

Original Article



Comparative Dermatoglyphic Study Between Schizophrenic Patients and Healthy Controls

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Abstract

Introduction: Dermatoglyphics is the branch of medical science that is concerned with the study of dermal ridges present on fingers, palms, toes and the soles of the human being. There may have some association between fingerprints and schizophrenia regarding the developmental background of skin ridge pattern and brain. So this study was conducted to find out the fingerprint patterns in schizophrenic patients and also to find out sex variation of fingerprint patterns in between schizophrenic male and schizophrenic female. **Objective:** This study was carried out with a view to find out the fingerprint patterns in schizophrenic patients. **Methodology:** A total of 200 samples were selected. Among them, 100 were schizophrenic and 100 were normal healthy control. Samples were taken in between 15 to 40 years of age. Selection of schizophrenic sample was performed by a qualified psychiatrist. Fingerprints were taken by Ink and pad method, described by Cummins. Fingerprint patterns were observed by using a magnifying glass. **Results:** The frequency of common fingerprint pattern was reduced in schizophrenia. In healthy control loop pattern was predominant. But in schizophrenia frequency of loop pattern was reduced and there was an increased frequency of whorl and arch pattern. **Conclusion:** As dermatoglyphics is genetically determined, predominant whorl and arch pattern found among the schizophrenic patients might provide a presumptive value which would aid in diagnosis of the disease.

Key words: Dermatoglyphics, Fingerprint, Schizophrenia.

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Introduction

The analysis of skin ridge patterns by studying prints of them (fingerprints) is known as dermatoglyphics.¹ Dermatoglyphics is a Greek word; "derma" means skin and "glyphic" means to curve. The meaning of dermatoglyph is "a skin curving".² Use of fingerprint is one of the easiest method of personal identification. Fingerprints have been studied from the very ancient time in the world. Thumbprints were used on clay seals in ancient china.³ Sir William Herschel, in the Indian subcontinent in 1958, started the use of thumbprints as a form of signature among the illiterate Indians.⁴ The word "Dermatoglyphics" was first utilized in medical research by an anatomist named Harold Cummins in 1926.⁵ The morphology of the epidermal ridge is genetically determined. Fingerprints develop between 11th to 24th weeks of gestation.⁶ This time is

also important for the brain development. They both have a common origin from the ectoderm germ layer.⁷ So, there may have some biological and clinical values associated between the origin of the brain and skin ridge patterns. Francis Galton classified fingerprint pattern into three major types. They are Loop, Whorl and Arch.⁸ Loops are about 70%, whorl about 25% and Arches are about 5% in normal distribution.¹

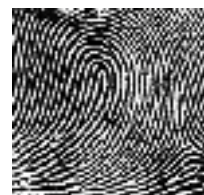


Illustration 01: Loop pattern (Adopted from reference no 17)

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Loop is such a pattern in which one or more ridges enter from either side, re-curve, touch or pass an imaginary line between delta and core and pass out upon the same side as the ridges entered.⁹



Illustration 02: Whorl pattern (Adopted from reference no 17)

Whorl is globalized by a typical concentric design. The majority of ridges incline to make a consummate circuit around the core, a pivotal feature in the interior of the pattern.⁹



Illustration 03: Arch pattern (Adopted from reference no 17)

The arches are described as patterns in which ridges enter from one side, elevate or curve at the center and flow out from the antithesis side.⁹

Schizophrenia is a clinical syndrome of variable, but profoundly disruptive, psychopathology that involves cognition, emotion, perception and other aspects of behavior. The expression of this manifestation varies across patients but the illness is always severe and is usually long lasting. Schizophrenia is equally prevalent in men and women. The incidence and prevalence rates are roughly equal worldwide which is about 1%.¹⁰

In the modern world dermatoglyphics has some important role in medical research. Presence of specific dermatoglyphic pattern is an accompanying feature in various groups of diseases such as chromosomal aberrations, sickle cell disease, psoriasis, cancer, congenital heart disease, mental disorder.^{11,12} Variation in the dermatoglyphic pattern is informative for early developmental brain disturbance. The variations do not suggest a specific disorder, but provides incentive to perform another test or re-examine the test results which was previously considered normal. When fingerprint patterns studied with clinical features of schizophrenia, they might help to confirm the diagnosis.

Material and Method

The present study was carried out in the Department of Anatomy and Department of Psychiatry at Rajshahi Medical College, Rajshahi in between January, 2017 to January, 2018. The research protocol was reviewed and approved by the Institutional Review Board of Rajshahi Medical College, Rajshahi. Two groups of people within the age of 15-40 years were randomly selected. One group containing 200 individuals of healthy control and another group of 200 schizophrenic patients were selected. Persons having a history of drug or alcohol abuse, an identifiable neurological disorder (e.g. Seizure, multiple sclerosis, etc.), head injury, any signs of mental retardation, psoriasis, congenital abnormalities like polydactyly, permanent scar on any of the either hand were excluded. The purpose and procedure of taking the finger print was first explained to the person. Fingerprint were taken by ink and pad method, which was described by Cummins. All the subjects were asked to wash their palmer aspects of finger clearly with soap and water. After drying by soft towel the fingers were placed on the ink pad. Then their fingers of both hands were placed on white papers and impressions were taken. The fingerprint patterns were noticed and then examined with magnifying glass to reveal the patterns of finger ridges. The fingerprint patterns of right and left hand were analyzed according to the subject and sex to the statistical test.

Illustration 04: Materials used for taking fingerprint.

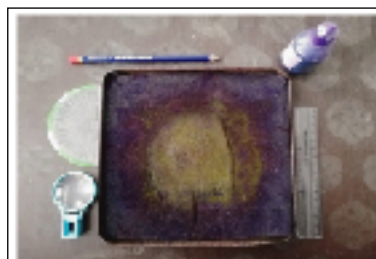


Illustration 05: Examination of a fingerprint using magnifying glass.



After data collection, processing and analysis were done. Observations and results were noted carefully. The results were presented in the forms of tables with necessary interpretation and inference. Collected data were analyzed by using computer based on SPSS software version-16. The test

of significance was conducted by using the Chi square test (X^2) and independent 't' test. The level of significance was set up at 0.05 and $P < 0.05$ was considered to be statistically significant.

Results

The present study showed that the frequency of common fingerprint pattern (loop pattern) was reduced in schizophrenic patients. Instead of that an increased frequency of whorl and arch patterns were found. Digit wise frequency of fingerprint patterns of schizophrenic male and schizophrenic female of the right and left hands were distributed in this study and their comparison was done. Both hands of the schizophrenic patients' loop pattern showed less frequency. The results were tabulated below according to fingerprint patterns of right and left hand among schizophrenic and healthy control groups. Digit wise distribution of fingerprint patterns of right and left hand among the groups are also presented below. The observation and results of this study were statistically analyzed and compared between the schizophrenic patients and the healthy control groups and between schizophrenic male and schizophrenic female patients also.

Figure 1: Distribution of schizophrenic patients and healthy controls by their sex (n=400).

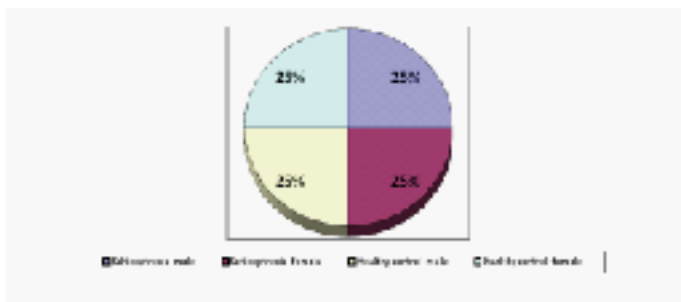


Table I: Fingerprint patterns of right hand in schizophrenic patients

Fingerprint pattern	Frequency (among 1000 fingers)	Percentage (100%)
Loop	505	50.5
Whorl	376	37.6
Arch	118	11.8
Other type	01	0.1

Table II: Fingerprint patterns of left hand in schizophrenic patients

Fingerprint pattern	Frequency (among 1000 fingers)	Percentage (100%)
Loop	497	49.7
Whorl	363	36.3
Arch	139	13.9
Other type	1	0.1

Table III: Fingerprint patterns of right hand in healthy controls

Fingerprint pattern	Frequency (among 1000 fingers)	Percentage (100%)
Loop	729	72.9
Whorl	239	23.9
Arch	32	3.2

Table IV: Fingerprint patterns of left hand in healthy controls

Fingerprint pattern	Frequency (among 100 fingers)	Percentage (100%)
Loop	770	77.0
Whorl	194	19.4
Arch	36	3.6

Table V: Digit wise distribution of fingerprint patterns of right hand in schizophrenic patients

Digit	Fingerprint patterns	Frequency (among 200 fingers)	Percentage (100)
1 st	Lo op	109	54.5
	Whorl	79	39.5
	Arch	12	6.0
2 nd	Lo op	70	35.0
	Whorl	78	39.0
	Arch	52	26.0
3 rd	Lo op	127	63.5
	Whorl	48	24.0
	Arch	25	12.5
4 th	Lo op	66	33.0
	Whorl	118	59.0
	Arch	16	8.0
5 th	Lo op	133	66.5
	Whorl	53	26.5
	Arch	13	6.5
	Other	1	0.5

Table VI: Digit wise distribution of fingerprint patterns of left hand in schizophrenic patients

Digit	Fingerprint patterns	Frequency (among 200 fingers)	Percentage (100)
1 st	Loop	108	54.0
	Whorl	68	34.0
	Arch	23	11.5
2 nd	Other Loop	1	0.5
	Whorl	80	40.0
	Arch Loop	52	26.0
3 rd	Whorl	72	36.0
	Arch Loop	39	19.5
	Loop	76	38.0
4 th	Whorl	110	55.0
	Arch Loop	14	7.0
	Loop	156	78.0
5 th	Whorl	33	16.5
	Arch	11	5.5

Table VIII: Digit wise distribution of fingerprint patterns of left hand in healthy controls

Digit	Fingerprint patterns	Frequency (among 200 fingers)	Percentage (100)
1 st	Loop	154	77.0
	Whorl	40	20.0
	Arch	6	3.0
2 nd	Loop	135	67.5
	Whorl	45	22.5
	Arch Loop	20	10.0
3 rd	Whorl	21	10.5
	Arch Loop	7	3.5
	Loop	130	65.0
4 th	Whorl	70	35.0
	Arch Loop	0	0.0
	Loop	179	89.5
5 th	Whorl	18	9.0
	Arch	3	1.5

Table VII: Digit wise distribution of fingerprint patterns of right hand in healthy controls

Digit	Fingerprint patterns	Frequency (among 200 fingers)	Percentage (100)
1 st	Loop	134	67.0
	Whorl	63	31.5
	Arch Loop	3	1.5
2 nd	Loop	135	67.5
	Whorl	43	21.5
	Arch Loop	22	11.0
3 rd	Loop	174	87.0
	Whorl	21	10.5
	Arch Loop	5	2.5
4 th	Loop	109	54.5
	Whorl	90	45.0
	Arch Loop	1	0.5
5 th	Loop	177	88.5
	Whorl	22	11.0
	Arch	1	0.5

Table IX: Comparison of fingerprint patterns of right hand between schizophrenic patients and healthy controls

Patterns of fingerprint	Group	Group		P-value
		Schizophrenia (n = 200)	Healthy controls (n = 200)	
1 st digit	Loop	109 (54.5%)	134 (67.0)	<0.01
	Whorl	79 (39.5%)	63 (31.5)	
2 nd digit	Arch Loop	12 (6.0%)	3 (1.5)	<0.001
	Loop	70 (35.0)	135 (67.5)	
3 rd digit	Whorl	78 (39.0)	43 (21.5)	<0.001
	Arch Loop	52(26.0)	22 (11.0)	
4 th digit	Loop	127 (63.5)	174 (87.0)	<0.001
	Whorl	48 (24.0)	21 (10.5)	
5 th digit	Arch Loop	25 (12.5)	5 (2.5)	<0.001
	Loop	66 (33.0)	109 (54.5)	
5 th digit	Whorl	118 (59.0)	90 (45.0)	<0.001
	Arch Loop	16 (8.0)	1 (0.5)	
5 th digit	Loop	133 (66.5)	177 (88.5)	<0.001
	Whorl	53 (26.5)	22 (11.0)	
	Arch	13 (6.5)	1 (0.5)	

Table X: Comparison of fingerprint patterns of left hand between schizophrenic patients and healthy controls

Patterns of fingerprint		Group		P-value
		Schizophrenia (n = 200)	Healthy controls (n = 200)	
1 st digit	Loop	108 (54.0)	154 (77.0)	< 0.001
	Whorl	68 (34.0)	40 (20.0)	
2 nd digit	Arch	23 (11.5)	6 (3.0)	<0.001
	Loop	68 (34.0)	135 (67.5)	
3 rd digit	Arch	52 (26.0)	20 (10.0)	< 0.001
	Loop	89 (44.5)	172 (86.0)	
4 th digit	Arch	39 (19.5)	7 (3.5)	< 0.001
	Loop	76 (38.0)	130 (65.0)	
5 th digit	Arch	14 (7.0)	0 (0.0)	<0.01
	Loop	156 (78.0)	179 (89.5)	
	Whorl	33 (16.5)	18 (9.0)	
	Arch	11 (5.5)	3 (1.5)	

Table XII: Comparison of fingerprint patterns of left hand between schizophrenic male and female

Patterns of fingerprint		Group		P-value
		Schizophrenic male (n = 100)	Schizophrenic female (n = 100)	
1 st digit	Loop	57 (57.0)	51 (51.0)	
	Whorl	36 (36.0)	32 (32.0)	0.165
2 nd digit	Arch	7 (7.0)	16 (16.0)	0.060
	Loop	28 (28.0)	40 (40.0)	
3 rd digit	Arch	24 (24.0)	28 (28.0)	0.064
	Loop	47 (47.0)	42 (42.0)	
4 th digit	Arch	13 (13.0)	26 (26.0)	0.075
	Loop	31 (31.0)	45 (45.0)	
5 th digit	Arch	6 (6.0)	8 (8.0)	0.580
	Loop	78 (78.0)	78 (78.0)	
	Whorl	18 (18.0)	15 (15.0)	
	Arch	4 (4.0)	7 (7.0)	

Table XI: Comparison of fingerprint patterns of right hand between schizophrenic male and female

Patterns of fingerprint		Group		P-value
		Schizophrenic male (n = 100)	Schizophrenic female (n = 100)	
1 st digit	Loop	51 (51.0%)	58 (58.0)	0.002
	Whorl	48 (48.0)	31 (31.0)	
2 nd digit	Arch	1 (1.0)	11 (11.0)	0.010
	Loop	25 (25.5)	45 (45.0)	
3 rd digit	Arch	28 (28.0)	24 (24.0)	0.023
	Loop	61 (61.0)	66 (66.0)	
4 th digit	Arch	8 (8.0)	17 (17.0)	0.032
	Loop	25 (25.0)	41 (41.0)	
5 th digit	Arch	7 (7.0)	9 (9.0)	0.139
	Loop	62 (62.0)	71 (71.0)	
	Whorl	33 (33.0)	20 (20.0)	
	Arch	5 (5.0)	8 (8.0)	

Discussion

In the present study, the percentage frequency of fingerprint patterns of schizophrenic patient and healthy control was distributed on tables.¹⁻⁴ The fingerprint pattern in schizophrenic patients shows that the loop was 50.5%, whorl was 37.6% and arch was 11.8% of right hand and loop was 49.7%, whorl was 36.3% and arch was 13.9% of left hand. The fingerprint pattern in healthy controls shows that the loop was 72.9%, whorl was 23.9% and arch was 3.2% of the right hand and loop was 77.0%, whorl was 19.4% and arch was 3.6% of left hand.

Percentage frequency of fingerprint patterns in schizophrenic patients was given by Sawant SU et al. (2013) which have few similarities with the present study where whorl pattern was common in schizophrenic patients.¹³ In the present study, whorl and arch pattern were more common in schizophrenic patients.

A dermaoglyphic study on Manic depressive psychosis and schizophrenia was done by Balgir RS et al. (1980). According to their finding loop pattern was less in number and whorl pattern has been frequently present in schizophrenic patients.¹⁴ Their findings were similar to the present study result.

Digit wise frequency of fingerprint patterns of schizophrenic patient and healthy control was distributed on tables.⁵⁻⁸ Loop pattern was predominant in 1st, 3rd and 5th digits

(54.5%, 63.5% and 66.5%, respectively) of the right hand of schizophrenic patients. In 2nd digit and 4th digit ((39.0% and 59.0%) whorl pattern was predominant (Table V). In left hand of schizophrenic patients loop pattern was predominant in 1st, 3rd and 5th digits (54.0%, 44.5% and 78.0%, respectively) and in 2nd digit (40.0%) and 4th digit (55.0%) whorl was predominant (Table VI). In table VII, right hand of healthy control's digit wise distribution of fingerprint patterns showed that loop pattern was predominant in all digits (67.0%, 67.5%, 87.0%, 54.5%, and 88.5%, respectively). Their left hand in table 8, also showed loop pattern as the predominant pattern in all digits (77.0%, 67.5%, 86.0%, 65.0%, and 89.5%, respectively).

In the present study digit wise frequency and statistical analysis were done between schizophrenic patients and healthy controls of their right and left hand in table IX and table X. But digit wise frequency and statistical analysis were not given by all previous researchers. Some of them showed the statistical analysis between schizophrenic male patients and male healthy controls or between female schizophrenic patients and female healthy controls. On both of the hands, whorl and arch pattern of fingerprints demonstrated their significant presence in schizophrenic patients than those of their healthy counterparts among all the digits and loop patterns were significantly more in healthy controls.

Digit wise frequencies of fingerprint patterns in schizophrenic and normal male given by Sawant SU et al. (2013) have some similarities with the present study. They found whorl pattern was more common in schizophrenic patient that was similar with the present study, but arch pattern was less frequent and their findings were not statistically significant.¹³

Digit wise frequency of fingerprint patterns of schizophrenic male and schizophrenic female of the right and left hand was distributed in this study and their comparison was done (Table XI and XII). In the right hand whorl pattern was more common in schizophrenic male and arch pattern is more common in schizophrenic female. Differences were significant in 1st to 4th digit. No significant difference found in 5th digit. In left hand similar finding has found that whorls were more in male schizophrenic patient and arch patterns were more in female schizophrenic patient but differences were not significant statistically. Both hands on the schizophrenic patient loop pattern showed less frequency.

Mellor C S (1968) conducted a study on schizophrenic subjects where the findings were not differing significantly. Mellor CS (1968) also listed a table where some investigators gave the frequency of fingerprint patterns of schizophrenic patients. As cited by Mellor, whorl and arch pattern commonly found by Raphael and Raphael, and Beckman et al. among the schizophrenic patients, the findings of them have similarities with the present study; Pons J found no difference between cases and controls; few similarities have found with the findings of Poll H, Moller N B, Wendt and Zell where Poll H showed that whorl pattern was more in schizophrenic female but their arch was less common and in schizophrenic male arch pattern was more common; Moller N B found increased frequency of arch pattern in both male and female

schizophrenic patient and increased frequency of whorl pattern in male schizophrenic patient; Wendt and Zell found more arch pattern in female schizophrenic patient and more whorl pattern in male schizophrenic patient, these findings have similarities with the present study results.¹⁵

Another study done by Papova FA et al. (2013) showed increased frequency of whorl pattern in schizophrenic male and whorl and arch pattern in schizophrenic female patients in both hands. Their differences were statistically significant. Present study result has similarity with their study.¹⁶

Kudalkar UN and Madhale NR 2016 conducted a study on dermatoglyphic patterns in schizophrenia which has some similarities with the present study. According to their finding whorl pattern was more in male schizophrenic patient, but the difference was not significant. The present study result also revealed whorl patterns frequency in male schizophrenic patient. Arch pattern was less frequent in female schizophrenic patient, which was not similar to the present study result.¹⁷

Conclusion

The frequency of common fingerprint pattern was reduced in schizophrenia. In healthy control loop pattern was predominant. But in schizophrenia frequency of loop pattern was reduced and there was an increased frequency of whorl and arch pattern. Dermatoglyphic trait has its own limitation when used alone, but combined with other clinical features it would play an important role in the diagnosis of schizophrenia.

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