International Scholars Journals

International Journal of Anatomy and Physiology ISSN 2326-7275 Vol. 14 (1), pp. 001-006, January, 2025. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Dermatoglyphic Patterns in Nigerian Sickle-Cell Anaemia Patients: A Study of 90 Cases

Oladipo GS*[1], Olabiyi O[2], Oremosu AA[2], Noronha CC[2], Okanlawon AO[2] and Paul CU[1].

[1]Department of Anatomy, College of Health Sciences, University of Port Harcourt , Rivers State, Nigeria
[2]Department of Anatomy, College of Medicine, University of Lagos Idi-Araba, Lagos - Nigeria.

Accepted 16 November, 2024

Dermatoglyphic analysis of 90 Sickle-cell Anaemia cases and 90 normal subjects was carried out in this study. It involved the digital patterns, ATD angle, A – B ridge count, axial triradius, digital triradius and palmar crease on the hands. 58.44% of the digital patterns in sickle-cell cases were ulnar loop as against 60.14% in the normals. The percentage of Whorl, arch and radial loop in Sickle-Cell group were 31.64%, 8.23% and 2.98% respectively as against 27.47%, 10.43% and 1.98% in the normals. The mean ATD values were 41° and 40° for the normal and sickle-cell groups respectively. The mean A – B ridge counts was 33.1 in sickle-cell group and 33.5 in the normals. No axial triradius was found in t [iii] (along the distal transverse crease) position in both groups. Most of the triradii were found in position t[i] (along or close to the thenar crease) in both groups. Only 3.6% of normals and 2.9% sickle-cell cases were found in t[ii] (along the proximal transverse crease) position. The mode of the frequency distribution of digital triradii of normals was 13 while they were 11, 14 and 15 for sickle-cell group. The means were 11.89 and 12.32 respectively. No Simean crease was found in both groups; however, 2.2% of the 90 sickle-cell cases had Sidney creases. The above-mentioned values were not statistically different when the two groups were subjected to appropriate statistical tests.

Key words: Dermatoglyphics, sickle-cell anaemia, Nigeria.

INTRODUCTION

Dermatoglyphic pattern is positively correlated in some disease conditions, both genetically determined and none genetically related. Such conditions include those associated with organic mental retardation (Boroffice, 1978; Stevenson et al., 1997; Than et al., 1998; Franceschini et al., 2002). It has been suggested also that dematoglyphic studies may aid in the diagnosis of such conditions (Rex and Preus, 1982; Schmidt et al., 1981). Nervous system disorders of functional ethiopathogenesis have also been positively correlated with dermatoglyphics; these include schizophrenia and schizotypal personality (Gengerelli and Thrasher, 1979; Weinstein et al., 1999; Van-os et al., 2000; Sivkov and Akabaliev, 1998) even in twins studies (Van-oel et al., 2001). A postulation for the above linkage is the common ectodermal origin of the central nervous system and the intergumentary system from which finger print pattern develop (Sivkov and Akasaliev, 1998; Bogdanov and Solonichenko, 1997).

However other syndromic conditions associated with mental retardation (Rodewald et al., 1994; Winiewska, 1985) and non syndromic conditions where affected organs and organ systems have no common ectodermal origin with the skin have also been positively correlated with dermatoglyphics. Examples are; Ankylosing spondylitis (Cvjeticanin et al., 2000; Essential hypertension (Pursnani et al., 1989) Systemic lupus erythromatosus (Schur, 1990) Vitiligo (Igbal et al., 1985) Congenital heart disease (Ahuja et al., 1982) and Rheumatic fever (Sanyal et al., 1978).

Genetic linkage and determination of dermatoglyphics is apparent (Panchekina et al., 2000), and it has in fact been described one of the best available diagnostic tool in genetic disorders (Bosco et al., 2001).

Genetically determined sickle cell anaemia is prevalent in Nigeria and the cause of considerable morbidity and mortality. Current post natal widely used investigative procedures include hemoglobin electrophoresis and solubility tests. These have the problem of interference from Hb F when done in the newborn (Wethers, 2000).

Our postulation was that since dermatoglyphic pattern are established prenatally, and are genetically determin-

*Corresponding author. E-mail: oladipogabriel@yahoo.com

Table 1. Percent frequency of digital patterns in both sickle cell (SS) and control (normal) groups.

Patterns	Sickle cell (SS) N=90			Normals (control group) n = 90		
	Male	Female	Average	Male	Female	Average
ARCH	5.58%	10.85%	8.23%	8.30%	12.56%	10.43%
WHORL	33.49%	29.79%	31.64%	27.02%	27.91%	27.47%
ULNAR LOOP	58.37%	58.51%	58.44%	62.13%	58.14%	60.14%
RADIAL LOOP	5.11%	0.85%	2.98%	2.55%	1.40%	1.98%

Table 2. Percent frequencies of digital patterns for each digit of both hands in male sickle cell (SS) and male normals "n" (control group).

Right hand digits			SS (N = 43)				NORMAL (N = 47)			
	R I		R II		R III		R IV		R V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	11.63	6.38	4.65	12.77	9.30	10.64	2.33	4.26	-	2.13
Whorl	51.16	40.43	44.19	27.66	23.26	19.15	41.86	44.68	13.95	14.89
Ulnar Loop	37.21	48.94	41.86	51.06	67.44	65.96	55.81	51.06	86.05	82.98
Radial Loop	-	4.26	9.30	8.51	-	4.26	-	-	-	-
Left hand digits			**SS (N = 43)**				**NORMAL (N = 47)**			
	L I		L II		L III		L IV		L V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	11.63	12.77	6.98	17.02	4.65	6.38	4.65	6.38	-	4.26
Whorl	44.19	29.79	32.56	29.79	30.23	19.15	37.21	36.17	16.28	8.51
Ulnar Loop	44.19	55.32	44.19	46.81	65.12	74.47	58.14	57.45	83.72	87.23
Radial Loop	-	2.13	16.28	6.38	-	-	-	-	-	-

$P < 0.05$

ed, early post natal dermatoglyphic analysis may aid in early diagnosis of sickle cell anaemia as suggested by earlier reports for other hemoglobinopathies (Gualdo, 1984).

This study was designed to elucidate the possible diagnostic value of the dematoglyphic features of 90 people with sickle cell anaemia.

MATERIALS AND METHODS

90 patients (all Nigerians) with Sickle-cell anaemia from the Sickle-cell units of Lagos University Teaching Hospital (LUTH) and General Hospital, Ikeja who attended clinics at the time of collecting data and 90 students (normals) of the Department of Anatomy, College of Medicine of the University of Lagos, Idi-Araba were screened for dermatoglyphic analysis. The members of the normal group were either AA or As genotype. Fingerprints were made with white paper and purple pad. Hand were thoroughly washed with water and soap and dried before taking prints. This was done to remove dirt from the hands.

Screening was done on the white duplicating paper containing the prints with the aid of magnifying glass. No distinction was made between the varieties of whorl (W) patterns; also tented arch was recorded simply as an arch (A). Loop was recorded as either ulnar loop (UL) or radial loop (RL) . The palmar flexion creases were considered to be abnormal if the proximal and distal transverse creases were fused into a single transverse palmar crease (Simean Crease) or if any of the transverse creases crosses the palm completely (Sidney Crease). All the patterns are as defined by Penrose (1963). A straight line was drawn to join A and B triradii and the number of intersecting ridges counted. This gives A – B ridge counts.

The various digits were designated as follows: Thumb – I; Index finger – II; Middle finger – III; Ring finger – IV; Little finger – V. 'L' and 'R' stand for left and right respectively.

It should be noted that t^{i} position is the area close to the flexor retinaculum. T^{ii} is along the ulnarside of proximal transverse crease while t^{iii} is along the ulnarside of distal transverse crease of the palm and that two triradii were attached to a whorl, one triradius to a loop and none to an arch since all arches were recorded as simple arch which has no triradius.

STATISTICS

The students't- test and chi- square were used for the statistical analysis in this study. All the values in all the parameters used did not have any statistically significant difference when the two groups were compared.

RESULTS

The percentages of digital patterns found in both sickle-cell group and the normals are summarized in Tables 1, 2, 3 and 4. Table 1 shows the percentages of digital patterns in the digits of both hands, when combined in

Table 3. Frequencies of digital patterns for each digit of both hands in female sickle cell (ss) group and female normals (n).

Right hand digits			SS (N = 47)				NORMAL (N = 43)			
	R I		R II		R III		R IV		R V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	10.64	16.38	14.89	16.28	14.89	13.95	6.38	-	-	2.33
Whorl	38.30	51.16	38.30	37.21	21.28	16.28	42.55	4.26	4.26	9.30
Ulnar Loop	48.94	32.56	46.81	44.19	61.70	69.77	51.06	74.42	95.74	88.37
Radial Loop	2.13	-	-	2.33	2.13	-	-	-	-	-
Left hand digits			**SS (N = 47)**				**"N" (N = 43)**			
	L I		L II		L III		L IV		L V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	14.89	27.91	21.28	18.60	14.89	18.60	6.38	9.30	4.26	2.33
Whorl	40.43	34.88	44.68	37.21	23.40	23.26	38.30	32.56	6.38	11.63
Ulnar Loop	42.55	34.88	34.04	37.21	59.57	55.81	55.32	58.14	89.36	86.05
Radial Loop	2.13	2.33	-	6.98	2.13	2.33	-	-	-	-

Table 4. Percent frequencies of digital patterns for each digit of both hands in sickle cell (ss) and normals groups (total population of males and females).

Right hand digits			SS (N = 90)				"N" (N = 90)			
	R I		R II		R III		R IV		R V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	11.11	11.1	10.0	14.4	12.2	12.2	4.4	2.2	-	2.2
Whorl	44.4	45.5	41.1	32.2	22.2	17.7	42.2	35.5	8.9	12.2
Ulnar Loop	43.3	41.1	44.4	47.7	64.4	67.7	53.3	62.2	91.1	85.5
Radial Loop	1.1	2.2	4.4	5.5	1.1	2.2	-	-	-	-
Left hand digits			**SS (N = 90)**				**"N" (N = 90)**			
	L I		L II		L III		L IV		L V	
Patterns	SS	N	SS	N	SS	N	SS	N	SS	N
Arch	13.3	20.0	14.4	17.7	10.0	12.2	5.6	7.7	2.2	3.3
Whorl	42.2	32.2	38.9	33.3	26.7	21.1	37.8	34.4	11.1	10.0
Ulnar Loop	43.3	45.5	38.9	42.2	62.2	65.5	56.7	57.7	86.7	86.6
Radial Loop	1.1	2.2	7.8	6.6	1.1	1.1	-	-	-	-

Males and females and combined population (average) Ulnar loop has the highest percentage in both male and female of the sickle- cell and normal (control) groups, the average percentage being 58.44% in SS group and 60.14 % in the control group. This is followed by whorl, arch and radial loop. The order of increase is the same in male and female in the two groups.

Although little difference in value occur but this is not statistically significant. Table 2 shows the percentages of digital patterns in male sickle-cell group and male control group (normals). The percentages of digital patterns in female Sickle-cell group and female normals (control group) are represented in Table 3. Table 4 digital patterns for each digit of both hands in Sickle-cell (SS) and normal (N) groups i.e. total population of males and females.

In both Male Sickle-cell and Male normal groups, no radial loop patter was found in the first and third digits of the right hand in Sickle-cell group. None of the groups has radial loop in the fourth and fifth right digits. It can also be observed in this table that whorl has the highest percentage (51.16%) in the first right digit of male sickle cell group. Ulnar loop follows: The order in normal group is as follows: Ulnar loop>whorl>arch>radial loop (48.94 %>40.43%>6.38%>4.26%). This order is the same in the remaining digits of the right hand. No arch was found in the fifth digit of the right hand of the sickle-cell group.

No radial loop pattern was recorded in L^{I} of SS group, L^{III}, L^{IV} and L^{V} of both normal and SS groups. The general order of increase on the left hand digits in Table 2 is as follows: Ulnar loop>whorl>arch>radial loop. This is the same in both groups. However, whorl and ulnar loop patt-

Table 5. Means, standard deviations (S.D) and standard errors (S.E) of palmar atd angles in male and female normals and sickle cell group.

Normals		SS		Normals	SS Group
Right palm	**Mean + S.E**	**Mean + S.E**	**Left palm**	**Mean+ S.E**	**Mean + S.E**
MALES	40.0 ± 0.89	40.0 ± 0.89	MALES	39.9 ± 0.89	39.6 ± 0.90
FEMALES	41.6 + 0.81	40.5 + 0.78	FEMALES	42.1 + 0.80	41.0 + 0.81

Sample size for Male normals = 27; Sample size for Male SS = 24; Sample size for Female normals = 43. P < 0.05

Table 6. Means, standard deviations (S.D) and standard errors (S.E) of palmar ATD angles in normal and sickle cell population.

Right palm	Mean +S.E	Left palm	Mean + S.E
Normals	41.0 ± 0.61	Normals	41.0 ± 0.61
Sickle cells	40.0 + 0.60	Sickle cell	40.0 + 0.60

P < 0.05.

Table 7. Position of axial triradius in normal and sickle cell population.

	Right palm		Left palm	
	Normal	**SS**	**Normal**	**SS**
Percentage of t^{I}	97.1	97.1	95.1	97.1
Percentage of t^{II}	2.9	2.9	4.3	2.9
Percentage of t^{III}	NIL	NIL	NIL	NIL

P < 0.05.

erns have the same percentage frequency in L^{I}.

The percent frequencies of digital patters for each digit of both hands in female SS and normal groups are shown in Table 3. No radial loop was observed in R^{II} of SS group, R^{III} of normal group, R^{IV} and R^{V} of both groups In R^{I} of normal group, whorl has the highest percentage of approximately 51.16% followed by ulnar loop (32.56%), arch (16.28%). No radial loop pattern was recorded for this digit. Other 'R' digits have the following order of increase: ulnar loop>whorl>arch>radial loop. In the left hand digits, in both groups, the order is: ulnar loop>whorl>arch >radial loop except in LII of SS group where whorl has the higher percentage. In L^{I} of the normal group, the percentage of ulnar loop and whorl is the same. It is also the same in L^{II} of the same group. No radial loop was recorded in L^{II} of SS group, L^{IV} and L^{V} of both normal and SS groups.

Table 4 is the summary of the total population of Table 2 and Table 3. Ulnar loop has the highest percentage in both groups in all digits of both hands except R^{I}. There was no radial loop in fourth and fifth digits of both group in both hands.

The means, standard deviations (S.D) and standard error of the mean (S.E.) palmar ATD angles are shown in Tables 5 and 6.

In Table 5, mean ATD angles in male and female normals and sickle-cell group, the value when male of Ss group was compared with male of normal group was similar. This was the same when females of the two groups were compared. Table 6 is a summary of the mean ATD angles in the total population i.e. male and female combined.

Analysis of axial triradii is shown in Table 7. No axial triradius was found in t^{iii} position in either of the group. Most triradii were found at ti position in both groups.

Table 8. Summary of frequency diitribution of triradii on digits of normal and sickle cell populations.

	Normals	Sickle cell group
Mode	13	11, 14, 15
Mean + SE	11.89 + 0.37	12.32 + 0.42

P < 0.05. NOTE: S.E - Standard Error of the Mean.

Table 9. Means, standard deviations (S.D) and standard errors (S. of palmar a-b ridge count in SS group and normals).

Groups	Mean + S.E	
	Right Palm	**Left Palm**
SS Group	32.58 ± 0.99	33.64 ± 1.03
Normal Group	33.48 + 1.31	33.57 + 1.08

P<0.05.

Occurrence at t^{ii} position is less compared with $t^{i.}$ The frequency distribution of triradii in the digits of both normal and sickle-cell cases are recorded in Table 8 Sickle-cell was trimodal. The modes are 11, 14 and 15. The normal group on the other hand was unimodal with a mode of 13. The means of sickle-cell group and nomal (control) group were 12.32 and 11.89 respectively.

Analysis of the palmar A – B ridge count in Table 9 shows that both sickle- cell and normal (control) groups have similar mean A – B ridge counts. The mean A–B 33.57 respectively. The values are 32.58 and 33.48 ridge count on the left palm of both groups are 33.64 and respectively on the right palm.

Palmar analysis of the sample in both the control (normal) group and sickle-cell cases showed that 2.2% of the 90 sickle-cell cases had Sidney lines (creases). The remaining 97.8% were normal. No Simian crease was recorded in both the normals and sickle-cell cases. No Sidney crease was recorded in normal cases.

DISCUSSION

Dermatoglyphic analysis of the digital patterns, axial triradius, digital triradius and palmar crease in Down Syndrome and normal individuals showed a statistically significant difference of 96% loop pattern as against 63.6% in the normals, 90% t^{ii} axial triradius position as against 1-4% in normals, 50% Simean crease in 50 cases of Down's syndrome as against less than 5% of the controls (Boroffice, 1978). Differences were also found when A– B ridge count in normal individual was compared with some abnormal situation. The average A–B ridge count in normal individuals was put at 34.

Normal ATD angle was equally put at 45^{o}. An average value that is far from these values is considered abnormal Statistical analysis of the observed dermatoglyphics parameters; digital patterns, axial digital triradius and palmar crease in sickle cell anaemia patients and control (normal) groups concluded that no significant difference exist between the two groups for all dermatoglyphic parameters studied. Though previous work has shown a positive correlation between a genetically determined blood disease; á-thalasemia 3, and dermatoglyphics, it is by no means established that peculiar dermatoglyphic patterns are a *sine qua non* diagnostic features of genetic determined haemoglobinopathies. Furthermore, in this study, both experimental and control groups were selected at random in two teaching hospital in Lagos state (a cosmopolitan area with diverse tribal and ethnic composition), with no sex or tribe matching between experimental and control subjects. Dermatoglyphics have been shown to have ethnic and racial variations (Harich et al., 2002; Kusuma et al., 2002; Igbigbi and Msamati, 2001; Oladipo and Akanigba, 2005). It is possible then than an ethnicity sensitive sample would yield a different result.

The presence of Sidney lines (creases) in 2.2% of cases of sickle-cell is not enough to conclude that sickle-cell anaemia has dermatoglyphic correlation. It is suggested by the result of this study that sickle cell anaemia should not be included in the list of the congenital and genetic defects that have demonstrated specific dermatoglyphic patterns.

However, field studies using sample frame across geographic and sociocultural groups with bigger and ethnicity sensitive samples may give opportunity for more definitive deductions.

REFERENCES

Ahuja YR, Annapurna V, Reddy YR, Reddy GD, Rao VS, Rao PN (1982). Dermatoglyphic stidies in congenital heart disease in India .Acta. Anthropogenet: 6(3): 141-150.

Bogdanov NN, Solonichenko VG (1997). Williams syndrome as a model of genetically determined right hemisphere dominance. Neurosci. Behav. Physiol. 27(3): 264-267.

Boroffice IA (1978). Down's syndrome in Nigeria; Dermatoglyphic analysis of 50 cases. Nig. Med. J. 8: 571-576.

Bosco JI, Rajangam S, Shankar J, Thomas IM (2001). Dermatoglyphics in 46, XY females. J. Indian Med. Assoc. 99(8):418-20.

Cvjeticanin M, Jajic Z, Jajic I (2000). Quantitative analysis of digitopalmar dermatoglyphics in men with Ankylosing spondylitis. Reumatiam. 47(1): 5-12.

Franceschini P, Guala A, Besana D, Di Cara G, Francseschini D (2002). A mentally retarded female with distinctive facial dysmorphism, joint laxity, clinodactyly and abnormal dermatoglyphics. Genet. Couns. 13(1): 55-58.

Gengerelli JA, Thrasher H (1979). Termination locus of palmar main line A of the left hand in relation to mental pathology. J. Psychol. 101:279-286.

Gualdo RE (1984). Biological distances in dermatoglyphics of beta-thalassemic subjects. Acta Athropogenet. 3-4: 223-230.

Harich N, Esteban E, Chafik A, Moral P (2002). Dermatologic characterization of berbers from morocco: Qualitative and quantitative digital and palm data. Ann. Hum. Biol. 29(4): 442-456.

Igbigbi PS, Msamati BC (2001). Palmar and digital dermatoglyphic characteristics of Zimbabwean subjects. East Afr. Med. J. 78(10): 536-539.

Kusuma YS, Babu BV, Naidu JM (2002). Finger ridge correlations among four tribes of Andra Pradesh, India. Coll. Antropol. 26(1): 319-323.

Oladipo GS, Akanigha BE (2005). Dermatoglyphic patterns in androgenetic alopecia in a South Eastern Nigeria Population. J. Expt. & Clin. Anat. 4(2): 44-47.

Panchekina EA, Benfer RA Jr, Vershoubskaya GG, Kozlov AI (2000). Genetic and environmental influence on symmetry of dermatoglyphic traits. Am. J. Anthropol. 111(4): 531-543.

Penrose LS (1963). Fingerprint, Palm and Chromosomes. Nature. 197: 933-938.

Pursnani ML, Elhence GP, Tibrewala L (1989). Palmar dermatoglyphics in essential hypertension. Indian Heart J. 42(2): 119-122.

Rex AP, Preus M (1982). A diagnostic index for Down's syndrome. J. Pediatr. 100(6): 903-906.

Rodewald A, Pankau R, Gosch A, Wessel A (1994). Dermatoglyphics peculiarities in patients with Williams-Beuren syndrome. Am. J. Genet. 15; 53(3): 227-235.

Sanyal SK , Mukerjee DP, Ahmed SH (1978). Dermatoglyphic alteration associated with acute rheumatic fever in children. Am. J. Dis. Child. 132(7): 692-695.

Schmidt R, Dar H, Nitowsky HM (1981). Dermatoglyphic and cytogenetic studies in parents of children with down's syndrome. Clin. Genet. 20(3):203-210.

Schur PH (1990). Fingerprint pattern of patients with systemic lupus erythromatosus and their relatives. J. Rheumtol. 17(4): 482-484.

Sivkov S, Akabaliev V (1998). Dermatoglyphics in schizophrenia: Qualitative aspects. Folia. Med. 40(3): 44-50.

Stevenson RE, Hane B, Arena JF, May M, Lawrence L, Lubs HA, Schwartz CE (1997). Arch finger prints, hypotonia and areflexia associated with x-linked mental retardation J. Med. Genet. 34 (6): 465-469.

Than M, Myat KA, Khadijah S, Jamaludin N, Isa MN (1998). Dermatoglyphics of Down's syndrome patients in Malaysia, a comparative study. Anthropology Anz. 56 (4): 351-365.

Van-oel CJ, Baare WF, Hulshoff-pol HE, Haag J, Balazs J, Dingemas A, Kahn RS, Sitskoorn MM (2001). Differentiating between low and high susceptibility to schizophrenia in twins: The significance of dermatoglyphic indices in relation to other determinants of brain development. Schizophr. Res. 52(3): 181-193.

Van-os J, Woodruff PW, Fananas L, Ahmad F, Shuriquie N, Howard R, Murray RM. (2000). Association between cerebral structural abnormalities and dermatoglyphic ridge count in schizophrenia. Compr. Psychiatry. 41(5): 380-384.

Weinstein DD, Diforio D, Schiffman J, Walker E, Bonsall R (1999). Minor physical anomalies, dermatoglyphic asymmetries and cortisol levels in adolescent in schizotypal personality disorder. Am. J.

Psychiatry. 156(4): 617-623.
Wethers DL (2000). Sickle cell disease in childhood: Laboratory diagnosis, Pathophysiology and health maintenance. Am. Fam Phys. 62 (5): 1013-1027.
Winiewska H (1985). Dermatoglyphic analysis of patients with Ankylosing spondylitis. Acta. Anthropogenet. 9(1-3): 162-168.