

## Relationship between Pattern of Fingerprints and Blood Groups

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### ABSTRACT

**Background and Aim:** Fingerprints are a unique identification tool useful in the forensic investigation for detection of crimes. The probability of two people having an identical pattern of fingerprints is one in 64,000 million. The ridge pattern of fingerprints developed during fetal period do not change throughout their life until skin decomposes. The pattern of fingerprints differ widely with blood group variation. Therefore, the present study aimed to correlate the pattern of fingerprints with blood groups.

**Methodology:** This prospective study was conducted on 178 medical students (MBBS and BDS) in the Department of Forensic Medicine, District Headquarters Hospital and Benazir Bhutto Hospital, Rawalpindi for the period from November 2021 to April 2022. Prior to study conduction, ethical approval was taken from the institutes research and ethical committee. Written informed consent was obtained from each individual. Participants with known blood groups having age range from 17 to 23 years were enrolled. Ink method was used for taking fingerprints. Patterns of fingerprints were categorized as loops, whirl, arches, and composite. SPSS version 25 was used for data analysis.

**Results:** Of the total 178 medical students, there were 48 (27%) male and 130 (73%) females. The overall mean age was 21.6 ± 1.4 years with an age range from 17 to 23 years. Out of total medical students, the incidence of blood group A, B, AB, and O was 53 (29.8%), 31 (17.4%), 19 (10.7%), and 75 (42.1%) respectively. The prevalence of Rh-positive was 90.4% (n=161) among the studied cases. Loop pattern was the most prevalent fingerprints pattern observed in 95 (53.4%) cases. Majority of loop patterns were seen in blood group O participants. Other fingerprints pattern such as whorls, arches, and composite were found in 49 (27.5%), 24 (13.5%), and 10 (5.6%) respectively.

**Conclusion:** The present study concluded that blood group "O" was the most prevalent group followed by A, B, and AB. Loop was the most common pattern of fingerprints among blood groups especially in blood group O. The prevalence of Rh-positive was found higher among the study cases.

**Keywords:** Pattern, Fingerprints, Blood group.

### INTRODUCTION

Fingerprints are epidermal ridges and volar aspect arrangement on palms, fingers, and soles. The smaller crimson along with wrinkles on skin over the palm and plantar aspects is known as ridges. Fingerprint is an individuality principle with permanent features that cannot be replicated in an individual's entire life span. It is the most special, significant, and accurate characteristic in the human body [1, 2]. The probability of two people having an identical pattern of fingerprints is one in 64,000 million. The ridge pattern of fingerprints developed during the fetal period do not change throughout their life until skin decomposes. The pattern of fingerprints differ widely with blood groups variation [3, 4]. A fingerprint is a representation of the friction ridge on all parts. Epidermis cornfield layer and dermal papillae are mainly associated with ridge patterns. During 3<sup>rd</sup> and 4<sup>th</sup> month of fetal life, primitive forms of epidermal ridges pattern could be characterized. Fingerprints could be classified as loops, arches, whorl, and composite. The palm fingers epidermal ridges can be fully developed during birth and remain unchanged for life except burns or trauma [5, 6]. Fingerprints, footprints, iris scanning, lip prints, and DNA profiling are all means of identifying person identity. The method of examining the impressions of the established friction skin ridges is known as fingerprint identification, also known as dactyloscopy. The palmar surface and digits can be examined to see if the impressions are from the same finger [7].

The presence or absence of inherited antigens in the red blood cells of human beings is classified as a blood group. Rh method and ABO are two significant blood groups. Based on plasma antigen existence, ABO blood grouping is further categorized into A, B, AB, and O variations [8, 9]. Gene association with other characters complicates the genetics of blood groups. The higher prevalence of duodenum ulcer in "O" blood group population and stomach cancer in "A" blood group people are the clinical importance of varieties in blood grouping. In comparison to the general population, the prevalence of "O" and "A" groups are significantly higher [10]. Various Dermatoglyphics

studies reported a significantly strong association between blood groups and pattern of fingerprints [10-12]. Because of fingerprints implications as an effective means of identification, this study attempted to evaluate finger -print patterns and their relationship with an individual blood group.

### METHODOLOGY

This prospective study was conducted on 178 medical students (MBBS and BDS) in the Department of Forensic Medicine, District Headquarters Hospital and Benazir Bhutto Hospital, Rawalpindi for the period from November 2021 to April 2022. Prior to study conduction, ethical approval was taken from the institute research and ethical committee. Written informed consent was obtained from each individual. Participants with known blood groups having age range from 17 to 23 years were enrolled. Ink method was used for taking fingerprints. Patterns of fingerprints were categorized as loops, whirl, arches, and composite. For fingerprints collection, inking roller was utilized and a 12 × 8 inches slab of plastic plate with black printer's ink thin layer uniformly smeared were used. On the glass slab, finger bulbs were rolled and impressions of individual fingers were taken in the specified or allotted space. Specialized proforma and separate plan prints for every single finger was used to avoid finger's misidentification.

Basic information such as name, gender, and age were recorded. All of the candidates' blood groups were also recorded. Subjects with scars on their fingers or deformities were barred from participating in the study. The prints were examined with a magnifying lens after they were taken. Primary fingerprint patterns (loops, whorls, arches, and composite) were observed, variables were tabulated, and descriptive analysis was performed. SPSS version 20 was used for data analysis.

### RESULTS

Of the total 178 medical students, there were 48 (27%) male and 130 (73%) females. The overall mean age was 21.6 ± 1.4 years with an age range from 17 to 23 years. Out of total medical

students, the incidence of blood group A, B, AB, and O was 53 (29.8%), 31 (17.4%), 19 (10.7%), and 75 (42.1%) respectively. Loop pattern was the most prevalent fingerprints pattern observed in 95 (53.4%) cases. Majority of loop patterns were seen in blood group O participants. Other fingerprints patterns such as whorls, arches, and composite were found in 49 (27.5%), 24 (13.5%), and 10 (5.6%) respectively. Gender's distribution is shown in Figure-1. Distribution of cases based on blood groups are represented in Table-I. The prevalence of different blood groups in medical students are illustrated in Figure-2. The pattern of fingerprint in terms of loops, arches, whorls, and composite are depicted in Figure-3. The prevalence of Rh-positive was 90.4% (n=161) among the studied cases as shown in Table-II.

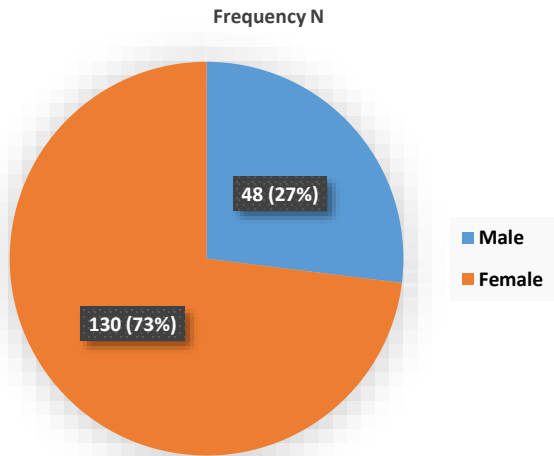


Figure-1: gender's distribution (n=178)

Table-1: Distribution of cases based on blood groups

Gender	BG "A" N (%)	BG "B" N (%)	BG "AB" N (%)	BG "O" N (%)	Total N (%)
Male	42 (24)	18 (10.1)	12 (6.7)	58 (32.6)	130 (73)
Female	11 (6.2)	13 (7.3)	7 (3.9)	17 (9.6)	48 (27%)
Total	53 (29.8)	31 (17.8)	19 (10.7)	75 (42.1)	178 (100)

\*BG blood group

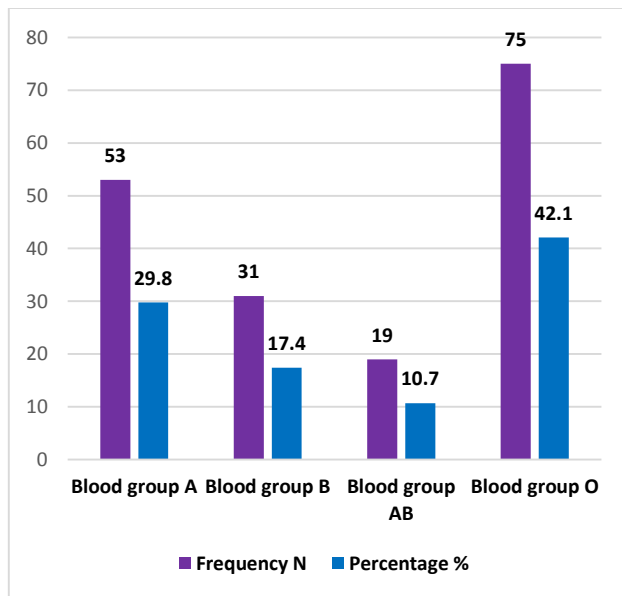


Figure-2: prevalence of different blood groups (n=178)

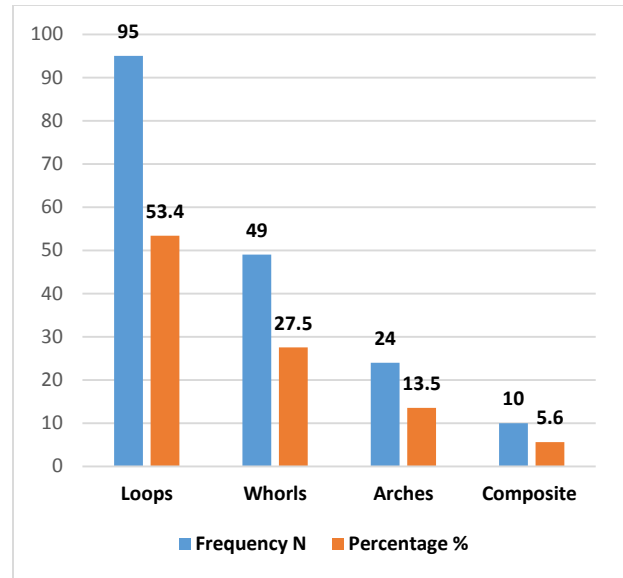


Figure-3: Pattern of fingerprints (n=178)

Table-2: Cases distribution based on Rh blood groups (n=178)

Blood groups	Rh + N (%)	Rh - N (%)	Total N (%)
A	53 (29.8)	0	53 (29.8)
B	26 (14.6)	5 (2.8)	31 (17.4)
AB	16 (9)	3 (1.7)	19 (10.7)
O	66 (37.1)	9 (5.1)	75 (42.1)
Total	161 (90.4)	17 (9.6)	178 (100)

### DISCUSSION

The present study focused on the association of different blood groups with patterns of fingerprints and found that blood group "O" was the most prevalent group among the study population. Loop was the most common pattern of fingerprint followed by whorls, arches, and composite. About 90.4% participants had a positive Rh blood group. Most Rh+ group students had "O" blood group on the basis of antigen in their plasma. Various studies reported similar findings regarding the pattern of fingerprints, the sequence of patterns was as follows; loops, whorls, arches, and composite [13-15]. Morris et al. [16] propose a study to investigate the relationship between patterns of fingerprint and "ABO" blood groups in men and women. Despite knowing the rarely vague and unchangeable conditions from birth to death, the present investigation is an attempt to associate the finger patterns and variety of blood groups.

The following conclusions are drawn from the current study: (a) Loops are frequently discovered pattern of fingerprint whereas the least common are arches in both men and women, as well as in "ABO" blood groups. (b) Loops was the predominant fingerprints among Rh+ blood group and whorls were prevalent among Rh- blood group. (c) The prevalence of loops and whorls are higher in little and center, and ring fingers. (d) The fingerprint essential pattern identified with ABO, or Rh blood gathering isn't clear but rather with singular digits of two hands.

Ravindran et al. [17] associated the fingerprint and blood groups. Fingerprint patterns can aid in predicting a person's sexual orientation and blood collection. It may aid in increasing the fingerprints legitimacy in identifying people and addressing wrongdoings. Loops were the predominant pattern of fingerprints whereas the least prominent was composite.

Another study by Shivhare et al [18] found that blood group Rh+ had higher prevalence than Rh- blood group. Besides O, A, and AB blood group, blood group B was most prominent group in all types in Rh+ students and same group B was the least common in Rh- blood group. Loops were more prominent in men, while whorls and arches were more prominent in women. Loops were

prevalent in all blood groups except A positive, where whorls predominated.

Sing et al. [19] reported that O blood group and loops are significantly attached to each other. Similarly, group B and arches and group AB and whorls are attached to each other. So, while the prediction of blood gathering may be possible with the investigation of unique finger impression patterns, which may be of extraordinary benefit in criminological medication, impact provincial varieties, sex, and hereditary variables should not be overlooked.

Siva et al. [20] discovered a link between blood collection, the spread of fingerprint patterns, and voluptuous coordination in her investigation. The loop was the most frequently seen followed by the composite and whorl curve. Similar findings were found in Smail et al. [21], Bhardawaj et al. [22], Elshafie et al. [23], and Sahito et al [24].

The current study found a link between fingerprint pattern distribution and blood group. People with ABO and Rh blood types have larger loops, medium whorls, and small arches. The general distribution pattern of the primary finger print was of the same order. Gupta et al [25] and Smail et al [26] discovered similar results.

## CONCLUSION

The present study concluded that blood group "O" was the most prevalent group followed by A, B, and AB. Loop was the most common pattern of fingerprints among blood groups especially in blood group O. The prevalence of Rh-positive was found higher among the study cases.

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