International Journal of Anatomy and Research,
Int J Anat Res 2018, Vol 6(2.1):5114-21. ISSN 2321-4287
DOI: https://dx.doi.org/10.16965/ijar.2018.134

Original Research Article

DERMATOGLYPHIC PATTERNS OF SCHIZOPHRENIC PATIENTS IN A NIGERIAN POPULATION

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ABSTRACT

Introduction: Dermatoglyphic studies have been associated with many physical, behavioural and pathological traits. Ridge patterns are established early in intrauterine life and serve as effective tools in determining the development of a particular trait. This study was aimed at finding out whether there exists any dermatoglyphic patterns that could serve as predictive tools in the early detection of schizophrenia in a Nigerian population.

Materials and Methods: The study was carried out on 100 Nigerians whose parents and grandparents are Nigerians. They were made up of 50 diagnosed schizophrenic patients (25 males and 25 females) recruited from the Federal Neuro-Psychiatric Hospital, Uselu, Benin City and 50 healthy controls matched for age and gender. The palms and digits of the subjects were scanned with an HP scanner and images in jpeg format recorded using an AutoCAD software version 2010 and the images were analyzed for arches, whorls, loops and ridges counted with atd angles measured using standard methods.

Results: There was significant increase in loops and decreased in arches in the schizophrenic when compared with the control groups. Also, observed were significant increase in fingerprint patterns on the right 1st digit of female schizophrenic patients, 3rd, 4th and 5th digits on the left side also in female schizophrenics but only on the 4th left digit in male schizophrenics. There was also increase in the mean total finger ridge count (TFRC) in male schizophrenic patients.

Conclusion: These findings are indicative of dermatoglyphic variability between patients with schizophrenia and healthy controls and could serve as markers in the prediction of schizophrenia in our studied population.

KEY WORDS: Dermatoglyphics, Patterns, Schizophrenics, Nigerians.

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Access this Article online	Journal Information
Quick Response code	**International Journal of Anatomy and Research** ICV for 2016 90.30 ISSN (E) 2321-4287 | ISSN (P) 2321-8967 **https://www.ijmhr.org/ijar.htm** **DOI-Prefix:** https://dx.doi.org/10.16965/ijar
DOI: 10.16965/ijar.2018.134	**Article Information** Received: 05 Feb 2018 Accepted: 07 Mar 2018 Peer Review: 06 Feb 2018 Published (O): 05 Apr 2018 Revised: None Published (P): 05 Apr 2018

INTRODUCTION

Association of dermatoglyphics with numerous physical, behavioural, pathological traits have been reported in recent years. As the epidermal ridge patterns are established early in intrauterine life, it is considered that it can be an effective tool in determining the risk of development of a particular trait [1].

Dermatoglyphics is the study of pattern traceries of fine ridges on fingers, palms and soles, which are very useful tools in personal identification and in the determination of paternity. It is of importance because unlike most human traits it is unaffected by age, and the detailed structure of individual ridges is extremely variable and are not influenced throughout postnatal life by the environment [2]. Once formed, they remain unchanged throughout life except

for absolute growth [3]. Although they may be said to be stable after the fourth month, disturbances of embryonic growth and development prior to this time may be reflected in abnormal pattern types and frequencies.

Palmar creases develop during the 2nd and 3rd months of intrauterine life and are not even influenced by the movements of the hand in utero [4]. They are of considerable clinical interest because they are affected by certain abnormalities of early development including genetic disorders [5]. Abnormal dermatoglyphic patterns have been demonstrated in several non-chromosomal genetic disorders and other diseases whose etiology may be influenced directly or indirectly, by genetic inheritance [6,7].

It has also been proven that genetic factors recognized by dermatoglyphics are responsible for schizophrenia [3].

Schizophrenia is a major psychiatric illness and has an incidence of 0.85% in the general population [8]. It is characterized by disturbances in thinking, emotional and volitional faculties in the presence of clear consciousness and usually leads to social withdrawal [3].

Structural brain abnormalities such as distortion of the corpus callosum [9,10], septum cavum pellucidum [11,12] and congenital malformations [13,14] are more common in patients with schizophrenia than in controls. This suggests that schizophrenia is partially due to impaired neuro development that might have resulted because of environmental and genetic factors [15].

The differences in dermal ridge counts tend to be randomly distributed in both directions, thus they are distributed with fluctuating asymmetry. If fluctuating asymmetry is greater than in normal subjects then this suggests that disturbances of foetal development may play some part in the later development of schizophrenia [16]. The neuro-developmental hypothesis of schizophrenia suggests that adverse genetic load in conjunction with environmental factors early in foetal life cause disruption of foetal neural development [17].

One approach to studying neuro-developmental factors has been to look for neuro-developmental markers in adult schizophrenic patients. These markers are usually physical characteris tics that are measurable in adults which reflect abnormal neuro-development processes that occurred before or shortly after birth. One of such markers studied the most are dermatoglyphics [18]. Dermatoglyphics is considered as a classical model of polygenic inheritance [19].

This means that several genes are involved in the inheritance of the dermal traits.

Dermatoglyphic abnormalities in schizophrenia may be environmental that occurs when the brain may also be particularly vulnerable to such insults. A study of environmental and neuro developmental risk factors in schizophrenic disorders showed that the neurodevelopmental theory of the etiology of schizophrenia indicated either genetically or epigenetically controlled faulty embryogenic development of structures of ectodermal origin like brain and skin [20].

Both the skin and brain develop from the same ectoderm and it is thought, therefore, that dermatoglyphics are informative for early disturbances in brain development in schizophrenia [15].

Dermatoglyphic studies in schizophrenia have been carried out by a large number of investigators since 1934. So far the evidence has been controversial, with some authors claiming definite diagnostic features, while some other studies point to them not having significant clinical value [21].

Previous studies have also documented that individuals with schizophrenia have been found to have fewer whorl patterns, more arches and lower total finger ridge count (TFRC) than unaffected controls [15,22,23]. Dermatoglyphic patterns which are externally visible on an imprint in schizophrenia are, however, an expression of genes not on gene action [3].

Despite the studies enumerated above not much work has been done in a Nigerian population and certainly none in our population studied with regards to dermatoglyphic patterns and schizophrenia hence the need to bridge this gap in knowledge. This study therefore tends to show whether there exists any specific dermatoglyphic patterns as well as other quantitative dermatoglyphic variables that could be used as predictive tools in the early detection of schizophrenia in our studied population.

MATERIALS AND METHODS

This was a descriptive cross-sectional study of 100 Nigerians whose parents and grandparents are Nigerians. Fifty (50) of them were diagnosed schizophrenic patients (25 males and 25 females) from the Federal Neuro-Psychiatric Hospital, Uselu, Benin city. The other 50 are healthy individuals (25 males and 25 females) who are students of Delta State University, Abraka who served as control. All the studied subjects were matched for age and gender. All the subjects in the control group had no family history of schizophrenia to the second generation.

Furthermore, all the subjects gave their consent to participate in the study. Schizophrenic patients with burns or wounds on the palms and those who had other genetically linked conditions except schizophrenia were excluded. Also excluded were the individuals in the control group who did not give consent as well as those who had any deformities on their palms. Written approval was also sort from all the Ethical committees of the centers where the study was carried out.

Demographic details were obtained by interview administered questionnaires, giving age, gender, Nationality of parents and grandparents of the subjects as well as confirmed genetically linked disorders which were recorded. Thereafter the palms and digits were then placed flat on the Hp scanner provided with the thumb approximately 30 – 40 degrees, with the other digits abducted between 10-15 degrees. The images were then recorded in jpeg format on the provided laptop.

The Hp Scanjet used had a resolution of 9000 x 4800dpi with an installed computer with AutoCAD software version 2010. The scanner software was installed into the laptop operating system, which was customized. The pictures of the scanned palms and digits were saved on scan folders for easy identification using a new method [24]. With the aid of the AutoCAD software programme, the scanned images were analyzed for arches, whorls, ulnar and radial loops according to the method of Cummins and Midlo [25]. Ridges were also counted according to the method of Holt [19] and a-b ridge counts and atd angles measured between a, t and d triradii of both palms for all the studied subjects. The data obtained were statistically analyzed using the Statistical Package for Social Sciences Version 15 (SPSS) Chicago, Illinois. The dermatoglyphic variables were evaluated by means, frequencies, percentages and chi-square was used for qualitative variables while t-test was utilized for quantitative variables. Statistical significance was considered at the level of $P<0.05$.

RESULTS

Table 1: Percentage frequencies of fingerprint patterns between schizophrenic and control groups.

Fingerprint Patterns	Male		Female	
	Study Group	Control Group	Study Group	Control Group
Whorls	14	17.2	12.4	12.8
Arches	19.2	32	32	48.4
Loops	66.8	50.8	55.6	38.3

Table 1 shows the percentage frequencies of fingerprint patterns between schizophrenic and control groups. For both male and female schizophrenic group, loops had significantly higher percentage frequencies in fingerprint patterns than the control group, similarly the schizophrenic group had lower frequencies of fingerprint pattern of arches than the control group ($P<0.05$), chi-square). There was however, no significance difference between both groups in whorl percentage frequencies in fingerprint patterns ($P>0.05$, chi-square).

Tables 2a & b show the fingerprint patterns, frequencies and percentages of both palms and digits in the control and schizophrenic groups in female and male subjects respectively. There was significant difference in the right palm first digit between the control and schizophrenic groups. This was also the case in the left palms and 3rd, 4th and 5th digits of the control and schizophrenic groups in females ($P<0.05$). In males, however, the only significant difference was in the 4th digit of the left side ($p<0.05$).

Table 3 shows the mean a-b ridge count of schizophrenic and control groups. There was no significant difference between the control and schizophrenic groups in both palms with the control group showing a significant difference only between the right and left palms ($P<0.05$).

Table 2a: Fingerprint patterns, Frequencies and percentages of both palms and digits in the control and schizophrenic groups in female subjects.

Female subjects																				
Fingerprint patterns	Right palms and digital										Left palms and digital									
	Control Group										Control Group									
	Frequencies and Percentages										Frequencies and Percentages									
	RHF1	%	RHF2	%	RHF3	%	RHF4	%	RHF5	%	LHF1	%	LHF2	%	LHF3	%	LHF4	%	LHF5	%
Arches	9	36	12	48	12	48	11	44	8	32	12	48	14	56	15	60	13	52	15	60
Loops	16	64	8	32	11	44	7	28	15	60	10	40	6	24	8	32	8	32	8	32
Whorls	0	0	5	20	2	8	7	28	2	8	3	12	5	20	2	8	4	16	2	8
Total	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100
	Study Group										Study Group									
Arches	5	20	9	36	11	44	9	36	9	36	9	36	13	52	1	28	6	24	6	24
Loops	14	56	10	40	13	52	12	60	15	60	12	48	8	32	17	68	17	68	18	72
Whorls	6	24	6	24	1	4	4	4	1	4	4	16	4	16	1	28	2	8	1	4
Total	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100
P = Value	0.03		0.69		0.76		0.31		0.82		0.69		0.81		0.04		0.04		0.02	

Table 2b: Fingerprint patterns, Frequencies and percentages of both palms and digits in the control and schizophrenic groups in male subjects.

Male subjects																				
Digital Fingerprint patterns	Right palms and digital										Left palms and digital									
	Control Group										Control Group									
	Frequencies and Percentages										Frequencies and Percentages									
	RHF1	%	RHF2	%	RHF3	%	RHF4	%	RHF5	%	LHF1	%	LHF2	%	LHF3	%	LHF4	%	LHF5	%
Arches	5	20	9	36	10	40	6	24	8	32	9	36	9	36	8	32	8	32	11	44
Loops	14	56	10	40	11	44	9	36	16	64	13	52	13	52	13	52	12	48	14	56
Whorls	6	24	6	24	4	4	16	10	40	1	4	3	12	3	12	16	5	20	0	0
Total	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100
	Study Group										Study Group									
Arches	7	28	4	16	4	16	6	24	2	8	9	36	4	16	4	16	0	0	5	20
Loops	12	48	16	64	18	72	13	52	22	88	12	46	17	68	17	68	21	84	19	76
Whorls	6	24	5	20	3	12	6	24	1	4	3	16	4	16	4	16	4	16	1	4
Total	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100	25	100
P = Value	0.78		0.18		0.11		0.42		0.1		0.91		0.27		0.39		0.005		0.13	

Table 3: Mean a-b ridge count of schizophrenic and control groups.

Variables	Schizophrenic groups	Control groups
Females		
Right palm	38.38 ±4.87	38.80 ± 3.98
Left palm	40.00 ± 3.99	39.12 ± 2.93
Mean ± S.D	39.64 ± 4.97	38.96 ± 3.45
P = Value	0.88	0.38
Males		
Right palm	37.80 ± 2.48	38.28 ± 4.37
Left palm	39.28 ± 3.21	37.04 ± 4.22
Mean ± S.D	38.54 ± 2.28	37.66 ± 4.28
P = Value	0.64	0.04

Table 4: Mean TFRC of males and females schizophrenic and control groups.

Variables	Females	Males
Study	94.56 ± 38.54	113.40 ± 22.70
Control	68.88 ± 53.47	93.04 ± 45.29
p.value	0.57	0.05

Table 5: Mean atd angle of right and left palms of males and females schizophrenic and control groups.

Variables	Schizophrenic group	Control group	p- value
Females			
Right palm	42.68 ± 4.82	43.16 ± 4.60	0.72
Left palm	42.52 ± 5.01	44.52 ± 5.47	0.18
Males			
Right palm	39.48 ± 4.57	40.88 ± 3.37	0.24
Left palm	40.08 ± 4.96	38.80 ± 2.63	0.28

Table 4 shows the mean TFRC between females and males schizophrenic and control groups. The schizophrenic male group had a higher TFRC than the male control group but this was not the same with female schizophrenic and control groups ($p<0.05$).

Table 5 shows the mean atd angle of the right and left palms of males and females schizophrenic and control groups. There was no

Table 6: Comparative dermatoglyphic studies of schizophrenic and control groups in different populations previously studied.

	Previous studies	Qualitative features			Quantitative features		Population
		Arches	loops	Whorls	TFRC	a-b ridge count at angle	Student
1	Poll, 1935	↑(m)	-	↓(m) ↑(F)	Not available		Germans
2	Werdt zell 1951	↓(M)	-	↓(M)	Not available		Germans
3	Pons 1959	No different in patterns between males and female but ↑ in patter for 3rd inter digital area.			Not available		Spanish
4	Rephael and Raphael 1962	↑	↓(whna loops)	↑	Not available		U.S.A
5	Singh, 1967	↑(m)	↑(m)	↑(m)	Not available		Indians
6	Mellor, 1968	↑in patterns in 3rd inter digital area			↑(M or F)		British
7	Rosner and steimery, 1968	↑in left index finger and right thumb also increase of ulnar loops in right index digit.			Not available		Negroid Males
8	Stowens et.al; 1970	↑	↓radial loops on index digit		Not available		Caucasian Females
9	Rothhammer et.al; 1971	No differences in dermatoglyphic features between schizopheances and controls			Not available		Chileans
10	Polednakk, 1972	↓↑Increased % of patterns in the 4th interdigital area but ↓ in the 3rd interdigial area.			Not available		Negroids
11	Dasguta et. al;	Noted differences in finger palman patterns in sching ophrenics			Not studied		Indians
12	Murphy, 1975	↑(m) ↓(m) ↓(m) Palmar patterns were different in schizophrerics ↓ frequencies of patterns in the 2nd and 3rd interdigital areas			Not available		North Indians Not Provided
13	Kemali et. al; 1976	↓	↑	↓	↓	- ↑(Not significant)	Italians
14	Mellor, 1992	Not studied			↑	↑ ↑	Canadian
15	Ponnudural et.al; 1997	No difference in finger patterns			↑	↑	Indians
16	Srinivas et.al; 1998	↑In the 3rd interdigital area of schizophrenics			Not studied		Indians
17	Sivkov and Akabalier, 1998	↑(F) ↑(m)	↑radial loop		Not studied		Not provided
18	Sathe and Gajbe, 1999	↓in ↑(F) tips only		finger	↓		Indians
19	Fearon et.al; 2001	Not studied			↓		Irish
20	Van Oel et.al , 2001	Not studied			↑		Durch
21	Paez et.al; 2001				↓	↓	Mexicans
22	Kelly et.al, 2004	Not studied			↑ Monozygotic twins		Irish
23	Chok et.al, 2005	Less complex pattern types in schizophrenics			↓		Not provided
24	Sawant et.al; 2013	↓finger tips only			-	↑	Indians
25	Chadikovska et.al; 2013	↑(m) ↓(f) ↓		↑	↓(F) ↓(F)	↑(M)	Macedonian
26	Sowjanyabend/amudi et.al; 2015	Not studied			↑	↓ -	Indian
27	Igbigbi et.al 2016 (Present study)	↓ ∈ ∈ Right 1st of git 3rd, 4th, 5th left git F left, 4 dit only male	↑	- ↑F	↑(M)	- -	Nigerians

Note:

↑ Increase in schizophrenic group, ↓ Decrease in schizophrenic group, - No difference between schizophrenic and control groups, M - Male, F - Female

significant difference between and within the groups in mean atd angle ($p>0.05$).

Table 6 compares the dermatoglyphic studies of schizophrenic and control groups in different populations previously studied with the present study in Nigerians. All these studies showed contradictory findings.

DISCUSSION

Qualitative variable: Our study had shown the significant increase in loops and decrease in arches in schizophrenic group when compared with the control group. This is in line with a Mocedonian study of 2013 [26], however, there was significant decrease in arches in females subjects who are schizophrenic but the reverse was the case in male schizophrenic subjects. This study was conducted in a Macedonian population. Two other studies one in Indian and another in a British population also showed significant increase in loops in schizophrenics when compared with controls but these were restricted to only female subjects [27,28].

However some other studies while showing significant increase in loop patterns were restricted in distribution. A study among Negroid males showed significant increase in the left index finger and right thumb only and also increase of ulnar loops only in the right index digit in schizophrenics [29]. Other studies showed significant increase in percentage of patterns in schizophrenics in the 4th interdigital area but a decrease in the 3rd interdigital area respectively [30]. Equally reported are significant increase in the 3rd interdigital area of schizophrenics in Indian subjects and also increase in radial loop in another documented study respectively [31,32]. Our study also showed significant increase in loop pattern frequencies in schizophrenics when compared with controls in the right 1st digit, 3rd, 4th, 5th digits in females, but only the left 4th digit in males (Tables 1, 2a and 2b).

Other previous studies have also documented a significant decrease in ulnar loops, radial loops only on the index digits, also a decrease only in male schizophrenics when compared with the control group respectively [33-35].

Our study showed a significant decrease in arches in schizophrenics similar to the studies of Polednak, [30] and Kemali [36]. Other studies also showed decrease in arches in schizophrenics which are restrictive, decrease only in males in a German population, decrease in a female British population, and also only in the fingertips of two other Indian Populations reported [28,37,38]. Equally reported was the significant decrease in frequencies of patterns in the 2ndand 3rd interdigital areas in schizophrenics when compared with the control group [35]. Other studies have shown significant increase in arches in schizophrenics in American subjects, Caucasian females, Macedonian males respectively [26,33,34].

The qualitative findings indicated above are contradictory as indeed was noted by the authors [39] in their review article. They attributed these findings to the heterogeneity of schizophrenia, ethnic and geographic variations in fingerprint pattern frequencies and sampling methods [40]. The differences in population sizes utilized by the different authors could be another important factor. Recent studies using more complex multivariate statistical techniques in dermatoglyphic comparisons between normal and schizophrenic populations tend to support the above assertions [1,26].

Quantitative Variables: Using quantitative variables, we have shown that TFRC was significantly increased in schizophrenic males when compared with controls (Table 4). The studies of some other authors using other population groups also showed this trend. However, in these studies of Canadians, Indians, Dutch populations the increase was not restricted to only male schizophrenic subjects respectively [1,15,41,42]. Other studies have also shown significant decrease in TFRC in some population groups like Italians, Mexicans and Macedonian females only respectively [27,37,43]. The reasons for these conflicting results could be as a result of those adduced above [Table 6].

Despite the foregoing what was however, noted from the various studies indicated above was that the normal gender difference in dermatoglyphic patterns was reduced in schizophrenic sample [44]. Our findings have shown that there are dermatoglyphic variabilities both

in qualitative and quantitative aspects of patients with schizophrenia and these could serve as markers in the prediction of schizophrenia in our studied population. We therefore recommend this simple, inexpensive, reliable and non-invasive indicator along with other indicators as a screening marker for schizophrenia in other population groups.

ACKNOWLEDGEMENTS

We wish to acknowledge the management and staff of the Federal Neuro-Psychiatric Hospital, Uselu, Benin city as well as the students of Delta State University, Abraka who served as control.

Conflicts of Interests: None

REFERENCES

[1]. Sowjanyabandlamudi, Viveka S, Viswamber V, Sudha MJ. Quantitative Analysis of Dermatoglyphics in Schizophrenic patients. Indian J. App. Res. 2015;5(5):787-789.

[2]. Gupta UK, Prakash S. Dermatoglyphics: a study of finger tips patterns in bronchial asthma and its genetic disposition. Kathmandu Univ. Med. J. 2003;1(4):4267-271.

[3]. Sawant SU, Kolekar SM, Jyothi P. Dermatoglyphics in male patients with schizophrenia. Int. J. Rec. Trends in sci. & Tech. 2013;6(2):109-114.

[4]. Alter M. Is hyperploidy of sex chromosomes associated with reduced total finger ridge count? Am. J. Hum Genet. 1965;17:473-476.

[5]. Walker HA. A dermatoglyphic study of autistic patients. J. Aut. Childhood Schizophrenia. 1977;7(1):11-21.

[6]. Bhanu B V. Ridge Course of the whorl's classification and methods. Am J. Phy. Anthrop. 1975;42:263-268.

[7]. Schanman B, Alter M. Dermatoglyphics in Medical Disorders New York. Springer – verlag.1976.

[8]. Harrison's Principles of Internal Medicine 12th ed. 2554, 2001 McGraw – Hill.

[9]. Foong J, Mairer M. Clark CA, Barker GJ, Miller DH, Ron MA . Neurophathological abnormalities of the corpus callosum in schizophrenia a diffusion tensor imaging study. J. Neurol. Neurosurg. Psychiatry. 2000;68:242-244.

[10]. Woodruff PW, McManus I.C, David AS. Meta-analysis of Corpus Callosum size in schizophrenia. J. Neurol. Neurosurg. Psychiatry. 1995;58:457-461.

[11]. Kirkpatrick B, Litman D, Kim JW, Vladir K, Breier A, Buchanan, RW . Failure of fusion of the septum pellucidum and the heterogeneity of schizophrenia J. Nero. Ment. Dis. 1997;185:639-641.

[12]. Kwon JS, Shenton ME, Hirayasu Y, Salisbury D.F., Fischer LA, Dickey CC, Yurgelun-Todd D, Tohen M, Kikinis R, Jolesz FA, McCarley RW. MRI study of Cavum Septi Pellucidi in schizophrenia, affective dis order and schizotypal personality disorder. Am. J. psychiatry. 1998;155;509-15.

[13]. Lane A, Kinsella A, Murphy P, Byme M, Keenan J, Colgan L. Cassidy B, Sheppard N, Horgan R, Waddington JL, Larkin C, O'Callaghan E. The anthrophometric assessment of dysmorphic features in schizophrenia as an index of its developmental origins psychol. Med. 1997;27:1155-1164.

[14]. Ismail B, Cantor-Graae E, McNeil TF. Minor physical anomalies in schizophrenic patients and their siblings. Am. J. Psychiatry. 1968;155:1695-1702.

[15]. VanOel CJ, Baare WFC, Hulshoff POL, HE, Haag J, Balazs J, Dingemans A, Kahn RS, Sitskoorn MM. Differentiating Between low and high susceptibility to schizophrenia in twins; the significance of dermatoglyphic indices in relation to other determinants of brain development. Schiz. Res. 2001;52:181-193.

[16]. Bracha HS, Torrey EF, Gottesmani I, Bigelow LB, Cunniff C, Second –trimester markers of foetal sizein schizophrenia; a study of monozygotic twins. Am. J. Psychiatry. 1992;149:1355-1361.

[17]. Langsley N, Miller P, Byrne M, Lawrie SM, McIntosh A, Johnstone EC. Dermatoglyphics and schizophrenia: findings from the Edinburgh high risk study. Schiz. Res. 2005;74(1):122-124.

[18]. Foster GM, Bracha HS, Sate P, Christenson DS, Preliminary Evdence for an Association Between Minor Physical Anormalities and second Trimester Neurodevelopment in schizophrenia. Psychiatry Res. 1994;53:119-127.

[19]. Holt SB . The role of dermatoglyphic in Medical biology. Med. World. Lond. 1964;101:112-125.

[20]. Loato MI, Belmonte- de- Abrea P. Knijnik D. Braz. J. Med. Biol. Res. 2001;34(2):155-163.

[21]. Murthy S, Wig NN. Dermatoglyphics in schizophrenia: The relevance of Positve family history. Bri. J. Psychiatry. 1977;130:56-58.

[22]. Key GM, Compton MT. Dermatoglyphic indices and minor physical anomalies in patients with schizophrenia and related disorders, their first degree biological relatives and non psychiatric controls. Psychiatry Res. 2010;178:255-259.

[23]. Reilly JL, Murphy PT, Byme M, Larkin C, Gill M, Dermatoglyphic fluctuating asymmetry and atypical handedness in schizophrenia. Schiz. Res. 2001;50:159-168.

[24]. Oghenemavwe EL, Osaat RS. An improvise Easy digital method for palmar and plantar dermatoglyphics. Biosci. & Bioeng. 2015;1(3):85-80.

[25]. Cummins H, Midlo C. Palmar and Plantar epidermal ridge configurations (dermatoglyphics) in European – Americans. Am. J. Phys Anthropol. 1926;9:471-502.

[26]. Chadikovska E, Lazarova D, Zafirova B, Trpkovska B, Zhivadiaok J. Dermatoglyphics in patients with schizophrenia – Findings in the Macedonian Population. Sec. Med. Sci. 2013;34(2):91-96.

[27]. Singh S. Dermatoglyphics in schizophrenia. Brit J. Psychiatry. 1967;17:348-356.

[28]. Mellor CS. Dermatoglyphics in Schizophrenia. Brit J. Psychiatry. 1968;114:1387-1390.
[29]. Rosner F. Steinberg FS. Dermatoglyphic patterns of Negro Men with schizophrenia. Diseases of the Nervous system 1968;29:739-743.
[30]. Polednak AP. Dermatoglyphics of Negro schizophrenic males. Brit. J. Psychiatry. 1972;120:397-398.
[31]. Srinivas N, Sayee R, Thomas IM. Palmar dermatoglyphic study in schizophrenic patients – a pilot study. J. Anat. Soc. India. 1998;47(1):41.
[32]. Sivkov S, Akabaliev. Dermatoglyphics in schizophrenia, qualitative aspcts. Folia Med. (Plovdiv). 1998;40(3):44-50.
[33]. Raphael T, Raphael LG. Fingerprints in Schizophrenia J. Am. Med. Ass. 1962;180(3):215-219.
[34]. Stowen D, Sammon J, Preoctor A. Dermatoglyphics in female schizophrenia. Psychiat. Quant. 1970;44:516.
[35]. Murphy SR. Dermatoglyphics in schizophrenia M.D. thesis (Psychiatry). Postgraduate Institute of Medical Education and Research, Chandigarh. 1975. (cited in Balgir R. S. and Srinivasa Murthy R. (1882)
[36]. Kemali D, Polani N, Polani PE, Amati A. A dermatoglyphic study of 219 Italian schizophrenic males. Cli. Genet. 1976;9(1):51-60.
[37]. Sathe V, Gajbe U. Study of palmar dermatoglyphics in Schizophrenia. J. Anat. Soc. India. 1999;48(1):43.
[38].Wendt GG, Zell W. Schizophrenia and Fingerleistenmuster. Arch. Pouchiat. Z. Neurol. 1951;186:456.
[39]. Sontakke BR, Wankhede V, Bokaria P, Waghmare JE, Tarnekar AM. Dermatoglyphic studies in persons with schizophrenia: A Review (cited from: Sowjanyabandlamudi et al., 2015).
[40]. Wendt GG, Rube M, Kindermann I, Papillaresten und Krankheit. Dt. Med. Wscher; 96, 1056 (cited from: Balgir RS and Srinivasa MR Dermatoglyphic studies in Schizophrenia: a Review. Indian J. psychiatry1971;24(3):248 -257.
[41]. Mellor CS. Dermatoglyphic evidence of fluctuating asymmetry in schizophrenia. Br. J. psychiatry. 1992;161:422.
[42]. Ponnudural R, Sarada MM, Mythu M. Dermatoglyphic fluctuating Asymmetry and symmetry in Familial and Non Familial Schizophrenia. Indian J. Psychiatry. 1997;39(3):205-211.
[43]. Paez F, Apiquian R, Fresan A, Puig A, Orozco B, Dela Fuente J, Sidenberg D, Nicolini H. Dermatoglyphic study of positive and Negative symptoms in schizophrenia Salud Mental. 2001;24(1):28-32.
[44]. Poll H. Dactylographische Creschlecht – Sunterschiede der schizophrene, Monastschr. Psychiat. Nemol. 1935;91:65.
[45]. Pons J. Relaciones entre esquizophrenia Y line as dermopapi: lilares. Genet. Iber. 1959;11:1.
[46]. Rothhammer F, Pereira G, Camousseight A, Benado M. Dermatoglyphic in schizophrenic patients. Hum. Hered. 1971;21:1198.
[47]. Dasgupta J, Dasgupta D, Balasubrahmanyam M. dermatoglyphic in the diagnosis of schizophrenia. Indian J. Psychiatry 1973;15:104.
[48]. Fearon P, Lane A, Airie M, Scannell J, McGowan A, Byreme M, Cannon M, Cotter D, Murphy P, Cassidy B, Waddington J, Larkin C, O'Callaghan E. Is reduced dermatoglyphic a-b ridge count a reliable marker of developmental impairement in schizophrenia? Schizophr. Res. 2001;50(3):151-157.
[49]. Kelly BD, Cotter D, Denihan C, Larkin D, Murphy P, Kinsella A, Walsh D, Waddington J, Larking C, O'Callaghan E, Lane A. Neurological soft signs and dermatoglyphic anomalies in twins with schizophrenia. Eur. Psychiatry. 2004;19(3):159-163.
[50]. Chok JT, Kwapil TR, Scheuemann A. Dermatoglyphic anomalies in psychometrically identified schiozoglyphic young adults. Schizophre. Res. 2005;72(2-3):205-214.

How to cite this article:

Igbigbi Patrick Sunday, Ominde Beryl Shitandi, Oyibojoba Oghenebare Andrew. DERMATOGLYPHIC PATTERNS OF SCHIZOPHRENIC PATIENTS IN A NIGERIAN POPULATION. Int J Anat Res 2018;6(2.1):5114-5121. **DOI:** 10.16965/ijar.2018.134