

Original Research Article

## Distribution of Fingerprint Patterns in Relationship to Gender and Blood Groups in North Indian Population (Predominantly Haryanvi)

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### ABSTRACT

Fingerprints are of paramount importance in forensic investigation. These are unique for an individual and remain unchanged throughout life. The present study was carried out among 100 paramedical students of PGIMS, Rohtak with an aim to study and correlate fingerprint pattern with blood group and gender. The results showed that majority of subjects belonged to blood group B. Loops were most frequently observed fingerprint pattern and arches were the least. Females had the highest number of loops and arches while males had highest frequency of whorls.

**Keywords:** Fingerprints, loops, whorls, arches, blood group, gender.

### INTRODUCTION

A set of physical, functional, normal or pathological characteristics which makes an entity definable and recognizable is known by the term 'Identity'. Different parameters used for the purpose of identification are fingerprints, handwriting, bite marks, DNA fingerprinting, lip marks etc. [1]

Palmar and plantar skin are marked by "carved works" i.e., friction ridges of raised portion of epidermis. The pattern of these markings on the fingers is known as dermatoglyphics. [2] Fingerprints are constant individualistic feature forming the reliable criteria for identification. [3,4] Human fingerprints are categorized into 3 basic groups - loops, whorls and arches. [5] Loops account for approximately 65% and are most common type. Ridge lines in loop pattern flow in from one side, sweep up in the centre, then curve back around and leave on the same side they entered. In the whorl

pattern, one or more ridge line curves around the core to form a circle or spiral. They account for about 30%. Arches are least common pattern (5%). In this type of pattern, ridge lines enter on one side, rise in the middle of pattern and exit on the other side of the print.

Karl Landsteiner discovered blood group system in 1901 comprising of 'ABO' and 'Rhesus' groups. Depending upon the presence of corresponding antigen in plasma and the presence or absence of 'D' antigen, the ABO system is further classified as A, B, AB and O blood group and Rhesus system as Rhesus positive (Rh +ve) and Rhesus negative (Rh -ve) respectively. [6]

A fingerprint pattern remains unchanged for the life of an individual; however, the print itself may change due to permanent scars and skin diseases. The combined effect of heredity and environment arbitrates the pattern of ridges.

Present study is an attempt to determine the distribution of different fingerprint patterns among individuals in Haryana (North India) and to associate them with gender and blood group.

## MATERIALS AND METHODS

50 male & 50 female students belonging to the age group 18-25 years were randomly chosen for the study from paramedical courses of PGIMS, Rohtak. Students having permanent scars on their finger, any hand deformity or an extra or bandaged finger were excluded from the study.

Age, sex & blood group were noted from their college identity cards.

Each student was asked to wash his hands thoroughly with soap & water and to dry them using a towel. Fingerprints of all

the ten digits of an individual were then taken on a white unglazed sheet using stamp pad ink. Care was taken to prevent smudging of the print by avoiding sliding of the fingers.

The finger print patterns were observed with the help of hand lens and were classified into loops, whorls and arches based on Henry's system of classification.

## RESULTS & OBSERVATION

Majority of subjects belonged to blood group B (36%) followed by O (32%), A (21%) and AB (11%). Blood group A and B were predominantly found in females whereas O and AB blood group were found more commonly in males. Rh -ve blood group was more commonly found in females in comparison to males. (Table 1)

TABLE 1: Study of distribution of blood groups according to gender

Blood group	Males			Females			Total
	Rh+ve	Rh-ve	Total	Rh+ve	Rh-ve	Total	
A	9	0	9(9%)	10	2	12(12%)	21 (21%)
B	14	2	16(16%)	18	2	20 (20%)	36 (36%)
AB	7	0	7(7%)	3	1	4 (4%)	11 (11%)
O	18	0	18(18%)	11	3	14 (14%)	32 (32%)
<b>Total</b>		<b>50</b>			<b>50</b>		<b>100</b>

Maximum 90 subjects in the study were Rh +ve and remaining 10 were Rh -ve. B +ve was most commonly found blood group & AB -ve was rarest. (Table 2)

TABLE 2: Distribution of subjects according to Rh factor of their blood group

Blood group	Rh +ve	Rh -ve
A	19 (19%)	2 (2%)
B	32 (32%)	4 (4%)
AB	10 (10%)	1 (1%)
O	29 (29%)	3 (3%)
<b>Total</b>	<b>90</b>	<b>10</b>

Loops (54.9%) were most frequently encountered fingerprint pattern followed by whorls (39.1%) and least occurrence was of arches (6.0%). (Table 3)

TABLE 3: Distribution of primary fingerprint patterns of all the fingers in both the hands

Fingerprint patterns	Total number	Percentage
Loops	549	54.90%
Whorls	391	39.10%
Arches	60	6.00%
<b>Total</b>	<b>1000</b>	

As compared to males, loops and arches were found higher in number in females. Contrary to this, whorls frequency was found to be higher in males. (Table 4)

TABLE 4: Number of fingerprint patterns among males and females

Fingerprint patterns	Males	Females	Total
Loops	246 (44.8%)	303 (55.19%)	549
Whorls	227(58.05%)	164 (41.94%)	391
Arches	27 (45%)	33(55%)	60

Among Rh-ve individuals, AB blood group subjects were found to have highest number of loops (70%) and least number of whorls (10%). Among Rh+ve individuals, loops were highest in AB blood group (74%) followed by B (53.44%), A (53.16%) and O (51.72%) blood group whereas whorls were highest in O blood group (42.41%) and least in AB blood group (15%). (Table 5)

**TABLE 5: Distribution of fingerprint patterns among different blood groups**

Type of pattern	A		B		AB		O	
	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve
Loops	101(53.16%)	8(40%)	171(53.44%)	17(42.50%)	74(74%)	7(70%)	150(51.72%)	21(70%)
Whorls	76(40%)	12(60%)	133(41.56%)	22(55%)	15(15%)	1(10%)	123(42.41%)	9(30%)
Arches	13(6.84%)	-	16(5%)	1(2.50%)	11(11%)	2(20%)	17(5.86%)	-
<b>Total</b>	<b>190</b>	<b>20</b>	<b>320</b>	<b>40</b>	<b>100</b>	<b>10</b>	<b>290</b>	<b>30</b>

**DISCUSSION**

As fingerprint patterns can be saved & recovered back at any point of time & they are never alike, these are used as a means of identification. Sir Edward Henry proposed the classification system of fingerprint patterns which is known as Henry’s system of classification. [1,3]

The present study has used 3 basic fingerprint patterns- loops, whorls and arches. The blood grouping systems taken into account are ABO and Rhesus which are being widely used today. [7]

Rastogi et al in 2010 had carried out a similar study on 200 medical students of Kasturba medical college, Mangalore. [8] Raloti et al took study on 89 medical students of B.J. Medical College, Ahmedabad, and Gujarat in 2012. [9]

Bhavana et al in 2013 completed the same study on 200 individuals from Hubli, Dharwad, and Karnataka. [6] Soman et al had also conducted a similar study in 2013 on 300 medical students of Yenepoya Medical College, Mangalore. [10] Ekanem et al studied 400 residents of Maiduguri, Nigeria in context of similar study. [5] The results of these studies compared with the present study are as follows.

Table 7 shows comparative study on distribution of blood groups of subjects according to gender. The results of the present study were in accordance with the results of Bhavana’s study where blood group B dominated followed by blood groups O, A and AB whereas in other studies blood group O was predominant followed by B, A and AB blood groups.

**TABLE 7: Comparison of distribution of blood groups of subjects according to gender**

Blood group	Bhavana D			Rastogi P			Soman			Ekanem			Present study		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
A	11%	10%	21%	16.5%	16.5%	28%	12.3%	10.3%	22.6%	4.5%	10.5%	15%	9%	12%	21%
B	17.5%	19.5%	37%	16.5%	15.5%	32%	13.3%	16%	29.3%	8.25%	8.75%	17%	16%	20%	36%
AB	3.5%	3.5%	7%	2%	2.5%	4.5%	2.7%	3%	5.7%	3.25%	3%	6.25%	7%	4%	11%
O	18%	17%	35%	15%	20.5%	21.7%	20.7%	42.4%	34%	27.75%	61.75%	18%	14%	32%	

M - Male F - Female T - Total

**TABLE 8: Comparison of distribution of blood groups of subjects according to Rh factor**

Blood group	Bhavana D		Rastogi P		Soman		Ekanem		Present study	
	Rh+ve	Rh-ve	Rh+ve	Rh-ve	Rh+ve	Rh-ve	Rh+ve	Rh-ve	Rh+ve	Rh-ve
A	19.5%	1.5%	26.5%	1.5%	20%	2.7%	15%	0	19%	2%
B	35%	2%	30.5%	1.5%	26.7%	2.7%	15.75%	1.26%	32%	4%
AB	6.5%	0.5%	4.5%	0	5.6%	0	6.25%	0	10%	1%
O	34%	1%	34.5%	1%	40.3%	2%	58.25%	3.50%	29%	3%

**TABLE 9: Comparison of distribution of primary fingerprint patterns among the subjects**

Fingerprint pattern	Bhavana D	Rastogi P	Soman	Ekanem	Raloti	Present study
Loops	58.9%	60.95%	60.9%	56%	57%	54.9%
Whorls	29.6%	32.55%	32.3%	30.8%	26%	39.1%
Arches	11.5%	6.5%	6.8%	13.2%	8%	6.0%
Composites	-	-	-	-	9%	-

**TABLE 10: Comparison of distribution of primary fingerprint patterns according to gender**

Fingerprint pattern	Bhavana D		Rastogi P		Soman		Raloti		Present study	
	M	F	M	F	M	F	M	F	M	F
Loops	47.38%	52.63%	47.58%	52.42%	46.8%	53.2%	54%	63%	44.8%	55.19%
Whorls	57.09%	42.90%	55.78%	44.22%	54.9%	45.1%	28%	23%	58.05%	41.94%
Arches	48.26%	51.73%	44.61%	55.38%	55.4%	44.6%	-	-	45%	55%

Table 8 shows comparative study on distribution of blood groups of subjects according to Rh factor. In the present study,

Rh +ve blood group was present predominantly in the majority of subjects whereas AB -ve blood group was found to

be the rarest. The present study results were similar with the previous studies.

Table 9 shows comparative data on distribution of primary fingerprint patterns among the subjects. Loops were most frequently present followed by whorls and arches. This common pattern was observed in all the studies.

Table 10 shows comparative data on distribution of primary fingerprint patterns according to gender. Present study showed predominance of loops and arches in females and of whorls in males which was similar to the studies of Bhavana, Rastogi and Raloti. In the study done by Soman, loops were most commonly present in females but arches and whorls were predominantly present in males. Ekanem reported loops and whorls to outnumber in males as compared to females.

Contrary to almost all the previous studies, present study showed predominance of loops and arches in 'AB' blood group and whorls in blood group 'O' individuals.

## CONCLUSION

Influence of regional variations, gender and genetic factors on fingerprint pattern should not be overlooked. Thus, present study may enhance the authenticity of the fingerprints in identification and detection of criminals.

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