

Dactylographic Pattern and Its Relationship with ABO-Rhesus Blood Group

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Abstract: Fingerprint patterns and blood groups are two invaluable tools for forensic identification.

The aim of this study was to detect any significant relationship of fingerprint pattern with ABO-Rhesus blood groups. The study was conducted among 68 medical students. Loop pattern is most common dactylographic pattern followed by whorl and arch pattern. Predominant blood group is B+ve followed by A+ve and O+ve. AB+ve is the least common blood group. In blood group A, B and O loop pattern is most common but in AB blood group loop and whorl have same distribution. In Rh+ individual loop pattern is dominant but in Rh-group whorl pattern is most common dactylographic pattern. In blood group A+, B+ and O+ loop pattern is most common but in AB+ group both loop and whorl patterns predominate. In B-ve group whorl is the most common dactylographic pattern.

Key words: ABO-Rhesus blood group, Dactylography.

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I. Introduction:

Dactylography or Fingerprint is one of the oldest reliable biometric indicators. Fingerprints represent the impressions left by the friction ridges of our finger [1]. There are four common patterns of fingerprints: loop, whorl arch & composite. It has been reported that the characteristic patterns of epidermal ridges are differentiated in their definitive forms during the third and fourth months of intrauterine life. Fingerprint patterns are genotypically determined and remain unchanged from birth until the person dies and decomposes. Fingerprints are abundantly [1] found in the scene of crime. Due to the uniqueness of individual fingerprint patterns, dactylography forms an important forensic tool for medico-legal identification.

So far, 35 major blood groups have been recognised by International Society of Blood Transfusion (ISBT 2014) which show anthropological variation in different human races [2]. Clinically, only ABO & Rhesus systems are of importance. However there are other minor systems like MN, Kell, Duffy, etc. The ABO system includes four major types of blood groups – A, B, AB and O; each of which can be of two subtypes based on Rh-typing – Rh-positive and Rh-negative. A scene of crime invariably has traces of blood in it.

In the present study, if our results demonstrate any statistically significant relationship of fingerprint with blood group, we can to some extent predict blood group of an individual based on the available fingerprint pattern and vice versa. This will help in more accurate identification of an individual and help to establish a link between crime & criminals or victims.

Many workers have studied the relationship between blood group and fingerprint patterns in different populations. A study by Desai et al [3] showed that, in people of Karnataka, loops dominated in all blood groups of both Rh positive and Rh negative individuals but whorls were more common in O negative blood group. Similar findings were reflected in a study at Mangalore by Rastogi et al [4], done among medical students. The higher prevalence of whorls in O negative blood group was also reported by Eboh [5], who conducted a similar study in Nigerian population.

In an Indian study Bharadwaja A et al [6], on medical students at Ajmer, it was observed that frequency of loops was highest in all blood groups, except AB blood group where the frequency of whorls was more than loop. In another Indian study by Maled V et al [7], it was found that loop pattern is most common among both Rh positive and negative group followed by whorl and arch. The higher frequency of whorls in AB blood groups was reported.

A Libyan study by Fayrouz I. N. et al [8] showed that in A+ and O+ individuals, loops were most frequent followed by whorls, while in blood group B, whorls were most common irrespective of Rh type.

According to Kshirsagar S.V. et al [9], arches were most common in O blood group individuals, whereas whorls were more common in AB blood group.

In another Indian study by Mehta A.A, et al [10] it was found that whorl, loop and arch were predominant in B, O and AB blood group respectively. Arch was most common in Rh negative blood group.

In a 2014 study conducted by Deopa D et al [11] in India, it was observed that loops were most common pattern in all blood groups except in blood group A positive. Whorls were highest in A & AB positive blood group and loops were highest in O & B blood group. Arches were least common in all blood groups.

In another recent study conducted by Adhya S. et al [12], it was found that the order of frequency is loop, whorl and arch in all blood groups except in B negative where whorl is more frequent than loop and in AB negative where arch is more than whorl pattern.

This study aims to evaluate the relationship between blood group and fingerprint patterns in the study population.

II. Aims and Objectives:

This study aims to determine if there is any statistically significant relationship between the blood group and fingerprint patterns in an individual, and the extent to which they can be used for medico-legal identification purpose.

III. Materials and Methods:

This was a cross-sectional descriptive randomised single-blinded study. The study was conducted among 68 subjects between the age groups of 18 to 20yrs in 2017.

The study was conducted after having clearance from Institutional Ethics Committee. After getting informed consent from the participants, they were included in the study.

Inclusion criteria:

- All consenting individuals

Exclusion criteria:

- Individuals with permanent scars on their fingers
- Individuals with any hand deformities due to injury, disease or birth defect
- Individuals having worn fingerprints, extra, webbed or bandaged fingers.

Altogether 13 subjects were excluded from the study.

Procedure for data collection:

- After brief introduction about the work, consent form & information brochure was distributed among the students. Data were collected from all the students who gave the consent to participate. It was of single blind procedure, no identification was recorded to reduce bias.
- Each subject was asked to wash hands thoroughly with soap and water and dry them using a towel.
- Each subject was asked to press his fingertip on the ink pad and then to the unglazed paper to transfer the fingerprint impression. This technique was followed for all ten fingers of both hands. In this way, the fingerprints of all the ten fingers were taken separately on the respective areas on the same sheet of paper. Care was taken to avoid sliding of fingers to prevent smudging of the print.
- After the fingerprints, details such as sex, age were noted. Their blood group were recorded from college ID-cards. Each subject was assigned a serial number.
- The fingerprint patterns were studied with the help of a magnifying lens and identified as: Loops, Whorls, Arches & Composites based on the appearance of ridge lines according to Henry-Galton system of classification. This system assigns each of the fingers a specific numeral according to sequence of position in hand, starting with right thumb as '1' up to left little finger as '10'. The distribution of fingerprint patterns in both hands of individuals and its relationship with the different ABO and Rh blood groups & the eye colour were evaluated and analysed statistically.

Instruments used:

Magnifying glass, unglazed white paper, ink pad, cell phone, statistical software Excel 2007 and IBM SPSS-20.

Source of finance:

The study was funded by researchers.

Plan of analysis:

Data were analyzed by percentage & tests of significance using statistical software. For comparisons, chi-square test was used to determine significance at $p < 0.05$. After analysis data were presented by tables.

The data obtained from current study were compared with similar studies available in literature.

Ethical consideration:

Extreme caution was taken to maintain confidentiality, and free voluntary consent was taken from the participants before trial.

Confidentiality:

Identity of the students cannot be revealed from the collected information. Participants' signatures were taken on informed consent forms only, which were completely separated sheets from the data collection sheets. This study will only be used for academic purpose not for commercial purpose.

IV. Observations and Results:

The present study was conducted on 68 subjects. So a total of 340 fingers were examined for ridge pattern.

Table 1: Distribution of primary finger print pattern of all fingers of left hand (n=68 x 5)

Pattern	Frequency (Percentage)
Loop	161(47.4%)
Whorl	129(37.9%)
Arch	50(14.7%)
Total	340(100%)

Findings: Loop pattern is most common dactylographic pattern followed by whorl and arch pattern.

Table 2: Distribution of subjects according to blood groups status (n=68)

Blood group	Rh positive	Rh negative	Total
A	17(25%)	0	17(25%)
B	28(41.2%)	1(1.5%)	29(42.6%)
AB	5(7.4%)	0	5(7.4%)
O	16(23.5%)	1(1.5%)	17(25%)
Total	66(97.06%)	2(2.94%)	68(100%)

Findings: Predominant blood group is B+ve followed by A+ve and O+ve. AB+ve is the least common blood group.

Table 3: Distribution of finger ridge patterns within ABO blood groups

Pattern of Finger ridge	ABO Blood Groups				Total
	A	B	AB	O	
Loop	44(51.8%)	64(44.1%)	12(48%)	41(48.2%)	161(47.4%)
Whorl	26(30.6%)	57(39.3%)	12(48%)	34(40%)	129(37.9%)
Arch	15(17.6%)	24(16.5%)	1(4%)	10(11.8%)	50(14.7%)
Total	85(100%)	145(100%)	25(100%)	85(100%)	340(100%)

Chi-square = 6.011 with 6 degrees of freedom ;P = 0.422

Findings: In blood group A, B and O loop pattern is most common but in AB blood group loop and whorl have same distribution.

Table 4: Distribution of finger ridge patterns within Rhesus blood groups

Pattern of Finger ridge	Rhesus Blood Groups		
	Rh+	Rh-	Total
Loop	157(47.6%)	4(40%)	161(47.4%)
Whorl	123(37.3%)	6(60%)	129(37.9%)
Arch	50(15.1%)	0	50(14.7%)
Total	330(100%)	10(100%)	340(100%)

Chi-square = 2.954 with 2 degrees of freedom; P = 0.228

Findings: In Rh+ individual loop pattern is dominant but in Rh- group whorl pattern is most common dactylographic pattern.

Table 5: Distribution of finger ridge patterns within ABO- Rhesus blood groups

Pattern of Finger ridge	Blood Groups								Total (%)
	A+ve	A-ve	B+ve	B-ve	AB+ve	AB-ve	O+ve	O-ve	
Loop	44(51.8%)	0	64(45.7%)	0	12(48%)	0	37(46.2%)	4(80%)	161(47.4%)
Whorl	26(30.6%)	0	52(37.1%)	5(100%)	12(48%)	0	33(41.2%)	1(20%)	129(37.9%)
Arch	15(17.6%)	0	24(17.14%)	0	1(4%)	0	10(12.5%)	0	50(37.9%)
Total	85(100%)	0	140(100%)	5(100%)	25(100%)	0	80(100%)	5(100%)	340(100%)

Chi-square = 16.326 with 10 degrees of freedom; P = 0.091

Findings: In blood group A+, B+ and O+ loop pattern is most common but in AB+ group both loop and whorl pattern predominant and also in B-ve group whorl is the most common dactylographic pattern.

V. Discussion:

Dactylography is an invaluable tool in forensic investigations. Traces of blood are usually detected at sites of crime. Any correlation between blood group and dactylography, therefore presents a unique combination of data that can be useful for forensic identification.

The prevalence of specific dactylographic patterns differs in different reports. In our study, loop pattern was most common dactylographic pattern followed by whorl and arch pattern. Predominant blood group was B+ve followed by A+ve and O+ve. AB+ve was the least common blood group.

In blood group A, B and O, loop pattern was found to be most common but in AB blood group loop and whorl had the same distribution.

In Rh+ individual loop pattern was dominant but in Rh- group whorl pattern was most common dactylographic pattern. In blood group A+, B+ and O+ loop pattern was most common but in AB+ group both loop and whorl patterns were predominant. In B-ve group whorl was the most common dactylographic pattern.

VI. Conclusion:

In our study, we could not establish a strong association between a specific dactylographic pattern and a specific blood group. It is probably due to the fact that the origin of finger-print patterns is largely due to a complex interplay of genetics and developmental factors. Blood groups, on the other hand, originate due to interaction of the paternal and maternal genes regulating their expression. It is possible that the relationship between blood group antigens and dactylography is much more complex, and possibly involve different sets of factors. Further research in this domain can throw more light upon this intriguing aspect of forensic biology.

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