

Distribution of fingerprint patterns among first year medical students in Al-Ameen Medical College, Bijapur

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Abstract: *Introduction:* Fingerprint evidence is undoubtedly the most reliable and acceptable evidence as one of the most mature biometric technologies and are considered to be legitimate proofs of evidence in courts of law for human identification all over the world as they are constant and individualistic *Aim:* The present study was done to see the pattern of fingerprints among first year medical students. *Methods:* Study was carried out among 120 first year medical students (60 male & 60 female) belonging to the age group 17-21 years of Al-Ameen Medical College, Bijapur, Karnataka, during the period of 2016-17. Fingerprints of the fingertips were taken using the ink method. Distribution of fingerprint patterns were studied in both hands among males and females and are compared. *Results:* As finger prints are unique, whorls are the most commonly occurring fingerprint pattern while arches are the least common. Frequency of whorls is comparatively higher and that of loops lower. *Conclusion:* Different patterns of fingerprints are present in different digits in both males and females.

Keywords: Fingerprints, Identification, Gender differences, Dermatoglyphics, Whorl, Loop, Dermal ridges.

Introduction

The various identification datas used are speech, teeth, gait, tattoo marks, fingerprints, footprints, birthmarks, moles, handwriting, bite marks, DNA fingerprinting etc. Dermatoglyphics have been analyzed since ancient times, but it was identification of an individual from fingerprints that brought a revolution in the field of crime investigation. Fingerprints are constant and individualistic and form the most reliable criteria for identification. Fingerprint is one of the oldest, reliable and mature biometric technologies and is considered one of the best, cheapest and legitimate proofs of identification. A Fingerprint is an impression of friction skin ridges, known as dermal ridges or dermal papillae. The study of epidermal ridge pattern on fingers, palm, and soles is known as "Dermatoglyphics". The first ever work for dermatoglyphics was done 3000 years ago in China. Harold Cummins first coined the word in 1926 [1].

The dermatoglyphic pattern makes their appearance as early as 10 weeks of intrauterine life [2]. The original ridge characteristics are not disturbed unless the skin is damaged to a depth of

about 1 mm [1]. Dermatoglyphics print remains ubiquitous throughout life and form the most reliable criteria of identification. Development of ridges was found to be affected by genetic and environmental factors. Once formed these pattern do not change throughout one's life [3]. The fact that skin of palm and soles has ridges that is unique to each individual has been used for personal identification [4]. Study of fingerprint patterns is considered to be the most reliable and absolute method of identification. Galton classified different fingerprint patterns on the basis of their primary pattern as loops, whorls and arches [5-6].

The distribution of these Galton type fingerprint patterns is said to vary in different population groups, and association of fingerprint patterns with diseases of genetic origin has been reported in the past [7-8]. Although average distribution of different fingerprint patterns is known worldwide [9], published literature on the distribution of fingerprint patterns on individual digits are very few. Fingerprint type Loops are the patterns that start from one side, move

towards the centre, curve backwards and terminate on the same side. Whorls are circular or spiral arrangement of ridges in the centre, and in Arches, the ridge lines start from one side and end at the opposite end. Double loops and central pocket loops are classified under whorls [6]. Although worldwide average distribution of different fingerprint patterns is known [9], there is paucity of published literature on the distribution of fingerprint patterns on individual digits.

The main aim of this study was to study the distribution of fingerprint patterns on different digits in males and female medical students and to find if any variation occurs between both sexes for both hands. Apart from use of dermatoglyphic in predicting the diagnosis of genetic disorders, it is used in forensic science for criminal identification. The arrangement of skin ridges is never duplicated in two persons even in monozygotic twins [10]; the similarities are closer among some individuals while in others the differences are marked [11]. Fingerprint scans can be used to validate electronic registration, cashless catering and library access especially in schools and colleges. The secretions in the fingerprints contain residues of various chemicals and their metabolites which can be detected and used for the Forensic purposes [12].

Material and Methods

The study of fingerprint was conducted in Department of Forensic Medicine Al-Ameen Medical College, Bijapur, Karnataka. The material consisted of rolled fingerprints of 120 first year Medical students, of which 60 were males and 60 females. The age group of the medical students ranged from 17 to 21 years. All healthy individuals with no history of any genetic disorders were included in the study. Written informed consent was taken from the study subjects. Dermatoglyphic prints were taken by using Ink Method by "Cummins and Midlo" [1, 13].

Ink method as described by Cummins and Midlo, which requires ink slab, inverted 'T' shaped pad, Kores duplicating ink, white paper, magnifying lens and soap was used. The ink was placed on the ink slab and the inverted 'T' shaped pad was soaked in it. The ink was evenly spread on the ink slab. Hands were thoroughly washed with soap

before taking prints. The fingers were rolled laterally on the ink slab and then placed on a white paper with one lateral edge and rolled over in opposite direction. Finger tip patterns of all the digits were recorded and studied with the help of magnifying lens. Parameters observed were loops, whorls, arches. The printed sheets were coded with name, age, sex, address. Finger print patterns were identified as: Loops, Whorls and Arches based on appearance of ridge lines. The present study evaluates the distribution of dermatoglyphic fingertip patterns in both hands among males and female first year medical students and the findings of the study are compared with the available data.

Results

Studies were conducted on all students of 120 fingerprints. Whorls were the most common pattern followed by Loops and Arches in both hands among males and females. While whorls were seen on all the digits, predominance of loops was evident on thumb, index and ring fingers.

Percentage of Pattern of finger prints seen in our study were as Whorls (53.9%), Loops (21.5%) & Arches (19.6%). Frequency of Whorls were predominantly found on thumb finger 148 (61.60%) followed by index finger 143 (59.50%), ring finger 129(53.80%), little finger 114 (47.50%).

Pattern of finger print	Number (%)
Whorls	646 (53.90 %)
Loops	257 (21.50 %)
Arches	235 (19.60 %)
Total	1200 (100 %)

Frequency of loops was maximum on the middle finger 73(30.40%) followed by little (23%) and ring finger (22%) and index finger (17.90%). Of the total arches were present on the thumb were 59 (24.60%), index finger 52 (21.60%), middle finger 51(21.20%) and little finger 41 (17%). There was insignificant difference in overall distribution of fingerprint

pattern in both hands among males and females. Frequency of different fingerprint patterns for

individual digits in both hands among males and females is shown in tables 1, 2 & 3.

Table-2: Distribution of Whorls, Loops and Arches among Males & Females

Digit	Sex	Whorls	Loops	Arches
Thumb (N=120)	Male	71 (59.10 %)	19 (15.80 %)	30 (25.00 %)
	Female	77 (64.10 %)	13 (10.80 %)	29 (24.10 %)
Index Finger (N=120)	Male	67 (55.80 %)	30 (25.00 %)	23 (19.10 %)
	Female	76 (63.30 %)	13 (10.80 %)	29 (24.10 %)
Middle Finger (N=120)	Male	49 (40.80 %)	48 (40.00 %)	24 (20.00 %)
	Female	63 (52.50 %)	25 (20.80 %)	27 (22.50 %)
Ring Finger (N=120)	Male	56 (46.60 %)	26 (21.60 %)	15 (12.50 %)
	Female	73 (60.80 %)	27 (22.50 %)	17 (14.10 %)
Little Finger (N=120)	Male	50 (41.60 %)	26 (21.60 %)	20 (16.60 %)
	Female	64 (53.30 %)	30 (25.00 %)	21 (17.50 %)

Table-3: Distribution of Finger print Patterns viz-a-viz digit

Digit	n	Whorls	Loops	Arches
Thumb	240	148 (61.60 %)	32 (13.40 %)	59 (24.60 %)
Index Finger	240	143 (59.50 %)	43 (17.90 %)	52 (21.60 %)
Middle Finger	240	112 (46.60 %)	73 (30.40 %)	51 (21.20 %)
Ring Finger	240	129 (53.80 %)	53 (22.00 %)	32 (13.40 %)
Little Finger	240	114 (47.50 %)	56 (23.00 %)	41 (17.00 %)
Total	1200	646 (53.80 %)	257 (21.50 %)	235 (19.60 %)

Discussion

The ridge pattern in a fingerprint is genetically determined and highly individualistic. It remains ubiquitous throughout one’s life [14-16]. Worldwide percentage distribution of loops, whorls, arches and composite is approximately 65%, 25%, 7% and 2-3% respectively [9]. But here highest percentages of fingerprint patterns were formed by whorls followed by loops and then arches. Similar percentages of various fingerprints patterns were found in the present study among medical students which coincides with most of the previous studies conducted [17-18].

Although whorls were the predominant patterns followed by loops and arches in our study which is not similar to the worldwide average but a study comprising British individuals observed frequency of whorls was higher and that of loops lower [19]. However, in our study the percentage of loops are relatively towards lower side compare to worldwide average while as the whorls are relatively towards higher side. Frequency of arches in our study was higher to

worldwide average. Overall preponderance of loops among medical students in our study is in accordance with that reported in other studies involving medical students. Frequency of loops and whorls in our study was higher and that of arches lower when compared to study done at Ajmer [20]. In our study viz-a viz variation of fingerprint pattern among individual fingers, few arches were reported in ring finger of female medical students. This observation is partly in line with observations seen in Nellimarla where no arches were reported in any of the fingers of the medical students [17]. The overall distribution of different fingerprint patterns however was not significantly different between hands and no statistically significant gender differences could be established, similar to a study done on indigenous black Zimbabweans [21]. However, frequency of loops among Zimbabweans was significantly higher when compared to other studies. According to Nayak SK. & Patel S [22] commonest occurrence of loop happens to be in finger V and III. Tanuj Kanchan and Saurabh [18]

studies showed whorl pattern in medical student were higher than other population which was conducted in Sikkim-Manipal Institute of Medical Sciences Gangtok. Sajjad Hamid et al [23] made this type of studies on medical students SKIMS medical college in Bemina found the same as the whorl patterns are higher than loop and arch in medical students.

Conclusion

From our study, following conclusions can be drawn that there are many criterias were used for the purpose of identification like race, sex, age, complexion, hair, scar, tattoo, footprint, occupation marks but fingerprint is found to be most reliable.

1. Frequency distribution of fingerprint patterns among Medical students differs from other population groups and frequency of whorls is comparatively higher and that of loops.
2. Distribution of fingerprint patterns was similar on both hands for both sexes. Thus while different patterns show preferences for different digits, bilateral variations in the distribution of fingerprint patterns do not occur. Similar studies in other population groups are desirable for better correlation.
3. These mentioned methods conclude that the fingerprint is fast and accurate for more reliable and secure system.

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