

## Original Research Article

# Finger and palmar dermatoglyphics in diabetic subjects: a study in a Nigeria teaching hospital

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## ABSTRACT

**Background:** The aim of this study is to evaluate digito-palmer print among diabetic patients visiting Irrua specialist teaching hospital (ISTH), Irrua Edo State, Nigeria.

**Methods:** Using standard procedures of the ink method, the finger prints of both hands were obtained and palm photographed were taken from clinically diagnosed diabetic patients. The data were analyzed using SPSS (version 21) and results presented in tables.

**Results:** The mean age of the patients was 59.64±9.73 years with 64% females. In the right hand the arch finger print was prevalent on the thumb and loop on the little, middle and ring fingers. In the left hand, the arch print was prevalent on the thumb, index and middle fingers. There was no significance between gender on the distribution of the various finger print patterns except in the right middle finger where females were significantly more likely ( $p < 0.05$ ) to present the loop finger print. The 310-palm print was prevalent in the right and left hands of the diabetic patients with 60% chances of symmetric. Female subjects were more likely to present the 310-palm print compare with male in both hands. The 311 point of origin, intercept and cross (PIC) was absent in the right palm of the male and absent on the left palm of the female.

**Conclusions:** It appears that there exists a variation in the dermatoglyphic patterns in diabetic patients. However, there is a need for larger population-based studies to standardize the parameters and translate the findings into clinical and public health practice.

**Keywords:** Dermatoglyphics, Digitopalmer print, Diabetic patients

## INTRODUCTION

The term dermatoglyphics was coined by Cummins and Midlo in 1926 from the Greek words 'derma' which means skin and 'glyphic' which means carvings.<sup>1,2</sup> To Kiran and Hegde, dermatoglyphics is the scientific study of fingers and palm prints while Marera et al refers to it as the skin markings engraved on the fingers, palms of the hand, toes and soles of the feet.<sup>3,4</sup> According to Verbov, the fingers and palms prints/ ridges are believed to enhance the sense of touch and Bhat et al reported that

they serve mechanical function during grip and prevent slippage.<sup>5,6</sup> The formation of these ridges takes is documented to place during the third week of intrauterine and remain unchanged once formed.<sup>7</sup>

The prints assessment in dermatoglyphics are being studied and have been reported to be significant in identification, with considerable importance in anthropology, criminology, medicine, chromosome abnormalities as well as aid prediction of various genetic and acquired disorders/diseases.<sup>8-13</sup> Since these dermal

ridges and their components are genetically determined and do not change throughout life, they have become of value as a supportive aid in the diagnosis of hereditary disorders.<sup>2,14</sup> So, it seems dermatoglyphics can be a noteworthy method for genetic studies and surveys related to the prevention of diabetes.

Diabetes is a serious and chronic disease that occurs, either when the pancreas cannot produce enough insulin, or when the body cannot use insulin effectively.<sup>15</sup> It is characterized by high levels of glucose in the blood, which may lead to progressive damage in most tissues and organs of the body such as heart, blood vessels, eyes, kidneys, skin, and nerves. According to the international diabetes federation (IDF), in 2017 there were 425 million people with diabetes, and are expected to be more than 629 million by 2045.<sup>16</sup> It was estimated that more than 15 million people in Africa have diabetes mellitus and Nigeria is among the top five countries with the burden of the disease in Africa.<sup>17</sup> Symptoms of diabetics are often less obvious or absent as such, the disease may not be diagnosed for several years, until the complications have already appeared.<sup>16,18</sup> Thus, early diagnosis and treatment are very important to prevent long-term complications of the disease.

It has been clearly established that conditions like diabetes and hypertension have genetic background, which is why there may show distinct findings in diseases which have genetic predisposition.<sup>19</sup> On the other hand, epidermal ridge patterns show significant associations with diseases with a strong or partial genetic background and is now a valuable companion to other methods used for diagnosis of some genetic diseases and syndromes genetically determined.<sup>19,20</sup> Application of the knowledge of biomarkers like fingerprint had been widely canvassed as helpful for early, prompt and effective screening of susceptible individuals from larger population settings.<sup>21</sup> It has been posited that dermatoglyphics as a field serves as a supportive and economically viable tool in the prediction and diagnosis of diabetes mellitus amongst individuals predisposed to developing this disorder.<sup>19,22</sup> The aim of the study is to evaluate digito-palmer print among diabetic patients visiting ISTH, Irrua Edo State, Nigeria.

## METHODS

### *Study design and area*

A descriptive cross-sectional study of diabetic patients visiting the diabetic unit of ISTH, Irrua, Nigeria. The hospital is located in Esan Central local government area in Edo State, Nigeria with administrative headquarters in Irrua. Esan central local government area was carved out from the former Okpebholo local government in the defunct Bendel State of Nigeria. The area is located within latitude 8° 35E and 8° 30N and longitude 8° 21E and 8° 35E.<sup>23</sup> The area is bounded in the north by Agbede, Etsako West LGA, south by Agbor,

East by Uromi and West by Ekpoma. With an area of 253 km<sup>2</sup> and density of 545.1/km<sup>2</sup>, the population census of 2006 placed her population to be 105, 242 and was projected to be 137900 in 2016. The area consists of the following towns and villages such as Irrua, Ewu, Opoji, Ugbegun, Igueben, Ebelle and Ewossa

### *Sample population*

The subjects for the study were 50 patients suffering from diabetic and attending outdoor or were admitted in the diabetic wards of ISTH, Irrua, Nigeria. Both male and female patients were included with no age restriction. They were diagnosed as diabetic patient by medically qualified personnel in the department and their history obtained from the case notes were used to select participants. The patients were not related to one another but the diagnostic groups were comparable with regard to age, sex, religion, socio-economic status and ethnic origin. The study extent from March 2021 to August 2021. However, approval to conduct the study was granted May, 2021 and sample collected between May 2021 to August, 2021.

### *Inclusion and exclusion criteria*

Participants included all male and female individuals who gave informed consent with no form of finger or palm deformity and are not seriously ill to participate in the study. However, patients who gave consent and had any distortions of fingers and palm and infected hand as well as wounds of fingers and palms prompting scars were excluded. Patients suffering from psychiatric disorders associated genetic abnormalities and the severely ill were also excluded in this study.

### *Ethical consideration*

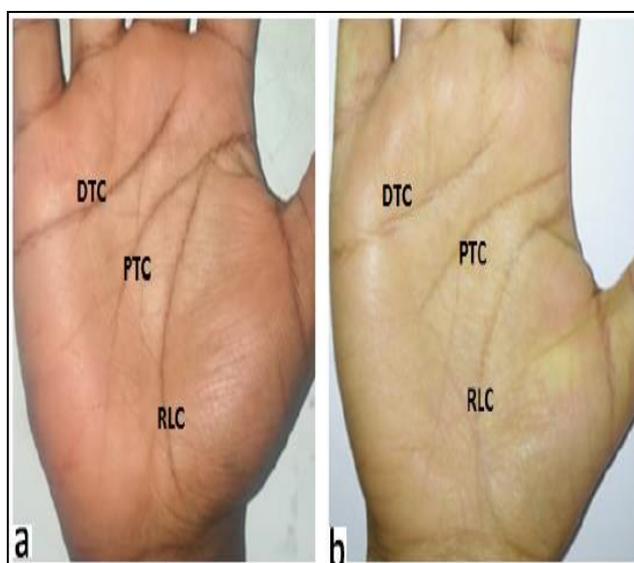
Prior to the study, the objectives of the study were explained to the chief medical director and the head of the departments of the units where subjects were to be sampled. Ethical approval was obtained from the Irrua specialist teach hospital health research and ethics committee (ISTH/HREC) with the assigned number ISTH/HREC/20212904/185. Thereafter, participants' consent was obtained after provision of adequate, clear and complete information about the study and they were asking to signed and date the written inform consent. Participants were informed that participation was voluntary and that data collected would be used mainly for research purposes. Finally, the study was performed in compliance with the Helsinki declaration; collected data were anonymous and were used only for academic purpose.

### *Sample collection and analysis*

Finger print patterns were studied on the 10 fingers using a stamp ink and white A4 sheets as documented in Offe et al with some modification.<sup>24,25</sup> Right and left palm

pictures obtained using mobile camera (20 MP resolution) previously documented by Anyanwu et al.<sup>25</sup>

Finger prints were studied with the help of a magnifying lens by grouping into the three basic pattern types as distinguished by Galton to be whorl, loop and arch.<sup>26</sup> Palm prints were analyzed using the number of primary creases, intersection of primary creases and complete transverse crease (PIC) criteria as in Mekbeb (Figure 1).<sup>27</sup> Abnormal creases were identified based on the relationships between the PTC and DTC as Simian, Sydney, and Suwon creases. According to the manner of origins of the three primary creases on the radial side of the palm, creases were classified as either one, two or three points of origin.<sup>28,29</sup> If both palms have same PIC profile and point of origin, it was termed symmetry otherwise it was labelled asymmetry.



**Figure 3: PIC identification in the palms.**

Where DTC: distal longitudinal crease; PTC: proximal longitudinal crease; RLC: radial longitudinal crease

**Statistical analysis**

The data were entered into Statistical Package for Social Sciences (SPSS) version 21.0 and analyzed using suitable statistical tools. The critical value for statistical significance was set at 0.05.

**Table 2: Gender differences in the distribution of the various finger print patterns in the right and left hand of the sampled diabetic subjects.**

Hand	Prints	Gender	Thumb	Index	Middle	Ring	Little
Right	Arch	Male	5	1	0	1	0
		Female	6	4	3	0	1
	Loop	Male	4	7	10	9	16
		Female	12	16	24	20	27
	Whorl	Male	9	10	8	8	2
		Female	14	12	5	12	4
		X <sup>2</sup>	1.365	1.718	6.008	2.227	0.608
		P value	>0.05	>0.05	<0.05	>0.05	>0.05

Continued.

**RESULTS**

**Demographic profile of diabetic patients**

Table 1 shows the demographic profile of the studied population. The mean age of the diabetic patients was 59.64±9.73 years and was within the range of 30 years to 70 years. They were 36.0% male and 64.0% female.

**Table 1: Demographic profile of the sampled diabetic patients.**

Variables	Frequency, n (%)	Mean
Age (Years)	-	59.64±9.73
Male	18 (36)	-
Female	32 (64)	-
Total	50 (100)	

**Finger print pattern of the sampled diabetic patients**

Table 2 shows the distribution of the various finger print patterns in the right and left hands of the diabetic subjects. The arch pattern of finger print was more prevalent in the right thumb while the loop pattern appears more on the right little, middle and right fingers. The whorl pattern was more seen on the right thumb, index and right fingers. In the left hand, the arch finger print appears more on the thumb, index and middle fingers while the hoop and whorl were evenly distributed except for the whorl of the little finger of the left hand where there as scanty of appearance.

Table 3 shows the gender differences in the distribution of the various finger print patterns in the right and left hands of the sampled diabetic subjects. In the right hand, the arch print was less in both male and female while it was the loop and whorl print that were more prevalent. In left hand, loop and whorl were almost evenly distributed while loops more prevalent in female left hands.

Table 4 shows the distribution of the various palm print according to the point of origin, intercept and cross (PIC) patterns in the right and left palms of the sampled diabetic subjects. The 310 PIC was observed to be more prevalent in the right and left hands of the diabetic subjects. There is also 60% chances of symetrism in both palm of diabetic subjects.

Hand	Prints	Gender	Thumb	Index	Middle	Ring	Little
Left	Arch	Male	3	5	3	0	1
		Female	7	4	6	2	3
	Loop	Male	8	5	6	9	15
		Female	14	19	20	21	27
	Whorl	Male	7	8	9	9	2
		Female	11	9	6	9	2
		X <sup>2</sup>	0.223	4.792	5.662	3.125	0.552
		P value	>0.05	>0.05	>0.05	>0.05	>0.05

**Table 3: Distribution of the various palm print according to PIC patterns in the right and left palms of the sampled diabetic subjects.**

Palm print patterns	Right hand	Left hand	Symmetrical (%)	Asymmetrical (%)
200 PIC	1	4		
300 PIC	14	14	30 (60)	20 (40)
301 PIC	1	1		
310 PIC	26	24		
311 PIC	1	1		
320 PIC	5	6		
321 PIC	2	-		
Total	50	50		

**Table 4: Distribution of the various finger print patterns in the right and left hands of the diabetic subjects.**

Hand	Prints	Thumb	Index	Middle	Ring	Little
Right	Arch	11	5	3	1	1
	Loop	16	23	34	29	43
	Whorl	23	22	13	20	6
Left	Arch	10	9	9	2	4
	Loop	22	24	26	30	32
	Whorl	18	17	15	18	4
Total		100	100	100	100	100

**Table 5: Gender differences in the distribution of the various palm prints according to the PIC patterns in the right and left palm of the sampled diabetic subjects.**

Palm print patterns	Right hand		Left hand	
	Male	Female	Male	Female
200 PIC	1	0	1	3
300 PIC	4	10	6	8
301 PIC	1	0	0	1
310 PIC	12	14	9	15
311 PIC	0	1	1	0
320 PIC	1	4	1	5
321 PIC	0	2	18	32
X <sup>2</sup>	6.082		3.833	
P value	>0.05		>0.05	

Table 5 shows the gender differences in the distribution of the various palm prints according to the point of origin, intercept and cross (PIC) patterns in the right and left palm of the sampled diabetic subjects. In both the right and left hands, the 310 PIC was more prevalent among the diabetic subjects and the female subjects were more likely to present the 310 PIC compare with male in both hands. The 311 PIC was absent in the right palm of the male and absent on the left palm of the female.

Statistically, there was no significant difference between the male and female in the different PIC presented.

## DISCUSSION

Dermatoglyphics has become a diagnostic tool in a number of diseases which have strong hereditary basis. DM has been described as a geneticist's nightmare and the several genetic factors have been linked to the disease

in various studies, spanning multiple gene effect at multiple loci involving more than seventy genes, with familial tendency with polygenic mode of inheritance, phenotypic expression modified by environmental factors throughout the lifespan.<sup>30,31</sup> It is therefore difficult to predict the occurrence of DM by a specific genetic test. DM is a disease with a long latent period before diagnosis and several long-term complications in the major organ systems of the body.<sup>30</sup> The pre-diabetic stage, which lasts for some years is said to be shorter.<sup>32</sup> It is in this regard that dermatoglyphics in DM can bridge the gap between predisposition, the pre-diabetic stage and the diagnosis. Once characteristic dermatoglyphics findings of particular diseases are noted, they can be used as markers to predict the disease in general population and can be used as a screening tool.

From Table 4 in this study, the mean age of the diabetic patients was 59.64±9.73 years and the patients were within the range of 30 years to 80 years and were more likely to be females. This implies that the diabetics examined at the hospital were mostly of maturity-onset diabetes and it nearly two times more likely to affect females than males. The arch pattern of finger print was more prevalent in the right thumb while the loop pattern appears more on the right little, middle and right fingers (Table 4). Panda et al showed increase in arches in diabetes in both sexes but Sant et al and Rezal et al showed increase in arches only in diabetic females.<sup>33-35</sup> The whorl pattern was more seen on the right thumb, index and right fingers. In the left hand, the arch finger print appears more on the thumb, index and middle fingers while the hoop and whorl were evenly distributed except for the whorl of the little finger of the left hand where there as scanty of appearance.

In the right hand, the arch print was less in both male and female while it was the loop and whorl print that were more prevalent, showed an insignificantly ( $p>0.05$ ) lesser distribution of arch pattern among diabetic males and females compared to control (Table 4). This finding is similar to Shrivastava et al, Ravindranath et al and Vera et al reported more arches only in diabetic females. Roshani et al and Padmini et al remarked more arches in females than males while Sengupta and Borush showed more arches in diabetic males.<sup>36-40</sup> In the left hand, the loop and whorl were almost evenly distributed while the loops were more prevalent in the female left hands. The whorl pattern from the study was insignificantly ( $p>0.05$ ) lesser in the male diabetics but more in female diabetics. These findings were consistent with the results of Sant et al and Vera et al which showed a significant rise of the whorls and arches with a decrease in the number of loops in the patients.<sup>34,38</sup> No significant increase either in males or females was shown in study done by Rajaniganda et al, Mandascue et al, Nayak et al and Umana et al, Sharma and Sharma and Sachdev reported that the diabetics have significantly lower arches than controls.<sup>42-46</sup> Both male and female diabetics showed a significant increase in frequency of loops and arches and a decreased frequency

of whorls especially in middle finger. Bala et al showed significantly decreased number of arches in the right hand of male diabetics and left hand of female diabetics.<sup>47</sup> Burute et al revealed that percentage of arches was more in diabetic males and females than in the controls and the difference observed in male group was not statistically significant.<sup>19</sup> Study by Marera et al showed a significant increase of arch patterns among diabetic patients than in the control group.<sup>4</sup> However some fingers such as the middle, ring and little finger completely lacked an arch pattern in both groups. Study by Roshani et al and Padmini et al showed more arches in females as compared to males in both right and left hands while Sengupta and Borush showed more arches in male diabetics.<sup>39-41</sup>

Table 4 shows the distribution of the various palm print according to the PIC patterns in the right and left palms of the sampled diabetic subjects. The 310 PIC was observed to be more prevalent in the right and left hands of the diabetic subjects. There are also 60% chances of symmetric in both palm of diabetic subjects. Finally, Table 4 shows the gender differences in the distribution of the various palm prints according to the PIC patterns in the right and left palm of the sampled diabetic subjects. In both the right and left hands, the 310 PIC was more prevalent among the diabetic subjects and the female subjects were more likely to present the 310 PIC compare with male in both hands. The 311 PIC was absent in the right palm of the male and absent on the left palm of the female. Statistically, there was no significant difference between the male and female in the different PIC presented. The findings of PIC patterns in the right and left palm of the sampled diabetic subjects were not significant ( $p>0.05$ ) when both the male and female right and left hands were compared.

## CONCLUSION

Dermatoglyphics, as a means of identification, has been used by man from ancient times and has received attention in recent time for the diagnosis of various diseases. In the present study it appears that there do exists a variation in the dermatoglyphic patterns of diabetic patients. The presence of an arch pattern on the right thumb and left thumb, index and middle fingers correspond to a higher risk of diabetic. Therefore, this study showed that dermatoglyphic may be used as a screening tool for the analysis of individuals who are more likely to have increased risk of diabetes mellitus and thus preventing the future diabetic problem. However, there is a need for larger population-based studies to standardize the parameters and translate the findings into clinical and public health practice.

## Limitations

The findings of the present study may be limited considering that it is a hospital-based study with small sample size that were more likely to be populace within

the study area and its environs. For this reason, the findings may not be a representation of the population. Thus, the need for further studies with the larger population.

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*Ethical approval: The study was approved by the Institutional Ethics Committee ISTH/HREC with the number 20212904/185.*

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