



## Digital Dermatoglyphics of the Hausa Ethnic Group of Nigeria

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### ABSTRACT

The study of dermatoglyphics is becoming interestingly applied in determining a number of medical and psychological traits like diabetes mellitus, genetic disorders, psychosis and many other clinical conditions in man. This dermatoglyphic study was conducted on 420 subjects (males  $n=210$  and females  $n=210$ ) belonging to the Hausa ethnic group of Nigeria. Finger prints were obtained following standard procedures using ink and finger print questionnaires. The results showed a frequency of 29.74% for arch and of 63.59% for loop. The pattern intensity index showed a higher value in males 12.62 than in the females 11.99. The Dankemeijer's index was higher in females, 31.67 than in males 13.10. The Furuhata's index was slightly high in females 47.87 than in the males 45.75. This is due to the abnormally high frequency of radial loops in the females. Ridge counting was done for each finger of 150 males and 150 females and the overall sum of ten fingers was obtained. The total mean ridge count showed statistically significant difference (male =  $101.84 \pm 3.17$ , females =  $97.38 \pm 3.72$ ,  $t=11.18$ ,  $p<0.001$ ). The right hands were found to possess higher ridge counts than the left in 2 out of 5 fingers in males and 3 out of 5 fingers in females ( $p<0.001$ ). Hausa females showed a higher difference in right hand than Hausa males in ridge count and a radically higher frequency of whorl pattern, this may be a signal to higher incidence of breast cancer, which needs further studies for verification.

Dermatoglyphic the study of finger prints have been of the one of the variation that man noticed and applied in sale, but was only established as a science with the publication of purkinje's thesis in 1823 (Gyenis, 2000), dermatoglyphics has found application in establishing ethnic difference (Harich et al., 2002) genetic inheritance, and population studies Harich et al. 2002; Karmakar et al. 2006)

Studies have implicated relationship of finger print patterns and ridge counts with certain medical disorders e.g. Obesity (Regoly-Merei et al., 1982) Psychosis (Gyenis et al., 1990; Saha et al. 2003), and breast cancer (Seltzer et al. 1990), rheumatoid arthritis (Roopa et al. 2003), Congenital talapus equinovarus (Kulkarni et al. 2006), carcinoma of the cervix (Inamdar et al. 2006), chromosomal anomalies anomalies leading to genetic disorders and congenital birth defects (Woolf and Ganas, 1976; Balgir and Mitra, 1986), sexual orientation in man (Hall and Kimura, 1994, Hall, 1999). It has also been recently linked to the fact that differences in finger prints on the right and left hands to indicate developmental disturbances resulting in fluctuation asymmetry (Babler, 1990; Moller, and Swaddle, 1997; Burton et al. 2003; Benderlioglu and Nelson, 2004).

This study conducted among the Hausa ethnic group of Nigeria, was carried out

in order to established, and to see if there is a sex difference in the finger prints of the Hausas.

### MATERIALS AND METHODS

The fingerprint patterns were obtained from 420 subjects (males  $n=210$  and females  $n=210$ ) of Hausa origin (mean age 23.06). The subjects were exclusively of Hausa origin and every care was taken not to include related subjects in the surgery. The materials used in this research were duplicating ink, rectangular glass slide which served as a roller to spread the ink, a square piece of glass which was used as the inking plate and a fingerprint questionnaire which served as the fingerprint card.

The fingerprint questionnaire was placed on a horizontal surface along with the inking plate. A small daub of ink was placed on the inking plate and thoroughly rolled until a very thin film covered the entire surface. The subject stood in front of and at forearms length from the inking plate and the side of the bulb of the finger was placed on the inking plate and rolled to the other side until it faced the opposite direction, this was reported on the fingerprint questionnaire. Ridge counting was made by the



methods of (Cummins and Midlo, 1961) and (Sheaum and Alter, 1996) on all ten fingers of subjects of 150 male and 150 female subjects that the ridges were clear for counting.

### Statistical Analysis

Data were presented as mean  $\pm$  standard deviation (SD), frequency of fingerprints pattern were calculated on the basis of percentages. Difference between males and females ridge count, and right and left fingers were evaluated using the student's t-test. Difference of ridge counts among different fingers of the same hand were tested using one way analysis of variation and significant difference was peg at  $P < 0.05$ . SigmaStat 2.0 for Windows (Systat Inc., Point Richmond, CA) was used for the statistical analyses.

### RESULTS

The frequency of finger print pattern and the dermatoglyphic indices are presented in

Table 1. Males and females only tend to have close frequency in whorl pattern, but showed marked differences in loop (radial and ulna) and arch pattern, with females having higher values in radial loop and arch patterns. In the indices females had lower values which are closer to males in pattern intensity index and Furuhashi's index but a higher value, which is far greater than the calculated male values, in Dankmeijer's index.

Table 2 shows the mean values of ridge counts in the right and left digits in both sexes.

Differences in mean ridge counts within digits of the same hand were also evaluated and showed statistical ( $P < 0.001$ ). The difference in mean ridge counts of right and left hand digits were also tested in both sexes three fingers fail to show any significant difference (in male digits III, IV and V and in females digits IV and V). Mean total ridge count of males ( $101.84 \pm 3.17$ ) were higher than and females ( $97.83 \pm 3.72$ )  $t = 11.18$  and  $P < 0.001$  (see Fig. 1).

The mean ridge count of fingers in the shows a descending order in counts  $IV > V > I > III > II$  on both hands, a similar pattern was seen was also observed in left hand in the males but the right showed a little variation ( $I > IV > V > III > II$ ). In both males and females the second digit possessed the lowest ridge counts (see Table 2).

### DISCUSSION AND CONCLUSION

The percentage of finger print pattern observed in this study closely equates with earlier reports in the Igbos (Ighibi et al., 1995; Olorundmi, 1995), especially in loop and whorl pattern the difference being the frequency of arch (6.62%) that radially lower than the ones report for the Igbos (12.50%) and the Yorubas (10.50%). This value in the Hausa is closer to the reports of Cummins and Midlo (1961) in the American Negroes who reported the frequency of 7.00%. The Hausa results show a consistent dermatoglyphics affinity with the reports of the Negroes populations. When compared with results from Asia (Tiwari and Chattopadhyay, 1968) and Australian Aborigines (Rao, 1972) there is a

Table 1: Frequency of pattern and indices of Hausa males and females (n = 210 for both sexes)

	Frequency of pattern types				Pattern intensity index	Dankmeijer's index	Furuhashi's index
	W	UL	RL	A			
Male	30.15	58.34	7.56	3.95	12.62	13.10	45.75
Female	29.33	38.41	22.86	9.29	11.99	31.67	47.87
M + F	29.74	48.38	15.21	6.62	12.13	22.26	46.77



Table 2: Mean ridge counts of right and left fingers in males and females Hausa subjects (n = 150 in both sexes), subjected Student t-test and one way ANOVA.

Side	Digits	Male Mean $\pm$ SD	Female Mean $\pm$ SD	t	P
Right	I	12.25 $\pm$ 0.56 <sup>a</sup>	10.24 $\pm$ 0.52 <sup>1</sup>	32.21	<0.001
	II	8.66 $\pm$ 0.40 <sup>b</sup>	8.52 $\pm$ 0.45 <sup>2</sup>	2.85	0.005
	III	9.05 $\pm$ 0.36 <sup>c</sup>	8.69 $\pm$ 0.37 <sup>3</sup>	8.54	<0.001
	IV	11.51 $\pm$ 0.38 <sup>d</sup>	11.41 $\pm$ 0.39 <sup>4</sup>	2.25	0.025
	V	10.78 $\pm$ 0.36 <sup>e</sup>	10.62 $\pm$ 0.36 <sup>5</sup>	3.85	<0.001
		<b>F = 2059.81</b>	<b>F = 1526.91</b>		
		<b>P &lt; 0.001</b>	<b>P &lt; 0.001</b>		
Left	I	10.32 $\pm$ 0.52 <sup>a</sup>	9.42 $\pm$ 0.79 <sup>1</sup>	11.66	<0.001
	II	8.09 $\pm$ 0.40 <sup>b</sup>	8.08 $\pm$ 0.46 <sup>2</sup>	0.20	0.84
	III	9.02 $\pm$ 0.44 <sup>c</sup>	9.01 $\pm$ 0.42 <sup>3</sup>	0.20	0.84
	IV	11.43 $\pm$ 0.38 <sup>d</sup>	11.40 $\pm$ 0.43 <sup>4</sup>	0.64	0.52
	V	10.73 $\pm$ 0.35 <sup>e</sup>	10.62 $\pm$ 0.36 <sup>5</sup>	2.44	0.02
		<b>F = 1327.50</b>	<b>F = 859.48</b>		
		<b>P &lt; 0.001</b>	<b>P &lt; 0.001</b>		

*The means of ridge counts in all fingers are statistically different from one another at P<0.05*

The t and P values of mean ridge counts between left and right fingers

Males

a = t = 30.93    P < 0.001  
 b = t = 12.34    P < 0.001  
 c = t = 0.65    P = 0.52  
 d = t = 1.82    P = 0.07  
 e = t = 1.22    P = 0.22

Females

1 = t = 10.62    P < 0.001  
 2 = t = 8.37    P < 0.001  
 3 = t = -7.00    P < 0.001  
 4 = t = 0.21    P = 0.83  
 5 = t = 0.00    P = 1.00



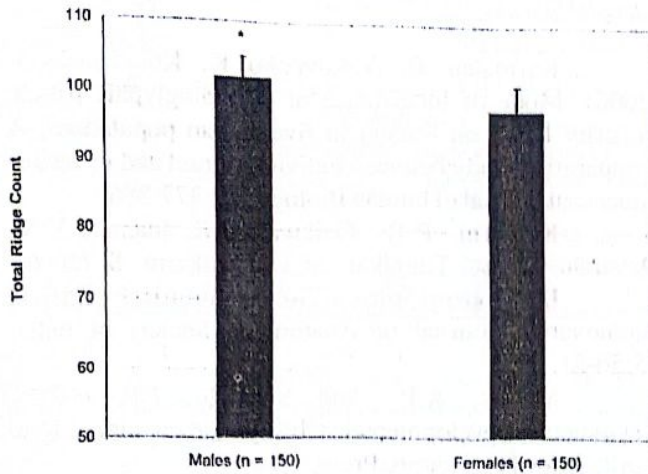


Fig. 1: Mean total ridge count in males and females Hausa ethnic group. Error bars indicate standard deviation. \*  $P < 0.001$

dramatic difference in the frequency of arch patterns because these populations showed very low arch frequencies typically below 2%, but again closer that of the European populations (Holt, 1962; Gualdi-Russo et al., 1982), which further validates that finger print are genetically determined (Holt, 1968; Blaber, 1991; Kulkarni et al., 2006).

A pattern intensity index (PII) of 11.79 is lower in the Yorubas than in the Hausa. The mean ridge counts in the males and females

. Dankneijers index was 42.73) in female was higher than in the males 31.35). These results are much higher than the Hausa index, Furuhashi's index in the males was 46.74 and 41.65 in the females. This result is slightly higher than that of the Hausa males and slightly lower than in Hausa female counterparts.

The PII was found to be 12.62 in males and 11.99 in females which is higher than those reported for other Negroes (Ighighi et al. 1994) which was 11.74 for Yoruba male and 11.36 for the Yoruba females. That of the Ighos was 11.03 for the males and 11.916 for females. The PIIs are low compared with those of the Mongoloids because the Hausa population had less dicentric whorls than in most Mongoloid populations.

The Tibetans with high PII of 15.28 fell essentially within the mongoloid range (Tiwari and Chattopadhyay, 1968). The Jivaro Indians had a high PII (13.71 in males; 13.07 in females) (Sunderlan and Rayman, 1968). Which fell within the range typical of various other

Amerindian groups (Cummins and Midlo, 1961). These include Chilean Indians (13.00), Middle American Indians (13.45) and the Eskimos (14.05). European levels were found to be lightly lower than these levels.

Generally, females show a higher frequency of arches than males and usually fewer whorls (Dankmeijer, 1938; Cummins and Midlo, 1961; Holt, 1968). This accounts for the higher Dankmeijers index of 31.67 in females and lower 13.10 in males observed. Furuhashi's index was found to be higher in females due to uncommonly high frequency of radial loop in the females as compared to the corresponding frequency of radial loops in males.

As for the ridge count the highest average value in both sexes was obtained on finger IV of both hands which was strongly related to the high frequency of large dicentric whorls on these fingers. It was higher for the right than for the left because right digits typically present a large number of whorls than the left (Cooke, 1962).

On all the fingers the ridge count was found to be higher in males as was expected from the higher PII. The mean total ridge count was 101.84 in males and 97.38 in females. This was due to the presence of more whorls and large sized loops in males than in females as reported by (Rao, 1972) and the male fingers are broader than those of the females. This accounts for the higher ridge count in the males.

The interesting findings from this study are the discovery that Hausa females have a very high frequency of whorls pattern. The higher percentage of whorls in Hausa females predisposes them to higher risk of developing breast cancer as reported by (Seltzer et al. 1990). The level of difference between right and left finger print counts is higher in Hausa females than the males, which implies that there may be more of embryological disturbance in females than males (Blaber, 1991; Moller and Swaddle, 1997; Burton et al. 2003; Benderlioglu and Nelson, 2004).

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