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A study of Fingerprints in Delta State, Nigeria

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ABSTRACT

Utilizing prints as a means of identification is one of the widespread methods in forensic anthropology and the most popular is fingerprint. The study aimed at investigating fingerprint patterns of individuals from Delta State, Nigeria. Participants were 85males and females each respectively. Fingerprints were taken with a Hewlett placard G4010 fingerprint scanner. Chi-square test established sex associated differences while Mood median test determined the laterality of friction ridges. All inferential statistical analysis was carried out at 95% confidence level, with *P*<0.05 as the significant value. The trend was UL>W>A>RL (63.94%, 26.29%, 8.18%, 1.59%) for the studied population. Findings showed that the most predominant pattern among the males was the whorls while ulnar loop and arches were frequently observed among the females. Fingerprints showed dimorphism for R3D and L2D ($\chi^2_{[df=3]}$ = 12.931, 10.181 ; *P*= 0.005, 0.017). Ridge counts also revealed sexual dimorphism for R2D, 3D, 4D, TR and L1D, 2D, 5D, TL; TFRC ($\chi^2_{[df=1]}$ = 6.815, 17.191, 4.628, 7.625; *P*=0.009, 0.001, 0.031, 0.006)(4.012, 11.390, 5.297, 4.618; 3.976; *P*= 0.045, 0.001, 0.021, 0.032; 0.046). We observed peculiarities in fingerprint patterns among individuals from Delta State while R3D and L2D can be used as a tool in estimating sex for forensic purpose.

Keywords: Fingerprints, Patterns, Delta State, Nigeria.

INTRODUCTION

Fingerprints have been described as the arrangement of epidermal ridges existing on the fingers.¹⁻² They are established on the principle that the skin of the balls present on fingers are covered with ridges and grooves which varies between individuals making identification possible.³ According to Adamu and Taura,⁴ features such as uniqueness, stability and pervasiveness of these prints are attributes used by forensic specialists in medicolegal investigations.⁴ The uniqueness of fingerprint have been attributed to the minutiae which was described as the most minute feature in dermatoglyphics.⁵⁻⁶ Their disposition and interrelation within fingerprints are the basic features used in forensic science because it has never been discovered that they are replicated among individuals.⁵⁻⁶

Several scholars had documented that these patterns are established during embryogenesis by the ratio of volar pad distances; height to width ratio alongside environmental influence and interaction of genes.⁷⁻⁸ Hence can be regarded as a multifactorial trait as earlier stated by Yang *et al.*⁹ According to previous reports, encoding of these prints occur at the interface between the dermis, therefore are not malformed or damaged by external skin injuries.¹⁰⁻¹¹ Though the number, contour, indentations, and spacing of these ridges varies among individuals, fingerprints have been generally classified into three categories: arch, loop, whorls and they are differentiated based on landmark structures formed by the triradii and core.¹²⁻¹⁴ Several studies had reported dermatoglyphic patterns of some tribes from Delta State ¹⁵⁻¹⁷ but literatures on a general indigenous trend are limited , hence we investigated fingerprint patterns among individuals who have their origin from Delta State inorder to observe peculiarities. This could be of importance to physical, cultural and forensic anthropologist.

MATERIALS AND METHODS

This study was a crossectional study which investigated 85males and females each respectively. Participants were unrelated and were 18years and above. Convenient sampling was adopted and preceding to the study, ethical clearance was obtained from the Ethics Committee of the University of Port Harcourt, Rivers State, Nigeria. Only individuals who were of Delta State descent and living within the State were investigated. Fingerprints were obtained by asking participants to placed their palms on a Hewlett placard G4010 Photo scanner,¹⁵ connected to a Hp laptop through a USB cord. The scanner was powered by a 500 solar power inverter connected to a 12volts rechargeable battery.¹⁸ Scanned prints were

analyzed after zooming them on the Hp laptop. Digits were numbered 1D to 5D which corresponded to the 1st finger (thumb) to the 5th finger (little) for both the right and left hands. Patterns were classified into arches, loops and whorls. In order to maintain confidentiality, the prints were coded with serial numbers. Ridges were obtained with an AUTOCAD software version 2010. Descriptive statistics were used to appropriately illustrate frequency and distribution of pattern. Chisquare test ascertained sex associated differences of fingerprints, mood median test was used to determine laterality of friction ridges in the studied population. All inferential statistical analysis was carried out at 95% confidence level, with P < 0.05 as the significant value.

RESULTS

 Table 1: Frequency Distribution of Fingerprint Pattern

Fingerprint Pattern	Frequency (%)
Arch	139(8.18)
Radial Loop	27(1.59)
Ulnar Loop	1087(63.94)
Whorl	447(26.29)
Total	1700(100.0)

Table 2: Qualitative fingerprint pattern and sex-associated differences for the right digits

Digit	Sex	Fingerprint	pattern	Chi-Square Tests				
		A (%)	RL (%)	UL (%)	W (%)	Df	X^2	P-value
R1D	Male	9(10.6)	-	49(57.6)	27(31.8)	2	2.785	0.248
	Female	8(9.4)	-	59(69.4)	18(21.2)			
	Total	17(10.0)	-	108(63.5)	45(26.5)	-		
R2D	Male	8(9.4)	4(4.7)	45(52.9)	28(32.9)	3	6.408	0.093
	Female	11(12.9)	13(15.3)	36(42.4)	25(29.4)			
	Total	19(11.2)	17(10.0)	81(47.6)	53(31.2)			
R3D	Male	5(5.9)	1(1.2)	49(57.6)	30(35.3)	3	12.931	0.005
	Female	7(8.2)	-	67(78.8)	11(12.9)			
	Total	12(7.1)	1(0.6)	116(68.2)	41(24.1)			
R4D	Male	-	-	45(52.9)	40(47.1)	2	5.720	0.057
	Female	2(2.4)	-	56(65.9)	27(31.8)			
	Total	2(1.2)	-	101(59.4)	67(39.4)			
R5D	Male	3(3.5)	-	74(87.1)	8(9.4)	2	0.435	0.804
	Female	4(4.7)	-	75(88.2)	6(7.1)			
	Total	7(4.1)	-	149(87.6)	14(8.2)			

Note: R=*Right, 1D*=*Thumb, 2D*=*Index, 3D*=*Middle, 4D*=*Ring, 5D*=*little, CI*=*Confidence interval Df*=*Degree of freedom; X²*=*Chi-square; A*=*Arch, RL*=*Radial Loop, UL*=*Radial Loop, W*=*Whorl*

	Summary statistics and distribution						Mood's Median Test			
Finger	Sex	Media n	N C Medi	Overall ian	N>Overall Median	Q3 - Q1	95% (median CI)	D F	Chi- Square	P- Value
R1D	Male Female Overal 1	14.00 13.00 13.00	37 49		48 36	9.00 7.00	(12,16) (11,14)	1	3.389	0.066
R2D	Male Female Overal 1	14.00 10.00 11.00	36 53		49 32	8.00 9.00	(10,14) (8,11)	1	6.815	0.009
R3D	Male Female Overal 1	14.00 10.00 11.00	31 58		54 27	8.00 6.50	(12,15) (8,11)	1	17.191	0.001
R4D	Male Female Overal 1	17.00 16.00 16.00	42 52		43 33	6.50 7.50	(15,18) (13,17)	1	2.380	0.123
R5D	Male Female Overal 1	14.00 12.00 13.00	38 52		47 33	7.00 6.00	(12,15) (11,14)	1	4.628	0.031
TR	Male Female Overal l	70.00 60.00 64.00	34 52		51 33	27.50 24.50	(63,76) (54,65)	1	7.625	0.006

Table 3: Mood's median test of the distributional difference in the right FRC of males and females

Note: R=Right, 1D=Thumb, 2D=Index, 3D=Middle, 4D=Ring, 5D=little, N=distribution, TR=Total right, CI=Confidence interval

Table 4: Qualitative fingerprint pattern and sex-associated differences for the right digits

Digit	Sex	Fingerprint	pattern	Chi-Square Tests				
		A (%)	RL (%)	UL (%)	W (%)	Df	X^2	P-value
L1D	Male	11(12.9)	-	53(62.4)	21(24.7)	2	0.625	0.732
	Female	13(15.3)	-	55(64.7)	17(20.0)			
	Total	24(14.1)	-	108(63.5)	38(22.4)			
L2D	Male	13(15.3)	2(2.4)	30(35.3)	40(47.1)	3	10.180	0.017
	Female	11(12.9)	7(8.2)	44(51.8)	23(27.1)			
	Total	24(14.1)	9(5.3)	74(43.5)	63(37.1)			
L3D	Male	9(10.6)	-	45(52.9)	31(36.5)	2	5.090	0.078
	Female	9(10.6)	-	58(68.2)	18(21.2)			
	Total	18(10.6)	-	103(60.6)	49(28.8)			
L4D	Male	4(4.7)	-	44(51.8)	37(43.5)	2	4.835	0.089
	Female	3(3.5)	-	58(68.2)	24(28.2)			
	Total	7(4.1)	-	102(60.0)	61(35.9)			
L5D	Male	3(3.5)	-	73(85.9)	9(10.6)	2	1.257	0.533
	Female	6(7.1)	-	72(84.7)	7(8.2)			
	Total	9(5.3)	-	145(85.3)	16(9.4)			

Note: L=Left, 1D=Thumb, 2D=Index, 3D=Middle, 4D=Ring, 5D=little, CI=Confidence interval Df=Degree of freedom; X²=Chi-square; A=Arch, RL=Radial Loop, UL=Radial Loop, W=Whorl

	Summar	s and distribution		Mood's Median Test					
Finger	Sex	Media n	N Overall Median	N>Overall Median	Q3 - Q1	95% (median CI)	D F	Chi- Square	P- Value
L1D	Male Female Overal 1	14.00 12.00 13.00	40 53	45 32	8.00 8.00	(12,16) (10,13)	1	4.012	0.045
L2D	Male Female Overal 1	12.00 10.00 10.00	32 54	53 31	9.00 8.00	(11,14) (7,10)l	1	11.390	0.001
L3D	Male Female Overal 1	13.00 12.00 12.00	40 46	45 39	6.00 6.00	(12,15) (10,13)	1	0.847	0.588
L4D	Male Female Overal 1	17.00 16.00 16.00	41 50	44 35	5.00 7.00	(15,18) (13,17)	1	1.915	0.166
L5D	Male Female Overal l	14.00 12.00 13.00	36 51	49 34	5.50 5.00	(13,15) (11,14)	1	5.297	0.021
TL	Male Female Overal I	68.00 62.00 64.00	37 51	48 34	35.00 24.00	(61,78) (52,65)	1	4.618	0.032
TFRC	Male Female Overal 1	141.00 121.00 128.50	36 49	49 36	60.00 51.00	(120,154) (110,133)	1	3.976	0.046

Table 5: Mood's Median Test of the Distributional Difference in the left FRC of Males and Females

Note: L=Left, 1D=Thumb, 2D=Index, 3D=Middle, 4D=Ring, 5D=little, N=distribution, TL=Total left, TFRC=Total finger ridge count of both right and left digits, CI=Confidence interval

The percentages of arches, radial loop, ulnar loop and whorls from this study were represented as 8.18%, 1.59%, 63.94% and 26.29%, (Table 1).

Findings from table 2 showed that 10.6%, 57.6% 31.8% males and, 9.4%,69.4%,21.2% females had arches, ulnar loop and whorls on their right thumb (R1D). Arches and radial loop were presented in 9.4% and 4.7% males as compared to their occurrence in 12.9% and 15.3% females for their respective index fingers (R2D). The right middle fingers (R3D) of males had 5.9%, 57.6%, 35.3% arches, ulnar loop and whorls as compared to 8.2%,78.8%,12.9% observed in females at p<0.05. Radial loop in 1.2% males was also on R3D at p<0.05. The whorls were observed represented in 47.1%; 9.4% males and 31.8%; 7.1% females for the right ring alongside little finger (R4D,5D). Further findings also discovered that females had 4.7% arches on their 5D as compared to 3.5% observed in males.

In table 3, we observed that the distribution of finger ridge counts (FRC) were sexually associated with R2D,3D,5D and total ridges for right fingers (TR) ($\chi^2_{[df=1]}$ = 6.815, 17.191, 4.628, 7.625; *P*=0.009, 0.001, 0.031, 0.006).

Findings from table 4 showed that 12.9%; 62.4% males and 15.3%; 64.7% females were presented with arches and ulnar loop for the left thumb (L1D). The whorls were noticed in 24.7% males and 20.0% females. The left index (2D) was seen to have radial loop in 2.4% males as compared to its occurrence in 8.2% females. We also observed ulnar loop and whorls on L3D, 4D, and 5D in 52.9%,51.8%, 85.9% and 36.5%, 43.5%, 10.6% males while it was distinct in 68.2%, 68.2%, 84.7% and 21.2%, 28.2%,8.2% females. The arches were also present in 4.7%;3.5% males and 3.5%;7.1% females on the left ring and little finger (L4D; 5D).

In table 5, we observed that finger ridge counts (FRC) were sexually associated with R1D,2D,5D and total

ridges for left fingers (TL) ($\chi^2_{[df=1]} = 4.012$, 11.390, 5.297, 4.618; p=0.009, 0.001, 0.031, 0.006). There was a significant sex-associated difference in distribution of total finger ridge counts for both the left and right digits ($\chi^2_{[df=1]}=3.976$, P=0.046).

DISCUSSION

The direction of fingerprint patterns in the studied population was UL>WL>A>RL. This was observed among other ethnic groups that are from Delta state. Jaiyeoba-Ojigho *et al.*, Eboh and Anibor *et al.* studies among the Itsekiri, Urhobo, Anioma and Ijaw ethnic groups conforms to our findings.¹⁵⁻¹⁷ This is an indication that majority of the people from Delta State have UL>WL>A>RL as their general trend. Furthermore, most of African studies conducted in Tunisia, Ghana, Kenya and Tanzania reported the ulnar loop as their most predominant pattern which was consistent with our study.¹⁹⁻²¹ Africans have been more associated with the ulnar loop as compared to the whorls and arches linked with the Asians', Tibetans'and, Eskimos'.²²⁻²⁴

We also investigated symmetry from this study and observed that the whorls were predominant on the right and left fingers of the males (1D to 5D) as compared to the ulnar loop which was common on R1D,3D,4D,5D and L1D to 4D in females. The arches were also more associated with the R2D,3D,5D and L1D, 5D of the females. Nevertheless, L2D and 4D of the males showed more arches than their counterparts. Radial loop was observed mainly on the index finger in the studied population. Further from the above, we can ascertain that ulnar loop and arches were more allied with the females as compared to the whorls being more associated with the males.

Findings were similar with Jaiyeoba-Ojigho et al.15 According to their study, the whorls and ulnar loop were the major patterns discovered among the Itsekiri males and females ,which was consistent with that of Eboh among the Urhobos'.¹⁵⁻¹⁶ Jaiyeoba-Ojigho et al. study also reported the aches common among the Urhobo females which was similar with our study.¹⁵ This is a clue that these patterns could define masculism and feminism on the respective fingers among individuals from Delta State. The Malawians and Zimbabweans had the arches as the most frequent pattern among the females which shows that this pattern could be associated with African women as earlier stated by Jaiyeoba-Ojigho et al.^{15,25} However findings from other ethnic groups located in other provinces of Nigeria did not conform to our findings. Ujaddughe et al. study among the Esan ethnic group in Edo State observed their females having more whorls on their left fingers as compared to the males while the loop was seen more on their males for both right and left fingers.²⁶Oladipo et al.among the Okrika people in Rivers State discovered the radial loop on the ring and little fingers (4D,5D) while Abdullateef et al. study among the Ebira-Tao people of the Ebira ethnic group in Kogi State reported the radial loop on all fingers.²⁸⁻²

Further findings showed that finger ridge counts (FRC) of R2D, 3D, 5D; L1D,2D,5D, absolute ridge count of the right and left fingers (ABR) were sexually dimorphic. We also observed dimorphism in total finger ridge counts (TFRC) in the studied population. However, R3D and L2D were the most sexually dimorphic fingers. Findings among the Hausas'of Kano State reported sexually dimorphism only on the left third digit(L3D) while a study among the Yoruba in Plateau State showed that the absolute ridge count and total finger ridge counts were not sexually dimorphic.²⁹⁻³⁰ Variation does not only occur in fingerprints but they are also population dependent. Hence could be vital to cultural, physical and forensic anthropologist.

CONCLUSION

We observed peculiarities in fingerprint patterns among individuals from Delta State while R3D and L2D can be used as a tool in estimating sex for forensic purpose.

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