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Fingerprint Ridge Count Bilateral Asymmetry with Body Composition Parameters Among Some Medical Students in Kano, Nigeria

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Abstract
Fingerprint is a texture formed by ridges on the human fingertip, and consists of a pattern of interleaved ridges and valleys that allow humans to grasp and grip objects. The study aimed at determining the relationship between fingerprint ridge count and bilateral asymmetry with body composition parameters. The study design involved a total number of 300 students. Bioelectric Impedance machine was used for measurements of body composition parameters. A direct sensing was used for fingerprint capturing. Ridge density was determined from the count of ridges found diagonally within a 25mm² in ulnar and radial areas. The average of fingerprint asymmetry was determined by adding up the ulna and radial and divide by 2 for all the fingers and subtracting the left digits from the right finger. A significant difference between males and females was observed in all the body composition parameters except in the BMI. The significantly higher median values were observed only in the muscle mass and resting metabolism in male participants compared to the females. With respect to fingerprint ridge counts, sexual dimorphism existed in index and little digit of both right and left digits. A significant difference was only found in the total left ridge count and total ridge count, which shows that females had higher mean and percentile values than males, whereas all other variables shows no significant difference. Right thumb shows a significant correlation with all the body composition parameters except with resting metabolism whereas the remaining digits correlated with some of the body composition parameters. Total right and left ridge count and total ridge counts shows a significant correlation with BMI, resting metabolism and visceral fat. However, no correlation was observed in the bilateral asymmetry of all the fingers except in the asymmetry of ring digit, for predicting of body composition from fingerprints ridge counts and bilateral asymmetry. Left index were found very significant in Muscle mass and resting metabolism formula for prediction of body composition from fingerprints ridge counts and bilateral asymmetry. In conclusion, the results of this study confirm that there is relationship between fingerprint ridge count and body composition parameters. Whereas bilateral asymmetry doesn't correlate with body composition parameters except in resting metabolism.

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Keywords: Bilateral asymmetry, body composition, ridge counts.

INTRODUCTION

Fingerprint simply refers to the texture formed by ridges on the top of human fingertip (Galton, 1892). It is the representation of the epidermis of a finger and consists of a pattern of interleaved ridges and valleys. The ridges evolved over the years to allow humans to grasp and grip objects (Andre´ *et al.,* 2010; Yum *et al.,* 2020), and form through a combination of genetic and environmental factors (Pechenkina *et al.,* 2000; Kahn *et al.,* 2001). No two individuals including identical twins have similar fingerprints (Maltoni *et al.,* 2009). Knowledge of fingerprint ridge counts and density have found to reduce the process of sex identification and determination by about 60% (Adamu *et al.,* 2018).

Dermatoglyphic asymmetry can be used to measure developmental instability during a precise period of fetal development (Richard *et al.,* 1987; Arrieta *et al.,* 1993). In humans, inbreeding (Markow and Martin, 1993), poor health conditions, and various neurological disorders, such as schizophrenia, attention deficit disorder, developmental delays in childhood, and Down syndrome are positively associated with fingerprint asymmetry (Barden, 1980; Mellor, 1992). The dermatoglyphic patterns of obese patients are dependent on such inherited or genetic tendencies towards obesity (Bray *et al.,* 1998; Bray *et al.,* 2000).The fingerprints profile may likely be associated with variables that have more affinity to genetic factor compared to the environmental factors (Oladipo *et al.,* 2010), and genes for limb development underlie variation in human fingerprint patterns (Li *et al.,* 2022). Therefore, population-specific study for establishment of relation may be useful in developing population-specific formulae for prediction of BMI from fingerprints (Mundorff *et al,.* 2014). There is scarcity of data on the relationship between fingerprint ridge count and bilateral asymmetry with body composition parameters. The relationship between fingerprint variables and adiposity indices have received minimal attention in the literature especially among Nigerian and African populations. Hence there is need for a reference data or baseline data on fingerprint ridge count, asymmetry and body composition parameters among Nigerian population. The use of fingerprint bilateral asymmetry in estimation of body composition will help in providing information useful in evaluating the health status of individual. The fingerprint ridge count and asymmetry may serve as an additional diagnostic tool for evaluation of an individual at risk of abnormal body composition. The study is therefore aimed at determining the relationship between fingerprint ridge count and bilateral asymmetry with body composition parameters among some cross sections of Nigerian medical students.

MATERIAS AND METHODS

Study location, design, and participants

The present cross-sectional study was conducted among students of two selected universities in Kano metropolis, Nigeria. We randomly selected sample of 150 males (mean age 21.94±2.31) and 150 females (mean age 20.13 ± 2.33 years) students from Colleges of Health Sciences of Bayero University, Kano and Maitama Sule University, Kano. to participate in the study The purpose of the study was explained to all the participants and their verbal consent was taken before conducting the study.

Inclusion/Exclusion Criteria

Registered students of College of Health Sciences Bayero University Kano and Faculty of Basic Medical Sciences, Maitama Sule University which are physically fit and has no any physical deformity especially at the tip of their fingers, among which are Hausa ethnic group were recruited for the study while non-registered students, students outside the College, any student with physical deformity especially in the tip of the fingers as well as non-Hausa students were excluded from the study.

Ethical Consideration

Ethical approval was obtained before the commencement of the study from ethical committee of the Department of Anatomy, Faculty of Basic Medical Sciences, Bayero University Kano. . Informed consent was also obtained from the participants before enrolment.

Methodology

The study was designed as a prospective cross sectional study and involved the collection of Bio-data using a semi structured questionnaire, body composition parameters and fingerprints for ridge counts.

Collection of Bio-Data and anthropometry

The Bio-data was collected using questionnaire and the information collected were sex, age, tribe or the ethnicity and location of birth of the participant. While for the anthropometry, the height, body composition and fingerprints were measured. .

Measurement of *Height*

The body height was measured from the vertex of the head of the subject to the sole of his foot, using stadiometer (RZ-160) following standard protocol to the nearest 0.5 cm.

Body composition parameters

Bioelectric Impedance machine (Omron®, HBF-514, China) was used for measurements of body composition parameters (BMI, body fat, muscle mass, resting metabolism, body age and visceral fat). The subject was asked to step on the main are on it bare-footed, making sure each of the heels is positioned on a heel electrode, and standing with their weight evenly distributed. Each participant stands with the knees and back straight with raised arms horizontally and elbow extended while holding the display unit. Participants were also asked to extend arms so as to form a 90° angle with respect to their body. Their age, gender and height were imputed, then the subject were asked to steps onto the scale platform. Electrodes in the foot sensor pads send a low, safe signal through the body. Weight was calculated automatically along with body fat content and Body Mass Index in seconds.

Capturing, Classification and Fingerprint Ridge Count

A direct sensing [thumbprint in contact with live scan (digital persona) sensor] fingerprint capturing method was used (Jain *et al.*, 2007). Software (Print analyzer) was designed using the Microsoft Visual Basic (version 6.0) programming language in order to save each fingerprint. The subjects were asked to clean their fingers to remove any dirt that may be associated with the skin ridges. The fingers were then placed on the fingerprint sensor individually (digital persona). After capturing a plain fingerprint, the type of digit (thumb) and the rest fingers, sex (male or female), side of the finger (left or right) and unique code (questionnaire code) of the participants were saved with each fingerprint. For each fingerprint two versions were captured, the original size image used for scaling and an amplified image (at a ratio of 7.74) for ridge density and thickness determination.

Ridge density (the number of ridges in a given space) was determined according to the method described by Acree (1999). The density was determined from the count of ridges found diagonally within a 25 mm^2 area in ulnar and radial areas of the finger print. The average of radial and ulnar ridges were taken as ridge count of each digit. The bilateral ridge asymmetry was determined by subtracting the left from right (R-L) for each digit. The total Bilateral Asymmetry was determined by subtracting the – total left ridge count from total right ridge count.

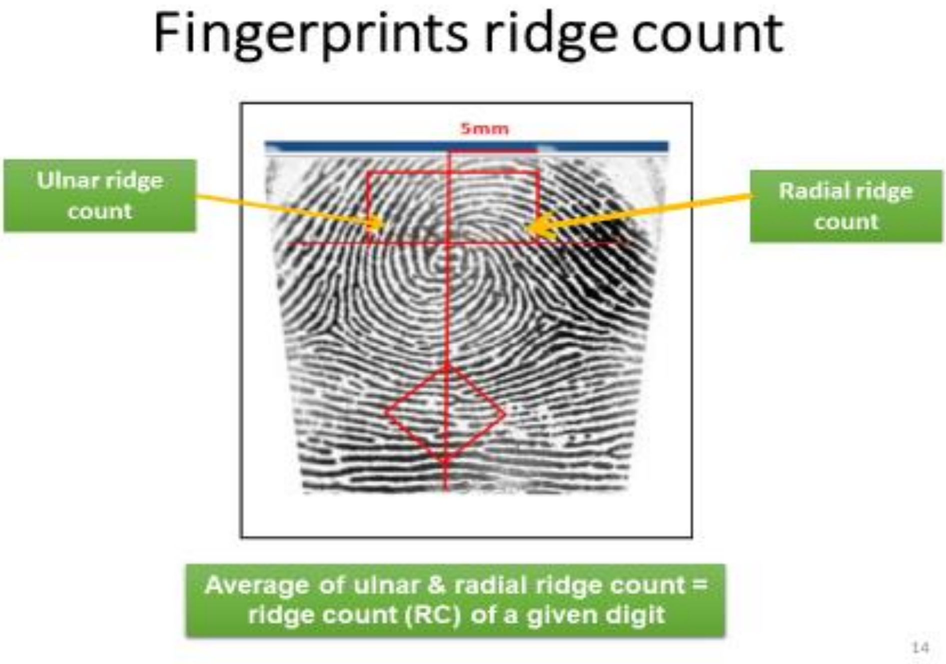

Figure 1: Determination of fingerprints ridge count

Measurement error

The values for the Cronbach's Alpha (reliability coefficient) ranged from 0 to 1, where 0 indicated "no reliability", ≥ 0 but <0.2 "slight reliability", 0.2 to < 0.4 "fair reliability", 0.4 to < 0.6 "moderate reliability", 0.6 to < 0.8 "substantial reliability", and 1 "almost perfect reliability"(Shrout and Fleiss, 1979). The Cronbach's Alpha of the ridge counts of the ten digits range from 0.99-1.00, except for radial left little and right thumb 0.94 and 0.74 respectively.

Data Analysis

The data were expressed in mean ± SD and quartiles. Mann Whitney test was used to compare differences in fingerprint and body composition parameters. Pearson correlation test was used to determine the correlation between fingerprints ridge count and body composition. Step-wise multiple regression analyses were used to generate a model for estimation body composition parameters from the fingerprint ridge count and bilateral fingerprint asymmetry. SPSS version 20 (IBM Corporation, for Windows), was employed for analysis of data. $P < 0.05$ was set as the level of significant.

RESULTS

Table 4.1 shows the descriptive statistics and percentiles of age, height, body composition and fingerprint ridge count of male and females participants. It was observed that males had significantly higher mean and median values compared to females. In both height and weight males had significantly higher mean and median values. A significant difference between males and females was observed in all the body composition parameters except in the BMI where no significant difference was observed between the sexes. The significantly higher mean and median values were observed only in the muscle mass and resting metabolism in males' participants compared to the female participants. With respect to fingerprint ridge counts, sexual dimorphism existed in the index and little digit of both right and left digits.

Table 1: Descriptive statistics and percentiles of age, height, body composition and fingerprint ridge count

	Male			Female			
Variables	Mean ± SD	Min-Max	Median (25,75)	Mean ± SD	Min-Max	Median (25,75)	Z Value
Age (years)	21.94 ± 2.31	18 – 30	21.50 (20, 23)	20.13 ± 2.33	18 - 33	20(18.75,21)	-7.61**
Height (cm)	169.67 ± 6.69	157 – 196	169.75(165, 73.5)	158.62 ± 5.66	143.5 - 172	158.25(155,162.63)	-12.07**
Weight (Kg)	58.45 ± 8.55	44.3 - 104.6	57.6(52.75,61.88)	52.11 ± 10.74	37.60 - 99.6	48.95(45.4,55.1)	-7.56**
BMI (Kg/m²)	20.3 ± 2.18	17.20 - 30.9	19.9(18.68,21.3)	20.62 ± 3.88	14.40 - 36.6	19.9(18.2,21.95)	-0.82
% Body Fat	13.15 ± 5.79	5 - 38.20	11.95(8.98,16.2)	28.66 ± 7.83	10.1 - 53.3	27.35(23.2,33.13)	-13.52**
% Muscle Mass	43.84 ± 3.66	28.5 – 49.9	44.3(42.08,46.4)	27.34 ± 3.15	20.1 – 43	27(25.2,28.7)	-14.78**
Resting Metabolism	1487.87 ± 119.62	1153 - 2058	1474.5(1409.75,1555.25)	1223.8 ± 120.86	1034 - 1783	1186(1146.5, 1263.5)	-13.13**
Body age (years)	20.2 ± 6.57	18 – 69	18(18,18)	22.85 ± 8.97	18 – 61	18(18,23)	-3.46**
Relative visceral fat level	2.75± 1.95	1 – 12	2(1,4)	3.03 ± 1.68	1 – 14	3(2,4)	-2.45*
Right thumb ridge count	9.84 ± 1.16	7 – 13	10(9,10)	9.63 ± 0.94	8 – 13	10(9,10)	-1.29
Right index ridge count	10.52 ± 1.32	8 – 14	10.5(9.5,11.5)	10.93 ± 1.13	8 – 14	11(10.5,11.63)	-3.07*
Right middle ridge count	10.94 ± 1.29	7 - 14.5	11(10,12)	11.19 ± 1.05	7.5 – 15	11(10.5,12)	-1.86
Right ring ridge count	11.15 ± 1.16	8 - 14.5	11(10.5,12)	11.17 ± 0.98	9 - 15	11.5(10.5,12)	-0.05
Right little ridge count	11.19 ± 1.07	9 – 14	11(10.5,12)	11.55 ± 1.15	8.5 - 17.5	11.5(10.88,12.5)	-2.76*
Left thumb ridge count	9.89 ± 1.06	7.5 – 13	10(9.5,10.5)	9.78 ± 0.86	7.50 - 13.5	10(9.5,10.5)	-0.78
Left index ridge count	10.5 ± 1.27	7.5 – 14	10.5(9.5,11.5)	11.03 ± 1.23	8.5 - 15.5	11(10,12)	-3.54**
Left middle ridge count	11.1 ± 1.30	7 – 15	11(10,12)	11.28 ± 1.1	8.5 - 16.5	11.5(10.5,12)	-1.50
Left ring ridge count	11.18 ± 1.12	8.5 - 14.5	11(10.5,12)	11.24 ± 1.1	8.5 – 18	11.5(10.5,12)	-0.34
Left little ridge count	11.24 ± 1.23	9 – 15	11(10.5,12)	11.68 ± 1.22	8.50 – 18	11.5(11,12.5)	-3.35**

* P < 0.05, **P <0.001, SD; standard deviation, max; maximum, min; minimum, 25^{th}& 75^{th}; percentiles

Table 2 shows descriptive statistics and percentiles of ridge count and bilateral ridge asymmetry in male and female participants. Significant difference was found only in the total left ridge count and total ridge count, which showed that females had higher mean and percentile values than males, whereas in the bilateral ridge count asymmetry all the variables shows no significant difference.

Table 2: Descriptive statistics and percentiles of ridge count and bilateral ridge asymmetry

Variables	Male			Female			Z value
	Mean ± SD	**Min-max**	**Median (25,75)**	**Mean ± SD**	**Min-max**	**Median (25,75)**	
TRRC	53.62 ± 4.89	39 – 68	53(50.5,56.5)	54.46 ± 4.46	42 - 74.5	54.5(51.5,57.5)	-1.81
TLRC	53.91 ± 4.87	42.5 – 69	53.75(50,55.01)	55.01 ± 4.8	43 - 81.5	55(52.25,57.5)	-2.32*
TRC	107.53 ± 9.56	82 – 137	107(100.5,113.25)	109.46 ± 9.1	85 – 156	109.5(104,115)	-2.09*
AT	-0.07 ± 0.88	-3 – 3	0(-0.5,0.5)	-0.16±0.57	-1.50 – 2	-0.5(-0.5,0.5)	-1.37
AI	0.01 ± 0.89	-2.5 – 2	0(-0.5,0.5)	-0.10±0.91	-3.00 - 2.5	0(-0.5,0.5)	-0.81
AM	-0.16 ± 1.05	-5 - 2.5	0(-1,0.5)	-0.09±0.71	-2.50 – 2	0(-0.5,0.5)	-0.71
AR	-0.03 ± 0.96	-2 - 2.5	0(-0.5,0.5)	-0.07±0.82	-3.00 – 2	0(-0.5,0.5)	-0.07
AL	-0.05 ± 0.82	-2 – 2	0-0.5,0.5)	-0.13±0.76	-2.50 – 2	0(-0.5,0.5)	-1.19
DR-L	-0.3 ± 2.00	-6.5 - 5.5	0(-1.5,1)	-0.55±1.79	-7.00 - 4.5	-0.5(-1.5,0.5)	-1.41

* $P < 0.05$, SD; standard deviation, max; maximum, min; minimum, 25^{th}& 75^{th}; percentiles. **TRRC;** total right ridge count, TLRC; total left ridge count, TRC; total ridge count, A; asymmetry, T; thumb, I; index, M; middle, R; ring L; little, DR-L; differences of right and left digits.

Table 3 shows relationship between body composition with ridge count and bilateral fingerprints ridge asymmetry. It was found that RT, RI, RM, RL, LT, LI, LR, TRRC, TLRC and TRC were significantly correlated with BMI. RT and LT were significantly correlated with Body fat. RT, RI, LI and LL were significantly correlated with muscle mass. RT, RR, LT, AT, AI, AM, AL and DR-L were not correlated with resting metabolism. RT, RL, LT, TRRC and TRC were significantly correlated with body age. It was also found that RT, RM, RR, LR, LL, TRRC, TLRC and TRC were significantly correlated with visceral fat.

Table 3: Pearson's correlation for relationship between body composition with ridge count and bilateral fingerprints ridge asymmetry

Variables	BMI	Body Fat	Muscle Mass	Resting Met.	Body Age	Visceral fat
RT	-0.173**	-0.186**	0.140*	-0.055	-0.153**	-0.165**
RI	-0.117*	0.069	-0.149**	-0.253**	-0.060	-0.073
RM	-0.158**	-0.015	-0.068	-0.200**	-0.113	-0.160**
RR	-0.094	-0.052	0.022	-0.054	-0.069	-0.115*
RL	-0.165**	0.022	-0.113	-0.211**	-0.132*	-0.111
LT	-0.137*	-0.124*	0.083	-0.058	-0.119*	-0.111
LI	-0.149**	0.074	-0.163**	-0.285**	-0.090	-0.112
LM	-0.105	-0.004	-0.051	-0.125*	-0.058	-0.108
LR	-0.147*	-0.085	0.021	-0.156**	-0.110	-0.134*
LL	-0.104	0.063	-0.134*	-0.212**	-0.056	-0.122*
TRRC	-0.168**	-0.031	-0.049	-0.192**	-0.123*	-0.147*
TLRC	-0.152**	-0.009	-0.069	-0.207**	-0.101	-0.140*
TRC	-0.163**	-0.020	-0.060	-0.204**	-0.114*	-0.146*
AT	-0.050	-0.086	0.078	0.003	-0.048	-0.074
AI	0.050	-0.009	0.024	0.055	0.045	0.058
AM	-0.067	-0.013	-0.020	-0.095	-0.070	-0.065
AR	0.070	0.042	0.001	0.129*	0.054	0.027
AL	-0.071	-0.067	0.050	0.032	-0.099	0.035
DR-L	-0.025	-0.053	0.054	0.056	-0.046	-0.004

*P <0.05, **P< 0.01, **TRRC;** total right ridge count, TLRC; total left ridge count, TRC; total ridge count, A;asymmetry, T; thumb, I; index, M; middle, R; ring L; little, DR-L; differences of right and left digits.

Right thumb showed a significant correlation with all the body composition parameters except the resting metabolism whereas, the remaining digits correlated with some of the body composition parameters. Total right and left ridge count and total ridge counts showed a significant correlation with BMI, resting metabolism and visceral fat. No significant correlation was found between the bilateral fingerprints ridge asymmetry and body composition parameters except in the asymmetry of ring digit which correlated with resting metabolism in Table 3 above.

Table 4 showed a step-wise multiple linear regressions for prediction of body composition from fingerprints ridge counts and bilateral asymmetry. Right thumb is significantly important in BMI, Body fat and visceral fat formula, for predicting of body composition from fingerprints ridge counts and bilateral asymmetry. Left index were found to be very significant in muscle mass and resting metabolism formula for prediction of body composition from fingerprints ridge counts and bilateral asymmetry.

Table 4: Step-wise multiple linear regressions for prediction of body composition from fingerprints ridge counts and bilateral asymmetry

Variable	Model	Equation (y= m x + c)	R	R^2	SEE	F	P value
Body mass index (BMI)	1	BMI=(-0.553)RT +25.84	0.173	0.030	3.10	9.19	0.003
Body fat (BF)	1	BF= (-1.969)RT +40.048	0.186	0.035	10.21	10.73	0.001
	2	BF=(-3.462)RT+(2.075)LI+32.218	0.283	0.080	9.99	12.92	0.000
%Muscle mass (MM)	1	MM=(-1.138)LI+47.843	0.163	0.026	8.84	8.089	0.005
	2	MM=(-2.421)LI+(3.016)RT+32.340	0.320	0.103	8.50	16.99	0.000
	3	MM=(-1.740)LI+(3.578)RT+(-1.422)LL+35.838	0.349	0.122	8.42	13.70	0.000
Resting metabolism (RM)	1	RM=(-39.913)LI+1785	0.285	0.082	171.47	26.42	0.000
	2	RM=(-52.084)LI+(25.866)RR+1627.94	0.313	0.098	170.21	16.13	0.000
	3	RM=(-37.260)LI+(34.20)RR+(-25.794)RI+1651.934	0.333	0.111	169.30	12.27	0.000
Visceral fat (VF)	1	VF=(-1.243)RT+33.608	0.153	0.024	7.879	7.177	0.008

SEE; standard error of estimate, R; right, L; left, T; thumb, I: index, RR: right ring,

DISCUSSION

In our study a significant difference between males and females was observed in all the body composition parameters except the BMI. Overall, more females preferred to be slightly underweight so as to have their ideal figure which may have been driven by media influences that portray small figures as ideal for females. On the other hand, more males preferred their ideal figure to be somewhat overweight. The aspiration of choosing an ideal body shape which is well-built and muscular may have influenced the males to have negative perceptions towards their own body shape as they desire to be heavier in weight (Patricia and Arnold, 2002).

A serious outcome of having distorted body images is anorexia, where it is known that anorexics detrimentally overestimate their own body size and shape (Gilbert, 2005). In this study significantly higher median values were observed only in the muscle mass and resting metabolism in male participants as compared to the females. Typically, dimorphism emerges just before sexual maturity, with the larger sex demonstrating either a more rapid growth, or an extension of the growth phase during this period (Willner and Martin, 1985). In humans, the ratio of brain volume to body size is the greatest of any primate. This characteristic result in the brain dominating energy requirements during early life, which is also the period during which energy requirements are met by maternal metabolism. High levels of body fat in female adolescents and young adult can therefore be attributed to the high energy demands of lactation (Wells, 2006) whereas the additional lean mass of men, which is only acquired around 17 years of age, is associated with greater physical work capacity (Bogin, 1999). Individuals with Klinefelter syndrome have an extra X chromosome but live as men. The extra X chromosome is associated with reduced testosterone levels during puberty, resulting in low levels of lean mass and bone density, and a predisposition to truncal obesity (East*et al.,* 1976; Bojesen*et al.,* 2006). Individuals with Turner syndrome are females who lack one X chromosome. This abnormality is associated with reduced height and lean mass as well as poor development of the ovaries and breasts, while total and visceral fat are increased (Gravholt *et al.,* 2006).

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With respect to fingerprint ridge counts, sexual dimorphism existed in the index and little digit of both right and left digits. Significant difference was found only in the total left ridge count and Total ridge count, which showed that females had higher mean and percentile values than males. Furthermore, statistically significant differences were observed between the sexes in the ridge density. Females had a significantly higher ulnar ridge density in the right thumb. It was documented that ridge density varies according to sex, age and population origin (Gutiérrez-Rodemero *et al.,* 2011). Sexual dimorphism has been reported in fingerprint ridges in different populations (Nayak*et al.,* 2010; Ahmed and Osman, 2016; Kapoor and Badiye, 2015; Thakar *et al.,* 2018; Kaur and Kaur 2019). In contrast to previous findings, it was reported that females had higher ridge counts in all the three areas among Mataco-Mataguayo (Gutiérrez-Rodemero*et al.,* 2011), Sudanese (Kapoor and Badiye, 2015) and Argentinian (Ivaldería*et al.,* 2016), Gujarati (Sharma *et al.,* 2018) and Indian (Kaur *et al.,* 2020) populations. To substantiate the variation between sexes, it was evident that females had finer epidermal ridges than their male counterparts (Oore, 1989). Males were also reported to have coarser ridges than females by approximately 10% (Králík and Novotný, 2003). In addition to this valid evidence, it was also noted that the difference between the finger ridge density in males and females in a given area may be linked to sexual dimorphism in body proportions, where on average males were heavier and taller than females, and therefore the same numbers of ridges were accommodated amongst females in a smaller surface area, thus a higher density is noted amongst females (Kapoor and Badiye, 2015 and Rishan*et al.,* 2010). In almost all of the populations, females had a greater number of ridges than males (Gutiérrez*et al.,*2011; Kapoor and Badiye, 2015; Ivaldería *et al.,* 2016), in all the areas where sexual dimorphism was exhibited.

whereas in the bilateral ridge count asymmetry all the variables show no significant difference in the sexes. A significant correlation was observed between % body fat, muscle mass, body age and visceral fat correlated with ridge count asymmetry of RT and LT. The ridge count asymmetry of RI and LI correlated with BMI and muscle mass. The BMI, body age and visceral fat on the other hand correlated with bilateral ridge count asymmetry RL, TRRC and TRC. Also RM, LR and TLRC correlated only with BMI. LL correlated only with muscle mass and visceral fat. RM also correlated with BMI and visceral fat but RR correlated only with visceral fat. However, no correlation was observed in the bilateral asymmetry of all the fingers except in the asymmetry of ring digit.

Right thumb is significantly important in BMI, body fat and visceral fat formula, for the prediction of body composition from fingerprints ridge counts and bilateral asymmetry. Left index were found to be very significant in muscle mass and resting metabolism formula for prediction of body composition from fingerprints ridge counts and bilateral asymmetry.

CONCLUSION

In conclusion, the results of this study confirm that there is relationship between fingerprint ridge count and body composition parameters. Whereas bilateral asymmetry doesn't correlate with body composition parameters except in resting metabolism.

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