


Dermatoglyphic Patterns Among Adolescents of the Ebira Ethnic Group of Kogi State, Nigeria

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Abstract

Dermatoglyphics have been widely studied and have been shown to vary across different ethnic populations. The present study investigates the dermatoglyphic patterns among adolescents of the Ebira ethnic group through selected dialects. A total of 591 subjects, both males and females, participated in the study. Prints were collected by conventional ink and roller method and read using hand magnifying lens. Analyses were performed using descriptive statistics, analysis of variance (ANOVA), *t*-test, and the chi-squared test. *P*-values < 0.05 were considered statistically significant. The result of the study showed that the three dialects had similar distribution of fingerprint patterns in the order ulnar loop > whorl > arch > radial loop. The fingerprint pattern showed strong statistical association with gender both within and across the dialects ($p < 0.001$). The palmar crease of the subjects showed the normal palmar crease to be the most prevalent (87%), followed by the Sidney crease (9%), and the Suwon crease (4%) being the least prevalent for both palms across the dialects. There was strong association with palm crease type and gender, with $p < 0.001$. The triradii angles of the palms revealed a mean value of acute angles. Females had significantly higher mean atd angles compared with male subjects, while males had significant higher mean dat angles compared with females for the three dialects. The adt angle, however, showed no significant mean difference between males and females. In conclusion, the present study evaluated the fingerprint patterns, the palmar creases and the triradii angles conforming anthropological similarities within these three dialects. However, gender differences were observed for the three dialects, with Ebira-Tao and Ebira-Etuno exhibiting shared patterns.

Keywords

- ▶ dermatoglyphics
- ▶ Ebira
- ▶ fingerprints
- ▶ palmar
- ▶ triradii

Introduction

Dermatoglyphic traits are widely used markers in analyses of fetal development, developmental disturbances, disease and genetics.^{1–3} The most commonly analyzed dermatoglyphic traits include descriptions of finger patterns and palm patterns; measurements of ridge counts between triradii

points formed by the convergence of three patterns of ridges; and measurements of the atd angle.⁴

The human body is covered by skin; however, the skin covering the palmar surface of the hand and the plantar surface of the foot differs both in texture and appearance from that found in other parts of the human body.⁵ The skin on the palmar and plantar surface is continuously wrinkled

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with narrow minute ridges known as friction ridges.⁵ The ridges are the raised portions of skin between furrows on either side. They are also known as papillary or epidermal ridges. The ridges flow in various directions, giving rise to innumerable patterns.⁶

Palmar creases are laid down during the first or second trimester of fetal life⁷⁻⁹ and remain unchanged thereafter.¹⁰ A fetus exposed to trauma during early development could show an increased prevalence of abnormal palmar crease patterns.¹¹

Palmar crease variants are classified based on the connection between the three major creases – radial longitudinal, proximal transverse, and distal transverse creases – that slope from the angle near the metacarpophalangeal joint of the index finger.¹² The studies conducted by Sharma et al¹³ suggested that the palmar crease is termed as normal when none of the transverse creases traverses entirely from the radial border to the ulnar border of the palm. Infrequently, these creases merge to signify a different thing.

Triradius is the point of confluence from where the ridges usually radiate in three different directions. Schaumann et al¹⁴ defined the 'triradius' as the meeting point of 3 ridges that form angles of $\sim 120^\circ$ with another. On the palm, there are generally four digital triradii in the distal portion. They are termed as a, b, c, and d, proceeding in the radioulnar direction. The axial triradius 't' is found usually near the proximal palmar margin. The triradius close to the palmar axis is termed as axial triradius. It is present normally near the proximal end of the palm and separates the thenar and hypothenar eminences. It is denoted as 't' and is usually not > 10% of the distance between the distal crease of the wrist and the proximal crease of the middle finger.¹⁵

Dermatoglyphics provide a pertinent area of research to geneticists interested in studying variations within and between populations.¹⁶ Dermatoglyphics have been used extensively to characterize and differentiate human populations; hence, they are highly suitable for studying population variations.¹⁷

Ebira, as a name, is used by not less than nine different but historically related groups of people. These are the Ebira Opanda, Ebira Jukun, Ebira Agatu, Ebira Toto, Ebira Abaji, Ebira Koto, Ebira Mozum, Ebira Etuno, and Ebira Tao. The Ebira Koto are found in the riverine area of the Niger-Benue confluence, while the Ebira Etuno inhabit the Igarra area of the Edo State.¹⁸ The Ebira Tao are found primarily in the Central Senatorial District of the Kogi State, with a sizeable spill over into the Lokoja Local Government Area.

The aim of the present study was to investigate the dermatoglyphic characteristics of the Ebira ethnic group using adolescents from selected secondary schools in the Okene, Igarra, and Koton Karfe local government areas.

Materials and Methods

The present study was performed in selected secondary schools from the Okene, Igarra, and Koton Karfe local government areas. A total of 591 secondary school subjects participated in the present study, involving males and females from the Ebira-Tao,

Ebira-Etuno, and Ebira-Koto dialects of the Ebira ethnic group of the Kogi state, Nigeria. There was a total of 199 Ebira-Tao participants; 100 males and 99 females; there was a total of 196 Ebira-Etuno participants; 98 males and 98 females; and of 196 Ebira-Koto participants; 97 males and 99 females. The age range of the subjects was between 13 and 17 years old.

The fingerprints were collected using standard ink and roller method according to the modified Cotterman technique.¹⁹ The fingerprints were taken after washing the hands with soap water and drying them completely. The smeared fingers of both hands were printed on a durable plain paper laid down on a pressure pad that consisted of 10 different blocks for 10 fingers of the right hand and left hand, respectively. The fingerprint pattern of each finger was observed with the help of a hand lens. The fingerprint patterns were classified into loops (ulnar and radial), whorls and arches according to the classification by Penrose et al.²⁰

The palm prints were collected using the standard ink and roller method. The right palm was smeared with ink already spread on a glass surface. The inked hand was horizontally pressed against the white plain paper with the fingers and palm thoroughly stretched. Slight pressure on the back of the hand was applied during the printing process. The complete palm print, along with the ridges on the hollow of the palm, as well as the ridges on the metacarpophalangeal areas, were obtained over the plain paper. The same procedure was followed to print the left palm. The palm prints were analyzed with the help of a hand magnifying lens for the type of crease, and for the triradii angles atd, dat, and adt.

Data were presented as frequencies and percentages for each fingerprint and palm crease types. The chi-squared test was also used to test for association between print patterns and gender, as well as print pattern and the different dialects. The chi-squared test was also used to test for the association between palmar crease types and gender. The *t*-test was used to test for mean differences between male and female subjects. Analysis of variance (ANOVA) was used to test for mean differences for the triradii angles between the three dialects.

Results

The result of the fingerprint patterns for Ebira-Tao subjects, as presented in ► **Table 1**, showed that the ulnar loop pattern has the highest frequency and percentage for all digits, with the radial loop pattern having the lowest frequency and percentages. The whorl pattern is next to the ulnar loop in frequency, followed by the arch. The little finger has the highest occurrence of the ulnar loop ($n = 169$ [84.9%], and $n = 179$ [89.9%] for the right and left little fingers, respectively [► **Table 1**]). The radial loop was observed more in the index finger, with frequency and percentage of 12 (6.0%) and of 21 (10.1%) in the right and left fingers, respectively (► **Table 1**). The whorl pattern was observed mostly in the thumb, with a frequency of 86 (43.2%) and of 84 (42.2%) for the right and left fingers, respectively (► **Table 1**). The thumb and index fingers had more frequencies of the arch pattern, with similar frequencies (► **Table 1**).

Table 1 Frequency and Percentages of Fingerprint Patterns of Ebir-Tao Subjects

| FINGERS | Right hand | | | | Left hand | | | |
|---------|------------|----------|-----------|----------|------------|-----------|-----------|-----------|
| | UL n (%) | RL n (%) | W n (%) | A n (%) | UL n (%) | RL n (%) | W n (%) | A n (%) |
| Thumb | 103 (51.8) | 2 (1.0) | 86 (43.2) | 8 (4.0) | 94 (47.2) | 1 (0.5) | 84 (42.2) | 20 (10.1) |
| Index | 110 (55.3) | 12 (6.0) | 65 (32.7) | 12 (6.0) | 108 (54.3) | 21 (10.6) | 58 (29.1) | 12 (6.0) |
| Middle | 152 (76.4) | 1 (0.5) | 41 (20.6) | 5 (2.5) | 139 (69.8) | 5 (2.5) | 48 (24.2) | 7 (3.5) |
| Ring | 119 (59.8) | 3 (1.5) | 77 (38.7) | 0 (0.0) | 135 (67.8) | 1 (0.5) | 62 (31.2) | 1 (0.5) |
| Little | 169 (84.9) | 0 (0.0) | 29 (14.6) | 1 (0.5) | 179 (89.9) | 1 (0.5) | 17 (8.6) | 2 (1.0) |

Abbreviations: A, arch; RL, radial loop; UL, ulnar loop; W, whorl.

The result of the fingerprint patterns for Ebir-Etuno subjects, as presented in **Table 2**, showed that the ulnar loop pattern had the highest frequency and percentage for all digits, with the radial loop pattern having the lowest frequency and percentages. The whorl pattern was next to the ulnar loop in frequency, followed by the arch. The little finger had the highest occurrence of the ulnar loop ($n = 151$ [77.0%] and $n = 166$ [84.7%] for the right and left little fingers, respectively [**Table 2**]). The radial loop was observed more in the index finger, with frequency and percentage of 8 (4.1%) and of 25 (12.8%) on the right and left fingers, respectively (**Table 2**). The whorl pattern was observed mostly in the thumb, with a frequency of 73 (37.2%) and of 78 (39.8%) for the right and left fingers, respectively (**Table 2**). However, both the thumb and ring fingers had similar values for the whorl pattern. The thumb and index fingers had higher frequencies of the arch pattern, with similar frequencies (**Table 2**).

The result of the fingerprint patterns for Ebir-Koto subjects, as presented in **Table 3**, showed that the ulnar loop pattern had the highest frequency and percentage for all digits, with the radial loop pattern having the lowest frequency and percentages. The whorl pattern is next to the ulnar loop in frequency, followed by the arch. The little finger had the highest occurrence of the ulnar loop ($n = 167$ [85.2%], and $n = 177$ [90.3%] for the right and left little fingers, respectively [**Table 3**]). The radial loop was observed more in the index finger, with frequency and percentage of 18 (9.2%) and of 16 (8.2%) on the right and left fingers, respectively (**Table 3**). The whorl pattern was observed mostly in the ring finger, with a frequency of 88 (44.9%) and of 85 (43.4%) for the right and left fingers, respectively (**Table 3**). However, both ring and thumb fingers had similar values for the whorl pattern. The thumb and index fingers had more frequencies of the arch pattern, with similar frequencies (**Table 3**).

Table 2 Frequency and Percentages of Fingerprint Patterns of Ebir-Etuno Subjects

| FINGER | Right hand | | | | Left hand | | | |
|--------|------------|----------|-----------|----------|------------|-----------|-----------|-----------|
| | UL n (%) | RL n (%) | W n (%) | A n (%) | UL n (%) | RL n (%) | W n (%) | A n (%) |
| Thumb | 166 (54.1) | 0 (0) | 73 (37.2) | 17 (8.7) | 96 (49.0) | 1 (0.5) | 78 (39.8) | 21 (10.7) |
| Index | 112 (57.1) | 8 (4.1) | 60 (30.6) | 16 (8.2) | 90 (45.9) | 25 (12.8) | 58 (29.6) | 23 (11.7) |
| Middle | 150 (76.5) | 2 (1.0) | 35 (17.9) | 9 (4.6) | 133 (67.9) | 5 (2.6) | 42 (21.4) | 16 (8.2) |
| Ring | 121 (61.7) | 5 (2.6) | 66 (33.7) | 4 (2.0) | 114 (58.2) | 4 (2.0) | 72 (36.7) | 6 (3.1) |
| Little | 151 (77.0) | 0 (0) | 38 (19.4) | 7 (3.6) | 166 (84.7) | 2 (1.0) | 24 (12.2) | 4 (2.0) |

Abbreviations: A, arch; RL, radial loop; UL, ulnar loop; W, whorl.

Table 3 Frequency and Percentages of Fingerprint Patterns of Ebir-Koto Subjects

| FINGER | Right hand | | | | Left hand | | | |
|--------|------------|----------|-----------|-----------|------------|----------|-----------|-----------|
| | UL n (%) | RL n (%) | W n (%) | A n (%) | UL n (%) | RL n (%) | W n (%) | A n (%) |
| Thumb | 91 (46.4) | 1 (0.5) | 82 (41.8) | 22 (11.2) | 82 (41.8) | 2 (1.0) | 84 (42.9) | 28 (14.3) |
| Index | 93 (47.4) | 18 (9.2) | 69 (35.2) | 16 (8.2) | 78 (39.8) | 16 (8.2) | 75 (38.3) | 27 (13.8) |
| Middle | 136 (69.4) | 0 (0) | 46 (23.5) | 14 (7.1) | 126 (64.3) | 2 (1.0) | 53 (27.0) | 15 (7.7) |
| Ring | 104 (53.1) | 1 (0.5) | 88 (44.9) | 3 (1.5) | 105 (53.6) | 2 (1.0) | 85 (43.4) | 4 (2.0) |
| Little | 167 (85.2) | 0 (0) | 27 (13.8) | 2 (1.0) | 177 (90.3) | 0 (0) | 18 (9.2) | 1 (0.5) |

Abbreviations: A, arch; RL, radial loop; UL, ulnar loop; W, whorl.

Table 4 Association Between Fingerprint Patterns and Spoken Dialects within Male Subjects

| Fingers | Sides | Ebira-Tao (n = 100) | | | | Ebira-Etuno (n = 98) | | | | Ebira-Koto (n = 97) | | | | χ^2 | p-value |
|---------|-------|------------------------|----|----|----|-------------------------|----|----|----|------------------------|----|----|----|----------|---------|
| | | UL | RL | W | A | UL | RL | W | A | UL | RL | W | A | | |
| Thumb | R | 50 | 2 | 44 | 4 | 58 | – | 31 | 9 | 45 | 1 | 41 | 10 | 8.707 | 0.191 |
| | L | 51 | 1 | 36 | 12 | 52 | – | 37 | 9 | 43 | 1 | 40 | 13 | 2.962 | 0.814 |
| Index | R | 82 | 8 | 1 | 9 | 76 | 6 | 1 | 15 | 43 | 17 | 32 | 5 | 82.089 | < 0.001 |
| | L | 75 | 15 | – | 10 | 56 | 19 | 1 | 22 | 39 | 8 | 39 | 11 | 96.680 | < 0.001 |
| Middle | R | 94 | 1 | – | 5 | 87 | 2 | – | 9 | 70 | – | 22 | 5 | 51.614 | < 0.001 |
| | L | 90 | 4 | – | 6 | 78 | 4 | – | 16 | 67 | 2 | 25 | 3 | 65.658 | < 0.001 |
| Ring | R | 97 | 3 | – | – | 88 | 5 | 1 | 4 | 48 | – | 49 | 0 | 125.114 | < 0.001 |
| | L | 98 | 1 | – | 1 | 87 | 4 | 1 | 6 | 52 | – | 45 | – | 115.449 | < 0.001 |
| Little | R | 99 | – | – | 1 | 91 | – | – | 7 | 86 | – | 11 | – | 33.830 | < 0.001 |
| | L | 97 | 1 | – | 2 | 92 | 2 | – | 4 | 90 | – | 7 | – | 20.380 | 0.002 |

Abbreviations: A, arch; RL, radial loop; UL, ulnar loop; W, whorl; χ^2 , chi-squared. $p < 0.05$ is considered statistically significant.

The association between fingerprint patterns and dialects among males of the 3 dialects showed significant association ($p < 0.05$), with exemption of the right and left thumbs (►Table 4). The association between fingerprint patterns and dialects among females of the three dialects showed significant association ($p < 0.05$), with exemption of the right and left thumbs and of the left little fingers (►Table 5).

Both palms of the subjects were studied and were classified into normal, Sidney, and Suwon crease types.

For Ebira-Tao subjects, 85.4% and 86.4% of the subjects had the normal crease type for the right and left palms, respectively. A total of 10.6% and of 11.6% had the Sidney crease for the right and left palms, while 4.0% and 2.0% had the Suwon crease for the right and left palms, respectively (►Table 6).

For Ebira-Etuno subjects, 86.7% and 92.9% of the subjects had the normal crease type for the right and left palms,

respectively. A total of 8.7% and of 6.1% had the Sidney crease for the right and left palms, while 4.6% and 1.0% had the Suwon crease for the right and left palms, respectively (►Table 6).

For Ebira-Koto subjects, 88.3% and 89.3% of the subjects had the normal crease type for the right and left palms, respectively. A total of 10.7% and 7.7% had the Sidney crease for the right and left palms, while 1.0% and 3.0% had the Suwon crease for the right and left palms, respectively (►Table 6).

For Ebira-Tao subjects, all of the males were observed to have the normal crease for both right and left hands. The females, however, had all the three types of palm creases, with the normal crease being more frequent, and with the Suwon crease being the least frequent for both hands (►Table 7). Statistically significant differences were observed at $p < 0.001$ (►Table 7).

Table 5 Association Between Fingerprint Patterns and Spoken Dialects within Female Subjects

| Fingers | Sides | Ebira-Tao (n = 99) | | | | Ebira-Etuno (n = 98) | | | | Ebira-Koto (n = 99) | | | | χ^2 | p-value |
|---------|-------|-----------------------|----|----|---|-------------------------|----|----|----|------------------------|----|----|----|----------|---------|
| | | UL | RL | W | A | UL | RL | W | A | UL | RL | W | A | | |
| Thumb | R | 53 | – | 42 | 4 | 48 | – | 42 | 8 | 46 | – | 41 | 12 | 4.525 | 0.340 |
| | L | 43 | – | 48 | 8 | 44 | 1 | 41 | 12 | 39 | 1 | 44 | 15 | 3.989 | 0.678 |
| Index | R | 28 | 4 | 64 | 3 | 36 | 2 | 59 | 1 | 50 | 1 | 37 | 11 | 27.405 | < 0.001 |
| | L | 33 | 6 | 58 | 2 | 34 | 6 | 57 | 1 | 39 | 8 | 36 | 19 | 29.278 | < 0.001 |
| Middle | R | 58 | – | 41 | – | 63 | – | 35 | – | 66 | – | 24 | 9 | 22.931 | < 0.001 |
| | L | 49 | 1 | 48 | 1 | 55 | 1 | 42 | – | 59 | – | 28 | 12 | 27.697 | < 0.001 |
| Ring | R | 22 | – | 77 | – | 33 | – | 65 | – | 56 | 1 | 39 | 3 | 36.670 | < 0.001 |
| | L | 37 | – | 62 | – | 27 | – | 71 | – | 53 | 2 | 40 | 4 | 29.624 | < 0.001 |
| Little | R | 70 | – | 29 | – | 60 | – | 38 | – | 81 | – | 16 | 2 | 15.982 | 0.003 |
| | L | 82 | – | 17 | – | 74 | – | 24 | – | 87 | – | 11 | 1 | 7.948 | 0.093 |

Abbreviations: A, arch; RL, radial loop; UL, ulnar loop; W, whorl; χ^2 , chi-squared. $p < 0.05$ is considered statistically significant.

Table 6 Frequency and Percentages of Palm Crease Type of the Studied Population

| PALM CREASE TYPE | EBIRA-TAO | | EBIRA-ETUNO | | EBIRA-KOTO | |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | RH n (%) | LH n (%) | RH n (%) | LH n (%) | RH n (%) | LH n (%) |
| NORMAL | 170 (85.4) | 172 (86.4) | 170 (86.7) | 182 (92.9) | 173 (88.3) | 175 (89.3) |
| SIDNEY | 21 (10.6) | 23 (11.6) | 17 (8.7) | 12 (6.1) | 21 (10.7) | 15 (7.7) |
| SUWON | 8 (4.0) | 4 (2.0) | 9 (4.6) | 2 (1.0) | 2 (1.0) | 6 (3.0) |

Abbreviations: LH, left hand; RH, right hand.

Table 7 Association Between Gender and Palm Crease Type in the Studied Population

| Palm crease | Ebira-Tao | | | | Ebira-Etuno | | | | Ebira-Koto | | | |
|-------------|--------------------|---------------------|----------|---------|-------------------|---------------------|----------|---------|-------------------|---------------------|----------|---------|
| | Males (n = 100) | Females (n = 99) | χ^2 | p-value | Males (n = 98) | Females (n = 98) | χ^2 | p-value | Males (n = 97) | Females (n = 99) | χ^2 | p-value |
| Right palm | | | | | | | | | | | | |
| Normal | 100 | 70 | 34.290 | < 0.001 | 98 | 72 | 29.976 | < 0.001 | 86 | 87 | 0.033 | 0.984 |
| Sidney | 0 | 21 | | | 0 | 17 | | | 10 | 11 | | |
| Suwon | 0 | 8 | | | 0 | 9 | | | 1 | 1 | | |
| Left palm | | | | | | | | | | | | |
| Normal | 100 | 72 | 31.554 | < 0.001 | 98 | 84 | 15.077 | 0.001 | 85 | 90 | 0.856 | 0.652 |
| Sidney | 0 | 23 | | | 0 | 12 | | | 8 | 7 | | |
| Suwon | 0 | 4 | | | 0 | 2 | | | 4 | 2 | | |

For Ebira-Etuno subjects, all the males were observed to have the normal crease for both right and left hands. The females, however, had all the three types of palm crease, with the normal being more frequent, and the Suwon crease being the least frequent for both hands, just as seen in the Ebira-koto subjects (►Table 7). Statistical significant differences were observed at $p < 0.001$ (►Table 7).

For Ebira-Koto subjects, both males and females were observed to have all the three palm crease types. However, the normal crease was more frequent, followed by the Sidney crease, with the Suwon crease being the least frequent for both hands in male and female subjects (►Table 7). However, there was no significant association (►Table 7).

The right and left tri radii atd and dat angles showed statistically significant differences in mean values between males and females in the Ebira-Tao and Ebira-Etuno dialects; with the females having higher mean atd angles for both hands, and males having higher mean dat angles (►Table 8). The Ebira-Koto dialect, however had similar results as the Ebira-Tao and Ebira-Etuno dialects (females having higher mean atd angles for both hands and males having higher mean dat angles), but showed no statistically significant difference (►Table 8).

The males of the three studied dialects showed no statistically mean differences in their right and left tri radii angles (►Table 9). The females of the three dialects showed no statistically mean differences in their tri radii angles for both hands (►Table 10).

Discussion

The frequency of the digital print patterns of all the studied subjects of the Ebira ethnic group in the Kogi state, Nigeria, was inconsistent with the findings of previous researchers in Nigeria and in other parts of the world.²¹⁻²⁵ The percentage frequency for both hands showed that the ulnar loop pattern had the highest frequency in both genres, followed by the whorl pattern; the arch was next, and the radial loop pattern was least prevalent. These findings were similar for the Ebira-Tao, Ebira-Etuno, and Ebira-Koto dialects, as shown in ►Tables 1,2,3.

The total percentages of fingerprints patterns for all 10 fingers in Ebira-Tao subjects were found to be: ulnar loop, 65.7%; radial loop, 2.4%; whorl, 28.5%; and arch, 3.4%. For Ebira-Etuno subjects, the total percentages of patterns for all 10 fingerprints were: ulnar loop, 63.2%; radial loop, 2.7%; whorl, 27.8%; and arch, 6.3%. For Ebira-Etuno subjects, the total percentages of patterns for all 10 fingerprints were: ulnar loop, 59.1%; radial loop, 2.1%; whorl, 32.0%; and arch, 6.8%. These findings revealed that the three studied dialects (Ebira-Tao, Ebira-Etuno and Ebira-Koto) had similar characteristics in fingerprints patterns in the form of ulnar loop > whorl > arch > radial loop; although the values for each dialect differs. These similarities in the findings of these three dialects are possibly an indication of their common ancestry. These percentages for the fingerprint patterns were inconsistent with reports by Odokuma et al²² among students in Delta, by Osunwoke et al²³ among the Okrika and Ikwere ethnic groups, by Umana et al²⁵

Table 8 Sexual Dimorphism of Triradii Angles in the Three Studied Dialects

| Parameter | EBIRA-TAO | | | | EBIRA-ETUNO | | | | EBIRA-KOTO | | | |
|-----------|--------------|--------------|-------|---------|--------------|--------------|-------|---------|--------------|--------------|-------|---------|
| | Males | Females | t | p-value | Males | Females | t | p-value | Males | Females | t | p-value |
| R-adt (°) | 38.20 ± 4.01 | 40.07 ± 5.07 | 2.889 | 0.004 | 38.88 ± 4.15 | 40.91 ± 5.32 | 2.980 | 0.003 | 37.91 ± 4.61 | 40.39 ± 4.93 | 3.643 | < 0.001 |
| R-dat (°) | 59.06 ± 4.63 | 57.21 ± 4.29 | 2.920 | 0.004 | 58.15 ± 4.80 | 56.60 ± 5.67 | 2.066 | 0.040 | 59.00 ± 4.90 | 56.85 ± 5.48 | 2.894 | 0.004 |
| R-adt (°) | 81.62 ± 3.92 | 81.18 ± 5.39 | 0.657 | 0.512 | 81.63 ± 4.50 | 81.63 ± 4.64 | 0.000 | 1.000 | 82.21 ± 4.09 | 81.96 ± 4.11 | 0.421 | 0.674 |
| L-adt (°) | 37.92 ± 4.01 | 41.34 ± 6.63 | 4.412 | < 0.001 | 39.21 ± 4.99 | 41.88 ± 4.84 | 3.794 | < 0.001 | 37.97 ± 4.79 | 41.06 ± 4.50 | 4.662 | < 0.001 |
| L-dat (°) | 58.72 ± 5.23 | 57.02 ± 5.19 | 2.302 | 0.022 | 57.97 ± 5.06 | 55.68 ± 5.19 | 3.121 | 0.002 | 59.16 ± 5.22 | 56.14 ± 4.45 | 4.368 | < 0.001 |
| L-adt (°) | 81.64 ± 4.74 | 81.79 ± 4.37 | 0.229 | 0.818 | 81.60 ± 4.19 | 81.36 ± 4.08 | 0.414 | 0.679 | 81.59 ± 4.16 | 81.40 ± 3.95 | 0.317 | 0.752 |

Values expressed as mean ± standard deviation.

R-adt, R-dat and R-ad t= Right triradii angles; L-adt, L-dat and L-adt = Left triradii angles.

in Abuth Zaria, by Danborn et al²⁶ among the Hausa ethnic group of Nigeria, who all reported a higher percentage of the loop pattern. The work of Biswas¹⁷ among the Indian population, and of Etta et al²⁷ among the Cross river people, however, reported the highest frequency of the whorl pattern, followed by the loop pattern.

It was observed that males had a higher percentage of the ulnar, arch and radial loop patterns, while the females had a higher percentage of the whorl pattern. These gender differences were statistically significant ($p < 0.05$) in almost all of the fingers, with the Ebira-Koto dialect having the least statistically significant difference. The observed gender differences in fingerprint patterns could be due to gender differences in trait heritability from the parents and to developmental variation between genres.^{28,29} The analysis of the data showed that the Ebira-Tao and Ebira-Etuno dialects had similar fingerprint patterns, with a slight difference from the Ebira-Koto dialect.

The males of three studied dialects showed a strong association ($p < 0.001$) between fingerprint patterns and dialects. However, the right thumb and left thumb showed no significant association. Male subjects of Ebira-Tao and Ebira-Etuno had the lowest occurrence of the whorl pattern, with the pattern seen mainly in the thumb and index fingers, as opposed to males of the Ebira-Koto dialect, who had occurrence of the whorl pattern in all of the fingers (► **Table 4**). These findings showed that the males of the Ebira-Tao and Ebira-Etuno dialects have more similarities in their fingerprint patterns compared with Ebira-Koto males.

The females of three studied dialects showed a strong association ($p < 0.001$) between fingerprint patterns and dialects. However, the right thumb, the left thumb, and the left little finger showed no significant association. Female subjects of Ebira-Tao and Ebira-Etuno had the lowest occurrence of the arch pattern, with this pattern not observed in the right and left ring and little fingers. This was opposed to the findings in females of the Ebira-Koto dialect, who had occurrence of the arch pattern in all of the fingers (► **Table 5**). These findings showed that the females of Ebira-Tao and Ebira-Etuno subjects have more similarities in their fingerprint patterns when compared with Ebira-Koto females.

Palm crease types have been investigated by many researchers, and in some cases investigations were done to observe their possible relation with numerical chromosomal aberrations. In the present study, the palm creases of seemingly healthy subjects were observed for their distribution in the population. The study revealed > 85% to be normal for the three dialects, followed by the Sidney crease, with the Suwon crease being the least common. Earlier researchers have reported similar findings, although in different population; Alhaji et al³⁰ among the Hausa; Taura et al³¹ still among Hausas; but a comparative study (between normal and epileptic persons); Oyinbo et al³² among the Ijaw ethnic group of Nigeria, all of which reported the highest frequency of the normal crease. Our findings, however, had no occurrence of the Simian crease. The work of Alhaji et al,³⁰ however, reported that ~ 8% among the Hausa had the Simian crease, and Oyinbo et al³² also reported 4.1% of the Simian crease among the Ijaw ethnic group. This inter-ethnic

Table 9 Comparison of the Triradii Angle Among Males of the Three Studied Dialects

| Parameters | EBIRA-TAO (n = 100) | EBITA-ETUNO (n = 98) | EBIRA-KOTO (n = 97) | | |
|------------|------------------------|-------------------------|------------------------|-------|---------|
| | Mean ± SD | Mean ± SD | Mean ± SD | f | p-value |
| R-atd (°) | 38.20 ± 4.01 | 38.88 ± 4.15 | 37.91 ± 4.61 | 1.331 | 0.266 |
| R-dat (°) | 59.06 ± 4.63 | 58.15 ± 4.80 | 59.00 ± 4.90 | 1.108 | 0.332 |
| R-adt (°) | 81.62 ± 3.92 | 81.63 ± 4.50 | 82.21 ± 4.09 | 0.628 | 0.534 |
| L-atd (°) | 37.92 ± 4.01 | 39.21 ± 4.99 | 37.97 ± 4.79 | 2.489 | 0.085 |
| L-dat (°) | 58.72 ± 5.23 | 57.97 ± 5.06 | 59.16 ± 5.22 | 1.334 | 0.265 |
| L-adt (°) | 81.64 ± 4.74 | 81.60 ± 4.19 | 81.59 ± 4.16 | 0.004 | 0.996 |

Abbreviation: SD, standard deviation.

R-atd, R-dat and R-adt = Right triradii angles; L-atd, L-dat and L-adt = Left triradii angles.

Table 10 Comparison of the Triradii Angle Among Females of the Three Studied Dialects

| Parameters | EBIRA-TAO (n = 99) | EBIRA-ETUNO (n = 98) | EBIRA-KOTO (n = 99) | | |
|------------|-----------------------|-------------------------|------------------------|-------|---------|
| | Mean ± SD | Mean ± SD | Mean ± SD | f | p-value |
| R-atd (°) | 40.07 ± 5.07 | 40.91 ± 5.32 | 40.39 ± 4.93 | 0.673 | 0.511 |
| R-dat (°) | 57.21 ± 4.29 | 56.60 ± 5.67 | 56.85 ± 5.48 | 0.346 | 0.708 |
| R-adt (°) | 81.18 ± 5.39 | 81.63 ± 4.64 | 81.96 ± 4.11 | 0.672 | 0.512 |
| L-atd (°) | 41.34 ± 6.63 | 41.88 ± 4.84 | 41.06 ± 4.50 | 0.579 | 0.561 |
| L-dat (°) | 57.02 ± 5.19 | 55.68 ± 5.19 | 56.14 ± 4.45 | 1.853 | 0.159 |
| L-adt (°) | 81.79 ± 4.37 | 81.36 ± 4.08 | 81.40 ± 3.95 | 0.332 | 0.725 |

Abbreviation: SD, standard deviation.

R-atd, R-dat and R-adt = Right triradii angles; L-atd, L-dat and L-adt = Left triradii angles.

variation could be due to difference means of classifying the crease or, possibly, to inter-ethnic differences themselves.

The sexual dimorphism study showed that both the Sidney and Suwon crease types did not feature among the males of Ebira-Tao and Ebira-Etuno subjects. Sharma et al¹³ had reported the Sydney crease to be more common among the females than among the males, but the work of Alhaji et al,³⁰ however, reported no Sidney crease among the palms of female subjects. For the Ebira-Koto, both males and females presented with Sidney and Suwon crease types in almost similar percentages. Therefore, this finding showed that Ebira-Tao and Ebira-Etuno subjects had more related palm crease types when compared with Ebira-Koto.

The tri-radii angles of both hands were investigated in the studied subjects. The tri-radii angles investigated were tri-radii atd, dat and adt angles. The findings from the study showed that tri-radii atd, dat and adt angles had similar mean values of for the right and left hands. The mean values for the three tri-radii angles were all < 90° (acute angles). The works of Khairnar et al,³³ of Navgire et al,³⁴ and of Chaudhari et al³⁵ have all reported mean tri-radii angles values of similar range. There were significant ($p < 0.05$) higher tri-radii atd angles observed in the female subjects compared with the males for the three studied dialects. Pakhale et al³⁶ performed a similar study among Indians and reported higher tri-radii atd angles in female subjects of both healthy and bronchial asthmatic patients

compared with males. The observed statistical mean difference between male and female subjects of Ebira-Tao and Ebira-Etuno could be a result of gender differences in the heritability of traits.

Tri-radii dat angle results showed significant ($p < 0.05$) higher mean values in males compared with female subjects for Ebira-Tao and Ebira-Etuno dialects. Although Ebira-Koto subjects showed no statistically significant mean difference between male and female subjects, the mean tri radii dat was also higher in the male subjects. The tri-radii adt angle, however, showed no statistical significant difference for the three dialects studied. These findings showed that the three dialects have similar tri-radii characteristics, suggesting a possible common ancestry.

Conclusions

From the present study, the fingerprint patterns of adolescents of the Ebira ethnic group followed a particular pattern of percentage frequency, which is ulnar loop > whorl > arch > radial loop, which implies similarities in the Ebira-Tao, Ebira-Etuno and Ebira-Koto dialects. Gender differences were observed between males of each dialect. Males of Ebira-Tao and Ebira-Etuno dialects have more similar patterns and distribution of fingerprint, like their females, indicating more similarities in the Ebira-Tao and Ebira-Etuno dialects, compared with the Ebira-Koto dialect.

The three dialects have a similar palmar crease distribution. The normal palmar crease was the most prevalent among the seemingly normal population of the Ebira ethnic group, followed by the Sidney palm crease, with the Suwon palm crease being the least prevalent. Only the females of Ebira-Tao and Ebira-Etuno subjects had the Sidney and Suwon palm creases, while both males and females of Ebira-Koto subjects had all the three palm crease types. Association between gender and palm creases was observed for Ebira-Tao and Ebira-Etuno subjects. This finding also showed more closeness of Ebira-Tao and Ebira-Etuno dialects.

The tri-radial atd, dat and adt angles of the subjects revealed mean acute angles for all the three studied dialects in the order atd < dat < adt angle.

Conflicts of Interests

The authors have no conflicts of interests to declare.

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