

## Palmar Dermatoglyphics in Essential Hypertension Amongst Rivers Indigenes

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**Abstract:** This study was carried out to determine the dermatoglyphic pattern associated with essential hypertension (EHP) amongst Rivers State indigenes in Nigeria. Digital and Palmer dermatoglyphic analysis of 50 patients with essential hypertension and 50 normal subjects was carried out. The numbers of male and female subject in each group was 26 and 24 respectively. The parameters investigated included: the Digital patterns, Digital ridge count, DAT angle, ATD angle, position of T-triradius, A - B palmer ridge count and Palmer crease pattern. The result showed that the percentage frequency of whorl digital pattern in both male and female EHP was higher than Normal males and females and whorls on the right hand were strongly associated with EHP with the first right digit of males and females showing percentage occurrence of 100% and 80.77% respectively. There was no significant difference ( $p > 0.05$ ) in both ATD and DAT angles in the right hands of patients with essential hypertension and normal subjects in both male and female. However, significant difference ( $p < 0.05$ ) was found in the ATD and DAT angles of the left hand of male EHP and normal subjects. The total digital ridge count was greater than 1000 in patients with EHP but less than 1000 in the control group. Percentage frequencies of position of T-triradii and palmar crease patterns showed no significant difference ( $p > 0.05$ ). The study has shown that EHP presents characteristic dermatoglyphic features which include: high frequency of whorl pattern and total digital ridge count of 1000 and above. This could be used for early diagnosis of the diseases.

**Key words:** Dermatoglyphics, essential hypertension, Nigerians

### INTRODUCTION

The science of dermatoglyphics involves the study of epidermal ridges present on the surface of palms, fingers, soles and toes. Cummins and Midlo, (1961) These epidermal ridges form well-defined patterns that characterize individuals and they have been found useful in the clinical diagnoses of hereditary diseases. Epidermal ridge patterns form early in fetal development and they remain unchanged throughout life and hence they could be used to indicate gene or chromosomal abnormalities Ravinda and Thomas, (1995).

Essential hypertension is another condition with genetic influence. It is defined as sustained high blood pressure not attributable to a single cause but reflecting the interaction of multiple genetic and environmental influences, such that siblings of hypertensive parent or parents stand a higher chance of developing hypertension in later life. Blood pressure depends on a combination of two factors: (a) how forcefully the heart pumps blood around the body (b) how narrowed or relaxed the arteries are. Hypertension occurs when blood is forced through the arteries at increased pressure Neal Uren and Dan Rutherford, (2004).

Dermatoglyphics had proved to be a very important tool used for the identification of most gene-linked abnormalities or diseases. A number of studies have shown dermatoglyphic correlation with a large number of genetic disorders (Shield *et al.*, 1995; Oladipo and Ogunnowo, 2004; Oladipo *et al.*, 2005; David 1981; Oladipo and Akanigha, 2005; Borroface, 1978; Oladipo *et al.*, 2007; Jalali *et al.*, 2002). The variables implicated include digital patterns, ATD angle, DAT angle, digital ridge, A-B palmar ridge counts, palmar

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crease pattern. (Borroffice, 1978; Borroffice *et al.*, 2007; Jalali E. and Hajian-Tilaki, 2002).

Since essential hypertension is one of the most common disease in the world affecting an estimated 20 percent of adult population and it is associated with high risk of morbidity and mortality. It is therefore important to developed method for early diagnosis of individuals who are at risk. The use of dermatoglyphics as presented in this work is a unique approach for early identification of such individuals, since dermatoglyphic patterns are established in utero Schaumann, (1983).

Godfrey *et al.*, (1993) examined how finger and palm prints are related to fetal growth and adult blood pressure (primary hypertension) living in Lancashire. They found that individuals who were thin at birth had more whorl patterns on their fingers. People who were short at birth in relation to their head circumference had longer hands and a narrower palmer angle. Mean systolic blood pressure was 8 mmHg higher (95% confidence interval 2 to 13;  $p = 0.01$ ) in the 93 men and women with a whorl pattern on one or more fingers compared with the 46 who had no whorls. The greater the number of fingers with whorls, the higher the systolic blood pressure. Whorls on the right hand were more strongly associated with higher systolic pressure than whorls on the left, mean systolic pressure rising by 2.2 mmHg (0.2 to 4.1;  $p = 0.03$ ) for each additional whorl on the right hand. People with long hands and a narrow palmar angle also had higher systolic pressure. Again, these associations were stronger for the right hand. Mean systolic pressure rose by 0.49 mmHg (-0.03 to 1.01;  $p = 0.03$ ) for each degree decrease in palmar angle on the right hand. They concluded that fingertip whorls and a narrow palmar angle are indelible markers of impaired fetal development at different stages in pregnancy. Both are associated with raised blood pressure in adult life.

In a study on palmar dermatoglyphics in essential hypertension, significant dermatoglyphic findings observed in both sexes of hypertensive cases as compared to controls were: (i) Increased Total finger Ridge count. (ii) Decreased frequency of Axial triradius t (in right palm female) and Axial Triradius t' and t'' in right palm (male) (iii) Decreased atd angle. (iv) Absence of Axial triradi in both the palms of an individual was found exclusively in hypertensive cases (10%) and in none of the controls Kulkarni and Herekar, (2006). Besides an increased "total finger ridge count (TFRC)" and decreased "atd" angle can be used as dermatoglyphic markers in essential hypertension, palmer crease pattern did not show any statistical significant variation Kulkarni and Herekar, (2006).

Since palmar dermatoglyphic patterns have been demonstrated in several genetic conditions in Nigerians Oladipo *et al.*, (2005) and the world over, are there specific digital dermatoglyphic patterns in essential hypertensive? In an attempt to answer this question we carried out this study on hypertensive patients from Rivers State in Nigeria.

## MATERIALS AND METHODS

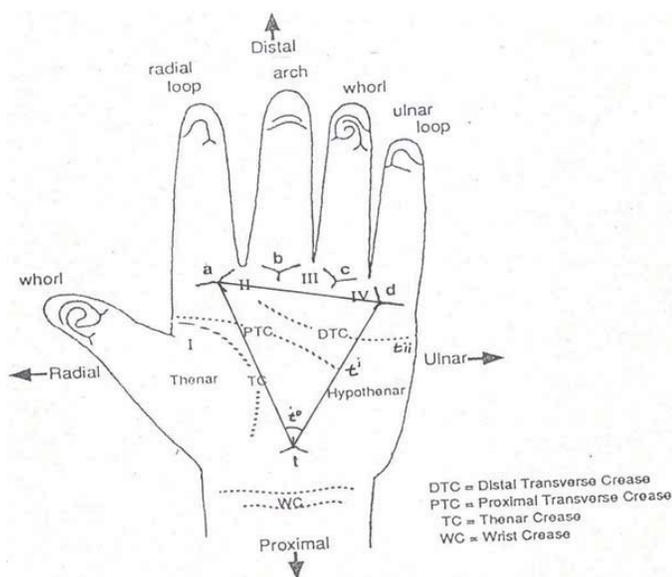
**Study location and population:** The study was a cross-section work undertaken primarily in the University of Port Harcourt Teaching Hospital (UPTH), Choba, Port Harcourt- Nigeria from April 2006- November 2007. The subjects were all Nigerians from Rivers State. This study was carried out with a total sample of 100 adult human subjects (35 years and above) comprising (50 healthy human subjects (control) - 24 females and 26 males and 50 patients with essential hypertension - 24 females and 26 males).

The blood pressure of patients was taken to ensure that patients have hypertension and that this hypertension is not due to a secondary factor. All investigations were carried out with the assistance of the consultants in charge of the unit. All subjects gave their consent. This blood pressure was measured using a stethoscope and a sphygmomanometer. An ink-print palmer and finger print method was used in collection of prints with both hands (right and left) initially washed with water, soap, and later wiped dry before taking prints in order to remove dirt from the hands. The white duplicating papers containing the prints were screened with the aid of magnifying glass in accordance with Cummin's method Cummins, (1929). The digital patterns were recorded as whorls (W), ulnar loop (UL), radial loop (RL) or arch (A).

A meter rule and pencil were used to map out ATD and DAT angles of both hands.

The angles were then measured with the aid of a protractor (Figure 1). Digital ridge counts were determined by counting the number of ridges that cross a straight line drawn from the core of a digital pattern to the digital triradius. The total ridges over all ten fingers were calculated as total ridge count (TRC). All measurements were taken as defined by Penrose, (1929). The right and left hands were designated as "R" and "L" respectively while the various digits were designated as: Thumbs – I; Index Finger – II; Middle Finger – III; Ring Finger – IV and the little finger – V.

**Data analysis:** The student t – test and chi-square test were used for statistical analysis at significance level of 0.05 .



**Fig. 1:** Scheme to show digital patterns, a,b,c,d and triradii, ATD and DAT angles<sup>(6)</sup>

### RESULTS AND DISCUSSION

Results of the study were presented in table 1-7. Tables 1A, 1B, 2A, 2B showed percentage frequencies of digital patterns of the left and right hands of patients with essential hypertension with whorl showing the highest frequency in most digits of the right and left hands of the patients, while in normal individuals ulnar loop had the highest frequencies of occurrence in the right hand. However, on the left hands of normal subject radial loop had the highest frequency.

Using chi-square ( $\chi^2$ ) test, it was observed that the differences in percentage frequencies distribution of digital patterns observed between patients with essential hypertension and normal subjects were statistically significant ( $p < 0.05$ ).

In all the digits of males and females, the highest digital ridge counts were observed in patients with essential hypertension (Table 3-4). The total digital ridge count was equal to or more than 100 in EHP patients while it was less than 1000 in normal subjects. The positions of T-triradii were similar in both groups. In both groups T-triradius was present mostly at 'T' position (Table 5). Tables 5 and 7 show the mean values of ATD and DAT angles respectively. The mean ATD and DAT angles of the two groups in both male and female were significantly different ( $p < 0.05$ ) on the left hand but not on the right hands of the subjects.

**Table 1A:** Percentage (%) frequencies of digital patterns of the right hands of patients with essential hypertension (EHP) and normal (N) male subjects (control).

Patterns	Ri EHP	Ri N	Rii EHP	Rii N	Riii EHP	Riii N	Riv EHP	Riv N	Rv EHP	Rv N
Arch (A)	0.00	46.15	7.70	19.23	3.84	19.23	0.00	7.69	0.00	3.85
Ulnar Loop (UL)	0.00	42.31	15.40	34.62	46.16	57.69	26.92	61.54	57.69	80.77
Radial Loop (RL)	0.00	3.85	7.70	34.62	0.00	3.85	0.00	3.85	3.85	7.69
Whorl (W)	100	7.69	69.20	11.54	50	19.23	73.08	26.92	38.46	7.69

$P < 0.05$

**Table 1B:** Percentage (%) frequencies of digital patterns of the left hand of patients with essential hypertension and normal (N) male subjects (control)

Patterns	Li EHP	Li N	Lii EHP	Lii N	Liii EHP	Liii N	Liv EHP	Liv N	Lv EHP	Lv N
ARCH (A)	0.00	38.46	11.54	26.92	3.85	19.23	0.00	15.38	3.85	15.38
Ulnar Loop (UL)	0.00	11.54	7.69	26.92	0.00	11.54	0.00	7.69	0.00	7.69
Radial Loop (RL)	19.23	34.62	19.23	34.62	57.69	57.69	38.46	50.00	57.69	69.23
Whorl (W)	80.77	15.38	61.54	11.54	38.46	11.54	61.54	26.92	38.46	7.69

$P < 0.05$

**Table 2A:** Percentage (%) frequencies of digital patterns of the right hands of patients with essential hypertension and normal(N) female subjects (control).

Patterns	Ri EHP	Ri N	Rii EHP	Rii N	Riii EHP	Riii N	Riv EHP	Riv N	Rv EHP	Rv N
ARCH (A)	0.00	25.00	12.5	45.83	0.00	37.50	4.17	29.16	0.00	12.50
(UL) Ulnar Loop	8.33	62.50	33.33	41.67	70.83	58.33	29.17	70.84	66.67	87.50
(RL)Radial Loop	0.00	8.33	0.00	4.17	0.00	4.17	0.00	0.00	0.00	0.00
Whorl (W)	91.67	4.17	54.16	8.33	29.17	0.00	66.66	0.00	33.33	0.00

P<0.05

**Table 2B:** Percentage (%) frequencies of digital patterns of the left hands of patients with essential hypertension and normal (N) female subjects (control)

Patterns	Li EHP	Li N	Lii EHP	Lii N	Liii EHP	Liii N	Liv EHP	Liv N	Lv EHP	LvN
ARCH (A)	4.17	37.50	8.33	29.17	0.00	29.17	4.17	16.67	0.00	12.50
(UL) Ulnar Loop	0.00	12.50	4.17	12.50	0.00	12.50	0.00	8.33	0.00	8.33
(RL) Radial Loop	12.5	45.80	45.83	50.00	75.00	50.00	45.83	75.00	83.33	79.17
Whorl (W)	83.33	4.17	41.67	4.17	25.00	4.17	50.00	0.00	16.67	0.00

P<0.05

Key: Ri= Right thumb, Li= Left thumb, Rii=Right index finger, Lii= Left index finger, Riii = Right middle finger, Liii=Left middle finger, Riv= Right ring finger, Liv= Left ring finger, Rv= Right little finger, Lv= Left little finger, EHP = Essential hypertensive patients, and N = Normal subjects.

**Table 3A:** Summation of the ridge count of each digit of right hand of female patients with essential hypertension (EHP) and normal (N) female subjects.

PARAMETER	Ri (EHP)	Ri (N)	Rii (EHP)	Rii (N)	Riii EHP	Riii N	Riv EHP	Riv N	Rv EHP	RvN	Total EHP	Total N
RIDGE COUNT	235	163	176	93	198	125	213	181	212	164	1034	726

**Table 3B:** Summation of the ridge count of each digit of left hand of the female patients with essential hypertension (EHP) and normal (N) female subjects.

PARAMETER	Ri (EHP)	Ri (N)	Rii (EHP)	Rii (N)	Riii EHP	Riii N	Riv EHP	Riv N	Rv EHP	Rv N	Total EHP	Total N
RIDGE COUNT	242	169	202	100	210	133	196	181	191	169	1041	752

**Table 4A:** Summation of the ridge count of each digit of right hand of male patients with essential hypertension(EHP) and normal (N) male subjects.

PARAMETER	Ri (EHP)	Ri (N)	Rii (EHP)	Rii (N)	Riii EHP	Riii (N)	Riv (EHP)	Riv (N)	Rv (EHP)	Rv (N)	Total EHP	Total N
RIDGE COUNT	305	147	243	192	239	196	272	228	261	235	1320	998

**Table 4B:** Summation of the ridge count of each digit of left hand of male patients with essential hypertension (EHP) and normal (N) male subjects.

PARAMETER	Li (EHP)	Li (N)	Lii (EHP)	Lii (N)	Liii EHP	Liii N	Liv EHP	Liv N	Lv EHP	Lv N	Total EHP	Total N
RIDGE COUNT	303	174	258	168	261	197	281	239	255	198	1358	976

**Table 5A:** Percentage (%) frequencies of position of T-triradii on the right hand of patients with essential hypertension (EHP) and normal (N) subjects/control (males and females).

Position of T-triradii	EHP(male)	EHP(female)	Control (male)	Control(female)
T	84.6%	91.7%	92.3%	79.2%
t <sup>i</sup>	15.5%	8.3%	7.7%	20.8%
t <sup>ii</sup>	0.0%	0.0%	0.0%	0.0%

**Table 5B:** Percentage (%) frequencies of position of T-triradii on the left hands of patients with essential hypertension (EHP) and normal (N) subjects (males and females).

Position of T-triradii	EHP (male)	EHP(female)	Control (male)	Control(female)
T	84.6	100%	88.5%	83.3%
t <sup>i</sup>	15.4	0.0%	11.5%	16.7%
t <sup>ii</sup>	0%	0.0%	0.0%	0.0%

**Table 6:** Summary of mean, ATD angles (°) of the palmer prints of patients with essential Hypertension and normal subjects (control).

PARAMETERS	REHP		RN		LEHP		LN	
	male	female	male	female	male	female	male	female
Mean	42.17	42.08	41.81	42.25	42.42	43.83	40.40	43.02
Standard Deviation	4.88	4.91	4.31	4.27	4.30	3.57	4.89	4.20

P>0.05 (right hand) P<0.05(left hand)

**Table 7:** Summary of mean DAT angles (°) of the palmer prints of patients with essential Hypertension and normal subjects (control).

PARAMETERS	REHP		RN		LEHP		LN	
	male	female	male	female	male	female	male	female
Mean	58.23	58.63	57.06	59.96	58.06	58.69	61.06	59.31
Standard Deviation	5.02	5.56	5.7	4.34	4.98	7.49	5.12	6.66

p>0.05 p<0.05

**Discussion:**

Most authors agree that unlar loop has the highest percentage followed by whorl, arch and radial loop in a population of normal individuals (Oladipo and Akanigha, 2005; Oladipo 2007). Oladipo and Akanigha (Oladipo and Akanigha 2005) reported that whorl had the highest frequency amongst individuals with alopecia. Our observation in this study was partly in agreement with most of these earlier authors and with that of Oladipo and Akanigha (Oladipo and Akanigha 2005) as whorl had the highest percentage on the right hand of patients with essential hypertension. The first right digits of all the male patients studied were 100% whorl while 91.67% were whorl on the same digits in female patients. The number of whorls was also significantly higher ( $p < 0.05$ ) in the other four fingers of the right hand in both males and females EHP patients. Similarly, on the left digits of patients, the number of whorls was significantly higher ( $p < 0.05$ ) than the control. The high percentage of whorl pattern could therefore be relied upon in making diagnosis of essential hypertension amongst the Nigerian population investigated as suggested by earlier researcher Kulkarmi and Herekar, (2006). One might say with 100% assurance that a male subject with whorl pattern of the first right digit from this population will develop hypertension later in life while in female it is 91% certain that the individual will develop this condition later in life.

The mean ATD angles of patients with essential hypertension in the present study had average values of  $42.2^{\circ}$  and  $42.9^{\circ}$  for male and females respectively. These values were, however, similar to those of the control group ( $p > 0.05$ ), with average mean ATD angles of  $41.1^{\circ}$  and  $42.6^{\circ}$  in males and females respectively. Similarly, no significant difference was found in the DAT angle between male and female patients and that of male and female control. A significant difference was, however, found in the ATD and DAT angles of male EHP patients and male control ( $p < 0.05$ ) on the left hand.

From the present study, Nigerians with essential hypertension demonstrated higher digital ridge counts in all the digits than the normal subjects. In addition, the total digital ridge count was higher than 1000 only in HEP patients. It was less than 1000 in the control group. Thus, it is clear from this observation that digital ridge count is a good marker for essential hypertension as an individual with total ridge count more than 1000 in Nigerian population is likely going to develop hypertension later in life. Our observation on the total ridge count agreed with findings of other authors on diabetes mellitus that reported a higher total digital ridge count in diabetes mellitus than normal population but varied from those of others authors on other genetic disorders who reported lower values Penrose, (1963).

The percentage frequencies of position of T-triradii in both patients and normal subjects were higher at 't' position in all subjects than other positions This suggests that the position of T-triradius might not be useful in determining individuals with essential hypertension.

**Conclusion:**

In conclusion, there are characteristic digital and palmar dermatoglyphic pattern such as: total digital ridge count of 1000 and above, high incidence of whorl pattern (100% in first right digit of males) are associated with essential hypertension. These features can be used in early diagnostic of essential hypertension in the population under investigation. This will definitely have an impact on reducing the mortality and morbidity from this silent killer called essential hypertension. Thus we recommend that similar studies should be carried out on other populations of the world in order to produce a more comprehensive data that could be use in early diagnosis in different populations.

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