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Original Article

PALMAR DERMATOGLYPHICS OF AUTISTIC AND HEALTHY CHILDREN IN RAJSHAHI DISTRICT OF BANGLADESH : A COMPARATIVE STUDY

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Abstract:

Background: *Dermatoglyphics is the scientific study of the typical ridges found on human fingers, palm of the hands, toes and soles of the feet. There may be variation of fingerprints between autistic and healthy children.*

Objective: *The purpose of the study was to assess and compare the fingerprint patterns between autistic and healthy children.*

Methodology: *It was a cross sectional type of comparative study conducted under the guidance of Anatomy department of Rajshahi Medical College for a period of 1 year from January 2023 to December 2023. This study was performed on 220 children between the age of 05-15 years group, among them 110 were autistic and 110 healthy children.. Fingerprints were taken by ink and pad method of Cummins..*

Result: *Distribution of fingerprint pattern in right hand of the autistic children showed that loop pattern was 63.6%, whorl was 24.9% and arch was 11.1% and in case of healthy loop was 74% whorl was 19.1% and arch was 6.7%. Fingerprint pattern of left hand of autistic children revealed that the loop was 66.4%, whorl was 22.4% and arch was 10.7% and in healthy children loop was 70.4%, whorl was 21.4% and arch was 7.8 %. The pattern differences between autistic and healthy children were highly significant ($p < 0.001$) .The mean ATD angle was 39.23° ± 2.5 in autistic children and was 43.23° ± 4.5° in healthy. The ATD angle was significantly increased in healthy children ($p < 0.001$ for each group).*

Conclusion: *The present study stated that the fingerprint pattern of autistic children was different from the healthy children. So, it might be helpful for the diagnosis of neurodevelopmental diseases.*

Key Word:
Dermatoglyphics, Loop,Whorl, Arch, ATD angle.

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Introduction:

Dermatoglyphics is the branch of Medical Science that deals with the study of epidermal ridges of skin found on the tip of the fingers, palm of the hand, tip of the toes and sole of the foot. Epidermal ridges are formed at 10th weeks of gestation and at 24th weeks they remain unchanged.[1] Dermatoglyphics is unique for each person, which may be determined by a number of parameters that could help in diagnosis and treatment of individual.[2] It is one of the most widely used method for personal identification.[3] It is a non-invasive method. In modern world the importance of fingerprint is not only restricted in the field of forensic and criminal applications but also important for

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anthropological and racial identification. Measurable parameter includes the frequency of ridges of particular pattern and disposition of triradius junctional areas where three sets of parallel ridges meet. Francis Galton (1892) classified fingerprint patterns into three major types: loop, whorl and arch. 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 that cross upon the same side as the ridges entered.[4] 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. The arches are described as pattern in which ridges enter from one side, elevate or curve at the center and flow out from the antithesis side.[5] Loops are about 60-70%, whorls are about 25-35% and arches are about 6-7% in distribution. Axial Triradius angle or ATD angle is a dermatoglyphics trait which is widely used in dermatoglyphics studies The angle is formed by drawing lines between the triradii below the index and little digit, most proximal triradius on the hypothenar region of palm.

Depending upon the proximity to the lower margin of the palm, it is designated as t, t‘ and t“.[6] The value of the angle < 45º corresponds to t, value of intermediate to 45º - 56º is t‘ and > 56º is t“.[7] Fingerprints are characterized by altering strips of raised friction ridges and the grooves that form specific pattern. So they remain intact throughout the life from infancy to old age. The properties of fingerprints are never duplicated. They are distinctive and unique for each individual.[7] Even identical twins do not have identical fingerprints though their identical genes given them very similar patterns.[9] Dermatoglyphics is correlated with genetical abnormalities. It is useful in diagnosis of congenital malformations and mental retardation such as Autism, Down syndrome, Schizophrenia etc. Specific dermatoglyphics in patients with autism and mental retardation can be used as screening tools for diagnosis.[10] The involvement of nervous system is correlated with the development of epidermal ridge pattern. Disorders of neural development such as autism which is marked by defective synaptic function and aberrant neural connectivity.[11] Formation of dermatoglyphics pattern is associated with testosterone during pregnancy, while testosterone also affected the development of nerve in the brain.[11]

The incidence and prevalence rates are roughly equal worldwide which is about 1% .[12] Autism is a condition involving a severe neurodevelopmental disorder and is characterized by impairment in social interaction and communication, as well as restricted and repetitive behavior.[3] Autism is usually classified under a large family called Autism Spectrum Disorder (ASD) or Pervasive Developmental Disorder (PDD). Autism Spectrum Disorder (ASD) are complex clinical condition of brain that express at around two with a core set of symptoms which is relating to people in unusual ways, delayed language development as well as repetitive or stereotyped behaviors.[13] Autism and fingerprints are associated with biological and clinical values as the ridges and brain have a common epidermal origin during 10th - 24th weeks of gestation.[14] Presence of specific dermatoglyphics pattern is an accompanying feature in various groups of diseases such as chromosomal aberrations, sickle cell disease, psoriasis, cancer, congenital heart disease and mental retardation.[15] But there are some exceptional condition in which there is absence of fingerprints termed as Adermatoglyphia (Gray’s 2021). In cases of leprosy, patients being treated with anticancer drugs, ectodermal dysplasia, repeated x-ray, acerbic agents, grievous injuries may cause harm to the fingerprints.[16] A very few number of study has been done about Palmar dermatoglyphics in autism in different countries. For this reason, this study would conducted. This study might provide information about the dermatoglyphics of autistic children in Rajshahi district of Bangladesh .

Materials and Methods

This was a cross-sectional type of comparative study, conducted in the Department of Anatomy, Rajshahi Medical College, Rajshahi. Data were collected from the Autistic Institutes for the autistic children and Primary and High school for healthy children over the period of January 2023 to December 2023. Total 220 children of 05-15 years age would be included in this study (110 autistic and 110 healthy children) their palm and fingers of both hands was placed on white paper and impressions were taken by ink pad Method of Cummins. The fingerprint pattern was observed and screened with magnifying glass to reveal the pattern of finger ridge. Their ATD angle was made by joining two lines from the triradii below the index and little digits. Data were expressed as frequency and corresponding percentage, quantitative data were presented as mean/median and standard deviation (SD).

Chi-square test was done for quantitative comparison. The statistical significance was evaluated as appropriate probability level and p < 0.05 was considered statistically significant for all tests by using SPSS (Statistical Package for Social Sciences), version 25.0. The statistical significance was evaluated as appropriate probability level and p < 0.05 was considered statistically significant for all test

Results :

Table-I

Distribution of Autistic and Healthy children by age (n =110 in each group)

Age	Frequency	%	Frequency	%
05-10 y	57	51.8	65	59.1
11-15	53	48.2	45	40.9
Total	110	100	110	100

A total 220 children were enrolled in this study. The mean age was 7.4± 2.5 SD years (range = 05- 15 years) in Autistic children and 13.6 ± 2.4 SD years in Healthy children.

Table-II

Distribution of children by sex (n =110 in each group)

Sex	Autistic children		Healthy children	
distribution	Frequency	%	Frequency	%
Male	58	52.7	54	49.1
Female	52	47.3	56	50.9
Total	110	100	110	100

Accordingly, the sex distribution, 58 (52.7%) were autistic male and 52 (47.3%) were autistic female. On the other hand 54 (49.1%) were healthy male and 56 (50.9%) were healthy female.

Table-III

Distribution of fingerprint pattern of right hand in Autistic and Health children

Fingerprint pattern	Autistic children n = (110 × 5) = 550		Healthy children n = (110 × 5) = 550	
	Frequency	%	Frequency	%
Loop	350	63.6	407	74
Whorl	137	24.9	105	19.1
Arch	63	11.5	38	6.9
Total	550	100	550	100

It revealed that fingerprints pattern of right hand. The loop pattern was 350 (63.60%), whorl was 137 (24.9 %), arch was 63 (11.5 %) in autistic and loop was 407 (74%), whorl was 105 (19.1 %), arch was 38 (6.9 %) in healthy children

Table-IV

Distribution of fingerprint pattern of left hand in Autistic and Healthy children

Fingerprint pattern	Autistic children n = (110 × 5) = 550		Healthy children n = (110 × 5) = 550	
	Frequency	%	Frequency	%
Loop	365	66.4	387	70.4
Whorl	123	22.4	118	21.4
Arch	62	11.2	45	8.2
Total	550	100	550	100

It revealed that fingerprints pattern of left hand : the loop pattern was 365 (66.40%), whorl was 123 (22.4 %) arch was 62 (11.2 %) in autistic and loop was 387 (70.4%), whorl was 118 (21.4 %), arch was 45 (8.2 %) in healthy children

Table-V

Comparison of ATD angle of right hand between autistic and healthy children

ATD angle	Autistic (n = 110)	Healthy (n = 110)	p-value
<45º	89 (80.9%)	72 (65.5 %)	< 0.001
45º-56º	19 (17.3%)	33 (30%)	< 0.001
>56º	02 (1.8%)	05 (4.5%)	< 0.001
Mean ATD	38.23º ± 2.5º	43.23º ± 4.5º	< 0.001

Mean angle = (34.34° ± 2.8 °) ; Range : (37Ú- 56Ú) in Autistic

Mean angle = (44.35° ± 7.5°) ; Range : (32Ú-84Ú) in healthy.

Table-VI

Comparison of ATD angle of left hand between autistic and healthy children

ATD angle	Autistic (n = 110)	Healthy (n = 110)	p-value
< 45º	86 (78.2%)	85 (65.5 %)	< 0.001
45-56º	23 (20.9%)	20 (30%)	< 0.001
Ã 56º	01 (0.9%)	05 (4.5%)	< 0.001
Mean ATD	39.23º ± 2.5º	42.23º ± 4.5º	< 0.001

Mean angle = (39.34° ± 2.8°) ; Range : (36°-55°) in Autistic

Mean angle = (43.35° ± 7.5°) ; Range : (32°-84°) in health.

Table-VII

Comparison of fingerprint pattern of right hand between autistic and healthy children :

Digit	Fingerprint pattern	Autistic (n=110)	Healthy (n=110)	p-value
1st	Loop	78 (70.9)	94 (85.5)	< 0.001
	Whorl	07 (6.4)	11(10)	< 0.001
	Arch	25 (22.7)	05 (4.5)	< 0.001
2nd	Loop	68 (61.8)	68 (61.8)	Ã 0.05
	Whorl	23.6)	30 (27.3)	< 0.001
	Arch	16(14.6)	12 (10.9)	< 0.01
3rd	Loop	71 (64.5)	83 (75.5)	< 0.001
	Whorl	27 (24.6)	18 (16.4)	< 0.001
	Arch	12 (10.9)	09 (8.1)	< 0.001
4th	Loop	42 (38.2)	69 (62.7)	< 0.001
	Whorl	65 (59.1)	33 (30)	< 0.001
	Arch	01 (0.9)	07 (6.4)	< 0.001
	Loop	91(82.7)	93 (84.6)	< 0.01
5th	Whorl	12 (10.9)	13 (11.8)	< 0.01
	Arch	07 (6.4)	04 (3.6)	< 0.001

Table-VIII

Comparison of fingerprint pattern of left hand between autistic and healthy children:

Digit	Fingerprint pattern	Autistic (n = 110)	Healthy (n =110)	p-value
1st	Loop	78 (70.9)	90 (81.8)	< 0.001
	Whorl	06 (5.5)	11 (10)	< 0.001
	Arch	26 (23.6)	09 (8.2)	< 0.001
2nd	Loop	71 (64.5)	66 (60)	< 0.001
	Whorl	25 (22.7)	29 (26.4)	< 0.001
	Arch	14 (12.7)	15 (13.6)	> 0.05
3rd	Loop	64 (58.2)	76 (69.1)	< 0.001
	Whorl	35 (31.8)	24 (21.8)	<0.001
	Arch	11 (10)	10 (9.1)	> 0.05
4th	Loop	56 (50.9)	67 (60.9)	< 0.001
	Whorl	50 (45.5)	37 (33.6)	< 0.001
	Arch	04 (3.6)	06 (5.5)	< 0.01
	Loop	96 (87.2)	88 (80)	< 0.001
5th	Whorl	07 (6.4)	17 (15.5)	< 0.001
	Arch	07 (6.4)	05 (4.5)	< 0.01

The comparison of fingerprint pattern of right hand between autistic and healthy children showed that.loop was higher in healthy than autistic and it was highly significant ($p < 0.001$) in all digits except 2nd digit.

The comparison of fingerprint pattern of left hand between autistic and healthy children showed that.loop was higher in healthy than autistic and it was highly significant ($p < 0.001$) in all digits.

Discussion:

In this study, the fingerprint of right hand in autistic children revealed that 63.6 % was loop pattern, 24.9% was whorl and 11.5% was arch. On the right hand of healthy children, the loop pattern of was 74%, the whorl was 19.1 % and arch was 6.9%. The fingerprints of left hand in autistic children revealed that the loop pattern was 66.4%, whorl was 22.4% and arch was

11.2%. The left hand of healthy children showed that the loop pattern was 70.4%, the whorl was 21.4% and arch was 8.2%. Nearly similar findings were seen.[2]

The significant increased frequency of whorl pattern and decreased arch pattern in autistic children were mentioned.[15]

The distribution of fingerprint pattern of right hand in autistic children by digit revealed that

the loop pattern was predominant on 1st, 2nd, 3rd and 5th digit while 4th digit showed predominant whorl pattern. The fingerprint pattern of left hand in autistic children by digit revealed that loop pattern was predominant on all the digits.

This study showed that, the loop pattern of healthy children was predominant on both hands.

The comparison of fingerprint pattern between the autistic and healthy children demonstrated that loop pattern was found statistically highly significant ($p < 0.001$) on both hands. The whorl and arch pattern of both hands was found statistically highly significant ($p < 0.001$).

Dissimilarity was also found in some cases.[11,14] The ATD angle of right hand < 45° was 80.9 % in autistic and 65.5% in healthy children, angle between 45º-56º was 17.3% in autistic and 30% in healthy children; angle > 56° was 1.8% in autistic and 4.5% in healthy children. The mean angle on right hand in autistic was 39.23º ± 2.5º and in healthy children was 43º.23° ± 4.5°. The ATD angle of the left hand, < 45° was 78.2 % in autistic and 70.9% in healthy children, angle between 45º-56º was 20.9 % in autistic and 20% in healthy children; angle > 56º was 0.9 % in autistic and 9.1% healthy children. The Mean angle was 39.34°±2.8° in autistic and 43.35°±7.5° in healthy children. Dissimilarity was found some study[2]. The comparison of ATD angle of both hands between autistic and healthy children was highly significant ($p < 0.001$).

Thye narrower ATD angle was observed (< 45º was 68.5% in autistic).[12]

Conclusion:

This study demonstrated that the fingerprint patterns of autistic children differ from healthy. In the autistic children, the loop pattern was 65 %, whorl was 23.6 %, and arch was 11.7%; in the healthy children, loop was 72.2 %, whorl was 20.3 % and arch was 7.5%. So, the loop pattern was predominant in both autistic and healthy children but relatively higher whorl and arch pattern were found in autistic children. Only the whorl pattern was predominant (59.1%) on 4th digit of right hand in autistic children. The ATD angle was narrower (< 45° was 80.9 % in autistic and 65.5% in healthy children) in autistic children than healthy (mean ATD angle was 38.23Ú ± 2.5Ú in autistic and 42.23Ú ± 4.5Ú in healthy children).

Limitation of the study:

The study was done only in Rajshahi district,

so the result was not represented the whole country. Sample size was small (Only 220). Modern technology like scanner machine was not possible to use, only traditional method was followed.

Recommendations:

Further extensive research might be done. A large sample size should be conducted to determine the prevalence of autism.

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