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Gender Dimorphism of Fingerprint Patterns in Five Digits Among Three Ethnic Groups in Nigeria: A Tool for Identification

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ABSTRACT

Dermatoglyphics study is an important aspect of forensic science in establishing one's identity. This study aims to empirically determine the dermatoglyphic pattern of fingerprints that is prevalent among genders of three ethnic groups (Urhobo, Ika, and Isoko. This study is a descriptive cross-sectional study conducted for six months among three ethnic groups in Delta State. The combined sample size for the study is one thousand two hundred (1200) subjects, each selected across the aforementioned ethnic groups. Data collected was subjected to statistical analysis, using the Statistical Package for Social Sciences (SPSS) version 20. P value <0.05 was considered significant. In all five digits, the most prevalent pattern of prints in males were whorls in the thumb, index, and middle digits, while arches and loops were prevalent in the ring and little digits. For females, the most prevalent were aches in the thumb and ring digits, while the loop was prevalent in the index, middle, and little digits. The current study shows that distinctions exist in patterns of fingerprint between genders. This study will be of great relevance in the fields of anthropology, forensic science, and population dynamics, especially in this era of incessant rise in insecurity in our present-day society.

Keywords: genders, fingerprint, five digits, identification

INTRODUCTION

Dermatoglyphics is the systematic study or assessment of fingerprints to ascertain identity. Fingerprint is the distinctive pattern of minute ridges in the horny layer of the skin.[1] Fingerprints identification is based on the fact that every individual has a unique pattern of prints. The pattern of prints visible on an individual digit follows this order: loops, whorls, and arches. It has been recognized that no two individuals have identical fingerprints, making fingerprints a means of identifying unique characteristics.[2]

The pattern of classifying fingerprints was developed by Francis Galton and Sir Edward Henry in the late 18th century.[3] It has been said that the knowledge of fingerprinting remains the most reliable discovery in criminal justice. Furthermore, only DNA can stand in place of fingerprints as a complete means of proving a person's identification. Prints are unaltered except there is damage to the skin/surface regions where they are seen.[4]

The premeditated impression of fingerprints may be formed by ink or greasy substances staining the edge/peaks of finger ridges/skin and transferring such to a smooth surface such as a fingerprint card.[5] Features of fingerprints usually contain an impression from the pad on the last joint of fingers and thumb, also the lower joints area of the fingers can be recorded.

Human fingerprints have been said to offer a great solution in crime detection since their early use in the 20th century.[6] A lot of criminals avoiding their fingerprints being identified now use gloves, furthermore detectives and forensic experts now use gloves to examine crime scenes to avoid contaminating them with their fingerprints,[7] human fingerprints are explicit, inimitable, unchanging, and durable over the life of an individual making them reliable as long term markers of human identity and may be used by police or other authorities to

recognize individuals who wish to hide their identity, or to recognize human who is unable to identify themselves as a result of being deprived or deceased and also, as in the case of natural disaster.[6] A ridge is a portion of the outer layer of the skin (epidermis) on the digits, the palm, or the sole.[8] These are caused by the underlying interface between the dermal papillae of the dermis and the interpapillary (rete) peys of the epidermis. These epidermal ridges have been reported to increase sensations triggered, for example, when fingertips sweep transversely on an uneven surface. These ridges are said to possibly help in holding irregular surfaces and may exceed surface contact in wet conditions.[9] Deposit of fingerprints is possible by the usual secretion of eccrine glands present in friction ridge skin, it is also possible by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface such as a fingerprint card.[5]

METHODOLOGY

Study Area

The subjects for this research were randomly selected from three study populations in Delta State. Delta State is a state in Nigeria, situated in the South-South geo-political zone of her country. The state is divided into three senatorial districts: Delta Central: (with 8 local governments), Delta North: (with 9 local governments), and Delta South: (8 local governments), with a total population of 4,098,291 with each of the districts having a population size of 1,575,738: 1,293,074 and 1,229,282 respectively (2006 National Population Census).[9]

Gender bias and equity were strictly avoided in the study population, as an equal number of subjects was selected both for males and females across three ethnic groups. This summed up to three hundred and thirty (330) male and female subjects in the Urhobo study population, one hundred and fifty (150) male and female subjects in the Isoko study population, one hundred and twenty (120) males and females in Ika population. Therefore, the male population makes up 50% and the female population makes up 50% for each ethnic group respectively. This method was considered sufficient to avoid any form of ethnic or gender bias on the outcome of the statistical analysis of data collected.

Of the Urhobo study population, subjects were randomly selected from towns and villages, including students of Delta State University in Abraka, State School of Nursing Eku, School of Health Technology Ufuoma, other Urhobo respondents were selected from Okpara (inland and waterside), Oria, Ekuigbo, Afisiere and Olomu. For the Isoko study population, subjects were randomly selected from Ozoro Polytechnic, Delta State University Oleh Campus, Olomoro, and Uzere. For the Ika study population, subjects were randomly selected from the College of Education Agbor, Abavo, Umunede, and Owa towns.

Sampling Technique

All subjects for this study were selected by simple random sampling technique,[10] as such all subjects in the total population of the three ethnic groups were given equal possibility of being selected. This reduces bias and optimizes the analysis of results, as such, creating unbiased statistics.

Sample Size

A sample size of one thousand two hundred (1200) subjects was selected for this study. It includes three hundred and thirty males and females each for subjects of Urhobo, one hundred and fifty males and females for Isoko, and one hundred and twenty for Ika, all of which are of Delta State origin. The formula used for sample size determination for this study was given by Cochran.[11] It was tested at a 95% confidence interval and a 3% margin of error. The sample size calculated using the formula below was 330, 150, and 120 for Urhobo, Isoko, and Ika respectively.

Sample Collection

Biometrics device (digital persona U.are.U 4500 fingerprint scanner) was connected to a Personal Computer, these devices were used to capture print patterns of individuals who gave voluntary consent. To ensure clarity of the prints a sanitizer was given to the subject to wipe their fingers before placing it on the device for capturing.

Data Analysis

All data collected and collated in the study was subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS) version 20. A significant association of fingerprint patterns within the population of the study was established using the chi^2 statistical tool. Statistical significance was considered when a P - value was less than or equal to 0.05 ($P \leq 0.05$).

RESULTS

The results are presented in the summarized table, showing the various patterns of prints that are prevalent in each of the digits among the study population.

Table 3a: Distribution of Fingerprint Patterns among Gender

Variables:	MALE	FEMALE	TOTAL	P-VALUE
Thumb (Patterns)	Frequency (%)	Frequency (%)	N (%)	
Arch	88(44.6%)	109(55.4%)	197(16.4)	
Loop	195(51.1%)	187(48.9%)	382 (31.8)	
Whorl	317(51.1%)	304(48.9%)	621 (51.8)	
TOTAL	600(100)	600(100)	1200 (100)	16.883
Index (Patterns)				
Arch	131(64.5%)	72(35.5%)	203(16.9)	
Loop	184(31.1%)	407(68.9%)	591(49.3)	
Whorl	285(70.2%)	121 (29.8%)	406(33.8)	
TOTAL	600	600	1200(100)	69.723
Middle (Patterns)				
Arch	107(47.4%)	119(52.6%)	226(18.3)	
Loop	295(45.6%)	352(54.4%)	647(53.9)	
Whorl	198(60.5%)	129 (39.5%)	327(27.3)	
TOTAL	600	600	1200(100)	47.688

Table 3b: Distribution of Fingerprint Patterns among Gender

Variables:	MALE	FEMALE	TOTAL	P-VALUE
Ring (Patterns)				
Arch	81(62.3%)	49(37.7%)	130(10.8)	
Loop	254(44.4%)	318(55.6%)	572(47.7)	
Whorl	265(53.2%)	233 (46.8%)	498(41.5)	
TOTAL	600	600	1200(100)	73.542
Pinky(Patterns)				
Arch	43(30.7%)	97(69.3%)	140(11.7)	
Loop	428(52.9%)	380(47.1%)	808(67.3)	
Whorl	129(51.2%)	123 (48.8%)	252(21.0)	
TOTAL	600	600	1200(100)	63.868

The table showed that females had a higher percentage of arches (55.3%) than males (44.6%), while males had a higher percentage of loops (51.1%) and whorls (51.1%) compared to that of female loops (48.9%) and whorls (48.9%) in thumb digit.

The table also showed that males had prevalences of whorls (70.2%), arches (64.5%), and loops (31.1%), while females had a prevalence of loops (68.9%), arches (35.5%), and whorls (29.8%) in index digit. In the middle digit, females had a higher percentage of arches (52.6%) and loops (54.4%) than male arches (47.4%) and loops (45.6%), but the prevalence of whorls (60.5%) in males was higher than that observed in female (39.5%). Moreover, the table showed that males had a higher percentage of arches (62.3%) than female arches (37.7%), females had a higher percentage of loops (55.6%) than males (44.4%), while males had a higher percentage of whorls (53.2%) than females (46.8%) in ring digit. Furthermore, the table showed that females had a higher prevalent of arches (69.3%) compared to male arches (30.7%), while males had a higher percentage of loops (52.9%) than females (47.1%), and whorls (51.2%) compared to that of female whorls (48.8%). The statistical analysis showed no significant differences in all digits among genders.

DISCUSSION

It has been established that no two individuals have the same pattern of fingerprints. The analysis showed that in the thumbs of both genders, there is a prevalence of the whorls pattern of print in males and a prevalence of arches in females. This finding shows that there exist dermatoglyphic distinctions in thumb digit among genders.

In the index digit, the study also revealed that males had a prevalence of the whorls pattern of print, as against females that had a prevalence of loops in this digit. Again this study showed that there exists

variability of fingerprint patterns in index digits among genders.

In the middle digit, the study showed that males had a prevalence of whorls, while females had a prevalence of loops. Gender dimorphism of fingerprints was also observed in this digit. The analysis from the ring digit showed that males had a prevalence of arches, while females had a prevalence of loops. This digit showed dimorphism in fingerprint patterns exists among genders. Furthermore, the loop was the most prevalent in males, while arches were most prevalent in females' little digits.

In all five digits, the most prevalent pattern of fingerprint observed in both sexes was loops, while whorls and arches had similar frequencies. Also, in all five digits, the most prevalent pattern of prints in males were whorls in the thumb, index, and middle digits, while arches and loops were prevalent in the ring and little digits. For females, the most prevalent was aches in the thumb and ring digits, while loops were prevalent in the index, middle, and little digits.

These findings are in agreement with an aspect of Safaa's research work,[12] who reported that loops were the predominate patterns in all analyzed digits, but this study failed to correspond with this same researcher who documented that loops were the most prevalent in males and whorls in females. The differences observed could be a result of racial variation.

Also, Igbigbi and Msamati[13] in their study on indigenous black Zimbabweans, in Kenyan and Tanzanian subjects found that ulnar loops were the most prevalent digital pattern in most digits, followed by whorls in males and arches in females. In another study by Jaga and Igbigbi in Ijaw subjects of Southern Nigerians;[14] Nithin et. al.,[15] reported that the most common occurrence was ulnar loops (52.3%) followed by whorl pattern (28.74%) in South Indians of Mysore. In another study,[16] it was documented that the most common patterns of prints observed among Anioma and Urhobo of Southern Nigeria were ulnar loops, whorls, and arches respectively.

Conclusion

Fingerprint study is an aspect of anthropology known as Dermatoglyphic, this aspect of anthropology has served various importance, one of such is the identification of law offenders. Fingerprints were not only unique among individuals, but their uniqueness was also observed among ethnic groups with respect to their five digits.

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