



FACTORS INFLUENCING *MORPHOGENIC VARIATIONS* IN 2D:4DRATIO AMONG THE THREE MAJOR NIGERIAN ETHNIC GROUPS (HAUSA, IGBO AND YORUBA) RESIDING IN JOS

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Abstract

Objective; This study was conducted to appraise the values of the 2D and 4D digit ratios and correlate them with other anthropometric variables and see what factors are responsible for their variations. The anthropometric study of the index (2D) and Ring (4D) digit of Hausa, Yoruba, and Igbo who resides in Jos was carried out.

Materials and Methods. A cross-section descriptive survey design was used to select three hundred participant from each tribe. They were randomly selected, excluding those with finger deformities. Fifty males and fifty females were selected from each of the three ethnic groups. The index 2D and ring 4D digits were measured from the basal crease to the tip using a vernier calliper, and the height and weight were measured. A questionnaire was designed by the researcher, administered, and retrieved. The data gathered was organized and presented using a descriptive statistical method. Frequency distribution table with results presented in percentages were used for the data analysis. The result showed that morphogenic variation in 2D:4D ratios is sexually dimorphic in the three tribes, males demonstrated lower digit ratio. It might also be influenced by hormones testosterone and estrogens in males and females respectively, other factors are ethnicity, height, age, and weight.

Results; Findings reveals, the Igbo ethnic group seems to have high 2D 4D ratio than the Hausa and Yoruba Ethnic group while the Hausa 2D 4D ratio is higher than the Yoruba. Environmental factors has little or no significant influence on the 2D 4D digit ratio.

Conclusion; The digit ratio amongst Hausa, Yoruba, and Igbo is sexually dimorphic and might not necessarily be affected by tribes or ethnicity.

Keyword; morphogenic variations, 2d:4d, ethnic groups, Anthropometry

Introduction

The variations within the Nigerian population provide a unique opportunity to study the morphogenic variations among the endogenous subpopulation consisting of different tribes, languages, and religious beliefs living within the different geographical locations. This sub-population offers

the opportunity to study the anthropometrical digits variations amongst these groups and tribes (Oladipo et al. 2009).

Literature suggests that the ratio of body proportion between men and women is different. McIntyre (2003) posits that that there are differences between the index fingers and the fingers between sexes. Research has shown that there is a direct

relationship between the index finger and the ring finger's length ratio and the amount of testosterone that a baby is exposed to during pregnancy (McIntyre, 2006). Higher testosterone levels are associated with smaller index fingers if compared with the ring finger (Walsh, 2010). In a study conducted by (Manning, et al. 2003) they reported that the smaller index finger in men has been associated with higher aggression in men throughout their life. However, this association was only applicable in physical aggression and not in verbal aggression or other types of hostile behavior (Wilson: 2010).

In human anatomy, digit ratio, 2D:4D (Index finger: Ring finger) is a sexually dimorphic trait. The ratio between the length of the index and the ring digit (2D:4D) may correlate with in-utero testosterone levels because it is sexually dimorphic with males having an average longer 4th digit relative to their 2nd digit showing a low 2D:4D ratio than females who have an average 2D:4D ratio. The relative length of the digits is set before birth and probably by 14th weeks of pregnancy (Manning and Taylor, 2001).

The sex differences in 2D:4D ratios is present before birth in human, which rule out any social influences that might affect digit growth differentially in the two sexes. Anatomically, the ring finger is the 4th digit of the human hand and 2nd most ulnar finger located between the middle finger and the little finger (Fink et al., 2004). While the index finger also referred to as five fingers, is the first finger and the 2nd digit of the human hand. It is located between the thumb and the middle finger.

The relative length of the second and fourth fingers has been proposed to indicate prenatal Sex hormones exposure (Manning, Salth, Wilson, and Lewis-Tones: 1998). The ratio is sexually dimorphic, this is because males typically display relatively longer ring fingers. This might be explained by finger and genital development both being controlled by HOXA and HOXD genes. Evidence for the efficacy of digit ratio as a proxy indication of the prenatal environment comes from (Lutchmaya, et al., (2004). who reported that the ratio of testosterone to estradiol observed through amniocentesis was associated with subsequent 2D:4D. In a recent study, Zheng and Cohn (2011) demonstrated that directly manipulating testosterone and estrogen level during gestation could alter the digit ratios of mice in a predictable manner.

The 2D:4D ratio has been shown to correlate with a considerable number of variables ranging from athletic performance to musical ability and susceptibility to disease (Manning, 2003). Some researchers suggest that 2D:4D is related to certain aspect of personality. For instance, when investigating associations with the Big Five, Voracek (2009) found that 2D:4D correlated positively with extraversion and negatively with openness to experience. Voracek (2009) further observed that 2D:4D in males was positively associated with beliefs in superstitions and the paranormal, and suggested that the findings may relate to schizotypy

Materials and methods

Study design and setting; A cross-sectional descriptive survey design was used in this study.

The study was carried out within Jos North Local Government Area of Plateau State. Jos is a city in the North Central region of Nigeria. The city has a population of about 900, 000 according to the last National Population Census conducted in 2006. Jos is the administrative headquarters of Plateau State, it is a cosmopolitan city and has many other tribes or ethnic groups apart from the three major Nigeria ethnic groups, among them are the Afizere, Anaguta, Berom, Mwaghavul, Ngas, Tarok, just to mention a few. In Jos Areas dominated by these 3 major tribes for decades were visited, such areas include:

Yoruba tribe: they are found to dominate areas like Rikos, AngwanRukuba, and NasarawaGwom.

Hausa tribe: they are mostly found around Bauchi Road, Angwan-Rogo, Angwan-Rimi, Gangare, and Dilimi.

Igbo tribe: they are found around Appata, Katako, and other business areas within the city of Jos. These areas were visited and the subjects randomly picked with regard to the inclusion and exclusion criteria. Sex difference was also considered.

Study population

The population of study was recruited from the three major ethnic groups (Hausa, Yoruba, and Igbo) of Nigeria, who are residing in Jos because Jos is a cosmopolitan melting pot of all Nigerian Languages subjects were traced to their 3rd generation before inclusion. Detail explanation as regards the process was given to the participants; participation was voluntary, with no cost to the subject and no consequences if one decided not to participate. Those who agreed to participate were expected to sign the consent form provided.

The information obtained during this exercise was kept with utmost confidentiality and would be for the purpose of research only.

Inclusion and exclusion criteria; Males or females within the age of 18 – 70 years were eligible to participate in this exercise their generation were traced to belong to either Hausa, Yoruba or Igbo who are residence of Jos. Members of the population who have deformed or curved digits especially 2D:4D and those who have had broken 2D:4D finger were excluded, those with long nails were advised to cut them low to avoid interfering with the measurement or remained excluded from participating in the exercise.

Sample size determination

The sample size of this study was determined using the Golden 2004 formula to calculate the sample size. The sample 300 subjects were randomly picked from each of Hausa, Yoruba, and Igbo.

Data collection instrument; The instrument used for data collection was a structured questionnaire. Titled: Questionnaire on anthropometric study of index (2nd) and ring (4th) digits among Hausa, Igbo, and Yoruba ethnic nationality residing in Jos. The questionnaire consisted of both open and closed-ended questions. It was divided into four (4) parts:

socio-demographic data, anthropometric Information's, anthropometric Measurement, and the relationship between 2D:4D ratio and social preferences.

Validity and reliability of the instrument

Content validity of the instrument was determined by the project supervisor who took his time to study the questionnaire, the objectives of the study, and the research questions to assess the relevance of the content, clarity of statements, and the logical or accuracy of the instrument. The expert opinion from him was used to effect changes in the questionnaire before administering to the subjects. A pilot test was carried out using 10% of the estimated sample size from the College of Nursing and Midwifery Jos, 30 students were selected from each of the ethnic groups under study who were not part of the study. The study employed test re-test and Cronbach's alpha reliability statistics to ascertain the reliability of the instrument with a reliability coefficient of 0.85 achieved.

Data collection procedure

The services of three research assistance were employed, they were lectures from the College of Nursing and Midwifery Jos. They were trained on the procedure of taking the anthropometric measurement, the content of the questionnaire and how to administered it, their ability to explain what they were thought showed that they understood the procedure.

The administration of the questionnaire and the measurements were carried out simultaneously within three weeks in different locations. The researcher and the assistants introduced themselves to the respondents at each location. The researcher presented a students' ID card to further convince the respondents that the excise was purely for academic purpose. Inform consent forms was given to each participant for their signature indicating their wiliness to participate in the exercise. They were instructed to read the content carefully and respond to each item accordingly. Those who could not read and write were assisted by the research assistants.

Ethical consideration

An introductory letter from the Department of human anatomy, Faculty of Medical Sciences University of Jos, was given to the subjects with a consent form, those who were willing to participate in the exercise signed the consent form before anthropometric measurement was done and questionnaire administered.

METHOD OF DATA ANALYSIS

Descriptive statistic which includes frequency, percentage, mean, and standard deviation were used to present the data. The analysis was performed using statistical package for social science version 170 computer software program.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the data obtained from the administration of the research instruments used to collate data for the study and the results are presented in tables according

to the objectives and research questions. The first part of the chapter presents the result of the data analyzed while the second part discusses the results based on the findings.

<i>Socio-Demographic Data</i>			
S/n	Description	Frequency	Percentage
1	Sex		
	Male	153	51
	Female	147	49
2	Marital Status		66
	Married	198	30.3
	Single	91	3.7
	Separated	11	
3	Educational Qualifications	5	1.7
	Primary	57	19
	Secondary	238	79.3
	Tertiary		
4	Religion		
	Christianity	179	59.7
	Islam	121	40.3
5	Ethnicity		
	Hausa	100	33.3
	Yoruba	100	33.3
	Igbo	100	33.3

N = 300

Table 1 presents the data on the socio-demographic profile of the respondents. There are 153 males and 147 female respondents. The married respondents are 198, the singles are 91 while those that are separated are 11. The educational qualifications of the respondents are primary, secondary, and tertiary education certificate holders accounting for 5, 57, and 238 respectively. The size of respondents that are Christians are 179 while those who practice Islam are 121. The three ethnic groups that responded to the instrument are Hausa, Yoruba, and Igbo with a sample size of 100 people from each of the three tribes.

Anthropometric mean measurement for all the three ethnic groups

S/n	Item Description	Mean	Standard Deviation
1	Left 2D	6.99	1.09
2	Left 4D	7.00	1.18
3	Right 2D	6.98	1.09
4	Right 4D	6.98	1.17
5	Height	54.57	13.19

6	Weight	52.24	14.56
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N=300

Table 2 shows the data on the anthropometric mean measurement for all the three ethnic groups of Hausa, Yoruba, and Igbo resident in Jos North Local government area of Plateau State. The mean measurement for left 2D is 6.99 inches, for the Left 4D is 7.00 inches, Right 2D and 4D are both 6.98 inches each while mean height and weight are 54.57 inches and 52.24 kilograms respectively.

Table 3: Anthropometric Mean Measurement for each of the three ethnic groups

S/no	Description	Hausa Mean	Yoruba Mean	Igbo Mean
1	Left 2D	6.856	6.640	7.500
2	Left 4D	6.866	6.638	7.518
3	Right 2D	6.807	6.633	7.499

4	Right 4D	6.866	6.642	7.447
5	Height	52.38	51.64	59.70
6	Weight	51.15	50.54	55.04

N=100 for each ethnic group

Table 3 presents the data on the anthropometric mean measurement for each of the three ethnic groups Hausa, Yoruba, and Igbo. The mean measurement of Left 2D for each of Hausa, Yoruba, and Igbo are 6.856, 6.640, and 7.500 inches respectively. The mean measurement of Left 4D for each of Hausa, Yoruba, and Igbo are 6.866, 6.638, and 7.518 inches respectively. The mean measurement of Right 2D for each of Hausa, Yoruba, and Igbo are 6.807, 6.633, and 7.499 inches respectively. The mean measurement of Right 4D for each of Hausa, Yoruba, and Igbo are 6.866, 6.642, and 7.447 inches respectively. The mean height for Hausas, Yorubas, and Igbos are 52.38, 51.64, and 59.70 inches respectively while the mean weight for each of the ethnic group is 51.15, 50.54, and 55.04 kilograms respectively.

Anthropometric mean measurement for each of the three ethnic groups according to gender

S/no	Description	Hausa Male Mean	Hausa Female Mean	Yoruba Male Mean	Yoruba Female Mean	Igbo Male Mean	Igbo Female Mean
1	Left 2D	6.670	7.042	6.451	6.808	7.206	7.794
2	Left 4D	6.376	7.356	6.074	7.138	7.068	7.968
3	Right 2D	6.592	7.022	6.432	6.811	7.210	7.788
4	Right 4D	6.400	7.332	6.091	7.130	7.034	7.860
5	Height	51.58	53.18	46.28	56.40	54.76	64.64
6	Weight	47.06	55.24	45.17	55.30	48.80	61.28

N for Hausa Male = 50, Female = 50; Yoruba Male = 53, Female = 47; Igbo Male = 50, Female = 50.

Chart representing Anthropometry mean measurement for all the three ethnic groups in CM

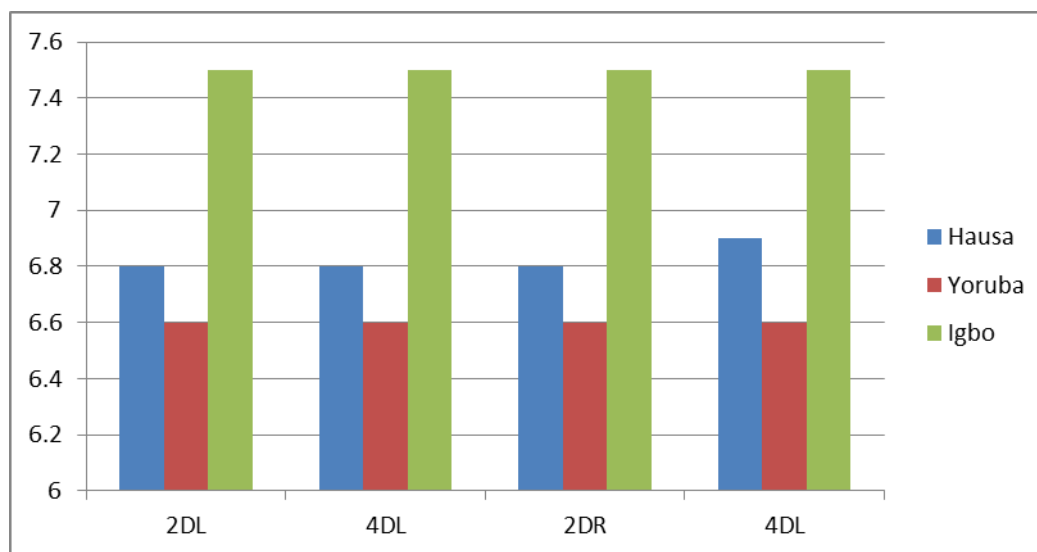


Chart representing mean height of the three ethnic groups in inches

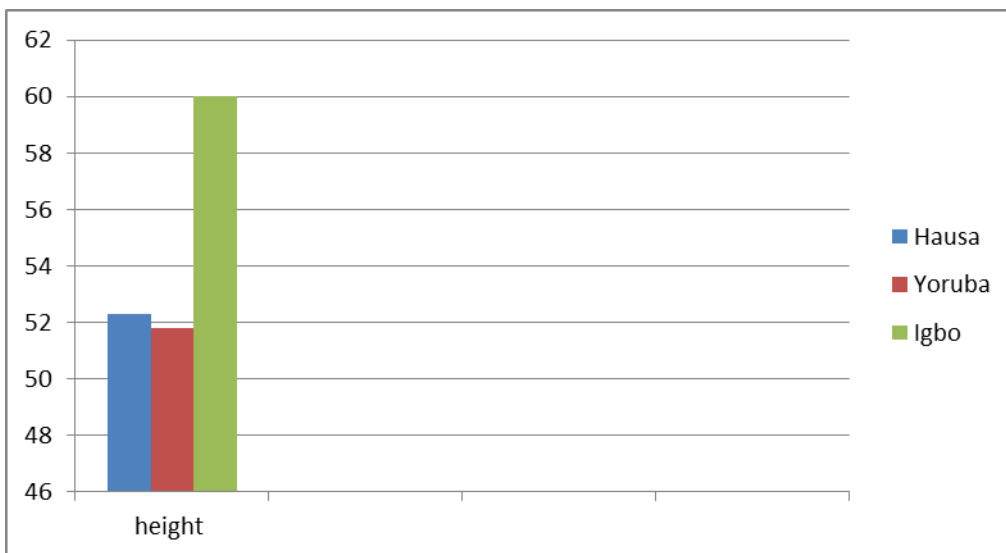


Chart representing mean Weight of the three ethnic groups in kilograms

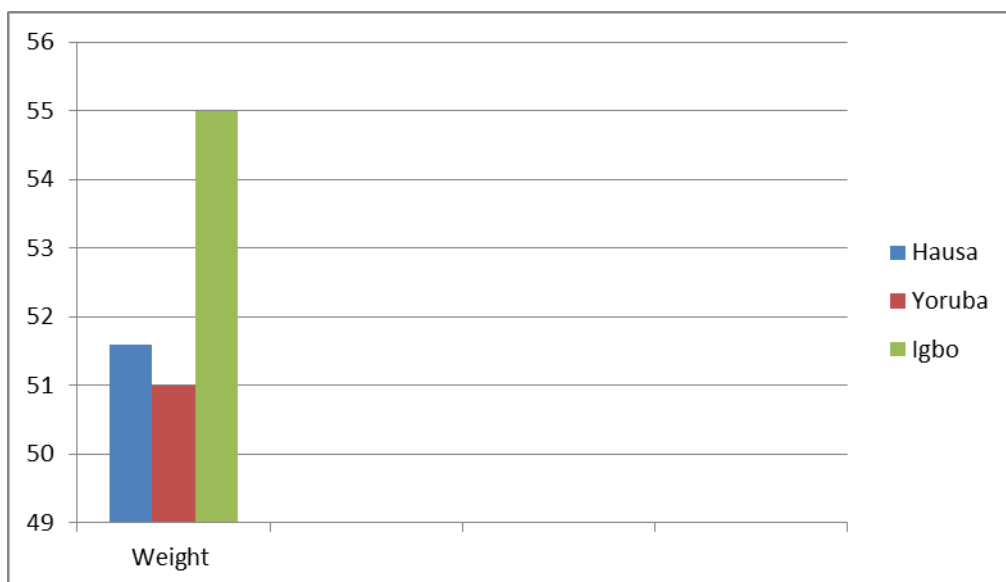


Table 4 presents the data on the anthropometric mean measurement for each of the three ethnic groups Hausa, Yoruba, and Igbo based on their gender. The mean measurement of Left 2D for each of Hausa Males and Females are 7.042 and 6.670 inches respectively. The mean measurement of Left 4D for each of Hausa males and females are 7.356 and 6.376 inches respectively. The mean measurement of Right 2D for each of Hausa males and females are 7.022 and 6.592 inches respectively. The mean measurement of Right 4D for each of Hausa males and females are 7.332 and 6.400 inches respectively. The mean height for Hausa males and females is 53.18 and 51.58 inches respectively while the mean weight for the Hausa males and females are 55.24 and 47.06 kilograms respectively.

The mean measurement of Left 2D for each of Yoruba Males and Females are 6.808 and 6.451 inches respectively. The mean measurement of Left 4D for each of Yoruba males and females are 7.138 and 6.074 inches respectively. The mean measurement of Right 2D for each of Yoruba males and

females are 6.811 and 6.432 inches respectively. The mean measurement of Right 4D for each of Yoruba males and female are 7.130 and 6.091 inches respectively. The mean height for Yoruba males and females is 56.40 and 46.28 inches respectively while the mean weight for the Yoruba males and females are 55.30 and 45.17 kilograms respectively.

The mean measurement of Left 2D for Igbo Males and Females are 7.794 and 7.206 inches respectively. The mean measurement of Left 4D for Igbo males and females are 7.968 and 7.068 inches respectively. The mean measurement of Right 2D for Igbo males and females are 7.788 and 7.210 inches respectively. The mean measurement of Right 4D for Igbo males and females are 7.860 and 7.034 inches respectively. The mean height for Igbo males and females is 64.64 and 54.76 inches respectively while the mean weight for Igbo males and females are 61.28 and 48.80 kilograms respectively.

Source of Anthropometric Information

S/no	Description	Frequency	Percent
1	Class Lectures	200	66.7
2	Internet	36	12
3	Lectures and Books	9	3
4	Books	12	4
5	Internet and Books	11	3.7
6	Internet and Lectures	8	2.7
7	From Relatives	2	0.7
8	From Friends	6	2
9	Not Applicable	16	5.3

N = 300

Table 5 is the data showing the sources of the anthropometric information by the respondents. The number of respondents who indicated that class lectures was their source of information were 200, those who got their information via the internet were 36, from lectures/books were 9, from books were 12, those who got their information from the combination of internet/lectures were 8. Information from friends and relatives accounted for 2 and 6 respondents respectively. The respondents who never got any information on anthropometric measurement were 16.

Relationship between 2D:4D ratio and social preference

S/no	Description	Frequency	Percent
1	Social preference is higher in female than in male	272	90.7
		28	9.3
	True		
	False		
2	Individuals with high 2D:4D ratio take risk more than those with Low 2D:4D	249	83
		51	17
	True		
	False		
3	Women with higher 2D:4D ratio have more reproductive chances	258	86
		42	14
	True		
	False		
4	Women with high 2D:4D ratio have higher sexual excitement and greater sex drives	244	81.3
		56	18.7
	True		

False			
5	Men generally have low sexual excitement compared to their female counterpart	239	79.7
	True	61	20.3
False			

Table 6 is the presentation of the data that shows the relationship between 2D:4D ratio and social preference. The data shows that the respondents agree that it is true that social preference is higher in female than in male. The same holds true for individuals with high 2D:4D who are prone to take risk more than those with low 2D:4D. Women with higher 2D:4D ratio have more reproductive chances; women with high 2D:4D ratio have higher sexual excitement and greater sex drives and men generally have low sexual excitement compared to their female counterpart.

Factors that influence 2D:4D ratio among the three ethnic groups (Hausa, Yoruba, and Igbo)

S/no	Description	Mean	Standard Deviation	Decision
1	2D:4D ratio varies with ethnicity	3.97	0.708	Agree
2	2D:4D ratio varies with height	4.67	0.500	Agree
3	2D:4D ratio varies with sex	4.70	0.465	Agree
4	2D:4D ratio varies with environment	2.00	0.421	Disagree
5	2D:4D ratio varies with age	4.58	0.642	Agree
6	2D:4D ratio has no variation	1.69	0.693	Disagree

Table 7 is the data that shows the factors that influence 2D:4D ratio among the three ethnic groups (Hausa, Yoruba, and Igbo) who live in Jos North local government area of Plateau State. The respondents agree that 2D:4D ratio varies with ethnicity, height, sex, and age but disagree that 2D:4D ratio varies with the environment and that there is no variation. Mean score for an agreed decision for a 4- point scale used is 2.50, and above while any mean score below 2.50 is considered as disagreed.

Determination of finger length ratio (2D:4D) of Hausa, Igbo, and Yoruba ethnic groups of Nigeria was done and the result

was compared with different anthropometric measurements both in males of adult Hausa, Igbo, and Yoruba.

Many researchers have attempted these measurements but the digit ratio values proved to be consistently reliable in sex dimorphism and it has demonstrated that a considerable proportional males have low digit ratio compared to the females (Brown et al., 2002). The present study was designed to establish the relationship between the Hausa, Igbo, and Yoruba finger length ration (2D:4D) and to ascertain if it has any relationship with ethnicity, height, weight, and environment.

From the study, it shows that 2D:4D ratios vary with ethnicity, height, sex, age, and weight. Environment plays very little or no influence at all in determining 2D:4D ratio, it was also discovered that 2D:4D has been found to be sexually dimorphic with females having higher digit ratio compared to males, By implication, this means that testosterone and estrogen determine the digit length of an individual. This finding is in line with earlier report by Oladipo et al., (2006). The sexual dimorphism in 2D:4D is influenced by prenatal testosterone concentration.

As indicated in the table below:

Table 8: Anthropometric mean measurement for each of the three ethnic groups according to gender

S/no	Description	Hausa Male Mean	Hausa Female Mean	Yoruba Male Mean	Yoruba Female Mean	Igbo Male Mean	Igbo Female Mean
1	Left 2D	6.670	7.042	6.451	6.808	7.206	7.794
2	Left 4D	6.376	7.356	6.074	7.138	7.068	7.968
3	Right 2D	6.592	7.022	6.432	6.811	7.210	7.788
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6	Weight	47.06	55.24	45.17	55.30	48.80	61.28

N for Hausa Male = 50, Female = 50; Yoruba Male = 53, Female = 47; Igbo Male = 50, Female = 50.

High concentration of fetal testosterone indicates 2D:4D ratio which therefore indicates high prenatal testicular activity. On the other hand, high estrogen level indicates a high digit ratio in both men and women (Manning et al.,2000).

From this study, digit ratio was found to be an intensified trait from the ancestral origins and thus showed remarkable ethnic differences in the same geographical location. This is in line with findings by Manning et al., (2003) who reported that 2D:4D shows strong ethnic differences but contradicts Oladipo et al., (2009) that there is no ethnic correlation in digit ratio. It is also in line with findings reported by Gwaniama and Themelandu () who reported ethnic differences in 2D:4D among Andoni and Ikwereethnic groups of the Niger Delta. Manning (2002) also reported significance as against Oladipo et al., (2006) who reported that there is no ethnic variation in digit ratio between Igbo and Urhobo and between Igbo and Yoruba ethnic groups in Nigeria.

The study further showed that anthropometry measurement of 2D:4D length according to gender depicts that second digit (2D) length in males were found to be shorter than fourth digit (4D) lengths and is significantly different between the three ethnic groups. This finding agrees with the report of George (1930) and Manning et al., (2000) who reported that second digit (2D) in males tends to be shorter than fourth digit (4D).

The study show that Hausa mean Value for 2D and 4D are 6.56am and 6.86am respectively, Yoruba mean values 2D and 4D are 6.638 am and 6.640 am respectively. While Igbo mean value for 2D and 4D is 7.500am and 7.518am respectively (Oladipo et al., 2009). Result from the anthropometry

measurement based on ethnic differences showed that there is a remarkable difference in the length of their index finger 2D and ring finger 4D.

Findings from this study showed that there are differences in the 2D:4D ratio between males and females of all the three ethnic groups under study. A smellier study was carried out by Gabriel and Oladipo et al., (2009) to investigate any tribal and sexual difference in the second to fourth digit ratio (2D:4D) of Igbos and Yorubas in Nigeria. Results from the study showed 2D:4D was sexually dimorphic in the two tribes. 2D:4D ratio in the sample of the Igbo population that was studied was found to be significantly higher in women than in men, a finding that is consistent with other studies of 2D:4D in other ethnic groups in Nigeria.

A study was carried out by Wilson (2010) on anthropometry of the index 2nd and ring 4th digit in Ebira ethnic group of Nigeria. It was observed that second digit in Ebira males was shorter than fourth digit length similar to findings from this study.

In conclusion, results from all the findings suggested that 2D:4D ratio is inherited. If digit ratio does not exhibit substantial ethnic variation, then the ethnic groups in question possibly have common ancestral background. 2D:4D showed strong sexual dimorphism and substantial ethnic variation within the same geographical location. This suggests that 2D:4D is inherited but not necessarily influenced by geographical location.

CONCLUSION

In conclusion 2D:4D ratio showed strong sexual dimorphism. Females have higher 2D:4D than their male counterpart. It also differs with ethnic differences, by implication, it is inherited not necessarily influenced by geographical location as aforementioned.

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Conflicts of interest

There are no conflicts of interest

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