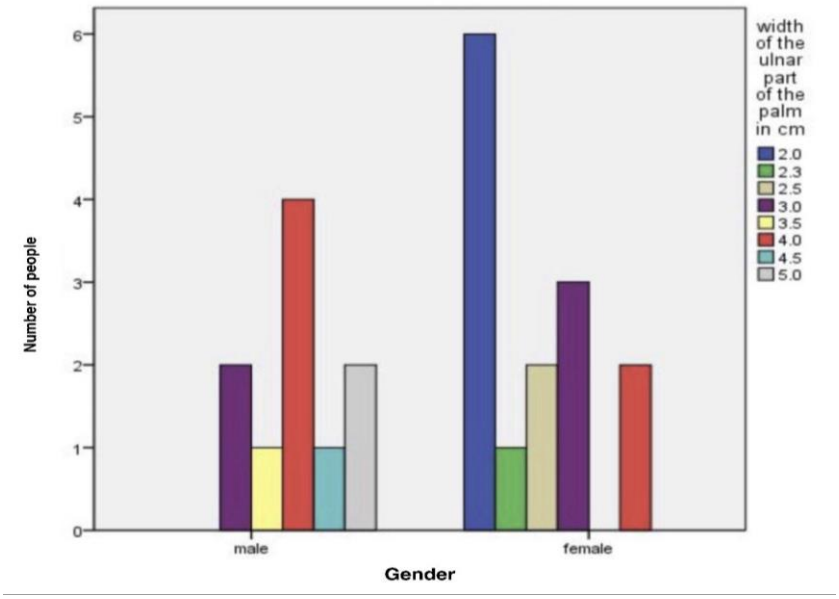

FIGURE 3: The graph shows the correlation between the width of the ulnar part of the palm between males and females (cm). X-axis denotes the gender (Male and female). Y-axis denotes the number of participants. There is a significant difference in the width of the ulnar part of the palm between males and females. Chi square test showing p=0.001 (p<0.005 indicating statistically significant).

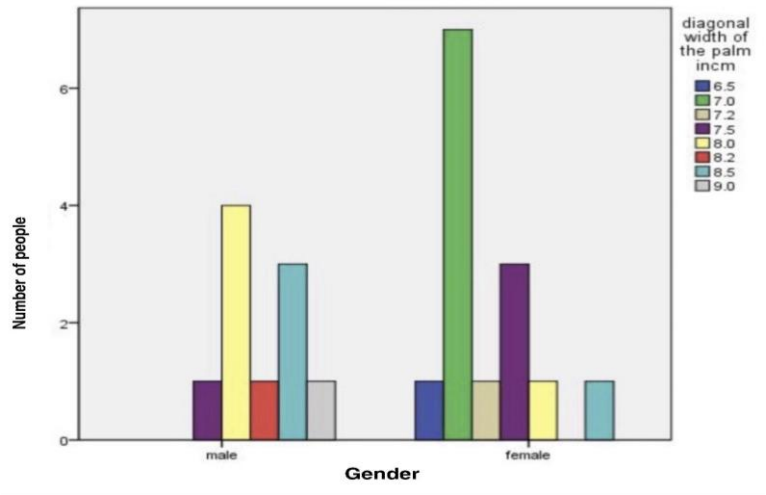

FIGURE 4: The graph shows the correlation between the diagonal width of palm in males and females (cm). X-axis denotes the gender (Male and female). Y-axis denotes the number of participants. There is a significant difference in the diagonal width of hand between males and females. Chi square test showing p=0.001 (p<0.005 indicating statistically significant).

Sex determination of unknown fragmentary evidence was a challenge for forensic experts however they compete with the challenge by inventing newer methodology for determining sex in the study hand length and breadth was determined as a sex indicators and an attempt was made to descriminate sex on the basis of hand dimensions. In males it was found that the hand length was significantly larger in males Sangeeta.Dey showed the same evidence in their study that the males have larger hand length (2).

Annapaola Fedato in his study shows the same evidence he states that females have relatively

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smaller hands than males. (21) Correlation of length of hand between males and females-chi square(p)=0.002<0.005 was found to be statistically significant. Thus we can say evidently that sexual dimorphism exists on the basis of hand length. There were also significant differences in the width of the ulnar part of the palm between males and females. M.A.Grigor also states that the same evidence shows that the ulnar width of the palm in males is larger than females.

Dey et al., also states the same evidence in his studies.(2) In our study correlation of width of palm between males and females are chi square (p)=0.001<0.005 which is statistically significant. The hand breadth was found to be the best predictor of sex in comparison with hand length.

The limitations of study include short sample size and it doesn't represent ethinic groups or population. The future scope of study is the use of method in forensics and future sciences

CONCLUSION

From the present study it can be concluded that the hand dimensions can be successfully applied to determine sex. Among the parameters hand width was identified as the more reliable predictor of sex. This study has implications in mass disasters and in criminal investigations where an isolated hand recovered needs further forensic identification. Thus it is possible to determine the human sex based on measurements of hands that are devoid of dermatoglyphic fractures.

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