



Geographical influence on digit ratio (2D:4D): a case study of Andoni and Ikwerre ethnic groups in Niger delta, Nigeria.

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ABSTRACT

The role of geographical location on digit ratio (2D:4D) in ethnic groups within the same geographical location was investigated. One thousand four hundred and two subjects drawn from Andoni and Ikwerre ethnic groups in the Niger Delta region of Nigeria were randomly selected for this study. These comprised 702 (50.07%) *Andonis* of which 350 (24.96%) were males while 352 (25.11%) were females and 700 (49.93%) were *Ikwerres* of which 461 (32.88%) were males and 239 (17.05%) females. A digital vernier caliper was used to measure the lengths of the second digit (2D) and fourth digit (4D). The ratio 2D/4D was then calculated for each subject. The results obtained showed positive significant differences ($p < 0.001$) in the lengths of 2D and 4D between males and females in the two ethnic groups. It also showed significant ($p < 0.001$) sexual and ethnic differences within same geographical location. This suggests that 2D:4D is inherited but not necessarily influenced by geographical location.

INTRODUCTION

Digit ratio commonly known as 2D:4D is the ratio of the index finger (2D) to ring finger (4D) (Manning et al, 2002). Digit ratio has been reported by many workers to show sexual dimorphism with women having higher ratio than men (Manning et al, 2002; Phelps 1952, George, 1998. Manning et al, 2002 reported that, for males, the index finger is generally about 96 percent of the length of the ring finger, which gives an average digit ratio for male of 0.96. Females have a digit ratio of about 1.0. The sexual dimorphism in 2D:4D is influenced by prenatal secretion of testosterone and estrogen. Testosterone negatively correlates with 2D:4D while estrogen correlates positively with 2D:4D (Manning et al, 2002). Fertility and human behavior (Manning et al, 2002), aggression and assertiveness (Wilson G. D; 1983) and (Allison et al, 2004), personality factor and hand skill and

medical conditions such as breast cancer, autism and Congenital Adrenal Hyperplasia (Windy M. Brown 2002) have also been explained with digit ratio study. Manning, 2002, reported significant racial and ethnic variations among Caribbean Jamaicans and white Caucasians. Oladipo et al, 2006 reported that there is no ethnic variation in digit ratio between Igbo and Urhobo and between Igbo and Yoruba ethnic groups of Nigeria respectively. They however recommended that tribes that are more distant be investigated to establish if any exist.

Andoni and Ikwerre ethnic groups though in the same geographical location, and sharing some common cultural values, have different ancestral origins. Andonis are Cameroonian descent (Enemugwem, 2006) while the Ikwerres are believed to be descent of Arochukwu and ancient

Benin Kingdom respectively (Akobundu, 2000). This study seeks to investigate whether the environment or location would have modified their

digit ratios over time since it was reported by Manning et al, 2003 that geographical location influences digit ratio.

MATERIALS AND METHODS

A total of 1402 human subjects between the ages of 15 and 60 were recruited by random sampling. Those having any form of hand deformity were excluded. Seven hundred and two were Andonis (50.07%). Out of 702, 350 were males (24.96%), 352 were females (25.11%). 700 were of the Ikwerre tribe (49.93%). Out of this number 461 (32.88%) were males while 239 (17.05%) were females. Digit length was measured on

the ventral (inferior) surface of the hand from the basal crease of the 2nd and 4th digits to the tip, using Venier calipers measuring to 0.01cm minor reading (. Values obtained were recorded, then 2D:4D calculated for each hand. The data was analyzed with descriptive statistics: Mean, standard error and Analysis of Variance (ANOVA) using SPSS software programmer.

RESULTS

The results of this study are presented on tables 1-4 and figures 3-6. Table 1 and figure 1 and 2 show the mean and standard error of 2D and 4D for both Andoni and Ikwerre males. Table 2 and figure 3 and 4 show the mean and standard error of 2D and 4D for both Andoni and Ikwerre females. Table 3 and figure 5 show the right and left digit ratios for males in Andoni and Ikwerre ethnic groups. Table 4 and figure 6 show the right and

left digit ratios of the Andoni and Ikwerre ethnic groups. There was a significant difference ($p < 0.001$) in 2D, 4D and 2D:4D between males and between females in the two ethnic groups. These differences confirm that 2:4D is sexually dimorphic. It also shows that 2D:4D exhibited ethnic variation within the same geographical location.

Table 1: shows the lengths of second and fourth digits in males of Andoni and Ikwerre tribes.

PARAMETER	AND./CM	IKWERRE/CM	F-RATIO	SIG. LEVEL
R2D±SEM	7.199±0.03	6.950±0.05	8.130	0.001
L2D±SEM	7.40±0.02	6.960±0.05	11.772	0.001
R4D±SEM	7.589±0.03	7.235±0.05	40.602	0.001
L4D±SEM	7.795±0.03	7.240±0.05	98.533	0.001
SAMPLE	350	461		

Table 2: Mean and standard error of the lengths of second (2D) and fourth (2D) digits for females of Andoni and Ikwerre tribes

PARAMETER	ANDONI	IKWERRE	F-RATIO	SIG. LEVEL
R2D±SEM	6.987±0.03	7.017±0.06	5.153	0.001
L2D±SEM	7.205±0.03	7.035±0.05	2.715	0.001
R4D±SEM	7.260±0.03	7.016±0.06	17.207	0.001
L4D±SEM	7.475±0.03	7.034±0.05	61.471	0.001
SAMPLE	352	239	---	---

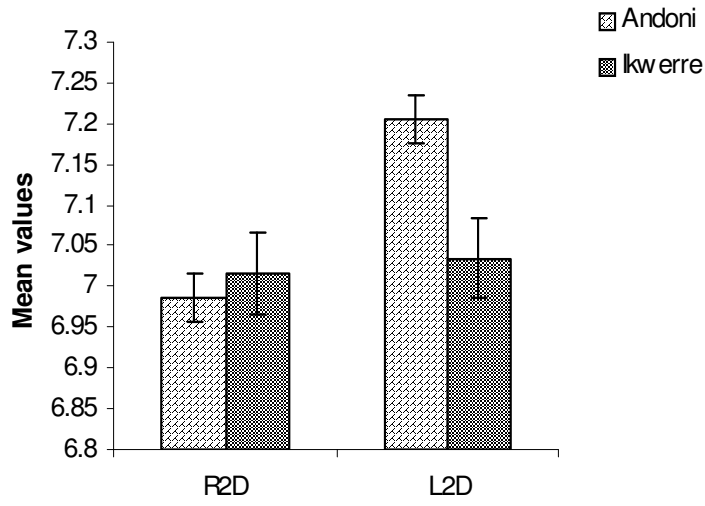


Figure 3: R2D and L2D for females

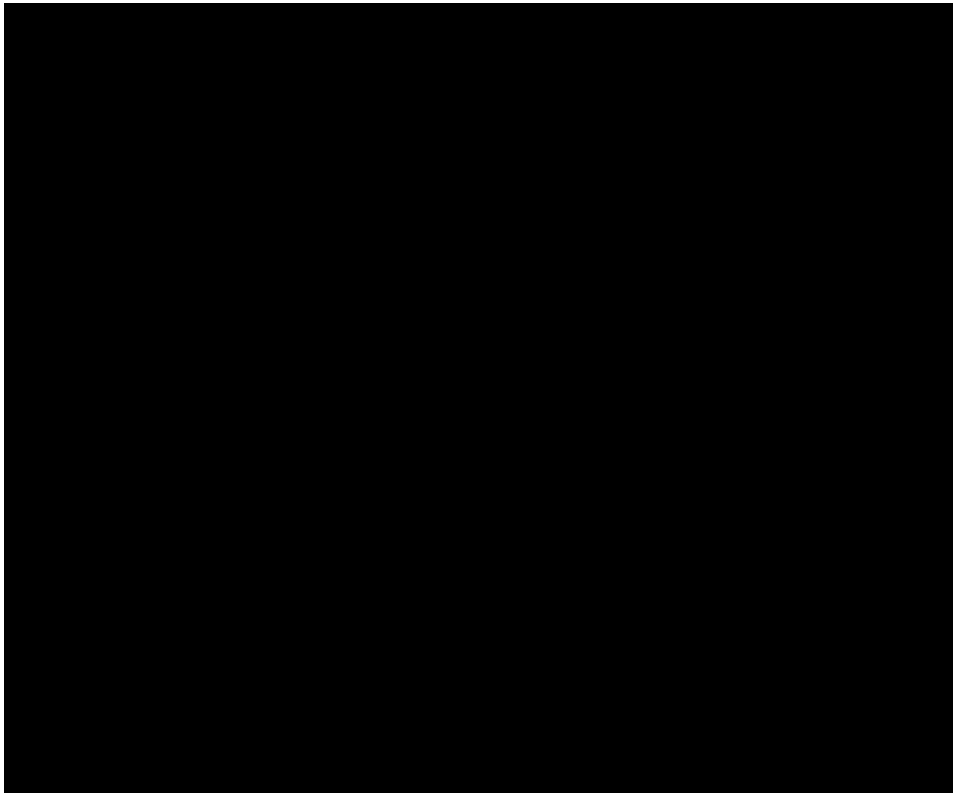
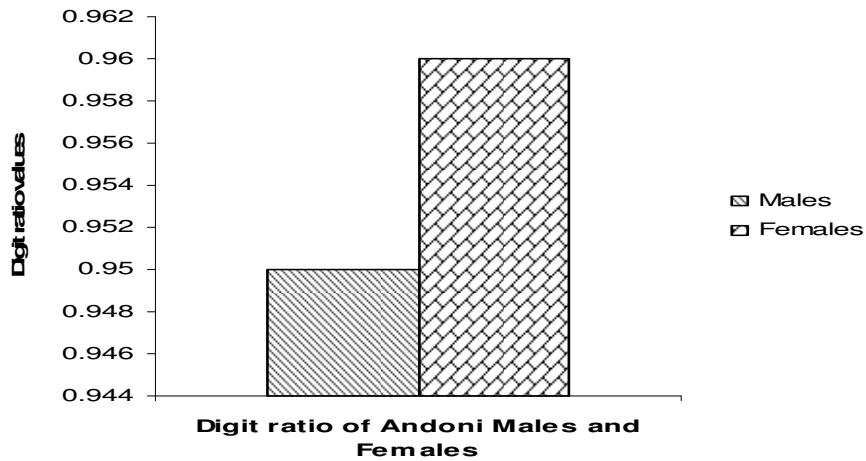
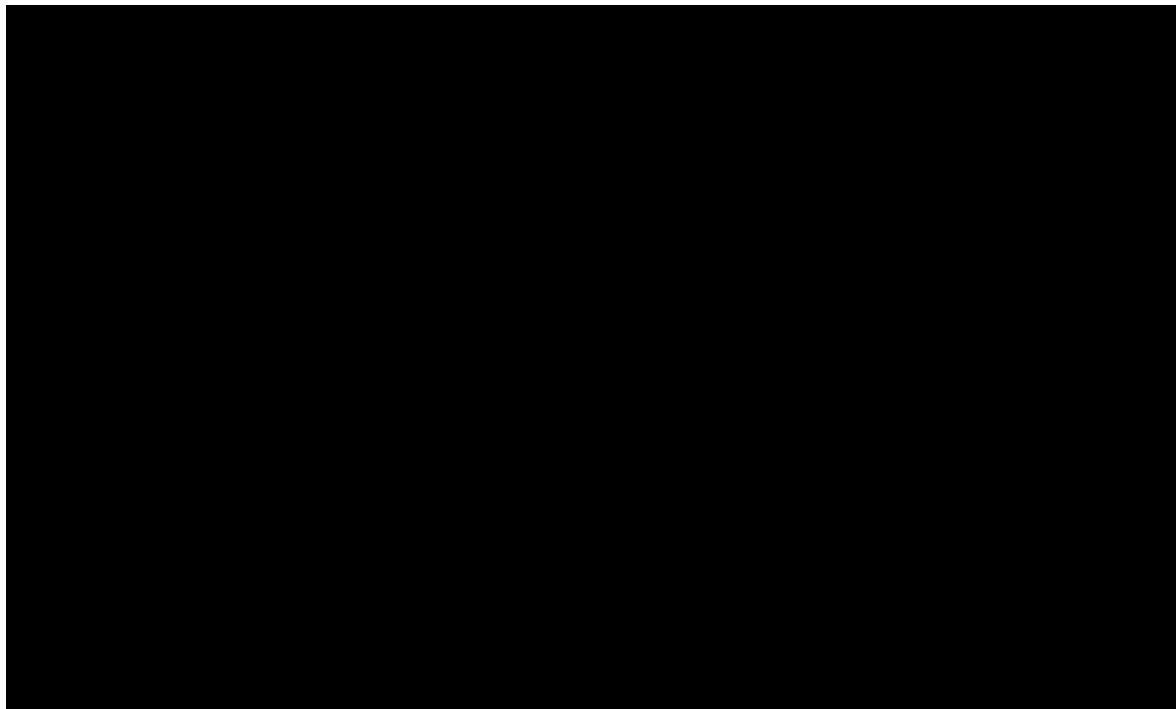


TABLE 3: Digit Ratio of males in the two tribes

PARAMETER	ANDONI	IKWERRE	F-RATIO	SIG. LEVEL
R2D:4D	0.95±	0.96±	6.22	0.001
L2D:4D	0.95±	0.96±	4.96	0.001

**Figure 5****Table 4:** Digit Ratio of females in the two tribes

PARAMETER	ANDONI	IKWERRE	F-RATIO	SIG. LEVEL
R2D:4D	0.96±0.002	1.00±0.001	46.58	0.001
L2D:4D	0.96±0.002	1.00±0.005	42.75	0.001



DISCUSSION

In this study, second digit lengths in males were found to be shorter than fourth digit lengths and significantly different between the two ethnic groups. This agrees with the reports of George (1930), Phelps (1952), Manning et al, (2000) who reported that second digits in males tend to be shorter than fourth digits. These digit lengths are influenced by testosterone and estrogen in utero (Manning et al, 2000). Ikwerre females had approximately the same lengths for second and fourth digits similar to observations of Manning et al, (2002). Andoni females had shorter second digit different from earlier reports (George, 1930, Manning et al, 2000).

In this study 2D:4D has been found to be sexually dimorphic with females having higher digit ratio compared to males. This observation is in line with earlier reports by Phelps 1952, George 1930, Manning et al, 2000, Manning et al, 2002, Manning et al, 2003, , Oladipo et al, 2006. This sexual dimorphism in 2D:4D is influenced by prenatal testosterone concentrations. This hormone is thought to modify developmental rate such as epidermal ridges of the digits (McEwen, 1981; MacLusky and Naftolin, 1981; Bardin and Caterall, 1981; Geschwind and Galaburda, 1985). High concentrations of fetal testosterone indicate a low 2D:4D ratio which therefore indicates high prenatal testicular activity. On the other hand 2D:4D is positively correlated with oestrogen in men and women. A high estrogen level indicates a high digit ratio in both men and women. The sexual dimorphism of 2D:4D has been reported in different parts of the world: United States of America (Males 0.96, Females 1.0), Micheal and Manning 2002, United Kingdom (Males 0.98, Females

1.00). In Nigeria it varies according to the ethnic group. Among the Igbos: Males 0.96 ± 0.02 , Females 1.0 ± 0.06 (Oladipo et al, 2006), Urhobos: Males 0.96 ± 0.02 , Females 1.0 ± 0.02 (Oladipo et al 2006), Ikwerres: Males $R0.96 \pm 0.003$, $L0.96 \pm 0.002$, Females: $R1.0 \pm 0.001$, $L1.0 \pm 0.005$, Andonis: Males $R 0.95 \pm 0.002$, $L0.95 \pm 0.002$, Females $R 0.96 \pm 0.002$, $L 0.96 \pm 0.002$) (present study).

The observed ethnic variation was similar to those of Manning et al. (2003) who reported that 2D:4D shows strong ethnic differences but contradicts Oladipo et al, 2006 and 2009 that there is no ethnic correlation in digit ratio.

In this study, digit ratio was found to be an inherited trait from the ancestral origins and thus showed remarkable ethnic differences in the same geographical location. This observation disagrees with Manning et al, (2003) who reported that 2D:4D is influenced by geographical location. For instance the digit ratios of the Igbos (Males 0.96, Females 1.0) and Urhobos (Males 0.96, Females 1.0) (Oladipo et al 2006) from where the Ikwerres are believed to originate are the same. This suggests that 2D:4D is inherited. If digit ratio does not exhibit substantial ethnic variation, then the ethnic groups in question possibly have a common ancestral background.

In conclusion, 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.

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