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Quantitative digito-palmar dermatoglyphics analysis in essential hypertension in a Nigerian population

Análisis cuantitativo de los dermatoglifos digito-palmares en la hipertensión esencial en una población nigeriana

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Abstract

Background: Hypertension is estimated to affect over a billion people globally, with that number likely to rise to 1.56 billion by 2025. Palmer dermatoglyphic is a non-invasive scientific study of epidermal ridges of the volar surfaces of the hands which is currently finding relevance in the management of gene-linked diseases.

Objectives: The goal of this study was to explore the relevance of quantitative palmar dermatoglyphic parameters in predicting the likelihood of developing essential hypertension in the study population.

Methods: The study was carried out with a total sample of 200 respondents consisting of 100 essential hypertensive and 100 normotensive individuals between the age group of 20-70 years. Interviewer administered structured questionnaire was used to collect relevant information from participants. Finger and palm prints were obtained through the use of CanoScan LiDE 300 scanner. Collected data were statistically analyzed using Statistical Package for the Social Science (SPSS) version 26.0 at a significance level of $p<0.05$. Results: The results obtained in this study showed that a-b ridge count in both hands was significantly lower ($p<0.05$) in the test group (34.61±3.550) compared to the control (41.83±5.019). Likewise the left atd angle of the test group (40.84) was significantly lower ($p<0.05$) compared to the control (42.54).

Conclusion: The findings in this study suggested that a significant association exists between palmer dermatoglyphic features and essential hypertension predicting the possibility of being a veritable tool in identifying those who are at higher risk of developing essential hypertension very early thereby allowing for targeted preventive measures.

Key words: Hypertension, Palmer dermatoglyphic, epidermal ridges.

Resumen

Antecedentes: Se calcula que la hipertensión afecta a más de mil millones de personas en todo el mundo, y es probable que esa cifra aumente a 1.560 millones en 2025. El dermatoglifo de Palmer es un estudio científico no invasivo de las crestas epidérmicas de las superficies volares de las manos que actualmente está encontrando relevancia en el tratamiento de enfermedades vinculadas a los genes.

Objetivos: El objetivo de este estudio fue explorar la relevancia de los parámetros dermatoglíficos palmares cuantitativos en la predicción de la probabilidad de desarrollar hipertensión esencial en la población de estudio. Métodos: El estudio se llevó a cabo con una muestra total de 200 encuestados, compuesta por 100 hipertensos esenciales y 100 normotensos con edades comprendidas entre los 20 y los 70 años. Se utilizó un cuestionario estructurado administrado por un entrevistador para recoger la información pertinente de los participantes. Las huellas dactilares y palmares se obtuvieron mediante el uso del escáner CanoScan LiDE 300. Los datos recogidos se analizaron estadísticamente con el Paquete Estadístico para las Ciencias Sociales (SPSS) versión 26.0 a un nivel de significación de $p<0,05$.

Resultados: Los resultados obtenidos en este estudio mostraron que el recuento de crestas a-b en ambas manos fue significativamente menor ($p<0,05$) en el grupo de prueba (34,61±3,550) en comparación con el control (41,83±5,019). Asimismo, el ángulo atd izquierdo del grupo de prueba (40,84) fue significativamente menor ($p<0,05$) en comparación con el control (42,54).

Conclusión: Los hallazgos de este estudio sugieren que existe una asociación significativa entre las características dermatoglíficas de la palma de la mano y la hipertensión esencial, lo que predice la posibilidad de ser una verdadera herramienta para identificar a aquellos que tienen un mayor riesgo de desarrollar hipertensión esencial de forma muy temprana, permitiendo así medidas preventivas específicas.

Palabras clave: Hipertensión, dermatoglifo de Palmer, crestas epidérmicas.

Introduction

The scientific study of epidermal ridges and their arrangement on the volar surface of the hands, fingers, feet, and toes is known as dermatoglyphics[1]. Dermatoglyphics is derived from the Greek words “Derma” (skin) and “glyphic” (carvings)[2]. The majority of dermatoglyphic features are formed in the womb between weeks 17 and 24 and do not alter throughout a person’s life[1]. Any form of growth disruption during the early stages of fetal life development might result in an aberrant dermatoglyphic pattern[3]. Dermatoglyphics has long been a valuable method for identifying gene-related abnormalities and disorders. A dermatoglyphic relationship has been found in a number of studies to be associated with a wide range of genetic diseases[4].

Essential hypertension is described as persistently high blood pressure that is caused by a combination of genetic and environmental variables. For example, siblings of hypertensive parents or parents are more likely to acquire hypertension later in life[4]. Essential hypertension can go unnoticed for a long time, but it can eventually lead to changes in artery elasticity, ocular lesions, and occasionally irreversible damage including myocardial infarction and apoplexy. Essential hypertension is defined by a systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg for a prolonged period of time. Dermatoglyphics is an advanced branch of medical research in which practitioners analyze skin ridge patterns to help detect chromosomal and other medical abnormalities[5]. Several investigations have found a link between dermatoglyphic characteristics and hypertension. Given these findings, it’s been hypothesized that the likelihood of developing hypertension later in life is linked to the development of dermatoglyphic features during the first trimester. If this hypothesis is proven, dermatoglyphic indicators could be utilized to screen out people who are at risk of becoming hypertensive[6]. Given the high mortality and morbidity rates associated with essential hypertension worldwide, particularly in Nigeria, the goal of this study is to see if the palmar dermatoglyphics pattern may be utilized to predict individuals at risk of developing essential hypertension in Ondo State, Nigeria.

Table I: Classification of blood pressure according to the ESC (European Society of Cardiology) Guidelines

Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	<120	<80
Normal	120-129	80-84
High normal	130-139	85-89
Grade 1 hypertension	140 – 159	90 -99
Grade 2 hypertension	160 – 179	100 – 109
Grade 3 hypertension	>= 180	>=110
Isolated systolic hypertension	>=140	<90

(Niebauer, *et al*., 2018)[12].

Materials and Methods

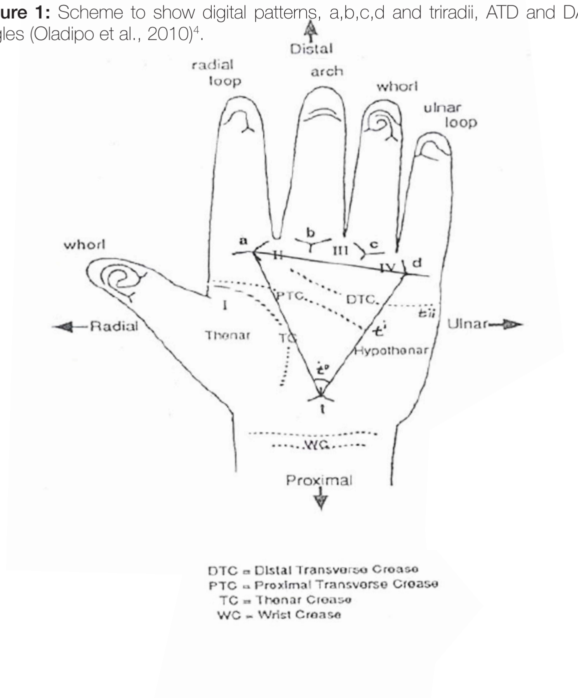
This is a cross-sectional observational study. The study was conducted at Federal Medical Centre, Owo, Ondo State, Nigeria and Oluwarotimi Specialist and Daignostic Centre Akure, Ondo State. This study was carried out with a total sample of 200 adult human subjects. The subjects were divided into two disjoint groups; test group (TG) [100 essential hypertensive patients (50 Males and 50 females) between the age group of 20-70 years] and control group (CG) [100 normotensive individuals (50 Male and 50 Female) between the age group of 20-70years].

Inclusion criteria: 1. Known essential hypertensive or newly diagnosed essential hypertensive by a competent clinician whether on treatment or not whose age is between 20 -70 years. 2. Normotensive individuals who has never been diagnosed of any form of hypertension and whose blood pressure was within normal limit and not below 20years or above 70 years.

Exclusion criteria: People with deformities and deep burns of fingers and palm, people below the age of 20 and above 70 years and people who were critically ill.

The palm prints were taken with a palm print scanner. The participants were asked to clean their hands to remove any dirt that may be associated with the skin ridges and place it on the electronic palm scanner. The palm prints were captured with the scanner and projected to the screen of the laptop connected to it. The palm prints were studied quantitatively for palmar angle parameters [Axial triradius (atd) and Digital triradius (dat) angles) using an AutoCAD software (**Figure 1**).

Figure 1: Scheme to show digital patterns, a,b,c,d and triradii, ATD and DAT angles (Oladipo et al., 2010)[4].



Data collection was done within the period of March 2021 to May 2021. 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 three sections A, B and C. Section A contained the bio-data of the subject, section B contained health related data and section C contained palmar dermatoglyphics data of the subject which were analysed.

Ethical Consideration

Ethical approval for the study was obtained from Federal Medical Centre, Owo, Ondo State, Nigeria with the reference number: FMC/OW/380/VOL.CX/162. Informed consents was taken from individual persons, explanations about the purpose of the research was given to them.

Blood Pressure Measurement

A digital Sphygmomanometer was used to measure blood pressure. The subject was asked to sit on a chair with feet flat on the floor and arm on the table at heart height. The cuff was wrapped around the upper arm, about 2-3 cm above the elbow, directly against the skin. The start button was pressed and machine was allowed to record measurement. The individual stayed still and did not move his/her arm until the measurement was complete. The arm cuff was completely deflated and removed after measurement. The systolic and diastolic values were recorded in mmHg and the sphygmomanometer was turned off.

Palmar 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. Palm angles were measured using AutoCAD software. The a-b ridge counts were determined by counting the number of ridges that cross a straight line drawn from a' triradius (at the base of index finger) to 'b' triradius (at the base of middle finger) of the palm in each hand.

Data were analyzed using the Statistical package for social sciences (SPSS) software version 26.0. Descriptive variables such as age, gender, anthropometric measurements and dermatoglyphic values were presented as frequencies, percentage and means (±standard deviation). The independent Student's t-test was used to determine significant differences between means of quantitative variables. The P value was regarded as significant at P<0.05 at a confidence interval of 95%.

Results

Results of the study were presented in **tables II-XII**. **Table II** shows the biodata of respondents. The means age of the test group was 48.67±14.70 while that of the control was 39.43±13.87. The mean Body Mass Index (BMI) of the test group was 25.18±6.51 and that of the control was 22.69±4.28.

Table III shows the a-b ridge count of respondent among test and control group. The mean of right a-b ridge count in the control group (41.83±5.019) was significantly (p<0.001) higher than the test group (34.61 ±3.550). The mean of left a-b ridge count in the control group (40.91±4.907) was significantly (p<0.001) higher than the test group (34.39±3.038).

Table IV shows the a-b ridge count of male respondent among the test and control group. The mean of right a-b ridge count and left a-b ridge count were significantly (p<0.001) higher in the control group than the test group.

Table V shows the a-b ridge count of female respondent among the test and control group. The right a-b ridge count was statistically (p<0.001) higher in the control group (42.56±4.949) than the test group (34.96±3.301). The left a-b ridge count was significantly (p<0.001) higher in the control group (41.46±5.504) than test group (34.64±2.884).

Table VI shows the a-b ridge count between male and female test group. There was no significant difference in the a-b ridge count among the genders.

Table VII shows the a-b ridge count between male and female control group. There was no significant difference in the a-b ridge count among the genders.

Table VIII shows the palmar angles of respondent. The left atd angle was significantly higher in the control group than the test group. There was no significant difference in the right atd angle, right dat angle and left dat angle in the test and control group among the genders.

Table IX shows the palmar angles between male and female test group. The right atd angle was significantly (p=0.032) higher in females (42.66±6.573) than in males (40.20±4.562). The left atd angle was significantly (p=0.005) higher in females (42.34±5.770) than in males (39.34±4.706). However, there was no significant difference in the right dat angle and left dat angle among the genders.

Table X shows the palmar angle between male and female control group. There was no statistical significant difference in the palmar angle among the male and female control group.

Table XI shows the palmar angle between female respondent among the test and control group. There was no statistical significant difference in the palmar angle (atd and dat angles) of females among the test and control group.

Table XII shows the palmar angle between male respondent among the test and control group. The left atd angle was significantly higher in the control group (41.8±5.460) than the test group (39.34±4.706). However, there was no significant difference in the right atd angle, right dat angle and left dat angle among the test and control group.

Table II: Showing the Age distribution and Body Mass Index of respondents.

Parameters	Test group (n=100)	Control group (n=100)	Total (n=200)
Age (Yrs)	48.67(14.70)*	39.43(13.87)*	44.05(14.99)*
20-30	15	28	43
31-40	13	29	42
41-50	21	21	42
51-60	26	11	37
61-70	25	11	36
BMI (Kg/m²)	25.18(6.5)*	22.69(4.28)*	23.93(5.66)*

[mean (SD)]*

Table III: a-b ridge count of respondent.

Parameters	Test Group N=100		Control Group N=100		P value
	Mean	**SD**	**Mean**	**SD**	
Right a-b	34.61	3.55	41.83	5.019	<0.001
Left a-b	34.39	3.038	40.91	4.907	<0.001

*

Table IV: a-b ridge count of male respondent.

Parameters	Male N=100				P value
	Test Group N=50		Control Group N=50		
	Mean	SD	Mean	SD	
Right a-b	34.26	3.784	41.10	5.032	<0.001
Left a-b	34.14	3.194	40.36	4.213	<0.001

*

Table V: a-b ridge count of female respondent.

Parameters	Female N=100				P value
	Test Group N=50		Control Group N=50		
	Mean	SD	Mean	SD	
Right a-b	34.96	3.301	42.56	4.949	<0.001
Left a-b	34.64	2.884	41.46	5.504	<0.001

*

Table VI: a-b ridge count of test group.

Parameters	Test Group N=100				P value
	Male N=50		Female N=50		
	Mean	SD	Mean	SD	
Right a-b	34.26	3.784	34.96	3.301	0.327
Left a-b	34.14	3.194	34.64	2.884	0.413

*

Table VII: a-b ridge count between male and female control group.

Parameters	Control Group N=100				P value
	Male N=50		Female N=50		
	Mean	SD	Mean	SD	
Right a-b	41.10	5.032	42.56	4.949	1.470
Left a-b	40.36	4.213	41.46	5.504	0.265

*

Table VIII: Palmar angles of respondent.

Parameters	Test Group N=100		Control Group N=100		P value
	Mean	**SD**	**Mean**	**SD**	
Right atd	41.43	5.763	42.63	6.483	0.168
Left atd	40.84	5.4517	42.54	5.704	0.032
Right dat	59.10	5.526	58.73	5.380	0.632
Left dat	59.35	5.876	58.06	5.169	0.101

*

Table IX: Palmar angles between male and female test group.

Parameters	Test Group N=100				P value
	Male N=50		Female N=50		
	Mean	SD	Mean	SD	
Right atd	40.20	4.562	42.66	6.573	0.032
Left atd	39.34	4.706	42.34	5.770	0.005
Right dat	60.34	4.939	57.86	5.845	0.240
Left dat	60.02	6.146	58.68	5.575	0.256

*

Table X: Palmar angle between male and female control group.

Parameters	Control Group N=100				P value
	Male N=50		Female N=50		
	Mean	SD	Mean	SD	
Right atd	41.62	6.315	43.64	6.555	0.120
Left atd	41.84	5.460	43.24	5.909	0.221
Right dat	58.86	5.139	58.60	5.660	0.810
Left dat	58.50	4.791	57.62	5.536	0.397

*

Table XI: Palmar angle between of female respondent.

Parameters	Female N=100				P value
	Test Group N=50		Control Group N=50		
	Mean	SD	Mean	SD	
Right atd	42.66	6.573	43.64	6.555	0.457
Left atd	42.34	5.770	43.24	5.909	0.443
Right dat	57.86	5.845	58.60	5.660	0.522
Left dat	58.68	5.575	57.62	5.536	0. 342

*

Table XII: Palmar angle between of male respondent.

Parameters	Male N=100				P value
	Test Group N=50		Control Group N=50		
	Mean	SD	Mean	SD	
Right atd	40.20	4.562	41.62	6.315	0.200
Left atd	39.34	4.706	41.84	5.460	0.016
Right dat	60.34	4.939	58.86	5.139	0.145
Left dat	60.02	6.146	58.50	4.791	0.171

*

* *[Data expressed as mean and SD. P-value < 0.05 was considred as statistically significant]*

Discussion

A number of studies have found that dermatoglyphic features are linked to essential hypertension. The importance of dermatoglyphics is not to diagnose an illness that has already occurred, but to avoid sickness by identifying people who have a hereditary susceptibility to specific diseases[7]. The present study consist of 200 (100 males and 100 females) Nigerian adults who were selected randomly irrespective of their ethnic groups.

In this study, the mean a-b ridge count in the control group was significantly (p<0.001) higher than the test group. This is similar to a study conducted in India by Devi et al.[8] who reported that a significant difference was observed between hypertensive and control group in their a-b ridge counts where control group found to have significantly higher a-b ridge counts than hypertensive patients.

In males, the mean of right and left a-b ridge count was significantly (p<0.001) higher in the control group than the test group. This was similar to the study by Tafazoli et al.9 in Iran where it was observed that in male group, the mean a-b ridge count was less in patients than in healthy people. In females, the mean of right and left a-b ridge count was significantly (p<0.001) higher in the control group than the test group. This was contrary to a similar study by Tafazoli et al.[9] in Iran where it was observed that there was no significant difference in the a-b ridge count of both hands of female test and control groups. The difference observed in this study may be due either to the varying sample size or racial and ethnic variation.

In the present study, the left atd angle was significantly higher in the control group than the test group, however, there was no significant difference in the right atd angle. This is contrary to a study by Nancy et al.[10] in India whereby it was reported that the mean atd angle in hypertensive patients for both hands was statistically significantly higher than controls. In males, the left atd angle was significantly higher in the control group (41.8±5.460) than the test group (39.34±4.706). This is similar to the study of Devi et al.8 whereby it was observed that in males, controls have higher 'atd' value than patients (Means = 47.57 and 45.22 respectively).

There was no statistical significant difference in the atd angles of females among the test and control group. This is contrary to the study done in Iran by Tafazoli et al.9 whereby it was stated that in females, atd angle was significantly higher in the test group than the control group.

In the test group, the right atd angle was significantly (p=0.032) higher in females (42.66±6.573) than in males (40.20±4.562). The left atd angle was significantly (p=0.005) higher in female test group (42.34±5.770) than male test group (39.34±4.706). This is contrary to the study done by Deepa[11] in India who observed decreased atd value for both sexes in hypertensive patients.

In the present study, there was no significant difference in the right and left dat angle in the test and control group among the genders. In males, there was no significant difference in the dat angle among the test and control group. This is similar to the study of Devi et al.[8] whereby it was reported that no significant difference was observed between groups and hands (left and right) for mean of 'dat' angles in males.

There was no statistical significant difference in the palmar angle among the male and female control group. This is similar to the study of Oladipo et al.[4] whereby it was reported that no significant difference was found in the DAT angle between male and female control group.

The results obtained in this study shows a definite association exists between palmar dermatoglyphics and essential hypertension. a-b ridge count and atd angle are lesser in essential hypertensive population compared to normal people. Thus, measurement of a-b ridge count can be used as a reliable predictive tool in early identification of individuals who are at higher risk of developing essential hypertension and preventive measures can be undertaken to prevent the occurrence of essential hypertension in those at risk.

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