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Distribution of Fingerprint Patterns in an Indian Population

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ABSTRACT: Fingerprints play a vital role in identification of individual in any forensic investigation. The present study is conducted on 536 Marathi subjects (256 males and 280 females) of Nagpur city, India to determine the predominant fingerprint pattern gender wise as well as in individual digits (fingers). Rolled impressions of all the ten digits were recorded and analysed. Ulnar loop (51.3 %) was found to be the most common pattern observed. No statistically significant difference (at level $p<0.05$) were observed between distribution of fingerprint patterns in males and females of the population.

Keywords: fingerprints, dermatoglyphics, Indian population, Marathi population, fingerprint distribution

Introduction

Determination of individuality or identification is one of the prime issues in forensic practice. Some of the important parameters usually noted for the purpose of identification are race, gender, age, skin texture and features, speech and voice, footprints, deformities, hair, tattoo marks, scars, occupational marks, handwriting, garments and personal articles, gait pattern, and DNA profile [1-10]. This may lead to either circumstantial identification or positive identification. But, out of all these parameters, one that stands out and is extensively used is "Fingerprints". Fingerprints often provide the stimuli that eventually lead to the positive identification of suspect, victim, culprit and/or deceased.

Dermatoglyphics (ancient Greek, derma= skin, glyph= craving) [8] is the term applied to the scientific study of prints of skin viz., fingerprints, footprints and palmprints. Fingerprints are characterized by alternating strips of raised friction ridges and depressed grooves on the palmar surface of the fingertips. The ridge patterns start to develop between the fifth and sixth week of intrauterine life, are fully formed by the 21st week and are permanent for life [11]. It has been estimated that chances of two persons having identical finger impressions is about one in sixty four thousand million population of the world [12]. Identical twins originating from one fertilized egg share the same DNA profile because they began existence as one entity, yet their fingerprints are as distinctive as any unrelated persons [13]. This accounts for the widespread usage of fingerprints for their permanence, individuality and uniqueness.

In the present study, an attempt has been made to determine the predominant finger print pattern in both genders as well as in individual digits of hands and to know if sexual dimorphism exists in Marathi population of Nagpur city of Maharashtra state in India.

Materials and Methods

The study was conducted on 536 Marathi subjects of Nagpur city which constituted of 256 males and 280 females. Informed consents were obtained from the subjects before taking the samples. Subjects who showed any sign of injury or disease affecting the fingerprint pattern were excluded from the study. Note that the presence of injuries or any such permanent markings on the fingertips affecting the fingerprints serves as highly individualizing characteristics but it was not suited for our study and hence ignored.

The subjects were asked to wash and dry their hands before giving the samples. They were then asked to roll their finger bulbs on the plate smeared with ink and imprint it on the 10-digit fingerprint identification slip designed for the study. Excessive pressure on the fingers while inking and recording was avoided [14]. The patterns on the rolled finger impressions were identified.

Statistical analysis was performed on the obtained results using t-test. The significance level was set at $p<0.05$ levels.

Result and Discussion

In the present study the ulnar loop (51.3%) was found to be the most predominant pattern. Population wise percentage distribution of pattern types in 280 female and 256 male subjects is shown in Table 1.

Table 1: Percentage distribution of fingerprint patterns in Marathi population

Patterns	Males (%)	Females (%)	Overall in Marathi Population (%)
Ulnar loop	49.21	53.42	51.32
Whorl	29.06	24	26.53
Twinned Loop	8.28	6	7.14
Central Pocket	5.31	6.14	5.73
Radial Loop	3.75	1.9	2.83
Accidental	1.9	2.42	2.16
Tented Arch	0.78	2.14	1.46
Plain Arch	0.78	2.14	1.46
Lateral Pocket Loop	0.93	1.85	1.39
Total	**100**	**100**	**100**

Ulnar loops were observed in 53.28% females as against in 49.21% males followed by whorl patterns in 24% females next to 29.06% in males. It was observed that whorl pattern was significantly higher in ring finger in both the sexes, females contributing about 42.14% of whorls against 36.42% of ulnar loops and in males 56.25% of whorls against 25% of ulnar loops (Table 2).

Table 2: Percentage distribution of patterns in different digits in males and females

Patterns	Males (Both Hands)					Females (Both Hands)				
	Little Finger	Ring Finger	Middle Finger	Index Finger	Thumb	Little Finger	Ring Finger	Middle Finger	Index Finger	Thumb
Ulnar loop	67.19	25	66.4	39.84	47.67	72.14	36.43	70	42.14	46.43
Plain whorl	13.28	56.25	21.09	29.69	25	10.71	42.15	15.72	24.29	27.14
Central Pocket	10.16	10.94	0.78	4.69	0	8.57	13.57	1.43	6.43	0.71
Tented Arch	0	0	0	3.12	0.78	1.43	2.86	0.71	5.71	0
Plain Arch	0	0	0.78	1.56	1.56	0.71	0	2.14	6.43	1.43
Radial Loop	4.69	2.34	4.7	4.69	2.34	2.86	0.71	1.43	3.57	0.71
Twinned Loop	3.12	4.69	3.13	10.16	20.31	0	3.57	6.43	5.71	14.23
Lateral pocket Loop	0	0	1.56	0.78	2.34	1.43	0	1.43	1.43	5
Accidental	1.56	0.78	1.56	5.47	0	2.15	0.71	4.3	4.3	4.3
Total	100	100	100	100	100	100	100	100	100	100

The results of our study are in accordance with the studies by Nithin *et. al.* in South Indians of Mysore who reported the most common occurrence of ulnar loops (52.3%) followed by whorl pattern (28.74%) [14], Gangadhar et al. in Adikarnataka population of Mysore city of Karnataka State who reported predominance of loop patterns (57.11%) followed by whorls (27.89%) and arches (15.00%) [15], by Jaga and Igbigbi in Ijaw subjects of Southern Nigerians [16], Igbigbi and Msamati in Kenyan and Tanzanian subjects [17] and by Eboh in Anioma and Urhobo population of Southern Nigeria where ulnar loop followed by whorls and arches patterns were reported [18].

The results of our study is in contrast with the studies by Ching Cho in New Zealand Samoans who reported the predominance of whorls (60.6%) followed by ulnar loops (38.65%) [18], by Banik *et. al.* among Rengma Nagas of Nagaland [19], by Biswas among Dhimals of North Bengal [20], by Tiwari *et. al.* among Tibetans [21], by Karmakar *et al.* among Muzziena Bedouin [22], by Singh *et. al.* in Rajputs of Himachal Pradesh [23] and Ghosh *et. al.* in Sunni Muslim males of West Bengal [24] who reported whorls to be the most common pattern, followed by loops and arches in both hands of male and females.

The difference between the distribution of fingerprint patterns among males and females of Marathi population was found to be statistically insignificant which is in accordance with Jaga *et. al.* [16].

Conclusion

Our study showed that the most common type of pattern observed in Marathi population is ulnar loop followed by whorls in both males and females. However, the frequency of whorl pattern is greater in ring finger in both the genders. No statistically significant differences are observed in the fingerprint

pattern distribution between males and females. Similar studies with different ethnic groups/populations and considering the possibility of existence of sexual dimorphism would be anticipated in the near future.

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