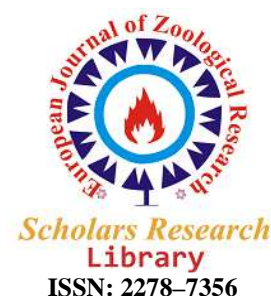




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The Effect of the Season of Birth and Fluctuating asymmetry on Second and Fourth Digit Lengths and Digit Ratio (2D:4D) in Nigerians

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ABSTRACT

Fluctuating asymmetry (FA) and season of birth season are factors that reflect and affect ontogenetic qualities and future development of an organism. The present study was conducted to investigate the degree FA and the effect of season of birth on second and fourth digits lengths and ratio (2D:4D). In this study 1451 subjects (males n= 779 and females n= 672) with mean age 20.64 ± 6.94 and 18.73 ± 6.29 . Subjects date of birth, and finger lengths were obtained for the determination of season of birth and calculation FA and 2D:4D ratio. Significant difference was observed in FA with males expressing higher degree of FA in second digit ($P=0.001$) and fourth digit ($P<0.001$) but there was no significant difference in the FA of 2D:4D ratio. For season of birth no differences exist in second and fourth digit lengths and 2D:4D ratio of males, but in female significant difference was noticed in right 2D:4D ratio ($P=0.02$). But when males and females were considered significant differences were obtained in all the parameters studied. This study has revealed that FA is more express in males than females and that season of birth according to Nigeria's weather pattern did not show the effect expected as seen in four weather seasons (autumn, fall, spring and winter).

Key words: Fluctuating asymmetry, season of birth, second digit, fourth digit, 2D:4D ratio, Nigerians

INTRODUCTION

FA is widely used as an indicator of biological quality due to the fact that it reflects the degree of developmental stability as a result of ontogenetic disturbances [1-4]. It is important for organism to maintain symmetry because studies have shown that symmetry is associated with a large number of perturbators like resistance to parasites, immune strength, strength, and mental acuity [2]. The effect of the season of birth has been reported in many investigations: neuropsychiatric conditions [5,6], birth weight [7], and short- and long survival in man [8].

The study of finger lengths and especially the ratio of second to fourth digit (2D:4D) has received great attention [9-12]. This ratio has been said to lower in the males than the females and have been reported to be established *in utero* as a result of the exposure of the fetus to androgens [13,14]. 2D:4D ratio has been reported to correlate positively with traits putatively linked to testosterone [15-17]

This study investigated the extent of FA and the effect of season of birth on the lengths and ratios of second and fourth digits in Nigerians.

MATERIALS AND METHODS

Study Location and Demographics

The study was conducted in the Ahmadu Bello University, Zaria. The study covered a period of 18 months (January 2006 to July 2007). Data on sex, age, ethnic background, date of birth and birth order of subjects were obtained for classification of digit ratio. The number of subjects who participated were 1451 (males $n = 779$ and females $n = 672$) with mean age of 20.64 ± 6.94 for males and 18.73 ± 6.29 for females with the age range of subjects from 16 to 45 years old.

Finger Length Measurements

Digit lengths were measured on the ventral surface of the hand from the basal crease of the digit to the tip of the finger (Fig. 1) using a digital sliding caliper (MicroMak, USA) measuring to 0.01mm and reported on a questionnaire. This measurement has been reported to have high degree of repeatability (Manning *et al.*, 1998).

Fluctuating Asymmetry

Fluctuating asymmetry of second and fourth digit lengths and digit ratio was studied in males ($n= 779$) and females ($n= 672$) subjects using established formula [18]. This part of the study is to ascertain the degree of fluctuating asymmetry in males and females subjects which is direct reflection of environmental perturbation during development.

$$FA = (L - R)/0.5 \times (R + L) [18]$$

Where FA = Fluctuating asymmetry, R = Right and L = Left.



Fig. 1: Measurement of 4D length using a digital caliper.

Season Birth

The study of the relationship between season of birth and 2D:4D was conducted, according to weather pattern observed in Nigeria. Season of birth was coded as 1) wet season (March - October) and 2) dry season (November - March) as established by the Metrological Society of Nigeria (1989). Seasons of birth were obtained as subjects reported their date of birth. The whole study population was classified on the basis of this and 2D:4D was tested against the season of birth.

RESULTS

Table 1 presents second and fourth digits lengths and 2D:4D ratio in males and females for both right and left hands. Significant differences were observed in second and fourth digits lengths between males and females. Left 2D:4D also showed significant difference ($P = 0.03$) with males having lower 2D:4D ratio than females.

Table 2 presents the FA for the 2D, 4D finger lengths and 2D:4D digit ratios indicated significantly higher FAs in males for 2D and 4D digit lengths ($t = 3.20$, $P = 0.001$ and $t = 4.28$, $P < 0.001$) respectively. FA in 2D:4D digit ratio is higher in females than males but is not statistically significant ($t = -1.41$, $P = 0.16$). Correlations analyses were conducted for FAs of 2D, 4D and 2D:4D in both males and females. The results are presented in correlation matrix (Table 3). All variables significantly correlated in both sexes at $P < 0.001$.

2D, 4D and 2D:4D were also considered on the basis of the season of birth of subjects. Considering two weather seasons seen in Nigeria, males do not show any significant difference in subjects born in dry and wet season (Table 4). For females (Table 5), the same scenario emerged were only right 2D and 2D:4D showed significant difference ($t = -2.67$, $P = 0.001$ and $t = -2.38$, $P = 0.02$). Table 6, presents the P values of the differences between males and females digit lengths and ratios born in wet and dry seasons.

Table 1: Second and fourth digit lengths and 2D:4D ratio in males and females.

Variables	Males (n= 306) Mean \pm SD	Females (n= 257) Mean \pm SD	t	P
Right 2D (mm)	72.25 \pm 5.47	66.77 \pm 5.36	11.95	<0.001
Right 4D (mm)	76.10 \pm 5.59	71.50 \pm 5.36	9.91	<0.001
Left 2D (mm)	73.14 \pm 5.25	68.67 \pm 5.72	9.70	<0.001
Left 4D (mm)	76.50 \pm 5.47	71.58 \pm 5.56	10.55	<0.001
Right 2D:4D	0.95 \pm 0.05	0.95 \pm 0.06	0.00	1.00
Left 2D:4D	0.96 \pm 0.05	0.97 \pm 0.06	-2.16	0.03

Table 2: 2D and 4D digit lengths and 2D:4D ratios according to fluctuating asymmetry in male and females subjects

Variables	Males (n =779) Mean \pm SD	Females (n = 672) Mean \pm SD	t	P
2D	-0.0110 \pm 0.0668	-0.00122 \pm 0.0460	3.20	0.001
4D	- 0.552 \pm 0.0650	-0.0415 \pm 0.0547	4.28	<0.001
2D:4D	-0.00249 \pm 0.0325	-0.00497 \pm 0.0345	-1.41	0.16

Table 3: Correlation matrix of fluctuating asymmetry in 2D, 4D and 2D:4D in male and female subjects.

Variables	Males (n = 779)			Females (n = 672)		
	2D	4D	2D:4D	2D	4D	2D:4D
2D	-	-0.24*	0.77*	-	-0.34*	0.52*
4D		-	-0.43*		-	-0.62*
2D:4D			-			-

* $P < 0.001$

Table 4: 2D, 4D and 2D:4D digit ratio according to season of birth in Nigeria in male subjects.

Variables	Wet season (n = 189) Mean \pm SD	Dry season (n = 117) Mean \pm SD	P
Right 2D (mm)	72.37 \pm 6.02	72.12 \pm 4.92	0.69
Right 4D (mm)	76.19 \pm 5.86	76.01 \pm 5.32	0.78
Left 2D (mm)	73.52 \pm 5.66	72.75 \pm 4.84	0.22
Left 4D (mm)	76.81 \pm 5.70	76.19 \pm 5.24	0.34
Right 2D:4D	0.95 \pm 0.05	0.95 \pm 0.04	0.81
Left 2D:4D	0.96 \pm 0.05	0.95 \pm 0.04	0.65

Table 5: 2D, 4D and 2D:4D digit ratio according to season of birth in Nigeria in and female subjects.

Variables	Wet season (n = 155)	Dry season (n = 102)	P
Right 2D (mm)	66.67 ± 5.16	66.86 ± 5.56	0.001
Right 4D (mm)	71.79 ± 5.16	71.20 ± 5.56	0.38
Left 2D (mm)	69.23 ± 6.21	68.11 ± 5.22	0.12
Left 4D (mm)	71.88 ± 5.30	71.27 ± 5.82	0.39
Right 2D:4D	0.96 ± 0.06	0.94 ± 0.05	0.02
Left 2D:4D	0.97 ± 0.06	0.96 ± 0.06	0.32

Table 6: Significant differences in 2D, 4D and 2D:4D digit ratio according to season of birth in Nigeria between male and female subjects.

Variables	Wet season	Dry season
Right 2D (mm)	<0.001	<0.001
Right 4D (mm)	<0.001	<0.001
Left 2D (mm)	<0.001	<0.001
Left 4D (mm)	<0.001	<0.001
Right 2D:4D	0.09	0.10
Left 2D:4D	0.09	0.14

DISCUSSION

The present study observed the existence of significant difference in fluctuating asymmetry (FA) in the 2D and 4D lengths, but FA fails to show significant difference 2D:4D ratio between males and females. Earlier reports [15] showed that males finger length asymmetries were positively correlated with testosterone, this completely agrees with the results of the present study where FA were higher in males than females in 2D and 4D. The result showing lack of significant difference in FA is in agreement with previous findings of [10,19]. Manning *et al.* (2006) suggest that high concentrations of testosterone and oestrogen (resulting in low and high values of 2D:4D respectively) are associated with high asymmetry scores in sexes. A related study [21], showed that directional asymmetry is influenced by prenatal testosterone and is strongly associated with indirect aggression in women.

Results from the study of 2D, 4D and 2D:4D with season of birth showed least effect. In males there was a complete lack of effect recorded in season of birth in 2D, 4D and 2D:4D according to Nigeria's dry and wet seasons. In this case effect was observed in the right 2D and 2D:4D. This agrees with reports that 2D:4D effect tends to be stronger in the right hand than the left [9,13,22,23]. The lack of effect in males would need further probing to ascertain the reason for this observation.

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