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Original Article

DERMATOGLYPHICS OF AUTISTIC PATIENTS IN LAGOS, SOUTHWEST NIGERIA

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ABSTRACT

Studies of selected traits were undertaken to determine the occurrence of dermatoglyphics in autistics as compared with the normal children in Lagos state. Finger and palm prints were taken from 22 autistic children and 22 normal children. Quantitative and qualitative analysis of the traits, descriptive statistics, t test ($p < 0.05$) and χ^2 ($p<0.001$), showed a significant difference in digital pattern types between autistic and normal children, but no significant difference in the total mean ridge count. Deferences in arches were not statistically significant. The total ridge count on both hands of autistic children is higher than in the normal. The *atd* (axial triradius) angle and *a-b* (distance between a triradius and b triradius) ridge count are higher in normal than in the autistic children. It was concluded that there is evidence to suggest the presence of definite dermatoglyphic features associated with autistic children compared to normal children.

Keywords: autistic, disorder, dermatoglyphics, development, patients
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INTRODUCTION

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 (Jasna *et al.,* 2003). It was first described by an American psychiatrist Leo Kanner (1943) and by an Austrian pediatrician Hans Asperger (1944). This condition manifests itself before a child is three years old and lasts for the person's whole life. Autism has a neurological

basis in the brain and genetic causes play a major role. However, the precise cause is still not known, nor it's true prevalence (Hill and Frith, 2003). Autism is usually classified under a larger family called the Autism Spectrum Disorder (ASD) or Prevasive Developmental Disorder (PDD) which include closely related syndromes such as Asperger Syndrome (World Health Organization, 2006). During early embryonic development, certain genetic factors which disrupt development of the central nervous system, could also influence early dermatoglyphic formation in autistic patients (Lainhart *et al.,* 1997). Therefore dermatoglyphics may offer some insight into the events during fetal development (Walker, 1977).

Dermatoglyphics is the study of the skin ridges found on the digits, palms, toes, and soles of primates and other mammals (Reed and Meier, 1990; Vashist., *et al*., 2010). The development of the ridges on the fingers, palms and soles occur between the 7th and 21st week of gestation, whilst the epidermal ridges appear on the pads by the 10th to 12th week of fetal life (Mulvihill and Smith, 1969). After this period, dermatoglyphic patterns remain unchanged except for an increase in size which is parallel with general growth. Studies have been conducted on digital and palmar dermatoglyphic patterns in certain medical conditions such as Down's syndrome, Turner's syndrome, Klinefelter"s syndrome, Cri-du-chat, Trisomy 13 and Trisomy 18 (Schaumann and Alter, 1976; Oladipo *et al.,* 2010; Vashist *et al*., 2011). The aim of this study was to analyse and compare the quantitive and qualitative dermatoglyphic traits in autistic and normal children in Nigeria.

MATERIALS AND METHODS

Subjects

The sample included 22 autistic children (14 males and 8 females) aged between 3 and 10 years. Subject selection was obtained at the Neurological Clinic, Lagos University Teaching Hospital (LUTH), Nigeria. Also, 22 normal children also participated in the study as the control samples. The controls were taken from the school system (Lagos university teaching hospital staff school).

Palm and finger prints of both hands were collected and analysed according to the techniques of Cummins and Midlo (1961). The dermatoglyphic traits analysed include:

(1) The Finger Print Patterns (FPP): the standard types of FPP considered were the arch (A), radial loop(r loop), ulnar loop (U Loop) and the whorl (W).

(2) Finger Ridge Count (FRC): for the left and right hand and the Total Finger Ridge Count (TFRC); this included the sum of the ten fingers ridge count. This counting was done along the straight line connecting the tri-radial point, formed by the confluence of the three ridge system to the point of core.

(3) a-b ridge count: this included two variables, the left and right hand a-b ridge count. The counting was done along the straight line, between 'a' triradius and the'd' triradius points.

(4) The atd angle was measured between 'a','t' and 'd' triradiu points for both hands. Following this procedure, the atd angle (measured in degrees) was

formed by drawing lines from the digital triradius 'a' to the axial triradius 'd'.

Statistical Analysis

The analyses included a descriptive statistics (mean (M) ± Standard Deviation (SD), using the student t-test ($p<0.05$) and ($p<0.001$) for the quantitative variables (student t- test was used in comparing all the quatitative parameter except analysis on percentage frequency of the total finger pattern in both normal and autistics groups in which chi-square was used)

RESULTS

The percentage frequencies of Arch, Ulnar loop, Radial loop and Whorl patterns of all the ten digits in both sexes in the two groups is shown in Table 1. Differences in finger patterns were in the proportion of arches (34.7%) and whorls (65.3%), in the autistic patients. Little differences exist in the loop pattern. The pattern difference between autistic and control subjects was significant, $\chi^2 = 19.634$, (df = 3), $p < 0.001$.

Table 2 showed the frequencies of finger pattern for each digit on both hands of female and male in both autistics and normal groups and total population (combination of male and female in each group). In the analysis, there was statistically significant increase for the left hand ($p<0.05$). A comparative study of each type of pattern showed significantly more whorls in autistic males than females. Also, there were more whorls in autistic females than their controls. The frequency of r loop was significantly higher for left hand in autistic male ($p<0.05$) than autistic female, while that of u loop was significantly lower for left hand in autistic male than normal male. In analyzing the arch pattern, a significant difference existed only for right hand ($p< 0.05$) with more arch in autistic males than autistic females.

The mean and standard deviation of the finger ridge count are shown in Table 3. The summed ridge counts of the right hand for the two groups in this study were greater than that of the left. Apart from the left hand of the autistic children, the digital ranking of the mean ridge scores for the left, right, and left plus right hands of the two groups were IV> I >V > III > II. The right hand of the autistic and the left plus right hand of the normal group indicated a reversal of digit IV and I. The left hand of the autistic children had a different mean ridge score ranking which was IV >I > III > V> II. The greatest variability in the normal population was on digit II, while the least was shown by digit V. This is true for the left and right hand. The autistic children however, had digit I as the most varied for right and right plus left hands. Digit II was the most variable for the left hand. The least varied was digit V for the left, right plus left hand but on the right hand digit IV was the least varied.

Table 1: Percentage frequency of total finger patterns in both normal and autistic groups

Finger Pattern	Normal Subjects No. (%)	Autistic Subjects No. (%)
Arch	22(10.0)	14(16.3)
Whorl	48(21.8)	91 (41.0)
U loop	77(35.06)	55 (24.8)
R loop	73(33.2)	62 (27.9)

Pattern difference: $\chi^2 = 19.634$ (df = 3); $P < 0.001$; *df=Degree of frequency

Table 4 showed the mean distribution of atd angle in both hands of normal and autistic subjectss. The mean atd angle for the autistic female group in the left and right hands were 46˚± 3.78 and 46.3˚ ± 4.50 respectively. In autistic males, the mean atd for the left hand was 42.6˚ ± 5.45 while, the right hand had 43˚ ± 5.66˚. The normal group have higher atd angle than the index group with the mean values of 48˚ ± 6.65 and 47.5˚± 6.93˚, respectively, for females while for the normal males it was 44.1˚ ± 5.63˚ on the left and 43.2˚ ± 5.64˚ on the right. The test was not statistically significant.

Table 2: Percentage frequencies of finger pattern for each digit of both hands in female group (autistic and normal), male group (autistics and normal) and total population (combination of males and females in each group).

Male n=(14)	Autistic					Normal				
Pattern	I	II	III	IV	V	I	II	III	IV	V
Arch										
R	7.1	-	21.4	-	-	14.2	-	7.1	7.1	7.1
L	7.1	21.4	7.1	-	-	42.9	28.9	71.4	28.6	85.7
R+L	7.1	10.7	14.3	-	-	28.6	14.3	39.3	17.9	46.4
Whorl										
R	64.5	50.0	35.5	42.9	35.7	35.7	28.6	21.4	50.0	-
L	50.0	35.7	35.7	50.0	21.4	28.6	21.4	14.3	57.1	7.1
R+L	57.1	42.9	35.7	46.4	21.4	32.1	25.0	17.9	53.6	3.6
Ulnar loop										
R	28.6	42.9	35.7	57.1	71.4	35.7	35.7	28.6	42.9	92.9
L	-	-	-	-	-	14.3	21.4	7.1	7.1	7.1
R+L	14.3	21.4	17.8	28.6	35.7	25.0	28.6	32.1	25.0	50.0
Radial loop										
R	-	7.1	7.1	-	7.1	14.2	-	7.1	7.1	7.1
L	42.9	42.9	57.1	50.0	78.6	42.9	28.9	71.4.	28.6	85.7
R+L	21.4	25.0	32.1	25.0	42.9	28.6	14.3	39.3	17.9	46.4
Female n=(8)										
Pattern										

Arch										
R	7.1	-	-	-	-	12.5	-	-	12..5	-
L	12.5	12.5	12.5	-	-	-	25.0	-	12.5	-
R+L	12.5	12.5	6.3	-	-	6.3	12.5	-	12.5	-
Whorl										
R	37.5	37.5	37.5	50.0	25.0	50.0	12.5	-	12.5	-
L	75.0	25.0	37.5	75.0	25.0	25.0	25.0	-	12.5	-
R+L	56.3	31.3	37.5	62.5	25.0	37.5	18.8	-	12.5	-
Ulnar loop										
R	50.0	50.0	62.5	57.1	62.5	35.7	35.7	28.6	42.9	92.9
L	-	-	-	-	-	14.3	21.4	7.1	7.1	7.1
R+L	25.0	25.0	31.3	25.0	31.3	25.0	28.6	32.1	25.0	50.0
Radial loop										
R	50.0	50.0	62.5	50.0	62.5	37.5	87.5	100.0	75.0	100.0
L	-	-	-	-	-	-	-	-	-	-
R+L	25.0	31.3	25.0	25.0	37.5	18.8	43.8	50.0	37.5	50.0

Male+female n=(22) Pattern										
ARCH										
R	9.1	4.5	13.6	-	-	13.6	22.7	9.1	45.5	-
L	9.1	18.2	9.1	-	-	9.1	27.3	4.5	59.1	-
R+L	9.1	11.4	14.3	-	-	11.4	25.0	6.8	52.3	-
Whorl										
R	54.5	45.5	36.4	45.5	22.7	40.9	22.7	13.6	36.4	-
L	59.1	31.8	36.4	59.1	22.7	27.3	22.7	9.1	40.9	4.5
R+L	56.8	38.6	36.4	52.3	22.7	34.1	22.7	11.4	38.6	2.3
Ulnar loop										
R	36.4	45.5	45.5	54.5	68.2	36.4	54.5	72.7	54.5	95 .5
L	-	-	-	-	-	9.1	13.6	4.5	4.5	4.5
R+L	18.2	22.7	22.7	27.3	34.1	22.7	34.1	38.6	29.5	50.0
Radial loop										
R	9.1	4.5	13.6	-	-	13.6	22.7	9.1	45.5	-
L	9.1	18.2	9.1	-	-	9.1	27.3	4.5	59.1	-
R+L	9.1	11.4	11.4	-	-.	11.4	25.0	6.8	52.3	-

*R= Right *L=Left *R+L=Right +Left

Table 3: Mean ± finger ridge counts of both hands in autistic and normal children

		Autistic			Normal		
Hand	Digit	Ridge Count	Mean	SD	Ridge Count	Mean	SD
Left Hand	I	264	13.2	5.98	250	11.36	5.50
	II	208	10.4	6.10	192	8.73	6.60
	III	232	11.6	5.99	211	9.59	5.11
	IV	281	14.05	4.15	249	11.32	4.67
	V	221	11.05	2.91	238	10.82	3.49
Right Hand	I	292	14.6	6.27	272	12.36	5.92
	II	214	10.7	4.71	194	8.82	6.46
	III	218	10.9	5.50	218	9.91	4.94
	IV	280	14	2.55	294	13.36	5.21
	V	232	11.6	3.59	246	11.18	3.19
Left + Right	I	556	27.8	6.09	522	23.73	5.66
Hand	II	422	21.1	5.38	386	17.55	6.51
	III	450	22.5	5.68	429	19.50	4.99
	IV	561	28.05	3.40	543	24.68	5.03
	V	453	22.65	3.24	484	22.00	3.29

Table 4**:** Mean ± SD of the atd angle of normal and autistic children, in both hands

	atd angles(degree)			
Sex	Normal Subjects		Autistic Subjects	
	Left	Right	Left	Right
Females	48.4 ± 6.65	47.5 ± 6.93	46 ± 3.78	46.3 ± 4.5
Males	44.1 ± 5.63	43.2 ± 5.64	44.1 ± 5.63	43 ± 5.66

Table 5: Mean ± SD of a – b ridge counts in normal and autistic subjects, in both hands

	a-b ridge count			
	Normal Subjects		Autistic Subjects	
Sex	Left	Right	Left	Right
Females	38.00 ± 4.31	38.90 ± 4.12	37.40 ± 3.20	37.10 ± 6.20
Males	37.00 ± 3.85	34.50 ± 6.52	37.90 ± 8.84	37.80 ± 7.72

The mean Total a – b Ridge Count (TABRC) in both hands is shown in Table 5. Female autistic children had lower mean TABRC than their normal counterparts while the reverse was the case for the male subjects, though such differences were not significantly different in all cases.

DISCUSSION

The results of this study showed some differences in the relative distribution of ridge patterns, as well as, digital and palmar ridge counts of the subject groups. Ridge pattern frequencies obtained from autistic children were markedly different from the control group, with increase in percentage of whorls, decrease in arches and loops. The significant increase in whorls is not in line with the findings of Hartin and Barry (1979). Decrease in the frequency distribution of arches in autistic subjects, though not statistically significant is also in contrast to those reported earlier in studies on autism (Walker, 1977; Hartin and Barry, 1979; Rosa *et al.,* 2001). Considerable variations have been reported on dermal patterns for adult schizophrenics. However, reduced arch patterns have been reported for childhood schizophrenics and a small sample of childhood psychotic or in mental defectives (Cummins and Midlo, 1961; Sank, 1968; Hilbun, 1970; Spence *et al.,* 1974). Whose findings are consistent with those of this study. The reduction in arch pattern of autistic children though not significant using t – test, $p<0.05$ may be as a result of reduced sample size available for this work. The autistic male showed higher frequency in radial loop than the autistic female subject although not statistically significant.

The summed ridge count of the right hand in both groups were greater than that of the left, these findings are consistent with Holt (1968) observation in a large normal population. Increase in the mean total ridge count of the autistic children, which was as a result of increase in whorl pattern, was not statistically significant. This observation contradicted those of Mellor (1968), Walker (1977) and Hartin and Barry (1979). The latter three research findings are in contrast to the higher ridge counts as also reported for a childhood psychotic group. However, the results of Hilbun (1970) and earlier research on adult schizophrenics (Singh, 1967; Rothhammer *et al.,* 1971) are in consonance with the findings of this study.

In this study, a smaller atd angle was observed in the autistic group but was not statistically significant from those of the control group. This is in line with the findings of Walker (1977). This may suggest possibilities of congenital interference in their development.

The a-b ridge count has a high degree of morphological variability related to environmental factors. Consequently, it has been considered particularly suitable in the investigation of developmental disorder of idiopathic origin. The a-b ridge count has been found to differentiate between patients of schizophrenia and normal controls (Turek, 1990; Fananas *et al.,* 1990; Fearon *et al.,* 2001). The results of this study showed insignificant a-b ridge count in the autistic female as compared with their control group. This is not statistically significant while in the male of the index group, it shows a slight increase in the mean a-b ridge count as compared to their normal group, though the difference was also not statistically significant.

This study confirms the presence of dermatoglyphic features associated with autism. The results are in certain aspects, similar to those obtained by previous researchers, but in other areas distinctly different. These suggest a racial and possibly environmental

influence on the dermatoglyphic pattern in autism. Also, there is a possibility that the cause of autism may be different in different parts of the world. However, field studies using larger sample frame may give opportunity for more definitive deductions.

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