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Fingerprint patterns of MBBS students: A study from Assam

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Abstract
Background: Fingerprint evidence is undoubtedly the most reliable and acceptable evidence till date in the court of law. Due to the immense potential of fingerprints as an effective method of identification, the present study aims to analyze their correlation with gender and locality. The word "Dermatoglyphics" indicates the study of epidermal ridge pattern on fingers, palm, and soles. In this study an attempt has been made to study the fingerprint patterns of medical students of Tezpur Medical College, Tezpur, Assam, India. Fingerprint patterns are studied in 200 students, 100 males and 100 females. Dermatoglyphic prints of the fingertips are taken using the ink method. Distribution of dermatoglyphic fingertip patterns are studied in both hands among males and females and compared.
Results: The results show maximum number of loops (52.3%), followed by whorls (42.2%) and arches (5.5%). In comparison with worldwide distribution of various fingerprint patterns, this study shows more numbers whorl pattern of fingerprints in Indian medical students, just like few other studies done earlier involving India medicos.
Conclusion: This study thus creates a doubt in the minds of the observers; do Indian Medical Students really show more whorls in their fingers?

Keywords: fingerprints, dermatoglyphics, gender, locality, whorls

Introduction

Fingerprints are impressions of patterns formed by the papillary or epidermal ridges of the fingertips. The study of epidermal ridge pattern on fingers, palm, and soles is known as "Dermatoglyphics". Harold Cummins first coined the word in 1926 [1]. Development of ridges was found to be affected by genetic and environmental factors. Once formed these pattern do not change throughout one's life [2].

In this era of technology, even after discovery of various new methods of identification, fingerprint still holds its numero-uno status as the surest data. Fingerprints are constant and individualistic and form the most reliable criteria for identification. Fingerprints 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 [3]. DNA profiling, though it is very sensitive, it could not surpass the advantages of fingerprint. Fingerprints are now a day's used in many of the offices, educational institutions to validate the presence of an individual.

Galton classified different fingerprint patterns on the basis of their primary pattern as loops, whorls and arches [4]. Double loops and central pocket loops are classified under whorls. Although worldwide average distribution of different fingerprint patterns is known [5], there is paucity of published literature on the distribution of fingerprint patterns on individual digits, especially in this part of the world.

The aim of the study is to ascertain the distribution of fingerprint patterns on different digits in males and females and to find if any variation occurs between both sexes for both hands; and also to find out any difference existed among the medical students in terms of percentage of various fingerprint patterns. This study is also aimed at determining any difference between distribution of fingerprint patterns among the students residing from rural and urban areas.

Materials and Methods

This study is conducted at Tezpur Medical College, Tezpur, Assam, India among the MBBS students. Rolled fingerprints of 200 medical students are taken on plain paper, of which 100 are males and 100 females. Individuals with known genetic diseases and skin disorders are excluded. Hands are washed thoroughly with soap and water before taking the prints. Carbon ink is applied to all the ten finger tips, and prints are taken on plain papers (proforma) by simply rolling the fingers from one side to another. Fingerprints thus taken are studied with the help of a magnifying glass and categorised accordingly as loops, whorls and arches. Data obtained from the study are tabulated and compared with already existing ones.

Results obtained are validated by Chi–square test (χ^2) and calculation of "p" value. A "p" value <0.05 is regarded as significant.

Results

A total of 2000 fingerprints have been studied and tabulated. Loop (52.3%) is the commonest fingerprint pattern found, followed by whorls (42.2%) and arches (5.5%) (Figure 1).

Table 1: More than half of the loops (54.3%) are distributed between little (28.3%) and middle fingers (26%), out of which little finger has shown slight more incidence. Out of all the loops (998+48=1046), only 4.59% are radial loops. Whorl pattern is predominantly present over the ring fingers (29.5%), followed by the thumb (25%). Nearly half (49.09%) of the arches are present over the index fingers, and only 5.45% arches are seen over the little fingers. Out of all, only middle fingers of both hands show significant difference (p value 0.0057) of fingerprint distribution. Loop pattern is more prevalent in right middle finger and left little finger.

Table 2: Comparison of fingerprint patterns of both sexes in all fingers shows significant difference in middle and little fingers (p value, middle finger – 0.0021, little finger - <0.0001).

Table 3: There is significant difference between distribution of all three fingerprint patterns amongst all five fingers (p value <0.0001).

Table 4: This shows comparison of sex distribution of various fingerprints of present study with other three studies done earlier.

Table 5: Comparison of urban and rural distribution of fingerprints shows that loops are more common in rural areas, whereas whorls and arches are more prevalent in students born and brought up in urban areas.

Table 6: Findings show that loop patterns are mostly present on right hand; arch patterns are predominant on left side, whereas whorls are equally distributed on both hands.

Discussion

Percentage of distribution of fingerprints

Fingerprint pattern is highly individualistic and genetically predetermined; no two individuals show same fingerprint pattern. Worldwide percentage distribution of loops, whorls, arches and composite is approximately 60-70%, 25-35%, 7% and 1- 2% respectively [5]. This study shows predominance of loop pattern, followed by whorls and arches, which are similar to worldwide distribution and a study did on British Individuals [6], but frequency of whorls is higher and that of loops is on lower side. In our study, percentage of whorls is more than the worldwide distribution but almost same with a study conducted on MBBS students by Kanchan *et al.,* [7]. Overall preponderance of loops among medical students in our study is in accordance with that reported in other studies involving medical students. [7, 9]. Study conducted by Prateek R *et al.,* shows less number of whorls (32.55%) amongst medical students [10]. Study conducted by Desai B *et al.,* (29.6%) shows similar distribution of whorl pattern just like worldwide distribution (25-35%) [11]; whereas studies conducted by Sandeep V *et al.,* (24.34%) and Sangita S Babu *et al.,* (23.8%) show lesser number of whorls than worldwide distribution [12, 13]. Our study shows only few radial loops (4.59%), just like the study conducted on British individuals (5.69) [6] and study of Wang L *et al.,* (4.47%) [14]. The Nagraj *et al.,* interestingly found equal numbers whorls and arches (both 14%) in their study, as compared to 64% of loops [15].

Sex distributions of various fingerprints

Comparison of fingerprint patterns of both sexes in all fingers shows significant difference only in middle and little fingers (p value, middle finger – 0.0021, little finger - <0.0001).

Present study shows less percentage of loops in females as compared to males, whereas percentage of whorls and arches in females are more than males (Table 4 and Figure 2). Studies of Prateek R *et al.,* (64.06%), Desai B *et al.,* (62.44%) and Nagraj *et al.,* (74%) show more percentage of loops in females than males; all these three studies also show less percentage of whorls in females than males (Table 4). In Nagraj *et al.,* [15], percentage of arches in females (10%) is less than males whereas Prateek R *et al.,* (7.2%) and Desai B *et al.,* (11.98%) show more percentage arches in females [10, 11].

Loop pattern is more frequently encountered on right side of male, whorl and arches are more common on left side of female. The Kanchal *et al.,* [7] in their study found more loops on left side female and whorls on right side of male.

Locality wise distributions various fingerprints

Our study shows more number of loops in students born and brought up in rural areas whereas percentage of whorls and arches are more in urban localities (Table 5).

Distributions of various fingerprints in different fingers

This study revealed preponderance of loop pattern on little and middle fingers, whorls on ring fingers and thumb, and arches on index fingers in both hands and both sexes. This finding is in accordance with Kanchan *et al.,* [7] and Mehta AA *et al.,* [10].

The most and least common pattern of various fingerprints of our study, study conducted by Kanchan *et al.,* [7] and Mehta *et al.,* [16] are tabulated below (Table 4,6).

Table no. 6 shows that whorl pattern is most commonly present on right ring finger in all the three studies. Our study shows equal number of whorl pattern on both the sides, whereas Kanchan *et al.,* shows equal number of arches on both sides.

Table 1: Distribution of various fingerprint patterns in fingers of both hands

Finger	Loop	Percentage (Col.2/1046)	Whorl	Percentage (Col.4/844)	Arch	Percentage (Col.6/110)	Total	χ^2 (p value)
1	2	3	4	5	6	7	8	9
Right Thumb	88	8.41	103	12.2	11	10	200	2.381
Left Thumb	85	8.13	108	12.8	5	4.54	200	(0.3041)
Thumb Total	173	16.54	211	25	16	14.54	400	
Right Index	85	8.13	90	10.66	26	23.64	200	0.5461
Left Index	77	7.36	94	11.14	28	25.45	200	(0.7611)
Index Total	162	15.49	184	21.8	54	49.09	400	
Right Middle	151	14.43	42	4.97	8	7.27	200	10.322
Left Middle	121	11.57	60	7.11	18	16.36	200	(0.0057)

Middle Total	272	26	102	12.08	26	23.63	400	
Right Ring	64	6.12	133	15.76	2	1.82	200	2.347
Left Ring	79	7.55	116	13.74	6	5.45	200	0.3093
Ring Total	143	13.67	249	29.5	8	7.27	400	
Right Little	144	13.77	54	6.4	1	.91	200	3.893
Left Little	152	14.53	44	5.21	5	4.54	200	(0.1427)
Little Total	296	28.3	98	11.61	6	5.45	400	
Right all	532	50.86	422	50	48	43.64	1000	2.084
Left all	514	49.14	422	50	62	56.36	1000	(0.3528)
Total	1046	100	844	100	110	100	2000	

Table 2: Distribution of various fingerprint patterns in both sexes

Finger	Sex	Loop	Whorl	Arch	χ^2 (p value)
Thumb (n=400)	Male	91	105	4	4.473
	Female	82	106	12	(0.1068)
Index (n=400)	Male	84	88	28	0.6441
	Female	78	96	26	(0.7247)
Middle (n=400)	Male	152	40	8	12.356
	Female	120	62	18	(0.0021)
Ring (n=400)	Male	68	130	2	2.829
	Female	75	119	6	(0.2431)
Little (n=400)	Male	166	34	0	19.562
	Female	130	64	6	(< 0.0001)
All (n=2000)	Male	561	397	42	14.630
	Female	485	447	68	(0.0007)

Table 3: Fingerprint pattern in different fingers and it's significant

FP pattern → Finger ↓	Loop	Whorl	Arch	χ^2 (p value)
Thumb	173	211	16	464.34 (<0.0001)
Index	162	184	54	
Middle	272	102	26	
Ring	143	249	8	
Little	296	98	6	

Table 4: Comparison of sex distribution of various fingerprints of present study with others

Present study						
FP pattern→	**Loop**		**Whorl**		**Arch**	
Sex ↓	**No**	**%**	**No**	**%**	**No**	**%**
Male	561	56.1	397	39.7	42	4.2
Female	485	48.5	447	44.7	68	6.8
Prateek R *et al.*, [10]						
FP pattern→	**Loop**		**Whorl**		**Arch**	
Sex ↓	**No**	**%**	**No**	**%**	**No**	**%**
Male	581	58.04	362	36.16	58	5.8
Female	640	64.06	287	28.72	72	7.2
Desai B *et al.*, [11]						
FP pattern→	**Loop**		**Whorl**		**Arch**	
Sex ↓	**No**	**%**	**No**	**%**	**No**	**%**
Male	558	55.41	338	33.57	111	11.02
Female	620	62.44	254	25.58	119	11.98
Nagraj *et al.*, [14]						
FP pattern→	**Loop**		**Whorl**		**Arch**	
Sex ↓	**No**	**%**	**No**	**%**	**No**	**%**
Male	10	50	3	15	3	20
Female	22	74	4	13	4	10

Table 5: Distribution of various fingerprint patterns according to locality

Pattern	Rural		Urban		Over all distribution	
	No.	%	No.	%	No.	%
Loop	437	53.29	609	51.61	1046	52.3
Whorl	343	41.83	501	42.46	844	42.2
Arch	40	4.88	70	5.93	10	5.5
Total	820	100.00%	1180	100.00%	2000	100%

Table 6: Comparison of fingerprint pattern findings in three different studies

Fingerprint pattern	Our study		Kanchan *et al.*, [7]		Mehta *et al.*, [15]	
	Most common	Least common	Most common	Least common	Most common	Least common
Loop	Left little	Right ring	Left little	Right thumb & right ring	Right little	Left index
Whorl	Right ring	Right middle	Right ring	Left little	Right ring	Right little
Arch	Left index	Right little	Right ring	Left ring	Left index	Thumbs
If we compare both hands (Common pattern)						
Loop	Right		Right		Left	
Whorl	Equal on both sides		Left		Right	
Arch	Left		Equal on both sides		Left	

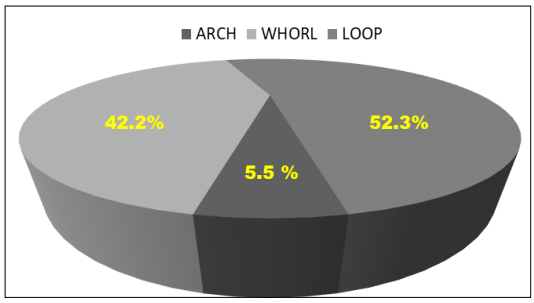

Fig 1: Percentage of Fingerprints

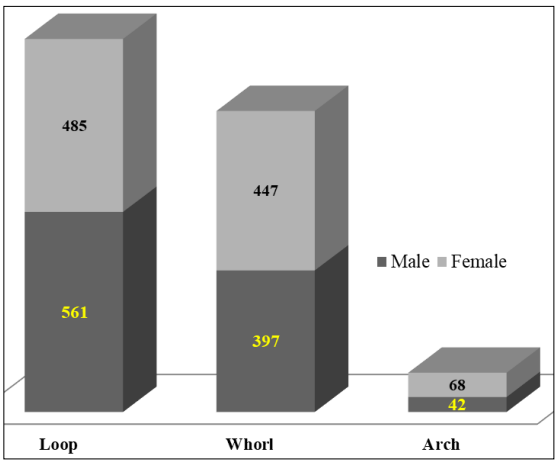

Fig 2: Sex distributions of various types of fingerprints

Conclusion

From our study following conclusion can be drawn

1. Just like worldwide distribution, we found that loop is the most common (52.3%) fingerprint in our study, followed by whorl (42.2%), but frequency of loop is lower than worldwide distribution, whereas whorls is on higher side.
2. Loops are mostly seen in middle and little fingers; and whorls are most common in ring fingers and the thumbs.
3. No significant differences are seen between right and left hands; except for the middle fingers, which show significant difference on right and left sides of all three patterns (p value 0.0057)
4. There is significant sex difference in the distribution of fingerprint patterns amongst both sexes (p value – 0.007); out of five fingers, only middle and little fingers precisely show significant sex differences (p value, middle finger – 0.0021, little finger - <0.0001).
5. Sex distribution of fingerprint pattern show presence of almost double number (1.88 times) of whorl pattern in little fingers of female than in male, and the arch pattern is completely absent in little fingers of male.
6. Almost half of the arches are seen on index fingers
7. There is no significant difference between distributions of fingerprint pattern is found in urban and rural locality.
8. At end, can we really comment that Indian Medical Students show more number of whorl pattern of fingerprints in their fingers? Similar studies catering more number of participants are desirable to make such a conclusion.

Conflict of Interest: None

Acknowledgement

MBBS students of Tezpur Medical College. The authors declare that we have no competing interests.

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