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Original Research Article

Investigation of Prevalence Pattern of Axial Triradii in the Ikwerres', Binis' and Igbos'

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Abstract

Background: This study was aimed at investigating the Prevalence Pattern of axial triradii in the Ikwerres' Binis' and Igbos'. The study was an observational, analytical and cross-sectional design with volunteers age ranging from 18-60 years. For the purpose of this study, an individual was considered to be a Nigeria of a particular ethnic group if the parents and four grandparents are of the same ethnic group. ***Materials and Methods:*** Cluster sampling method was used for the study. The selection and collection of required parameters relied on informed consent of volunteer subjects. This was done by giving them a copy of the informed consent letter which was signed and dated. A total of 1,200 subjects (Bini 400, Ikwerre 400 and Igbos 400) subjects were recruited for the study. The fingerprints were obtained using print scanner (Hp G3110 Photo scanner) following Oghenemavwe and Osaat (2015) improvised model. ***Results and Discussion***: Result of the study showed that the total prevalence of the axial triradii across the three ethnic groups (n=1,200). For Ikwerre (n=400), the total prevalence of the triradii were thus for the right: **t** 210(52.5%), $\mathbf{t^1}$ 128(32.0%), $\mathbf{t^2}$ 62(15.5%) while on the left thus **t** 204(51.0%), $\mathbf{t^1}$ 126(31.5%) and $\mathbf{t^2}$ 70(17.5%). For Bini (n=400) were thus on the right: **t** 192(48.0%), $\mathbf{t^1}$ 130(30.3%), $\mathbf{t^2}$ 78(19.5%) while on the left thus **t** 187(46.8%), $\mathbf{t^1}$ 131(32.8%) and $\mathbf{t^2}$ 82(20.4%) and the Igbos (n=400) were thus on the right: **t** 181(45.3%), $\mathbf{t^1}$ 115(28.8%), $\mathbf{t^2}$ 104(25.9%) while on the left thus **t** 174(43.5%), $\mathbf{t^1}$ 116(29.0%) and $\mathbf{t^2}$ 110(27.5%). In the prevalence of the position of axial triradii across the three ethnic groups, the **t**-position was the most prevalent, followed by $\mathbf{t^1}$ and $\mathbf{t^2}$. In the Igbo population there was an increased prevalence of t^2 on the left hand compared to the Ikwerre and Bini population. ***Conclusion*:** The similarity in prevalence pattern of the axial trradii suggests possible genetic proximity and that the Ikwerre people may possibly have received contributions from both Bini and Igbo ethnic groups in the formation of the Ikwerre ethnic group.

Keywords: Ikwerre, Bini, Igbo, triradii, prevalence.

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INTRODUCTION

A triradius is formed by the confluence of three ridge systems. The geometric center of the triradius is designated as the triradial point. Ideally, the triradial point is the meeting point of three ridges that form angles of approximately 120 degrees with another [1].

The triradii is recognized by the meeting point of the ridges shown below:

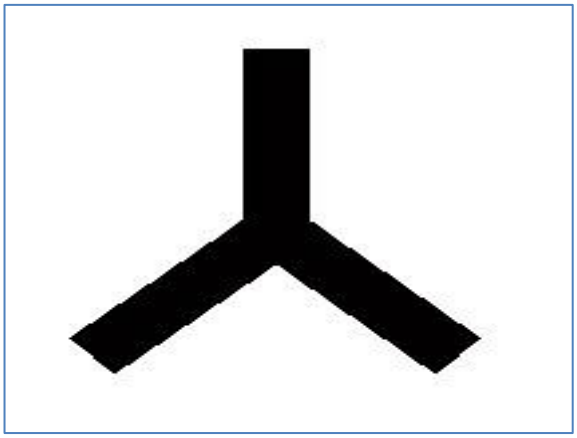


Fig-1: Showing the meeting point of the ridges to form a triradius [2]

The position of axial triradii varies and is designated according to the positions as **t** triradius, when it is located at the base of the palm, $\mathbf{t^1}$ – when it is located midway towards the centre of the palm and $\mathbf{t^{11}}$ when it is located very close to the centre of the palm.

The triradius as an element of dermatoglyphics has been used in diagnostics for genetic conditions, ancestral study to determine interpopulation relationship. It is in the light of this information that the prevalence of triradii was examined in Ikwerre, Bini and Igbo ethnic groups to establish whether there is a unique pattern or not.

The Ikwerre people have stated that they have their ancestral root from the Bini ethnic group with history that documented how the ancestor of the Ikwerre fled the old Bini and came down to the present location of the Ikwerre ethnic to settle. Again, the Igbo ethnic group lay claims on the Ikwerre people. This controversy has persisted for very long time without any thorough scientific investigation to back any of these claims. It is based on this paucity of information that this study was undertaken to explore whether there is an anatomical evidence to back or reject any of the claims [3-7].

There have some reports on investigations done by other researchers on the positions of axial triradii [8-20]. There is paucity of information on the position of axial triradii in these tribes under investigation. *Aim and Objective*: This study was aimed at investigating the Prevalence Pattern of axial triradii in the Ikwerres' Binis' and Igbos'.

Scope of the Study

This study was done specifically on the digital prints.

Significance of the Study

This study will benefit the body of knowledge on ancestry of Ikwerres which will be significant to historians, sociologists, anthropologists, Rivers State people and Ikwerres specifically.

METHODS

Research Design: The study was descriptive and cross-sectional. For the purpose of this study, an individual was considered to be a Nigeria of a particular ethnic group if the parents and four grandparents are of the same ethnic group. Volunteers with age ranging from 18-60 years from the Ikwerre, Bini and Igbo extractions were recruited for this study by random sampling. The study was conducted from January 6 - December 20, 2018.

Data Collection

The selection and collection of required parameters relied on informed consent of volunteer subjects after the procedure was explained to them. This was done by giving each volunteer a copy of the informed consent letter which was signed and dated. A brief questionnaire on the age, sex, ethnicity of the parents and grandparents was self-administered except for the subjects that could not read or write where the researcher administered the questionnaire himself. A total of 1,200 (Bini 400 subjects, Ikwerre 400 subjects and Igbos 400) subjects were recruited for the study. Obtaining data for dermatoglyphics: the fingerprints were obtained using print scanner (Hp G3110 Photo scanner) using the improvised method described by Oghenemavwe and Osaat (2015). The subjects were asked to wash their hands thoroughly with water, detergent and dried with a hand towel (clothe) before taking prints. This process was followed to avoid the interference of dirt with the photo images of the print. In course of taking the prints a little pressure was put to press the palm on the scanner for adequate contact between the palm and the scanner. The first step of the scanning process was to place the palm or sole on the scanner, closed the scanner cover to the extent the hand or feet can accommodate and then click on scan. Allow the exposure light which could be seen from the scanner glass surface to run through until it showed the scan preview on the computer screen. Once the scanned image appeared on the computer screen, the following was done: a) cropped the picture to reduce the extra space surrounding the picture of the palm. b) clicked on correct picture menu and did the followings: change "removed dust" and "scratches" from normal to high, changed "sharpen" from medium to extreme and clicked on descreen; c) Adjusted the colour of the scan by clicking on "adjust colour" menu then selected "invert colour" or "invert grayscale colour"; d) clicked on resize output and changed percentage scale from 100 to 10 to reduce the size of the picture. e) Changed the output type from colour to grayscale. After all these changes were done, clicked on "finish". Then the scanner did the final scanning. This was the second step in the scanning process. Because the scanning process was a bit slow, after the automatic re-scanning, it was possible to switch the scanner cord to any other USB ports on the computer to make it faster. At this point, a new scan could begin, while the former one was still running until it finished by itself. When it had finished scanning, the scanned picture was saved in scan folder. It could be resaved using appropriate file name for easy identification. After prints had been obtained it was magnified using the zooming tool on Hp laptop connected to the scanner via USB cords where the data collected was examined, identified and grouped into the various categories and recorded.

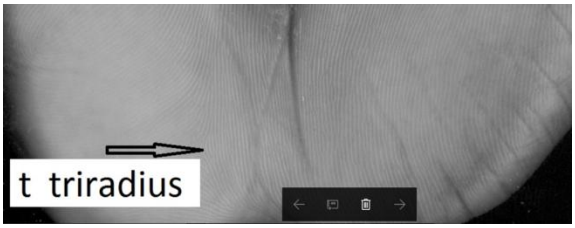


Fig-1: t position of triradius (zoomed) from the study

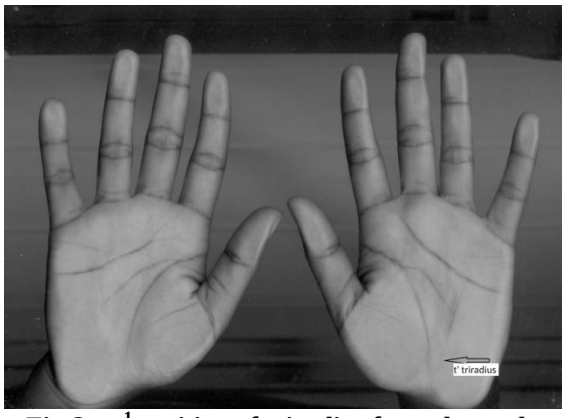


Fig-2a: t^1 position of triradius from the study

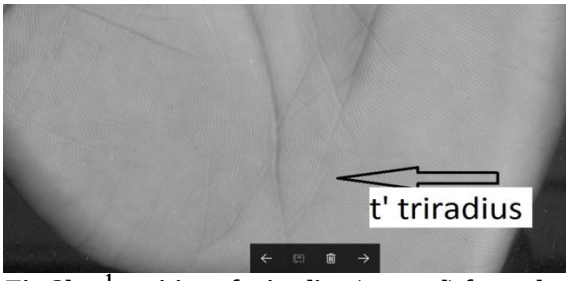


Fig-2b: t^1 position of triradius (zoomed) from the study

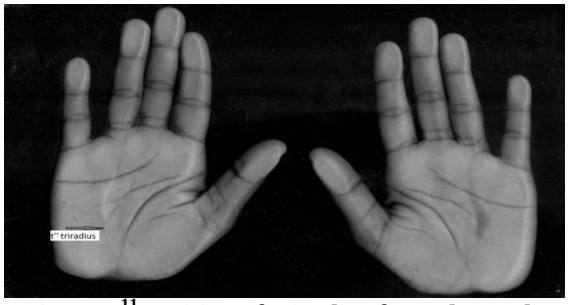


Fig-3a: t^{11} position of triradius from the study

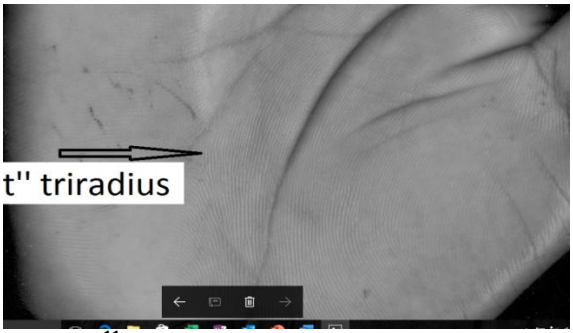


Fig-3b: t^{11} position of triradius (zoomed) from the study

Data Analysis

Data obtained were inputted into Microsoft excel 2010 for data analysis using chi square test to determine the prevalence of the various triradii positions amongst the Ikwerre, Bini and Igbo ethnic groups.

Criteria for Subject Selection

Subjects recruited were indigenes of the ethnic groups under investigation with no form of anatomical abnormality of the hands. Blurred prints were excluded as well as foreign nationals.

Ethical Consideration

Ethical clearance was obtained from the Research Ethics Committee of the University of Port Harcourt with REC Number: UPH/CEREMAD/REC/MM59/036 before commencement of the study.

RESULTS

In table 1 the following were the prevalence of axial triradii of the Ikwerre ethnic group. The males (n=210) had the following: on the right the **t** triradii was 121(57.6%), $\mathbf{t^1}$ 68(32.4%), $\mathbf{t^2}$ 21(10.0%) whereas on the left were the following **t** 118(56.1%), $\mathbf{t^1}$ 70(33.3%) and $\mathbf{t^2}$ 22(10.6%). The females (n=190) had the following prevalence of the triradii on the right: **t** 90(47.4%), $\mathbf{t^1}$ 58(30.5%), $\mathbf{t^2}$ 42(22.1%) while on the left **t** was 86(45.3%), $\mathbf{t^1}$ 56(29.5%) and $\mathbf{t^2}$ 48(25.2%). The total prevalence (n=400) of the triradii for Ikwerre ethnic group were thus for the right: **t** 210(52.5%), $\mathbf{t^1}$ 128(32.0%), $\mathbf{t^2}$ 62(15.5%) while on the left thus **t** 204(51.0%), $\mathbf{t^1}$ 126(31.5%) and $\mathbf{t^2}$ 70(17.5%). The Bini ethnic group had for the males (n=225) on the right the **t** triradii was 113(50.2%), $\mathbf{t^1}$ 68(30.2%), $\mathbf{t^2}$ 44(19.6%) whereas on the left were the following **t** 111(49.3%), $\mathbf{t^1}$ 68(30.2%) and $\mathbf{t^2}$ 46(20.5%). The females (n=175) had the following prevalence of the triradii on the right: **t** 79(45.1%), $\mathbf{t^1}$ 62(35.4%), $\mathbf{t^2}$ 34(19.5%) while on the left **t** was 76(43.4%), $\mathbf{t^1}$ 63(36.0%) and $\mathbf{t^2}$ 36(20.6%). The total prevalence (n=400) of the triradii for Bini ethnic group were thus for the right: **t** 192(48.0%), $\mathbf{t^1}$ 130(30.3%), $\mathbf{t^2}$ 78(19.5%) while on the left thus **t** 187(46.8%), $\mathbf{t^1}$ 131(32.8%) and $\mathbf{t^2}$ 82(20.4%). While the Igbo ethnic group had for the males (n=230) on the right the **t** triradii was 104(45.2%), $\mathbf{t^1}$ 81(35.2%), $\mathbf{t^2}$ 45(19.5%) whereas on the left were the following **t** 101(43.9%), $\mathbf{t^1}$ 78(33.9%) and $\mathbf{t^2}$ 51(22.2%). The females (n=170) had the following prevalence of the triradii on the right: **t** 77(45.3%), $\mathbf{t^1}$ 34(20.0%), $\mathbf{t^2}$ 59(34.7%) while on the left **t** was 73(42.9%), $\mathbf{t^1}$ 38(22.4%) and $\mathbf{t^2}$ 59(34.7%). The total prevalence (n=400) of the triradii for Igbo ethnic group were thus for the right: **t** 181(45.3%), $\mathbf{t^1}$ 115(28.8%), $\mathbf{t^2}$ 104(25.9%) while on the left thus **t** 174(43.5%), $\mathbf{t^1}$ 116(29.0%) and $\mathbf{t^2}$ 110(27.5%).

In table 2 the following were the prevalence of axial triradii of the males (n=665) across the three

ethnic groups. For Ikwerre (n=210): on the right the **t** triradii was 121(57.6%), $\mathbf{t^1}$ 68(32.4%), $\mathbf{t^2}$ 21(10.0%) whereas on the left were the following **t** 118(56.1%), $\mathbf{t^1}$ 70(33.3%) and $\mathbf{t^2}$ 22(10.6%), Bini (n= 225): on the right the **t** triradii was 113(50.2%), $\mathbf{t^1}$ 68(30.2%), $\mathbf{t^2}$ 44(19.6%) whereas on the left were the following **t** 111(49.3%), $\mathbf{t^1}$ 68(30.2%) and $\mathbf{t^2}$ 46(20.5%), for the Igbos (n=230) : on the right the **t** triradii was 104(45.2%), $\mathbf{t^1}$ 81(35.2%), $\mathbf{t^2}$ 45(19.5%) whereas on the left were the following **t** 101(43.9%), $\mathbf{t^1}$ 78(33.9%) and $\mathbf{t^2}$ 51(22.2%).

In table 3 the following were the prevalence of axial triradii of the females (n=535) across the three ethnic groups. Ikwerre females (n=190) had the following prevalence of the triradii on the right: **t** 90(47.4%), $\mathbf{t^1}$ 58(30.5%), $\mathbf{t^2}$ 42(22.1%) while on the left **t** was 86(45.3%), $\mathbf{t^1}$ 56(29.5%) and $\mathbf{t^2}$ 48(25.2%). Bini females (n=175) had the following prevalence of the triradii on the right: **t** 79(45.1%), $\mathbf{t^1}$ 62(35.4%), $\mathbf{t^2}$ 34(19.5%) while on the left **t** was 76(43.4%), $\mathbf{t^1}$ 63(36.0%) and $\mathbf{t^2}$ 36(20.6%). Igbo (n=170) had the following prevalence of the triradii on the right: **t** 77(45.3%), $\mathbf{t^1}$ 34(20.0%), $\mathbf{t^2}$ 59(34.7%) while on the left **t** was 73(42.9%), $\mathbf{t^1}$ 38(22.4%) and $\mathbf{t^2}$ 59(34.7%).

In table 4 the following were the total prevalence of the axial triradii across the three ethnic groups (n=1,200). For Ikwerre (n=400), the total prevalence of the triradii were thus for the right: **t** 210(52.5%), $\mathbf{t^1}$ 128(32.0%), $\mathbf{t^2}$ 62(15.5%) while on the left thus **t** 204(51.0%), $\mathbf{t^1}$ 126(31.5%) and $\mathbf{t^2}$ 70(17.5%). For Bini (n=400) were thus on the right: **t** 192(48.0%), $\mathbf{t^1}$ 130(30.3%), $\mathbf{t^2}$ 78(19.5%) while on the left thus **t** 187(46.8%), $\mathbf{t^1}$ 131(32.8%) and $\mathbf{t^2}$ 82(20.4%) and the Igbos (n=400) were thus on the right: **t** 181(45.3%), $\mathbf{t^1}$ 115(28.8%), $\mathbf{t^2}$ 104(25.9%) while on the left thus **t** 174(43.5%), $\mathbf{t^1}$ 116(29.0%) and $\mathbf{t^2}$ 110(27.5%).

Table-1: Prevalence of axial triradii in Ikwerre, Bini and Igbo ethnic groups

Parameters	Right			Left		
	t	$\mathbf{t^1}$	$\mathbf{t^2}$	**t**	$\mathbf{t^1}$	$\mathbf{t^2}$
Ikwerre						
Males (n=210)	121(57.6)	68(32.4)	21(10.0)	118(56.1)	70(33.3)	22(10.6)
Females (n=190)	90(47.4)	58(30.5)	42(22.1)	86(45.3)	56(29.5)	48(25.2)
Total (n=400)	210(52.5)	128(32.0)	62(15.5)	204(51.0)	126(31.5)	70(17.5)
Bini						
Males (n=225)	113(50.2)	68(30.2)	44(19.6)	111(49.3)	68(30.2)	46(20.5)
Females (n=175)	79(45.1)	62(35.4)	34(19.5)	76(43.4)	63(36.0)	36(20.6)
Total (n=400)	192(48.0)	130(30.3)	78(19.5)	187(46.8)	131(32.8)	82(20.4)
Igbo						
Males (n=230)	104(45.2)	81(35.2)	45(19.5)	101(43.9)	78(33.9)	51(22.2)
Females (n=170)	77(45.3)	34(20.0)	59(34.7)	73(42.9)	38(22.4)	59(34.7)
Total (n=400)	181(45.3)	115(28.8)	104(25.9)	174(43.5)	116(29.0)	110(27.5)

Table-2: Prevalence of axial triradii of the males across the three ethnic groups

Parameters	Right			Left		
	t	$\mathbf{t^1}$	$\mathbf{t^2}$	**t**	$\mathbf{t^1}$	$\mathbf{t^2}$
Ikwerre n=210)	121(57.6)	68(32.4)	21(10.0)	118(56.1)	70(33.3)	22(10.6)
Bini (n=225)	113(50.2)	68(30.2)	44(19.6)	111(49.3)	68(30.2)	46(20.5)
Igbo (n=230)	104(45.2)	81(35.2)	45(19.5)	101(43.9)	78(33.9)	51(22.2)

Right hand, **t:** Ikwerre>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre=Bini<Igbo**;** $\mathbf{t^2}$: Ikwerre<Bini<Igbo.
Left hand, **t:** Ikwerre>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre>Bini<Igbo**;** $\mathbf{t^2}$: Ikwerre<Bini<Igbo

Table-3: Prevalence of axial triradii of the females across the three ethnic groups

Parameters	Right			Left		
	t	$\mathbf{t^1}$	$\mathbf{t^2}$	**t**	$\mathbf{t^1}$	$\mathbf{t^2}$
Ikwerre (n=190)	90(47.4)	58(30.5)	42(22.1)	86(45.3)	56(29.5)	48(25.2)
Bini (n=175)	79(45.1)	62(35.4)	34(19.5)	76(43.4)	63(36.0)	36(20.6)
Igbo (n=170)	77(45.3)	34(20.0)	59(34.7)	73(42.9)	38(22.4)	59(34.7)

Right hand, **t:** Ikwerre>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre<Bini>Igbo**;** $\mathbf{t^2}$: Ikwerre>Bini<Igbo.
Left hand, **t:** Ikwerre>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre<Bini>Igbo**;** $\mathbf{t^2}$: Ikwerre>Bini<Igbo

Table-4: Total prevalence of the axial triradii across the three ethnic groups

Parameters	Right			Left		
	t	t^1	t^2	t	t^1	t^2
Ikwerre (n=400)	210(52.5)	128(32.0)	62(15.5)	204(51.0)	126(31.5)	70(17.5)
Bini (n=400)	192(48.0)	130(30.3)	78(19.5)	187(46.8)	131(32.8)	82(20.4)
Igbo (n=400)	181(45.3)	115(28.8)	104(25.9)	174(43.5)	116(29.0)	110(27.5)

Right hand, **t:** Ikwerre>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre<Bini>Igbo**;** $\mathbf{t^2}$: Ikwerre<Bini<Igbo.
Left hand, **t: Ikwerre**>Bini>Igbo**;** $\mathbf{t^1}$**:** Ikwerre<**Bini**>Igbo**;** $\mathbf{t^2}$: Ikwerre<Bini<**Igbo**

DISCUSSIONS

Prevalence of position of axial triradii in Ikwerre, Igbo and Bini males and females showed that there was sexual dimorphism in the prevalence of the triradii with males having more prevalence than the females across the ethnic groups. This present study agrees with the findings of Paul *et al*. [10] where they reported that there was sexual dimorphism in the distribution of the triradii with the males having higher prevalence of **t,** $\mathbf{t^1}$ while the least prevalent position was **t[**11].

Comparison between the males across the three ethnic groups showed that on the right hand for **t** position, the Ikwerres had higher prevalence than the Bini people and the Binis had higher prevalence than the Igbo people, for $\mathbf{t^1}$ the Ikwerre and Bini people had similar prevalence which was lower than that of the Igbos. Whereas the distribution of $\mathbf{t^2}$ position showed that the Ikwerre people had lower prevalence than the Bini people which were both lower than that of the Igbo people. On the left hand, for the **t**-position the Ikwerre people had higher prevalence than the Bini people and Binis' higher than the Igbos, for $\mathbf{t^1}$ the Ikwerre had higher prevalence than the Binis' but were both lower than the Igbos. Finally, for $\mathbf{t^2}$ the Ikwerre people were seen to have lower prevalence than the Bini people which were both lower than the Igbos. This trend of prevalence agrees with the reports of Micle *et al.* [13] and Karmakar and Malhotra [14].

Amongst the females across the three ethnic groups, the same result was seen on both hands for the **t** position the Ikwerre people had higher prevalence than the Bini people who also had higher prevalence than the Igbo people, for $\mathbf{t^1}$ the Ikwerre people had lower prevalence than Bini people which were both higher than the Igbos. For the $\mathbf{t^2}$ the Ikwerre ethnic group had higher prevalence than Bini people which were both lower than the prevalence of the Igbos. It implies that the Igbos had a relatively higher prevalence of $\mathbf{t^2}$ position than the Ikwerre and Bini people suggesting a difference in the trend for the Igbos. This similarity between the Ikwerre and Bini people tells a great deal of interpopulation affinity as marked by Karmakar [15] who stated similar result in his study on Dhangar castes of Maharashtra, India.

The prevalence in the total populations across the three ethnic groups showed similar trend bilaterally. The **t** position showed higher prevalence in Ikwerre ethnic group and least prevalence in the Igbos. The $\mathbf{t^1}$ position indicated that the Bini people had the highest prevalence while Igbos had the least prevalence finally for $\mathbf{t^2}$ position; Igbos had the highest prevalence and the Ikwerres the least prevalence. The trend of the prevalence across the three ethnic groups showed that the Ikwerre people had closer prevalence pattern to the Bini people than the Igbos. In a similar fashion, Mukherjee [16] and Badiyea *et al.* [20] who stated that the most prevalent triradii in their study was **t** triradii which corroborates the findings of this present study. This may suggest that the Ikwerre people have a closer genetic makeup to the Bini people than the Igbos but not too far apart. Generally, across the three ethnic groups, the most prevalent triradii was the t, followed by t^1 then t^2.

The similarity in prevalence pattern of the axial trradii suggests possible genetic proximity and that the Ikwerre people may possibly have received contributions from both Bini and Igbo ethnic groups in the formation of the Ikwerre ethnic group.

CONCLUSION

Across the three ethnic groups, the most prevalent triradii was the t, followed by t^1 then t^2. The similarity in prevalence pattern of the axial trradii suggests possible genetic proximity and that the Ikwerre people may possibly have received contributions from both Bini and Igbo ethnic groups in the formation of the Ikwerre ethnic group.

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AUTHOR'S CONTRIBUTION

We write to state that both authors have contributed significantly, and that all authors are in agreement with the contents of the manuscript. 'Author A' (John Nwolim Paul) designed the study and protocol, wrote the first draft of the manuscript; 'Author B' (Gabriel Sunday Oladipo) 'reviewed the design, protocol; 'Author C' (Loveday Ese Oghenemavwe) examined the intellectual content of the manuscript. All authors read and approved the final manuscript.

REFERENCES

1. Schaumann, B., & Alter, M. (2012). *Dermatoglyphics in medical disorders*. Springer Science & Business Media.
2. Martijn. The TRIRADIUS in a fingerprint: how it develops, it's characteristics. http://www.modernhandreadingforum.com/t736-the-triradius-in-a-fingerprint-how-it-develops-it-s-characteristics-a-definition. 2011. Accessed October 10, 2019.
3. Tasie, G.O.M. (2000). Chairman's Opening Remarks at the Maiden Ikwerre Annual Thanksgiving Day, Mimeo. 3-6, 2000.
4. Adekson, A. O. (2004). *The'Civil Society'Problematique: Deconstructing Civility and Southern Nigeria's Ethnic Radicalization*. Routledge.
5. Agumagu, J. (2006). Aro factor in Ikwerre history: A case of inter-ethnic relations. *Journal of Niger Delta Research*, 8(1): 13-18.
6. Amadi, K.O.(2003). The Ikwerre people and their Neighbours. Nduka, O. Ed. Studies in Ikwerre history and culture. Vol. II. Port Harcourt. 28-30.
7. Onwuejeogwu, M. A. (1992). *The social anthropology of Africa: An introduction*. Heinemann Educational Books (Nigeria) Plc.
8. Holt, S. B., & Sharma, P. D. (1977). Absence of triradius d on the palms of normal people. *Annals of human genetics*, *41*(2), 195-197.
9. Oladipo, G. S., Paul, C. W., Bob-Manuel, I. F., Fawehinmi, H. B., & Edibamode, E. I. (2009). Study of digital and palmar dermatoglyphic patterns of Nigerian women with malignant mammary neoplasm. *Journal of Applied Biosciences*, *15*, 829-834.
10. Paul Chikwuogwo, W. (2018). Determination of the prevalence of position of axial triradii in acquired idiopathic blindness in some selected schools for the blind in Nigeria. *Sudan Medical Monitor*, *55*, 56.
11. Vashist, M., Yadav, R., & Kumar, A. (2009). Axial triradius as a preliminary diagnostic tool in patients of mental retardation. *Internet J Biol Anthropol*, *4*, 1-5.
12. Sandhu, B. S., Pathak, R. K., & Kaul, S. (1985). Lateral Displacement of the Axial Triradius with Reference to the Hand Skeleton: A-New Genetic Marker for Population Definition. *Indian Anthropologist*, *15*(2), 161-166.
13. Micle, S., Kobyliansky, E., Arensburg, B., & Nathan, H. (1980). The digital triradii of the palm: a dermatoglyphic study. *Zeitschrift für Morphologie und Anthropologie*, 322-328.
14. Karmakar, B., & Malhotra, K. C. (1987). Types and combinations of axial triradii among the 20 Dhangar castes of Maharashtra, India. *International Journal of Anthropology*, *2*(2), 171-181.
15. Karmakar, B. (1990). Distribution and population variation of total number of palmar triradii among 20 Dhangar castes of Maharashtra, India. *International Journal of Anthropology*, *5*(3), 255-269.
16. Mukherjee, D. P. (1966). Inheritance of total number of triradii on fingers, palms and soles. *Annals of human genetics*, *29*(4), 349-353.
17. Natekar, P. E., Desouza, F., & Pandey, A. K. (2006). Axial Triradii in Carcinoma of Breast. *The Anthropologist*, *8*(3), 193-195.
18. David, T. J. (1971). The palmar axial triradius t. A new method of location. *Human heredity*, *21*(6), 624-627.
19. Ranganath, P., Rajangam, S., & Kulkarni, R. N. (2004). Triradii of the palm in idiopathic epilepsy. *J Anat Soc India*, *53*, 22-24.
20. Badiye, A., Kapoor, N., & Mishra, S. D. (2019). A novel approach for sex determination using palmar tri-radii: A pilot study. *Journal of forensic and legal medicine*, *65*, 22-26.