

Study of fingerprint patterns among south Indian population- A cross sectional study

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Abstract

Background: The identification of a person means knowing positively who a given person is. The human identification is a universal process based on scientific principles mainly involving the finger printing. This prospective study was carried out over among 500 individuals of south Indian origin comprising of 250 male and 250 females, to ascertain the prevalence of type of fingerprints in each finger and their gender distribution. In the present study the general distribution of fingerprint pattern is noted in the same order as described in the literature. i.e. highest loops(55.3%), moderate whorl(34.7%), and least arch(10.0%). Loop (57.4%) and arch (14.6%) fingerprint was found to be more prevalent in females than that of males. The Whorl fingerprint is more prevalent in males (41.5%) compared to females (28.0%). The right hand shows prevalent Loop and whorl fingerprints and arch fingerprint was more in left hand.

Key words: Fingerprints, Finger wise distribution, Gender

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INTRODUCTION

Identification means determination of the individuality of a person based on certain physical characteristics unique to that individual. ¹ The identification of both living and dead is something in which medical evidence may play an important role, sometimes constitutes the only evidence which helps in establishing the identity of an individual. Study of fingerprints as a method of identification is also known as Dactylography or Dactyloscopy and at present it is also known as Henry – Galton system of identification. ² Finger prints are impressions of patterns formed by the papillary or epidermal ridges of the fingertips. These ridges are generally referred to a papillary or friction ridges. The

ridges have a definite shape and appear in variable configurations or patterns, each possessing specific individual details by which positive identification can be made. ³ The ridge pattern of fingers appears between 12-16 weeks of intrauterine life and the formation is completed by 24 weeks. Finger print patterns are distinctive and remain unchanged throughout life, and even after death till the skin decomposes. But in some instances the fingerprints do alter in some unnatural changes to fingerprint ridges include deep cuts or injuries penetrating all layers of the epidermis and some diseases such as leprosy. Fingerprint's being the effective method of identification; an attempt has been made in the present work to scrutinize their prevalence and gender distribution and also distribution of fingerprints in each fingers. This study may help in using fingerprints as an important aid in determining the gender and finger wise distribution thus, enhancing the authenticity of fingerprints in detection of the crime and criminals.

MATERIAL AND METHOD

After obtaining clearance from institutional ethics committee the study was undertaken in the Department of Forensic Medicine and Toxicology, JSS Medical College,

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JSS University Mysore, Karnataka, India during the period from July 2012 to August 2014. The study conducted up on 500 individuals (250 male and 250 female) comprising the south Indian Students and Staff members of J.S.S Medical College, Mysore and general population of south Indian origin. The informed written consent was taken from the subjects prior to taking the fingerprints. Students less than 18 years and those with leprosy, electrical injury and radiation exposure which are known to cause permanent impairment of finger print patterns were excluded. The finger prints were collected by using inkless fingerprint pad. The subject was asked to wash and dry their hands to remove dirt and grease. Then the finger bulbs were rolled on the inkless fingerprint pad - “the thumbs

were rolled towards the subject’s body and the fingers were rolled away from the body, i.e. thumb in fingers out method”. The precaution was taken to avoid smudging. Then the rolled impressions of each finger were obtained in the allotted space for that finger on the proforma. In this way for each and every individual the prints of ten fingers were prepared. After the fingerprints were acquired, details such as name, sex and age were noted. The fingerprint patterns were studied with the help of a magnifying lens and were identified as: Loops, Whorls and Arches based on the appearance of ridge lines according to Henry’s system of classification.

Ethical Clearance: Taken from Ethical Committee J.S.S. Medical College, Mysore.

RESULTS

In the present study finger prints were obtained from all the subjects. Total sample size was 500 (250 males and 250 females). Finger prints from all the 10 fingers were obtained and entered in the excel sheet. The data obtained was analyzed using SPSS for windows version 16.0 and the EPI info 3.5.1 windows version following results were drawn and interpreted.

Table 1: Showing general distribution of fingerprint patterns

Fingerprints		Frequency	Percent
Valid	Loop	2765	55.3
	Whorl	1737	34.7
	Arch	498	10.0
Total		5000	100.0

Among the 500 subjects studied in this study, loops were the predominant fingerprint pattern (55.3%) followed by whorl (34.7%) and the least frequent pattern was arch (10%).

Table 2: Showing sex-wise distribution of fingerprint patterns

Sex	Fingerprints		
	Loop	Whorl	Arch
Male	1327(53.2%)	1037(41.5%)	132(5.3%)
Female	1438(57.4%)	700(28.0%)	366(14.6%)

*Significant $p < 0.001$ *

In both the sexes the predominant finger print is the loop followed by whorl and then arch pattern. This study revealed that in the male population studied, loop pattern was the most prevalent (53.2%), followed by Whorl (41.5%) and then arch (5.3%). Females in the population studied showed higher incidence of loop pattern (57.4%), followed by whorl (28%) and the least being the arch (14.6%). In gender wise distribution the females showed prevalent loop and arch prints compared to males and the males showed highest whorls compared to females.

Table 3: Showing distribution of fingerprint patterns in both hands

	Fingerprints	Sex		Total
		Male	Female	
Left	loop	663(50.0%)	662(50.0%)	1325(100.0%)
	whorl	505(58.6%)	357(41.4%)	862(100.0%)
	arch	82(26.2%)	231(73.8%)	313(100.0%)
	Total	1250	1250	2500
Right	loop	664(46.1%)	776(53.9%)	1440(100.0%)
	whorl	532(60.8%)	343(39.2%)	875(100.0%)
	arch	50(27.0%)	135(73.0%)	185(100.0%)
	Total	1246	1254	2500

*Significant $p < 0.001$

The male study group showed higher prevalence of loop in the left hand and whorl in both the hands as compared to females. The females showed high prevalence of loop compared to males in right hand and arch fingerprint in both the hands. There have been many studies done on the prevalence and distribution of various finger print patterns, similarly this study also analyzed the prevalence and distribution of patterns in the target population. The analysis revealed the following.

Table 4: Showing predominant finger print in left little finger

Patten	Sex		Total
	Male	Female	
Loop	178(71.2%)	167(66.8%)	345(69.0%)
Whorl	66(26.4%)	34(13.6%)	100(20.0%)
Arch	6(2.4%)	49(19.6%)	55(11.0%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

Loops were the predominant pattern in the prints of left little finger in both male and female, but males showed higher prevalence compared to females. The Females showed high prevalence of arch fingerprint compared to males.

Table 5: Showing predominant finger print in left ring finger

Left ring finger	Sex		Total
	Male	Female	
Loop	102(40.8%)	108(43.2%)	210(42.0%)
Whorl	141(56.4%)	115(46.0%)	256(51.2%)
Arch	7(2.8%)	27(10.8%)	34(6.8%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

Prints from the left ring finger were predominantly of whorl pattern in both the sexes, with 56.4% and 46% respectively, followed by loop and arch patterns.

Table 6: Showing predominant finger print in left middle finger

Left middle finger	Sex		Total
	Male	Female	
Loop	152(60.8%)	141(56.4%)	293(58.6%)
Whorl	79(31.6%)	50(20.0%)	129(25.8%)
Arch	19(7.6%)	59(23.6%)	78(15.6%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

Females showed higher percentage (23.6%) of arch pattern compared to whorls in the left middle finger.

Table 7: Showing predominant finger print in left index finger

Left index finger	Sex		Total
	Male	Female	
Loop	119(47.6%)	108(43.2%)	227(45.4%)
Whorl	93(37.2%)	77(30.8%)	170(34.0%)
Arch	38(15.2%)	65(26.0%)	103(20.6%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

In left index finger, females showed higher prevalence of arch fingerprint pattern compared to male subjects.

Table 8: Showing predominant finger print in left thumb

Left thumb	Sex		Total
	Male	Female	
Loop	112(44.8%)	138(55.2%)	250(50.0%)
Whorl	126(50.4%)	81(32.4%)	207(41.4%)
Arch	12(4.8%)	31(12.4%)	43(8.6%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

Analysis of the prints from the left thumb of males showed higher incidence of whorls followed by loops, while in females loops were more prevalent followed by whorl. Arch was the least common pattern in both the sexes.

Table 9: Showing predominant finger print in right thumb

Right thumb	Sex		Total
	Male	Female	
Loop	119(47.6%)	147(58.8%)	266(53.2%)
Whorl	124(49.6%)	83(33.2%)	207(41.4%)
Arch	7(2.8%)	20(8.0%)	27(5.4%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

The right thumb prints showed higher percentage of whorls in males compared to loops. Females had higher percentage of loops compared to males.

Table 10: Showing predominant finger print in right index finger

Right index	Sex		Total
	Male	Female	
Loop	108(43.2%)	127(50.8%)	235(47.0%)
Whorl	118(47.2%)	76(30.4%)	194(38.8%)
Arch	24(9.6%)	47(18.8%)	71(14.2%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

Males showed higher percentage of whorls compare to loops in the right index finger.

Table 11: Showing predominant finger print in right middle finger

Right Middle	Sex		Total
	Male	Female	
Loop	164(65.6%)	187(74.8%)	351(70.2%)
Whorl	75(30.0%)	35(14.0%)	110(22.0%)
Arch	11(4.4%)	28(11.2%)	39(7.8%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

In right middle finger, females showed higher prevalence of loop and arch fingerprint patterns compared to males and males showed higher prevalence of whorl fingerprint pattern compared to females.

Table 12: Showing predominant finger print in right ring finger

Right ring finger	Sex		Total
	Male	Female	
loop	87(34.8%)	131(52.4%)	218(43.6%)
whorl	157(62.8%)	109(43.6%)	266(53.2%)
arch	6(2.4%)	10(4.0%)	16(3.2%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

In prints of the right ring finger, males showed higher percentage of whorls (62.8%) than loops (34.8%).

Table 13: Showing predominant finger print in right little finger

Right little finger	Sex		Total
	Male	Female	
Loop	185(74.0%)	185(74.0%)	370(74.0%)
Whorl	60(24.0%)	38(15.2%)	98(19.6%)
Arch	5(2.0%)	27(10.8%)	32(6.4%)
Total	250(100.0%)	250(100.0%)	500(100.0%)

Significant P<0.001

In right little finger, loop and arch fingerprint patterns were the predominant patterns seen in females, and the whorl pattern was more prevalent in males.

DISCUSSION

Comparison of finger prints is a universally accepted method of establishing identity of an individual. The main objective of the present study was to determine the prevalence of Fingerprints and their gender wise distribution among the south Indian population and also to study the finger wise predominance of finger prints. In the present study, inkless fingerprint pad was used for recording the fingerprint patterns, as it is easy to carry and once the fingerprint is obtained, leaves no residues on the fingers. Nithin MD, *et al.* done a study on fingerprint classification and their gender distribution among South Indian population ⁴ revealed higher percentage of loop (55.28%) in females when compared to males (49.32%). Whorl pattern of finger prints was seen in significantly higher numbers in both ring fingers than loop, and the present study is in agreement with these findings. Sangam MR, Krupadanam K. Anasuya K, done a study on south Indian population to determine the bilateral asymmetry and sex differences in distribution of finger print pattern ⁵, loops and arches were seen higher in the females than in the males. Whorls were more frequent in males than the females, which was similar to the present study. Loops were predominantly seen in the little finger, which was also agreement with the present study. In a study done by Nagesh KR, Sahoo P, Ashoka B on Determination of hand from a fingerprint ⁶ revealed that the whorl patterns were observed commonly in thumb, index and ring fingers with maximum in a ring finger in both the hands. The present study also revealed the whorl fingerprint pattern was predominant in left ring finger in both the sexes and right ring finger in males. Also the whorl was commonly found in both the thumb and right index finger of male sex, which was also agreement with the present study. Prateek Rastogi and Keerthi R Pillai have done a study on fingerprints in relation to gender and blood group ⁷ revealed that the Males have a higher incidence of whorls and females have a higher incidence of loops and the present study is also agreement with these findings. Katwal B, Timsinha S, Limbu BK *et al.* have done a study on Fingerprint analysis and gender predilection among medical students of Nepal Medical College and Teaching Hospital ⁸, revealed that the Significant increase in the frequency of loops was seen in the little finger followed by middle finger and higher percentage of whorls was observed on the ring finger. Highest preponderance of arches was present in index finger. The present study is also in agreement with these findings.

CONCLUSION

The following conclusions were drawn from our study

- General distribution of fingerprint pattern in this study is noted to be in the same order as described in the literature. i.e. highest Loops, moderate Whorl, and least Arch.
- Loop (57.4%) and Arch (14.6%) fingerprint was found to be more prevalent in females than that of males.
- The Whorl fingerprint is more prevalent in males (41.5%) compared to females (28.0%).
- The right hand showed prevalent Loop and Whorl fingerprints but the Arch fingerprint was more in left hand.
- In finger wise distribution of fingerprints the Loop fingerprint is being predominant in most of the fingers.
- The whorl fingerprint dominates the Loop fingerprint in the left ring finger in both the genders.
- The male group also showed that the Whorl fingerprint being dominant compared to Loop fingerprint in left thumb (50.4%), right thumb (49.6%), right index (47.2%) and right ring finger (62.8%).
- The Arch fingerprint being the least type, in females it has overriding the Whorl fingerprint in left little (19.6%) and left middle finger (23.6%).

Fingerprints are already been an established entity in the field of identification. Hence similar type of studies should be conducted on a larger group so as to increase the accuracy of prediction and to establish the individuality of a person.

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