

Sexual Dimorphism and Relationship between Chest, Hip and Waist Circumference with 2D, 4D and 2D:4D in Nigerians

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Abstract

Rescently the subject of 2D:4D ratio has received great attention because reports have linked to traits that are influenced by testosterone and estrogen. The present paper reports the study of 2D, 4D and 2D:4D and their relationship to some anthropometric traits in Nigerians. 1400 subjects (males = 713 and females n = 687) participated in the study. Lengths of 2D and 4D were significantly higher in males ($P < 0.001$) while 2D:4D mean was lower in males than females (males = 0.95 ± 0.04 females = 0.96 ± 0.05 , $t = -1.73$ and $P < 0.001$). 2D and 4D showed significant relationship with height, weight, chest, waist and hip circumferences. This study strongly confirms the sexually dimorphic nature of 2D:4D. Even though it fails to show relationship between 2D:4D and BMI, chest, waist and hip circumferences as reported in other studies. This could result from the multiethnic diversity of the Nigerian population.

INTRODUCTION

Studies have also established sexual dimorphism in 2D:4D digit ratio (_{1, 2, 3}). Men have been reported to have lower ratio than women (_{1, 4}). This dimorphism is reported to be established in utero between the 13th and 14th week of gestation (₅), under the influence of prenatal androgens and estrogens (_{1, 6}). Sexual dimorphism in 2D:4D have also been reported in mouse and birds (_{7, 8}). 2D:4D has been associated with a number of traits linked to sex hormones. These include fertility, sexual attitudes, sexual orientation, spatial ability, aggression and sport (_{6, 9, 10}).

Since the report by Manning et al (₁₁) on 2D:4D, the subject have received tremendous attention. Recently researchers have been trying to investigate the relationship between 2D:4D and traits like coronary heart disease (₁₂), gym-based physical fitness (₁₃), development of psychopathology (₁₄), cooperative behaviour (₁₅), attention deficit hyperactivity disorder (₁₆).

To the best knowledge of the authors only one reports exists on the 2D:4D in Nigerians. This study was conducted to investigate the nature of 2D:4D in Nigerians.

MATERIALS AND METHODS

SUBJECTS AND ANTHROPOMETRY

Finger lengths measurements were obtained from 1400 subjects (males n = 713 and females n = 687) after given informed consent with mean age of 20.64 ± 6.94 for males, and 18.73 ± 6.29 for females. Digit length was measured on the ventral surface of the hand from the basal crease of the digit to the tip of the second and fourth digits in both right and left hands using an Avenger digital caliper (MicroMak, USA) measuring to 0.01mm. Finger lengths data on subjects were classified on the basis of their sex and subjected to statistical analysis to test the hypothesis that there is strong sexual dimorphism in the 2D:4D ratio in man. Measurements of height, weight, chest and waist circumferences were further obtained from 444 males and 308 females out of the total number of subjects who volunteered. From these parameters indices of body mass index, waist-chest ratio and waist-hip circumference were calculated using standard formulas (₁₇).

STATISTICAL ANALYSES

Data were expressed as mean \pm standard deviation (SD). Student's t-test was used to test for the difference in 2D, 4D and 2D:4D in the right and left hands of subjects and

between female and males. Pearson correlation was applied to test the relationship between 2D, 4D and 2D:4D and some anthropometric indices (BMI, WHR, and WCR). Statistical significant difference was deemed acceptable at $P < 0.05$. SigmaStat 2.0 for Windows (Systat Inc., Point Richmond, CA) was used for the statistical analyses.

RESULTS

Considering all the variables studied the results indicated strong sexual dimorphism as shown in Figs. 1 and 2, with statistical significance difference ($P < 0.001$) in males and females.

Figure 1

Figure 1: 2D and 4D digit lengths in right and left hands of subjects according to sex. Digits are significantly longer in males than in females ($*P < 0.001$).

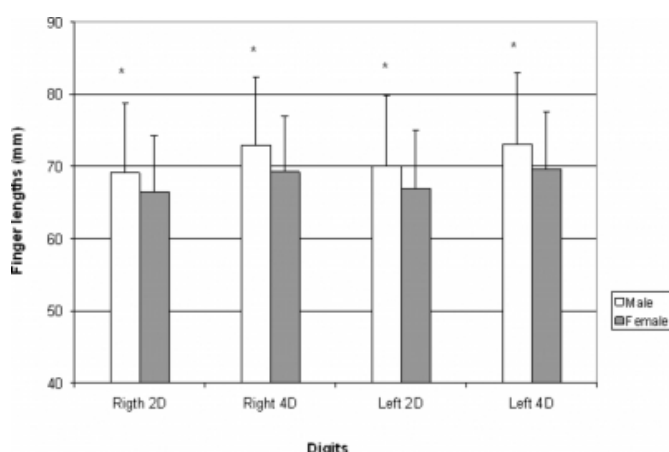
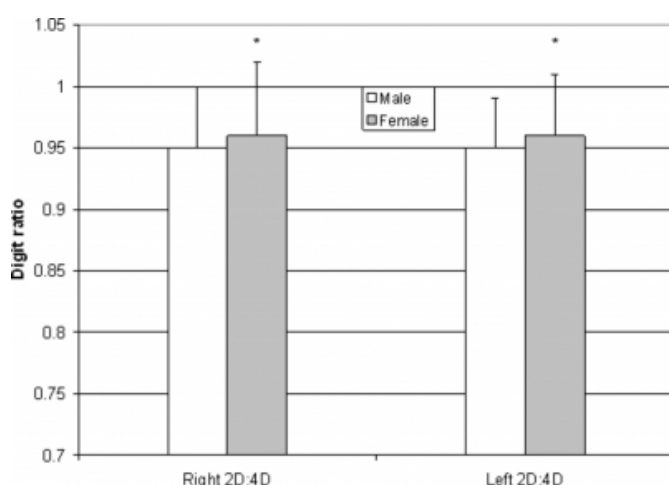


Figure 2

Figure 2: Digit ratios in males and females. Error bars indicate standard deviation. Digit ratios are significantly higher in females $*P < 0.001$.



The 2D, 4D digit lengths and 2D:4D were further correlated

to investigate whether some of the somatometric variables that are sensitive to estrogenic and androgenic effects which include chest, waist and hip circumferences. The results (Table 1) showed significant correlations in chest and hip circumferences for the 2D and 4D digit lengths in both hands, but for waist circumference only 4D right digit correlated ($r = 0.17$, $P < 0.05$). Digit ratios in both hands failed to show any significant correlations in male subjects. In females subjects none of the variables correlated ($P > 0.05$), this indicates that androgenic effect is stronger than estrogenic which is mainly seen in females.

Figure 3

Table 1: Correlation coefficients of 2D and 4D digit lengths and 2D:4D ratios in males and females.

	Males n = 444			Females n = 308		
	Height	Weight	BMI	Height	Weight	BMI
Right 2D (mm)	0.36***	0.26***	0.04	0.35***	0.23***	0.07
Right 4D (mm)	0.48***	0.37***	0.07	0.36***	0.18***	0.02
Left 2D (mm)	0.44***	0.35***	0.08	0.44***	0.27***	0.07
Left 4D (mm)	0.51***	0.38***	0.08	0.37***	0.19***	0.02
Right 2D:4D	0.05	0.02	-0.01	0.02	0.05	0.05
Left 2D:4D	-0.10	-0.05	0.01	0.11*	0.13*	0.09

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

Height, weight and BMI correlated with 2D and 4D digit lengths and ratios in both males and females subjects. There were significant correlations between digits lengths in males ($P < 0.001$) and females ($P < 0.01$ and $P < 0.001$) for height and weight respectively. Digit ratios showed significant correlations in the left hand only in the females ($P < 0.05$). BMI failed to show any significant correlation with digit lengths and digit ratios in both males and females (see Table 2)

Figure 4

Table 2: Correlation of 2D, 4D and 2D:4D of right and left hands in males and females.

	Males n = 444			Females n = 308		
	Circumferences					
	Chest	Waist	Hip	Chest	Waist	Hip
Right 2D (mm)	0.25***	0.13	0.23**	0.08	0.02	0.02
Right 4D (mm)	0.30***	0.17*	0.30***	0.10	0.06	0.06
Left 2D (mm)	0.24***	0.13	0.24***	0.09	0.07	0.08
Left 4D (mm)	0.27***	0.14	0.26***	0.07	0.04	0.04
Right 2D:4D	-0.10	-0.12	-0.12	-0.03	-0.06	-0.06
Left 2D:4D	-0.12	-0.13	-0.14	0.05	0.07	0.07

* P < 0.05

** P < 0.01

*** P < 0.001

* P < 0.05 ** P < 0.01 *** P < 0.001

DISCUSSION

The results of this study confirm the existence of sexual dimorphism of 2D, 4D and 2D:4D with women having lower finger lengths and higher digit ratios (1, 18, 19). Since digit ratio is associated with levels of sex hormones, this study also checked the relationship of 2D:4D with chest, waist and hip circumferences and waist-hip ratio. These relationships have been established in other populations (20, 21). The present results only showed significant relationship between 2D and 4D lengths in right and left hands with chest, waist and hip circumferences in males but not in females. The relationship with 2D:4D was stronger in males than in females, which reflects that the relationship between 2D:4D is stronger in males than females.

Other studies (18, 22) have established relationship between height, weight and BMI. The present study investigated the same phenomena in this Nigerian population. The result did not show any significant relationship between 2D:4D either in right or left hands, which agrees with the report of Neave et al (22) and Vehmas et al (4) but it is in contrast to that of Manning et al (18), who reported relationship between 2D:4D with Waist, hip circumferences and BMI. When considering digit lengths as entities both right and left 2D and 4D showed significant correlation with weight and height.

Previous study (23) has reported sexual dimorphism in the length of hand and foot in humans. The findings from the present study confirms this reports by the fact that 2D and 4D lengths are significantly longer in males than in females. The correlation of 2D and 4D with height in both males and females, also agrees with previous reports, the only new information is that BMI do not show any correlation with 2D

and 4D according the results of the present study.

Early studies describing 2D:4D ratios have indicated that the strong difference and relationship with traits putatively link to testosterone is more significant in the right than the left hand (1, 5, 19). The present study is the first to the best knowledge of the authors to show that the left 2D:4D is stronger than the right, which may be due to ethnic and geographical location as earlier reported that latitude have effect on 2D:4D (18, 24, 25).

In conclusion, our study has provided the first data in Nigerians demonstrating sexual dimorphism in 2D, 4D and 2D:4D ratio and relationship between 2D, 4D, and 2D:4D ratio to height, weight body circumferences (chest, waist and hip).

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