

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

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Abstract: The Anthropometric Study of Index (2D) and Ring (4D) Digits of Ebira tribe of Nigeria was carried out to determine the values of the 2D and 4D digit ratios and correlate them with other anthropometric variables. Six hundred adults between ages of 18 years and above were recruited randomly excluding those with hand deformities. Three hundred were males and three hundred were females and of these numbers, one hundred males and one hundred females students were selected from each of the participating areas. The index (2D) and ring (4D) digit lengths were measured from the basal crease to the tips using a digital measuring tape and the height and weight were measured. The 2D:4D ratios were then determined for each subject while the height and weight were used to calculate the BMI and the data analyzed. The results show significant difference ($p < 0.01$) in 2D:4D ratio between the males and the females. Males have longer fourth (4D) and shorter second (2D) digit lengths with lower digit ratio while females have shorter fourth (4D) and longer second (2D) digit lengths with higher digit ratio. The result confirms that digit ratios are sexually dimorphic and there was a positive correlation between height, weight, BMI and digit lengths in both males and females. The result of the 2D:4D ratios of the Ebira ethnic group show that the 2D:4D ratio of females was greater than the digit ratio of the males and also the digit ratio has no relationship with either height, weight or BMI of an individual and represents the original data for the people of the Ebira tribe of Nigeria.

Key words: 2D:4D digit ratios, anthropometry, finger, ebira tribe, height, weight

INTRODUCTION

The diversity of Nigerian population provides a unique opportunity to study the morphogenetic variations amongst the endogenous sub-populations consisting of different tribes, languages and religious beliefs living in different geographical and ecological conditions. These sub-populations offer opportunities to study the anthropometric digit variations amongst these groups and tribes (Oladipo *et al.*, 2009). For over one hundred years it has been known that men and women have different ratios of their body proportions. It has been shown that there are differences between the index and ring fingers between sexes (Manning *et al.*, 1998; McIntyre, 2003). It has also been found that there was a direct relationship between the index and ring finger length ratios and the amount of testosterone that a baby was exposed to during pregnancy (McIntyre, 2006). Higher prenatal testosterone levels are associated with smaller index fingers in comparison to the ring finger (Wilson, 1983; Walsh, 2010). In the study of Manning *et al.* (2003), smaller index fingers in men have been associated with higher levels of physical aggression in men throughout their life. This association was only true for physical aggression, not

verbal aggression or other types of hostile behaviors (Wilson, 2010; Williams *et al.*, 2000).

Wilson (1983) had proposed that skeletal structure and personality were simultaneously affected by sex hormone levels in the uterus. Hormones carry out their functions by evoking responses from specific organs or tissues that are adapted to react to minute quantities of such hormones (Grimbos *et al.*, 2010; Gobrogge *et al.*, 2008). Scientists are beginning to understand the correlation between digit ratio and a psychological trait within members of the same sex (Nelson *et al.*, 2006; Okten *et al.*, 2002).

In Humans, finger length ratio of the index and ring finger (2D:4D) is a sexually dimorphic trait. The ratio between the length of the index and ring digit (2D:4D) may correlate with *in utero* testosterone levels because, it is sexually dimorphic (Baker, 1888; George, 1930; Manning *et al.*, 1998) with males having on average longer 4th digits relative to their 2nd digits showing a low 2D:4D ratio than females, who have on average, had a higher 2D:4D ratio. The relative lengths of the digits are set before birth and probably by 14 weeks of pregnancy (Garn *et al.*, 1975; Manning *et al.*, 1998). The 2D:4D ratios have been reported to be negatively correlated with

testosterone levels and positively associated with estrogen levels in adults (Manning *et al.*, 1998; Manning and Taylor, 2001). The sex differences in 2D:4D ratio is present before birth in human, which rules out any social influences that might affect digit growth differentially in the two sexes. All somatic sex differences in mammals to date have been found to be due to either androgenic masculinization or effects of the sex chromosomes (Fink *et al.*, 2006; Malas *et al.*, 2006). The Androgen Insensitivity Syndrome (AIS) finding rules out a role for sex chromosomes in the sex differences in digit ratios and the prenatal sexual dimorphism indicates that androgens act before birth to affect digit ratios (Paul *et al.*, 2006; Fink *et al.*, 2004b).

Anatomically, the ring finger is the fourth digit of the human hand and the second most ulnar finger located between the middle finger and the little finger (Arthur *et al.*, 1998; Fink *et al.*, 2004a) while the index finger also referred to as forefinger, is the first finger and the second digit of a human hand. It is located between the thumb and the middle finger. It is usually the most dexterous and sensitive finger of the hand (Arthur *et al.*, 1998; Fink *et al.*, 2004b). It has been shown that men have relatively shorter index fingers than the ring fingers (Burriss *et al.*, 2007; Brown *et al.*, 2002; Neave *et al.*, 2003). Men with more masculine finger ratios are perceived as being more masculine and dominant by female observers and tend to perform better in a number of physical sports (Neave *et al.*, 2003; Churchill *et al.*, 2007; Lutchmaya *et al.*, 2004). A low 2D:4D ratio has been shown to correlate with high testosterone levels which is characteristic of males, while a high 2D:4D ratio is correlated with low testosterone level, a characteristic of females (Manning, 2002). The aim of the present study is to study the anthropometric differences in the 2nd and 4th digit ratios in Ebira people of Nigeria.

METHODOLOGY

Subjects: The population of study consists of Students of the Ebira ethnic extraction of Okene Local Government Area of Kogi State-Nigeria. Three Secondary Schools were randomly selected from the list of Secondary Schools in Okene Local Government Area. The Schools selected were Ebira Community Secondary School Ogaminana Okene, Adavi Local Government Science Secondary School Nagazi Eba and Government Science Secondary School Ogaminana. The study was carried out on a cross sectional sample of 600 adult students for the study. Three hundred (300) of the respondents were males while the remaining 300 were females, of these, one hundred males and one hundred females were selected from each of the participating schools. Data on age, sex, ethnic background were collected through oral interview and structured questionnaire as primary data collection and the Anthropometric measurements as secondary data collection.

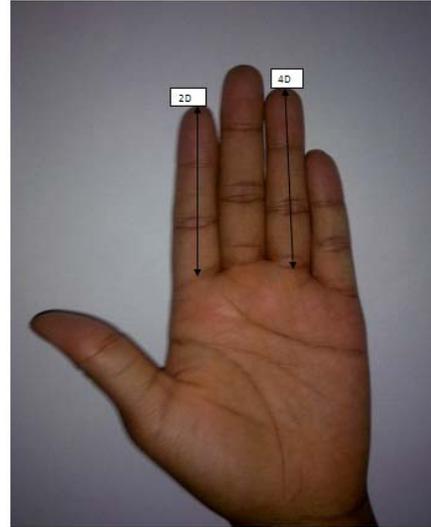


Fig. 1: shows the females digit length

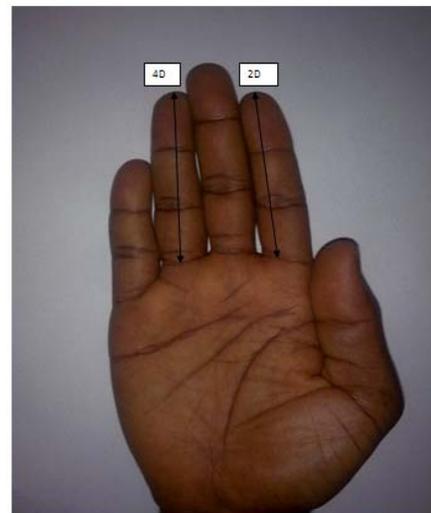


Fig. 2: shows the males digit length.

Sample size and sample techniques: A total of 600 Ebira adults of age between 18 years and above were used for the study. The sample comprised of 300 normal Ebira males and 300 Ebira females. The subjects were selected at random and were purely Ebiras 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 with the aid of a digital measuring tape from the tip of the digit to the ventral proximal crease as show in Fig. 1 and 2 where there was a band of crease at the base of the digit, the most proximal crease was used (Fink *et al.*, 2004a, b). Subjects with injuries or deformities in any of the hands were excluded from the study. All measurements were made carefully with digits fully extended. The data used for the research study was

collected in the three Schools in Okene area of Ebira land of Kogi State of Nigeria and analyzed in the Ahmadu Bello University Department of Human Anatomy between August and November 2011, under the supervision of the first Author.

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 Ebira Ethnic Nationality of Nigeria’’ that was developed on the basis of Manning *et al.* (1998) and Manning *et al.* (2000). The questionnaires consist of two sections. Section one is made up of personal demographic information with questions on the lineage of the respondents, while section two contained information on anthropometric measurements.

Method of validation of instruments: Three parameters were investigated which includes height, weight and the length of index (2ndD) and ring (4thD) of both hands. Medical terminologies were not introduced in the questionnaire appropriate to make it clearer to the respondent at all level. Careful and appropriate steps were taken to protect the rights of the respondents. Potential respondents were informed that the survey was completely voluntary and all participation was confidential. All information through oral interview was collected from the respondents and were compared and analyzed.

Sample/statistical analysis: Data was expressed as Mean±Standard deviation (±SD). Descriptive statistics and students’ T-test were used to analyze and determine the parameters studied in both males and females. The relationship between the parameters studied was established using Pearson correlation to establish the strength of the relationship between the lengths of second and fourth digits (2D & 4D), the digit ratios and the other Anthropometric variables in both sexes. Statistical significance was accepted at P value less than or equal to <0.01 (p<0.01).

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 index finger (2D), ring finger (4D) and the ratios of 2D:4D in both males and females. The mean values in males are 7.43, 8.03 and 0.93 cm while in females are 7.07, 7.57 and 0.94 cm, respectively. The difference in the mean values of the lengths of index finger (2D), ring finger (4D) and 2D:4D ratios between the males and females of Ebira ethnic group are statistically significant (p<0.01) as shown in Table 1 and, Fig. 3 and 4.

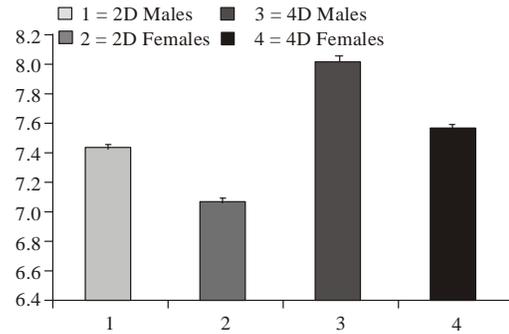


Fig. 3: Show the differences in the length of 2D:4D in Ebira males and females

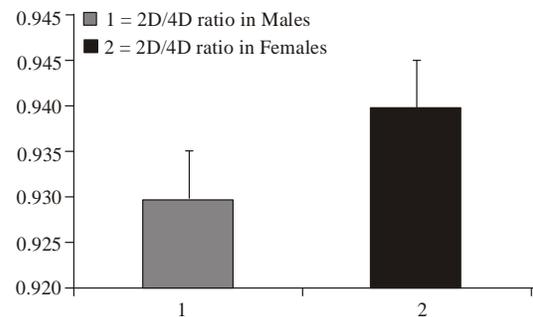


Fig. 4: Show the difference in 2D:4D ratios between Ebira males and Females

Table 1: Shows the mean, ±SEM of 2D, 4D lengths and the ratios of 2D:4D in males and females of Ebira ethnic group of Nigeria

Parameters	Males±SEM	Females±SEM	t-values	Sig. level
R2D	7.43±0.03	7.07±0.03	7.973	p<0.01
L2D	7.43±0.03	7.07±0.03	7.973	p<0.01
R4D	8.03±0.03	7.57±0.03	10.055	p<0.01
L4D	8.03±0.03	7.57±0.03	10.055	p<0.01
R2D:4D	0.93±0.03	0.94±0.03	4.8784	p<0.01
L2D:4D	0.93±0.03	0.94±0.03	4.8784	p<0.001

**: p<0.01 show that statistical significant difference was found with right 2D, right 4D, left 2D, left 4D, right 2D:4D and left 2D:4D ratio

Table 2: General statistics of the anthropometric parameters used

Parameters	Sex	Mean±SD	Min	Max	N
2D:4D	M	0.93±0.03	6.25	950	300
	F	0.94±0.03	6.15	9.00	300
Height (unit)	M	162.1767±8.26801	144.00	185.00	300
	F	155.553±8.6624	53.00	175.00	300
Weight	M	57.523±9.1591	40.00	95.00	300
	F	53.453±7.5921	40.00	81.00	300
BMI	M	22.410±3.783	13.89	25.68	300
	F	22.600±10.506	23.14	37.75	300

The results show that the mean height (162.17) of males exceeded the mean height (155.55) of females. The mean weight (57.52) of males exceeded the mean weight value (53.45) of females. But the mean BMI (22.60) of females exceeded the mean BMI (22.41) of males (Table 2).

Table 3 shows the correlation matrix of the anthropometric parameters. The result shows a positive

Table 3: Correlation matrix of the anthropometric parameters used

	Males			Females		
	R2D:4D	BMI	N	R2D:4D	BMI	N
Height (cm)	.....	0.059	300	.....	0.143	300
Weight (kg)	0.017	0.611**	300	-0.052	- 0.702**	300
BMI (kg/m ²)	0.065	0.959**	300	0.061	0.248**	300
	0.059	.....	300	-0.052	.....	300

** : p<0.01 show significant correlation between height, weight and BMI in both males and females

correlation (p<0.01) between BMI and height, BMI and weight, but there was no correlation between BMI and 2D:4D digit ratios.

DISCUSSION

Determination of Finger length ratio (2D:4D) of Ebira ethnic group of Nigeria was done and the results was compared with different anthropometric measurements both in males and females of adult Ebira people. Many researchers have attempted these measurements but the digit ratio values proved to be consistently reliable in sex dimorphism and it has been demonstrated that a considerable proportion of normal males have low digit ratios compared to the females (Brown *et al.*, 2002). The present study was designed to establish the relationship between the Male and female finger length ratios (2D:4D) and to ascertain if it has any relationship with height, weight and BMI. The results from the present study show there was a relationship between 2D:4D ratios in males and females of Ebira ethnic nationality of Nigeria.

The study done by Manning *et al.* (2000) showed that Females had longer second digits than fourth digits while males have longer fourth digits than second digits. This accounted for the higher digit ratios in females than in males. The results of the males and females 2D:4D ratios however confirmed that digit ratios (2D:4D) are sexually dimorphic phenomena. It was observed in the present study that males have longer digits compared to females which is however not common when compared to other studies (Galis *et al.*, 2009; Rahman and Wilson, 2003; Okten *et al.*, 2002; Gobrogge *et al.*, 2008).

It was observed from the present study that second digit length in Ebira males was shorter than fourth digit length which was significantly different when compared with that of the females. This finding agrees with the reports of George (1930), Manning (1998) and Manning *et al.* (2000), who reported that second digits in the males tend to be shorter than fourth digits. These digits lengths are influenced by testosterone and estrogen *in-utero* (Manning *et al.*, 2000). The observed second digit lengths for Ebira females was similar to observations of Manning *et al.* (1998), Manning (2002) and Manning *et al.* (2004), that the second and fourth digit lengths in females are approximately the same or is like that of males. In the present study, 2D:4D ratio has been found to be sexually dimorphic with females having higher digit ratios

compared to males. This observation agrees with earlier reports by George (1930), Manning *et al.* (1998), Manning *et al.* (2001), Manning (2002), Manning *et al.* (2003) and Oladipo *et al.* (2009). This sexual dimorphism in 2D:4D ratios are influenced by prenatal testosterone concentrations. This hormone is thought to modify developmental rate such as epidermal ridges of the digits during fourth weeks of fetal development (Wallien *et al.*, 2008; McFadden and Shubel, 2002; Neave *et al.*, 2003; Manning *et al.*, 2004; Geschwind and Galaburda, 1985). High concentrations of fetal testosterone indicate a low 2D:4D ratios, which therefore indicate a high prenatal testicular activity. On the other hand 2D:4D is positively correlated with oestrogen in men and women (Williams *et al.*, 2000; Paul *et al.*, 2006; Malas *et al.*, 2006; Putz *et al.*, 2004).

In Nigeria, digit ratios vary according to the ethnic groups. Among the Igbos and Urhobos, males have shorter digit ratios than the females (Oladipo *et al.*, 2009), while in the Ikwerres and Andonis, males have shorter digit ratios than the females (Oladipo *et al.*, 2009). The present study of Ebira ethnic group shows that males have shorter digit ratios than the females which agrees with the rest of Nigerian ethnic groups though the values of the ratios are not the same but they follow similar trends. The observed ethnic variation was similar to those of Manning *et al.* (2003), who reported that 2D:4D shows strong ethnic differences. The result of the present study suggests that there is a positive correlation between BMI and height and BMI and weight, though females have higher BMI than males. Our study failed to show positive correlation between the finger length ratios (2D:4D) with BMI, height and weight of the study population and is consistent with the early hypothesis that fetal hormones affect 2D:4D ratios (Martel *et al.*, 2008; Putz *et al.*, 2004; Richard *et al.*, 2006; Wallien *et al.*, 2008).

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