Original Article

Pattern of Fingerprints and Its Association with Gender among Medical Students of Peshawar Medical College

Farzand Iqbal[1,3*], Naveed Alam[2], Rubina Salma Yasmin[3], M.Asghar Khattak[1], Noreen Farid[4] and Ijaz Aziz[5]

[1]Department of Forensic Medicine, Kabir Medical College, Peshawar, Pakistan
[2]Department of Forensic Medicine, Northwest School of Medicine, Peshawar, Pakistan
[3]Department of Forensic Medicine, Peshawar Medical College, Peshawar, Pakistan
[4]Department of Forensic Medicine and Toxicology, Foundation University Medical College, Islamabad, Pakistan
[5]Department of Forensic Medicine, Mekran Medical College, Turbat, Pakistan

ARTICLE INFO

ABSTRACT

Dermatoglyphics is the scientific discipline that studies the patterns and characteristics of fingerprints. When it comes to criminal justice and medical law, fingerprints are crucial. The analysis and comparison of unknown prints found at a crime scene with known prints of witnesses, victims, and possible perpetrators can greatly aid investigators and analysts in their pursuit of justice. **Objectives:** To identify fingerprint patterns and determine its association with gender among medical students of Peshawar. **Methods:** This cross-sectional descriptive study was conducted on students of Peshawar Medical College, Peshawar from 1st December 2021 to 1st June 2022. After a multi-stage proportional sampling process, a total of 300 students were included in the study, with 120 females and 180 males. After obtaining written agreement and adhering to stringent inclusion and exclusion criteria, students' fingerprints were placed on white paper using a stamp pad. The paper already bore the students' names, ages, sexes, and professional years. Statistical analysis was conducted using SPSS version 25.0, with descriptive and inferential statistics applied as necessary. **Results:** The most common fingerprint pattern was the loop pattern, followed by the whorl pattern at 30.33 percent. The average age of the participants in the study was 21.54 ± 2.33 years, with a male-to-female ratio of 1.5:1. All of the fingerprint patterns showed no significant association with gender. **Conclusions:** The study found that Loop fingerprints were more common than other fingerprints. Also, there is no statistically significant association between gender and fingerprints.

INTRODUCTION

Dactylography is the scientific investigation of fingerprints for identification. The theory holds that the skin on the balls of the fingers and thumbs has unique ridges that remain consistent throughout life. No two hands have the same pattern. Identification refers to the determination of a person's individuality. There are two sorts of individuality: complete and incomplete. Complete refers to an emphasis on distinct characteristics. Partial or partial identification involves determination of only little information about a person [1]. Extensive research has been conducted on the patterns and characteristics of fingerprints, highlighting their potential as indicators of individual traits and attributes. One particular area of interest is the investigation of the relationship between fingerprint patterns and sex, which has garnered significant attention among researchers. Understanding the association between sex and fingerprint patterns holds practical implications in forensic investigations, criminal profiling, and biometric systems [2]. The convenience, low cost, and high efficacy of fingerprints make them an ideal identification tool. A fingerprint is an imprint made by the flat of one or more fingers, and the pattern formed by these impressions is known as a fingerprint pattern [3]. A fingerprint is indicative of many different things.

Iqbal F et al.,

Hereditary, environmental, and other regional factors are among the many that influence fingerprints [4]. The skin on the hands and feet has a distinct texture and look compared to the rest of the body. The skin on the palmar and plantar surfaces is wrinkled and has small ridges called friction ridges. The ridges produced during the fetal stage do not change their course or alignment throughout an individual's life, until obliterated by the decomposition of the skin after death. [5]. Chromosomal syndromes cause changes in the body at t h e genetic level which lead to variations in fingerprint patterns. In Down syndrome (Trisomy21) there is a predominance of ulnar loops along with a large palmar crease, similarly, in Turner syndrome (45X0) whorls pattern is predominant [6]. There are four main categories of fingerprints: loop, whorl, arch, and composite. The ridge pattern determines if a fingerprint has an ulnar or radial loop, and the whorl pattern determines whether it has a circular or spiral pattern. Composite fingerprints can have four different patterns: plain, tented, central pocket loop, and twinned. Plain and tented arches are two subtypes of arch fingerprints. Fingerprints from extensively decomposed bodies can be extracted from the skin's dermis or, if the epidermis is removed, from the skin's epidermis. It is also possible to extract fingerprint prints from modified putrefied bodies (sometimes known as mummified mummies) by soaking the fingertips in a mild alkaline solution. With the use of contemporary technology, fingerprints can be transferred across continents or between nations [7]. Even with identical twins with strikingly comparable genetic makeup, the likelihood of identical fingerprints is quite low. About one in sixty-four million people have fingerprints that are identical to each other [8]. Dermatoglyphics is a useful non-invasive diagnostic tool that is widely utilized in anthropology, genetics, and medicine for early risk assessment of particular diseases [9]. During fetal life, the development of the primary ridges begins around the 12–16-week mark and is finished by the 24th week, or approximately the 6th month of gestation [10]. Since ancient times, people have used fingerprints as a form of identification. However, this study aimed to study pattern of fingerprints among medical students and its association with gender to gain insight into the expected gender based on fingerprint analysis.

The objective of this study was to identify fingerprint patterns and determine its association with gender among medical students of Peshawar

METHODS

From 1st December 2021 to 1st June 2022, a total of 300 students were included in this cross-sectional descriptive study at Peshawar Medical College, Peshawar by obtaining data collection permission letter with Reference No:

PMC/PGMDE/369.

Sample size was calculated by using formula for finite population i.e $n = \dfrac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \frac{z^2 \times p\,(1-p)}{e^2 N}}$

(CI=95%, p=0.5%, e=0.05, N = population size that varies). Five equal clusters were made for the professional years of MBBS and in each cluster simple random sampling technique was applied. For randomization students roll numbers were taken. Research randomizer online was applied to select the sample randomly. Those students, who deny giving consent after being selected by randomizer, skipped and next available student was enrolled. Students of any age and gender from all professional years of Peshawar Medical College, Peshawar were included in our study. While Students with any hand deformity like permanent scars on fingers, any skin disease like leprosy, worn fingerprints and extra fingers were excluded. Fingerprints were taken on white paper using a stamp pad after the students' informed written agreement had been obtained. The paper already bore the students' names, ages, sexes, and professional years. Using a powerful hand lens (TAG3™ magnifying glass 50 Mm double reading glass optical graded lens with 5x and 10x magnifying capacity), primary patterns (loops, whorl, arches and composite) after fingerprints were procured. Each finger in the finger print slip was assigned a number, ex: The 1st number was assigned to the right thumb and 10th to left little finger based on the presence of ridge lines according to classification of Henry, s system (Henry's Ten Digit Classification).To conduct statistical analysis, the statistical package SPSS version 25.0 was utilized. When necessary, descriptive and inferential statistics were applied. For each possible association between gender and fingerprint pattern, we applied a chi-square test to see whether there was a statistically significant relationship (p <0.05).

RESULTS

Our study included 300 students, with an average age of 21.54 ± 2.33 years. The gender ratio in the sample of 300 students was 180 (60%) males and 120 (40%) females. The table 1 shows that most common fingerprint pattern was loop pattern 164 (54.66%), followed by whorl pattern 91 (30.33%) and arch 28 (9.33%). In our study least common fingerprint pattern observed was composite 17 (5.66%).

Table 1: The Pattern Distribution of Fingerprints

Fingerprint Pattern	Frequency (%)
Loop	164 (54.66%)
Whorl	91 (30.33%)
Arch	28 (9.33%)
Composite	17 (5.66%)
Total	300 (100%)

The table 2 showed that loop pattern was most common in both sexes, followed by whorl, arch and composite respectively. There was no statistically significant association between fingerprint pattern and gender with a P value of more than 0.05.

Table 2: A Comparison of the Distribution of Fingerprint Patterns among Sexes and their Association with Gender

Fingerprint Pattern	Gender		p-Value
	Male	Female	
Loop	99	65	<0.288
Whorl	55	36	
Arch	18	10	
Composite	8	9	

DISCUSSION

Loop Fingerprint pattern was seen in 54.66 percent of the student's fingers, according to the study. Following that, 30.33 percent of the study's participants underwent a whorl fingerprint analysis. The average age of the participants in the study was 21.54 ± 2.33 years, and there were 1.5 times as many males as females. While there was no statistically significant correlation observed among gender and fingerprint patterns. Based on research carried out in Egypt 60 adults from Egypt and 60 from Malaysia were included in the study, with an average age of 22.37 ± 1.79 years, which is slightly older than the average age in the current research [11]. In a similar way another study conducted in Nigeria on a sample of 400 students mean age was recorded to be 21.86 ± 3.37 years, which is very close to what has been recorded in this study [12]. The participants' ages ranged from 18 to 25 years old, in contrast to a previous study in Lahore that included 150 students with ages ranging from 19 to 21 [13]. There is a 60% male prevalence in the results. Among 490 participants in a Nigerian study on gender predisposition, 51.8% were male, indicating a preponderance of males [14]. In another study conducted in Korea on 193 different participants, results revealed male dominance at 51.9% again similar to what has been reported in this study [15]. In contrast to the findings of this study, research conducted in Pakistan found that 70% of the students surveyed were female. The sample size was 100 individuals from Avicenna Medical College Lahore [13]. 62% of the male population was recorded in local research conducted in Abbottabad, which is nearly identical to the findings of this study According to the results, 54.66% of students had a loop fingerprint pattern, whereas 30.33% had a whorl print. [16]. Different studies worldwide have reported different numbers, in a study conducted in Nepal on a sample of 1960 participants, loop fingerprint was found to be most prevalent with 52.71%, followed by the Whorl type of fingerprint (27.38%) as reported in this study [17]. This research's findings are consistent with those of another Egyptian study in which 305 Libyan medical students ranked loop fingerprints highest (50.5% vs. 35.1%), which is statistically significant [18]. The results of yet another Nepalese investigation on 300 people showed that 51.13% of fingerprints were loops and 43% were whorls [19]. Similar to this study, another one published in the Journal of Ayub Medical College, Abbottabad similarly found that the most common fingerprint pattern in the city of Abbottabad was the loop pattern [16]. The research proved without a doubt that Loop is the most common fingerprint pattern. Our study found no significant association among fingerprints and gender. Similarly, another study found the same results [20-21].

CONCLUSIONS

Among medical students, the study found that loop fingerprints were more common than other fingerprints pattern. There was no statistically significant association between gender and fingerprints when looking at relationship statistics.

Authors Contribution

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

REFERENCES

[1] Zariwala R, Garg S, Khakhkhar T. A study of co-relationship among dactylography and blood groups among second year undergraduate students–A pilot project. Journal of Forensic Medicine and Toxicology. 2022 Aug; 39(1): 31-6. doi: 10.5958/0974-4568.2022.00007.2.

[2] Kalyan Varma R, Anand VS, Suresh AV. A study on relationship between the sex and patterns of fingerprints and distribution of patterns of fingerprints among gitam medical students. International Journal of Academic Medicine and Pharmacy. 2023 Sep; 5(4): 1514-7. doi: 10.47009/jamp.2023.5.4.301.

[3] Aamir Y, Masood R, Irshad N, Malik R, Farid N, Shahab MA. Relationship between Pattern of Fingerprints and Blood Groups. Pakistan Journal of Medical & Health Sciences. 2022 Nov; 16(09): 698-700. doi: 10.53350/pjmhs22169698.

[4] Králík M, Polcerová L, Čuta M. Sex differences in frequencies of dermatoglyphic patterns by individual

fingers. Annals of human biology. 2019 Apr; 46(3): 231-45. doi: 10.1080/03014460.2019.1622778.

[5] Kukadiya U, Trivedi P, Rathva A, Lakhani C. Study of fingerprint patterns in relationship with blood group and gender in saurashtraregion. International Journal of Anatomy and Research. 2020 Apr 1; 8(2): 7564–7. doi: 10.16965/ijar.2020.159.

[6] Sarfraz NJC. Adermatoglyphia: barriers to biometric identification and the need for a standardized alternative. 2019 Feb; 11(2): e4040. doi: 10.7759/cureus.4040.

[7] Subrahmanyam B, Phanindra S. Forensic medicine, toxicology and medical jurisprudence. Second Edition. New Dehli: CBS Publishers & Distributors Private Limited; 2018.

[8] Polcerová L, Chovancová M, Králík M, Beňuš R, Klíma O, Meinerová T *et al.* Radioulnar contrasts in fingerprint ridge counts: Searching for dermatoglyphic markers of early sex development. American Journal of Human Biology. 2022 May; 34(5): e23695. doi: 10.1002/ajhb.23695.

[9] Temaj G. Application of dermatoglyphics traits of population variation study. Acta morphologica et anthropologica. 2021; 28(3-4):123-9.

[10] Shrivastava M, Jain AP, Agarwal R, Vishwakarma AK. Dermatoglyphic pattern in relation to ABO, RH blood group among medical students. Journal of Forensic Medicine and Toxicology. 2023 May; 40(1):49-52. doi: 10.5958/0974-4568.2023.00012.1.

[11] Aziz MA, Dine FMMBE, Saeed NMM. Cheiloscopy and Dactylography in relation to ABO blood groups: Egyptian vs. Malay Populations. International Journal of Business, Human and Social Sciences. 2019; 13(2): 135-40. doi: doi.org/10.5281/zenodo.2571843.

[12] Magaji H, Musa M, Badamasi I. Relationship between finger print patterns with blood group and genotype among basic medical science, students of Bayero University, Kano. Bayero Journal of Pure and Applied Sciences. 2020 Dec; 12(2): 182-90. doi:10.4314/bajopas.v12i2.27.

[13] Abbasi MH, Mengal MA, Muhammad Akhtar Khan RMA, Habib H, Bhatti YA. Comparative study of dactylography among the students of Avicenna Medical College Lahore. Pakistan Journal of Medical and Health Sciences. 2012 Jun; 6(2): 362-265.

[14] Eboh DE. Fingerprint patterns in relation to gender and blood group among students of Delta State University, Abraka, Nigeria. Journal of experimental and clinical Anatomy. 2013 Jul; 12(2): 82–6. doi: 10.4103/1596-2393.127969.

[15] Cho C. A finger dermatoglyphics of the New Zealand-Samoans. Korean Journal of Biological Sciences. 1998; 2(4): 507-11. doi: 10.1080/12265071.1998.9647453.

[16] Khan O, Haroon MZ, Rashid MA, Khan MN, Khan D. Left hand thumb imprint patterns among medical students. Journal of Ayub Medical College Abbottabad. 2017 Jul; 29(3): 466-7.

[17] Shrestha I and Malla BK. Study of fingerprint patterns in population of a community. Journal of the Nepal Medical Association. 2019 Sep; 57(219): 293. doi: 10.31729/jnma.4621.

[18] Fayrouz INE, Farida N, Irshad AH. Relation between fingerprints and different blood groups. Journal of forensic and legal medicine. 2012 Jan; 19(1): 18-21. doi: 10.1016/j.jflm.2011.09.004.

[19] Kc S, Maharjan N, Adhikari N, Shrestha P. Qualitative analysis of primary fingerprint pattern in different blood group and gender in Nepalese. Anatomy research international. 2018; 2018(1): 2848974. doi: 10.1155/2018/2848974.

[20] Nandan SRK, Bandaru BK, Santosh ABR, Thankappan P, Chundru NSV, Amudala R. A study on association and correlation of lip and finger print pattern analysis for gender identification. Journal of Dr. YSR University of Health Sciences. 2015 Jul ; 4(3): 176-81. doi: 10.4103/2277-8632.165406.

[21] Singh DV, Kumar DK, Singh DK, Pal DG. Dactylography-Clinical profiling of medical students. International Journal of Life Sciences Biotechnology Pharma Research. 2024 Jun; 13(6): 157–62. doi: 10.69605/ijlbpr_13.6.30.

117