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Research Article

AN EVALUATION OF FEMININE DISCRIMINATION FROM LATERAL PALM PRINT RIDGE DENSITY IN THE POPULATION OF HARYANA

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A R T I C L E   I N F O

A B S T R A C T

Today generation is based on the new technology and amount of information is increasing day by day and protection has become difficult. Individual identification becomes main requirement for personal, legal, social and for other reasons. Accurate identification and authentication plays a major role for security. Investigation procedure has been modified drastically and we are witnessing the velocious unfolding of the scientific world. Fingerprint, palm prints verification is one of the most reliable personal identification method and it plays a very important role in forensic application like criminal investigation, which was once bound solely to patterns has opened new ways for the identification. Ridge density is among one of the neoteric advancements where one can count the number of ridges per unit area of all the ten fingers and their mean can be used for the calculation. In this present study, 200 samples including 100 males and 100 females from both hands were collected from the population of Haryana for the feminine discrimination. In the duration of this study, it was observed that the females have higher number of ridge count in 9mm^2 following the standard procedure. From this study, it was concluded that the higher ridge densityis more likely to be of females whereas lower ridge density tends to be of male high level of confidence (P < 0.01). With above given parameters, it will be very helpful to exclude out a major section of suspects for conclusive identification.

INTRODUCTION

An ever- increasing frequency of crime has made it mandatory to adopt the new scientific methods and tools for investigation, so that, no loop hole could ever be leftfor the conclusive identification of culprit. These evidences, which are encountered in various form the crime scene play a vital role in the investigation to nab the suspect, although, all the evidences are not directly related to the individualization of the suspect/ culprit but provide in such a way that it facilitates about the information of individual in discrete forms such as biological fluids, finger prints, palm prints, anthropological tissues etc. Fingerprints, palm prints and sole prints are known as perpetual, unique and universal since these exists in form of evidences[1,2]. It has been stated that not even monozygotic twins bear the same fingerprints, palm prints features. It has been proved that chances of two persons having identical fingerprint impressions are about one in sixty-four thousand million of the world population[3,4.]. During the investigation, these prints are encountered in diversified forms such as static prints, half-static or dynamic prints formation and treated by several breeds of battery of powders, chemical which depends upon the deposition of prints.

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Meanwhile the crime scene analysis, the prints are encountered either from the finger tips or from the lower part of palm (Hypothenar area), the outer second and fourth quadrant of thumb prints and inner side of index finger, outer edge of little fingers[5]. These prints are implemented either during the holding of weapon of offence, culprit put hands against any surface to take the support or at entry point of high level. In such cases, a limited number of ridges are encountered which some time do not have sufficient amount of details about the suspect in form of individual features. Besides, the pattern of prints, other factor that is also important in fingerprints; are ridge density which is the number of ridges present per unit area of a finger[6,7]. Ridge density of fingerprint is acknowledged to be sexually dimorphic and has been proved in distinct studies that the females have greater number of ridge count followed by any international standard of ridge count such as 9 mm^2, 16 mm^2, 25 mm^2 than male as well as on the basis of two parameters which is ridge width and distance between the ridges. This study was mainly focused gender discrimination from the number of ridge count in 9 mm^2 from the lower part (hypothenar area) of palm prints of the population of Haryana. Heretofore, similar study was conducted on the north Indian population (local Jaat residents of Uttar Pradesh) from the latent palm prints and successfully eliminated the information about gender inequity[8,9,10]. As a resultant, it was observed

that male and female can be differentiated on the ground of ridge count from both of hands of same individual even the ridge count differs from hand to hand of same subject[11,12,13]. As per the best of our knowledge, the use of dermatoglyphics (hypothenar area of palm print) for gender determination amongst the population of Haryana has not been done yet.

MATERIALS AND METHODS

In this study, all the (200) samples, including 100 males and 100 females were collected from the district of Sonipat, panipat, Jhajhar, Hisar of Haryana from the age group of 18-30 years. All the subjects were selected randomly for sampling procedure and the verbal consent were taken prior. The subjects which were having any injury (damaged basal generating layer) or disease of palm (scars on palm, leprosy etc.) were excluded from samples. All the subjects were asked to wash/clean their hands first from sanitizers or hot water so that the dust and other ingredients could be removed. Finger printing black ink was applied over the palmar surface on both of the hands by using the cotton and then subjects were asked to implement their palmar surface over the A4 size white sheet. All the samples were preserved at room temperature inside the white paper envelope to avoid the destruction from the atmospheric dirt and moisture. In each square ($9mm^2$) of the lower palm prints (Hypothenar area), all the ridges were counted from one edge to the diagonally adverse edge. Shown in figure-1,
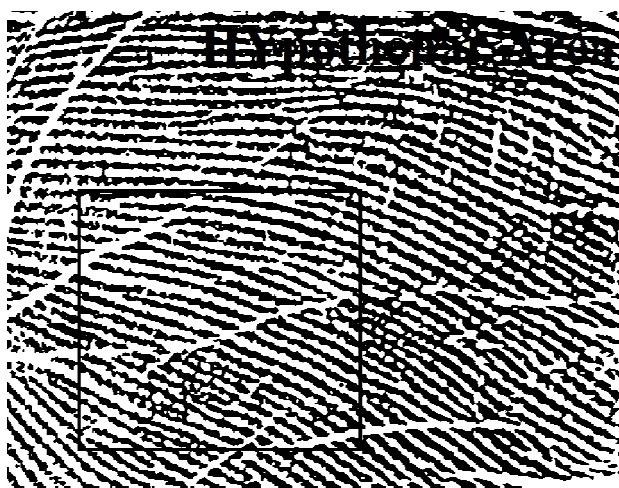

Figure 1 lower area of palm print (hypothenar area).

Small dots were not counted, while all other individual features such as forks, lakes were counted as two ridges. During the analysis of samples, a hand lens of 5X, 10X were used and all the photographs were taken by the Samsung Galaxy J7, 13 mega-pixels' camera. All the calculations were done by using the advance technology including Microsoft office excel. The comparison of means for means of both of hands and gender discrimination were executed using two tailed fashion *t*-test as embedded in SPSS version 17.0

RESULT AND DISCUSSION

Since a few of decades, fingerprints have been used and studied for personal identification. Its helped the people to investigate about the suspect and to nab them. Meanwhile, advance technology has taken over the recognition from velocious prints, though, the information obtained from fingerprints is not sufficient. Therefore, palm prints which include more information than other prints (fingerprints) is

now focused for investigation and research purpose. Ridges of palm prints are usually count between two digital tri-radius. In this study, to determine the gender; t-test were used for statistical analysis.

From the analysis of the samples, when compared the mean values of MRH (7.97), standard deviation (1.143) with FRH (8.73), standard deviation (1.49) have a significant difference. While at other hand, the observed values of MLH (6.95) and standard deviation (0.192) and for FLH (7.97) and standard deviation (0.184) were also highly significant. The observation table for both of genders are given below in table number -1. As per the exists researches, it has been confirmed that female have greater number of ridge count in comparison of male in fingerprints. From this research, it is concluded that the ridge count in palm prints of females are also greater than male, as MRH (7.97) < FRH (8.73) and MLH (6.95) <FLH (7.97) indicate the level of significance.

Table 1 showing the result from the data

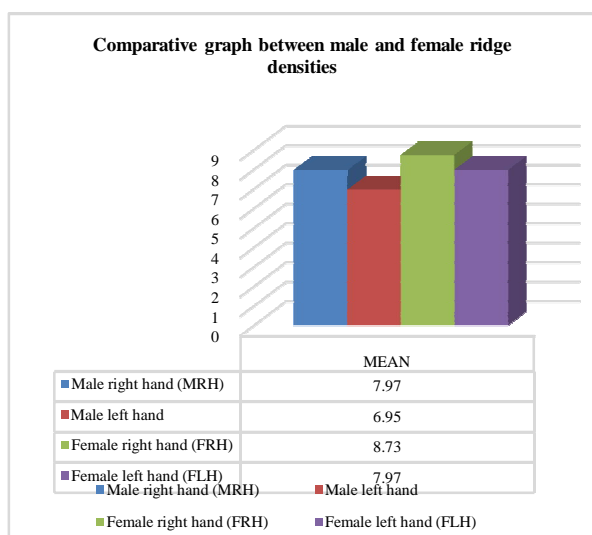| Characteristics values	Male right hand (MRH)	Male left hand (MLH)	Female right hand (FRH)	Female left hand (FLH)
Mean	7.97	6.95	8.73	7.97
Variance	1.328	1.324	2.33	1.32
Standard deviation	1.143	1.062	1.49	1.15
Standard error	0.185	0.192	0.228	0.184
Coefficient of variation	0.158	0.152	0.170	0.147

All the calculation was performed in two tailed fashion, t-test embedded in spss software. The significance level of gender discrimination was compared between both hands obtained values and even hand to hand of same individual as MRH =7.97 & MLH =6.95, while for female FRH=8.73 & FLH=9.97. The obtained t- values for male was -3.3412 while p- value was 0.0067. it shows the highly significant at 99% level of confidence where P < 0.01. In case of females, the obtained t- value was -2.9819 and p- value was 0.0197. At 99% of level of confidence, this indicates the high significant level as P < 0.01 which shows that there is perfect positive co-relation. Shown in table-2 below-

Table 2 showing the result of t-test performed for discrimination

Calculated Values	Male	Female
T- Values	-3.3412	-2.9819
P- Values	0.0067	0.0197
Significance	P < 0.01	P < 0.01

From the obtained values, ithas been confirmed that the conclusive gender discrimination can be done from the palmprints ridge densities but also the prints of same individual from both of the hands can be differentiated. The comparative graphical representation for gender discrimination is shown in graph-1.

The outcome of this study is hence verifiable and can convince to be a useful tool in the hand of investigation officer to find out the person at omission. This is easiest way to discriminate between the gender from the palm printsridges count so far and increases the accuracy and speed of gender discrimination.

Comparative graph between male and female ridge densities

	MEAN
■ Male right hand (MRH)	7.97
■ Male left hand	6.95
■ Female right hand (FRH)	8.73
■ Female left hand (FLH)	7.97

■ Male right hand (MRH) ■ Male left hand
■ Female right hand (FRH) ■ Female left hand (FLH)

Graph 1 Graphical representation of gender discrimination from palm prints ridge densities.

CONCLUSION

With the advancement of technologies, new and further research has been conducted on the affinity between dermato-glyphics and their utilization for the investigation purpose, research of disease or heredity. The greater significance of palm prints in forensic has been used for gender discrimination and conclusive identification of suspect. Many researcher show that the palm prints play a vital role and can cause outstanding differences such as nationality, various geological position. Since, there is no huge and complete palm prints reference database, therefore, it is needed to be fixed for study function and investigation. An ample will be made which will correlate the palm prints with disease, heredity, intelligence growth and any permanent change. The outcome of this study is encouraging and will promptly act as a supportive tool for forensic experts and in law enforcement, as they can be used as presumptive indicators of the gender of an unknown print left at a crime scene. These results can be analyzed in two ways one in broad spectrum simply by looking ridge patter either coarse (males) or fine (females) while other is by looking for the minute aspect of ridge density in the identification process and justice can be served as soon as possible.

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