



## Evaluation of Correlation between Blood Group System & Fingerprint Classification System in both female and male

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**Abstract**— Fingerprints are classified and documented on the basis of ridge patterns. The impressions made by the pattern of any individual remain unchanged throughout his or her life. The study was carried out on 74 female and 50 male individual subjects having different ABO blood groups, all the 10 finger's fingerprints were divided into loops, whorl and arches. The results showed that majority of the subjects belonged to blood group B followed by blood group O. The finger print pattern of loops had the highest frequency while arches were the least. Blood group B were mostly associated with the loop pattern while blood group AB had the least frequency in all the fingerprint patterns. It was concluded that there was an association between distribution of fingerprint patterns, blood group and gender and thus prediction of gender and blood group of a person was possible based on the fingerprint patterns.

**Index Terms**— Blood group, Fingerprints, Gender, Pattern, Relation.

### I. INTRODUCTION

Fingerprint evidence is undoubtedly the most reliable and acceptable evidence till date in the court of law. Fingerprints follows the Locard's principle of exchange. A reliable personal identification is critical in the subject of forensics as is faced with many situation like civil, criminal, commercial, and latest in financial transaction frauds, where the question of identification becomes a matter of paramount importance. 'ABO' system is classified as A, B, AB, O blood group types according to presence of corresponding antigen in plasma. 'Rhesus' system is classified into 'Rh positive' and 'Rh negative' according to presence or absence of 'D' antigen. The study is about relationship between blood group and fingerprint, which is helpful in forensic analysis.

The fingerprints are one of the most importance evidence because of the following features:

1. Fingerprints are unique.
2. Fingerprints are permanent.
3. Fingerprints are universal.
4. Fingerprints are inimitable.
5. Fingerprints are classifiable.
6. Fingerprints are frequently available in crime situations, as evidence.

Fingerprints can be used for both non-criminal and criminal purpose. In criminal purpose, the obvious uses are to connect the suspect or criminal to the crime scene or to connect the particular item to suspect or criminal. This assists in the investigation by proving and disproving a set of facts or circumstance occurs at the scene of crime. Fingerprint evidence can also help to corroborate information. In non-criminal purpose, commonly known as civil matters, fingerprints are of used for identification purpose in disasters or mass disasters like flood, earthquake, building collapsed, etc. There are three types of fingerprint patterns.

1. Arch Pattern
2. Whorl Pattern
3. Loop Pattern

The classification and identification of fingerprint pattern is based on Ridge Counting, Ridge Tracing and Henry Classification.

The ABO blood-group system involves two antibodies and two antigens, which are found in human blood. Antigen A and antigen B are present on the red blood cells. Antibody A and antibody B are present in the serum. On the basis of antigen property of the blood, all humans are classifiable into 4 groups, group A (person have antigen A), group B (person have antigen B), group AB (person have both antigen A and antigen B), group O (person have not any of antigen A and antigen B). There is an agglutination reaction between same antigen and antibody. For example, antigen A agglutinates the antibody A and antigen B agglutinates with antibody B.

## II. OBJECTIVES OF THE STUDY

- To analyse patterns and ridge characteristics of developed rolled fingerprints in females by using inkpad and with the help of Henry classification method.
- To determine ABO blood group /Rh group of subjects.
- To correlate any relation between dactylographic patterns and blood groups using statistical software (IBM SPSS Statistics).

## III. MATERIALS AND METHODS

Before collecting data, each subject(s) are well informed about the principle, purpose, procedure and considerations from the data. The study was conduct among 128 subjects both male and female, belonging to age group 18+ years.

### MATERIALS:

- INK pad (Shiny SM-2 Finger and Thumb Print Ink Pad)
- A4-size Fingerprint Sheet
- Blood grouping kit (HIMEDIA) ( used only when subject didn't know about her Blood group otherwise there Valid Identification Card is used to note down Blood group)
- Pricking Needle (HIMEDIA – comes with Blood-Group kit)
- Glass slide (HIMEDIA – comes with Blood-Group kit)
- Spirit/Alcohol swabs
- Magnifying lens (Deli)

### Method to take fingerprints:

Write details of subject on the fingerprint sheet. Each subject will ask to wash her hands thoroughly with soap or hand wash and water and dry using a towel. To begin this process, with the use of ink and roller method, a small amount of ink is deposited at the edge to edge on fingers with the help of the Fingerprint Ink. Take the fingerprint at the allotted space on the fingerprint sheet. The same method was repeat for all the finger of both hands. In this way, the plain fingerprints of all the ten digits will take separately on the same sheet of paper. It takes ideally 4 to 5 minutes behind one person. But it takes more time if fingerprint's quality is not good at a time. Its takes up to 10 minutes for one person.

### Analysis of Blood Group:

Fingertip will be cleaned with the help of alcohol/spirit swabs. With the help of pricking needle or lancet, prick the fingertip, take the three blood drop samples. The blood group will be identified using antiserum A, B and D (based on Ag-Ab 'agglutination reaction'). If the subject is know her blood group. This procedure is not required. Subject's valid identification proof (College Identity Card, other Identity Card which have subject's Blood group present on It.) is valid for note down blood group.

### Further analysis:

After the fingerprint acquired, Primary patterns (loops, whorls and arches) observed with the help of a powerful magnifying lens.

- Fingerprint sheet had assigned number (like F01).
- Perform a Henry's Classification to classify fingerprints.
- After that data transfer to Microsoft Excel software for counting.
- Transfer excel data file into IBM SPSS Statistics version 25.
- The significance of this software for our data is 95.0 % ( It's also a default setting of Software it self.)

The P-value = 0.05 is default setting of software.

**Steps for Statistical Data Analysis in the IBM SPSS Statistics:**

- Analyze → Descriptive Statistics → Crosstabs
- New window of “Crosstabs” is open.
- Now All fingerprint data is select for the “Row(s)” and Blood group is select for the “Column(s)”
- Go to Statistics. Here again new window of “Crosstabs:statistics” is open. Select the Chi-Square and hit the continue. Then click the ok button.
- It opens a new window which has statistical data as well as Chi- square data.

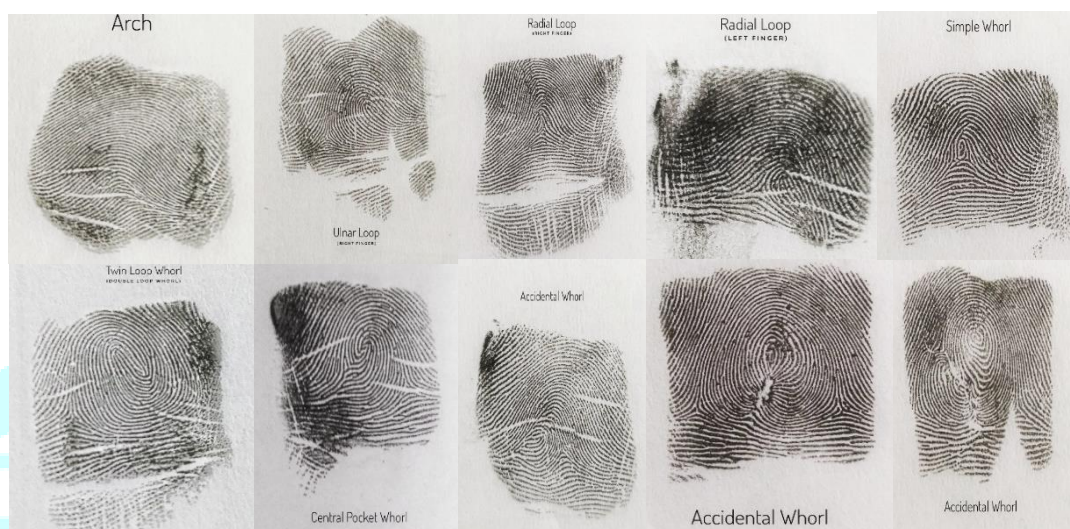
**IV. RESULTS AND DISCUSSION**

FIGURE 1: TYPES OF FINGERPRINTS FOUND DURING THE STUDY AND ANALYSIS

The study and analysis of fingerprint, blood group and the data generated from the IBM SPSS Statistics version 25, the results are in tabular form for fingerprint patterns distribution, blood-group detail of all the subjects and the relation between the fingerprint of each finger and blood-group.

Fingerprint Pattern	Worldwide Percentage Distribution of Fingerprints	Total	Percentage Distribution of Fingerprints in this study
<b>Loop</b>	60-70 %	733	57.24 %
<b>Whorl</b>	25-35 %	505	39.48 %
<b>Arch</b>	3-5 %	42	3.28 %
<b>Total</b>	<b>100 %</b>	<b>1280</b>	<b>100 %</b>

Table 1 shows the detail of distribution of the fingerprint pattern among the subjects. Worldwide distribution percentage of fingerprint pattern are as following, the loop pattern consist about 60-70%, the whorl pattern consist about 25-35% and the arch pattern consist about 3-5%. This study is conducted on 128 subjects, which mean the 1280 fingers and its 1280 fingerprints. In this study the percentage distribution of fingerprints are as following, the loop pattern consist of 733 (57.24%), the whorl pattern consist of 505 (39.48%), and the arch pattern consist of 42 (3.28%). From this table, the percentage distribution is slightly different than worldwide percentage distribution of fingerprints. In this study whorl patterns are slightly increased than worldwide percentage, loop pattern slightly decreased than worldwide percentage.

Blood Group	Rh+	Percent Rh+	Rh-	Percent Rh-	Total	Total Percent
<b>A</b>	24	<b>20.51 %</b>	0	<b>0 %</b>	24	<b>18.75 %</b>
<b>B</b>	50	<b>42.74 %</b>	3	<b>27.273 %</b>	53	<b>41.40 %</b>
<b>AB</b>	4	<b>3.42 %</b>	2	<b>18.181 %</b>	6	<b>4.68 %</b>
<b>O</b>	39	<b>33.33 %</b>	6	<b>54.545 %</b>	45	<b>35.15 %</b>
<b>Total</b>	<b>117</b>	<b>100 %</b>	<b>11</b>	<b>100 %</b>	<b>128</b>	<b>100 %</b>

Table 2 is about the blood group detail distribution among subjects of this study. From the 128 subjects 24 subjects have A positive blood-group, 50 subjects have B positive blood-group and 3 subject have B negative blood-group, 4 subject have AB positive and 2 subject have AB negative blood-group, 39 subjects have O positive and 6 subjects have O negative blood-group.

Fingerprint Pattern	Blood group A		Blood group B		Blood group AB		Blood group O	
	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve	Rh +ve	Rh -ve
Arch	32	0	54	4	3	2	36	7
Loop	126	0	254	21	21	15	188	27
Whorl	82	0	192	5	14	3	166	25
Total	240	0	500	30	38	20	390	59

Table 3 is about distribution of finger print patterns among ABO and Rh Blood Groups. According to the table blood group B +ve has the highest numbers of the loop patterns which is 254, followed by whorl pattern which is 192. From the table blood group A -ve has none of the finger print patterns. Blood group O +ve is on the second place with the 188 of loop patterns followed by whorls patterns which is 166. From the data analysis its shows that majority of subjects have B blood group (53 subjects) following by O blood group (45 subjects), A blood group (24 subjects), AB blood group (6 subjects). In this study, the loop patterns are higher than other types of patterns but whorls patterns are nearly the same as loop pattern. This can be seen in the above Tables. As per the statistical data of fingerprints, it shows that Loop is the most common pattern in both gender but in this study along with loop pattern, whorl pattern can be seen higher as loop pattern. Arc pattern is as rare as it's known. There are many patterns comes under the whorl pattern known as Composite Fingerprint Pattern. This kind of pattern also found in this study. The hypothesis was to find out the relationship between Blood Group and Fingerprint Patterns. From the chi-square method (Done by IBM SPSS Statistics version 25) and Chi-square chart, our hypothesis is proven positive at the point. The Degree of freedom value for all the finger is 6 and 3(Ring and little finger) (because they don't have an arch pattern). The p-value for all the finger is less than 8.0000. Here default P-value is 0.05 for our statistical analysis. Form the generated data from statistical software, Probability level (alpha) of our data is less than Chi-Square distribution table. So Hypothesis is likely acceptable.

## V. CONCLUSION

The present study is an attempt to associate fingerprint patterns with the blood group of a female and male subjects. Fingerprint patterns can help predict the gender and blood group of an individual. It may help in increasing the authenticity of fingerprints in the identification of individuals and the solving of crimes. It can narrow down the suspect list (the law of probability). The blood group B is predominate in both gander. Followed by blood group O, A, and AB. Majority of the subjects in the study belonged to blood group B; followed by blood group O, A and AB. The general distribution pattern of the primary fingerprint was of the same order in individuals with A, B, AB and O blood groups. In this study Moderate frequency of loops and whorls (except Right Middle & Little and Left Little Finger), and low of arches. All fingerprint is unique hence it can be very effectively used as evidence for identification in the court of law. In this study loops are the most commonly occurring finger-print pattern and Arches are the least common. Blood group B is the most common and blood group AB is the rarest. Similar studies should be conducted on larger subjects to increase the accuracy of prediction.

## VI. FUTURE PROSPECTIVE

This kind of study must be conducted on a large population. The study can be conducted area-wise, it is also useful to solve the crime. There are some more individual characteristics like Foot print and lip print can be associate with fingerprint and blood group of an individual.



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