

## Palmar and digital dermatoglyphic patterns in the Ndokwas of Delta State, Nigeria

E Anibor, PS Igbigbi, OG Awwioro and A Okpor

Department of Anatomy and Cell Biology, Faculty of Basic Medical Sciences,  
College of Health Science, Delta State University,  
Abraka, Delta State, Nigeria



### Summary

We determined asymmetry, complexity and pattern polarization of dermal ridges and palmar variables of atd angle, a – b ridge count and total finger ridge count of dermal ridges among the Ndokwa people of Nigeria. 400 healthy students who are Ndokwas were studied. Ink prints of their fingers and palms were obtained. Counting and classifying of Palmar and digital ridge pattern configurations of arches, loops and whorls was based on standard techniques. Ulnar loops polarized preferentially to digits III, IV and V and radial loops to digit II. Female subjects had higher counts of radial loops ( $p < 0.001$ ) than the males. Male subjects had a higher whorl count than the females ( $p < 0.05$ ). Our findings form useful baseline data for subsequent longitudinal cytogenetic studies on the Ndokwa people.

**Keywords:** *Dermatoglyphics, Ndokwa, dermal ridges, palmar, digital, Nigeria.*

### Résumé

Le but de cette étude était de déterminer les asymétries, la complexité et la polarisation fréquence des rides dermiques et les variables palmaires angulaires, le taux des rides a – b et des rides des doigts parmi le peuple Ndokwa au Nigeria. Au total, 400 étudiants sains de Ndokwa étaient étudiés. Les empreintes des doigts, des pieds et paume étaient obtenus, comptés et classés selon la fréquence et les configurations des rides palmaires et digitales basées sur les techniques standards. Les loupes ulnaires polarisés préférentiellement des doigts III, IV et V et loupes radiales sur les doigts II. Les sujets femelles avaient les taux plus élevées de loupes radiales ( $p < 0.001$ ) que chez les males. Male subjects had a higher whorl count than the females ( $p < 0.05$ ). Nos résultats forment les données de base pour d'autres études longitudinales cytogénétiques sur le peuple Ndokwa.

### Introduction

The term dermatoglyphics was derived from the Greek word, "dermis" meaning skin and "glyph" meaning curving. Dermatoglyphics is the science of configuration of epidermal ridges of the volar surfaces of the fingers, toes, palms and soles [1]. Dermatoglyphic traits serve as useful tools in the diagnosis of congenital malformations [2]. They are valuable as somatic markers of genetic and environmental influences that may destabilize developmental processes prenatally [1,3-5].

Research on Dermatoglyphics among Nigeria populations have been restricted to a few tribes. Boroffice reported on digital patterns of ten ethnic groups [6]. Igbigbi *et al.*, reported on the palmar and digital dermatoglyphics of the Yoruba and Ibo tribes of Nigeria [7]. Dermatoglyphic pattern in Ibo and Ikwerre ethnic groups was reported by Oladipo *et al* [8]. Research on dermatoglyphics has not been carried out among the Ndokwa people of the Niger Delta region of Southern Nigeria to the best of our knowledge.

This study examines the pattern of asymmetry and polarization of dermal ridges among the Ndokwa ethnic group with the intent to provide data that can serve as a control series in future longitudinal cytogenetic studies. Analysis of digital dermal ridges will be useful as markers of teratogenic insults, and may also examine the likely health impact of any petrochemical pollutant in the environment of the Ndokwa people.

### Materials and methods

Senior secondary school students constituted the study population. The schools involved were Aboh Grammar School, Aboh; Ashaka Grammar School, Onuabo and Prince of Peace Secondary School, Ushie; all in Ndokwa East Local Government Area. Also Amoji Secondary School, Onicha Ukwuani; Ogbe Grammar School, Kwale and Quality Foundation School, Emu, all in Ndokwa West Local Government Area. Others are Obiaruku Grammar School, Obiaruku; Cardinal Group of Schools, Obiaruku; Ebodei Secondary School, Ebodei; Antilyn Group of



Schools, Umutu; Precious Academy, Umuaja and Umutu mixed Secondary School, Umutu; all in Ukwuani Local Government Area. The different clans in Ndokwaland were therefore adequately represented. Ethical issues were not forgotten as permission was obtained from the research and ethics committee in the College of Health Sciences, Delta State University, Abraka, Nigeria. The authorities of the different schools gave permission and the participating students gave their consent after being briefed on the procedure and reason for the research. Only apparently healthy and physically able-bodied volunteers were sampled and constituted the study population and those with non-Ndokwa contributors to their ancestral lineage were excluded.

Bilateral palmar and digital prints were obtained by the inking procedure described by Antonuk [9]. Rolled ink prints were made of the fingers. All prints were studied with the aid of a hand lens and analyzed based on the traditional classification of finger and palmar patterns

the digit) were differentiated from the radial loops (loops that open towards the radial side of the digit). The distribution of each pattern type across the ten fingers was considered. The arch/whorl ratio and the whorl/loop ratio were determined to provide an assessment of the degree of pattern complexity among the sampled subjects. The total finger ridge counts (TFRC) and pattern Intensity Index (PII) for both male and female were also calculated. So also was the calculation of atd angle and a-b ridge count. Tests of significance were done using chi-square tests for digital variables (arch, whorl, ulnar loop and radial loop) and student t-tests for palmar variables (atd angles, a-b ridge counts and TFRC).

### Results

Table 1 shows the overall distribution of digital dermal ridge pattern types in both male and female gender. Concerning pattern asymmetry, the arches are more on the left hand digits in both genders. There was no significant difference between the number of arches



**Figure 1.** The different digital pattern types of whorl, loop and arch.

**Table 1:** Summary of counts of digital types (%) in the sampled Ndokwa subjects

Pattern type	Male Left Hand	Right Hand	Mean	Females Left Hand	Right Hand	Mean
Arch	15.92	14.35	15.4	15.5	14.8	15.15
Whorl	33.26	35.14	34.20	29.3	27.9	28.60
Ulnar loop	49.49	48.19	48.84	52.7	55.6	54.15
Radial loop	1.31	2.30	1.81	2.5	1.6	2.05
Arch / whorl	47.88	40.86	44.37	52.90	53.05	52.98
Whorl / loop	65.58	69.58	67.53	53.08	48.86	50.97

described by Cummins and Midlo [1]. Digital dermal ridge pattern types were classified into arches, loops and whorls (Fig. 1). These were counted. Ulnar loops (open towards ulnar side of

in females and their male counterparts ( $p > 0.05$ ). Whorl count was higher on right hand digits for male subjects, while the converse was the case for the female subjects. Whorl count was significantly higher

in males in comparison to females ( $p < 0.05$ ). Ulnar loop count was higher on the left hand digits than it was on the right hand digits for male subjects, while the converse was the case for the female subjects. Radial loop count was higher on the right hand digits than it was on the left hand digits for male subjects, while in the female the converse was the case. The radial loop count was significantly higher in the females in comparison to their male counter parts ( $p < 0.05$ ). There was no significant difference between the ulnar loop counts of both male and female gender ( $p > 0.05$ ).

female gender. Homologous fingers tended to have comparable counts for each pattern type.

Table 4 presents TFRC and PII in the sampled Ndokwa subjects. Table 5 shows the atd angle and a-b ridge count in sampled Ndokwa subjects. There was no significant difference between both genders in terms of a-b ridge count ( $p > 0.05$ ).

Table 6 shows comparison of total finger ridge count, atd and palmar a-b ridge count between Ndokwa and other Nigerian tribes. It could be seen that the Ndokwa subjects have a lower TFRC and a-bridge count than the other five Nigerian tribes compared.

**Table 2:** Finger Pattern frequency in male subjects (n = 200), in sampled Ndokwa subjects.

Male Right Hand					Male Left Hand				
Finger	Pattern Types				Finger	Pattern Types			
	A	R	U	W		A	R	U	W
RI	34	0	54	113	LI	37	0	68	91
RII	39	18	57	84	LII	45	10	50	93
RIII	34	2	110	54	LIII	33	4	105	61
RIV	13	0	85	102	LIV	13	0	108	78
RV	7	0	154	32	LV	11	0	166	21
Total	127	20	460	385	Total	139	14	497	344

**Table 3:** Finger pattern frequency in female subjects (n = 200), in sampled Ndokwa subjects

Female Right Hand					Female Left Hand				
Finger	Pattern Types				Finger	Pattern Types			
	A	R	U	W		A	R	U	W
RI	34	1	48	85	LI	40	2	58	99
RII	42	11	56	56	LII	59	18	50	68
RIII	38	0	91	42	LIII	45	3	96	54
RIV	18	1	100	57	LIV	17	0	113	70
RV	13	0	142	13	LV	14	0	174	11
Total	145	13	437	253	Total	175	23	491	302

*Key*

RI – RV = Right fingers      LI – LV = Left fingers

A = Arch, R = Radial loop, U = Ulnar loop and W = whorl

Table 1 also presents the pattern complexity. The arch/whorl ratio (Darkmeijer's index) is 44% for males and 53% for the females ( $p < 0.001$ ). The whorl/loop ratio was 68% for males and 51% females ( $p < 0.001$ ).

Tables 2 and 3 shows the pattern of polarization of each dermal ridge pattern type across the ten digits in the sample population. Ulnar loops polarized preferentially to digits III, IV and V (middle, ring and little fingers) and radial loops localized to digit II (index finger) in both sexes. Arches were more in digits I, II and III (thumb, index and middle fingers) in both male and

**Table 4:** Total finger ridge count (TFRC) and pattern intensity index (PII) in sampled Ndokwa subjects

	Male	Female
TFRC Mean	102.91	99.94
Standard Deviation	37.11	37.55
PII Mean	10.30	10.00



**Table 5:** atd angle and a-b range count in sampled Ndokwa subjects

	Male	Female
atd Mean	39.39	40.97
Standard Deviation	3.91	4.73
a-b Mean	68.11	69.50
Standard Deviation	11.00	9.18

**Table 6:** Comparison of total finger ridge count, atd and palmar a-b ridge count among Ndokwa subjects and other Nigerian tribes

Population	TFRC	Female ATD	ABRC	Population	TFRC	Male ATD	ABRC
Ndokwa	99.94±37.6	40.97±4.75	69.50±9.2	Ndokwa	102.91±37.11	39.39±3.91	68.11±11.0
Ibo <sup>7</sup>	111.4±40.2	76.6±7.8	73.4±8.9	Ibo <sup>7</sup>	113.8±44.3	77.1±4.1	74.2±8.5
Yoruba <sup>7</sup>	121.6±39.2	77.9±11.8	74.4±5.9	Yoruba <sup>7</sup>	101.6±37.9	76.3±4.7	72.8±8.5
Hausa <sup>12</sup>	124.7±8.2	79.72±6.25	78.7±9.4	Hausa <sup>12</sup>	130.1±9.1	78.04±7.91	72.9±10.4
Urhobo <sup>12</sup>	110.48±15.5	68.10±8.70	74.4±8.9	Urhobo <sup>12</sup>	115.5±16.8	59.90±8.70	74.4±6.10
Ogoni <sup>10</sup>	109.70±49.9	42.09±5.3	73.2±9.6	Ogoni <sup>10</sup>	128.3±48.4	39.57±5.13	75.6±12.8

## Discussion

The results of this study demonstrate that homologous fingers tend to have comparable counts of pattern types. This is in accordance with what has been obtained among other Nigerian tribes previously studied [7,10]. Left hand digits have slightly higher counts of arches as compared to right hand digits in both male and female gender. This is similar to what has been documented previously. Also in accordance with the previous studies above is the tendency among the Ndokwa people for males to have a relatively higher count of whorls.

It was only in male Ndokwa subjects that whorl patterns and radial loops occurred more commonly on right hand digits. This is a slight deviation from the generalization of Cummis and Midlo, where it is expected that whorl patterns and radials loops should occur more commonly on the right hand digits in both sexes as compared to the left hand digits [1]. The documented tendency for left hand digits to have a slightly higher count of arches as compared to the right hand digits in both sexes was demonstrated among the Ndokwa people. Concerning pattern polarization, radial loops expected localized to the index finger in this study as has been demonstrated in previous studies [11].

In terms of pattern complexity, the arch/whorl ratio (Dankmeijer) index was observed to be 44% for male Ndokwa subjects: a value that is similar to that reported for male Urhobo (41%) and Hausa

(47%) of Nigeria [12]. This value is in the intermediate range by African standards. This is so because wide variations in arch/whorl ratio exist among Africa populations. The highest index of 110 is seen among the Bushmen and the lowest of 10 among Batwa of West Kiva [1]. In female subjects, the arch/whorl ratio is 53%. This is similar to that reported for female Ogoni (50%) [10] and slightly

higher than female Yoruba and Ibo (44% and 43% respectively) [7].

In conclusion, this study therefore shows that the pattern asymmetry and polarization of digital dermal ridge pattern types among the Ndokwa people is in conformity with the pattern expected in a normal Nigerian population. However, the ABRC in the male and female as well as the TFRC in the female are markedly lower than the values in other Nigerian tribes compared. This may be due to the unique genotype of the Ndokwas.

## References

1. Cummins H and Midlo C. Finger prints, palms and soles: An introduction to Dermatoglyphics. Dover Publication. New York. 1961; 1 – 5.
2. Penrose L. S. Medical significance of finger prints and related phenomena. Brit. Med. J. 1968; (2) 321.
3. Schaumann B and Alter M. Dermatoglyphics in Medical Disorders. Springer – Verlag. New York. 1976; 220 – 289.
4. Ahuja YR and Plato CC. Effect of environmental pollutants on Dermatoglyphics. In Durhan NM and Plato CC (eds). Trends in Dermatoglyphics Research. Kluwer Academic Publishers. London. 1990; 125 – 128.

5. Rosa A, Gutierrez B, Guerra A, Arias B and Fananas L. Dermatoglyphics and abnormal palmar flexion creases as markers of early prenatal stress in children with idiopathic intellectual disability .J. Intellect Disabil. Res. 2001; 45 (5): 416 – 423
6. Boroffice R A. Digital Dermatoglyphic patterns in a sample of Nigeria population. Am. J. of Physical Anthropol. 1978; 49: 167 – 170
7. Igbigbi PS, Didia BC, Agan TU and Ikpa RE. Palmar and digital dermatoglyphics in two ethnic communities in Nigeria. West Afri. J. of Anat. 1994; 23: 147 – 178
8. Oladipo GS, Olotu J and Didia BC. Dermatoglyphic pattern in Igbo and Ikwerre ethnic groups. J. Sci. Technol. Res. 2005; 4 (2): 24 - 27
9. Antonuk SA. To the method of receiving of human palmar prints. Voprosy Anthropol. 1975; (50): 217 – 221
10. Jaja BNR. Asymmetry and pattern polarization of digital dermal ridges among the Ogoni people of Nigeria. Scientific Research and Essays. 2008; 3 (2). 51 – 56
11. Meier RJ. Digital dermatoglyphics. Encyclopedia of Human Biol. Academy press Inc. London
12. Igbigbi PS, Didia BC, Owhojedo H and Obochio O. Comparative Palmar and Digital Dermatoglyphics of Hausa and Urhobo Ethnic Groups in Nigeria. West Afri J. Anat. 1996; 4: 51 - 56

Received: 09/04/10

Accepted: 13/01/11

