

Stature Estimation among three Ethnic Groups in Delta State of Nigeria using the Second and Fourth Finger Lengths

Ijeomah Trust Azubike^{1*}, Patrick S. Igbigbi¹

¹Department of Human Anatomy and Cell Biology, Delta State University, Abraka, Nigeria.

ABSTRACT

Introduction: The progressive rise in the spate of crime and natural disasters has increased the need for human identification by forensic experts and this is based on individual morphologic features. This study was aimed at estimating stature among three ethnic groups in the Delta State of Nigeria using the second and fourth finger lengths.

Materials and Methods: A total of 1176 adult individuals, comprising 583 males and 593 females participated in the study. An interviewer-administered questionnaire, a Digital verniercaliper, and a standiometer were used to obtain data from the subjects. The data collected was statistically analyzed using Statistical Package for Social Sciences (SPSS) Version 20, by calculating means and standard deviations as well as standard errors, with a p-value set at <0.05

Results: There was observed statistically significant difference in stature between the males and females. The study also revealed males have longer fourth digits and a lesser second-to-fourth digit ratio than females ($p<0.05$). A significant correlation was also found between height and the length of the second and fourth digit lengths but with a higher correlation with the fourth digit length ($p<0.05$).

Conclusion: This study has indicated that the second and fourth fingers are reliable parameters for stature estimation and can be employed as a tool in human forensic identification.

Keywords: Anthropometry, Finger length, Nigeria, Stature.

Address of Corresponding Author

Ijeomah Trust Azubike; Department of Human Anatomy and Cell Biology, Delta State University, Abraka, Nigeria.

E-mail: ijeomahtrust@gmail.com

Crossref Doi: <https://doi.org/10.36437/irmhs.2023.6.4.A>

Introduction

Personal identification of an individual is an important aspect of Forensic science. The biological profile of a person which includes; age, gender, ethnicity, and stature can be determined using anthropometry (Ishak et al., 2012, Enaohwo and Igbigbi, 2006; Enaohwo Mamerhi, Okoro Godswill, 2018; Anibor et al., 2023).^{1,2,3,4} Among these 'big fours' of anthropology, height estimation is seen to be an important anthropometric parameter to Anthropologist, Anatomist, Obstetrician, and in Medico-legal practice. In the case of living individuals, it is based on some morphological characteristics peculiar to that individual while in the case of skeletal remains it is rather more cumbersome and requires exhaustive examination of the

skeletal remains recovered from the crime scene (Rastogi et al., 2008).⁵ Such estimation is based on the relationship that exists between skeletal elements and stature which happens to be a classic anthropometric quantitative trait due to its ease of measurement, approximately normal distribution, and relative stability in adulthood, and thus the target of extensive research across many fields of science. Because of the effect of various factors such as genetic and environmental factors, influencing adult stature, different nomograms become necessary for different populations in stature estimation.

Many studies by anatomists have shown a positive correlation between stature and various body

parts, an example of such is from hand dimensions in different populations (Ishak et al., 2012; OKORO et al. 2023; Tyagi et al., 1991; Lalit et al., 2014; Oladunni Abimbola Ebeye, Ogheneyeborue Godswill Okoro, Joyce EkemeIkubo, 2021)^{1,6,7,8,9} and offered regression equations for such populations but there is a paucity of data for studies on the fingers and stature estimation in different ethnicities, hence this study. This study was embarked upon firstly, to establish possible estimation of stature using the second and the fourth finger lengths among adult individuals of the Ijaw ethnic group; secondly, to show which of the fingers shows more correlation with adult stature and then, derive a correlation equations for stature estimation using the second fourth finger length in the Ijaw ethnic group.

Materials and Methods

This study was carried out in Bomadi town in Bomadi Local Government, Okpara-inland in Ethiope East Local Government Area, Abbi Town in Ndokwa West Local Government Area, of Delta South, North and Central senatorial districts of Delta State. It involved 1176 adults comprising 583 male and 593 female adults of ages 18-60 years. Data was obtained using an interviewer-administered question for ethnic identification, while the second and fourth finger lengths and adult individual statures of males and females were measured using a digital Vernier caliper and standiometer respectively.

Height was measured while the subject was made to stand erect against the wall with a standiometer, without shoes or socks, the heels opposed, and the eyes directed straight ahead. While erect against a wall, his/her buttocks, shoulder blades, and back of the head were in close contact with the wall, and the head was placed in a position called the "Frankfurt plane" (World Medical Association, 2013).¹⁰ The length of the second finger (2D) and 4th finger (4D) of the right hand of each subject was measured with the aid of manual vernier calipers, with the hand in the supine position while the fingers were abducted and from the tip of the finger to the ventral proximal crease, where there is a band of

crease at the base of the finger, the most proximal crease was used.

Ethical approval with reference number; DELSU/CHS/ANA/68/78 was obtained from the Faculty of Basic Medical Sciences, College of Health Sciences, Delta State University, Abraka, from the paramount rulers of Bomadi, Okpara-inland, Abbi towns while only subjects that offered their consent to participate in the study were allowed in the study in accordance with the guidelines of medical research involving human subjects (Yamada et al., 1981).¹¹

The data obtained was statistically analyzed using the statistical package for Social Sciences (SPSS) Version 20, by calculating means and standard deviations. A paired T-test was used with p-value set at <0.05 i.e. values less than this said to be significant. Regression formulae were also derived for calculating the stature using the length of the index and ring fingers.

Results

The results of this study are shown in tables and figures below. The study which involved 1176 adults comprising 583 males and 593 females across the three ethnic groups is represented in the tables and figures below starting from the sociodemographic features, the anthropometric data, then the regression analysis.

The obtained age range of the respondents shows that the highest percentage of respondents were within the range of 26-40 years representing 49.62% of the entire number of respondents while the age range 18-25 had the highest number of participants representing 60.15% among the Ndokwas (table 1). The sex of respondents which is presented in Table 2 shows that a higher number of respondents were females, representing 50.40% of the total participants.

The maximum, minimum, average, range, and standard deviation (SD) of male and female heights of participants in centimeters are presented in Table 3 with the highest maximum

and mean values recorded among the males across the ethnic groups. The maximum measured height of 192cm was recorded in the Urhobo group but Ijaw males were found to be averagely tallest of the three ethnic groups with a mean height of $170.47 \pm 7.58\text{cm}$ while the mean female height was highest among the Ndokwas with a mean of $161.10 \pm 6.85\text{cm}$.

Table 4 represents the finger lengths in centimeters (cm) of males and females as well as their standard deviations. The males were observed to have longer second and fourth finger lengths than females and their fourth finger longer than the second across the three ethnic groups. The maximum fourth finger lengths were recorded among the Urhobo and Ijaw males (9.32cm) while the maximum value for the second finger was recorded among the Ndokwa females (8.99cm). The highest mean value for the second finger was recorded among the Ijaw males ($7.50 \pm 0.54\text{cm}$) while the highest mean value for the fourth finger was from among the Ndokwa males ($7.63 \pm 0.52\text{cm}$). The highest mean second finger length was among Ijaw females while the Ndokwa females had the highest mean fourth finger length.

The obtained values for height and finger lengths were then subjected to a test of statistical

significance to assess statistically significant difference between gender in each and across the ethnic groups and a significant difference in height between genders in and across the ethnic groups. There was statistically significant difference in second and fourth finger lengths between males and females in each group except among Ijaws and between genders combined across the ethnic groups as shown in table 5 below.

The table 6 and 7 has the correlation coefficients for the second and fourth finger for each gender, across ethnicity and gender combined. The tables show that the second and fourth finger has a positive correlation with height, both in males and females across the three ethnic groups. However, the correlation coefficient is found to be higher with the fourth finger. The tables 8 and 9 show same for the different regression equations for estimating adult height in males and females using the second and fourth finger lengths. The formulae are derived for males and females separately in and across ethnicities. The regression formulae given as $Y=a + bX$, where "Y" is the estimated height from the regression equation, "a" is the regression constant, "b" is the regression coefficient while Y is the measured length of the finger (8 and 9).

Tribe	Age	Frequency	Percentage
Urhobo	18-25	130	32.80
	26-40	196	49.50
	41-60	70	17.70
Total		396	100.00
Ndokwa	18-25	237	60.20
	26-40	79	20.10
	41-60	78	19.80
Total		394	100.00
Ijaw	18-25	121	31.30
	26-40	192	49.70

	41-60	73	18.90
Total		386	100.00

Table 1: Showing the age distribution of participants.

Tribe	Sex	Frequency	Percentage
Urhobo	Male	190	48.00
	Female	206	52.00
Total		396	100.00
Ndokwa	Male	201	51.00
	Female	193	49.00
Total		394	100.00
Ijaw	Male	192	49.70
	Female	194	50.30
Total		386	100.00

Table 2: Showing the sex distribution for each ethnic group.

ETHNIC GROUP	GENDER	Maximum (cm)	Minimum (cm)	Mean(cm)	Range	Standard Deviation SD (±)
Urhobo	M	192.00	147.00	170.30	45.00	6.94
	F	174.00	137.00	158.48	37.00	6.65
Ndokwa	M	186.00	154.00	170.12	32.00	8.54
	F	179.00	142.00	161.10	37.00	6.85
Ijaw	M	186.00	154.00	170.47	32.00	7.58
	F	174.00	137.00	158.85	37.00	6.66

Table 3: The maximum, minimum and mean height in cm, of the participants as well standard deviation in each of the ethnic group.

ETHNIC GROUP	Gender	Finger	Maximum (cm)	Minimum (cm)	Mean (cm)	Range (cm)	Standard Deviation SD (±)
Urhobo	M	2 ND	8.95	5.88	7.48	3.07	.55
		4 TH	9.32	5.88	7.63	3.44	.54
	F	2 ND	8.15	6.01	6.97	2.14	.44
		4 TH	8.11	6.16	7.10	1.95	.45
Ndokwa	M	2 ND	8.25	5.34	7.25	2.91	.56

		4 TH	8.00	6.26	8.32	1.74	.43
	F	2 ND	8.99	5.57	6.96	3.42	.52
		4 TH	8.73	5.57	7.19	3.16	.49
Ijaw	M	2 ND	8.95	5.88	7.50	3.07	.54
		4 TH	9.32	5.88	7.63	3.44	.52
	F	2 ND	8.15	6.01	7.00	2.14	.45
		4 TH	8.11	6.16	7.12	1.95	.46

Table 4: Showing the maximum, minimum and mean of second and fourth finger lengths in cm for each ethnic group.

Ethnic group	Sex	2 nd Finger (cm)	4 th Finger(cm)	Ratio
Urhobo	Male	7.48	7.63	0.98
	Female	6.97	7.10	0.98
Ndakwa	Male	7.25	8.32	0.87
	Female	6.97	7.18	0.97
Ijaw	Male	7.50	7.63	0.98
	Female	7.00	7.12	0.98

Table 5: Showing the second and fourth finger length ratios in each ethnic group.

Ethnic Group	HEIGHT t-test (M/F)	Degree of freedom	Significant.(2-tailed)	Inference
Urhobo	4.134	395	0.001	Significant
Ndakwa	3.369	393	0.002	Significant
Ijaw	3.267	385	0.001	Significant
	2 ND FINGER (M/F)			
Urhobo	3.066	395	0.000	Significant
Ndakwa	3.058	393	0.000	Significant
Ijaw	4.178	385	0.001	Significant
	4 TH FINGER (M/F)			
Urhobo	3.034	395	0.002	Significant
Ndakwa	3.056	393	0.000	Significant
Ijaw	3.073	385	0.001	Significant
	2 ND :4 TH			
Urhobo	3.001	1	0.000	Significant
Ndakwa	4.103	1	0.020	Significant
Ijaw	0.034	1	0.230	Not Significant
ACROSS ETHNIC GROUPS	2 ND :4 TH			

Male	2.462	2	0.023	Significant
Female	2.003	2	0.023	Significant

Table 6: Showing the level of significance for the groups.

ETHNIC GROUP	SEX	FINGER	CORRELATION COEFFICIENT(r)	SIGNIFICANCE VALUES
Urhobo	Male	2 ND	+0.213	0.000
		4 TH	+0.342	0.000
	Female	2 ND	+0.211	0.000
		4 TH	+0.302	0.000
Ndakwa	Male	2 ND	+0.271	0.000
		4 TH	+0.144	0.002
	Female	2 ND	+0.172	0.000
		4 TH	+0.123	0.000
Ijaw	Male	2 ND	+0.321	0.000
		4 TH	+0.390	0.000
	Female	2 ND	+0.231	0.000
		4 TH	+0.189	0.000

Table 7: Showing the individual sex correlation coefficient for the two fingers in each ethnic group. Significant at p<0.01.

Ethnic group	Finger length (X)	Regression -Constants (a)	Regrssion Coefficients (b)
Urhobo	2 nd	85.278	10.926
	4 th	81.726	11.202
Ndakwa	2 nd	97.461	9.595
	4 th	164.272	0.185
Ijaw	2 nd	81.870	11.416
	4 th	78.588	11.659

Table 8: Showing the gender combined regression constants "a" and regression coefficient "b" from where the regression equations were generated for the different ethnic groups after a regression analysis.

Simple Linear Regression formulae	Ethnic Group	Finger	Equations
$Y = a + Bx$	Urhobo	2 nd	$Y1 = 85.278 + 10.926X1$
		4 th	$Y2 = 81.726 + 11.202X2$
$Y = a + Bx$	Ndokwa	2 nd	$Y1 = 97.461 + 9.595X1$
		4 th	$Y2 = 164.272 + 0.185X2$
$Y = a + Bx$	Ijaw	2 nd	$Y1 = 81.870 + 11.416X1$
		4 th	$Y2 = 78.588 + 11.659X2$

Table 9: Showing common regression analysis for each ethnic group from the second and fourth fingers.

Ethnic group	Finger	Male	Female	%	%
Urhobo	2 nd	170.27	158.41	99.98	99.96
	4 th	170.24	158.48	99.96	100.00
Ndokwa	2 nd	170.06	161.48	99.96	100.24
	4 th	170.11	161.02	99.99	99.95
Ijaw	2 nd	170.49	158.93	100.01	100.05
	4 th	170.59	158.97	100.07	100.08

Table 10: Showing the percentage predictive values of each finger in the three ethnic groups.

Discussion

This study was embarked upon to establish adult stature variation among three different ethnic groups in Nigeria, to establish possible estimation of stature using the second and the fourth finger length among the three ethnic groups as well as establish and derive correlation equations for each ethnic group and test the existence of sexual dimorphism in the length of the second and fourth fingers.

From the study, it was observed that there was a difference in adult male and female stature within and across the three ethnic groups – Ndokwa, Urhobo, and Ijaws. The maximum height measurement of 192 cm was recorded from the

male of the Urhobo ethnic while the minimum measurement of 137cm was recorded from the Urhobo and Ijaw (table 3). The males were found to be averagely taller with values ranging from $170.12 \pm 8.54\text{cm}$ to $170.47 \pm 7.58\text{cm}$ while that of the females ranged from 158.48cm to $161.10 \pm 6.85\text{cm}$ across the three ethnic groups (Table 3). This difference was found to be statistically significant and is similar to the findings in a study carried out among the three major ethnic groups in Nigeria by Numan et al., (2013)¹² and that of the study done by Eboh and Igbigbi, (2017)¹³ on stature estimation from cephalometric parameters of young adults in five ethnic groups in Nigeria in which the males were found to be have higher mean stature than females with statistical

significance across the ethnicities in both studies. This difference between male and female height is explainable according to Yamada et al., (1981)¹¹ by the association of the Y chromosome with stature and the age of puberty being two years later in males, giving extra growth time in males. Other studies reporting similar findings between males and females include – Didia et al., 2009; Damborno et al., 2009; Egwu et al., 2012; Ilayperuma et al., 2009; Ebite et al., 2008; Anderson, et al., 1997.¹⁴⁻¹⁹ Comparing the groups, the Ijaw males were observed to be averagely tallest with a mean height of $170.47 \pm 7.58\text{cm}$, followed by the Urhobos with a mean height of $170.30 \pm 6.94\text{cm}$, and then the Ndokwas $170.12 \pm 8.54\text{cm}$ however, Ndokwa females were tallest with a mean height of 161.10cm , followed by the Ijaws with a mean height of $158.85 \pm 6.66\text{cm}$ then the Urhobos with female mean height of $158.48 \pm 6.65\text{cm}$. The Ijaws and the Urhobos were found to share similarities in height characteristics to the Ndokwas, which could be due to their nearness in geographical location. This agrees with findings in the study by Eboh and Ighigbi, (2017)¹³ which showed that only a slight difference in stature existed among the Ikweres, Izon, Benin Ndokwa, and Binis, a feature they attributed to nearness in geographic location of the five ethnic groups. The difference in height between genders was found to be statistically significant across the ethnic groups. The possible explanation of the above findings in this study is further portrayed in the light of the study by Numan et al., (2013)¹², in which Hausas were found to be tallest with longer hands than the Igbos and the Yorubas. There was a statistically significant difference in stature between the Hausas and the Yorubas but not between the Ibos and the Yorubas. The Ibo females were found to be tallest while the Hausa females were taller than the Yorubas though with no statistical difference between the Ibos and Hausas as well as between the Hausas and Yorubas. The stature difference across ethnicities according to Rastogi et al., 2008, 5 has been established to possibly be due to genetic, environmental, and nutritional factors. The findings of males being taller than females across the three ethnicities are also in tandem with

findings in the studies by Kachan and Krishan 2011.²⁰

This study (table 4), has also revealed a second finger length ranging from 8.95cm to 5.34cm in males and 8.99cm to 5.57 cm in females, while the fourth finger ranges from 9.32cm to 5.88cm in males and 8.73cm to 5.57cm in females across gender in the three ethnic groups. The highest mean second finger length was recorded among the Ijaw males ($7.50 \pm 0.54\text{cm}$) while the highest mean fourth finger length was recorded among the Ndokwa males ($8.32 \pm 0.43\text{cm}$). Thus, the males were generally found in this study, to have longer fourth finger length than the second. The second to fourth finger ratios were similar in males and females across the three ethnicities (0.97 and 0.98) except for the Ndokwa males who had a more masculine ratio of 0.87. The observed difference in second to fourth finger length was found to be statistically significant between both genders across and within each ethnic group except among the Ijaws. This finding which agrees with those of Ibegu et al., 2012;²¹ Oladipo et al., 2009²² who reported a smaller second-to-fourth finger ratio in males than females, showing that the second and fourth fingers exhibit sexual dimorphism which is in tandem with the findings of Oladipo et. al., 2017.²³ This sexually dimorphic feature according to McIntyre, 2006²⁴ has been discovered to be due to the existence of a direct relation between the ratio of the second and the fourth finger length and the level of testosterone that a baby was exposed to in-utero. Hence, the higher the level of testosterone exposure in utero, the smaller the second finger length in comparison with the fourth finger (Wilson, 1983).²⁵ The values in those similar studies done in Nigeria are not exactly the same though but similar.

Several studies in the past have established a clear relationship between the individual height and various long bones like metatarsals (Bidmos, 2008)²⁶, phalanges (Hossain et al., 2010)²⁷ and in a bid to establish new parameters, various other body parts have been used such as the skull, the teeth, the vertebrae (Amit et. al., 2014)²⁸ but for

short bones which become very relevant in the case of severely mutilated individual remains, few studies have been done establishing same. The study has in line with the above studies, proven such a relationship by a positive correlation coefficient so far generated from the second and the fourth finger lengths.

Comparing the males to females across the three ethnic groups, this study has established that the predictive value of the second and fourth fingers are higher in the males than in females across the three ethnic groups and this finding is in agreement several other studies including that of the study by Oladipo et. al., 2015 (28) who concluded that among the Annangs, the predictive value of the right foot, right second and fourth finger was higher in males than the females.

Conclusion

From the above study, it could be concluded that the second and fourth fingers are reliable parameters for the estimation of stature. Though the second and fourth fingers are reliable parameters in stature estimation, the fourth finger is more reliable. In the estimation of stature, ethnicity plays a role in the distribution and estimation, hence the need for specific regression equations for different ethnic groups. Thus, finger length can be successfully relied upon by forensic experts in human identification.

References

1. Ishak NI, Henry N, Franklin D (2012). Estimation of stature from hand and handprint dimensions in a Western Australian population. *Forensic Science International*. 216(1-3):199.1-7. doi: <https://doi.org/10.1016/j.forsciint.2011.09.010>
2. Enaohwo and Igbigbi, P.S. (2006). [Cephalix index in Ovu community of Delta State](#). *Abstract of Anat. Soc. Nigeria*. 3:26.
3. Enaohwo M and Okoro G. (2018). [Anthropometric study of the frontal sinus on plain radiographs in Delta State University Teaching Hospital](#). *Journal of Experimental and Clinical Anatomy*. 17(2):49-51.
4. Esinulo Ogechi Peace, Anibor Ese, Enaohwo Mamerhi Taniyohwo. (2022). [The Variations of Auricular Tubercle among Ika People in Delta State, Nigeria](#). *IJO-International Journal of Health Sciences and Nursing*. 5(9):1-9. <http://ijo-journals.com/index.php/hsn/article/view/586>
5. Rastogi P, Nagesh KR, Yoganarasimha K (2008). Estimation of stature from hand dimensions of North and South Indians. *Legal Medicine*. 10:185-189. doi: <https://doi.org/10.1016/j.legalmed.2008.01.001>
6. Udi OA, Okoro OG, Enaohwo TM, Douglas B. (2023). Nutritional knowledge and body mass index among students at Novena University, Ogume, Nigeria. *Folia Medical Indonesiana*. 59(1):1-6. doi: <http://dx.doi.org/10.20473/fmi.v59i1.39977>
7. Tyagi AK, Kohli A, Verma SK, Aggarwal BB (1999). Correlation between stature and finger length. *International Journal of Medical Toxicology Legal Medicine*. 1:20-2. <https://www.indianjournals.com/ijor.aspx?target=ijor:ijmtlm&volume=1&issue=2&article=006>
8. Lalit K., Sandeep A., Rajesh G., Amit P., (2014). Correlation between the index finger Stature in Uttarakhand Population. *Anthropologist*. 17(3):1007-1009; doi: <http://dx.doi.org/10.1080/09720073.2014.11891481>
9. Oladunni AE, Ogheneyeborue GO, Joyce Elkubor. (2021). [Radiological assessment of age from epiphyseal fusion at the wrist and ankle in Southern Nigeria](#). *Forensic Science International: Reports*. 3:1-4. doi: <https://doi.org/10.1016/j.fsir.2020.100164>
10. World Medical Association (2013). "Declaration of Helsinki: Ethical Principles for Research Involving Human Subjects". *Journal of American Medical Association*.

- Association, 310 (20): 2191-2194; <https://doi.org/10.1001/jama.2013.281053>
11. Yamada K., Ohta M., Yoshimura K., Hasekura H. (1981). A possible association of Y chromosome heterochromatin with stature. *Hum Genet.* 58:268-270; <https://doi.org/10.1007/bf00294920>
 12. Numan A. I, Idris M. O, Zirahei J. V, Amaza D. S, Dalori M. B. (2013). Prediction of stature from hand anthropometry: A comparative study in three ethnic group in Nigeria. *British Journal of Medicine & Medical Research.* 3(4): 1062-1073.
 13. Eboh D. E., Igbibi P. S., (2017). Stature estimation from the cephalometric parameters of young adults in five Nigerian ethnic groups. (2017). *Italian Journal of Anatomy and Embryology.* 22(2):98-109; <https://oajournals.fupress.net/index.php/ijae/article/view/1594>
 14. Didia B. C., Ethelbert C. N., Okechukwu A., (2009). Stature estimation formulae for Nigerians. 54(1):20-1; doi: <https://doi.org/10.1111/j.1556-4029.2008.00915.x>
 15. Danborno, B., Adebisi, S.S., Adelaiye, A.B. and Ojo, S.A. (2010). Relationship between finger ratio (2D:4D) and birth weight in Nigerians. *Anthropologist* 12: 127-130. doi: <https://doi.org/10.1080/09720073.2010.11891142>
 16. Egwu J., Ikechukwu A. C, Chinedu A. F, Emeka A. G, Kingsely O. C, Chinedu U. G., (2014). Stature estimation using right fingers and palm length in Igbo population, Nigeria. *Annals Bioanthropology.* 2:23-8. doi: <https://doi.org/10.4103/2315-7992.143405>
 17. Ilayperuma I, Nanayakkara G, Palahepitiya N. (2009). The prediction of stature based on hand length. *Galle. Med.* J. 14:15-18; doi: <https://doi.org/10.4038/gmj.v14i1.1165>
 18. Ebite LE, Ozoko TC, Eweke AO, Otuagu PO, Oni AO, Om Iniabohs FAE, (2008). Height: Ulna ratio: A method of stature estimation in a rural community in Edo State, Nigeria. *Internet Journal of Forensic Science.* 3 (1); <https://ispub.com/IJFS/3/1/10500>
 19. Anderson, W. W., Ayala, F. J., Michod R. E. (1977). Chromosomal and allozymic diagnosis of three species of *Drosophila*, *Drosophila pseudoobscura*, *Drosophilapersimilis* and *Drosophila Miranda*. *J. Hered.* 68(2):71-74; doi: <https://doi.org/10.1093/oxfordjournals.jhered.a108793>
 20. Kachan T, Krishan K (2011). Anthropometry of hand in sex determination of dismembered remains - a review of literature. *Journal of Forensic and Legal Medicine.* 18(1):14-7; doi: <https://doi.org/10.1016/j.jflm.2010.11.013>
 21. Ibegbu A.O., Danjuma Z.C., Hamman W.O., Umana U.E., Ikyembe D.T., et. al., (2012). Anthropometric Study of the Index (2nd) and Ring (4th) Fingers in Ebira Ethnic Group of Nigeria. *Asian Journal of Medical Sciences* 4(2): 79-84;
 22. Oladipo S. G., Fawehinmi H. B., Ezon-Ebidor E., Osunwoke A. E., Ordu K. S., (2009). Second to fourth finger ratio in Nigerian Igbos and Yorubas. *Science Research Essays* 4:1146-8. <https://academicjournals.org/journal/SRE/article-full-text-pdf/C7C977418673>
 23. Oladipo G. S., Anugweje K. C., Jervas K., Amasiatu V. C., Ipigansi U. N., Enefe G., (2017). Second digit length, fourth digit length and second to fourth digit ratio (2D:4D): Relevance in choice of male footballer athletes and female no footballer athletes. *Anthropology.* 2(1):23-28.
 24. McIntyre, M. H, (2006). The use of digit ratios as markers for perinatal androgen

- action. *Reproductive Biological Endocrinology*. 4:10; doi: <https://doi.org/10.1186%2F1477-7827-4-10>
25. Wilson G. D., (1983). Finger Length as an index of assertiveness in Women. Personality and individual differences. 4:111-112.
26. Bidmos MA (2008). Estimation of fragmentary femora in indigenous South Africans. *International Journal of Legal Medicine*. 122:293-99; doi: <https://doi.org/10.1007/s00414-007-0206-2>
27. Hossain S, Begun JA, Banu LA, Rahman F, Akhter Z (2010). Prediction of stature from hand length and breadth -An Anthropometric study on Christian Gara tribal Bangladeshi females. *Bangladesh Journal of Anatomy*. 8(1):21-27.
28. Amit G., Kiran K., Devi C. S., Vijay W., Anshi J., Kayen S. K., (2014). Stature and gender determination using odontometry and skull anthropometry. *Journal of Forensic Dental Science* 6 (2):101-106.doi: <https://doi.org/10.4103%2F0975-1475.132536>

How to cite this Article: Ijeomah Trust Azubike, Patrick S. Igbigbi; [Stature Estimation among three Ethnic Groups in Delta State of Nigeria using the Second and Fourth Finger Lengths](#); Int. Res. Med. Health Sci., 2023; (6-4): 1-11; doi: <https://doi.org/10.36437/irmhs.2023.6.4.A>

Source of Support: Nil, **Conflict of Interest:** None declared.

Received: 04-07-2023; **Revision:** 27-8-2023; **Accepted:** 2-09-2023