Forensic Study on Fingerprint Pattern Distribution in Relation to Gender and Ethnic Differences among Cadets in Nigeria Police Academy Wudil Kano

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Abstract

Dermatoglyphics is the science that studies the epidermal ridge pattern on fingers, palms and soles. The study of this epidermal ridge pattern on fingers is known as "fingerprinting". Fingerprinting plays a vital role in the science of criminal investigation particularly in the identification of individuals due to uniqueness and is considered conclusive evidence in the court of law. Dermatoglyphics studies of the fingerprint were taken during the study using standard ink method. A total of 2100 fingerprints were collected and analyzed, compared, evaluated and verified (ACE-V) from 210 cadet officers of Nigeria Police Academy Wudil, Kano state, Nigeria. The fingerprints were collected then distributed and classified into three (3) main pattern types as Loop, Arch and Whorl, among the major ethnic groups in Nigeria (Hausa, Igbo and Yoruba). The percentage distribution of the pattern showed that, the loop pattern was most common among the male cadets from the Hausa group with 16% while it was least common among the males from the Igbo group with 13.6%. Loop pattern also recorded the most common among the females of the Hausa group with 7% while it was least common among the females from the Igbo group with 6.0%. The arch was most common among the males from the Yoruba group with 3.6% while it was least common among the males of the Hausa group with 2.6%, arch pattern also recorded the most common among the female from the Yoruba group with 1.3% while it was least common among the females from the Hausa group with 0.7%. The whorl was most common among the males from the Igbo group with 6.9% while it was least common among the males from the Hausa group with 4.5%, whorl pattern also recorded the most common among the females from the Igbo group with 2.5% while the it was least common among the females from Hausa group with

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1.8%. Statistically no significant difference ($p<0.05$) was observed between the gender and ethnic group distribution of fingerprint patterns among cadet officers of the Nigeria Police Academy Wudil, Kano state, Nigeria.

Keywords: Dermatoglyphics; Fingerprint Pattern; Gender; Ethnic Group

Introduction

Fingerprint may be defined as an impression from the ridge crests of the friction-skin of the ventral surface of a digit. As the terminal phalange is the only one constantly exhibiting a "pattern" configuration, it is the one utilized for making identification records, although identification may as accurately be made from an impression of either remaining phalange, or the palm of the hand or the sole of the foot. Fingerprints have been the gold standard for personal identification within the forensic community for more than one hundred years. The science of fingerprint identification has evolved over time from early use of fingerprints to mark business transactions in ancient Babylonia to their use today as core technology in biometric security devices and as scientific evidence in courts of law throughout the world [1]. Fingerprints have had a lot of forensic and commercial applications. Recent advances in automated fingerprint identification technology, coupled with the growing need for reliable person identification have resulted in an increased use of fingerprints in both government and civilian applications such as border control, employment background checks, and secure facility access [2]. Determination of individuality or identification is one of the prime issues in forensic practice. Some of the important parameters usually noted for the purpose of identification are race, gender, age, skin texture and features, speech and voice, footprints, deformities, hair, tattoo marks, scars, occupational marks, handwriting, garments and personal articles, gait pattern, and DNA profile [3]. The study was aimed at evaluating the relationship between cadets' fingerprints patterns of different gender and ethnic groups in Nigeria Police Academy. Fingerprints form definite patterns that appear to have a general resemblance in shape and design. Their resemblance allowed fingerprint pioneer to device systems of classification for fingerprint patterns among individuals during investigation by law enforcement agent [4]. In view of that this research may provide a baseline information of the large collection of fingerprint that can be filed according to different gender and ethnic groups among cadets' officers in Nigeria Police Academy.

Materials and Methods

This research study was conducted at Nigeria Police Academy (Polac) in Wudil Local Government Area Kano State Nigeria, which is located in East Central Area of Kano State, and in the central area of Kano Region between longitude 8° 45'E, as well as between latitude 11° 37'N and latitude 11° 56'N. It shares its western boundary with Warawa LGA to the northwest and Dawakin Kudu LGA to the southwest. It is bounded to the south and southeast by Garko LGA and on the east by Albasu LGA (southeast), Gaya (east) and Ajingi, northeast and north. Wudil Local Government have two Tertiary Institutions of which Nigeria Police Academy (Polac) is one of them, and it's a regimental Institution which embodies a rich diversity of cadets from the 36 states and Capital of the country. This study was conducted on 210 cadet officers (150 male and 60 female) from Nigeria Police Academy Wudil, Kano Nigeria. Subjects with any form of deformation were not included in the study. They were from the three major ethnic group of the country which include Hausa, Igbo and Yoruba and belonging to different geopolitical zones of the country. More so, information relating to their sex were also noted and recorded. The age of the subjects ranged from 18-27 years as given by the subjects and they participated voluntarily in the study. The subjects were asked to wash his or hands thoroughly with soap and water and dry them using a towel. They were then asked to press their fingertip on the fingerprinting ink pad, and then to the fingerprint card to transfer the fingerprint impression. This method was repeated for all fingers of both hands. In this way, the plain fingerprints of all ten digits were taken separately on the fingerprint cards.

Results and Discussions

Overall Distribution of Fingerprint among Cadets of Major Ethnic Group in Nigeria Police Academy

The results in table 1 showed the distribution of fingerprint pattern among cadets in Nigeria police

academy. The loop pattern recorded by the Hausa ethnic group was most common with 498 pattern out of the 2100 fingerprint analyzed, which was followed by the Yoruba ethnic group with a total of 443 loop pattern, and while the Igbo with 414 loop pattern. Furthermore for the Arch fingerprint pattern, the Yoruba ethnic group had recorded highest with 103 arch pattern, followed by the Igbo with 88, and while the Hausa with 69 arch pattern. For Whorl fingerprint pattern, the Igbo had the highest with a total 198 followed by the Yoruba with 154 and while the Hausa with 133 Whorl pattern.

FINGERPRINT PATTERN	ETHNIC GROUP			
	IGBO	YORUBA	HAUSA	TOTAL
Loop	414 (19.8%)	443 (21.1%)	498 (23.7%)	1355
Arch	88 (4.2%)	103 (4.9%)	69 (3.3%)	260
Whorl	198 (9.4%)	154 (7.3%)	133 (6.3%)	485
TOTAL	700	700	700	2100

Table 1: Overall Distribution of Fingerprint among cadets of major Ethnic group in Nigeria Police Academy.
NOTE: The values in parenthesis represent the percentage (%) of the distribution.

Distribution of Fingerprint Patterns among Cadet in Relation to Gender in Ethnic Group

The results in Table 2 showed the distribution of fingerprint among cadets in relation to gender in ethnic group. The male gender of the Hausa group had the highest loop pattern with total occurrence of 351, followed by the Yoruba with 313 while the least was the Igbo with 287 loop pattern. The Arch pattern of the fingerprint was also relatively highest with 75 among the male in Yoruba group, followed by the male Igbo with 67 while the least was recorded among the male of the Hausa with 54. The whorl fingerprint pattern was found to be the highest among males of the Igbo group with 146, followed by the males of Yoruba with 112 and lastly the males of Hausa with 95. The results also revealed that the males cadets of the three major ethnic group (Hausa, Igbo and Yoruba), in Nigeria Police Academy had taken the lead in all the fingerprint pattern.

FINGERPRINT PATTERN	IGBO		HAUSA		YORUBA		TOTAL
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	
Loop	287(13.6)	127(6.0)	351(16.71)	147(7)	313(15)	130(6.1)	1355
Arch	67(3.1)	21(1)	54(2.6)	15(0.7)	75(3.6)	28(1.30)	260
Whorl	146(6.9)	52(2.5)	95(4.5)	38(1.8)	112(5.3)	42(2)	485
TOTAL	500	200	500	200	500	200	2100

Table 2: Distribution of fingerprint pattern among cadets in relation to Gender in Ethnic group.
NOTE: the values in parenthesis represent the percentage (%) of the distribution

Percentage Distribution of Fingerprint Pattern among Cadets of major Ethnic Group on the Right and Left Digits

A total of 2100 fingerprint patterns were studied. Loops were the most common pattern followed by whorls and arches in both hands among males and 'females. While loops were the predominant patterns on both Right and left digits, predominance of whorls was evident in the Igbo group. Loops were most often found on Hausa group (12.1% and 11.6%) followed by Yoruba (10.4 % and 10.7%) and Igbo (9.8% and (9%). The percentage Frequency of whorls was most common among the Igbo group (4.4% and 5.0%) followed by Yoruba (3.7% and 3.6%) and while the least frequency was recorded among Hausas (3.0% and3.3%). More so, the percentage frequency of arch was most common among the Yorubas (2.5% and 2.4%), followed by the Igbo (2.4% and 1.8%), while the Hausa group (1.5% and 1.8%). There was a significant difference in overall distribution of fingerprint

pattern on both hands (right and left digits) among cadets of the three major ethnic group is shown in Table 3.

FINGERPRINT PATTERN		IGBO	HAUSA	YORUBA	TOTAL
Loop	Right Digits	206 (9.8)	254(12.1)	219(10.4)	679
	Left Digits	208 (9.9)	244(11.6)	224(10.7)	676
Arch	Right Digits	51 (2.4)	32(1.5)	53(2.5)	136
	Left Digits	37 (1.8)	37(1.8)	50(2.4)	124
Whorl	Right digits	93(4.4)	64(3.0)	78(3.7)	235
	Left digits	105(5)	69 (3.3)	76(3.6)	250
Total		700	700	700	2100

Table 3: Percentage distribution of fingerprint pattern among cadets of the major Ethnic group on the right and left digits.
NOTE: the values in parenthesis represent the percentage (%) of the distribution.
p-value = 0.0035

Discussion

The use of fingerprint pattern during this study was based on several fundamental principles; the first which state that, the probability of finding two people with identical fingerprint is very small. Infact no two individuals have ever been found same. The second principle state that, an individual fingerprint do not change with time in respective of ethnic group and gender, it remains unchanged until death [5]. So therefore, fingerprint pattern is highly individualistic and genetically predetermined; no two individuals show same fingerprint pattern. Worldwide percentage distribution of loops, whorls, arches and composite is approximately 60-70%, 25-35%, 7% and 1- 2% respectively [6]. The present study reveals that loop was the most frequent observed pattern of fingerprint followed by whorl and arch in both males and females which is in line with the generally observed pattern in worldwide research [7]. Gender dimorphisms were not observed as similar reported by Jaja and Igbigbi in their study of digital and palmar dermatoglyphics of the Ijaw of Southern Nigeria [8].

The loop were found to be higher in the Hausa ethnic group followed Yoruba the Igbo. The whorl tends to be significantly predominant in the Igbo followed by the Yoruba and Hausa ethnic group. The percentage of Arch tends to be higher in the Yoruba ethnic group which is closely followed by Igbo and Hausa ethnic group. The pattern observed was similar to the study conducted by Anibor, et al. on palmar and digital dermatoglyphic patterns in the Ndokwas of Delta state, Nigeria [9]. These variations in distribution of fingerprint patterns may be due to environmental and genetics factors, these reasons has been researched and reported, that fingerprint patterns are genetically determined and influenced by physical, environmental and topological factors [10].

Also, the variability of epidermal ridge breadth in humans is substantial [11]. Dermatoglyphic features statistically differ between the sexes and ethnic groups as similarly reported by Harold, et al. 2005.

Conclusion

Fingerprint analysis plays a role in convicting the person responsible for an audacious crime. Fingerprint has been used as a biometric for the gender and age identification because of its unique nature and do not change throughout the life of an individual [12]. In fingerprint, the primary dermal ridges (ridge counts) are formed during the gestational weeks 12-19 and the resulting fingerprint ridge configuration (fingerprint) is fixed permanently [13]. Ridges and their patterns exhibit number of properties that reflect the biology of individuals. Fingerprints are static and its size and shape changes may vary with age but basic pattern of the fingerprint remains unchanged.

The present therefore tries access if there exist a relationship between fingerprint patterns with gender and ethnic group among cadets of the Nigeria police academy, which may help in increasing the authenticity of fingerprints in identification of individuals and solving of crimes around the study area.

It is therefore recommended that more research on Dermatoglyphic study be carried out in order to reveal

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our intrinsic qualities and talents, enhance learning experiences by identifying learning styles, personalise academic and extracurricular programs. Which may be based on the scientific premise that the patterns on one's fingertips are in synchronized with the patterns on an individual's left and right brain [14,15].

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