



Digito-palmar Dermatoglyphics Patterns May Predict the Risk of Hypertension among Nigerians

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Abstract

Background: Dermatoglyphics is a very important tool used to recognize certain gene-related defects or diseases. Essential hypertension is a disorder which has genetic influence and is defined as persistent high blood pressure not related to a single cause but reflecting the activity of various genetic and environmental factors, such that siblings of hypertensive parent or parents stand a higher likelihood of developing hypertension in later life.

Objectives: Comparing Digito-palmar dermatoglyphic patterns among hypertensive and normotensive Nigerians.

Methods: 400 hypertensive subjects were compared with 400 normotensive controls. All had qualitative digito-palmar dermatoglyphic patterns done.

Results: The study shows that essential hypertensive patients have significantly higher frequency of whorl patterns and a decrease frequency of loops and arches on both right and left fingertips than controls.

Conclusion: Whorl pattern of digito-palmar dermatoglyphic can be reliably used as a predictive tool for individuals who are at higher risk of developing essential hypertension and preventive measures can be targeted.

Keywords: Dermatoglyphics, Hypertension and Prevention

1. Introduction

Dermatoglyphics is a scientific study of epidermal ridges and their arrangement on volar surface of the hands, fingers, feet and toes [1]. It is a unique stable marker of identity and also a useful tool in the diagnosis of congenital malformations, established in utero. Palmar prints are universal, original and permanent, and can be collected. The term was coined by Cummins and Midlo in 1961. The word "Dermatoglyphics" is derived from the Greek word "Derma" meaning skin and "glyphic" meaning carvings [2]. Most dermatoglyphic traits develop in utero during weeks 17 through 24 and remain unchanged during the individual's lifetime [1]. Any type of disrupted growth in earlier stages of fetal life development may result in abnormal pattern of dermatoglyphics [3]. Dermatoglyphics has been a very important tool used to recognize certain gene-related defects or diseases. A number of studies have shown a dermatoglyphic link with a large number of genetic disorders [4].

Essential hypertension is defined as persistent high blood pressure not related to a single cause but reflecting the activity of various genetic and environmental factors, such that siblings of hypertensive parent or parents stand a higher likelihood of developing hypertension in later life [4]. Essential hypertension proceeds for a long period without complications or damages, but progressively it may determine alterations in the elasticity of the vessels, lesions of the eyes, and sometimes-irreversible damage such as myocardial infarction, heart failure, stroke and apoplexy. Essential hypertension is characterized by sustained systolic pressure of greater than 140 mmHg and a diastolic blood pressure at greater than 90 mmHg. Dermatoglyphic is one of the advanced branches of medical science where the dermal ridge patterns are used by clinicians as an aid in predicting chromosomal and other medical disorders [5]. Asymptomatic hypertension will be discovered early in the majority of cases, allowing for early intervention, better treatment, and a better prognosis.

This will in no small way have significant impact in lowering hypertension-related morbidity and mortality. In this study, we compare digito-palmar dermatoglyphic patterns among hypertensive and normotensive Nigerians.

2. Materials and Methods

This is a cross-sectional observational study. The study was conducted at Oluwarotimi Specialist and Diagnostic Centre, Akure, State Specialist Hospital, Akure, Federal Medical Centre, Owo, Ondo State, Nigeria and Federal University of Technology, Akure, Ondo State. This study was carried out with a total sample of 800 adult human subjects. The subjects were divided into two disjoint groups; test group (TG) [400 essential hypertensive patients (200 Males and 200 females) between the age group of 20 - 70 years] and control group (CG) [400 normotensive individuals (200 Male and 200 Female) between the age group of 20-70years].

Inclusion criteria: Known hypertensive, newly diagnosed hypertensive whether on treatment or not

Exclusion criteria: People with deformities and deep burns of fingers and palm, people below the age of 20 and above 70 years, people who were not willing to participate and people who were critically ill.

Data collection was done within the period of March 2021 to March 2022 using a well-structured interviewer administered questionnaire, in which personal information, parameters investigated and blood pressure of participants were recorded. The questionnaire was divided into two sections; A contained the bio-data of the subject, section B contained fingertip dermatoglyphic data of the subject.

2.1 Ethical Consideration

Ethical approval for the study was obtained from Federal Medical Centre, Owo, Ondo State, Nigeria. Informed consents was taken from individual persons, explanations about the purpose of this research was given to them.

2.2 Data Collection

Data were collected using a semi-structured questionnaire in which bio data and dermatoglyphic parameters of participants were recorded. The questionnaire was divided into 2 sections (A and B). Section A contained the bio-data of the subject, section B contained dermatoglyphic data of the subject.

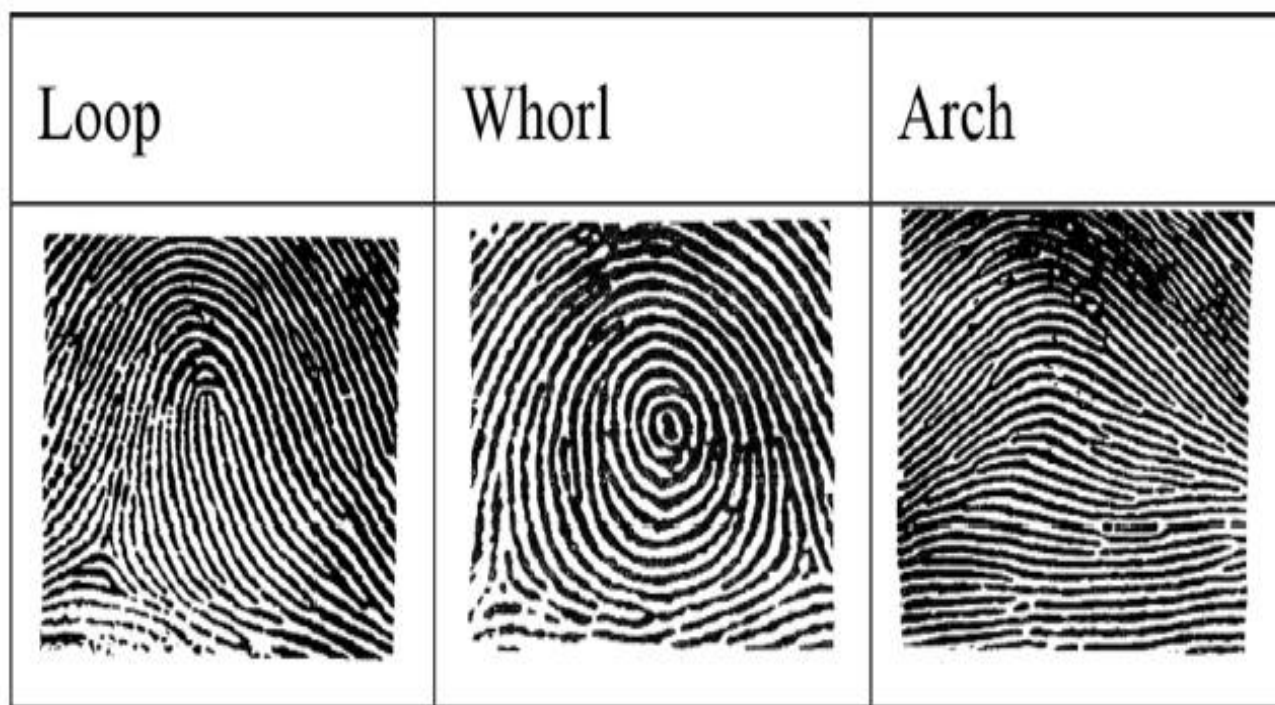
2.3 Fingertip Dermatoglyphics Parameters

CanoScan LiDE 300 scanner version 1.5.0 was used to obtain the fingerprint of individuals. The right and left hands of the respondent were cleaned and placed gently on the screen of the scanner which was connected to a HP Folio 13-laptop computer and a digital image of the hands were

obtained. The lid of the scanner was closed when scanning to minimize undesirable stray of light. The scanned images were immediately coded with an ID number. The fingerprint patterns were recorded as whorls (W), ulnar loop (UL), radial loop (RL) or arch (A) (Figure 1).

Data were analyzed using the Statistical package for social sciences (SPSS) software version 26.0. Comparisons of continuous dermatoglyphic data between subjects with hypertension matched controls normotensives were made with 2-tailed t-test for independent groups. Categorical variables of subjects with keloids were compared with controls by chi-square. Level of statistical significance was set at $P < 0.05$ at a confidence interval of 95%.

Figure 1: Finger Print Patterns



3. Results

Table 1 shows the significant distribution of fingerprint pattern on right hand among test group and control group. Test group showed a significant increase of whorls and a decreased frequency of ulnar loops in all digits as compared to control group ($p < 0.001$). The highest frequency of whorl pattern was seen on the thumb among test group (79%) as compared to control (28%) while

the highest frequency of ulnar loop was seen on the little finger of control group (92%) as compared to test group (60%). The highest frequency of arch pattern was seen on the thumb finger in the control group (19%) compared to the test group (8%) and the highest frequency of radial loop was seen on the index finger among the control group (8%) compared to the test group (2%).

Table 2 shows the significant distribution of fingerprint pattern on left hand among test group

and control group. Test group showed a significant increase of whorls and a decreased frequency of ulnar loops in all digits as compared to control group ($p < 0.001$). The highest frequency of whorl pattern was seen on the thumb among test group (75%) as compared to control (23%) while the highest frequency of ulnar loop was seen on the little finger of control group (90%) as compared to test group (66%). The highest frequency of radial loop was seen on the index finger among the control group (4%) compared to the test group (1%). Highest frequency of arch was seen in thumb among control (28%) compared to test group (8%).

Table 3 and 4 shows the frequency of fingertip pattern in all digits in test group and controls. The whorl pattern was observed to be consistently higher in the test group compared to the control on both hands. Increase in percentage frequency of

whorl was observed in both male (65.0%) and female (56.5%) test group compared to male (18%) and female (15.5%) control group. Decreased incidence of ulnar loop was observed in male (33%) and female (37.5%) test group compared to male (65%) and female (71.5%) control group. Decreased frequency of arch was also noted in male (1%) and female (6%) test group compared to male (15.5%) and female (12%) control group. Radial loop was more frequent in control male (1.5%) and female (1%) than test group male (1%) and female (0%).

Table 5 reveals the finger print patterns from previous studies by different authors among different ethnic groups. Higher frequency of the whorl pattern among hypertensive patients was consistently seen in all the studies.

Table 1: Frequency distribution of fingerprint patterns for right hand of respondent

		RIGHT HAND					
Digit	Fingertip pattern	Test Group (N=400)	Control Group (N=400)	Chi-Square	Df	p value	
Thumb	Whorl	316(79%)	112(28%)	53.032	2	<0.001	
	Ulnar loop	52(13%)	212(53%)				
	Radial loop	0(0%)	0(0%)				
	Arch	32(8%)	76(19%)				
Index	Whorl	288(72%)	92(23%)	48.459	3	<0.001	
	Ulnar loop	88(22%)	224(56%)				
	Radial loop	8(2%)	32(8%)				
	Arch	16(4%)	52(13%)				
Middle	Whorl	200(50%)	24(6%)	51.467	3	<0.001	
	Ulnar loop	184(46%)	324(81%)				
	Radial loop	4(1%)	0(0%)				
	Arch	12(3%)	52(13%)				
Ring	Whorl	304(76%)	108(27%)	48.363	3	<0.001	
	Ulnar Loop	92(23%)	272(68%)				
	Radial loop	0(0%)	4(1%)				
	Arch	4(1%)	16(4%)				
Little	Whorl	156(39%)	24(6%)	37.025	2	<0.001	
	Ulnar Loop	240(60%)	360(90%)				
	Radial Loop	0(0%)	0(0%)				
	Arch	4(1%)	16(4%)				

[Statistical analysis was done by chi-square; Data expressed frequency (%). P-value < 0.05 was considered as statistically significant].

Table 2: Frequency distribution of fingerprint patterns for left hand of respondent

LEFT HAND							
Digit	Fingertip pattern	Test N=400	Group	Control Group N=400	Chi Square	Df	p value
Thum b	Whorl	300(75%)		92(23%)	54.488	3	<0.001
	Ulnar loop	68(17%)		192(48%)			
	Radial loop	0(0%)		4(1%)			
	Arch	32(8%)		112(28%)			
Index	Whorl	268(67%)		92(23%)	39.401	3	<0.001
	Ulnar loop	100(25%)		220(55%)			
	Radial loop	4(1%)		16(4%)			
	Arch	28(7%)		72(18%)			
Middl e	Whorl	208(52%)		24(6%)	58.304	2	<0.001
	Ulnar loop	184(46%)		292(73%)			
	Radial loop	0(0%)		0(0%)			
	Arch	8(2%)		84(21%)			
Ring	Whorl	252(63%)		76(19%)	44.226	3	<0.001
	Ulnar Loop	144(36%)		268(67%)			
	Radial loop	0(0%)		4(1%)			
	Arch	4(1%)		52(13%)			
Little	Whorl	132(33%)		24(6%)	24.185	2	<0.001
	Ulnar Loop	264(66%)		360(90%)			
	Radial Loop	0(0%)		0(0%)			
	Arch	4(1%)		16(4%)			

[Statistical analysis was done by chi-square; Data expressed frequency (%). P-value < 0.05 was considered as statistically significant].

Table 3 : Dermatoglyphic pattern distribution in cases and controls

Parameters	TEST GROUP (N=400)		CONTROL GROUP (N=400)	
	Hypertensives		Normotensives	
Whorl	242(60.5%)		66(16.5%)	
Ulnar Loop	142(35.5%)		273(68.25%)	
Radial Loop	2.0(0.5%)		6(1.5%)	
Arch	14.0(3.5%)		55(13.75%)	

Table 4: Dermatoglyphic pattern distribution in cases and controls with sex distribution

Parameters	TEST GROUP (N=400)		CONTROL GROUP (N=400)	
	Male N = 200	Female N = 200	Male N = 200	Female N = 200
Whorl	130(65%)	113(56.5%)	36.0(18%)	31.0(15.5%)
Ulnar Loop	66(33%)	75(37.5%)	130(65%)	143(71.5%)
Radial Loop	2(1%)	0(0%)	3(1.5%)	2(1%)
Arch	2(1%)	12(6%)	31(15.5%)	24(12%)

Table 5: Comparison of finger print pattern in essential hypertension

Name of study	Country	Group	Dermatoglyphic Findings			
			Whorl	Ulnar loop	Radial loop	Arch
Present study (2022)	Nigeria	Test group = 400	Higher frequency	Lesser frequency	Lesser frequency	Lesser frequency
		Control = 400	Lesser frequency	Higher frequency	Higher frequency	Higher frequency
Oladipo et al., (2010)	Nigeria	Test group = 50	Higher frequency	Lesser frequency	Lesser frequency	Lesser frequency
		Control = 50	Lesser frequency	Higher frequency	Higher frequency	Higher frequency
Tafazoli et al., (2013) ^[4]	Iran	Test group = 40	Higher frequency	Lesser frequency	Lesser frequency	Higher frequency
		Control = 20	Lesser frequency	Higher frequency	Higher frequency	Lesser frequency
Bulagouda et al., (2013) ^[9]	India	Test group = 100	Lesser frequency except in right hand of female text group	Lesser frequency	Higher frequency	Higher frequency
		Control = 100	Higher frequency except in right hand of female text group	Higher frequency	Lesser frequency	Lesser frequency
Kachhave et al., (2013)	India	Test group = 60	Higher frequency	Lesser frequency	Higher frequency	Lesser frequency
		Control = 60	Lesser frequency	Higher frequency	Lesser frequency	Higher frequency
Kwame et al., (2021)	Ghana	Test group = 200	Higher frequency	Lesser frequency	Higher frequency	Higher frequency
		Control = 200	Lesser frequency	Higher frequency	Lesser frequency	Lesser frequency
Arista et al., (2013)	India	Test group = 131	Higher frequency	Higher frequency	Higher frequency	Lesser frequency
		Control = 145	Lesser frequency	Lesser frequency	Lesser frequency	Higher frequency

4. Discussion

Several studies have provided evidence that dermatoglyphic traits are associated with essential hypertension. The relevance of dermatoglyphic is not to diagnose an existing disease, but to prevent a disease by identifying individuals with the genetic predisposition to develop certain diseases ^[9].

In the present study, both the left and right hand of the test group showed a significant increase of whorls and a decreased frequency of ulnar loops in all digits as compared to control group ($p < 0.001$). This is similar to the study of Ganesh et al.

^[8] whereby it was reported that a higher frequency of whorls and low frequency of ulnar loops in all the fingers of hypertensive. The highest frequency of ulnar loop was seen among the control group as compared to the test group. This is similar to the study of Ganesh et al. ^[8] whereby it was reported that ulnar loop was frequent in controls compared to hypertensive. The highest frequency of arch pattern was seen in the control group compared to the test group and the highest frequency of radial loop was seen among the control group compared to the test group. This is contrary to the study of Nancy et al. ^[10] in India where it was observed that loops and

arches pattern was found to be in higher percentages in both hands of patients with hypertension compared with controls. The reason for these findings may be due to the ethnic and racial difference among the populations.

In this study, the highest frequency of whorl was seen among the test group as compared to control group in the right and left hand of males. This is similar to the findings of Oladipo et al. [4] whereby it was reported that the number of whorls was also significantly higher ($p < 0.05$) in the right and left hand in both males and females essential hypertensive patients. The highest frequency of ulnar loop was seen in the control group compared to test group. This is similar to the study of Bulagouda et al., [9] whereby it was observed that the right and left hand of both male and female control group showed more number of ulnar loops than test group. Arches were significantly frequent among the control group compared to test group. This is contrary to the study of Bulagouda et al., [9] whereby it was reported that the right and left hand of the both male and female study group showed more number of arches than controls.

In this study, the highest frequency of whorl was seen on the thumb among the test group as compared to control group in the right and left hand of females. This is similar to the findings of Oladipo et al. [4] whereby it was reported that the number of whorls was also significantly higher ($p < 0.05$) in the right and left hand in both males and females essential hypertensive patients. The highest frequency of ulnar loop was seen among the controls compared to the test group. This is similar to the study of Bulagouda et al., [9] whereby it was observed that the right and left hand of both male and female control group showed more number of ulnar loops than study group. Arches were significantly frequent among the control group compared to test group. This is contrary to the study of Bulagouda et al., [9] whereby it was reported that the right and left hand of the both male and female study group showed more number of arches than controls.

In the comparison of finger print patterns in essential hypertension from previous studies by different authors among different ethnic groups, higher frequency of whorl was seen among hypertensive patients in this study. Therefore, high

percentage of whorl pattern could therefore be relied upon as predictive risk of essential hypertension amongst the Nigerian population.

5. Conclusion

The present study is a totally noninvasive assessment that predicts risk of being hypertensive. The results obtained in this study shows a definite association exists between whorl dermatoglyphic pattern and essential hypertension. Hypertension in most cases asymptomatic will be diagnosed early, early preventive measure and better treatment and prognosis. This is in no small way reduces the morbidity and mortality associated with hypertension.

Recommendation

Presently there are very few studies on palmar dermatoglyphic in essential hypertension within Nigeria. It is recommended that further studies should involve genetic linkage between specific dermatoglyphic and essential hypertension.

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