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**Original Article**

# Association of different finger prints in relation to ABO and Rh blood groups

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A R T I C L E I N F O

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*Association*
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A B S T R A C T

Aims: Traditional methods of personal identification include anthropometry, dermatoglyphics, DNA finger-typing and differentiation by blood groups. Among these, fingerprints are probably the most common biometric technique used in this context, allowing fast and secure identification. In recent years, the potential of finger prints to determine sex and human identification has been well exhibited. However, very few studies have been conducted correlating finger prints with blood groups. Hence the aim is to study the distribution of different finger prints among the subjects with different ABO and Rh blood groups. Methods: The total sample consisted of 200 BDS students comprising of 143 females and 57 males. All the individuals' finger prints and blood groups were studied. The fingerprint patterns were identified based on the appearance of ridge lines and classified into loops, whorls and arches. Blood groups were analyzed by placing a drop of blood on the slide and treated with anti-sera. The data was statistically analyzed using Z - test. Results: Loops were the predominant pattern; followed by whorls and arches. Majority of the subjects belonged to blood group O; followed by A, B and AB. Statistically in blood group B, frequency of loops was significantly higher as compared to other groups ($p<0.001$). Further frequency of loops was significantly ($p<0.001$) highest in Rh-positive subjects and Rh negative subjects had significantly higher proportion of whorls. Conclusion: Our study results showed that there is an association between finger prints and blood groups. Accordingly dermatoglyphics may help in using fingerprints as an important aid in blood group determination and vice versa and thus enhancing the accuracy of finger prints in detection of criminals.



## 1. Introduction

One of the challenges faced by man in earlier days was to establish the identity of an individual. Identification of humans is a prerequisite for personal, social and legal reasons. Traditional methods of personal identification include anthropometry, dermatoglyphics, DNA finger-typing, sex determination, and estimation of age, measurement of height, post-mortem reports and differentiation by blood groups. Among these, fingerprints are probably the most common biometric technique used in this context, allowing fast and secure identification [1, 2].

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It was in 1926 that Cummins introduced the term "Dermatoglyphic". It is the term applied to the study of naturally occurring patterns on the surfaces of hands and feet. They develop between 13th to 19th weeks of prenatal life [3].

The term "finger-print" predominantly means an impression of the epidermal ridges of the fleshy distal portion of a finger. Finger-prints may be deposited in natural secretions from the eccrine glands present in epidermal ridge skin or formed by applying ink and pressing the finger on paper and this is used as a means of establishing identity [2, 4].

Fingerprints have some important characteristics that make them invaluable evidence in crime scene investigations: A fingerprint is unique to a particular individual, and no two fingerprints possess exactly the same set of characteristics.

Fingerprints do not change over the course of person's lifetime. Fingerprint patterns can be classified into loops, whorls and arches, which can be used to narrow the range of suspects. Thus fingerprints form the most reliable criteria for identification [3, 5].

Blood grouping is also one of the most reliable traditional identification methods. Blood group system was discovered way back in 1901 by Karl Landsteiner. Till date, 19 major groups have been identified which vary in their frequency of distribution. Among them only 'ABO' and 'Rhesus' groups are of major importance [6].

In recent years, the potential of finger prints to determine sex and human identification has been well exhibited and documented [5, 7]. However, very few studies have been conducted correlating finger prints and blood groups. Hence, the aim of this research was to study the distribution of different finger prints among the subjects with different ABO and Rh blood groups. Correlating finger prints with blood groups may be useful in forensic science in accurate identification of an individual than by using finger prints alone.

## Material and Methods

### Subjects

The total sample consisted of 200 BDS students in which 143 were females and 57 were males in the age group of 17 to 22 years. Consent of all the individuals and ethical clearance from the institution was obtained to carry out the study. All the individuals' finger prints and blood groups were studied. Students with permanent scars on their fingers or thumbs, with any hand deformities due to injury or disease were excluded from the study.

Recording the finger prints

The materials used were ink pad, white chart paper and magnifying lens. Each subject was asked to wash their hands thoroughly and then asked to press their fingertip on the stamp pad and then to the paper to transfer the fingerprint impression. The same method was repeated for all the fingers of both hands. In this way, fingerprints of all the ten digits were taken separately on the respective blocks on the same sheet of paper.

Examination of the finger prints

The fingerprint patterns were studied with the help of a magnifying lens and were identified based on the appearance of ridge lines.

In order to classify the finger prints in this study, the classification scheme proposed by Galton was used depending upon their primary pattern [Figure 1] [3, 8]:

1. Loops,
2. Whorls and
3. Arches

Recording the blood groups

Blood groups of the subjects were analyzed by placing a drop of blood on the slide and treated with anti-A and anti-B sera. Positive agglutination of the blood on treating with anti-A is considered as blood group A, positive reaction with anti-B is considered as blood group B, if no agglutination is produced then the blood group is O and if agglutination is seen with both anti-sera then blood group AB is considered. Similarly, positive agglutination reaction with Rh antigen is considered Rh positive or otherwise as Rh negative.

Statistical analysis

The data was analyzed for percentage proportions and compared. Statistical analysis was performed for distribution of finger prints in relation to ABO and Rh blood groups, using Z- test. P-value <0.05 was considered to be statistically significant.

## Results

Females outnumbered the males in the study, the male: female ratio being 1:2.8. Overall, no two individuals had a similar type of finger prints.

Fingerprints

On evaluating fingerprints in all the fingers of both the hands, loops were the predominant pattern (53%); followed by whorls (39%) and arches (8%). Frequency of loops was found to be higher in both males and females followed by whorls and arches [Table 1, Figure 2].

Blood groups and Rh system

Majority of the subjects (40%) in the study belonged to blood group O; followed by blood group A (27%), B (20%) and AB (13%). Frequency of blood group O was higher in both males and females followed by blood group A, B and AB. Frequency of blood group A and B was similar in males (Figure 3).

190 subjects (95%) in the study had Rh-positive factor, of which 76 cases belonged to blood group O, 54 cases blood group A, 45 cases blood group B and 15 cases showed blood group AB. Only 10% of cases belonged to Rh-negative factor [Table 2, Figure 4].

Finger prints in relation to different blood groups

Frequency of loops was highest in all the individual blood groups of ABO blood group system; followed by whorls and arches except in AB blood group, where loops and whorls were equally distributed. On the whole, incidence of loops varied between 48% (in AB blood group) to 60% (in B blood group), whorls varied between 32% (in AB blood group) to 48% (in B blood group) and arches varied between 4% (in AB blood group) to 9% (in A blood group).

Among the subjects of different blood groups:

1. Blood group A showed highest loops (52%), moderate whorls (39%) and arches were least common (9%). Statistically in blood group A, no significant difference with different finger print patterns was observed as compared to other groups.

2. Similarly blood group B showed highest loops (60%), moderate whorls (32%) and arches were least common (7%). However, in Group B, frequency of loops was significantly higher as compared to other groups ($p<0.001$), the frequency of whorls was significantly lower as compared to other groups. Statistically no significant difference with respect to arches was observed in Group B as compared to other groups.

3. Blood group AB showed highest loops and whorls (48%), however arches were least common (4%).

4. Blood group O showed highest loops (51%), moderate whorls (42%) and arches were least common (7%). Further in blood group O, loops were significantly higher as compared to other patterns.

Frequency of loops were significantly ($p<0.001$) highest in Rh-positive subjects. Compared to Rh-positive subjects, Rh negative subjects had significantly higher proportion of whorls. Although proportion of Rh-negative subjects with loops was lower as compared to Rh-positive subjects yet the difference was not significant statistically. Further proportion of subjects with arches was statistically significant in Rh-negative subjects.

**Table 1: Percentage-wise distribution of finger print patterns among males and females**

| **Patterns** | **Males (n=143)** | **Females (n=57)** | **Total (n=200)** |
|---|---|---|---|
| Loops | 272 (46%) | 794 (56%) | 1066 (53%) |
| Whorls | 236(41%) | 549 (39%) | 785 (39%) |
| Arches | 73(13%) | 76 (5%) | 149 (8%) |
| Total | 581 | 1419 | 2000 (100%) |

**Table 2: Distribution of blood groups according to gender and Rh blood groups**

| Blood groups | Males | Females | Rh-positive | Rh-negative | Total |
|---|---|---|---|---|---|
| A | 16 (28%) | 39 (27%) | 54 (28%) | 1 (10%) | 55 (27%) |
| B | 16 (28%) | 35 (24%) | 45 (24%) | 6 (60%) | 51 (20%) |
| AB | 6(11%) | 9 (7%) | 15 (8%) | 0 | 15 (13%) |
| O | 19 (33%) | 60 (42%) | 76 (40%) | 3 (30%) | 79 (40%) |
| Total | 57 | 143 | 190 (95%) | 10 (5%) | 200 |

**Type 3: Association of finger print patterns in relation to blood groups**

| Patterns | Loops | Z-score; p-value | Whorls | Z-score; p-value | Arches | Z-score; p-value |
|---|---|---|---|---|---|---|
| A | 284 (52%) | z=0.918 p=0.358 | 216 (39%) | z=0.013 p=0.992 | 50 (9%) | z=1.721 p=0.085 |
| B | 308 (60%) | z=3.605 p<0.001 (S) | 164 (32%) | z=-3.801 p<0.001 (S) | 38 (7%) | z=0.001 p=1.000 |
| AB | 72 (48%) | z=-1.353 p=0.177 | 72 (48%) | z=2.282 p=0.023 | 6(4%) | z=-0.918 p=0.358 |
| O | 402(51%) | z=-1.705 p<0.001 (S) | 333 (42%) | z=2.148 p=0.032 | 55(7%) | z=-1.673 p=0.095 |

*P* > 0.05 is not significant, while *p* < 0.05 is significant

**Table 4: Association of finger print patterns in relation to Rh blood groups**

| Patterns | Loops | Z-score; p-value | Whorls | Z-score; p-value | Arches | Z-score; p-value |
|---|---|---|---|---|---|---|
| Rh-positive | 1020 (56%) | z=3.501 p<0.001 (S) | 660 (36%) | z=-1.452 p=0.177 | 135 (8%) | z=3.723 p<0.001 (S) |
| Rh- negative | 46 (25%) | z=-1.673 p=0.095 | 125 (67%) | z= -8.280 p=<0.001 (S) | 14 (8%) | z=-0.064 p=0.002 |

*P* > 0.05 is not significant, while *p* < 0.05 is significant

**Fig. 1 Various types of finger print patterns**

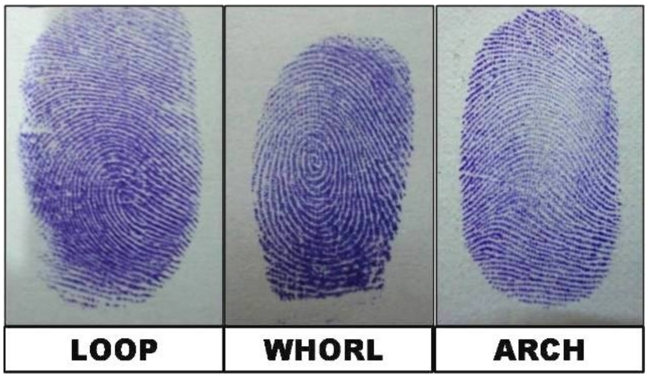



**Fig. 2 Graph showing distribution of finger prints in males and females**

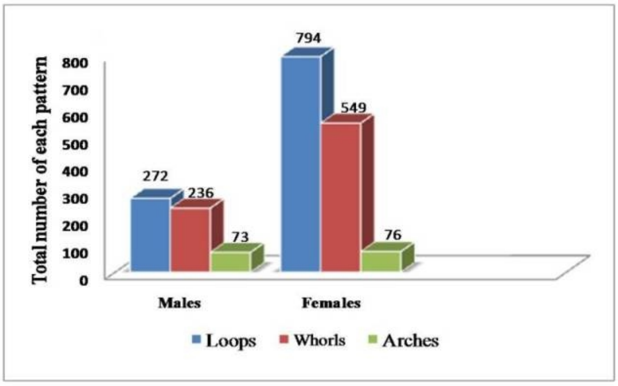



**Fig. 3 Graph showing distribution of ABO blood groups in males and females**

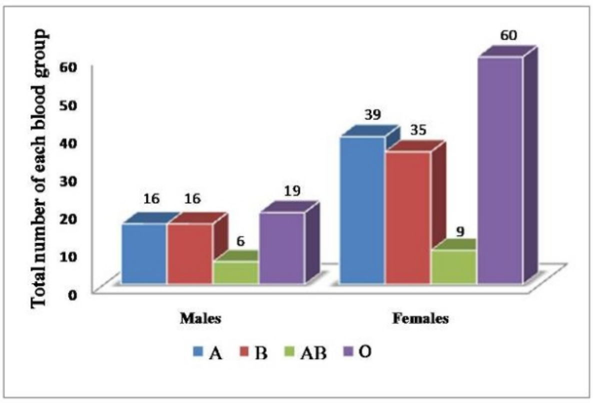
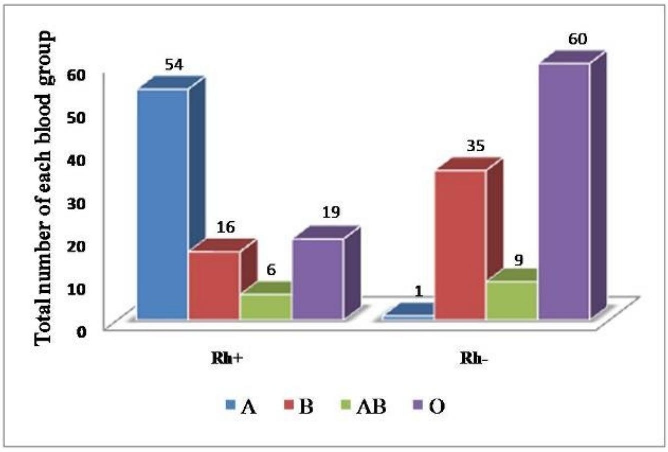



**Fig. 4 Graph showing distribution of ABO blood groups in Rh-positive and Rh-negative individuals**




## Conclusion

Dermatoglyphics is relatively an age old method among the large number of identification tools available in forensic sciences. Fingerprints collected at a crime scene can be used to identify both suspects and victims. Recently fingerprint scans are extensively used to validate electronic registration, cashless catering, records to access especially in schools and colleges. Our study results showed that there is an association between finger prints and blood groups. Accordingly dermatoglyphics may help in using fingerprints as an important aid in blood group determination and vice versa and thus enhancing the accuracy of finger prints in detection of criminals. This association of finger prints and blood groups warrants further research on larger sample.

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