ORIGINAL ARTICLE

DIGIT RATIO (2D:4D): A CONTRIBUTOR TO TRUSTWORTHINESS AMONG AFRICANS

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ABSTRACT

Studies conducted on Caucasian subjects have shown a link between increased testosterone levels and an increase in interpersonal betrayal behaviors as well as a reduction in the 2D:4D ratio. It's unclear, however, whether this holds for tribes in Africa. Although 2D:4D may be used as a measure of exposure to prenatal testosterone, it is important to recognize that this association is limited to those who identify as Caucasian. The present study aims to determine the association of the 2D:4D ratio with trustworthiness in the African population. Four hundred and two (402) people were selected at random from two organizations in the Kano state. Both TOAKAN and the Tsaya da Kafarka Taxi Drivers Association are involved in this matter. Participating individuals' ages varied from eighteen to fifty (18-50). A direct method of measuring was used to approximate the lengths of the second and fourth digits. To further assess how trustworthy people perceive one another, a 45-question trustworthiness questionnaire (TQ) was also created. The mean value of 2D: 4DR was 0.98±0.04 which was higher than 2D: 4DL with a mean value of 0.96±0.05. Two components of the dependability scale, 2D: 4DRight(R), Total trustworthiness, and Consistency, were shown to have a positive and statistically significant relationship. On the other hand, no association was found between the 2D:4DLeft (L) and any of the dependability metrics.

Keywords: Digit ratio, Trustworthiness, correlation, Africa.

INTRODUCTION

The ratio of the length of the second (index) finger to the length of the fourth (ring) finger (digits: 4D), which represents the relative length of the second (the "index" finger) and the fourth, has been the subject of a significant amount of research. The consistency of this pattern has been noted across various cultures (3). During the initial stages of development, there is a consistently higher ratio observed in females as opposed to males (2). It has been established for many years that the ratio of 2D to 4D represents an individual variation in prenatal gonadal hormone exposure and varies by gender. Consequently, males might exhibit negative digit ratios relative to females (4). Reduced 2D to 4D ratios show that prenatal testosterone levels are proportionally higher than estrogen levels.

Athletic performance, assertiveness, aggressiveness, and physical strength are among the qualities that exhibit a correlation with the 2D:4D digit ratio. Males with a higher 2D to 4D ratio were more likely to develop obesity and cardiovascular disease, according to a study that used neck circumference and 2D to 4D ratio as indicators of body composition. Research has found that lower 2D:4D ratios are correlated with greater levels of social uncertainty (6). Individuals with a reduced 2D:4D ratio may exhibit heightened vulnerability to manipulation by others, potentially leading to heightened unease concerning social status or betrayal in interpersonal relationships. According to a second hypothesis, agents with higher levels of concern about losing status would be less reliable in general but more suspicious of others. Anyone you can put your faith in and know they won't let you down in any manner is trustworthy. The ability to trust someone and the likelihood that you will trust them appropriately are both correlated with testosterone levels (7–10).

Concerning the relationship between 2D:4D and credibility, prior research has reached inconsistent outcomes. The importance of 2D:4D in predicting trustworthiness among the African population has also been underappreciated since its inception. The present research might benefit from an understanding of the 2D:4D ratio and its relationship to the reliability of the African population, which could lend credence to the effects of prenatal androgens. Examining the correlation between the 2D:4D ratio and trustworthiness in the African community is the main purpose of this research.).

MATERIALS AND METHODS
Study area
The research was focused on the Hausa, an ethnic group known for its substantial population in the Kano region of Nigeria, situated in West Africa. Kano, with a population of 9,383,682 million people, is the most populous state in Nigeria. In the urban region of the state, encompassing an area of 137 square kilometers, the 2006 Nigerian census tallied a population of 2,163,225 people. The region is composed of the following six local government areas (LGAs): Kano Municipal, Nassarawa, Tarauni, Dala, and Fagge. The Hausa dominate the population of the city (11).

Study design
The study was cross-sectional (prospective approach).

Sample Size Determination
The sample size was determined using the formula developed by Cochran (12) as shown below;

$$n = \frac{Z^2pq}{d^2}$$

Where

n = desired sample size

Z = confidence level (How confident the actual mean falls within your confidence interval) 1.96 at 95%

p = How much variance is expected in the responses 50%

q = 1 – p,

d = degree of precision/ margin of error which is 5%.

$$\mathbf{n} = \frac{Z^2pq}{d^2} = \frac{(1.96)^2 \times 0.5 \times (1 - 0.5)}{(0.05)^2} = 384$$

The minimum sample size needed for the study was 384.

Study Subjects
The population of the state's metropolitan areas was composed of taxi or tricycle drivers who were men. For a sample size of forty-two (402) individuals, sources including the Tricycle Operators Association Kano (TOAKAN) and the Tsaya da Kafarka Taxi Drivers Association in Kano state were selected at random. The age of the participants in this investigation varied between 1 and 50 years. The research excluded individuals who sustained injuries to their fourth or second fingers, were not Hausa ethnic, were not employed as

48

taxi drivers or tricycle operators, and did not have tendon or carpal region abnormalities, deformities, scars, inflammation, or damage.

Ethical approval and Informed consent
Consent that is both well-informed and morally sound Before commencing the study, the researchers sought ethical authorization from the Ethical Committee of the College of Health Science at Bayero University Kano. The approval numbers in question were NHREC/06/12/19/43 and BUK/CHS/HREC/167 (see the appendix). Acquiring the informed consent of the subjects was necessary.

Measurements of the digit lengths and determination of 2d: 4d
A direct technique of measurement was used to determine the lengths of the fourth and second digits. Following the steps outlined by Manning and Tailor, the participants were asked to remove the rings (13,14). As a further step, we measured the second and fourth digits on the backs of both hands to get their lengths. From the base of the digit to its tip, the measurement was taken. To guarantee a precision of 0.01 mm, vernier calipers were used. After twice measuring each digit and determining the mean, the average was then found. If there was a band of creases at the base of the digit, the one that was determined to be the most proximal was given the greatest consideration. Figure 1 shows the computational process for calculating the 2D:4D ratio from the observed digit lengths: taking the length of the second digit and dividing it by the length of the fourth digit (14).

Trustworthiness
The trustworthiness questionnaire of 45 items (TQ45) was designed to gauge the levels of trustworthiness of individuals. The TQ contains five scales, labeled 1. Integrity (fifteen items) which contains three subscales labeled (a) Honesty (five items), (b) Openness (five items), and (c) Humbleness (five items) 2. Ability (fifteen items) which contains three subscales labeled (a) Consistency (five items) (b) Delivery (five items) (c) Training (five items) 3 Benevolence (fifteen items) (a) Kindness (five items) (b) Bravery (five items) (c) Morality (five items). The responses were generated, and each item was answered based on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). High scores on these measures are considered reliable and valid self-reported indices of trustworthiness,

and finally, the sum of all the subscales was calculated to find the total trustworthiness of the individual. The scales of items with an asterisk (*) were reversed.

The modified Trustworthiness questionnaire was translated into Hausa language (appendix I) at the Department of English, Bayero University Kano Nigeria for easy understanding.

Validity and Reliability
The questionnaire as the instrument for data collection was validated by the research supervisor. All recommendations, suggestions, and corrections were duly considered by the researcher. The reliability of an instrument (that is the questionnaire) was ascertained through the test re-test method. This was done by administering the instrument to a sample and after some time, the same instrument was administered for a second time to the same sample. The two results were collected, and a coefficient of reliability was obtained.

Statistical analyses
The Pearson correlation coefficient was utilized to quantify the associations between the 2D:4D and the level of trustworthiness. The means were utilized to represent the data rather than standard deviations. The analyses were conducted with the assistance of SPSS version 20. $P < 0.05$ was determined to be the predetermined threshold for statistical significance

RESULTS
Table 1 displays the descriptive statistics for the digit ratio and digit lengths of the sample population. Unlike 4DRight, the mean value for 2DRight was 72.18±4.86mm or 74.09±5.08mm. The 4DLeft had an average value of 75.10±5.33mm, whereas the 2DLeft had an average value of 72.15±4.83mm. The average value of the 2D:4D ratio for the right hand (2D:4D R) was 0.98±0.04, which was substantially greater than the average value of the 2D:4D ratio for the left hand (2D:4D L), which was 0.96±0.05.

Table 2: shows a correlation between different digit lengths and ratios with different components of trustworthiness. It was observed that 4DR was negatively correlated with Honesty and 2D: 4DR showed a significant positive correlation with Consistency and average trustworthiness. It was noted on the left side that 2DL negatively correlated with Honesty and 4DL correlated with Honesty. However, no correlation was observed between 2D: 4DL with all components of trustworthiness.

49

DISCUSSIONS

For the present study, the baseline data of digits' lengths and digit ratios for the Taxi and Tricycle Drivers of the Kano metropolis were established. We hypothesized that the digit ratio would show a significant correlation with self-reported trustworthiness.

There is a statistically significant positive correlation between the correct 2D:4D and certain facets of trustworthiness, according to the findings of the present study. Lower 2D: 4D ratios were associated with higher levels of social mistrust, contrary to the results of earlier studies. This result aligns with the conclusions drawn in multiple studies that have also observed a comparable effect after testosterone stimulation (6). There exists a correlation between testosterone stimulation, which is quantified as a reduced 2D:4D ratio, and an elevated subjective cost of interpersonal betrayal. More precisely, it is correlated with heightened apprehension regarding the experience of status revocation, especially in cases where one is deceived by another person. The heightened anxiety associated with the loss of status would subsequently lead to a greater lack of confidence in other agents, rather than an improvement in their ability to discern the trustworthiness of others (6). A separate study found that individuals who participated in the ultimatum, dictator, public good, and trust games and had a higher 2D:4D ratio exhibited greater generosity (15). This finding is significant because benevolence is one of the 45 components comprising the evaluation of trustworthiness.

Conversely, no statistically significant correlation is observed between the 2D:4DL and any of the trustworthiness components. Moreover, only two aspects of trustworthiness exhibited significant correlation, even in the right digit ratio. The initial finding indicates a correlation coefficient of 0.103 between the right 2D:4D and consistency (CN), and a correlation coefficient of 0.098 between the right 2D:4D and average trustworthiness (AT). These correlations are both exceedingly faint.

There are some individuals who exhibit a higher degree of benevolence, trustworthiness, and reciprocity in comparison to others. A portion of the variance could plausibly be ascribed to discrepancies in cultural expectations (16, 17). There exists a hypothesis suggesting that behavior is influenced by genetics, and thus to some extent, it can be considered heritable (18, 19). The extent to which individuals are exposed to

hormones during prenatal development may be a determinant of propensities for various social behaviors (20, 21). Likewise, distinct biological and genetic factors may influence individuals' predispositions towards particular social behaviors during particular stages of development. It is acknowledged that hormones such as androgens and cortisol, which are recognized for their organizational effects on the human body and brain, may influence behavior in the future (23). There is indeed fetal exposure to these hormones. The transmission of behavior from one generation to another may occur through this mechanism, as hormone levels are significantly influenced by genetics (24).

CONCLUSION

It was observed that 2D: 4DR showed a significant positive correlation with Consistency and Total trustworthiness. While on the left, no correlation was observed between 2D: 4DL with all components of trustworthiness.

Recommendations

1. The data generated for behavioral traits and digit ratio should be used as baseline data or reference values among the Hausa population.
2. The policymakers may consider the result of this study in deciding on commercial transport for counseling and rehabilitation.
3. Further study should be carried out on different populations and also among the different ethnic groups and larger sample sizes should also be used to explore more on the relationship between behavioral traits and digit ratio
4. There is a need for similar research using different methods of behavioral traits examination such as the trust game instead of the self-report trustworthiness questionnaire

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50

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51

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TABLES AND FIGURE

Table 1: Descriptive statistics of digit lengths, digit ratio

Parameters (mm)	Minimum	Maximum	Mean ± SD
2DR	55.65	87.21	72.18±4.86
4DR	54.47	88.00	74.09±5.08
2D:4DR	0.83	1.13	0.98±0.04
2DL	52.86	87.45	72.15±4.83
4DL	57.14	90.42	75.10±5.33
2D:4DL	0.84	1.11	0.96±0.05

Table 2: Correlation between digit length, ratios, and trustworthiness

Variables	HN	OP	HM	CN	DL	TR	KN	BR	MR	AT
2DR	-0.091	-0.015	0.043	0.080	-0.035	-0.033	-0.044	0.034	0.074	0.026
4DR	-0.116*	-0.025	-0.017	0.006	-0.076	-0.062	-0.060	-0.019	0.043	-0.025
2D:4DR	0.037	0.009	0.086	0.103*	0.062	0.038	0.023	0.075	0.039	0.098*
2DL	-0.101*	-0.077	0.070	0.044	-0.047	-0.064	-0.013	0.037	0.094	0.019
4DL	-0.143**	-0.040	0.015	-0.001	-0.095	-0.066	-0.053	-0.015	0.036	-0.045
2D:4DL	0.072	-0.053	0.073	0.060	0.062	0.004	0.055	0.071	0.073	0.088

*$P< 0.05$, **$P <0.01$, HN: Honesty, OP: Openness, HM: Humbleness, CN: Consistency, DL: Delivery, TR: Training, KN: Kindness, BR: Braveness, MR: Morality, AT: Average trustworthiness
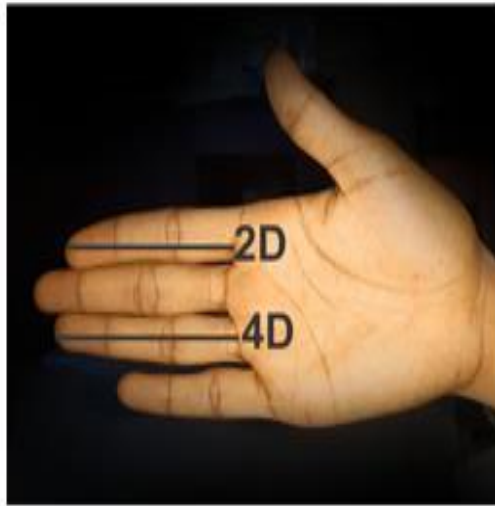
Figure 1: Photograph showing the landmarks for measurement of 2D and 4D.

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ETHICAL APPROVAL

Sequel to your application dated 24th April, 2021, seeking for approval to conduct a research titled, **RELATIONSHIP BETWEEN FACIAL MASCULINITY-FEMININITY WITH 2D:4D, AGGRESSION AND TRUTHWORTHINESS AMONG HAUSA TAXI AND TRICYCLE DRIVERS POPULATION IN KANO METROPOLIS**, the College Health Research Ethics Committee (CHS-HREC) has reviewed your proposal and made observations which you adequately addressed.

In view of the above, ethical approval is hereby granted to conduct the research. You are required to submit progress report on the study to the committee on regular basis and also a full report upon completion.

This appoval is valid for 2 years from the date of approval. Extension may applied for.

Please accept the kind assurances of the committee.

Best wishes.

Ummi M. Gwadabe
Committee Secretary
For: Chairman