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Original Research Article

Retrospective Study of Correlation Between Finger Print Pattern and Blood Grouping in First Year MBBS Students of NAMO Medical Education and Research Institute, Silvassa

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Abstract:

Introduction: The pursuit of accurate individual identification methods has driven research in fields like forensic science, genetics, and medical diagnostics. Fingerprints, known for their unique and stable nature, have captivated attention alongside blood grouping in medical practices. Fingerprint patterns—loops, whorls, arches—offer distinct identities, while blood groups, ABO and Rh, impact transfusions and compatibility. This study explores potential correlations between these traits, aiming to deepen genetic understanding and applications in forensics and medicine, focusing on first-year MBBS students at NAMO Medical Education and Research Institute, Silvassa.

Material and Methods: In this retrospective study, we explored the intriguing correlations among fingerprint patterns, blood grouping, and gender distribution in a cohort of 200 first-year MBBS students at NAMO Medical Education and Research Institute, Silvassa. Data on fingerprint patterns and blood groups were collected during the admission process, and statistical analysis was performed to explore potential correlations.

Results: Our findings revealed a distinct prevalence of loop patterns (42.5%) as the most common fingerprint pattern among participants, with arch patterns (34.5%) and whorl patterns (23.0%) following suit. Notably, blood group A+ exhibited a preference for whorl patterns (42.55%), while loop patterns were prominent in blood group B+ (49.06%). Gender distribution closely mirrored blood group representation, underscoring potential genetic influences. These intriguing associations between fingerprint patterns, blood groups, and gender emphasize the complexity of genetic interactions and warrant further exploration.

Conclusion: Our study unveils significant correlations between fingerprint patterns, blood groups, and gender distribution among first-year MBBS students. Loop patterns predominate, with distinct preferences observed in blood groups. These findings provide novel insights into genetic interactions with implications for forensics and medical diagnostics.

Keywords: Fingerprint patterns, Blood grouping, Loop patterns.

Introduction

The quest for accurate and reliable methods of individual identification has been a longstanding challenge in various fields, including forensic science, genetics, and medical diagnostics.[1] Among the diverse biometric markers available, fingerprints have gained considerable attention due to their uniqueness and stability throughout an individual's lifetime.[2] Concurrently, blood grouping, particularly within the ABO and Rh systems, has held significant importance in medical practices such as blood transfusions, organ transplantation, and disease diagnosis.[3]

Fingerprints, characterized by intricate patterns formed by ridges and furrows on the fingertips, have been extensively studied for their potential as distinctive identifiers.[4,5] These patterns, established during fetal development, remain unchanged from birth to death and are influenced by genetic and environmental factors. The patterns fall into three primary categories: loops, whorls, and arches, each contributing to an individual's unique fingerprint identity.[6] The rarity of identical fingerprints and the inability to inherit these patterns have solidified their role in forensic investigations, biometric authentication, and medico-legal procedures.[7]

In parallel, blood grouping has been a cornerstone of medical practice. The ABO blood group system, comprising antigens A, B, and H, along with the Rh(D) antigen, has significant implications for blood transfusions and organ compatibility. These blood group antigens extend beyond red blood cells, being expressed on other human tissues and cells, potentially linking them to broader physiological traits.[8]

The exploration of potential correlations between fingerprint patterns and blood grouping has emerged as an intriguing avenue of research. Various studies across different populations have suggested connections between these two seemingly distinct traits.[9,10] Investigations have been conducted to ascertain whether specific fingerprint patterns are more prevalent among individuals of certain blood groups. Such correlations, if established, could contribute to a deeper understanding of genetic influences on both traits and may find practical applications in forensic identification and medical procedures.While existing studies have examined this relationship in various populations, the present research aims to bridge a critical gap by investigating the correlation between fingerprint patterns and blood grouping specifically within the population of first-year MBBS students at NAMO Medical Education and Research Institute, Silvassa. By retrospectively analyzing available data, this study seeks to identify potential links between these traits and contribute to the broader understanding of human genetics, forensics, and medical diagnostics.

Material and Methods

This retrospective study aimed to explore the potential correlation between fingerprint patterns and blood grouping among first-year MBBS students at NAMO Medical Education and Research Institute, Silvassa, spanning the academic year from May 2021 to April 2022.The study population encompassed first-year MBBS students who were enrolled at NAMO Medical Education and Research Institute during the academic year 2021-2022. In total, 200 students were included in the analysis.

Inclusion criteria encompassed first-year MBBS students at NAMO Medical Education and Research Institute and the availability of complete fingerprint pattern and blood grouping data for each student. Exclusion criteria involved students with incomplete or missing fingerprint pattern and blood grouping data, as well as those with any medical condition that might affect fingerprint patterns or blood grouping.

Data collection procedures involved the routine acquisition of fingerprint patterns and blood grouping data during the admission process for first-year MBBS students at NAMO Medical Education and Research Institute. In line with our retrospective study's meticulous approach, a blue ink stamp pad was employed for the collection of participants' fingerprints. To uphold anonymity, a distinct code was assigned to each participant, ensuring the confidentiality of their identity throughout the study. Before recording fingerprints, stringent hand hygiene measures were adhered to, including thorough hand washing followed by drying. Fingerprint patterns were categorized into three primary groups: loops, whorls, and arches, employing established classification methods [11]. Blood grouping analysis was conducted using standard slide agglutination techniques, employing antiserum A, B, and D for ABO and Rh blood group determination.

Statistical analysis was conducted using Microsoft Excel 2021 and IBM SPSS 25.1. The distribution of fingerprint patterns on both hands of the individuals was assessed, along with its relationship to sex, different blood groups, and Rh blood types, through frequency distribution and the Chi-square test. A significance level of $p < 0.05$ was utilized to ascertain the association between variables.

Ethical considerations were given due importance, with the study securing approval from the Institutional Ethics Committee of NAMO Medical Education and Research Institute prior to initiation (Approval No: DMHS/IEC/2016/214/2288). All participants' data were treated confidentially, adhering to ethical guidelines to safeguard participants' rights and privacy.

Results

In present study, the most prevalent age among the students is 18, making up 41.0%, followed by 19 at 38.0%. Additionally, ages 17 and 20 constitute 7.0% and 14.0%, respectively, of the total observed values.

Table 1: Distribution of age in years (n = 200)

Age in years	Frequency	Percentage (%)
17	14	7.0%
18	82	41.0%
19	76	38.0%
20	28	14.0%

In present study consisting of 200 first-year MBBS students, the Loop patterns emerge as the most prevalent at 42.5%, followed closely by arch patterns at 34.5%. Whorl patterns constitute 23.0% of the distribution. (Fig 1) In males, loop patterns dominate (48.24%), followed by arch (34.58%) and whorl (17.18%) patterns. Similarly, among females, loop patterns also lead (47.31%), followed by arch (34.41%) and whorl (18.28%) patterns. (Fig 2) Overall, this distribution emphasizes similar pattern prevalence in both genders, with loops being the most common.

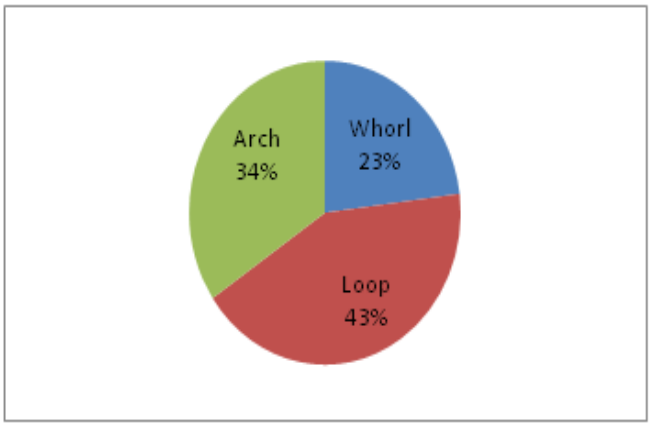

Figure 1: Fingertip pattern in the digit

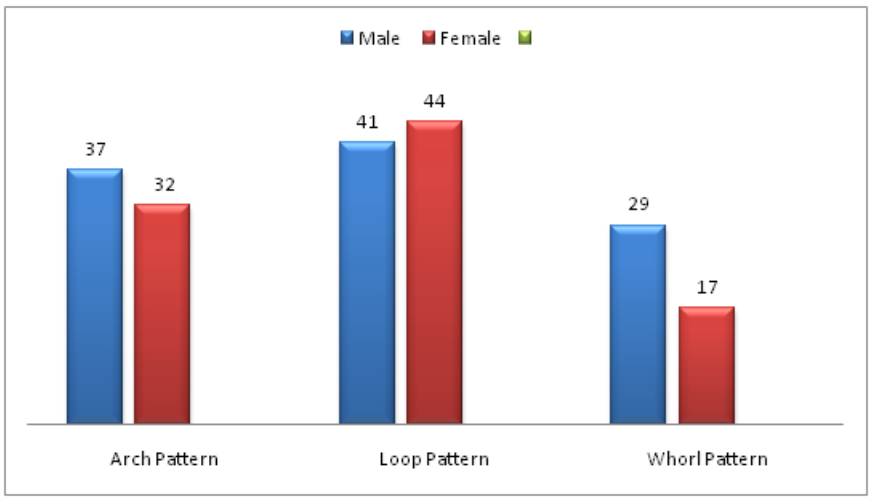

Figure 2: Fingerprint Diversity: Gender Patterns

The study results(Table 2)shows a clear picture of how different fingerprint patterns on hands are linked to blood groups in a group of 200 people. Each blood group seems to have a unique fingerprint pattern preference. For instance, people with blood type A+ have more whorl patterns (the swirl-like pattern) on their fingertips, while A- individuals have an even mix of arch and loop patterns. Blood type B+ folks show a strong liking for loop patterns, and those with AB+ blood have a balance of both arch and loop patterns. It's interesting that blood type O+ individuals lean more towards loop patterns on their fingertips, while those with O- blood predominantly have arch patterns. The study results indicate a strong link between fingerprint patterns and blood groups. The low value of 0.037* suggests this connection is meaningful, not random chance. Blood group A+ exhibits a higher prevalence of whorl patterns (42.55%) compared to arch (29.79%) and loop (27.66%) patterns, followed by blood group B+ with prominent loop patterns (49.06%).

Table 2: Distribution of fingertip pattern of hand according to blood group (n = 200)

Blood Group	Arch Pattern (n, %)	Loop Pattern (n, %)	Whorl Pattern (n, %)	Total	Chi square & p value
A+	14 (29.79%)	13 (27.66%)	20 (42.55%)	47	19.15 0.037*
A−	1 (50.00%)	1 (50.00%)	0 (0.00%)	2	
B+	21 (39.62%)	26 (49.06%)	6 (11.32%)	53	
B−	2 (50.00%)	1 (25.00%)	1 (25.00%)	4	
AB+	7 (46.67%)	8 (53.33%)	0 (0.00%)	15	
O+	21 (27.63%)	36 (47.37%)	19 (25.00%)	76	
O−	3 (100.00%)	0 (0.00%)	0 (0.00%)	3	
Total	69 (34.50%)	85 (42.50%)	46 (23.00%)	200	

*Significant at 5%

In our study, it was found that among 200 subjects blood group A+ is almost evenly split between genders (23.50%), while A− is rare (1.00%). Blood group B+ slightly favors males (26.50%), whereas B− leans toward males (2.00%). AB+ is well-balanced (7.50%), O+ is nearly equal (38.00%), and O− follows suit (1.50%). Overall, blood group representation aligns closely with gender distribution (53.50% males, 46.50% females).

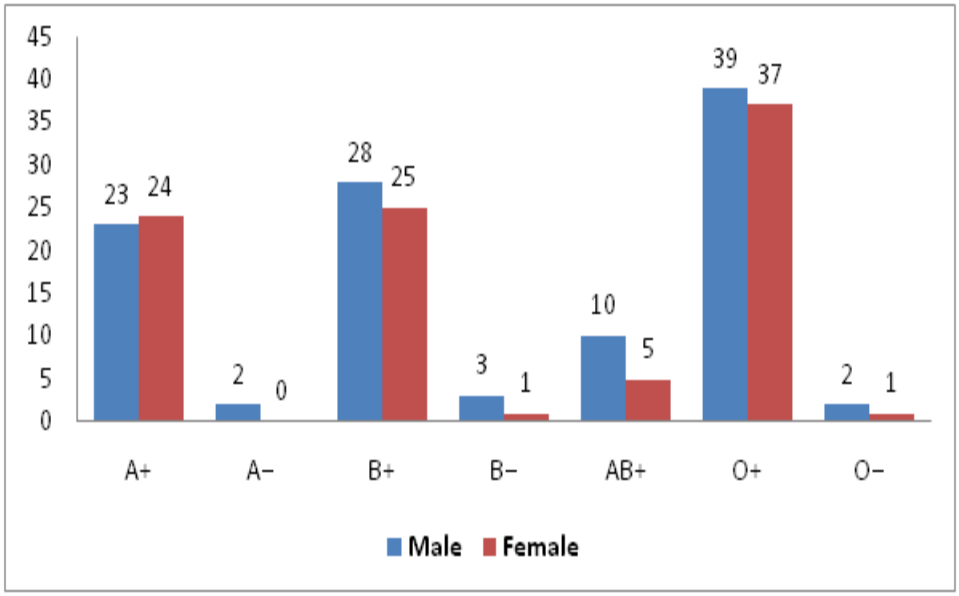

Figure 3: Association of Fingerprint Pattern to blood Group

Discussion

In our present study, the most prevalent age is 18, constituting 41.0%, closely followed by 19 at 38.0%. Comparatively, the study by Manikandan et al. demonstrates a similar trend, with the highest percentage observed at 18 years (49%), followed by 19 years (29%), 17 years (16%), and 20 years (7%). It's noteworthy that our findings align closely with their results, corroborating the dominance of ages 18 and 19 in this age group.

In our study of 200 first-year MBBS students, Loop patterns dominated (42.5%), followed closely by arch patterns (34.5%), while whorl patterns constituted 23.0% (Fig 1). Among males, loop patterns were prominent (48.24%), followed by arch (34.58%) and whorl (17.18%) patterns. Likewise, in females, loop patterns prevailed (47.31%), followed by arch (34.41%) and whorl (18.28%) patterns. These findings indicate a consistent pattern distribution between genders, predominantly favoring loops. Corroborating our results, Manikandan et al.[12] reported loop patterns as most prevalent (40%), followed by arches (39%) and whorls (32%). Additionally, Vankara et al.[13] found loops to be the prevailing pattern, with no significant correlation between fingerprint patterns and sex, aligning with Verma et al.[14] and Narayana et al.[15] studies.

Furthermore, Vankara et al.[13] noted higher loop incidence in males (76.6%) compared to females (70.7%), while whorls and arches were more frequent in females (26.2% and 3.0%) than in males (21.5% and 1.9%).Our findings underscore the consistency of loop pattern prevalence. Similar distribution trends and gender-based variations in patterns across multiple studies emphasize the enduring nature of these observations and contribute to a broader understanding of fingerprint patterns within diverse

populations, in line with earlier research by Rastogi et al.[16],Sudikshya et al.[17], Verma et al.[14], and Narayana et al.[15]studies.

In our study, the relationship between fingerprint patterns and blood groups becomes evident, revealing unique preferences for each blood group. For instance, A+ individuals display a higher occurrence of whorl patterns (42.55%), while A- individuals exhibit a mix of arch and loop patterns. Blood group B+ individuals lean toward loop patterns (49.06%), and those with AB+ have a balanced representation of both arch and loop patterns. Notably, blood type O+ leans toward loop patterns, while O- individuals predominantly possess arch patterns. Our results signify a strong association between fingerprint patterns and blood groups, with a significance value of 0.037*.

Comparing to other studies, Rastogi et al.[16] noted that blood group B was the most common (37.7%), followed by O (29.8%), A (23.0%), and AB (9.5%). They observed statistically significant differences in finger pattern distribution across ABO blood groups (p=0.0003), though non-significant across Rh blood groups (p=0.08).In a parallel vein, Manikandan et al.[12] found that the highest incidence of whorl patterns was in A+ (44%), arch in A- (100%), B+ (48%), and AB+ (58%) for loop patterns. Similarly, Habsi et al.[18] noted that the arch pattern had the lowest percentages in all blood groups, except A- and B-. Fayrouz et al.[19] reported loop predominance in Rh-positive A and O groups, with whorls being highest in the Rh-negative counterparts.Furthermore, Nanakorn et al.[20], Ahmad and Karmakar[21], and Sandhu et al.[9] all echoed the correlation between primary fingerprint patterns and ABO–Rh blood groups, reinforcing the significance of this association. Interestingly, a study by Sharma et al.[22] suggested a genetic basis for the association between fingerprints and blood groups, reinforcing the potential connection between biometric markers and genetic variations. The collective evidence underscores the complexity of these relationships and highlights the need for further exploration, especially across larger and diverse populations in varying geographical contexts.

In our study, we found significant links between blood group distribution and gender. Blood group A+ displayed almost equal representation across genders (23.50%), while A− was rare (1.00%). B+ slightly favored males (26.50%), B− leaned towards males (2.00%), and AB+ had balanced distribution (7.50%). O+ and O− showed nearly equal proportions (38.00% and 1.50%). Similarly, Vankara et al.[13] found that blood group O displayed a higher incidence of loops in males (77.1%) compared to females. Additionally, females in blood groups A and B exhibited a higher incidence of whorls (26.3%), while the AB blood group displayed the least incidence (26.1%) compared to males. The frequency of arches was highest in females of blood group A (3.15%), and least common in blood group B (2.8%) compared to males. Rastogi et al.[16] also noted a parallel trend, with blood groups A and B dominating among males, while blood group O was more prevalent among females. Males exhibited a higher frequency of whorls, while females showed a higher rate of loops.

The overall distribution of primary fingerprint patterns followed a similar order in individuals with ABO and Rh blood groups, emphasizing the prevalence of loops, moderate occurrence of whorls, and lower frequency of arches. Collectively, these studies suggest a strong interplay between blood group distribution, gender, and fingerprint patterns. While the precise mechanisms behind these associations warrant further investigation, these consistent patterns point to potential genetic and biological influences that warrant deeper exploration.

Conclusion

In conclusion, we found significant correlations between fingerprint patterns, blood grouping, and gender distribution among first-year MBBS students. The most prevalent fingerprint pattern observed across all participants was the loop pattern with whorl patterns being prominent in A+ and loop patterns favored by B+ individuals. Moreover, distinct gender-based preferences emerged, as loop patterns were prevalent among both males and females.These observations underscore the complexity of genetic and biometric interactions and warrant further investigation to unveil their underlying genetic and physiological mechanisms.

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