

Fingerprint Analysis and Gender Predilection among Medical Students of Nepal Medical College and Teaching Hospital

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ABSTRACT

Introduction: Fingerprint is an impression of friction skin ridges, known as dermal ridges or dermal papillae, on a surface and its study is known as Dermatoglyphics. The Henry Classification System classifies the fingerprint patterns (in order of decreasing frequency) into Loop (60-70%); Whorl (25-35%); Arch (5%-7%) and Composite (2-3%). Through its unique characteristics, the scientific study of fingerprint provides a special service in the administration of justice in court of law and in other areas where positive identification is of paramount importance. As there is no sufficient study on fingerprints based on the Nepalese population this study will provide facts and figures regarding pattern distribution of fingerprints and gender predilection in Nepalese population.

Materials and Method: The present study was conducted over a period of 5 months from December 2015 to May 2016 among Nepalese medical students of Nepal Medical College and Teaching Hospital, Kathmandu. The sample size consisted of 200 medical students (100 males and 100 females) with age ranging from 18-25 years.

Results: Loops are the most commonly occurring fingerprint pattern while arches are the least common. Males have a higher incidence of loops and females have a higher incidence of whorls.

Conclusion: Our study showed that the most common type of finger print pattern was loop. However, distribution of dermatoglyphic patterns being almost similar on both hands bilateral variations could not be established but association existed between distribution of fingerprint patterns and gender.

Keywords: Identification, Fingerprints, Nepal, Gender.

INTRODUCTION

Personal identification through fingerprints has been known since long and is considered as the greatest contribution to the law enforcement. Fingerprint is considered one of the best, cost-effective, constant, individualistic and legitimate proofs for identification of an individual. [1] Fingerprint is an impression of friction skin ridges, known as dermal ridges or dermal papillae, on a surface. "Dermatoglyphics" is the study of epidermal ridge pattern present

on fingers, palm, and soles. Harold Cummins considered as the father of dermatoglyphics first coined the term in 1926. [2] The dermatoglyphic pattern i.e. the papillary dermal ridges and furrows on the finger and toes develop by 12th to 16th week of embryonic development and their formation gets completed by the 14th week i.e. about the 6th foetal month. [3] These ridges and furrows by their arrangement form different patterns which are absolutely constant and persist throughout life. [4]

Development of ridges was found to be affected by genetic and environmental factors. Once formed these patterns do not change throughout one's life [5] until destroyed by decomposition of the skin after death. [3] However, they may be altered or scarred in conditions like leprosy, electrical injury, exposure to radiation, ridge alteration in eczema, scleroderma, ridge distance change in rickets etc. The Henry Classification System classifies the fingerprint patterns (in order of decreasing frequency) into Loop (60-70%); Whorl (25-35%); Arch (5%-7%) and Composite (2-3%). [6] Various physical evidences used for identification are finger prints, DNA profiling, lip marks, foot prints, bite marks etc. Fingerprints are constant and individualistic and form the most reliable criteria for identification. Finger prints follow the Locard's Principle of Exchange. The secretions in the fingerprints contain residues various chemicals and their metabolites which can be detected and used for the forensic purposes. [7] Through its unique characteristics, the scientific study of fingerprint provides a special service in the administration of justice in court of law and in other areas where positive identification is of paramount importance. [4]

There is no sufficient study based on the Nepalese population regarding fingerprints; so this study will provide information regarding pattern of distribution of fingerprints and gender predilection.

MATERIALS AND METHODS

Sample collection

The present non-interventional, descriptive study was conducted over a period of 5 months December 2015 to May 2016. The study was approved by the Institutional Ethics Committee (IEC) of Nepal Medical College and Teaching Hospital (NMCTH), Jorpati, Kathmandu, Nepal. The total sample comprised of 200 medical students (100 males and 100 females). Age group 18-25 years was targeted considering their accessibility to the department of Forensic Medicine. All

the subjects were briefed about the purpose of the study and written informed consent was obtained from each of them before taking the samples.

Sample technique: The sample was collected by simple random sampling method.

Inclusion criteria: Only healthy Nepalese medical students free from deformities of fingers or hand or disease or birth defects were included in the study.

Exclusion criteria: Foreign students and any Nepalese medical student having deformity like permanent scars on their finger or thumb, or hand deformities following injuries or birth defects or any kind of disease, those with worn fingers, extra webbed or bandage fingers were not included as part of the study.

Instrument used

1. Pre - structured Performa
2. Stamp pad (Camlin, size: 157×96 mm.)
3. Unglazed paper
4. Hand magnifying lens
5. Pencil

Technique: Each subject was asked to wash their hands thoroughly with soap and water and dry them using a towel. The subjects were then instructed to press the bulb of their fingers on the stamp pad. The smeared fingers of both hands were printed on an unglazed plain paper which consisted of ten different blocks for ten fingers of right hand and left hand respectively. Both rolled and plane prints of right and left hand were taken. After obtaining the finger prints the basic details such as name, age and sex was also collected. Primary patterns loops, whorl, arches and composite based on the appearance of ridge lines were observed with the help of a powerful hand lens. Precaution was taken to avoid sliding of fingers to prevent smudging of the print.

Classification used: Henry system of classification. This system assigns each finger number according to the order in which it is located in hand, beginning with the right thumb as number one and ending with the left little finger as number ten.

Statistical analysis: The distribution of dermatoglyphic fingertip patterns in both hands of individuals and its relationship with gender was evaluated and analyzed statistically using SPSS version 21.

RESULTS

Table 1: Distribution of Primary Fingerprint Patterns in Right and Left Hands

Digits		Gender		Pattern of fingerprint				
		Male	Female	n	Loops %	Whorls %	Arches %	Composite %
Thumb	Right	100	100	200	105(52.5)	89(44.5)	6(3)	0(0)
	Left	100	100	200	97(48.5)	90(45)	12(6)	1(0.5)
	R+L	200	200	400	202(50.5)	179(44.75)	18(4.5)	1(0.25)
Index	Right	100	100	200	97(48.5)	79(39.5)	23(11.5)	1(0.5)
	Left	100	100	200	92(46)	79(39.5)	27(13.5)	2(1)
	R+L	200	200	400	189(47.25)	158(39.5)	50(12.5)	3(0.75)
Middle	Right	100	100	200	146(73)	41(20.5)	13(6.5)	0(0)
	Left	100	100	200	129(64.5)	52(26)	18(9)	1(0.5)
	R+L	200	200	400	275(68.75)	93(23.25)	31(7.75)	1(0.25)
Ring	Right	100	100	200	75(37.5)	122(61)	3(1.5)	0(0)
	Left	100	100	200	79(39.5)	115(57.5)	6(3)	0(0)
	R+L	200	200	400	154(38.5)	237(59.25)	9(2.25)	0(0)
Little	Right	100	100	200	150(75)	45(22.5)	5(2.5)	0(0)
	Left	100	100	200	152(76)	44(22)	4(2)	0(0)
	R+L	200	200	400	302(75.5)	89(22.25)	9(2.25)	0(0)
All digits	Right	500	500	1000	573(57.3)	376(37.6)	50(5)	1(0.1)
	Left	500	500	1000	549(54.9)	380(38)	67(6.7)	4(0.4)
	R+L	1000	1000	2000	1122(56.1)	756(37.8)	117(5.85)	5(0.25)

Fingerprint pattern analysis of 2000 fingers (200 subject X 10 fingers of right and left hand) showed that, overall loop pattern (56.1%) were the most commonest type of finger print pattern in both hands among males and females followed by whorls (37.8%), arches (5.8%) and composite (0.25%) pattern (Table 1). While loops were the predominant patterns on the thumb, middle and little fingers, predominance of whorls was evident on ring, thumb and index fingers. Loops were mostly noticed on little finger (75.57%)

followed by middle (68.75%) and thumb (50.5 %). Frequency of whorls was maximum on the ring finger (59.25%) followed by thumb (44.75%) and index finger (39.5%). Frequency of arches was predominant in index (12.5%) and middle fingers (7.75%). Only a minimal proportion (0.25%) of composite pattern was notice in all the digits of both the hands. There was insignificant difference in overall distribution of fingerprint pattern in both hands among males and females.

Table 2: Distribution of number of pattern of finger prints among males and females

Type	Male	%	Female	%	Total	Percentage
Loops	579	57.9	543	54.3	1122	56.1
Whorls	370	37.0	386	38.6	756	37.8
Arches	47	4.7	70	7.0	117	5.8
Composite	4	0.4	1	0.1	5	0.25
Total	1000	100	1000	100	2000	100

Table 2 shows the distribution of finger prints among both the genders. The frequency of distribution of loop pattern was found to be higher in males (57.9%) as compared to females (54.3%) whereas the whorl pattern was more predominant in females (38.6%) as compared to males (37%). Similarly, frequency of distribution of arch pattern was more in females (7.0%) than males (4.7) while composite pattern

being the least type of pattern was slightly more in males (0.4%) than in female (0.1%)

DISCUSSION

The finger ridge pattern is genetically determined and highly unique. Worldwide percentage distribution of loops, whorls, arches and composite is approximately 65%, 25%, 7% and 2-3% respectively. ^[8] In this study loops (56.1%)

were the most common fingerprint pattern, followed by whorls (37.8%), arches (5.85%) and composite (0.25%) in both hands among males and females.

The overall preponderance of loops in our study is in accordance with other studies involving medical students. [7,9-12] Although loops were the predominant patterns followed by whorls and arches in our study which is similar to the worldwide average, frequency of whorls was higher and that of loops were lower in comparison to standard distribution of occurrence. [13] Frequency of loops and whorls in our study was higher and that of arches lower when compared to study done at Ajmer. [7] In our study arches though less in frequency were observed more in female medical students. In Nellimarla no arches were reported in any of the fingers of the medical students. [12] Our study of fingerprint patterns on individual digits revealed preponderance of loops on little and middle finger, whorls on ring finger and thumb and arches on the index finger in both hands, which is in accordance with the study done on British subjects [13] and to the results of [14,15] on Indian population.

It has been observed that particular type of patterns is relatively more common in one of the genders despite loop being commonest pattern. The loop and composite patterns were commoner in male while whorl and arch patterns were found to be predominant among female students. This is in accordance to a study conducted in Nepalese population. [16]

Hence, it can be concluded that overall distribution of fingerprint patterns showed no bilateral significant difference between hands due to distribution of dermatoglyphic patterns being almost similar on both hands but showed an association between distribution of fingerprint patterns and gender.

CONCLUSION

In this study loops were the predominant pattern in both males and females. Although loops were the

predominant patterns followed by whorls and arches similar to the worldwide average the frequency of whorls were comparatively higher and that of loops lower when compared with worldwide distribution percentage. Significant increase in the frequency of loops was seen in the little finger followed by middle finger. Higher percentage of whorls was observed on the ring finger whereas highest preponderance of arches was present in index finger. However, distribution of dermatoglyphic patterns being almost similar on both hands bilateral variations could not be established but there was an association between distribution of fingerprint patterns and gender.

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