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Finger Dermatoglyphics Of The Asante Population Of Ghana

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Abstract: ***The epidermis of fingers, palms and soles of the feet are all stuffed with ridges and furrows which are organized into unique prints. These prints are greatly influenced by genes and partially, the amniotic environment. These details provide information which help in singling out an individual or narrowing down the number of suspects in forensic investigations. The aim of this research was to study the variations of dermal patterns of the Asante population of Ghana. Two hundred (100 males and 100 females,) sample units were collected from the Asante population. For each individual, the fingerprint of all ten fingers were collected and studied. The fingerprint type and type characteristics; finger ridge count, total finger ridge count (TFRC) and Pattern Intensity Index (PII) were determined and compared within the population. The population statistics were also compared with other study populations. In the Asante population, 68.45% of all pattern types were loops, 22.55% were whorls while 9.0% were arches. Males also vary significantly from females on the basis of finger pattern type frequency (p- 0.000). The mean TFRC for the Asante population was 122.97 for males and 118.65 for females. The Asantes showed similarities with the populations of Nigeria. In conclusion, TFRC and pattern type frequencies can be used as tools for identifying a person's ethnicity and gender.***

I. INTRODUCTION

The volar surfaces of the palms, fingers, soles and toes are characterized by raised lines and depressions. The raised lines called ridges and the depressions, called the furrows facilitate friction (Chattopadhyay & Sharma, 1969). These arrangements of the ridges and furrows form different patterns (Chattopadhyay, 1966). These patterns are called prints (Yount, 2007). Fingerprints may be found at all places where people interact including crime scenes. Most often, they are not visible to the unaided eye (hence referred to as latent prints) and so methods of making prints visible are used. Several methods can be employed to develop these prints; powder and tape, Magna Brush, the cyanoacrylate fuming method, Ninhydrin, Iodine Fuming, Silver Nitrate, Amido Black etc. (Sodhi & Kaur, 2001). Since no two fingers, even if they are from the same individual, are exactly alike, finger prints are used for identification purposes throughout the world. Fingerprints offer an infallible means of personal identification. That is the essential explanation for fingerprints having replaced other methods of establishing the identities of criminals reluctant to admit previous arrests.

Forensic investigations have become very relevant since crime rate as well as family and corporate disputes have been on the increase in recent times. Fingerprint analysis is one of the early aspects of forensic investigations and has been utilized in diverse case resolutions (Eboh, 2013). Its history can be linked to a number of nations and even kingdoms before the appearance of modern civilization.

The Asante people are located in the middle sector of Ghana. The current day urbanization has taken several other ethnic groups to these locations while some Asantes have also relocated to other places within and out of the country.

II. METHODOLOGY

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

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and Midlo (1961). Digital dermal ridge pattern types were classified into whorls, arches and loops. It was done in such a way that the entire finger surface was covered in the ink before the actual printing and each finger was rolled from finger to finger. This ensured that all essential features were visible on the prints. No pressure or force was applied on the fingers during the collection of the prints, rolling was done gently to prevent smudging the print.

The collected samples were studied by microscopy. For each unit: the fingerprint type and type characteristics, finger ridge count (TRC), Absolute/Total finger ridge count (ARC) and Pattern Intensity Index (PII) were determined and compared within the population. The population statistics were also compared with the other study populations. During the counting, every ridge (island or dot ridges, short ridges, long ridges and an abrupt ending ridges) given one ridge count. Points of origin of bifurcations found on the imaginary along which the counting was carried out was assigned a ridge count of two.

III. RESULTS AND DISCUSSION

Table 1 shows the distribution of the pattern types of fingerprints on all 10 digits of Asante males. In the Asante males, the loop pattern was the most common (65.9%+1.6%), followed by whorls (22.5%) and the Arch pattern being the least (10.0%).

	Right hand					Left hand					Total /%
Pattern	thumb	Index finger	Middle finger	Ring finger	Little finger	thumb	Index finger	Middle finger	Ring finger	Little finger	
Whorl	54	15	12	32	11	36	34	21	4	6	**22.5**
Arch	6	11	15	5	7	15	10	16	7	8	**10.0**
Ulnar loop	39	62	72	63	82	49	56	61	89	86	**65.9**
Radial loop	1	12	1	0	0	0	0	2	0	0	**1.6**

Table 1: Percentage distribution of pattern types on all 10 fingers in Asante males

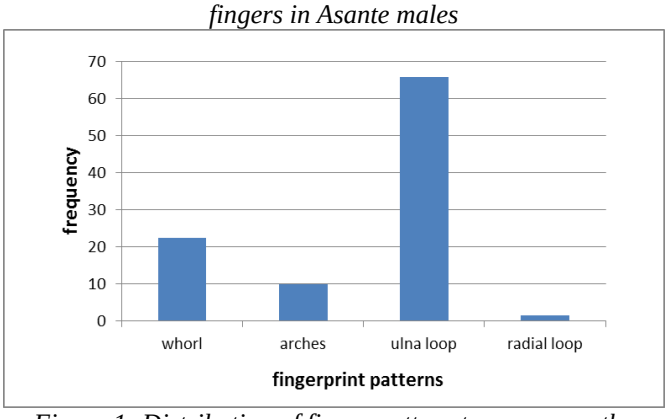

Figure 1: Distribution of finger pattern types among the Asante males

The table below shows the distribution of the pattern types of fingerprints on all the digits of Asante females. In the Asante females, the loop pattern was the most common (68.4%+1.0%), followed by whorls (22.6%) and the Arch pattern being the least (8.0%).

	Right hand					Left hand					Total /%
pattern	thumb	Index finger	Middle finger	Ring finger	Little finger	thumb	Index finger	Middle finger	Ring finger	Little finger	
Whorl	49	35	15	18	0	36	29	24	16	4	**22.6**
Arch	4	4	0	0	0	19	28	11	10	4	**8.0**
Ulnar loop	47	56	85	82	100	45	38	65	74	92	**68.4**
Radial loop	0	5	0	0	0	0	5	0	0	0	**1.0**

Table 2: Percentage distribution of pattern types on all 10 fingers in the Asante females

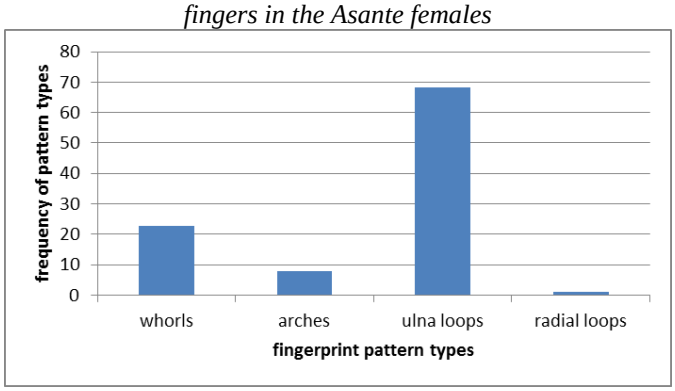

Figure 2: distribution of finger pattern types among the Asante females

Tables 3 shows the percentage distribution of the pattern types in the Asante population. The most common pattern type in the population is the loop pattern (67.15% ulnar +1.3% radial), followed by whorls (22.55%) and the Arch pattern type happens to be the least common (9.0%)

Pattern	males	Females	Total percentage
Whorls	22.5	22.6	22.55
Arch	10	8.0	9.0
Ulnar loop	65.9	68.4	67.15
Radial loop	1.6	1.0	1.3
Total	**100**	**100**	**100**

Table 3: Percentage distribution of pattern type in the Asante population

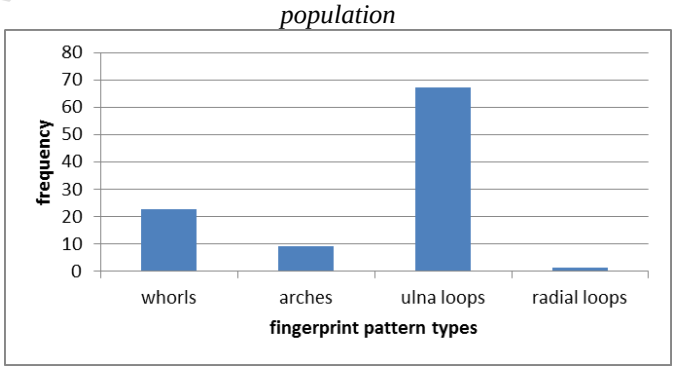

Figure 3: Distribution of finger pattern types in the Asante population

Comparing the pattern type results of the Asantes with some African populations reveal a form of relatedness in their origin. The findings in the Asante population are synonymous to the characteristics of the Hausa and the Yoruba populations of Nigeria. The finding of Danborno and Idris (2007) in the Hausa ethnic group shows that 29.74% of the patterns were whorls, 63.59% were loops and 6.62% arches. The distribution in the Yoruba population is as well dominated by the loop pattern (63.45%), followed by the whorl pattern (26.03%) and then arches (10.5%). These values are very close to the results generated from the Asante population as illustrated in Figure 3 above.

Sexual dimorphism in dermatoglyphic patterns is attributed to heritability (Arrieta et al, 1991). A statistically significant variation in sexual dimorphism enhances the

authenticity of fingerprints in the resolution of crimes and identification of the source of unknown prints (Deopa *et al*, 2014). The sex difference on the basis of pattern type characteristics between Asante males and Asante females (p-0.000) was statistically significant (Table 4). This confirms the opinion shared by several authors that sexual dimorphism is expressed in fingerprints even though its determination failed in some populations (Arrieta et al, 1991). A study carried out by Deopa *et al*, (2014) revealed that fingerprints are very valuable parameters for sex difference identification. The table below shows the significance of variation with respect to gender. At 95% confidence interval, the p-value for the test with the Asante population is 0.000. This is below the α-value of 0.05, the difference is therefore statistically significant.

	Df	Asymp. Sig. (2-sided)
Asante males and Asante females	9	0.000

Table 4: Pattern type variation between males and females

A study of dermal patterns of Zimbabweans showed that, TFRC was higher in males than in females (Igbigbi and Msamati, 2002), a results comparable to the data obtained from the Zulus population of South Africa. The situation was however different for the Yoruba of Nigeria and the Malawians (Igbigbi and Msamati, 1999). The sex difference within the Asante population (p-0.355) in terms of TFRC was however not significant.

The Total Finger Ridge Count (TFRC) for the Asante males and females is 122.87 and 118.65 respectively (Fig.4 and Fig. 5). By comparison with the African population, the results for the Asante males are similar to that of the Malawian population while those of the females resemble the data for the Zulus of South Africa (119.55) and the Kenyan females (116.26) as reported by Igbigbi & Msamati (1999).

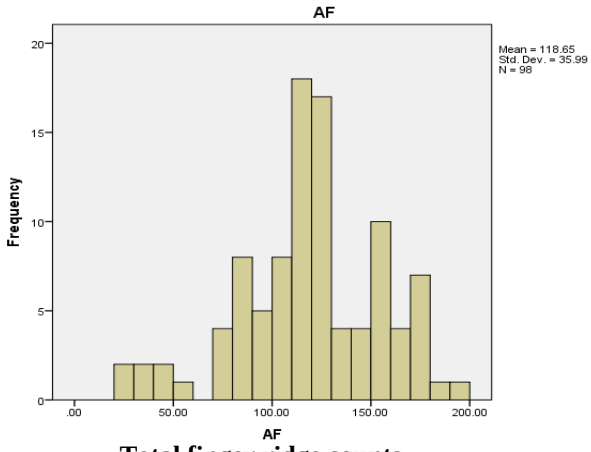

Figure 4: Distribution of total finger ridge count among the Asante females

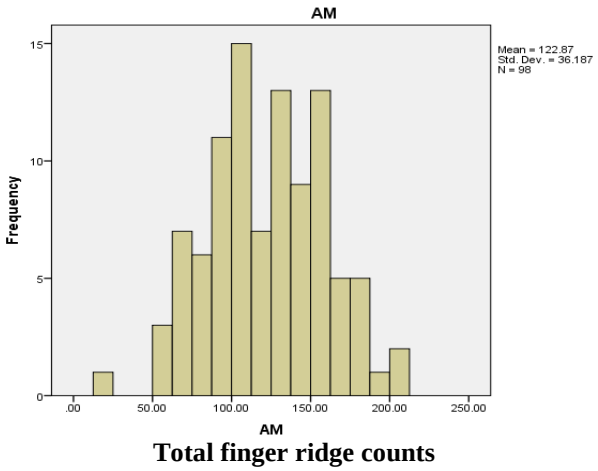

Figure 5: Distribution of total finger ridge count among the Asante males

Dermatoglyphic parameters have been used to substantiate racial history in several populations. The factors that determine the nature and features of dermal prints were greatly investigated in the 1950s. The polygenic characteristics are more efficient in tracing diverse populations. The polygenic nature of dermal prints makes them less affected by random genetic drift and free from assortative mating effect (Meier, 1980). These traits have the advantage of being not only less affected by the environment, but also less affected by gene flow as opposed to anthropometric variables which are highly influenced by the environment and blood groups' susceptibility to gene flow. Dermatoglyphic traits are therefore considered as being one of the most suitable means for population and race analysis (Meier, 1980). This has facilitated the use of dermal pattern analysis by many researchers in physical anthropology and forensic science (Adamu, 2012).

The resemblance of the Asante population to the Yoruba and Hausa people of Nigeria reflects the history gathered for the populations. The Asantes of Ghana are believed to have migrated from the ancient Ghana empire which was located at the current day Mali with some populations of Nigeria (Waziri 2002; Broussalian, 2011). This may therefore account for the similarities in dermatoglyphic characteristics shared by the Asante and Nigerian populations.

From the results, an Asante is likely to have about 22.55% whorls, 9.0% arches and 68.45% loops as the frequency of his/her pattern types. In addition, an Asante male will have an average TFRC closer to 122.87 while a female's average will be about 118.65. Even though the Asantes share some dermatoglyphic characteristics with the some Nigerian populations, differences still exist with respect to TFRC, these factors combined can be utilized by forensic experts and other professionals who seek personal identification mechanisms or parameters.

IV. CONCLUSION

From the study of the Finger Pattern Types and the Total Finger Ridge Counts the following conclusions emerge out:

- ✓ The Asantes show preponderance of loops to whorls and arches.
- ✓ The Asantes show similarities with the populations of Nigeria

Focusing future researches are toward identifying others parameters of fingerprints will facilitate the use of dermatoglyphics as a tool for human identification.

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