Determination of the palmar ridge counts and angles in acquired idiopathic blindness in some selected schools for the blind in Nigeria

Abstract

Background: Ridges are delicately sculpted skin surface and their configural arrangements present on human fingers, toes, and soles. Aim: This study was aimed at determining the palmar ridge counts and palmar angles in acquired idiopathic blindness.

Materials and Methods: The study had 72 subjects comprising 36 blind (14 females and 22 males) and 36 nonblind (18 females and 18 males). Palmar prints were obtained using print scanner (HP G3110 Photo Scanner).

Results: The mean and standard deviation of the ridge counts for the total blind subjects: on the right hand, A–B was 26.02 ± 2.96, B–C was 27.04 ± 2.81, C–D was 33.16 ± 3.55; and on the left hand, A–B was 26.51 ± 2.38, B–C was 26.99 ± 2.89, and C–D was 33.20 ± 3.44. Considering the total ridge counts for the nonblind subjects on the right hand: A-B was 35.53 ± 1.99, B-C was 22.83 ± 1.87, and C-D was 41.20 ± 2.75; and on the left hand: A-B was 32.72 ± 2.54, B-C was 22.89 ± 2.24, and C-D was 41.30 ± 2.57. The palmar angles had the following values for the blind: on the right hand, ATD angle was 38.69° ± 3.65°, DAT angle was 60.11° ± 4.45°, and TDA angle was 81.19° ± 4.06°, while on the left hand: ATD angle was 38.47° ± 4.14°, DAT angle was 60.28° ± 4.49°, and TDA angle was 81.19° ± 4.50°.

Conclusion: This study provides baseline information for researchers who will find it relevant in the course of their research with respect to palmar ridge counts and angles.

Key words: Angles, idiopathic blindness, Nigeria, ridge counts

INTRODUCTION

Ridges are delicately sculpted skin surface and their configural arrangements present on human fingers, toes, and soles.[1] Dermal ridges originate from fetal volar pads made up of mesenchymal tissue beginning at the 6th–7th week of intrauterine life. The size and position of the volar pads are pivotal in the presentation of the ridge patterns.[1] It further suggests that small pads produce arches and larger pads produce loops or whorls. A shift of the volar pad laterally induces asymmetry in the pattern of the ridges. Ridges become visible at about 3 months and are completed by the 6th month of prenatal development.[1] Dermatoglyphic patterns result from convolutions of layers of cells of the epidermis of the skin. The pore of the sweat glands are located at the peak of the ridges.[1] Ridges are formed during embryonic stage of the growth and remain unchanged after birth. However, extensive physical labor can wear them down and scars can distort the pattern.[1]


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MATERIALS AND METHODS

Research design
The finger and toe prints of the blind sampled from selected special schools and centers for the blind (handicapped) in Nigeria (Oji River in Enugu State, Special Education School for the Blind in Afara-Ukwu, Umuahia in Abia State, Centre for Special Education, Creek Road, Borokiri, Port Harcourt), irrespective of ethnicity and age. The selection and collection of required parameters relied on informed consent of volunteer subjects. This was performed by reading them a copy of the informed consent letter. The palm prints were obtained using a print scanner (HP G3110 Photo Scanner). A total of 72 (36 blind and 36 nonblind) participants were recruited for the study that comprised 22 blind male and 14 blind female participants and 18 male and 18 female nonblind participants. Figure 1 shows the structure of ridge patterns in the finger.[13]

The sampling technique used was purposeful sampling, and ethical clearance was obtained from the Ethics Committee of the University of Port Harcourt.

Data collection
AutoCAD software (AutoCAD 360 version 1.3 by Autodesk, Incorporated. 2011. San Rafael, California: United States of America) was used to make a straight line from the core of one triradius to the next triradius and the number of complete ridges that cut across the straight line was counted for A–B, B–C, and C–D ridge counts. For palmar angles, the three triradii were located and identified from the base of the index finger as “a,” base of the little finger as “d,” and the base of the palm as “t” after which, a straight line was taken “a” to “d” down to “t” and back to “a” forming a triangle. To determine each angle, the angular dimension tool on the AutoCAD was used. The angular tool was placed on both lines connecting the angle and clicked which indicated the angular dimension for each of the angles (ATD, TDA, and DAT). At the end, the data gotten were recorded for computation.

Data analysis
Data analysis was carried out using IBM SPSS Statistics for Windows, Version 22.0. IBM Corp. 2013 Armonk, New York: United States.

RESULTS

The results of this study are presented in [Tables 1 and 2].

In Table 1, the mean and standard deviation of the ridge counts for the total blind subjects: on the right hand, A–B was 26.02 ± 2.96, B–C was 27.04 ± 2.81, and C–D was 33.16 ± 3.55; and on the left hand, A–B was 26.51 ± 2.38, B–C was 26.99 ± 2.89, and C–D was 33.20 ± 3.44. Considering the total ridge counts for the nonblind subjects on the right hand: A–B was 35.53 ± 1.99, B–C was 22.83 ± 1.87, and C–D was 41.20 ± 2.75; and on the left hand: A–B was 32.72 ± 2.54, B–C was 22.89 ± 2.89, and C–D was 36.89 ± 3.44. Considering the nonblind male subjects, on the right hand: A–B was 29.13 ± 4.51, B–C was 24.88 ± 2.89, and C–D was 36.89 ± 5.47. In the blind male subjects, on the right hand: A–B was 29.69 ± 4.55, B–C was 24.85 ± 2.89, and C–D was 36.81 ± 5.21. Considering the nonblind male subjects, on the right hand: A–B was 29.27 ± 4.12, B–C was 24.93 ± 3.18, and C–D was 37.18 ± 5.42; and on the left hand: A–B was 29.61 ± 3.96, B–C was 24.94 ± 3.30, and C–D was 37.25 ± 5.06. In the blind female subjects, on the right hand: A–B was 29.44 ± 3.60, B–C was 24.99 ± 3.49, and C–D was 37.52 ± 4.66; and on the left hand: A–B was 29.52 ± 3.13, B–C was 25.04 ± 3.71, and C–D was 37.76 ± 4.85. Considering the nonblind female subjects, on the right hand: A–B was 29.37 ± 3.42, B–C was 24.84 ± 3.30, and C–D was 37.60 ± 4.68; and on the left hand: A–B was 29.62 ± 3.20, B–C was 25.14 ± 3.80, and C–D was 37.72 ± 4.79.

In the male subjects, the TDA was consistently high, followed by the DAT and finally the ATD. For the blind subjects: on the right hand, the ATD angle was 37.05 ± 4.13, DAT angle was 60.97 ± 4.15, and TDA angle was 82.01 ± 3.31; on the left hand: A–B was 36.80 ± 4.47, DAT angle was 52.04 ± 4.35, and TDA angle was 78.56 ± 4.79.

### Table 1: The mean and standard deviation of the ridge counts in both blind and nonblind males and females

<table>
<thead>
<tr>
<th>Ridge count of the blind and nonblind subjects</th>
<th>Right hand</th>
<th>Left hand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A–B</td>
<td>B–C</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blind</td>
<td>29.13 ± 4.51</td>
<td>24.88 ± 2.89</td>
</tr>
<tr>
<td>Nonblind</td>
<td>29.27 ± 4.12</td>
<td>24.93 ± 3.18</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blind</td>
<td>29.44 ± 3.60</td>
<td>24.99 ± 3.49</td>
</tr>
<tr>
<td>Nonblind</td>
<td>29.37 ± 3.42</td>
<td>24.84 ± 3.30</td>
</tr>
<tr>
<td>Total</td>
<td>26.02 ± 2.96</td>
<td>27.04 ± 2.81</td>
</tr>
<tr>
<td>Total blind</td>
<td>35.53 ± 1.99</td>
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</tr>
</tbody>
</table>

*P > 0.05, there was no statistically significant difference in the two groups in all on comparison.

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In Table 2, the mean and standard deviation of the palmar angles in the total blind and nonblind subjects was shown as follows: For the blind: on the right hand, the ATD angle was 38.69 ± 3.65, DAT angle was 60.11 ± 4.45, and TDA angle was 81.19 ± 4.06, while on the left hand, ATD angle was 38.47 ± 4.14, DAT angle was 60.28 ± 4.49, and TDA angle was 81.19 ± 4.50. For the nonblind subjects: on the right hand, the ATD angle was 34.57 ± 2.69, DAT angle was 62.92 ± 2.17, and TDA angle was 82.58 ± 1.80; whereas on the left hand, the ATD angle was 34.65 ± 2.62, DAT angle was 62.76 ± 2.35, and the TDA angle was 82.66 ± 1.74. The difference between the ridge counts in the blind and nonblind subjects was attributed to genetic interplay in the blind subjects.

In the female subjects, the C–D ridge count was consistently high, followed by the A–B ridge count and then B–C ridge count. In the blind females, the A–B, B–C, and C–D ridge counts were lesser on the right hand than the left hand. Again, in the nonblind females, the A–B, B–C, and C–D ridge counts were lesser on the right hand than the left hand as it was for the blind subjects. Between the blind and nonblind subjects: on the right hand, the A–B and B–C ridge counts were higher in the blind than the nonblind subjects, but the C–D ridge count was higher in the blind than the nonblind. The difference between the ridge counts in the blind and nonblind subjects was attributed to genetic interplay in the blind subjects.
C–D ridge count was higher in the nonblind subjects than the blind subjects. Between the blind and nonblind subjects: on the left hand, A–B and B–C ridge counts were higher in the nonblind than the blind subjects, but the C–D ridge count was higher in the blind subjects than the nonblind subjects. It suggests that there was a genetic input which accounts for the difference between the ridge counts in the blind and nonblind subjects.

However, in the male subjects, the TDA was consistently high, followed by the DAT and finally the ATD. For the blind subjects, ATD and DAT angles were higher on the right than the left hand whereas TDA was lesser on the right than the left hand. For the nonblind subjects, the ATD and TDA angles were lesser on the right hand than the left hand whereas the DAT angle was higher on the right than left hand. Between the blind and nonblind subjects: on the right hand, the ATD angle was higher in the nonblind than the blind while the DAT and TDA angles were lesser in the nonblind than the blind subjects; whereas on the left hand, ATD, DAT and TDA angles were higher in the nonblind than the blind subjects. The difference between the angles in the blind and nonblind subjects was attributed to genetic interplay in the blind subjects.

In addition, in the female subjects, the TDA was consistently high, followed by the DAT and finally the ATD. For the blind and nonblind subjects, the ATD and TDA angles were lesser on the right than the left hand while DAT angle was higher on the right than the left hand. Between the blind and nonblind subjects: on the right hand, the ATD and DAT were higher in the nonblind than the blind but TDA was lesser in the nonblind than blind subjects whereas on the left hand, ATD angle was higher on the nonblind than the blind but DAT and TDA angles were lesser in the nonblind than blind subjects. There were indications of genetic input as in the males.

**CONCLUSION**

This study provides anthropometric data for researchers and forensic experts and in medical diagnosis relevant to dermatologists.

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Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**