

Analysis of left thumb print pattern among different human blood groups

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ABSTRACT

Introduction: A fingerprint is the reproduction of the friction ridges present on the inner surface of a fingertip. In the court of law, fingerprint proof is undeniably the most dependable and acceptable evidence till date. Fingerprint is the effective method of identification for Aadhar card for general population and also for suspects and victims.

Aim and objective: The present study was to analyze relationship between fingerprint patterns, gender, blood group and common clinical complaints.

Material and Methods: In the present study 150 members participated, out of which 75 males and 75 females were randomly selected from different locations in Chennai, Tamilnadu. The study project was started after obtaining approval from Institutional Ethics Committee. The fingerprint patterns were recognized based on the appearance of ridge lines to determine loops, whorls, mixed or composite and arches. Blood groups were confirmed on the basis of presence or absence of agglutination as per the standard protocol.

Results: Total number of loops found in both gender in the left thumb print were 60 (40%), followed by whorls 40 (27%), Mixed 34 (23%) while Arches were present in a low frequency 16 (11%). Most of subjects in our study belonged to blood group "O" followed by "B", "A" and "AB" blood groups. Blood group O positive was the most common, whereas O negative and AB negative were the rarest. Highest numbers of Loops were found in blood groups O, B compared to A and AB. Frequency of all finger print patterns was found to be more in females. Some common clinical complaints were seen in all the blood groups.

Conclusion: The present study confirms that loop was the most common fingerprint pattern while arch was the least common. This study revealed that there was a relationship between distribution of fingerprint patterns, blood group and gender and thus prediction of gender and blood group of a person may be possible based on his/her fingerprint pattern to identify suspected victims of crime, biometric security, mass disaster etc. Accordingly the relationship of blood group and different diseases can be used for early prediction and consequently for prevention of the progression of different diseases.

Key Words: Fingerprints pattern; Blood groups; Common clinical complaints; Gender

INTRODUCTION

The skin is noticeable by "carved works" especially on the palms and soles. These markings on the fingers are called dermatoglyphics (1). In dermatoglyphics, the impressions made by the minute ridge patterns have exactly the same arrangement and the pattern of any individual remain unchanged throughout life. These features statistically differ among sexes, ethnic groups and age categories (2). Fingerprints are the unique characteristics mainly used in personal identification pertinent to forensic cases for hundreds of years. Fingerprints are composed of various fine ridges which are mainly distributed in the palmer region of hands (3).

The fingerprint is an impression of the friction ridges of all part of finger. A friction ridge is a raised section of the epidermis on the digits or on the palmar and plantar skin, composed of one or more connected ridge units of friction ridge skin. Finger-prints may be deposited in natural secretions from the eccrine glands present in friction ridge skin or they may produce by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface (4).

The dermal carvings or finger prints present for the 1st time on the fingers, palm, soles and toes of humans 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, produced 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 (5) or until the skin was destroyed by burn, chemicals, cuts and diseases affecting the skin. Finger print pattern are genotypically determined and remain unchanged from birth till death. Two persons having identical finger prints are about one in 64 thousand millions (6).

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 (7). Four types of finger prints patterns observed in fingers are Loops, Whorls, Arches, and Mixed or Composites (4). Loops are the most common types of all fingerprints,

accounts about 65%. When one or more than one ridge enter from one side of the pattern and recurve to exit from the same side of point of entry, it forms a loop. The fingerprint pattern whorl may be spiral, oval, circular or any variety of a circle and account for approximately 30%. Arches are the simple pattern but rare (about 5%). The fingerprint pattern has ridges running from one side to the other side of the print without having any re-curve (8). The term composite is used for combination of pattern that does not fit in to any of the above classification (9).

Finger prints are nowadays used for many purposes including Aadhar. Fingerprint is the effective method of identification for Aadhar card in general population (10). Fingerprints collected at a crime scene can be used to identify suspects, victims and other persons who touched the surface, fingerprint scans can be used to validate electronic registration, cashless catering and library access especially in schools and colleges (11).

Blood group systems were discovered way back in 1900 by Karl Landsteiner. Total 19 major groups have been identified which vary in their frequency of spreading various races of mankind. Clinically, only 'ABO' and 'Rhesus' groups are of major importance. 'ABO' system is further differentiated as A, B, AB, O blood group types according to presence of corresponding antigen in plasma (12). Yet another biological record that remains unchanged throughout the life time of an individual is the blood group. Determining the blood group of a person from the samples obtained at the site of crime, helps identify a person. Landsteiner classified blood groups under the ABO blood group system (13).

The aim of the research was to determine the correlation between finger print, gender, blood group and common clinical complaints.

MATERIALS AND METHODS

In this study, fingerprints were collected from a total of 150 members from different locations, in which 75 males and 75 females were identified during June to December 2017 by simple random sampling. All subjects with the age from 20 to 60 years who voluntarily consented to participate in this study were included. After taking consent from the subjects, the prints from the left thumb finger were

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taken on Pre-designed proforma containing participant name, age, gender, blood groups of the subjects and common clinical complaints. The procedure for blood collection and finger prints were explained to each subjects and participant's common complaints were also recorded. The study project was started after approval of Ethics Committee.

Collection of the finger prints

Fingerprints were analyzed by using powerful magnifying hand lens, ink pad and white chart paper. All subjects were asked to wash their hands thoroughly and then asked to press their left thumb fingertip on the ink pad and then to the paper to transfer the fingerprint impression. The same method was followed for all the participants.

Assessment of the finger prints

The fingerprint patterns were identified based on the appearance of ridge lines. The gender and age of all subjects were noted and the fingerprint patterns were identified as loop, whorls, and arches and mixed based on the appearance of the ridge lines with the help of a magnifying lens. In order to classify the finger prints, the classification scheme proposed by Galton was used depending upon their primary pattern (14,15).

1. Loops
2. Whorls
3. Arches
4. Mixed or Composite

TABLE 1

Prevalence of finger prints among males and females (n=150).

Male	Total (%)	Female	Total (%)
75	50	75	50

TABLE 2

Prevalence of blood groups among males and females (n=150).

Blood Groups	Males		Females			Total
	No	Frequency	No	Frequency	No	Frequency
A	19	25%	15	20%	34	23%
B	25	33%	27	36%	52	35%
O	29	39%	30	40%	59	39%
AB	2	3%	3	4%	5	3%

Blood group test

Blood sample was collected by pricking the finger with a sterile lancet after washing it with methylated spirit. A drop of blood from each subject was assimilated with Anti-serum A, Anti-serum B and Anti-serum D on a pure tile. Blood groups were resolved on the basis of presence or absence of agglutination (16).

Inclusion criteria

- Participants between the age group 20 to 60 years
- Subjects free from any infection on the left thumb

Exclusion criteria

- Participants with permanent scars, lesion, cuts
- Subjects with hand deformity due to injury, birth defect or disease.

RESULTS

In the present study, a total of 150 members were participated, out of which (75) 50% were males and (75) 50% were females as shown in Table 1.

Table 2 and Figure 2 showed the distribution of blood groups according to gender, blood group O frequency is higher in females (40%) than males (39%) and blood group B is higher in female (36%) than males (33%) and blood group A frequency is higher in males (25%) than females (20%), while blood group AB is higher in females (4%) than males (3%).

In this study, four different types (loop, whorl, mixed and arch) of thumb

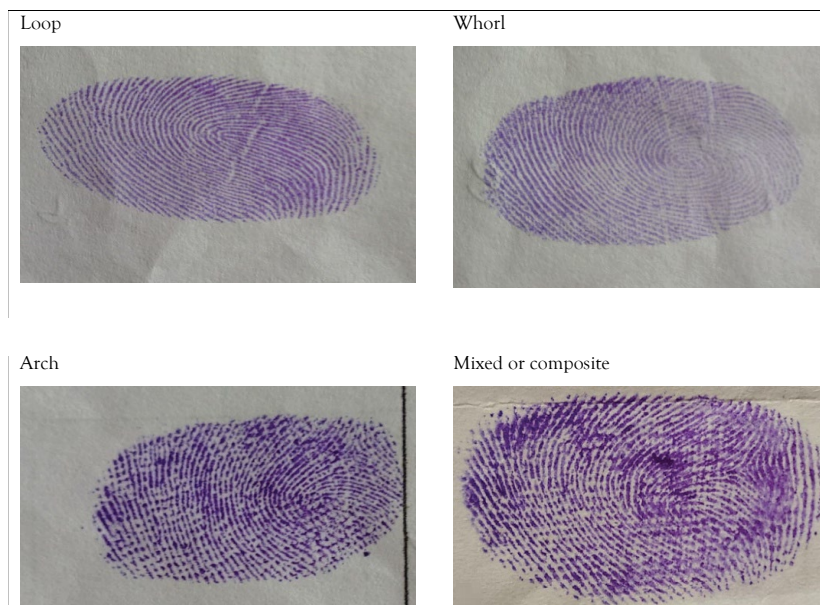


Figure 1) Various types of finger print patterns.

print patterns were identified as depicted in Figure 1. Total number of loops found in both gender in the left thumb print were 60 (40%) contributing the highest frequency, followed by whorls 40 (27%), Mixed 34 (23%) while Arches were present in a low frequency 16 (11%) as shown in the Table 3 and Figure 3. Table 3 clearly shows that, patterns have been found to be predominant among females than males.

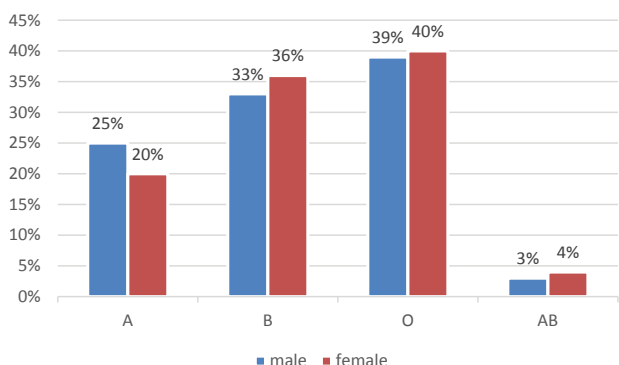


Figure 2) Graph showing distribution of ABO blood groups in males and females.

TABLE 3

Gender-wise distribution of left thumb finger print.

Patterns	Total		Males		Females	
	No	Frequency	No	Frequency	No	Frequency
Loops	60	40%	26	17%	34	23%
Whorls	40	27%	16	11%	24	16%
Mixed	34	23%	14	9%	20	14%
Arches	16	11%	4	2%	12	8%

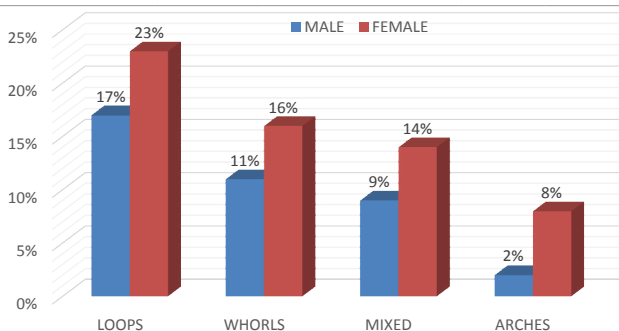


Figure 3) Graph showing distribution of left thumb print patterns among males and females.

Table 4 shows prevalence of finger print patterns in different blood groups. Total no of loops found in left thumb finger were 64 (43%), similarly numbers of whorls were 46 (31%), numbers of mixed were 28 (19%) and arches were 12 (8%).

TABLE 4

Prevalence of fingerprint patterns among blood groups.

Type of finger print	A+	A-	B+	B-	O+	O-	AB+	AB-	Total (%)
Loop	15 (10%)	1 (0.6%)	16 (11%)	NIL	29 (19%)	NIL	3 (2%)	NIL	64 (43%)
Whorl	13 (8%)	3 (2%)	9 (6%)	NIL	17 (11%)	NIL	4 (3%)	NIL	46 (31%)
Mixed	4 (3%)	1 (0.67%)	11 (7%)	NIL	7 (5%)	NIL	4 (3%)	1 (0.6%)	28 (19%)
Arch	1 (0.6%)	NIL	4 (3%)	NIL	6 (4%)	1 (0.6%)	NIL	NIL	12 (8%)

This table clearly indicates that Loops were predominantly found in blood group O+ (19%) followed by B+ (11%) , A+ (10%) and least in AB+ (2%) and A- (0.6%), while whorls were predominantly found in blood group O+ (11%) followed by A+ (8%), B+ (6%) and least in AB+ (3%), A- (2%), whereas mixed were common in B+ (7%) followed by O+ (5%), AB+ (3%) and A+ (3%) and least in A- (0.6%) and AB- (0.6%), while arches were the most common in blood group O+ (4%), B+ (3%) and least common in A+ (0.6%) and O- (0.6%) respectively, whereas none of the subjects showed blood group B negative.

Based on the blood groups, the more common clinical complaints were noted, Hypertension, Gastritis, Peptic ulcer, bronchial asthma were noted in blood group O, Anaemia, Gastritis, Rheumatoid Arthritis, Osteoarthritis in blood group A, Anaemia, Gastritis, Diabetes, Hypertension in blood group B, whereas Bronchial asthma, Hypertension and Diabetes in blood group AB as shown in the Table 5. Hence the association of blood group and different diseases can be used for early prediction and prevention of different diseases.

TABLE 5

Common clinical complaints among blood groups.

Blood Groups	Complaints
A	Anaemia, Gastritis, Rheumatoid Arthritis, Osteoarthritis
B	Anaemia, Gastritis, Diabetes, Hypertension
O	Hypertension, Gastritis, Peptic ulcer, Bronchial asthma
AB	Bronchial asthma, Hypertension, Diabetes

Early detection of the crime is a challenge in crime investigation. Repeatedly, fingerprints and blood stains are the only evidence left at the crime scene for identification of the crime. The present study determines to identify the significant relationship between fingerprint patterns, gender and blood group. Thus this study improves the reality of fingerprints in crime investigation and as well as to analyse the common clinical complaints based on blood groups.

DISCUSSION

The identification by fingerprint is the most reliable. The role of finger prints is of vital importance in establishing the identity of culprits at scene of crime and in the victims of mass disaster (17).

The present study reveals that total no of loops found in left thumb finger were 60 (40%), numbers of whorls were 40 (27%), and numbers of mixed were 34 (23%) and arches were 16 (11%). Similar study done by Sam et al., thumbprint pattern analysis showed that, loops were the most common pattern (57.1%), followed by whorls (30.35%), composite (6.35%) whereas arches were present in a smaller percentage (6.2%) of the study group (18).

It is also evident from the study that loop was the most frequently observed pattern of fingerprint followed by whorls, mixed and arches in both gender. Similar study conducted in south Indian population by Gangadhar et al. and Nithin et al. (19,20). The findings proved that, finger print patterns were found to be predominant among females than males and which does not coincide with the study conducted in New Zealand which revealed abundant whorls (55.6%) than loops (43.6%) in males and much higher frequency of whorls (65.6%) and lower frequency of loops (33.7%) in females (21).

Most of the subject in our study belonged to blood group "O" followed by "B", "A" and "AB" blood groups. Similar results were reported by Bharadwaja et al. (7) and Prateek et al. (22). On the other hand, in contrary to this study, Mehta et al. (23) and Desai et al. (24) observed the dominance of blood group "B" followed by blood groups "O" and "A." The frequency of blood group "AB" was least in their study.

This study showed that the loops were of high frequency in O+ve group and least in A- group. Whorls were of high frequency in O+ve and least in A-ve. The frequency of mixed was also high in B+ve and least in A- and AB-. Arches were of high frequency in O+ve and least in A+ve and O-ve. These observations were different from the findings of Hamid et al. (25) who reported only 3 patterns among which loops were of high frequency in B+ve and least in AB-ves. The frequency of whorls was also high in B+ve. Arches were of high frequency in B group and least in AB group.

In the present study, loop pattern was observed highest frequency 64 (43%) in different blood groups. The whorls 46 (31%) and mixed 28 (19%) were moderate and arches 12 (8%) was the least pattern observed. This findings match with the results of Bharadwaja et al. and Mehta et al. (7,23). However, in the present

study, arches were more common in blood group O+ (4%), B+ (3%) and least in A+ (0.6%) and O- (0.6%) which does not correlate with Aarushi et al. (26) where none of arches were reported.

This study highlights that blood group A were found to be the most common in males, blood group O was the most commonly seen blood group in females and the study also reveals that frequency of loops, followed by whorls, mixed and arches were greater in females as compared to males.

The study shows that highest prevalence of bronchial asthma is found in O blood group followed by AB blood group. Similar study done by Pahuja et al. (27) reported bronchial asthma in AB blood group then in O blood group. In this study, arthritic diseases were reported in blood group A, whereas diabetes and asthma in AB blood group and which is not similar to the study done by Senofontov, who had reported that patients affected with arthritic diseases belonged to blood type O, whereas the patients affected with diabetes and asthma were more typically blood group type A (28).

CONCLUSION

Finger prints are never alike and they never change from birth till death and moreover fingerprints are completely unique to every individual person. That is why finger prints were such a good way of identifying criminals. Our study results showed that there is an association between distribution of fingerprint patterns, gender, blood group and common clinical complaints. This study reveals a significant association of blood groups O, A, B, AB to Hypertension, Peptic ulcer, Anaemia, Rheumatoid Arthritis, Gastritis, Diabetes and Bronchial asthma. The predominance of loop was highest among all blood groups.

According to this study, following results were observed:

- Loops were the most common finger-print pattern and Arches were the least common.
- Whorls and mixed were moderate.
- Highest numbers of Loops were found in blood groups O, B compared to A and AB.
- Blood group O positive is the most common.
- O negative and AB negative is the rarest.
- Loops, whorls, mixed and arches were highest in females.
- Group A was the most common blood group among males.
- Blood group O, B, were the most commonly seen blood groups in females.
- Some common clinical complaints were seen in all the blood groups.

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