OPEN ACCESS

Scholars Bulletin

Abbreviated Key Title: Sch Bull
ISSN 2412-9771 (Print) |ISSN 2412-897X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Subject Category: Human Anatomy

Sole Dermatoglyphic Pattern of Elele People, Rivers State, Nigeria

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DOI: 10.36348/sb.2023.v09i07.002 | **Received:** 30.07.2023 | **Accepted:** 05.09.2023 | **Published:** 31.08.2023

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Abstract

Background: There is no known study on the sole dermatoglyphic pattern of the Elele people that could serve as their baseline data; hence, this study was done to provide baseline data for the sole dermatoglyphic patterns of the Elele people of the Ikwerre ethnic group in Rivers State, Nigeria. ***Material and methods:*** A Non-experimental analytical and cross-sectional study. 200 subjects [males 107, females 93] pure-breed indigenes of Elele extraction were purposively sampled, on the basis of both parents and grandparents to the fourth generation being natives of Elele. Participants who had distortions and malformations of the sole were excluded from the study. The parameters studied includes: the dermatoglyphic patterns on the soles and toes participants in Elele, Rivers State, Nigeria. The patterns on the sols and toes were observed and classified following the standard procedure. ***Result and Discussions:*** The study also showed the following distribution on the toe for the males [arch 253 (47.5%), whorl 134(25.2%), loop 145(27.3%)]; the females on the other hand had [arch 383(40.9%), whorl 289(30.9%), loop 264(28.2%)]. The arch pattern was most frequent in both genders. And the total distribution showed thus: arch 636(43.3%), whorl 423(28.8%), loop 409(27.9%). Dankmeijer's index [male 1.32, female 1.880, total 1.50]; Pattern Intensity Index [male 84.2, female 41.3, total 125.5]. The results show that the pattern intensity index is greater in females than in males. While the Dankmeijer's index was higher in males than females. ***Conclusion:*** The study showed that the loop pattern was most frequent on area I and II in both genders, whorl pattern was most frequent on area I and II in the males and area I and IV in the females, and the arch pattern was most frequent on area I and II in both genders. The absence of whorl on the toes of males was seen as a characteristic pattern for the males in Elele.

Keywords: Dermatoglyphic pattern, plantar arches, whorl, soles, toes.

INTRODUCTION

Dermatoglyphics is the scientific study of fingerprints, lines, mounts and shapes of hands, as distinct from the superficially similar pseudoscience of palmistry [1]. It also refers to the making of naturally occurring ridges on certain body parts, namely palms, fingers, soles, and toes. Dermatoglyphics has a lot of applications in modern-day population and medical research, including anthropology, genetics, and medicine [2]. It is also used as a valuable non-invasive diagnostic tool and early assessment of risk for certain medical conditions [3].

The study of dermatoglyphics has some adjunctive value in the diagnosis of genetic syndromes, such as Down syndrome and other congenital medical disorders [4]. It can also be used to evaluate the role of

dermatoglyphics in early detection of bronchial asthma, as well as to predict class III skeletal malocclusion in children [5].

Furthermore, dermatoglyphics can be used as a screening technique for selecting patients suspected of genetic or chromosomal defects for further, more detailed analysis [6]. The main types of print patterns found on palmer, digital, sole and the toe areas in order of increasing complexity are: Arches, Loops, and Whorls [7]. This classification is dependent on the number of triradii present in or near the pattern A triradius is present when three ridge systems meet at a localized region [8]. Whorls are concentrically ridged dermatoglyphic pattern with two triradii situated at the periphery of the whorl facing each other with the whorl pattern in between [9]. Loops possess only one triradius situated at the base of the loop pattern. Loop patterns are classified based on their area of distribution and the direction of their cores [10]. Arches have no tnradius and are rare if not absent in most samples except on the palms, digits and toes [11, 12].

There some existing works on sole dermatoglyphics, digital dermatoglyphics, toe prints and at diverse levels of the study [13-18].

Dermatoglyphics, as part of the anthropological study, aims to have an anthropological profile of the indigenous tribes and ethnic groups that would form a database for reference purposes, which is useful for other studies as it provides baseline data for future studies. There is no known study on the sole dermatoglyphic pattern of the Elele people that could serve as their baseline data; hence, this study was done to provide baseline data for the sole dermatoglyphic patterns of the Elele people of the Ikwerre ethnic group in Rivers State, Nigeria.

MATERIALS AND METHODS

A Non-experimental analytical and cross-sectional study. Two hundred healthy males and females of Elele extraction were purposively sampled, on the basis of both parents and grandparents to the fourth generation being natives of Elele. Participants who had distortions and malformations of the sole were excluded from the study. This was to ensure that result obtained were not distorted by other tribal inputs from the non-indigenes of Elele. The soles of the participants feet were washed using water, soap and dried with a dry clean towel. Hp G3110 photo scanner print capture model was used to capture the sole prints of the participants, the photoscans were transferred to a laptop (HP) for reading, identification, and classification. The various sole patterns of arches, loops and whorls were counted using a laptop zooming tool for a clearer view and classified using the standard method (loesch and skrinjaric method). The number of loops, whorl & Arch obtained from both soles, and data analysis was done using simple proportion.

TOE PATTERN VARIABILITY IN BOTH SEXES

Two methods have been recommended in comparing the frequency of toe pattern in different sample populations, that is.

1. Dankmeijer's index

The Dankmeijer's arch/whorl index is an inverse relation between the frequency of whorls and arches expressed as fraction, or percentage. Dankmeijer adopted the formula below to calculate the index in sample population comparison.

$$\text{Dankmeijer's index} = \frac{Total\ frequency\ of\ arches}{Total\ frequency\ of\ whorls}$$

2. Pattern intensity index (PII)

The pattern intensity index is the mean number of triradii found on the toe per individual. This value can be estimated for any sample from the frequency of whorls and loops in the sample bearing in mind that each whirl has two triradli and each loop has one triradius.

Pattern Intensity Index = Mean No. of triradii on toes per subject

PII = 2(Mean No. of whorls) + mean No. of loop

The percentage % frequency of loops, whorls and arches are calculated as follows:

$$\%\ \text{Frequency of loop} = \frac{No.of\ loops\ in\ area}{Total\ No.of\ sample} \text{ X } 100$$

$$\%\ \text{Frequency of whorl} = \frac{No.of\ whorls\ in\ area}{Total\ No.of\ sample} \text{ X } 100$$

$$\%\ \text{Frequency of arches} = \frac{No.of\ arches\ in\ area}{Total\ No.of\ sample} \text{ X } 100$$

Classification of Sole Patterns

For descriptive purposes, the sole was mapped topographically into ten zones based on the original nomenclature of Cummins & Midlo (1943). Areas I to V indicate the distal plantar zone, while areas VI to X indicate the proximal plantar zone.

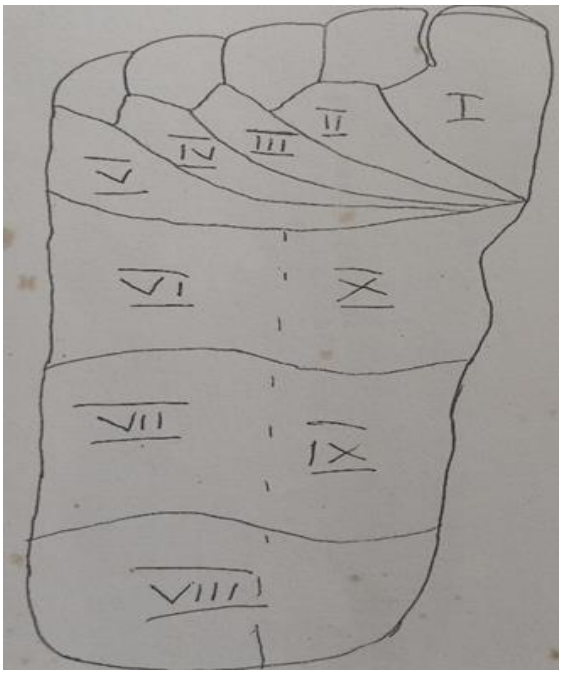

Figure 1: Mapping of the sole into zones

Figure 2: Indicating dermatoglyphic patterns on the sole

LOOP DISTRIBUTION ON THE PROXIMAL AND DISTAL SOLE

The nomenclature used in the classification is as follows: e.g

I_p-Peripheral loop at area I
I_c-Central loop at area I
I_T-Tibial loop at area 1
Viii-fibular loop at area viii

Table 1 depicts the percentage frequency of loop patterns classified on the proximal and distal soles of the sample population respectively.

The percentage frequency was calculated using the formula:

$$\% \text{ Frequency} = \frac{Number\ of\ loops\ in\ area}{Total\ number\ of\ sample} x100$$

WHORL DISTRBUTION ON THE DISTAL SOLE

Examination of the plantar surface of all the subjects in the sample populations revealed that whorl patterns were confined to the distal sole area only (i.e., areas I, II, Ill, IV, and V).

Table 3 depicts the percentage frequencies of their whorl patterns classified on the distal sole. The percentage frequency for whorl pattern distribution was calculated using a similar method for loop pattern.

$$\% \text{ Frequency} = \frac{I\ or\ II\ or\ V}{Total\ number\ of\ sample} x100$$

DERMATOGLYPHIC PATTERNS FOUND ON THE TOES

The patterns found on the toes can be divided into three categories: 1. Whorl patterns; 2. Loop patterns; 3. Arch patterns

In dermatoglyphics, the toes are numbered from the big toe I to the small toe V.

Loop pattern: loop patterns were found to be more numerous than whorl patterns in both sexes and on both

feet. The percentage frequency of the distribution of loop patterns on the toes will provide a basis for comparison.

Whorl patterns: the whorl pattern was found to be more abundant on the big toe (Hallux) of females and was virtually absent on the small toe. As well as absent in the toes of males.

Arch patterns: this was shown to be the most abundant dermatoglyphic pattern found in all the toes. They are found alongside other dermatoglyphic patterns. They differ from whorls and loops since they do not possess any triradii. Their abundance was observed on the toes of both sexes, and on both feet, their percentage frequencies are depicted.

RESULTS

Table 1: Distribution of loop patterns on the proximal and distal sole

SAMPLE		NO	I_P	I_C	I^F	II_P	II_C	III_P	III_C	IV_P	$1V_C$	V
MALE	L	107	60 (21.9)	13 (4.8)	5 (1.8)	11 (4.0)	44 (16.1)	16 (5.9)	30 (11.0)	17 (6.2)	25 (9.2)	52 (19.1)
	R	107	47 (14.4)	25 (7.6)	5 (1.5)	10 (3.1)	52 (16.0)	22 (6.7)	54 (16.5)	31 (9.5)	42 (12.8)	39 (11.9)
FEMALE	L	93	24 (13.6)	8 (4.5)	4 (2.3)	7 (3.9)	19 (10.7)	13 (7.3)	34 (19.2)	15 (8.5)	28 (15.8)	25 (14.2)
	R	93	18 (8.4)	11 (5.2)	6 (2.8)	8 (3.8)	29 (13.6)	27 (12.7)	31 (14.6)	31 (14.6)	17 (7.9)	35 (16.4)

Key; L = LEFT FOOT, R = RIGHT FOOT, I_P = PERIPHERAL LOOP AT AREA I, I_C = CENTRAL LOOP AT AREA I, I^F = FIBULAR LOOP AT AREA I, II_P= PERIPHERAL LOOP AT AREA II, II_C= CENTRAL LOOP AT AREA II, III_P = PERIPHERAL LOOP AT AREA III, III_C = CENTRAL LOOP AT AREA III, IV_P = PERIPHERAL LOOP AT AREA IV, IV_C = CENTRAL LOOP AT AREA IV, V = PERIPHERAL LOOP AT AREA V

Table 2: Numerical and percentage distribution of Loops on the Toes of participants

Sample		n	I	II	III	IV	V
Male	L	107	49(32.2)	39(25.7)	32(21.0)	19(12.6)	13(8.5)
	R	107	41(36.6)	27(24.8)	21(18.1)	15(13.4)	8(7.1)
Female	L	93	33(39.7)	22(26.5)	12(14.5)	9(10.8)	7(8.4)
	R	93	30(48.4)	14(22.5)	8(12.9)	6(9.7)	4(6.5)

The loop pattern was most frequent on area I and II in both genders as shown above.

Table 3: Numerical and percentage distribution of whorl on the Toes of participants

Sample		n	I	II	III	IV	V
Male	L	107	69(45.7)	31(20.5)	25(16.6)	15(9.9)	11(7.3)
	R	107	65(47.1)	27(19.6)	20(14.5)	18(13.0)	8(5.8)
Female	L	93	26(45.6)	7(12.3)	9(15.8)	11(19.3)	4(7.0)
	R	93	34(44.1)	10(12.9)	13(16.9)	14(18.3)	6(7.8)

The whorl pattern was most frequent on area I and II in the males and area I and IV in the females.

Table 4: Numerical and percentage distribution of arch on the toes of participants

Sample		n	I	II	III	IV	V
Male	L	107	72(37.3)	36(18.7)	29(15.0)	31(16.0)	25(13.0)
	R	107	66(34.7)	42(22.1)	33(17.4)	30(15.8)	19(10.0)
Female	L	93	44(34.4)	35(27.3)	17(13.3)	21(16.4)	11(8.6)
	R	93	39(31.2)	33(26.4)	19(15.2)	18(14.4)	16(12.8)

The arch pattern was most frequent on area I and II in both genders.

Table 5: Toe pattern variability in both sexes

Pattern variability	Male	Female	Total
Dankmeijer's Index (DI)	1.32	1.88	1.50
Pattern Intensity Index (PII)	84.2	41.3	125.5

The results show that the pattern intensity index is greater in females than in males. While the Dankmeijer's Index (DI)was higher in the males than females

DISCUSSION(S)

Summary of Results

The study showed that the loop pattern was most frequent on area I and II in both genders, whorl pattern was most frequent on area I and II in the males and area I and IV in the females, and the arch pattern was most frequent on area I and II in both genders.

The study also showed the following distribution on the toe for the males [arch 253 (47.5%), whorl 134(25.2%), loop 145(27.3%)]; the females on the other hand had [arch 383(40.9%), whorl 289(30.9%), loop 264(28.2%)]. The arch pattern was most frequent in both genders. And the total distribution showed thus: arch 636(43.3%), whorl 423(28.8%), loop 409(27.9%).

Implications of Findings

The study revealed that the whorl patterns were found on the toes of female subjects but absent on the toes of male subjects. These findings here are in agreement with the work of Igbigbi *et al*., [17], where a similar pattern was observed in the urhobos. The study also found that the distribution of whorl patterns in the sole area is also greatest in the hallucal area. It is least abundant in the hypothenar distal area and is not found beyond this region.

The percentage frequency of loop patterns classified on the sole showed that the distribution of loop patterns, especially on the distal sole area with special reference to the hallucal area, was greater in male subjects than in females. The distribution of loop patterns was also found to be greater on the left sole than on the right. This result corroborates the findings and reports of the previous authors [11, 14, 15, 17], who reported similar trends in their studies.

The results show that the pattern intensity index is greater in females than in males. While the Dankmeijer's index was higher in males than females. From the results, Dankmeijer's index for this study was lower than that of Rajput and Brahmin populations in India [16]. However, the pattern intensity index of this study was much higher than that reported on Rajput and Brahmin populations in India [16]. The pattern intensity index was higher in the females than the males, which corroborates the findings of Igbigbi *et al*., [17].

CONCLUSION

The study showed that the loop pattern was most frequent on area I and II in both genders, whorl pattern was most frequent on area I and II in the males and area I and IV in the females, and the arch pattern was most frequent on area I and II in both genders.

The result of the study showed the following distribution on the toe for the males [arch 253 (47.5%), whorl 134(25.2%), loop 145(27.3%)]; the females on the other hand had [arch 383(40.9%), whorl 289(30.9%), loop 264(28.2%)]. The arch pattern was most frequent in both genders. And the total distribution showed thus: arch 636(43.3%), whorl 423(28.8%), loop 409(27.9%).

Dankmeijer's index [male 1.32, female 1.880, total 1.50]; Pattern Intensity Index [male 84.2, female 41.3, total 125.5]. The results show that the pattern intensity index is greater in females than in males. While the Dankmeijer's index was higher in males than females.

ACKNOWLEDGEMENTS

We appreciate the contribution of the study participants and all staff members of the department of anatomy, Rivers State University to the success of this study.

Funding: The study was self-funded.

Declaration of Conflict of Interest: We declare that there is no conflict of interest.

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