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Dermatoglyphics and Their Association with Gender and Blood Group in Medical Students at Islam Medical and Dental College

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ABSTRACT

Dermatoglyphics is defined as the study of the patterns present on fingers, toes, palms and soles which develop by the 24th week of gestation and remain permanent throughout life. A significant association has been confirmed between the different ABO blood groups, gender and dermatoglyphic patterns. **Objectives:** To investigate the fingerprint patterns among male and female students at Islam Medical and Dental College, Sialkot, and their relationship with blood groups. **Methods:** This cross-sectional study was conducted at Islam Medical and Dental College, Sialkot, in the year 2023 from mid-November to mid-December. 300 healthy students, aged 20 to 22 years, including 108 male and 192 female, participated. Fingerprints were collected using an ink pad, while blood grouping was performed using the slide method. Using SPSS version 26.0, the data were analyzed. The chi-square test ($p<0.05$) was used to evaluate relationships, and continuous variables were given as mean ± SD and categorical variables as frequencies. **Results:** The most prevalent blood type among all students was O+, and the most common fingerprint pattern was the loop pattern. Blood group and fingerprint pattern were shown to be significantly correlated in female medical students; those with loop patterns indicated a higher frequency of the B+ blood group, while those with whorl patterns indicated a higher frequency of the O+ blood type. **Conclusions:** It was concluded that a significant association of blood groups with dermatoglyphic patterns in female medical students was seen whereas in male, there was no link between blood groups and fingerprint patterns.

INTRODUCTION

Every individual possesses distinctive characteristics, which differentiate him from other individuals. These specific features can be categorized as structural, physiological, pathological and psychological which are important for an individual as personal, social or legal purposes in forensic anatomy [1]. Dermatoglyphics, the study of epidermal ridge patterns on fingers, toes, and palms begins in the 10th week of gestation and is fully developed by the 24th week [2]. These patterns are determined by dermal papillae during fetal development and remain permanent and consistent throughout life [3]. Both environmental factors and genetic factors influence the dermatoglyphic patterns which make them relevant in identifying variations in the genotype and phenotype among populations [4]. Numerous studies have explored the relationship between gender, blood group and dermatoglyphic patterns as loop patterns are frequently observed in individuals with blood group B, while whorl patterns are prevalent in those with blood group O, indicating potential genetic links between ABO blood groups and fingerprint types. This association suggests a strong potential genetic correlation between the ABO blood group system and dermatoglyphic patterns in distinct genders [5, 6]. Gender differences in fingerprint patterns are also notable with male often exhibiting more loops and whorls, and females displaying more arches [7].

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Research has been done on the association between medical students' blood groups and dermatoglyphic patterns, but not much on the relationship between gender and blood groups in Punjab's tertiary medical institutions (Pakistan).

This study aims to examine fingerprint patterns and how they differed across genders to evaluate how the students at Islam Medical and Dental College in Sialkot related to their blood types. Because this study is multilayered and covers both the genetic foundation of dermatoglyphics and the significance of gender variations in fingerprint patterns related to blood groups, the results may be useful as a prediction tool for health consequences.

METHODS

The cross-sectional study was conducted at Islam Medical and Dental College, Sialkot in the Anatomy Department, Sialkot. After the approval of the synopsis by the Ethical Review Board, Islam Medical College, Sialkot, the study was done from mid-November 2023 to mid-December 2023 (reference letter no 900/IMC/ERC/000103). An open epi sample size calculator was used to calculate the sample size [8]. At a 95% confidence level, the population proportion of students was 50%, the error margin was 5%, and the total population was 1000.10, with a computed sample size of 278. Three hundred healthy students, ages twenty to twenty-two, participated in the study. Of them, 192 (64%) were female and 108 (36%) were male first, second-year MBBS and first-year BDS medical students. The study population consisted of all the willing and healthy students who showed up on the day of blood grouping and fingerprinting. Students with blood-related illnesses, hand injuries, bandages on their hands, and hand deformities were not allowed to participate in the study. A straightforward, practical sampling method was applied. Before taking the prints, informed written consent was obtained. The fingerprinting process was carried out under strict scrutiny. The participants' hands were cleaned with soap and water and allowed to air dry. After that, each participant's right thumb was placed on an ink pad. Along with their age and gender, the prints were taken from the questionnaire page. Code numbers were assigned to each student. After that, the fingerprints were examined under a magnifying glass to determine if they were loop, whorl, or arch, and the results were noted on a data sheet. For blood grouping, a clean glass slide was taken, and three circles were drawn on it. Anti-A was added to the first circle followed by Anti-B to the second circle and Anti-D in the third circle with a dropper. The ring finger was then carefully rubbed and cleaned with an alcohol swab in the vicinity of the fingertip, where a blood sample was to be taken. Using the lancet, pricked the ring fingertip and removed the first drop of blood. Once the blood began to flow, it was allowed to land on the three glass slide circles by gently pressing with the fingertip. A toothpick was then used to mix the blood sample gently, and the results were recorded on the questionnaire after a minute of waiting. The SPSS version 26.0 software was used to do statistical analysis. The mean ± SD is used to represent continuous data, whereas frequency and percentages were used to represent categorical ones. To verify the relationship, the chi-square test was employed. p-values less than 0.05 were regarded as statistically significant.

RESULTS

Three hundred healthy students, aged 21 ± 0.85, took part in the research of which 108 (36%) were male and 192 (64%) were female. The most observed blood group was O+ (31%) followed by B+ (28.3%) and A+ blood group (22.3%) whereas the blood types with the lowest observation rates were AB− (1%) and B− (3.7%). The fingerprint pattern with the highest frequency of observation was the loop (50.6%) and whorl (40.7%) whereas the least was the arch (8.7%) (Table 1).

Table 1: Percentage and Frequency of Gender, Blood Group and Fingerprint Patterns (n=300)

Frequency of Gender	Frequency of Blood Groups									Frequency of Fingerprint Patterns		
Male	Female	A+	A-	B+	B-	AB+	AB−	O+	O−	Loop	Whorl	Arch
108 (36%)	192 (64%)	67 (22.3%)	11 (3.7%)	85 (28.3%)	11 (3.7%)	19 (6.3%)	3 (1%)	94 (31.3%)	10 (3.3%)	152 (50.6%)	122 (40.7%)	26 (8.7%)

In female, the commonest blood group was O+ (n=58) and B+ (n=57) and the least observed was AB− (n=2) and A− (n=5) (Figure 1).

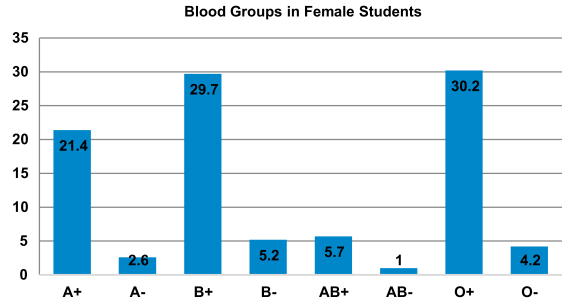

Figure 1: Percentage of Blood Groups in Female Students (n=192)

Whereas the loop pattern was the most frequent (n=99), and the arch pattern was the least frequent (n=11) in females, (Figure 2).

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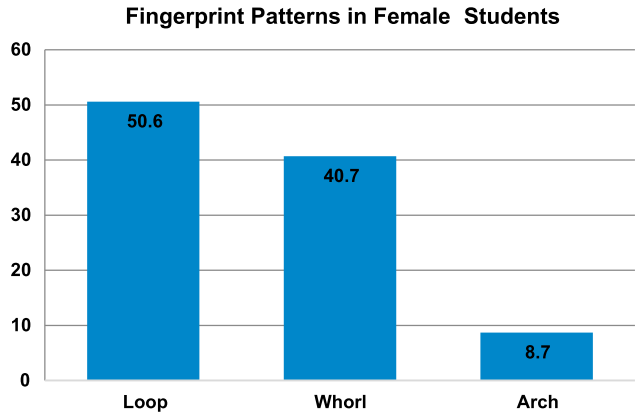

Figure 2: Percentage of Fingerprint Patterns in Female Students (n=192)

Comparing the blood groups with the fingerprint patterns, we found that female students with loop had higher frequency of B+ blood group (38.4%) and those having whorl patterns had increased frequency of O+ blood group (41.5%). This demonstrated a strong significance between female medical students' blood types and fingerprint patterns (p=0.033) (Table 2).

Table 2: Association of Fingerprint Patterns and Blood Groups with Corresponding Percentages in Female Students

Fingerprint Pattern	Blood Group Percentage within Fingerprint Patterns								p-value (Chi-Square)
	A+	A-	B+	B-	AB+	AB-	O+	O-	
Loop	23.2%	4.0%	38.4%	2.0%	4.0%	1.0%	22.2%	5.1%	0.033
Whorl	19.5%	1.2%	17.1%	7.3%	8.5%	1.2%	41.5%	3.7%	
Arch	18.2%	0.0%	45.5%	18.2%	0.0%	0.0%	18.2%	0.0%	

In male, O+ (n=36) and B+ (n=28) were the most frequent blood group, subsequently the least observed was B− and AB−(n=1)(Figure 3).

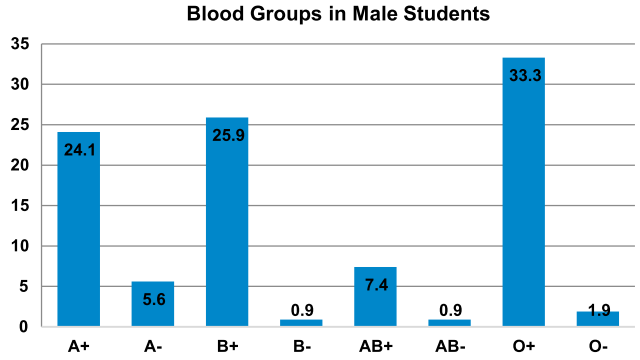

Figure 3: Percentage of Blood Groups in Male Students (n=108)

Whereas the loop pattern was most frequent (n=53), and the arch pattern was the least frequent in male gender (n=15)(Figure 4).

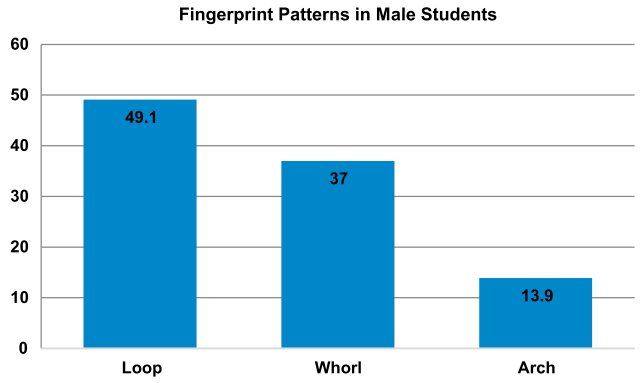

Figure 4: Percentage of Fingerprint Patterns in Male Students (n=102)

Comparing the blood groups with the fingerprint patterns, we found that male students with loop had almost equal frequency of A+ (24.5%) and O+ (28.3%) blood group and those having whorl patterns had equal amounts of B+ and O+ blood group (35%). These results also reflected an association between the blood group and fingerprint patterns in male medical students as it was not significant (p=0.250).

DISCUSSION

Our main objective was to prove a relationship between fingerprint patterns and blood groups with the gender of medical students at Islam Medical College, Sialkot in this study. The percentage of blood group O+ and loop pattern was most prevalent among the medical students. In both genders, the common blood group and fingerprint pattern were O+ and B+ and loop. B+ was the most prevalent blood group in females with loop patterns, while O+ was more common in those with whorls. In male students, findings were mixed as loop patterns had both A+ and O+ blood groups and those having whorl patterns had equal amounts of B+ and O+ blood groups. In female medical students, the relationship between blood type and fingerprint was statistically significant whereas in male medical students, the blood group frequencies were almost equally distributed among different fingerprint patterns and showed no association. The most common blood group in our analysis was O+, which is consistent with another study that found that O is the most common blood group in Pakistan. [9]. Loop pattern was the most common fingerprint pattern among the students which is in line with multiple previous studies conducted in Pakistan have consistently found that loop patterns are the most common fingerprint type among medical students in KPK and Punjab. As Iqbal *et al.*, reported loops as the predominant pattern in Peshawar [10], while Khan *et al.*, found 58% of students in Abbottabad had loop patterns [11]. Similarly, Abbasi *et al.*, observed in medical students of Lahore that a 50% loop pattern was common [12]. Female students having loop pattern fingerprints had the majority

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of the B+ blood group which is supported by one significant study by Manikandan *et al.*, which indicated that the B+ blood group was more likely to have the loop pattern. [13]. However, in another research, it was assessed that in female loops were the most common fingerprint, but it did not specifically link this prevalence to the B+ blood group as loops are the major pattern among the populations [14]. Similarly, in another study loop patterns had a higher prevalence of blood group O+ [15]. These conflicting results indicate that although loop patterns are prevalent, the distribution of various blood groups is balanced across different populations which implies that the association between B+ and loop patterns may not be as strong as suggested [16]. The female having whorl pattern had the majority of the O+ blood group which is backed by a study conducted by Aamir *et al.*, which indicated that blood group O was prevalent among individuals with whorl patterns [17], but a different study on the Omani population discovered that the A–, B+, and O– blood groups had the highest frequency of the arch pattern. This suggests that there can be substantial population-to-population variations in the correlation between blood types and fingerprint patterns [18]. The patterns of fingerprints and blood types were significantly correlated in female medical students which is in line with a previous study done by Koura *et al.*, in which they examined the correlation between ABO/Rh blood groups and fingerprint patterns in an Egyptian population. The results showed that there was a statistically significant correlation between blood groups and certain fingerprint patterns, especially in females. This links the genetic factors influencing blood group determination with the factors responsible for the development of fingerprint patterns. [16]. A research study by Alam *et al.*, in Karachi, Pakistan, assessed the linkage between fingerprints, lip prints, and blood groups. They found that certain fingerprint patterns were significantly associated with specific blood groups among females, indicating that blood groups may influence the distribution of fingerprint patterns in this demographic [19]. Furthermore, findings from the Pratinidhi *et al.*, study lend credence to this idea by showing that Rh-positive people especially women had a significantly higher frequency of loops and whorls. This discovery suggests that fingerprint creation may be influenced by the same genetic factors that underlie blood group inheritance [20]. More research work needs to be done with a large demographic sample size across multiple institutions to find out the association between gender, blood group and dermatoglyphics.

CONCLUSIONS

It was concluded that the most prevalent fingerprint pattern was the loop pattern, while the most common blood group throughout the sample size was O+. Blood group and fingerprint pattern were shown to be significantly correlated in female medical students; those with loop patterns indicated a higher frequency of the B+ blood group, while those with whorl patterns indicated a higher frequency of the O+ blood type. In comparison to female, no significant association was found between blood group and fingerprint patterns in male medical students. These findings suggest that while some associations may exist between blood group and fingerprint patterns in female, further investigation is needed to clarify these relationships, particularly in male students where no significant associations were observed. Since this study was conducted in a single medical institution, the results may not be generalizable.

Authors Contribution

Conceptualization: RMZ, RA
Methodology: RA, MJ, AR
Formal analysis: AA
Writing review and editing: AA, MZ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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