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The Study of Finger print Patterns among Male and Female

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Abstract

Dermatoglyphics, the study of epidermal ridges on palm, sole and digits, is considered as most effective and reliable evidence of identification and plays a major role in any crime investigation. The finger prints are unique and distinguishable for every individual. The objective of the present study was to study the finger prints of different Individuals and compare particular pattern in the different gender. This study was conducted on 150(75 males and 75 females in the age group of 18-50 years) persons randomly selected. Finger prints were recorded with the help of Camalin ink on bond paper and were analyzed. The mean age for male was 35.78 years and for female 28.52years. The predominant pattern among both Male and Female was loop, (62.8%) in Male and (58.8%) in Female respectively which was followed by whorl (24.53%) in Male and (32%) in Female respectively. Plain arch pattern in male and female was 10.14% and 7.34% respectively. Ulnar loop was commonly seen in all fingers whereas radial loop was predominantly seen on index fingers in both sexes.

Key words: *Finger prints; Whorl; Groove; Gender; Arch; Ulnar loop; Radial loop*

Introduction

Identity is asset of physical characteristics, functional or psychic, normal or pathological that defines an individual. The term Identity is defined as whatever makes an entity definable and recognizable. The various methods by which identity of a person can be known include fingerprints foot prints, bite marks, lip prints, DNA profiling, iris imaging, etc.[1] The skin on the palmar and planter surface of the hand and foot is continuously wrinkled with narrow minute raised portion of the epidermis known as friction ridges. These ridges are also referred to as 'dermal ridges' or 'dermal papillae.' Fingerprints are impressions made by these minute ridges or patterns found on fingertips. Early, in the fetal period, proliferation of the corium (dermis) forms papillary projections into the epidermis forming papillary ridges. The pattern of the papillary ridges in the hands is completely established between 11th and 24th weeks of gestation.[2]The ridges thus, formed during the foetal period do not change their course or alignment throughout the life of an individual, until destroyed by decomposition of the skin after death.[3] The study of fingerprint is called dermatogylphics and its use as means of identification is called dactyloscopy.[4, 5,6] It is based on the principle that the individual peculiarities of the patterns formed by the arrangements and distribution of the papillary or epidermal ridges on the finger tips are absolutely constant and persistent throughout life, from infancy to old age, and that the patterns of two hands do not resemble each other. Even the finger prints of twins are not similar.[7]Sir William Janus Herschel, in 1858, first used this system in India. Later, in 1892 Sir Francis Galton systematized this method, and first Fingerprint Bureau was established in Kolkata.[8]

Fingerprint based recognition systems work in two modes: verification and identification. In verification mode, the systems verify the person's identity using a 1: 1 comparison between the person's fingerprints and those stored in the record. Verification process confirms whether the identity of the person with the fingerprint is

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the valid person. However, the process used in fingerprint identification systems is more complex than the process employed in verification especially for large database because fingerprint identification requires the input fingerprints to be compared with all the fingerprints in the database for matching. While verification uses 1:1 comparison for matching, fingerprints identification require 1:N comparison to establish if the individual is present in the database.[9] Finger prints follow the Locard's Principle of Exchange. The secretions in the fingerprints contain residues various chemicals and their metabolites which can be detected and used for the forensic purposes.[10]They can be found in the scene of occurrence from which the presence of a suspect or a victim or any other person can easily be proved. Fingerprints are now a day used in many of the offices, educational institutions to validate the presence of an individual. Galton type dermatoglyphic patterns is said to vary in different ethnic groups, and its association with diseases of genetic origin has been reported in the past.[11,12]The aim of this study was to determine fingerprint patterns of an individual. This will serve as an important aid in sex determination and help in forensic identification at the site of crime.

Material and Methods

The present prospective study was carried out on 150 voluntarily persons (75 male and 75 female persons) of 18-50 years from general population over a period of 6 months. Persons having healthy hands were included in this study. Individual with any congenital or acquired deformity or scars on fingers, suffering from any chronic skin disease, having worn finger prints or extra or bandaged fingers was excluded.

The study protocol was approved by an institutional ethical committee before commencing it. Informed consents were obtained from the subjects before taking the samples. Each individual was asked to wash his/her hands thoroughly with soap and water to remove dirt and oil and dry them using a towel. He/she was then asked to press his/her fingertips on the stamp pad of CAMLIN Company of size 157×96 mm and roll it laterally on the ink slab and then placed on a white paper with one lateral edge and roll over in opposite direction. Care was taken to avoid sliding of fingers to prevent smudging of the print. The primary fingerprint patterns were observed with the help of a magnifying lens and were identified into basic three patterns; loops, whorls and arches according to Galton□s classification.[8] Each finger in the finger print slip was assigned a number, eg: The 1st number was given to the right thumb and 10th number to left little finger. Confidentiality of the subjects was maintained. The distribution of fingerprint patterns in both hands of individuals and its relationship with sex were analyzed for percentage proportions and compared. Statistical analysis was performed using chi-square and p value < 0.05 was considered to be statistically significant.

Results

The mean age for male was 35.78 years and for female 28.52years.The predominant pattern among both males and females was loop, (62.8%) in males and (58.8%) in females which was followed by whorl (24.53%) in males and (32%) in females respectively. (Table number 1) Comparison of all fingerprint patterns between males and females using the chi-square test showed a value of 24.905 with 2 degrees of freedom and significant difference ($p < 0.001$). Amongst the loop pattern radial loop pattern was predominant in males (21.06%) and least common pattern was that of accidental loop (0.53%) where as in females the most pre-dominate pattern amongst loop was that of ulnar loop (20.26%) as shown in table number 2. Plain Whorl pattern was predominant in females (30.26%) as compared to males (23.73%).Where as plain arch pattern in male and female was 10.13% and 7.33% respectively (Table 2).(Chi-square value 109.909 with 9 degrees of freedom and p-value <0.0001).

Table - 1: Distribution of fingerprint patterns in male and females

Fingerprint pattern	Males (%)	Females (%)	Chi-square value	p-value
Loops (Plain loop + Radial loop +Ulnar loop +Double loop + Central pocket loop + Accidental loop)	471 (62.8)	441 (58.8)	109.909 with 9 degrees of freedom	< 0.0001
Whorl + Accidental whorl)	184 (24.53)	240 (32)		
Arches(Arch+ Tented arch)	95 (12.67)	69 (9.2)		

Table - 2 : Distribution of fingerprint patterns and its percentage

Fingerprint pattern	Males (%)	Females (%)	Chi-square test	p-value
Plain loop	72 (9.6)	105 (14)	109.909 with 9 degrees of freedom	< 0.0001
Radial loop	158(21.06)	147(19.6)		
Ulnar loop	151 (20.13)	151 (20.14)		
Double loop	42 (5.6)	17 (2.3)		
Central pocket loop	44(5.86)	20 (2.65)		
Accidental loop	4 (0.53)	1(0.13)		
Whorl	178 (23.73)	227 (30.26)		
Accidental whorl	6 (0.8)	13 (1.73)		
Plain Arch	76 (10.13)	55 (7.33)		
Tented arch	19 (2.53)	14 (1.86)		
Total	750(100)	750 (100)		

Table- 3: Distribution of patterns in different digits in male and females both hands

Patterns	Males					Females				
	Little finger	Ring finger	Middle finger	Index finger	Thumb	Little finger	Ring finger	Middle finger	Index finger	Thumb
Plain loop	34	16	8	-	14	28	18	10	23	26
Radial loop	14	31	37	48	28	16	30	29	57	15
Ulnar loop	68	24	29	30	-	30	34	33	30	24
Double loop	-	7	6	15	14	4	3	5	1	4
Central pocket loop	11	10	17	-	6	6	3	6	2	3
Accidental loop	-	-	-	-	4	-	-	-	-	1
Whorl	17	45	28	29	59	47	36	52	30	62
Accidental whorl	-	-	-	-	6	4	3	-	-	6
Arch	6	17	15	19	19	15	18	12	3	7
Tented arch	-	-	10	9	-	-	5	3	4	2
Total	150	150	150	150	150	150	150	150	150	150

Discussion

The pattern of the papillary ridges on the fingers remains unchanged in an individual, throughout his/her life.[13]The first ever work for dermatoglyphics was done somewhat around 3000 years back when Chinese used fingerprints to sign legal documents.[14]In the pre-independence era of India, Herschel used fingerprints for personnel identification.[15]

The present study was done to identify the gender of a person in the general population of North India and also as a tool of forensic identification at the site of crime.

In this study the predominant fingerprint pattern among both male and female was loop, 62.8% and 58.8% respectively. It is in accordance with study done by other workers who reported it to be 62.17% and 63.17% respectively.[16]The simple loops characterized by one triradius and one core are very common in most of the human populations and moreover, for some human groups they represent the most frequent patterns of fingers´ terminal phalanges.[17,18] Due to their frequent presence on fingers, fingerprints of loops are important

pieces of physical evidence in criminal investigation and forensic personal identification using fingerprinting. Assessment of loops and its size is a part of some widely used fingerprint identification systems.[19]In our study incidence of whorl pattern in male and female population was 24.53% and 32% respectively which was almost in accordance with the studies done by Koneru et. al. on a Manipur population and reported it to be 36% and 37% respectively.[20]Whereas other workers reported it to be 32% and 29% respectively.[21]The whorl is that type of pattern in which at least two deltas are present with a re-curve in front of each.[14] In the present study incidence of arches in male and female was 12.67% and 9.2% respectively whereas much higher incidence was reported by other workers, 48.26% and 51.73% respectively.[22]Arches can be classified into plain arch and tented arch. Plain arch is made up of ridges lying one above the other. Tented arch consists of one up thrusting ridge, which tends to bisect superior ridges at right angles. [14]In the present study ulnar loop pattern was predominantly seen on the little fingers of male population followed by whorl pattern on thumb, radial loop pattern on the index fingers and arch pattern less commonly seen on different fingers.(Table 3).Whereas on the female hands, radial loop pattern was predominantly seen on the index fingers followed by whorl pattern on thumbs, ulnar loop pattern was common on different fingers and arch pattern on ring fingers. (Table 3) Nithin V et al. in their study reported ulnar loop as the most frequent fingerprint pattern in the total population as well as in the sex wise distribution.[23]A study by Bansal et al. found that males showed predominance of loop pattern in all the fingers except ring finger which showed whorl pattern in both the hands. Females showed prevalence of loop pattern in all the fingers respectively.[24]Ulnar loops are highly abundant in all fingers. In contrast, radial loops occur much less frequently, mostly on the index fingers and their frequency on other fingers is much lower with virtually zero frequency on the little fingers. The highest occurrence of the radial loops on the index finger was explained by radially asymmetrical position of the embryonic pad of the index finger, which is formed in a functional position against embryonic pad of the opposing thumb.[25]

Limitations of the Study: Subjects with finger pathologies and deformities could not be established as they were not assessed. Forensic identification of such individual remains questionable.

Conclusion

Dermatoglyphics has long been documented as a scientific and valuable method for medico-legal, anthropological and genetic studies. Based on the results of this study, it is hereby concluded that the prediction of gender of a person is not possible on the basis of the person's fingerprint pattern alone but is useful forensic tool in human identification. It aids in identification of suspect in case of crime.

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Ethical Clearance: - Ethical clearance was taken from the Institutional Ethical Committee for Research, C.M.C. Ludhiana

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