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Full Length Research Paper

Asymmetry and pattern polarization of digital dermal ridges among the Ogoni people of Nigeria

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Dermal ridges express patterns of asymmetry and polarization across the fingers that can characterize human populations. They are also known somatic markers of teratogenic insults. This study documents the asymmetry and pattern polarization of dermal ridges among the Ogoni people of Nigeria. Ink prints of the fingers were obtained from 406 apparently healthy Ogoni subjects and dermal ridge pattern types of whorls, arches, ulnar loops and radial loops identified and their pattern of polarization across the ten digits established for each hand in each sex. Ulnar loops polarized preferentially to digits III –V; arches to digits I-II; whorls to digits I, II, and IV; and radial loops to digits II. Female subjects had higher counts of arches (P <0.001), radial loops and ulnar loops (P>0.05) than the males, while male subjects had higher counts of whorls (P<0.01) than the females. The findings of this study form useful baseline data for subsequent longitudinal cytogenetic studies on the Ogoni people.

Key words: Dermatoglyphics, Ogoni, dermal ridges, Nigeria.

INTRODUCTION

The dermal ridges on the fingers are configured into distinct pattern types with each type having a pattern of polarization across the digit that is genetically determined yet susceptible to modification by environmental influences operative during early embryogenesis (Meier, 1991; Sadler, 2004). Among apparently healthy populations, a general trend in the pattern of asymmetry and digital polarization of dermal ridges has been noted (Meier, 1991; Vecchi, 2005). Yet, this trend still expresses racial and indeed tribal variations that may be useful for phenotypic differentiation between human groups (Igbigbi and Msamati, 2005).

Research evidences have underscored the value of didigital dermal ridge polarization and asymmetry as putative somatic markers of genetic and environmental influences that may destabilize developmental processes prenatally (Schauman and Alter, 1976; Ahuja and Plato, 1990; Cummins and Midlo, 1961; Rosa et al., 2001).

Previous studies on this subject among Nigerian populations have been restricted to only a few tribes, despite the fact that over two hundred tribal entities exist in the country (Ojikutu, 1964; Jantz and Brehme, 1978; Igbigbi et al., 1994, 1996; Oladipo et al., 2005). To our awareness, it has not been carried out among the Ogoni people of the Niger delta region of southern Nigeria.

The Ogoni people are critical to the political economy of Nigeria in view of the high concentration of oil and petrochemical activity in Ogoni land and the attendant political agitations that accompany oil exploitation in the Niger Delta region (Maier, 2000). We undertook this study to document the pattern of asymmetry and polarization of dermal ridges among an apparently healthy Ogoni population with the intent to provide data that can serve as a control series in future longitudinal cytogenetic studies, utilizing analysis of digital dermal ridges as markers of teratogenic insults, to examine the likely health impact of any putative oil and petrochemical pollutant that may be operative in the environment of the Ogoni people.

MATERIALS AND METHODS

Study population and ethical consideration

This study was conducted among Senior Secondary School Students in Ogoniland, Rivers State of Nigeria. The schools were Beeri High School, Beeri; Community Secondary School, Bomu; Government Secondary School, Nonwa; and, Community Secondary School, Nweol. Selected Schools were chosen based on their geo-

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Whorl Loop Arch

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

Table I. Summary of counts of digital ridge pattern types in the sampled Ogoni subjects.

Pattern type	Males		Females	
	Right	Left	Right	Left
Arch	89	93	120	160
Whorl	377	332	272	286
Ulnar Loop	528	562	581	537
Radial Loop	21	25	42	32

graphic location and population mix, which ensured adequate representation of the different clans in Ogoni land. We obtained permission to conduct the study from the authorities of the selected schools and participating students were properly briefed on the purpose and procedure of the research. Only verbally consenting volunteers were sampled for the study and each of them was given a token of appreciation.

Inclusion and exclusion criteria

Sampled subjects were physically able-bodied volunteers who are Ogoni by tribe and had parents and grandparents who are also Ogoni by tribe. Each subject was also asked if there were any non-Ogoni contributions to his/her ancestral lineage as far back as he/she could recollect or might have been told. Those who gave a positive answer were excluded.

Print collection and analysis

Rolled ink prints of each digit was obtained according to the inking procedure described by Antonuk (1975), then studied with the aid of a magnifying lens and analyzed according to standard techniques as described by Cummins and Midlo (1961). Digital dermal ridge pattern types were classified into whorls arches and loops (Figure 1). Loops that opened towards the ulnar side of the digit were further classified as ulnar loops while those that opened towards the radial side of the digit were identified as radial loops. Distinction was not made amongst the varieties of whorl patterns. We examined the distribution of each pattern type across the ten fingers. The degree of pattern complexity among the sampled subjects was also assessed by using the arch/whorl and the whorl/loop ratio. Tests of significance was done using chi (X^2) square.

RESULTS

Clear fingerprints were obtained from 406 subjects consisting of 203 males and 203 females.

The overall distribution of digital dermal ridge pattern types in both sexes is presented in (Table 1). The pattern of polarization of each dermal ridge pattern type across the ten digits in the sampled population is as shown in (Figures 2, 3, 4 and 5). A scrutiny of these data revealed the following:

Pattern asymmetry

Arch count was higher on the left hand digits as compared to right hand digits in both sexes. Female subjects had significantly higher counts for arches than their male counterparts ($P<0.01$). This disparity was expressed across all ten digits but most especially on the thumb, index and middle fingers of the left hands.

Whorl count was higher on right hand digits than it was on left 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 ($P<0.05$). Counts of ulnar and radial loops were higher on left hand digits in comparison to right hand digits in male subjects. But the reverse was seen in both pattern types for female subjects. The intersex differences in ulnar and radial loop counts did not reach statistically significant levels with $P>0.05$.

Pattern polarization

In both males and females, a relatively higher frequency of ulnar loops was seen on digits III-V (middle, ring and little finger). Radial loops localized to digit II (index finger) in both sexes while arches were preferentially distributed to digits I-III (thumbs, index and middle fingers) of both hands. This polarization pattern was irrespective of sex. Whorls occurred more often on digits I, II and IV (thumb, index and ring fingers) in the sampled population. In all, homologous fingers tended to have comparable counts for each pattern type.

Pattern complexity

The arch/whorl ratio was 26% for male and 50% for fe-

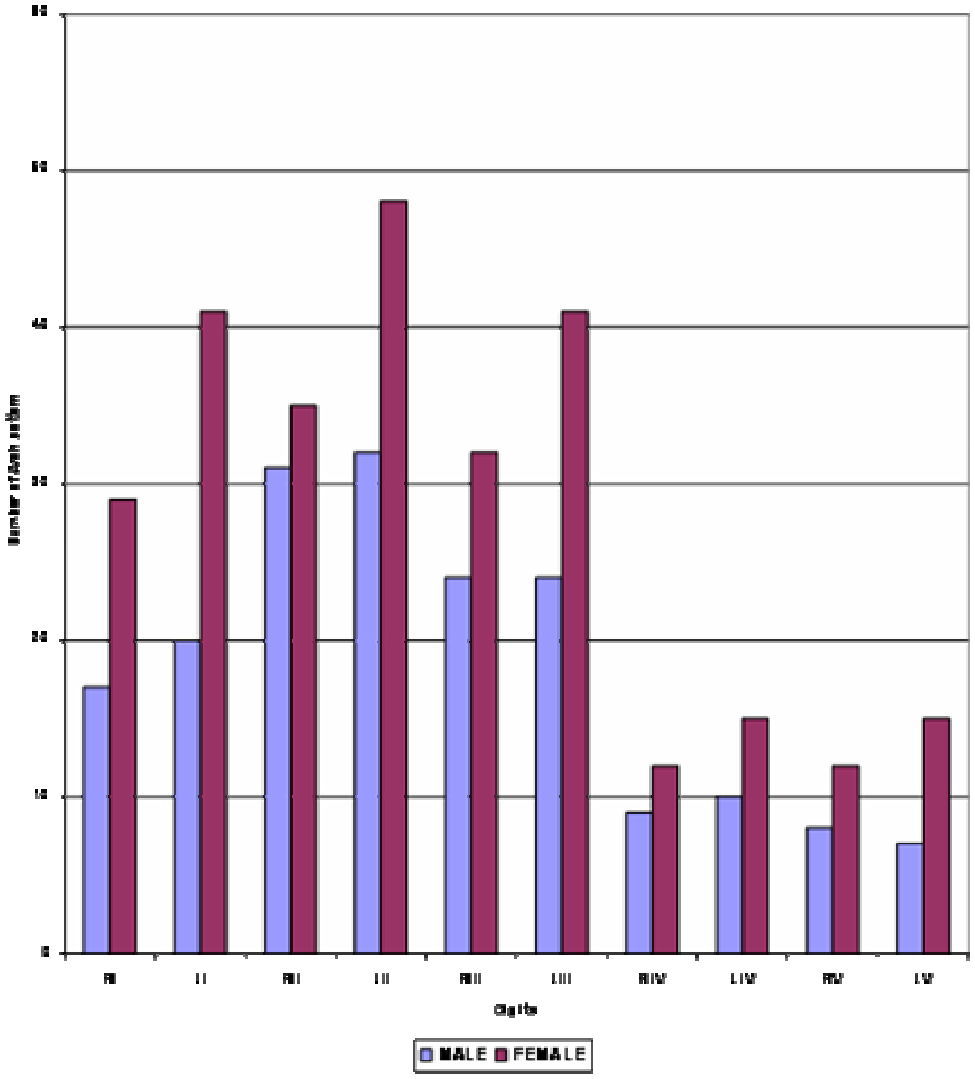

Figure 2. Bar chart showing the polarization pattern of arch pattern in sampled subjects.

male subjects (P<0.001) while the whorl/loop ratio was 60.5% for male and 46.8% for female subjects (P<0.05). In (Table 2), comparative data are presented of pattern asymmetry and complexity variables amongst the Ogoni, Yoruba, Ibo, Hausa and Urhobo tribes. It could be seen that male subjects of these Nigerian tribes tended to have a higher count of whorl pattern on the right hand relative to the left hand. Male Ogoni subjects have the lowest arch/whorl ratio of the five indigenous Nigerian tribes compared.

DISCUSSION

Variations seen in the distribution of dermal ridge pattern types across the fingers form part of dermatoglyphic studies. Cummins and Midlo (1961) as well as Schauman and Alter (1976) have carried out large scale reviews of data on the subject in apparently healthy populations and in certain disease states. The documented tendency for homologous fingers to have comparable counts of pattern types in healthy people and for left hand digits to have a slightly higher count of arches as compared to right hand digits in both sexes was demonstrated in our sampled population. The tendency for males to have a relatively higher count of whorls and for females to have a relatively higher count of arches was also seen among the Ogoni people.

According to the generalization of Cummins and Midlo (1961), it is expected that whorl patterns and radial loops should occur more commonly on right hand digits in both sexes as compared to left hand digits. This pattern of hand asymmetry was not clearly the case among the Ogoni people. While among the male subjects, it was the finding in relation to whorls, in the females; it was radial loops that expressed the expected pattern of hand asymmetry. Bilateral hand asymmetry in relation to whorls and

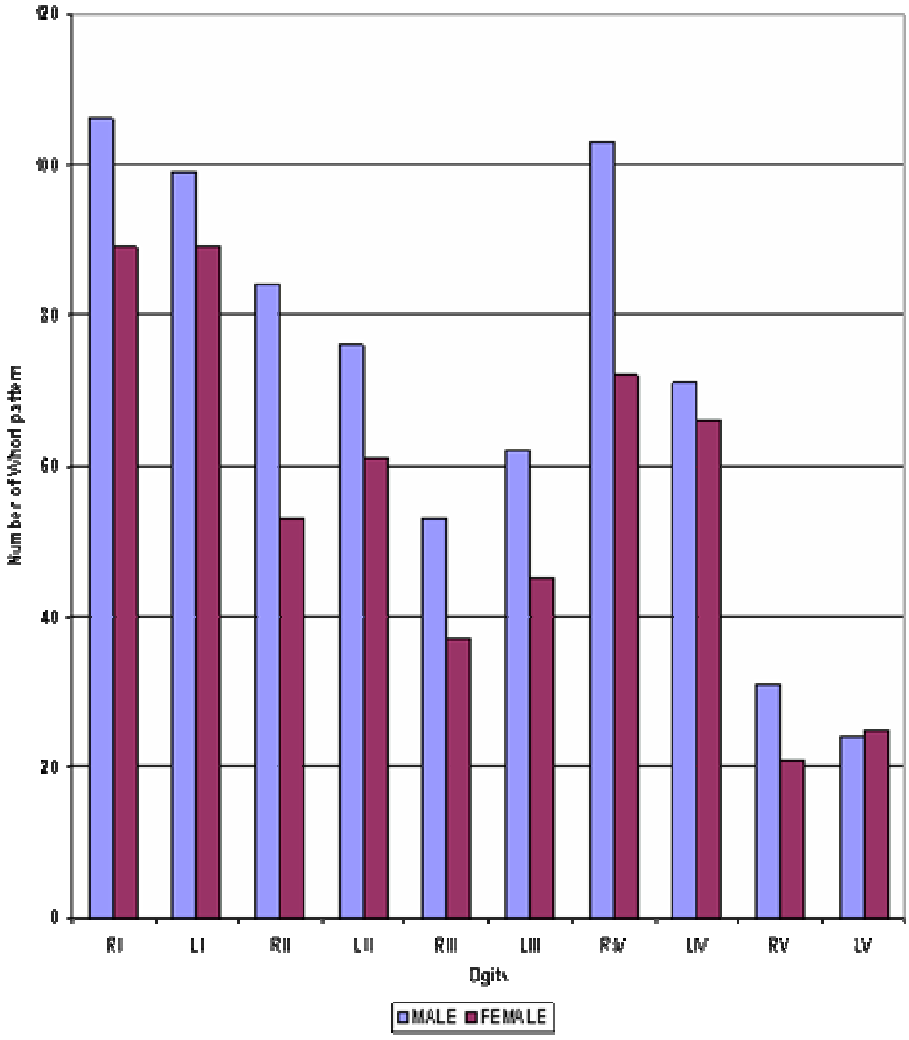

Figure 3. Bar chart showing polarization pattern of whorl pattern in sampled Ogoni subjects.

and radial loops has been observed among male subjects of the Yoruba, Ibo, Hausa and Urhobo tribes of Nigeria but not among their female counterparts (Table 2).

A similar pattern of hand asymmetry to what was seen among the Ogoni people of this study has also been demonstrated in other African tribes such as the Baganda of Uganda (Virji, 1977), Fali and Bamileke tribes of Cameroon (Glanville, 1968), Hehe of Tanzania (Roberts, 1962) and Kusasi of Ghana (Rigter's Aris, 1975). It would appear therefore that the generalization of Cummins and Midlo in relation to asymmetry of whorl and radial loop patterns is more appropriate for Caucasians than it is for African populations.

In terms of pattern polarization, the findings in the Ogo-ni are consistent with trends expected in a normal population, the difference being in the finding of a comparatively high count of ulnar loops on the ring fingers and of whorls on the index fingers among the Ogoni subjects. This feature is probably unique to the people given that genetically programmed minor differences in the timing of embryonic growth and differentiation during dermal ridge formation is responsible for the variations seen in the digital distribution of dermal ridge patterns across human populations (Meier, 1991). Radial loops, expectedly, localized preferentially to the index finger in the sampled subjects (Meier, 1991). In patients with trisomy 21 (Down's syndrome), it localizes preferentially to the ring and little fingers (Schauman and Alter, 1976).

Wide variations in arch/whorl ratio, also called Dankmeijer index, exist among African populations. The highest index of 110 is seen among the Bushmen and the lowest index of 10 among Batwa of West Kiva (Cummins and Midlo, 1961).In this study, the arch/whorl ratio was observed to be 26% among male Ogoni subjects: a value that is in the low range of this variable and is similar to what has been obtained among male subjects of the Hausa tribe of Nigeria (Igbigbi et al., 1996), male Bagan-

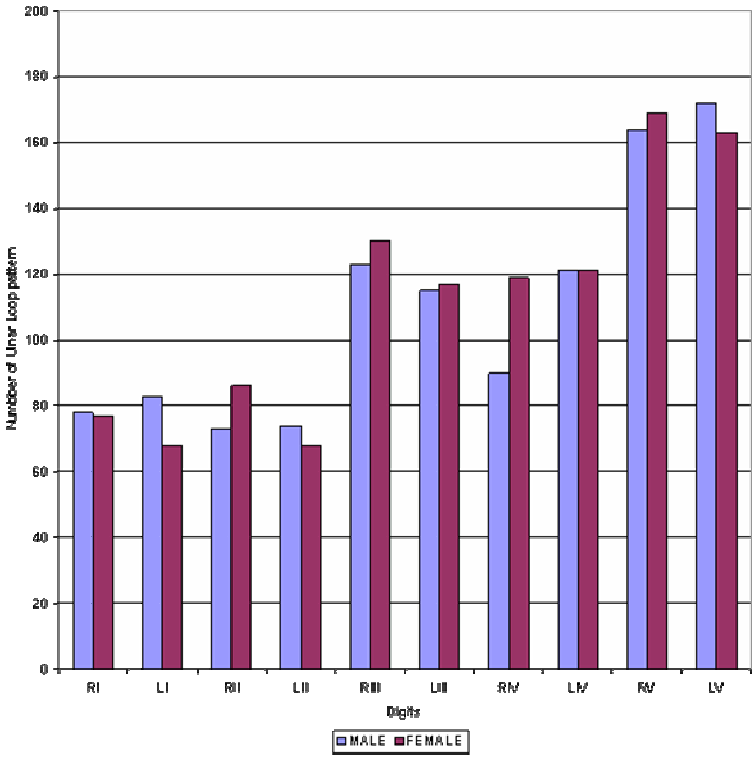

Figure 4. Bar chart showing polarization pattern of ulnar loop in sampled subjects.

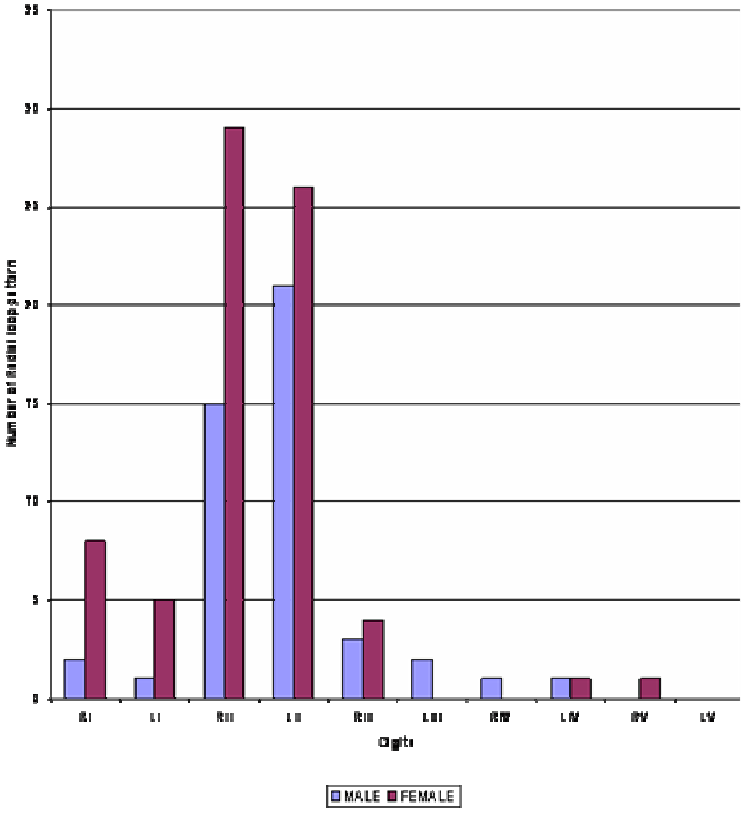

Figure 5. Bar chart showing polarization pattern of radial loop in sampled Ogoni subjects.

Table 2. A comparison of pattern asymmetry and complexity variables between the Ogoni and other Nigerian tribes previously reported. Figures are reported as percentages.

V	Yoruba (1994) +				Ibo (1994) +				Hausa (1996) + +				Urhobo (1996) + +				Ogoni (Present study)			
	M [250]		F [133]		M [250]		F [140]		M [300]		F [305]		M [342]		F [270]		M [203]		F [203]	
	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
A	10.1	10.2	10.2	11.6	11.4	14.4	11.4	12.9	7.1	9.5	13.7	16.1	11.8	14.6	11.8	14.1	8.7	9.2	11.8	15.8
W	28.5	26.7	23.3	25.7	24.2	22.3	28.1	28.3	36.8	34.3	31.5	29.9	35.1	29.7	31.6	32.6	37.1	32.8	26.8	28.2
U	58.7	61.2	65.4	66.5	61.8	62.0	58.3	55.7	53.8	54.9	53.1	51.9	49.4	53.0	54.7	51.3	52.0	55.5	57.2	52.9
R	2.7	1.9	1.1	2.3	2.6	2.3	2.1	3.1	2.4	1.3	1.7	2.1	3.7	2.7	1.9	2.0	2.1	2.5	4.1	3.2
A/W	35.4	38.2	43.8	45.1	47.1	64.6	40.6	45.6	19.3	27.7	43.5	53.8	33.6	49.2	37.3	43.3	23.5	28.1	44.0	56.0
W/L	46.4	42.3	35.0	40.9	37.6	34.7	46.5	48.1	65.5	61.0	57.5	55.4	66.1	53.3	55.8	61.2	68.5	56.6	43.7	50.3

V = Variables, A = Arch, W = Whorl, U = Ulnar loop, R = Radial loop, M = Male, F = Female, R = Right, L = Left, [ ] = Sample size Sources: +: Igbigbi et al, 1994; ++; Igbigbi et al, 1996.

da of Uganda (Virji, 1977) and Peul tribe of Mali (Glanville and Huizinga, 1966); but significantly lower than values in the male Urhobo (40%), Yoruba (36%), and Ibo (55%). In the female subjects, the arch/whorl ratio is rather on the intermediate range by African standards but is similar to values reported for female Yoruba, Ibo (Igbigbi et al., 1994), Hausa and female Baganda of Uganda as well as female Peul of Mali. The observed sexual differences in this variable reflects the tendency for females to have a higher count of arch and lower count of whorls in comparison to males. This tendency is probably indicative of the modulatory influence which genes borne on the variable segments of the sex chromosomes have on the several ontogenic processes regulating ridge pattern morphogenesis in utero. In conclusion, the study has shown that the pattern of asymmetry and polarization of digital dermal ridge pattern types among the Ogoni people of the Niger Delta region of Southern Nigeria, to a certain extent is in conformity with the patterns expected for an apparently healthy population and similar to what is seen in other African tribes previously studied. The features in which this people differ from other populations most likely reflect the unique, inherent genotype of the Ogoni people.

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