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RELATIONSHIP OF NASAL DIMENSIONS AND THUMBPRINT AMONG STUDENTS OF DELTA STATE UNIVERSITY, ABRAKA

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ABSTRACT

The estimation of individual variation using demographic features has long been considered as a useful marker within the domain of biological anthropology. The purpose of the study was to determine the relationship of nasal dimensions with thumbprint ridge counts among students of Delta State University, Abraka. The study investigated a total of three hundred and eighty – four (384) subjects. Data from this study was analyzed with the aid of statistical package for social sciences (SPSS, version 21.0). Student T-test was used in testing the significance differnce between mean of males and females. The results shows that females have higher ulner ridge on right thumb, Males have higher arch, Whorl ridge in the right thumb and also Males have higher Ulner, arch, whorl ridge on the left thumb. The study therefore concludes that sexual dimorphism exists among studied parameters.

Keywords: Nasal Dimensions, Thumbprint, Students

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Introduction

Background of Study

The determination of individual variation using dermatoglyphic features has long been considered as a useful marker within the domain of biological anthropology (Reddy *et al.*, 2000, Karmakar *et al.*, 2006). In the case of faces, the situation is very similar to dermatoglyphics (fingerprints) (Cummins and Midlo, 1961). Human fingers are known to display friction ridge skin (FRS) that consists of a series of ridges and furrows, generally referred to as fingerprints. Fingerprint friction ridge details are described in a hierarchical order ranging from level zero to three, mainly based on resolutions (Jain *et al.,* 2007).

Each of the levels reveals different categories of fingerprint features. Level zero (texture) is for revealing localized textural pattern. Level one (pattern) is for revealing macro detail such as ridge flow and pattern type. Level two (points) is the Galton characteristics, or minutiae points, such as bifurcations and endings and level three (shape) includes all dimensional attributes of a ridge, such as ridge path deviation, width, shape, pores, edge contour, incipient ridges, breaks, creases, scars, and other permanent details (Hong *et al.*, 1998). Therefore, an important characteristic of individual fingerprint will be more appreciated from level one through level three. This therefore brings the need for assessing fingerprints right from pattern type, minutiae points and other associated features and characteristics of the ridges such as ridge density, thickness and pore (Jain *et al.,* 2007).

There are basically three patterns of fingerprints, they include, arches: the ridges enter from one side of the finger, rise in the center forming an arc, and then exit the side of the finger. Loop: the ridge enters from one side of a finger, form a curve and tend to exit from the same side they entered from. Whorl: the ridges form circularly around a central point on the finger (Ashbaugh, 1999; Langerberg, 2005). The second feature of interest is fingerprint minutiae, a term which was coined by Galton, to refer to the small distinguishing features associated with the individual ridge which show great variability in different population and constituting the basis for identification of fingerprint impressions in the field of forensic sciences (Gutie´rrez-Redomero *et al.*, 2007).

Another ridge feature which is close to ridge minutiae is ridge pores. The earlier forensic utility of ridge pore was seen in the study of ridges by Locard, in 1912, which observed 9 to 18 pores per centimeter of the ridge. It was therefore suggested that 20 to 40 pores should be sufficient to establish identity (Ashbaugh, 1999). It was also reported that size, shape, position, and a number of pores on the ridges are individualistic and useful in personal identification (Nickell and Fischer, 1999). Based on the position on the ridges, pores are often divided into two categories: open and closed. A closed pore is entirely enclosed by a ridge, while an open pore intersects with the valley lying between two ridges (Kryszczuk *et al*., 2004).

Human identification could also be achieved by anthropometric methods such as the epidermal ridges anthropometry where ridge breadth is measured by a forensic anthropologist for such purpose. The true breadth of a ridge is the distance between the center of one epidermal furrow and the center of the next furrow along a line at right angle to the direction of the furrows (Kamp *et al.*, 1999). Also, the number of ridges per linear unit enables the estimation of the breadth of the ridge by dividing the linear unit by the number of ridges (Cummins *et al*., 1941). Hecht was the first to report on ridge breadth growth; however, the extensive literature on epidermal ridge breadth was achieved by Cummins and co-workers (Kamp *et al*., 1999). Some dectelocopists have taken new dimension in the study of ridge breadth by studying a ridge density per square area to further establish the individual variation in fingerprints features (Nayak *et al*., 2010).

Another important and interesting aspect of human characterization and identification is a

facial assessment. This is one of the field of biological anthropology which gained acceptance with the emerging science of biometrics in the forensic sciences and other related scenarios such as combat of terrorism, illegal immigration, and any means of personal identification (Gibellia *et al.,* 2012). The facial trait of an individual has been defined as the soft tissues of the face together with the underlying bony skeleton. The traits are the main indicative features in physical appearance, which is always associated with social acceptance, psychological well-being, and self-esteem of an individual (Sahin and Gazileri, 2001).

Anthropometric assessment, such as linear dimensions of specific facial regions has also been investigated for personal identity and can serve as a way of revealing information with respect to the biological profile; ancestry, sex and the age of an individual. It was therefore reported that the role of such metric assessment in forensic sciences has been questioned by another investigator (Kleinberg *et al*., 2007). Different technologies were used in the past decade for metric characteristics of human faces (Ferrario *et al*., 1995). Ethnic variation in the facial profile necessitates the need for an ethnic-specific facial model in order to accommodate various fields of application such as plastic (both cosmetic and reconstructive) and orthodontic surgery (Porter and Olson, 2001).

Statement of Problem

Dermatoglyphics in developing countries such as Nigeria has focused on dermatoglyphic patterns and ridge counts (Ogunranti and Sorgia 1984; Jaja and Igbigbi, 2008), but not so much on other features such as ridge breadth which is useful in personal identification or forensic science. Hence, our current knowledge of variability of the relevant features is inadequate, hence the need for the study.

Rationale of Study

There is a need for base-line anthropological data among students of Delta State University, Abraka especially with respect to thumbprints. Extraction of various forms of variable associated fingerprint will enrich the information regarding the fingerprint, hence will serve as database and reference information as the need may arise as there are very little or no such attempt among students of Delta State University, Abraka.

Research Question

The study was guided by the following research questions:

i. Is there a prevalent type of thumbprint among male and female students of Delta State University, Abraka?
ii. Is there a relationship between nasal dimensions with thumbprint in male and female students of Delta State University, Abraka?

Hypotheses

The study has the following research hypotheses which are expressed in their null form(s):

H_o1: There is no prevalent type of thumbprint among male and female students of Delta State University, Abraka.

H_o2: There is no relationship between nasal dimensions with thumbprint in male and female students of Delta State University, Abraka

Significance of the Study

Data obtained from this study will be relevant in the field of forensic medicine and allied profession. Hence, generating a reference value for relationship between nasal dimensions and thumbprints are important in forensic anthropology.

RESEARCHMETHODOLOGY

Study Design

A cross-sectional design was employed in this study.

Study Area

The study was conducted in Delta State University, Abraka.

Study Population

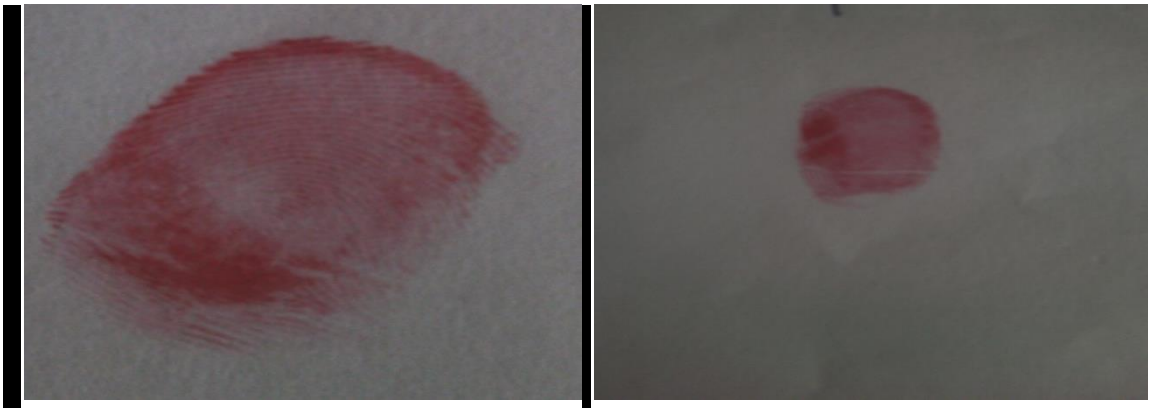
The individuals to be investigated in the study were male and female students aged 19-35 years from Delta State University, Abraka.

Sample and Sampling technique

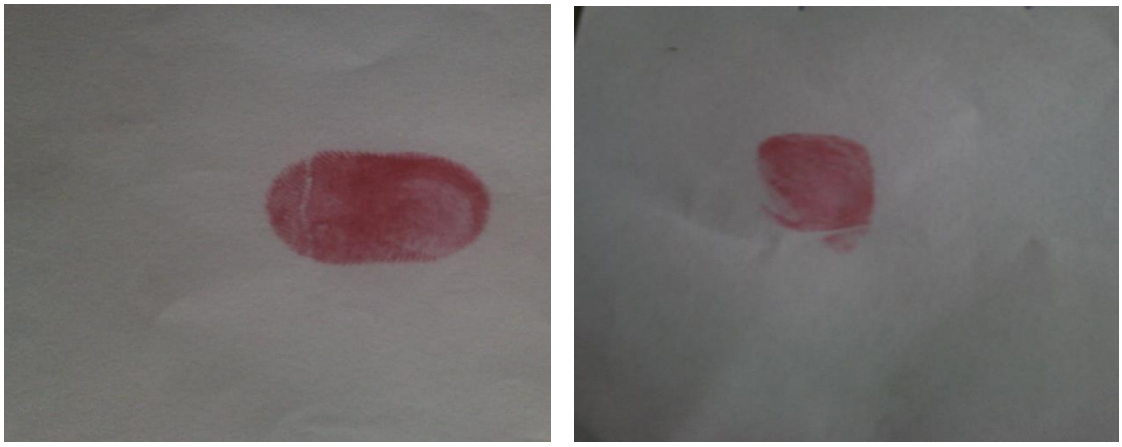
A total of five hundred and thirty-four (534) subjects comprising three hundred and ninety-eight (398) males and one hundred and thirty-six (136) females participated in the study. The minimum sample size needed for the study was three hundred and eighty-four (384) which was calculated using a formula (Oyejide, 1991) below;

$n = Z2pq/\ d2 = (1.96)^2 \times 0.5 \times (1-0.5) / (0.05)^2 = 384$

Where n = desired sample size, Z = confidence level (How confident the actual mean falls within your confidence interval) 1.96 at 95%, p = prevalence/standard deviation (How much variance expect in the responses) 50% (0.5), q = 1 – p, d = degree of precision/ margin of error which is 5%.



Right thumbprint (male) Left thumbprint (male)



Right thumbprint (female)Left thumbprint (female)

Nasal height (male) Nasal width (female)

Fig 3.4: Diagram of parameters taken

Method of Data Collection

The study was conducted in three phases; the first phase includes capturing of the frontal and lateral profile of the face using a digital camera which was followed by capturing of thumbprints using a live scanner (digital persona). The fingerprints and facial images were saved for each individual with similar codes.

The second phase involved the reading of the study variables from images of faces and fingerprints captured in the field. The images codes were matched before reading and recording of the image variables. Phase III involved transfer of all the information from images into Microsoft excels for subsequent use during analyses.

The participant was asked to clean his/her thumb to remove any dirt that may be associated with the skin ridges. The thumb was then placed on the fingerprint sensor, digital persona (Plate I). After capturing a thumbprint, the type of finger (thumb), sex (male or female), side of the finger (left or right) and unique code of the participants was saved with each thumbprint. The typical name of each saved thumbprint carries the finger side, sex, unique code and size.

For the purpose of ensuring real size measurements, an ink method was used to collect the thumbprints of randomly selected participants. The thumbs were cleaned with tissue paper and freed from dirt. The subjects were made to roll the tip of their thumb across the surface of an already made ink-stained pad, ensuring that the ink covered the pattern area.

Selection Criteria

i. Apparently healthy subjects whose thumbs and face were free from any inflammation, deformity or pathological changes were included in this study.

ii. Male and female subject with excessive facial hair, which obscures some of the facial landmarks were excluded from the study.

Ethical Consideration

Approval for this study was obtained from the Research and Ethics Committee of the Faculty of Basic Medical Sciences, Delta State University, Abraka.

Data Analysis

The quantitative and qualitative data was expressed as mean ± SD and frequency/percentages respectively. Independent sample t-test was used to test for sex differences in the variables.

PRESENTATION OF RESULTS

This chapter presents the results from the thumbprint ridge count and facial parameters among male and female students of Delta State University, Abraka. The results were presented in tables for the ease of clarity and understanding.

Table 1: Gender and patterns of right thumbprint

Pattern	Male (%)	Female (%)
Arch	10(62.50)	6(37.50)
Whorl	58(53.7)	50 (46.30)
Ulna loop	70(48.30)	75(49.70)

Source: SPSS Output

Table 1 : depicts gender and patterns of right thumbprint. It was observed that females have significantly higher ulna ridge in the right thumb than their male counterpart. The arch was more on the right thumb of males than in the females while the whorl was significantly higher in males

than in females. Table 2 : depicts gender and patterns of left thumbprint. It was observed that males have significantly higher ulna ridge in the left thumb than their female counterpart. The arch was more on the left thumb of males than in the females while the whorl was significantly higher in males than in females.

Table 3 : shows the group statistics for gender and patterns of right and left thumbprint. It was observed that the arch was higher on the left thumb compared to the right side. The whorl was also higher on the right thumb than on the left thumb. The ulna loop was higher on the right thumb when compared to the left thumb. The arch was more on the right and left thumb of males than in the females; the whorl was significantly higher on the right and left thumb of males than in females while the ulna loop was higher in females than in males only on the right and higher on the left in male than in female.

Table 2: Gender and patterns of left thumbprint

Pattern	Male (%)	Female (%)
Whorl	20(8.0)	19(7.5)
Arch	16(62.2)	12 (4.4)
Ulna Loop	39(12.0)	27(9.2)

Source: SPSS Output

Table 3: Group statistics for gender and patterns of right and left thumbprint

Pattern	Male (%)	Female (%)
Arch (right)	10(62.50)	6(37.50)
Arch (left)	16(65.2)	12 (4.4)
Whorl (right)	58(53.7)	50 (46.30)
Whorl (left)20(8.0)	19(7.5)	
Ulna loop (right)	70(48.30)	75(49.70)
Ulna loop (left)	39(12.0)	27(9.2)

Source: SPSS Output

Table 4: Descriptive statistics of nasal dimensions of males

Variables	**N**	**Minimum (mm)**	**Maximum (mm)**	**Mean (mm)**	**Std. Dev.(mm)**
Nasal height	384	18.82	37.76	31.32	4.17
Nasal width	384	21.99	39.68	32.06	3.88
Nasal index	384	70.03	123.08	100.75	12.47

Source: SPSS Output

Table 4: shows the descriptive statistics of nasal dimensions of males. The mean value of nasal height, nasal width and nasal index were 31.32±4.17mm, 32.06±3.88 and 100.75±12.47mm respectively.

Table .5 : shows the descriptive statistics of nasal dimensions of females. The mean value of nasal height, nasal width and nasal index were 30.67±5.47mm, 31.93±3.15 and 95.55±11.92mm respectively.

Table. 6: depicts the test of significant difference (t-test) of parameters measured between males and females for both right and left thumb. The result in the above table suggests that there was a statistical significant difference in thumbprint patterns and this was statistically significant at ($p \leq 0.05$).

Table 5: Descriptive statistics of nasal dimensions of females

Variables	N	Minimum (mm)	Maximum (mm)	Mean (mm)	Std. Dev.(mm)
Nasal height	384	22.04	40.82	30.67	5.47
Nasal width	384	24.82	24.82	31.93	3.15
Nasal index	384	63.66	122.33	95.55	11.92

Source: SPSS Output

Table .6: Test of Significant difference (t-test) of parameters measured

Parameters	N	Df	*p*-value
Right thumb (male)	384	148	0.000
Right thumb (female)	384	148	0.000
Left thumb (male)	384	148	0.000
Left thumb (female)	384	148	0.000

Source: SPSS Output

Table .7: Test of Significant difference (t-test) of parameters measured

Parameters	N	Df	*p*-value
Nasal height (male) (female)	384	149	0.000
Nasal width (male) (female)	384	149	0.000
Nasal index (male) (Female)	384	149	0.000

Source: SPSS Output

Table. 7: depicts the test of significant difference (t-test) of parameters measured between males and females. The result in the above table suggests that there was a statistical significant difference in nasal parameters and this was statistically significant at ($p \leq 0.05$)

Discussion of findings

The study has shown that there is a significant association between the thumbprint patterns and vertical class III neoclassical facial proportion only when the frequency of both left and right thumbprint patterns were considered as a single entity (Lawan *et al.,* 2017).

The three thumbprint patterns highlighted in this study were arches, ulna loop and whorls. These thumbprint patterns (arches, ulna loop and whorls) were also highlighted in a study by Micle, (1989) and Sarda, (2002) who reported similar thumbprint patterns which were investigated in their study. Another study by Dasai, (2007) on Indians also reported the thumbprint patterns as arches, ulna loop and whorls).

This present study shows that homologous finger tend to have comparable counts of pattern types, thus this statement is in agreement with prior studies by Igbigbi *et al.,* (1994) and Jaja, (2008) who in their study reported that homologous fingers tend to have comparable counts of fingerprints patterns. Another study also confirmed that homologous finger therefore have comparable counts patterns (Danborno and Idris, 2007). Similarly, Etah, (2007) reported that homologous fingers have similar counts of fingerprints patterns.

Females significantly have more of the ulna ridge in the right thumb than their male counterparts and this difference were statistically significant. This finding is in accordance with prior studies by Esperanza *et al.,* (2008) and Fanda, (2008) who found women to have a significantly higher ridge density than men in the distal region of all ten (10) fingers (radial and ulna count areas) except in the proximal region (lower count area). was also reported that one of the reasons why males tend to have lower ridge count compared to females is due to sexual dimorphism in the body form, in which male on the average have higher stature (Krishan *et al.,* 2010; Kapoor and Badiye, 2015). It was reported that for every 100 mm increase in body height, there is significant increase in some facial dimensions such as face width, nasal root breadth, and nose breadth as well as significant decrease in other variables such as bigonial breadth (Zhuang *et al.,* 2010).

The arches were seen to be least in the distribution and more on the right thumb of males than in females. This finding concurs with previous study by Hassan, (2017) who reported that the frequency of the pattern of the left and right thumbprint patterns follow the universal trends, with arches as least, followed by whorls and loop the highest. This present study also agrees with study by Kanchan and Rastogi, (2009) in nonhomogeneous population from North and South India has shown considerable sexual dimorphism in hand and thumbprint patterns; male dimensions and arches especially on the rights thumb being larger than females. There seems to be an indication that the total ridge count is influenced by the genetic component of the individual especially by the sex chromosome component.

The whorl pattern was observed to be more on the left hand and were majorly distributed among the males compared to that of the females and this difference was statistically significant by comparison. This finding is in agreement with prior studies by Ezzat *et al.,* (2017) and Hassan *et al.,* (2018) that reported that the left hand has the whorl pattern which is majorly distributed and that this was seen more in males than seen in females. Our study is also in keeping with another study conducted by Anibor *et al.,* (2011) that reported the whorl patterns to be more distributed on the left hand and majorly distributed among the males compared to that of the female subjects studied.

Males were observed to have significantly higher ulna ridge on the left than that of their female counterparts. This finding concurs with previous

work by Anibor *et al.,* (2011) who stated that the ulna ridge pattern of male subjects was of higher values on the left hand when compared with that of the female subjects. Similarly, Eruma, (2009) also reported in his study that male subjects have higher ulna ridge count on the left when compared with the left hand of the female subjects.

The male mean nasal length and nasal width were reported in this study to have higher mean value compared to that of the female. Also, the t-values showed that the variables were statistically significant with males having higher nasal length and nasal width than their female counterparts ($p<0.05$). Comparing this study with the works of previous researchers, it was discovered that our study is in agreement with previous researches conducted by Anibor *et al.,* (2011), Aaron *et al*., (2011) in Nigeria and Querba *et al., (*2008) in South-West of Iran who amongst others reported significant differences in the mean nasal length and nasal width of males and females, confirming the males to have higher nasal parameters than the females and thus reported that nasal parameters could be used to determine thumb print patterns in individuals. The reason for the possible variation in the nasal dimensions as reported, may be possibly due to genetic, hormonal, nutritional status and other related factors.

This present study further showed that the mean nasal index values of male and female subjects were statistically significant. This again indicates that males therefore have higher mean nasal index values in comparison with that of female subjects. This present study corroborates with the study by Anibor *et al.,* (2011), Eruma, (2009) and Aaron *et al*., (2011) who amongst others reported a larger mean nasal index value for males than in females.

Conclusion

The arch was higher on the left thumb compared to the right side. The whorl was also higher on the right thumb than on the left thumb. The ulna loop was higher on the right thumb when compared to the left thumb. The arch was more on the right and left thumb of males than in the females; the whorl was significantly higher on the right and left thumb of males than in females while the ulna loop was higher in females than in males only on the right and higher on the left in male than in female. Also, the nasal parameters of the males were significantly higher in males than in females.

Recommendations

The study therefore recommends that future studies should be done using a larger sample of subjects. Also future study should be carried out using other facial parameters like orbital dimensions with age and ethnic consideration.

Contribution to Knowledge

1. This study has further established that males have significantly higher nasal length, width and index than their female counterparts.

2. This study has further confirmed that the facial parameters like the nasal dimensions of male and female have significant positive relationship with thumbprint pattern especially in identical twins since development of fingerprints and faces of identical twins originate from the same DNA leading to considerable genetic similarity.

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