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Anthropometric Study of the Index (2nd) and Ring (4th) Digits in the Igala Ethnic Group of Nigeria

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ABSTRACT

The anthropometric study of the index and ring fingers of the Igala ethnic group of Nigeria was carried out to determine the values of the 2nd and 4th digit ratios and to see their correlation with other anthropometric variables. Six hundred and two adolescents secondary school students between the ages of 13-19 years were recruited in this study, three hundred and twenty-two were females and two hundred and eighty were males. The index (2nd) and ring (4th) digits length were measured using a Vernier caliper, the height and the weight were also measured. The 2D:4D were determined for each subject while the height and weight were used to calculate the BMI. The result showed significant difference ($p < 0.05$) in 2D:4D between males and females. The male subjects had longer fourth (4D) and shorter second (2D) digits length with lower digit ratio while the female subjects had shorter fourth (4D) and longer second (2D) digits length with higher digit ratio. The result confirms that digit ratio is sexually dimorphic and there was a positive correlation between height, weight, and BMI with digit lengths in both males and females but the 2D:4D had no relationship to height, weight or BMI.

Keywords: 2D:4D digit ratios, finger, Igala tribe, height, weight

INTRODUCTION

2D:4D refers to the ratio between length of the 2nd (index finger) and the 4th (ring finger) which varies due to exposure to androgen and it is measured from the midpoint of the bottom crease where the fingers join the hands to the tip of the fingers¹. This ratio is calculated by dividing the length of the index finger of a given hand by that of the ring finger of the same hand, it is sexually dimorphic, as it has a lower value in males as compared to females^{2,3} with a normal range of 0.947 ± 0.029 in males, and 0.965 ± 0.026 in females⁴. It has been suggested that 2D:4D is affected by exposure to androgens such as testosterone, as a study conducted using mice showed that Mice with higher testosterone and low estrogen levels had more male-like digits (low 2D:4D ratio), while mice with higher estrogen levels or low testosterone levels had higher, more feminine digits ratios, that is high 2D:4D^{5,6}. It is the most strongly dimorphic of all the human digit ratios combinations⁷ the differences in the finger length ratio is said to reflect the influence of prenatal testosterone during development^{8,9}. The second is that allelic variation in androgen receptor sensitivity influences digit ratio, most masculine finger ratios are associated with androgen receptor alleles with fewer CAG base pair microsatellite repeats in the terminal domain¹⁰. Children with congenital adrenal hyperplasia (CAH) tends to show masculine or lower digit ratio due to increased exposure to levels of androgens from early gestation to neonatal period¹¹ whereas children with

Klinefelter's syndrome, depicts higher or feminine digit ratios, which is attributed to a low testosterone exposure^{12,13}. When the mother is involve in smoking during pregnancy, it elevates the prenatal testosterone and in turn is associated to low or masculine 2D:4D ratios in children¹⁴. Both male and female with high level of developmental androgen, depicts more masculine finger length ratios than control^{15,16}. Digit ratio has continuously shown more dimorphism on the right hand than the left in humans¹⁷. When both right and left and digit ratios were used to investigate the relationships between digit ratio and psychological factors, stronger effects were observed on the right hand as compared to left^{18,19}. Men with smaller 2D:4D ratios are perceived as being more masculine and dominant by female observers²⁰. More significant correlations have been found between more masculine (small) digit ratios and achievement, ability, and speed in a variety of sports and visual spatial ability^{21,22}. Most male- like digit ratios have been observed to be associated to deleterious traits such as increased rates of autism, immune deficiency and reduced verbal fluency⁹. Cognitive or personality traits are also associated with digit ratio, as men tend to be more aggressive than women²³.

MATERIALS AND METHODS

Subjects: The population of study consists of students of Our Lady Secondary School Anyigba, they were from Ankpa, Dekina, Idah, Ibaji, Igalamela, Olamaboro, Ofu, and Omala Local Government Area of Kogi State-

Nigeria. The study was carried out on a cross sectional sample of 602 adolescent students, two hundred and eighty-eight (288) of the correspondents were males while three hundred and two (302) of the correspondents were females. Data on age, sex, ethnic background were collected as primary data through oral interview and structured questionnaire while anthropometric measurements were collected as the secondary data.

Sample size and sample techniques: A total of 602 Igala adolescents of age between 13 to 19 years were used for the study. The subjects were selected at random and were purely Igalas by both parents and grandparents. The length of the second digits (2D) and fourth digits (4D) of the left and right hand of each subject were measured using a Vernier caliper from the tip of the digit to the basal crease. Subjects with hand injuries or deformities were excluded from the study.

Instrumental design: The instrument used for the study was a structured questionnaire titled "Questionnaire on Anthropometric Study of the Index (2nd) and Ring (4th) Digits in Igala Ethnic Group of Nigeria" which was developed on the basis of Manning *et al.*⁵. The questionnaire has two sections. Section one is made up of personal demographic information, while section two had questions on anthropometric measurements.

Method of validation of instrument: Three parameters were mainly investigated, which includes height, weight and length of the index and ring fingers. Careful and appropriate steps were taken to protect the right of the respondents.

Sample/ statistical analysis: Data was expressed Mean $\pm$ Standard deviation ($\pm$ SD). Descriptive statistics and students T'- test were used to analyze and determine the studied parameters in both males and females. The relationship of the studied parameters was established using Pearson's correlation to establish the strength of the relationship between the lengths of the second and fourth digits. P value less than or equal to 0.05 was deemed significant.

RESULTS

The result of the Anthropometric study of the differences in index finger (2D), ring finger (4D) and their ratio shows there was a significant difference between the lengths of the index finger, ring finger and the ratios of 2D:4D in both males and females. The mean values in males are 5.85 cm, 6.44 cm, and 0.92 while in females 6.99cm, 6.89cm and 1.01. The difference in the mean values of the length of the index finger (2D), ring finger (4D) and 2D:4D between the males and females of the Igala ethnic group are statistically significant ($p < 0.01$) as shown in Table 2. Also Table 3 shows the correlation matrix between second digit length, fourth digit length and 2D:4D bilaterally in males and females.

Table 1: General statistics of the anthropometric parameters used

Parameter	Males (n=280) Mean $\pm$ SD	Min-Max	Females (n=322) Mean $\pm$ SD	Min-Max	t	P
Height (cm)	146.72 $\pm$ 11.85	120.00-170.00	152.13 $\pm$ 8.13	125.00-175.00	6.61	0.001
Weight (kg)	46.58 $\pm$ 7.23	26.00-70.00	53.85 $\pm$ 7.17	29.00-89.00	12.36	0.001
BMI (kg/m ²)	21.74 $\pm$ 3.38	12.8-38.9	23.37 $\pm$ 3.58	13.00-37.00	5.71	0.001

Table 2: 2D, 4D lengths and 2D:4D ratio in males and females

Parameter	Males (n=280) Mean $\pm$ SD	Min-Max	Females (n=322) Mean $\pm$ SD	Min-Max	T	P
Right 2D (cm)	5.85 $\pm$ 0.73	5.00-8.80	6.99 $\pm$ 0.72	5.00-8.80	19.31	<0.001
Right 4D(cm)	6.34 $\pm$ 0.68	5.00-8.60	6.91 $\pm$ 0.55	5.60-8.60	11.38	<0.001
Left 2D(cm)	5.81 $\pm$ 0.74	5.00-8.20	6.79 $\pm$ 0.65	5.00-8.00	17.31	< 0.001
Left 4D(cm)	6.44 $\pm$ 0.64	5.10-8.50	6.89 $\pm$ 0.63	0.72-8.50	8.54	< 0.001
Right2D:4D	0.92 $\pm$ 0.04	0.85-1.05	1.01 $\pm$ 0.08	0.86-1.30	17.44	<0.001
Left 2D:4D	0.90 $\pm$ 0.04	0.80-1.00	0.97 $\pm$ 0.06	0.77-0.97	17.56	<0.001

Table 3: Correlation matrix of 2D, 4D and 2D:4D with anthropometric variables

Parameter	Female		Male	
	Right	Left	Right	Left
2D				
Height	0.25***	0.31***	0.003*	0.243**
Weight	0.41***	0.36***	0.405	0.130*
BMI	0.18**	0.100	0.030	-0.134**
4D				
Height	0.14*	0.124*	-0.021**	0.242**
Weight	0.07	0.014	0.014	0.131*
BMI	-0.05	-0.073	0.040	-0.131*
2D:4D				
Height	0.19***	0.005	0.017	0.164**
Weight	0.45***	-0.011	-0.008	0.075
BMI	0.26***	0.008	-0.034	-0.104

***. Correlation is significant at the 0.001 level (2-tailed), ** Correlation is significant at 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The determination of digit length (2D:4D) was done in a cross section of adolescents from the Igala ethnic group, and the results were compared between males and females. Previous studies in this field have shown that digit ratio values are reliable in determining sexual dimorphism and it has been demonstrated that a considerable proportion of normal males have low digit ratio has compared to females¹⁵. This study was designed to establish a relationship between male and female digit ratios (2D:4D) and to see if it has any relationship with height, weight and BMI. The result from this study has shown that there is a relationship between 2D:4D in males and females of the Igala ethnic group of Nigeria.

Manning *et al* showed a longer index finger length than that of the ring finger in females while males had a longer ring finger length and a shorter index finger⁵. This accounted for the higher digit ratio seen in females than in males. It was observed in the present studies that females have longer digit length than males, which is common when compared to other studies²⁴.

It was observed from this study that second digit length in Igala adolescent males was shorter than the fourth digit length which showed significant difference when compared with that of the females. This is in agreement with the reports of George and Manning *et al*. their reports showed that second digit in males tends to be shorter than fourth digit²⁵. The digit length is influenced by testosterone and estrogen, as testosterone tends to reduce 2D:4D by reducing the length of the second digit, while estrogen increases 2D:4D by enhancing the length of the second digit^{26, 27, 28}. In the present study, it was observed that 2D:4D is sexually dimorphic with females having higher digit ratios compared to males and this is due to the fact that the estrogen in females

enhances the length of the second digit giving them a higher digit ratio while the testosterone in the males reduces the length of the second digit, giving the males a lower digit ratio. This is in agreement with earlier reports by Manning *et al*. and Oladipo *et al*.^{10,29}.

Nigeria ethnic groups have shown variation in the distribution of digit ratio. Males have shorter digit ratio than the females among the Igbos and Urhobos²⁹, males have shorter digit ratio than the females among the Ikwerres and Andonis²⁹ and also among the Ebiras³⁰. The present study of the Igala ethnic group shows that males have lower digit ratios than the females, this agrees with report from other ethnic groups though the value for the ratios are not the same.

The result showed that there was a positive correlation between R2D:4D with height, weight and BMI in females which agree with the report of Meera *et al*. but this disagrees with the report of Manning *et al* which reported that there was no significant correlation between height and weight and digit ratios for 69 men and 62 women with the exception of positive correlation between the weight and 2D:4D of the right hands³¹. The result also showed a significant correlation between digit lengths and height bilaterally in both males and females. This agrees with the study of Meera *et al* but is not in agreement with the report of Ibegbu *et al*^{30,31}.

CONCLUSION

The 2D:4D in females was greater than that in males. There was a positive correlation between second and fourth digit length and height in males and females bilaterally. The result showed no positive correlation between the 2D:4D, height, weight and BMI of the study population. Results from the present study indicate that 2D and 4D lengths is a proxy indicator of height when it is difficult to measure height directly.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest

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