Mini Review Paper

Study of Fingerprint Patterns in Relationship with Blood group and Gender- a Statistical Review

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Abstract

Finger prints are considered as the best tool of identification. Finger print evidence is by far the most effective and reliable evidence in the court of law. Two major aspects which prove the efficiency of finger prints are, the ridges formed during the foetal period do not change their course of alignment throughout the life of an individual until the skin is decomposed and the other one is two finger prints of either a same individual or two different individuals are never alike, they differ in their patterns and ridge characteristics. Due to its effectiveness or we can say its potential fingerprints are considered as conclusive evidence in the court of law. Present study is an attempt to analyze and correlate fingerprint patterns with gender and blood group of an individual. We have carried a study with 200 individuals among which 100 were male and 100 were female subjects having different ABO blood groups belonging to different age groups. This study was carried out in Hubli-Dharwad, Karnataka, India. All the 10 fingerprint patterns were divided into Loops, Whorls and Arches. Results show that Loops are most commonly found fingerprint patterns and Arches are least common. Loops dominated in all the Blood groups of both Rh positive and Rh negative individuals but Whorls were found to be dominating in O negative blood group. The only association between gender and finger print patterns in this study is that Loops and Arches were found in higher frequency in Females compared to Males and whorls were found to be high in males compared to females.

Keywords: Association, fingerprints, blood groups, patterns.

Introduction

The skin covers the anterior surface of human hand and planter surface of the human foot is different in the texture and appearance than the one which covers the rest of the human body. This skin on the palmar and planter surface is continuously wrinkled with narrow minute ridges known as friction ridges. A finger print is an impression of the friction ridges on all parts. The dermal carvings or finger prints appear for the first time on the human fingers, palm, soles and toes from 12th to 16th week of embryonic development and their formation gets completed by the 14th week i.e. about the 6th foetal month. 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[1].

Various physical evidences used for identification are finger prints, DNA profiling, lip marks, foot prints, bite marks etc. Fingerprints are constant and individualistic and form the most reliable criteria for identification. 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[2]. 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.

Blood group system was discovered way back in 1901 by Karl Landsteiner. So, for 19 major groups have been identified which vary in their frequency of distribution amongst various races of mankind. Clinically, only 'ABO' and 'Rhesus' groups are of major importance. 'ABO' system is further classified as A, B, AB, O blood group types according to presence of corresponding antigen in plasma. 'Rhesus' system is classified into 'Rh +ve' and 'Rh –ve' according to the presence or absence of 'D' antigen[3].

Material and Methods

The present study was carried out in Hubli- Dharwad of Karnataka, India, 200 persons were participated in the study voluntarily and their finger prints were collected. The finger prints were taken using the stamp pad of CAMLIN Company of size 157×96 mm. The smeared palm and fingers of both hands were printed on a durable plain paper laid down on a pressure pad which consisted of ten different blocks for ten fingers of right hand and left hand respectively. Both rolled and plane prints of right and left hand were taken. After obtaining the finger prints the basic details such as name, age and sex was

also gathered. Primary patterns (loops, whorl and arches) were observed with the help of a powerful hand lens. Blood groups of all the persons were also noted for further study. If the blood group wasn't known then the blood group was identified using antiserum A, B and D. Literacy among the subjects was also noted down. Each finger in the finger print slip was assigned a number, ex: The 1st number was given to the right thumb and 10th number to left little.

Note: Subjects with permanent scars on their fingers or thumbs, with any hand deformities due to injury, were excluded from our study.

Results and Discussion

Table-1 shows distribution of blood groups according to Gender. Majority of the subjects belonged to the blood group B i.e. 74(37%) followed by 0; 70(35%), A; 42(21%) and AB; 14 (7%). Blood group B was predominantly found in females but in males both B and O were almost equal.

Table-1
Showing Distribution of Blood Groups according to Gender

Blood group	Male		Female		Total	
A	22	11 %	20	10 %	42	21 %
B	35	17.5 %	39	19.5 %	74	37 %
AB	7	3.5 %	7	3.5 %	14	7 %
O	36	18 %	34	17 %	70	35 %
Total	100		100		200	

Table-2
Showing Distribution of subjects according to Rh factor of their Blood Group

Blood Group	Rh- Positive		Rh- Negative	
A	39	19. 5 %	3	1.5 %
B	70	35 %	4	2 %
AB	13	6.5 %	1	0.5 %
O	68	34 %	2	1 %
Total	190	95 %	10	5 %

Table-2 shows distribution of subjects according to Rh factor of their blood group. 190 among 200 subjects belonged to Rh + whereas 10 of 200 subjects were Rh -. Out of 190 Rh+ subjects majority of the subjects, 70(35%) belonged to blood group B, 68(34%) belonged to O, 39(19.5%) belonged to A and only 13(6.5%) belonged to blood group AB. Similarly among 10 Rh-subjects 3(1.5%) belonged to A, 4(2%) to B, 2(1%) to O and only 1(0.5%) belonged to blood group AB. The percentage of Rh – subjects was as usual less in the study.

Table-3
Showing Distribution of Primary Finger print patterns of all the fingers in both the hands

Fingerprintpatterns	Total number	Percentage (%)
Loops	1178	58.9 %
Whorls	592	29.6 %
Arches	230	11.5 %
Total	2000	100 %

Table-3 shows distribution of finger print patterns of all the fingers in both the hands. Total no of loops found in all the digits were 1178 (58.9%). Similarly numbers of whorls in all the digits of both the hands were 592(29.6%) and numbers of arches were 230(11.5%). This table clearly indicates that Loops rule the chart followed by whorls and arches

Table-4
Showing the number of the finger print patterns among Males and Females

Finger print patterns	Male		Female	
Loops	558	47.38 %	620	52.63 %
Whorls	338	57.09 %	254	42.90 %
Arches	111	48.26 %	119	51.73 %

Table-4 shows the distribution of finger print patterns among both the genders. Frequency of Loops were found to be higher in females; 620(52.63%) and Whorls were found to be higher in males; 338(57.09%). Arches were found more in females; 119(51.73%) compared to males; 111(48.26%).

Table-5

Showing Distribution of Fingerprint Patterns among A, B, AB, O blood groups with Rh factors

Type of Pattern	Blood Group A		Blood Group B		Blood Group AB		Blood Group O	
	Rh +	**Rh -**	**Rh +**	**Rh -**	**Rh +**	**Rh -**	**Rh +**	**Rh -**
Total Loops	226	18	417	27	79	5	402	4
Percentage (%)	57.94	60	59.57	67.5	60.76	50	59.11	20
Total Whorls	122	8	194	7	49	4	194	14
Percentage (%)	31.28	26.67	27.71	17.5	37.6	40	28.52	70
Total arches	42	4	89	6	2	1	84	2
Percentage (%)	10.76	13.34	12.71	15	1.53	10	12.35	10
Total	390	30	700	40	130	10	680	20

Table-5 shows the distribution of the finger print patterns among ABO blood groups of all the fingers. More numbers of loops were found in blood group B i. e. 59.57% followed by O i. e. 59.11% among the Rh + individuals. But the incidence of whorls is found to be predominant in the blood group O in Rh - individuals. Whorls in Rh + individuals were equally dominant in both B and O blood groups; 194. Arches were least commonly found in all the blood groups. Least numbers of arches were seen in the blood group AB and more number in B.

As soon as the finger print is obtained from a scene of crime the next important job is classifying the finger prints (Henry's Ten Digit Classification, 1897). The purpose of classifying the finger prints is to get them systematically back whenever necessary. The present study is an approach to further classify finger print patterns. These patterns fall into three general classes called Arches, Loops, and Whorls. Arches are the simplest patterns and also the rarest. There are two types: plain arches and tented arches. In both types the ridge lines flow into the print from one side, rise in the middle of the pattern, and flow out to the other side of the print. Loops are formed by ridge lines that flow in from one side of the print, sweep up in the center like a tented arch, and then curve back around and flow out or tend to flow out on the side from where they entered. Loops are designated as being either radial or ulnar, depending on which side of the finger the lines enter. The loop is the most common of all the patterns. There are four different whorl patterns: the plain whorl, the central pocket loop, the double loop, and the accidental whorl. Their common features are that they have at least two deltas and one or more of the ridge lines curves around the core to form a circle or spiral or other rounded, constantly curving form. The accidental whorl can be any pat-tern or combination of patterns that does not fit into any of the above classifications. The term "Compo-site" is used to describe such patterns. Positive identification using fingerprints can be established only if 16 to 20 points of similarity exist in the minutiae[4].

This study was an approach to associate finger prints, blood groups and gender. Blood group B was predominantly found among the subjects followed by O. The distribution of primary finger prints among the subjects was high frequency of loops moderate of whorls and low of arches. Bharadwaja[2] et al conducted a study during 2000-2001 on 300 medical students with different ABO blood groups in Rajasthan which revealed that individuals with blood group A have more of loops, while that of blood group AB had more of whorls[2]. Similarly, Dr. Prateek. Rastogi and Ms. Keerti. R. Pillai[5] also conducted a study among 200 medical students of Kasturba Medical College, Mangalore which showed that blood group A had higher frequency of Loops and blood group O had higher frequency of whorls and arches were found to be high in blood group A[5]. Results of the present study differ comparatively.

Conclusion

Present study is an attempt to analyze and correlate fingerprint patterns with gender and blood group of an individual. Although we know that finger prints are never alike and they never change from birth till death, this study is an attempt made by us to associate finger prints with gender and blood group of an individual which may in turn enhance the authenticity of the fingerprints in identification and detection of criminals.

From the above study the following results were found: i. Loops are the most commonly found finger-print pattern and Arches are the least common. ii. Blood group B positive is the most common and O negative and AB negative is the rarest. iii. More number of whorls were found in O negative compared to other Rh – blood groups (Similar to the result of Dr. Prateek. Rastogi and Ms. Keerti. R. Pillai), iv. Loops and arches were common in Blood group B and O. v. Blood group B+ and O+ equally had highest number of whorls. vi. Least arches seen in Blood group AB. vii. Loops and Arches were highest in Females and Whorls highest in Males. viii. Highest numbers of Loops were found in blood groups B and O compared to A and AB.

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