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Comparative Study of Fingerprint Patterns of Two Ethnic Groups: A Nigerian Study

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ABSTRACT

Background: The uniqueness of fingerprints have made it possible for anthropologist to carry out studies on ethnic differences, heritability and linguistic relationships among individuals. The study aimed at investigating and comparing fingerprint patterns of the Itsekiri and Urhobo ethnic groups in Warri, South Southern Nigeria. **Methods:** A total of 30 males and 30 females each from the Itsekiri and Urhobo tribe were investigated. Fingerprints of participants were obtained with a Hewlett placard G4010 fingerprint scanner. Chi-square and Mann Whitney U test were used to test for an association between non parametric variables, significance was accepted at $P<0.05$. **Results:** Finding showed that the ulnar loop was the most predominant pattern in the studied population. Fingerprint patterns and total finger ridge count showed dimorphism among the Itsekiris' as compared to the atd angle of the left fingers seen in the Urhobos' ($p = 0.021; 0.010; 0.038$). Significant differences were observed in fingerprint patterns of the right and left thumb alongside the right middle finger among the respective tribes ($P=0.047; 0.007; 0.024$). Findings also showed a significant difference in TFRC and atd angle between the Itsekiris' and Urhobos' ($P= 0.010; 0.002; 0.027$) . **Conclusions:** The ulnar loop was dominant among the Itsekiri females and Urhobo males while the whorl and arch patterns were frequent in the Itsekiri males and the Urhobo females.

Keywords: Delta State; fingerprint; Itsekiri; Urhobo; Warri.

INTRODUCTION

It has been observed that perculiar skin features present on the palm and soles of individuals makes them unique.[1] These attributes are recognized as friction ridges which leaves impressions described as fingerprints when in contact with an object or surface.[1] The foremost perception of fingerprints as a measure of identification were observed on past scrolls from ancient Chinese lineage and in clay emblems from past Babylonians.[2] Ancient Indians are known to have also understood the magnanimity of the use of dermatoglyphics in demonstrating originality in documentation.[3]

In addition to its medicolegal use in identification, fingerprints had earlier been utilized in understanding genetics and linguistics.[4-5] In an investigation which compared finger ridge counts among three Roman and twelve world populations, findings showed that there was an association linking the linguistically definite Roma populations, a section of the Indo-European language family and the Urali which is part of the Dravidian language family of a South Indian populace.[4] A previous study carried out by Slatis et al. among 571 Isrealis' indicated that fingerprints were an hereditary trait.[5] Also from Hepburn postulated theory, friction ridges aids in grasping through increased level of friction connecting the ridges and the grasped object.[6]

The uniqueness of fingerprint has been attributed to the minutiae.[7] It has been described as the most minute feature in dermatoglyphics and they are reflected in three basic configurations: bifurcations, ending ridges and dots.[8] Their disposition and interrelation within fingerprints are the basic attributes used in forensic investigation, because it has never been discovered that these minutiae are replicated among persons.[9]

Fingerprints have been studied among various ethnic groups in Nigeria,[1] but there are no reports on fingerprints of the Itsekiri ethnic group in Nigeria, hence this study to our best of knowledge will for the first time demonstrate fingerprint patterns among the Itsekiris' and compare their patterns with the Urhobos.

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METHODS

The study adopted a cross-sectional design comprising of 30 males and 30 females each from the Urhobo and Itsekiri tribe respectively in Warri city, Delta South, Nigeria. Participants were 18years and above. Warri city has a population of over 311,970, comprising mainly of the Urhobo, Itsekiri and Ijaw people.[10] It was described as one of the major axis of petroleum enterprise and business in Southern Nigeria[11]. In advance to the study, Ethical consent was obtained from the Research and Ethics Committee of the Faculty of Basic Medical Sciences, Delta state University on the 8th of October 2018 (DELSU/CHS/ANA/18/09). Simple random sampling was used to obtain participants from private and public schools located in Warri. Sample size was obtained with the modified Cochran formula (n= (n0/1+n0-1)/N) due to the fact that our sample size was less than 1000. The objectives and advantages of the study were outlaid to the participants. Those with deformities of the hand were not considered for the investigation. Informed consent was obtained from participants after assuring them of the safety of the procedure. Fingerprints were obtained with a Hewlett placard G4010 Photo scanner G4010 fingerprint scanner (Figure 1).

Figure 1. Hp G4010 fingerprint scanner.

The scanner was illuminated with a 500 solar power inverter which was linked to a 12 volts rechargeable battery. Inorder to get an explicit and well expounded imprints, fingerprints were taken in a less anxious and finish position. Finger prints of all ten fingers of both left and right hands were taken and interpreted based on the three cardinal dermatoglyphics landmarks which have been termed the triradius, core and radiant (Figure 2).

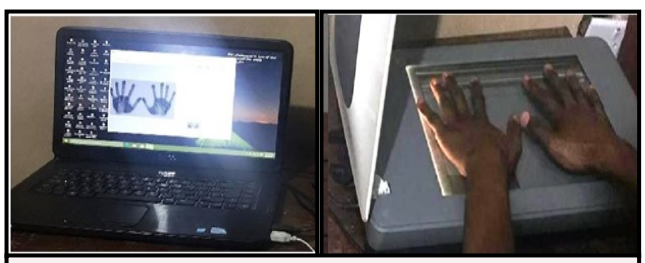

Figure 2. Photoplate illustrating fingerprints capturing.

They were classified as whorls, arches, radial and ulnar loop.[12] Based on the location of the triradius, we could identify the whorls from the scanned prints because it posseses two triradii, arches were distinguished with the absence of a triradius , ulnar loops were identified becaused it had one triradii at the thumb side while radial loops had a triradii at the side of the little finger. Ridge counts were counted by drawing lines from the triradius to the core of patterns (Figure 3) while atd angles were

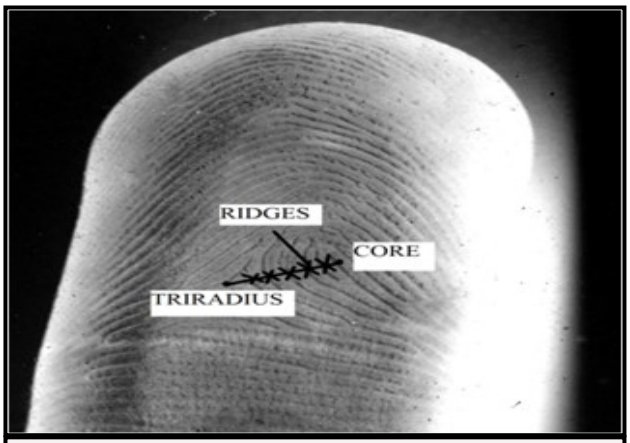

Figure 3. Illustration of finger ridge count.

obtained from lines drawn between the triradii beneath the index and little finger and the most proximal triradius on the hypothenar region of the palm (Figure 4). Data were represented in tables to

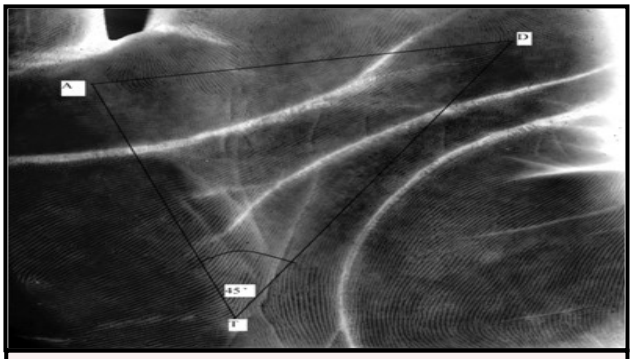

Figure 4. The palm illustrating ATD angle.

show distribution of fingerprint patterns among the Urhobo and Itsekiri tribe. Chi-square was used to test for association between gender and fingerprint patterns. An independent-test was used to compare means of dermatoglyphic variables among males and females of the respective tribes. Statistical evaluation was effected using SPSS 20 Software Version. Significance was accepted at $P<0.05$.

RESULTS

Table 2 showed that the ulnar loop was seen in 47.3% and 52.7% Itsekiri males and females as compared to 52.1% and 47.9% Urhobo males and females. The whorl pattern was seen in 57.8% and 42% Itsekiri males and females in contrast to 50%

Table 1. Distribution of Fingerprint Patterns in Itsekiri and Urhobo Ethnic Group.

Ethnic Group	Patterns	Frequency
Itsekiri		
Ulnar Loop	368	61.3
Whorl	119	19.8
Arch	108	18
Radial Loop	5	0.8
Urhobo		
Ulnar Loop	361	60.2
Whorl	156	26
Arch	78	13
Radial Loop	5	0.8

Table 2. Gender Comparison of Fingerprint Distribution in both Itsekiri and Urhobo Ethnic Group.

Patterns	Male	Female	Total	P value
Itsekiri				
Ulnar Loop	174 (47.3)	194 (52.7)	368 (100)	
Whorl	78 (57.8)	57 (42.2)	135 (100)	0.021*
Arch	43 (46.7)	49 (53.3)	92 (100)	
Radial Loop	5 (100)	-	5 (100)	
Urhobo				
Ulnar Loop	188 (52.1)	173 (47.9)	361 (100)	
Whorl	78 (50.0)	78 (50.0)	156 (100)	0.234
Arch	33 (42.3)	45 (57.7)	78 (100)	
Radial Loop	1 (20.0)	4 (80.0)	5 (100)	

Urhobo males and females each respectively. The arches was reflected in 46.7% and 53.3% Itsekiri males and females as against 42.3% and 57.7% Urhobo males and females while the radial loop was seen in 80% Urhobo females. There was a significant difference in fingerprint patterns among male and female Itsekiris' at $p<0.05$.

Fingerprints patterns of each digits were compared among the Itsekiris' and Urhobos' (Table 3) and findings showed that 50% Itsekiris' and 45.3% Urhobos' had the ulnar loop at their right thumb while it was reflected on the left thumbs of 43.3% Itsekiris'and 60% Urhobos' at $p<0.05$. The whorl pattern was seen on the right middle finger of 10% Itsekiris' in contrast to 25% Urhobos' while the arch pattern was observed on the right middle finger of 21.7% itsekiris' as compared to 8.3% Urhobos' at $p<0.05$.

The mean rank of total finger ridge counts among the itsekiris' was 52.31 while that of the Urhobos' was 68.69 at $p<0.05$ (Table 4).

Table 5 showed the mean rank of total finger ridge counts of the itsekiri males and females as 35.17 and 25.83 at $p< 0.05$ in contrast to 30.93 and 30.07 observed among the Urhobo males and females . Findings from this study showed that the atd angles

Table 3. Specific Comparison of Fingerprint Patterns between Itsekiri and Urhobo Ethnic Group.

		Right Hands			Left Hands		
Digit	**Pattern**	**Itsekiri**	**Urhobo**	**P value**	**Itsekiri**	**Urhobo**	**P value**
Thumb	Ulnar Loop	30 (50.0%)	29 (48.3%)	0.047*	26 (43.3%)	36 (60.0%)	0.007*
	Whorl	14 (23.3%)	21 (35.0%)		6 (10.0%)	12 (20.0%)	
	Arch	16 (26.7%)	7 (11.7%)		28 (46.7%)	12 (20.0%)	
	Radial Loop	-	3 (5.0%)		-	-	
	Total	60 (100%)	60 (100%)		60 (100%)	60 (100%)	
Index	Ulnar Loop	27 (45.0%)	30 (50.0%)	0.926	25 (41.7%)	30 (50.0%)	0.429
	Whorl	14 (23.3%)	14 (23.3%)		17 (28.3)	17 (28.3)	
	Arch	16 (26.7%)	13 (21.7%)		16 (26.7%)	13 (21.7%)	
	Radial Loop	3 (5.0%)	3 (5.0%)		2 (3.3%)	-	
	Total	60 (100%)	60 (100%)		60 (100%)	60 (100%)	
Middle	Ulnar Loop	41 (68.3%)	40 (66.7%)	0.024*	40 (66.7%)	30 (50.0%)	0.162
	Whorl	6 (10.0%)	15 (25.0%)		10 (16.7%)	17 (28.3%)	
	Arch	13 (21.7%)	5 (8.3%)		10 (16.7%)	13 (21.7%)	
	Radial Loop	-	-		-	-	
	Total	60 (100%)	60 (100%)		60 (100%)	60 (100%)	
Ring	Ulnar Loop	35 (58.3%)	33 (55.0%)	0.931	41 (68.3%)	34 (56.7%)	0.289
	Whorl	23 (38.3%)	23 (41.7%)		15 (25.0%)	23 (38.3%)	
	Arch	2 (3.3%)	2 (3.3%)		4 (6.7%)	3 (5.0%)	
	Radial Loop	-	-		-	-	
	Total	60 (100%)	60 (100%)		60 (100%)	60 (100%)	
Little	Ulnar Loop	52 (86.7%)	52 (86.7%)	0.158	51 (85.0%)	47 (78.3%)	0.559
	Whorl	8 (13.3%)	5 (8.3%)		6 (10.0%)	10 (16.7%)	
	Arch	-	3 (5.0%)		3 (5.0%)	3 (5.0%)	
	Radial Loop	-	-		-	-	
	Total	60 (100%)	60 (100%)		60 (100%)	60 (100%)	

Table 4. Comparison of Total Finger Ridge Counts (TFRC) between the Itsekiris' and Urhobos'.

Ethnic Group	N	(Mean Rank)	Sum Ranks	Mann-Whitney U	P-Value
Itsekiri	60	52.31	3138.50	1308.50	0.010*
Urhobo	60	68.69	4121.50		

Table 5. Gender Comparison of Total Finger Ridge Counts (TFRC) between Itsekiris' and Urhobos'.

Ethnic Group	Gender	N	Mean Rank	Sum Ranks	Mann-Whitney U	P-Value
Itsekiri	Male	30	35.17	1055.00	310.00	0.038*
	Female	30	25.83	775.00		
Urhobo	Male	30	30.93	928.00	437.00	0.848
	Female	30	30.07	902.00		

of the right fingers among the Itsekiri was 50.63 and 70.38 for the Urhobos' at $p<0.05$. Further findings revealed that the atd angle for the left fingers of the itsekiris' was 53.48 while the Urhobos' had 67.52 at $p<0.05$(Table 6).

Table 6. Comparison of ATD Angles between the Itsekiris' and Urhobos'.

Ethnic Group	N	ATD Angle							
		Right Hand			P-Value	Left Hand			P-Value
		Mean Rank	Sum Ranks	Mann-Whiney U		Mean Rank	Sum Ranks	Mann-Whiney U	
Itsekiri	60	50.63	3037.50	1207.50	0.002*	53.48	3209	1379.00	0.027*
Urhobo	60	70.38	4222.50			67.52	4051		

Table 7 showed the mean rank of ATD angles for the left fingers of the Urhobo males and females as 25.85 and 35.15 at $p<0.05$.

Table 7. Gender Comparison of ATD Angles between the Itsekiris' and Urhobos'.

Ethnic Group	Gender	N	ATD ANGLE							
			Right Hands			P-Value	Left Hands			P-Value
			Mean Rank	Sum Ranks	Mann-Whiney U		Mean Rank	Sum Ranks	Mann-Whiney U	
Itsekiri	Male	30	31.30	939.00	426.00	0.721	30.72	921.50	443.50	0.923
	Female	30	29.70	891.00			30.28	908.50		
Urhobo	Male	30	27.78	833.50	368.50	0.227	25.85	775.50	310.50	0.038*
	Female	30	33.22	966.50			35.15	1054.50		

Table 8 compared total finger ridge counts of males and females from this study to those of other tribes.

Table 8. A comparison of TFRC between Itsekiri / Urhobo subjects and other Nigerian tribes.

A. MALE		
Study	**Population**	**TFRC**
Present study	Itsekiri	101.6
Present study	Urhobo	128. 7
Jaja and Igbigbi[13]	Ijaw	113.8
Igbigbi et al.[1]	Ibo	113.8
Igbigbi et al.[1]	Yoruba	101.6
Igbigbi et al.[1]	Hausa	130.1
Jaja [14]	Ogoni	128.3
Anibor et al.[15]	Ndokwa	102.9
B. FEMALE		
Study	**Population**	**TFRC**
Present study	Itsekiri	75.5
Present study	Urhobo	101.9
Jaja and Igbigbi[13]	Ijaw	111.4
Igbigbi et al.[1]	Ibo	111.4
Igbigbi et al.[1]	Yoruba	121.6
Igbigbi et al.[1]	Hausa	124.7
Jaja[14]	Ogoni	109.7
Anibor et al.[15]	Ndokwa	99.9

Findings shows that the Ijaw males and females had a total finger ridge count of 113.8 and 111.4 while those of the Hausa was 130.1 and 124.7

DISCUSSION

Fingerprint pattern in the studied population

The study of dermatoglyphics has its medicolegal value in the identification of individuals, sex , race and ethnic differences.[12] Findings from this study revealed that the most predominant fingerprint pattern was the ulnar loop ,which was followed by the whorl pattern and the arches. These findings were similar to other Nigerian studies carried out among several ethnic groups .[13-14,16] The ulnar loop has been associated with the Africans alongside the Europeans in contrast to the Asians and Tibetans linked with the whorl patterns while the arches connected with the Eskimos and the Bushmen emanating from Central Africa.[17-19] The radial loop was the least observed pattern from this study. This is in contrast to other investigations carried out in other parts of Africa.[20] According to a study carried out among Kenyans and Tanzanians , the arches was reported as the least observed pattern.[20] This study showed that the arches were more common among the females. This indicates that when an arch pattern is found on either hand of a Nigerian female , its' most likely she is from the Urhobo or Itsekiri tribe. Findings were similar to an inquiry carried out among Malawians and Zimbabweans which highlighted the arch pattern as the most frequent pattern observed among females.[20] Therefore there is a probability that African women are associated with the arch patterns. Findings were also in concordance with Cummins and Midlo, (1961); Holt ,(1968) who stated that in all digits , arches in females are almost twice than in males.[21-22] Further findings from this study showed that the atd angles of the respective tribes showed sexual dimorphism.

Total finger ridge counts of the Urhobo males from this study was higher than those of previous studies

from the Ijaw, Igbo, Yoruba, Hausa and Ndokwa males[1,13] while those of the females from this investigation was lower than those reported from several authors from the Ijaw, Yoruba, Hausa and Ogoni tribe .[1,13-14]

Comparism of fingerprint patterns among the Itsekiris' and Urhobos'.

This study showed that fingerprint pattern is a sexually dimorphic trait among the Itsekiris' as compared to the Urhobos'. The Ulnar loop and whorl pattern were predominant among the Urhobos' in contrast to the arches seen in the Itsekiris'. Findings among the Urhobos' were similar to Yang et al. and Rao,[23-24] who discovered that the whorl was predominant among the Chinese population and the Australian Aborigines. Marera,[25] described the arrangement of the ridges in whorls as a succession of concentric rings and these ridges spirals around the core in either a clockwise or anticlockwise direction.[25] The arches observed among the Itsekiris' have been reported the simplest pattern found on the fingertip, formed by succession of more or less parallel ridges.[25] According to Igbigbi,[26] arch ridges tend to enter from one side of the print and leave on the other side . Findings from the Itsekiris' was also in concordance with a population study investigated in Malawi which highlighted the arches as the predominant pattern seen in both male and females.[20]

It was also observed from this study that the ulnar loop occurred more among the Itsekiri females while it was common in the Urhobo males. The whorl and arch patterns from this study were frequently observed among the Itsekiri males as compared to thier predominance in the Urhobo females. This means that when a whorl or arch pattern is seen in an itsekiri, there is a probability that such a person is a male while it shows feminism among the Urhobos'. Findings among the Itsekiris' were similar to a study carried out among the Kanuri Ethnic group of North Eastern Nigeria.[27] The supremacy of the arches seen among the Urhobo females conforms with a previous study carried out among the Annang ethnic group in Akwa Ibom State, Nigeria.[12]

It was discovered from this investigation, that the total finger ridge counts of males from the Itsekiri tribe was significantly higher than those of the females indicating sexual dimorphism. This was similar to previous studies carried out among the Ijaw and Akwa Ibom ethnic groups in Nigeria.[12,15] Findings was not in accordance with Igbigbi and Msamati.[20] Their previous study reported that the total finger ridge counts of the females were significantly higher than those of the males.[20] Apart from its sexual dimorphic feature , heritability has also been demonstrated by early pioneers of fingerprints.[22] According to Sarah Holt, variation of ridge counts has a genetic basis and environmental impact has an effect on the embryogenesis of finger ridges.[22]

From this study the atd angles of the Urhobo females was significantly higher than those of the males for the left fingers. Concerning pattern asymmetry , the ulnar loop were associated more with the right middle and little fingers of the Itsekiris' in contrast to the left thumbs and little fingers of the Urhobos'. The radial loop was associated with the left index finger of the Itsekiri as compared to the right thumbs of the Urhobos'. Disparity of findings conform to the generalization of Cummis and Midlo,[21] who stated that the radial loop was expected to be associated with the right as compared to the left fingers.[21] Findings were also similar to an Egyptian study which discovered that the ulnar loop were discovered among the right digits of both males and females.[28]

CONCLUSIONS

Findings from this investigation showed that fingerprints of the Urhobo and Itsekiri exhibited a significant difference on the right and left thumb alongside the middle finger. Findings will be vital to forensic anthropologist.

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