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Brief Report

Comparative Dermatoglyphic Study between Autistic Patients and Normal People in Iran

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Abstract

Autism is a neurodevelopmental disorder originating from early childhood; nevertheless, its diagnosis is in older ages. In addition to heredity, environmental factors are also of great significance in the etiology of the disease. Dermatoglyphic patterns, albeit varied, remain stable for a lifetime and yield a large number of patterns upon examination. Studies have shown a significant association between dermatoglyphics and some diseases, especially genetic ones. We compared fingerprints between patients with autism and normal individuals in a Fars population living in Khorasan-Razavi Province, Iran, in 2015. The right and left hand fingerprints of 104 autistic individuals (case group; age range=5–15 y) were collected using a fingerprint scanner. The same process was performed for 102 healthy individuals, in the age range of 6 to 25 years. All dermatoglyphic patterns and ridge counts were determined. The data were analyzed using the Mann–Whitney nonparametric test and binomial distribution. There was a significant difference in the distribution of the dermatoglyphic patterns on the right and left thumbs and the index fingers between the case and control groups ($P<0.05$). The patients had a significantly higher count of loops on their right and left thumbs and their index fingers. A significant decrease in ridge counts for the right and left thumbs and the index fingers was observed in the patients compared to the controls. The results suggested that the patterns were associated with the risk of autism. The patterns may be drawn upon as biometric parameters in the screening of children with autism.

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Keywords ● Autistic disorder ● Dermatoglyphics ● *Fingerprint* ● Child ● Risk

What's Known

- Since dermatoglyphic patterns (both ridge count and fingerprints) formed in development may take an abnormal pattern, they could help identify the cause of some diseases.
- Important information on the correlation between finger patterns and ridges and the risk of some diseases such as schizophrenia has been reported.

What's New

- Given the impact of genetic and environmental factors in autism as well as the probable coincidence of genetic effects on developmental variations evident in dermatoglyphic patterns, the present study demonstrated significant differences in the loop pattern distribution of the left index finger and the arch and loop patterns of the left thumb between controls and patients.

Introduction

Autism is a group of neurodevelopmental abnormalities originating from early childhood and is classified into different diagnostic groups, including autistic disorder, Asperger syndrome, atypical autism or autism-like condition, Rett syndrome, and childhood disintegrative disorder.[1,2] A group of cognitive disorders and neurobehavioral abnormalities that could be seen in the form of socialization problems, impaired verbal and nonverbal communication, and restricted and stereotyped patterns of behavior manifest in the affected children.[2,3]

To date, examinations of different kinds of genetic variations have found that hundreds of genes are associated with autism.[4] Thus, autism spectrum disorder is not caused by defects in a

single gene; it is rather caused by defects in a genetic pathway as environmental factors influence the quality and quantity of gene expression through affecting genes responsible for the disease, with these changes transferred to the next generation.[5]

Dermatoglyphics is the study of ridges in palms; one in which feet and fingertips as well as genes play a decisive role in the emergence of these patterns.[6,7] Finger ridges are formed under the control of both environmental and genetic factors so they could serve as a reflection of genetic and early developmental events. Studies have revealed a relationship between dermatoglyphics and some negative factors during gestation.[8] Fine dermal ridges at fingertips are formed at the end of the 4th month of gestation.[9] Since dermatoglyphic ridges formed in this critical period may take an abnormal pattern, they could assist in identifying the cause of some diseases.[10] Important information on the correlation between finger ridges and the risk of some diseases such as schizophrenia has been reported.[11] Qualitative dermatoglyphic patterns are classified into 3 major groups: arch, loop, and whorl. The present study evaluated and examined the quantitative and qualitative characterizations of the dermal ridges of fingertips and their patterns in autism sufferers, and the results were compared with those from a control group to assess the existence of any significant relationship between the patterns and the risk of autism.

Patients and Methods

The present research, designed as a cross-sectional study, was performed via random sampling in 2015. The study population comprised a group of patients with autism and a group of healthy controls from the Fars population living in Khorasan-Razavi Province, Iran.

The case group, consisting of 16 girls and 88 boys (age range=5–15 y; mean age=12±3/2 y), was selected from individuals with autism, confirmed by a psychiatrist and the medical commission according to the DSM–5 diagnosis criteria. The control group was comprised of 16 girls and 86 boys (age range=6–25 y; mean age=16±6/3 y) with no history of genetic disease and no symptoms of autism both in themselves and their first-degree relatives. The case group was randomly selected from among students with Fars ethnicity studying in schools and universities in Khorasan-Razavi Province.

Sample size was estimated by using PASS software. In view of that, the minimum sample sizes of 102 and 104 for the case and control groups, respectively, were considered.

Dermal Ridge Records

In this research, the fingerprints of the participants' right and left index fingers and thumbs were collected in both groups. The type of pattern having been determined, the fingerprints were investigated for the frequency of each pattern and ridge count. In all the stages of the research, the authors adhered to all relevant technical principles to ensure that the fingerprints were valid and reliable. An optical fingerprint scanner (Futronic-FS80), connected to a computer via a USB cable, was employed for fingerprinting.

Ridge count was verified by counting the number of lines between the center point and the triradius of each finger. Subsequently, the data obtained were analyzed via statistical methods. Due to the non-normal distribution of the data obtained for ridge count, the findings were analyzed using the Mann–Whitney nonparametric test in SPSS software (version 21). The ridge patterns were analyzed using binomial distribution with regard to the homogeneity of these patterns.[11]

Ethical Considerations

The participants' written consent was obtained and to protect the participants' privacy, all information was kept confidential and used anonymously.

Results

In this study, 104 patients with autism (5–15 years old) and 102 healthy volunteers (6–25 years old) were enrolled. The ridge counts and ridge patterns of the right and left thumbs and index fingers were separately analyzed in the 2 groups. The mean ridge counts for both groups are depicted in tables 1 and 2. The mean ridge counts of the index finger on both left (17.99±2.39) and right (16.37±2.87) hands of the control group were significantly higher than those of the patient group (left: 14.79±3.90, right: 13.80±4.62; P<0.001). The results also revealed that the mean ridge count of the right thumb in the healthy group was significantly higher than that in the patient group (16.27±3.36 vs. 13.40±4.89; P<0.001). The mean difference for the ridge count in the left thumb was acquired in both case and control groups (14.73±4.70 vs. 16.55±3.35, correspondingly; P=0.001).

Tables 1 and 2 present the frequencies of the dermatoglyphic patterns in the 2 groups. The exact binomial test was used to compare

Table 1: Frequency distribution of the index fingerprint patterns in the 2 groups

Groups	Patterns							
	Arch		Whorl		Loop		Total	
	Number	%	Number	%	Number	%	Number	%
Left index								
Case	8	7.69	42	40.39	54	51.92	104	100
Control	7	6.86	61	59.80	34	33.34	102	100
Right index								
Case	8	7.69	43	41.35	53	50.96	104	100
Control	11	10.79	55	53.92	36	35.29	102	100

Table 2: Frequency distribution of the thumb fingerprint patterns in the 2 groups

Groups	Patterns							
	Arch		Whorl		Loop		Total	
	Number	%	Number	%	Number	%	Number	%
Left thumb								
Case	4	3.85	42	40.38	58	55.77	104	100
Control	16	15.69	49	48.04	37	36.27	102	100
Right thumb								
Case	6	5.77	40	38.46	58	55.77	104	100
Control	12	11.76	50	49.02	40	39.22	102	100

the distribution of these patterns between the 2 groups. The distribution of the loop, arch, and whorl patterns of the index finger on the right hand was uniform in both groups, with no significant difference between the frequencies of these patterns. A homogeneous and uniform distribution pattern was also observed for the right thumb in the 2 groups.

For the index finger of the left hand, the arch and whorl patterns illustrated a uniform distribution in both controls and patients, while the distribution of the loop pattern revealed a statistically significant difference between the 2 groups (P=0.042). In the left-hand thumb, the arch and loop patterns were an indication of a non-uniform distribution, which was statistically significant (P=0.012 and P=0.04, respectively). No significant differences were observed in the frequency of the whorl pattern for the left thumb between the 2 groups.

Discussion

Dermatoglyphic patterns may be considered promising tools in diagnosing psychological disorders such as schizophrenia and bipolar disorder. Moreover, several studies have confirmed significant associations between dermatoglyphic patterns and some diseases with genetic predisposition. Hence, dermatoglyphics can be regarded as a useful and effective method for the early diagnosis and initial screening of some diseases.[12] In view of the fact that dermatoglyphic patterns remain unchanged from birth to the end of life of the individual and the ease of pattern characterization, a confirmation of the relationship between these patterns and the risk of autism could offer a clue for the diagnosis of patients. Several studies have evaluated the association between these patterns and the risk of autism. In 2013, Stošljević et al.[13] studied 182 boys with autism and 182 healthy men and reported significant differences in the distribution of both arch and whorl patterns between the patients and controls. In another study performed by Arrieta et al.[14] in Spain, children with autism displayed a significantly greater number of loop patterns and a significantly fewer number of whorl patterns than healthy controls.

In 1990, Wolman et al.[15] in America studied finger ridges in a group of 95 individuals with autism and compared the findings with those in a control group. Their findings revealed that there was no significant association with the different patterns of finger ridges between the patients and the controls. In 2003 Milicic et al.[16] in Croatia observed a significant difference in the ridge count of fingertips and palms between patients with autism and healthy controls. This significant difference was also noticed between the family members of the patients and those of the healthy controls. In another study performed in 1979 in Australia, a group of 32 children with autism and a control group of 32 healthy subjects were examined. Hartin et al.[17] established a significant difference in the distribution of dermal patterns and that of finger ridges between the 2 groups.

In the present study, differences between the mean ridge counts on the right and left thumbs and index fingers as well as the distribution of the dermatoglyphic patterns on the 2 fingers were compared between autistic patients and healthy controls. The mean ridge counts were found to be higher in the control group for both fingers on both hands (left thumb: P=0.001, other fingers: P<0.001). No significant difference was observed between the 2 groups in the distribution of the loop, arch, and whorl patterns on the thumb and index finger of the right hand, whereas a nonsignificant difference was observed between the 2 groups in the loop pattern distribution of the index finger on the left hand (P=0.042). Further, arch and loop each had a significantly higher frequency in the left thumb of the control and patient groups, respectively (P=0.012 and P=0.040).

In light of the statistical results obtained and the relationship between the distribution of the dermatoglyphic patterns along with significant differences in the ridge count between the case and control groups, it can be concluded that the patterns are associated with the risk of autism. Moreover, the dermatoglyphic patterns could be considered a mode of early screening of children with autism.

Conclusion

The current study demonstrated that these differences made it possible to distinguish patients with autism from control subjects. Our results encourage further studies to explain the exact role of both genetics and environment. Such studies should focus on genetic factors that simultaneously control the development of dermatoglyphic patterns as well as autism. Further investigations with more informative data on the association between the genetic background of dermatoglyphic patterns and autism will help establish these patterns as a valuable diagnostic approach.

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Conflict of Interest: None declared.

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