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SEX AND STATURE ESTIMATION FROM ODONTOMETRIC PARAMETERS IN IKWERRE ETHNIC GROUP IN RIVERS STATE OF NIGERIA.

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Abstract

Sex and stature estimation are important factor to be considered in identifying unknown human skeletal remains. Some skeletal body parts have been used like the pelvic and skull bones. However, teeth can also be used on the ground that it has high resistance to post-mortem biodegradation. Also, jaw has complement of thirty-two teeth, thereby when others are missing or destroyed, some could be well preserved. This study was aimed to estimate sex and stature using odontometric parameters in Ikwerre ethnic group in Rivers State of Nigeria. This cross-sectional descriptive study involved 200 volunteers between the ages of 15 to 30 years (100 males and 100 females) whose parents are from same ethnic group. The measured parameters were maximum mesiodistal width (MD), buccolingual dimension (BL) and crown height (CH) of the right maxillary and mandibular incisors, canines and premolars. The height of the volunteers was also measured. The teeth were measured using a pair of sterile divider and electronic digital vernier caliper to the nearest 0.01mm and the height was measured using stadiometer. SPSS software version 20.0 was used for statistical analysis. Discriminant function analysis was used to design a predictive model for sex. Multivariate Regression Analysis was used to design a predictive model for stature. The results showed that the mean values of all teeth variables were greater in males than in females except buccolingual of second maxillary incisor (BL2), crown height of first mandibular incisor (CH6) and buccolingual of second maxillary premolar (BL10). Discriminant Function Analysis of all measured parameters showed that scores that predict male is 0.711 while -0.711 for female. Stepwise Discriminant Function Analysis showed maxillary canine to be the best predictor of sex followed by mandibular canine. Predictive model for sex identification was generated. Multivariate regression analysis showed significant ($p < 0.05$) correlation of height with all measured parameters and was used to derive predictive model for stature estimation. This study showed that the combination of the teeth could be used to estimate sex and stature.

Key words: Odontometry, Sex prediction, Stature estimation, Mesiodistal, Buccolingual, Crown height, Ikwerre.

INTRODUCTION

The teeth are used for breaking down food materials, [1] and also for defence. Outside these roles, some evidence has shown that teeth could also be used in estimating sex and stature for archaeological, anthropological and forensic studies.[2,3,4,5] Sex estimation is an important step in

building biological profile of unidentified skeletal remains recovered in medico-legal contexts.[2] This makes the search for missing persons possible, with the potential of recovering ante-mortem records for comparison and establishing identity.[3] Sex estimation of unidentified skeletal remains is important and various skeletal parameters in the body have been used.[3] Among skeletal parameters, includes the pelvic and skull bones which are known to give 100% success in sex identification.[4,5] Sex dimorphism in tooth size and the accuracy of odontometric sex estimation, is found to vary in different regions and ethnic groups, and researchers have advocated the need for population-specific data.

Stature has also been shown to have a definite and proportional relationship with many parts of the human body such as the cranial and facial bones,[6] long bones,[7,8] trunk,[9] and foot bones [10]. Dentine which forms the bulk of the tooth and determines the dimension of the tooth originates from the ectomesenchyme (neural crest cells) and long bones from the mesoderm, both are basically mesenchymal tissue (connective tissue) that have similar structural components.[11,12] Hence, it is reasonable to presume a correlation between tooth dimensions and the stature in an individual.

There is scarcity of information and data regarding the use of teeth in estimation sex and stature in Africa especially Nigeria, hence the aim of the study to ascertain if the teeth can be used in estimating sex and stature in Ikwerre ethnic group and also to generate a predictive model for this purpose.

MATERIALS AND METHODS

This cross-sectional descriptive study involved 200 volunteers between the ages of 15 and 30 years. A Stratified random sampling method was used to select the volunteers. The study involves tooth measurements and height of the volunteers. It was limited to young adults with complete set of fully erupted healthy teeth which are intact, free of pathology and wear, with no dental history of crown restorations, supranumerary teeth, reflecting unaltered anatomy. The volunteers were counselled regarding the nature of the procedure. Only those who signed their informed consent and showed keen cooperation participated in the study.

Measurements

Each subject was made to sit on a chair. With the aid of a light source, the lips were retracted using sterile wooden tongue depressor. The mesiodistal width (MD) is the maximum distance between the mesial surface and distal surface of the teeth. It is usually the point where the crown of the teeth makes contact with adjacent teeth. This distance was measured directly on the subjects using a pair of sterile manual divider held parallel to the occlusal plane (See figure 1).

Figure 1: Mesiodistal width of the teeth

The dimension of the divider was read on a digital verniers calliper to the nearest 0.01mm.The mesiodistal width of the following right maxillary teeth were measured, these include, the first incisor (MD1), second incisor (MD2), canine (MD3), first premolar (MD4) and second premolar (MD5). This was also done for the right mandibular teeth and parameters measured were the first incisor (MD6), second incisor (MD7), canine (MD8), first premolar (MD9) and second premolar (MD10).

The buccolingual diameter (BL) was also measured using pair of divider and this is the distance between the buccal and lingual surfaces of the teeth measured at the thickest point (see figure 2).

Figure 2: Buccolingual diameter of the teeth

The dimension of the divider was read on the digital verniers calliper to the nearest 0.01mm. The buccolingual diameter of the following right maxillary teeth were measured, these include, the first incisor (BL1), second incisor (BL2), canine (BL3), first premolar (BL4) and second premolar (BL5) and the parameters for the right mandibular teeth were also measured; they include the first incisor (BL6), second incisor (BL7), canine (BL8), first premolar (BL9) and second premolar (BL10).
The crown height (CH) is the vertical distance between the tip of the occlusal surface and marginal gingival (line of the gum) (see figure 3).

Figure 3: Crown height of the teeth

The measurement was taken using sterile pair of divider over the buccal surface and the dimensions of the pair of divider were read on a digital verniers calliper to the nearest 0.01mm. The crown height of the following right maxillary teeth were measured, these include, the first incisor (CH1), second incisor (CH2), canine (CH3), first premolar (CH4) and second premolar (CH5). This was done also for the right mandibular teeth and the parameters measured were the first incisor (CH6), second incisor (CH7), canine (CH8), first premolar (CH9) and second premolar (CH10)
The Stature (HT) of each subject was measured as the lenght from the vertex to the floor with the volunteer standing barefooted using anthropometric meter rule. An L-shaped stadiometer, with one

arm sliding against the vertical plane, was brought down on to the volunteer's head and the height read off the scaled vertical plane.
All the measurements were done by a single examiner to eliminate inter-observer error and were taken two times. The average of the two values was obtained to minimize the intra-observer error.

Statistical Analysis

SPSS software version 20.0 was used for data analysis. The data collected were tabulated and the mean, standard deviation, standard error, variance, minimum and maximum value were calculated for the tooth size and stature. Multivariate Stepwise discriminant function analysis was used to generate a predictive model for sex determination. Regression analysis was used to derive predictive model for stature estimation from measured parameters with respect to sex.

RESULTS

The results of the study are presented in tables and bar charts as shown below. Results in table 1 showed the mean value, standard error, range, standard deviation, variance, minimum value and maximum value of all the measured parameters for Ikwerre ethnic group irrespective of sex with the BL4, BL5, CH1 and MD1 showed to have the highest mean value ranging from 10.55, 9.71, 9.52 and 9.10 respectively while BL2, MD6, BL7 and BL6 was shown to have the smallest mean value ranging from 5.99, 5.98, 5.91and 5.61respectively.

Table 1: Descriptive statistics of measured parameters for irrespective of sex

Parameters	N	Range	Minimum value	Maximum value	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
HT	200	0.38	1.47	1.85	1.64	0.01	0.07	0.01
Age	200	5.00	15.00	20.00	16.16	0.08	1.11	1.24
BL1	200	6.99	3.24	10.23	6.73	0.06	0.84	0.70
MD1	200	5.72	5.09	10.81	9.10	0.06	0.85	0.72
CH1	200	5.69	6.24	11.93	9.52	0.07	0.99	0.98
BL2	200	7.91	3.39	11.30	5.99	0.07	1.04	1.09
MD2	200	3.73	5.49	9.22	7.35	0.05	0.71	0.50
CH2	200	5.69	4.50	10.19	8.05	0.07	0.95	0.91
BL3	200	5.51	4.31	9.82	7.69	0.07	0.97	0.93
MD3	200	5.55	4.42	9.97	8.17	0.05	0.74	0.55
CH3	200	5.62	5.51	11.13	8.78	0.08	1.08	1.16
BL4	200	5.68	5.40	11.08	10.55	0.07	1.01	1.00
MD4	200	3.97	5.60	9.57	7.74	0.04	0.63	0.40
CH4	200	7.04	3.64	10.68	7.57	0.06	0.83	0.68
BL5	200	4.86	5.24	10.70	9.71	0.49	0.99	0.96
MD5	200	4.76	5.22	9.98	6.98	0.05	0.73	0.53
CH5	200	4.36	4.69	9.05	6.40	0.06	0.83	0.69
BL6	200	5.23	3.60	8.83	5.61	0.06	0.81	0.65
MD6	200	5.34	4.19	9.53	5.98	0.05	0.65	0.43
CH6	200	3.82	6.04	9.86	7.83	0.06	0.88	0.77
BL7	200	3.65	4.16	7.81	5.91	0.05	0.69	0.48
MD7	200	4.00	5.09	9.09	6.53	0.04	0.59	0.35

CH7	200	5.00	5.09	10.09	7.87	0.06	0.91	0.84
BL8	200	6.17	5.19	11.36	7.26	0.06	0.88	0.78
MD8	200	3.94	6.01	9.95	7.47	0.05	0.66	0.44
CH8	200	4.90	6.50	11.40	9.01	0.07	1.02	1.03
BL9	200	4.75	5.40	10.15	8.11	0.06	0.81	0.66
MD9	200	4.95	5.27	10.22	7.65	0.05	0.72	0.52
CH9	200	5.79	4.19	9.98	7.89	0.06	0.81	0.66
BL10	200	4.47	5.52	9.99	8.25	0.06	0.84	0.71
MD10	200	4.24	5.69	9.93	7.69	0.05	0.75	0.56
CH10	200	5.84	5.16	9.31	7.59	0.06	0.82	0.67

Results in table 2 showed the mean value, standard error, range, standard deviation, variance, minimum value and maximum value of all the measured parameters for female volunteers with the CH1, BL4, BL5 and MD1 showed to have the greatest mean value ranging from 9.44, 9.40, 9.17 and 8.90 respectively while BL2, BL7, MD6 and BL6 was shown to have the least mean value ranging from 6.03, 5.87, 5.79 and 5.46 respectively. Figure 4 showed the bar chart of the mean value of the odontometric parameters in the female with the CH1 having the highest mean value and BL6 having the smallest mean value.

Table 2: Descriptive statistics of measured parameters for female volunteers

	N	Range	Minimum value	Maximum value	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
HT	100	0.26	1.48	1.74	1.61	0.01	0.05	0.00
Age	100	5.00	15.00	20.00	15.98	0.11	1.15	1.31
BL1	100	5.12	3.24	8.36	6.64	0.08	0.82	0.67
MD1	100	5.07	5.39	10.46	8.90	0.08	0.79	0.62
CH1	100	4.57	7.36	11.93	9.44	0.09	0.87	0.75
BL2	100	6.35	3.39	9.74	6.03	0.11	1.05	1.11
MD2	100	3.24	5.49	8.73	7.21	0.06	0.64	0.41
CH2	100	3.87	6.12	9.99	8.01	0.09	0.88	0.77
BL3	100	4.10	5.72	9.82	7.56	0.09	0.88	0.77
MD3	100	5.10	4.42	9.52	7.93	0.08	0.75	0.56
CH3	100	5.55	5.51	11.06	8.61	0.10	1.00	1.00
BL4	100	6.32	5.40	11.72	9.40	0.09	0.91	0.83
MD4	100	3.34	6.23	9.57	7.59	0.06	0.57	0.33
CH4	100	6.06	3.64	9.70	7.40	0.08	0.78	0.61
BL5	100	5.86	5.24	11.10	9.17	0.10	1.01	1.02
MD5	100	3.59	5.22	8.81	6.80	0.06	0.62	0.38
CH5	100	4.34	4.71	9.05	6.29	0.08	0.82	0.68
BL6	100	5.23	3.60	8.83	5.46	0.07	0.71	0.50
MD6	100	2.61	4.19	6.80	5.79	0.06	0.57	0.33
CH6	100	3.82	6.04	9.86	7.90	0.09	0.90	0.81
BL7	100	2.95	4.21	7.16	5.87	0.07	0.66	0.44
MD7	100	3.77	5.32	9.09	6.42	0.06	0.62	0.39

CH7	100	4.75	5.34	10.09	7.81	0.10	0.95	0.91
BL8	100	3.94	5.25	9.19	7.02	0.08	0.79	0.62
MD8	100	3.10	6.01	9.11	7.26	0.05	0.55	0.30
CH8	100	4.82	6.55	11.37	8.83	0.10	0.96	0.93
BL9	100	4.63	5.40	10.03	8.03	0.09	0.90	0.81
MD9	100	3.92	5.27	9.19	7.48	0.08	0.77	0.60
CH9	100	3.91	5.83	9.74	7.77	0.07	0.73	0.53
BL10	100	4.39	5.52	9.91	8.28	0.07	0.73	0.53
MD10	100	4.24	5.69	9.93	7.65	0.08	0.82	0.67
CH10	100	3.24	5.16	8.40	7.01	0.07	0.69	0.48

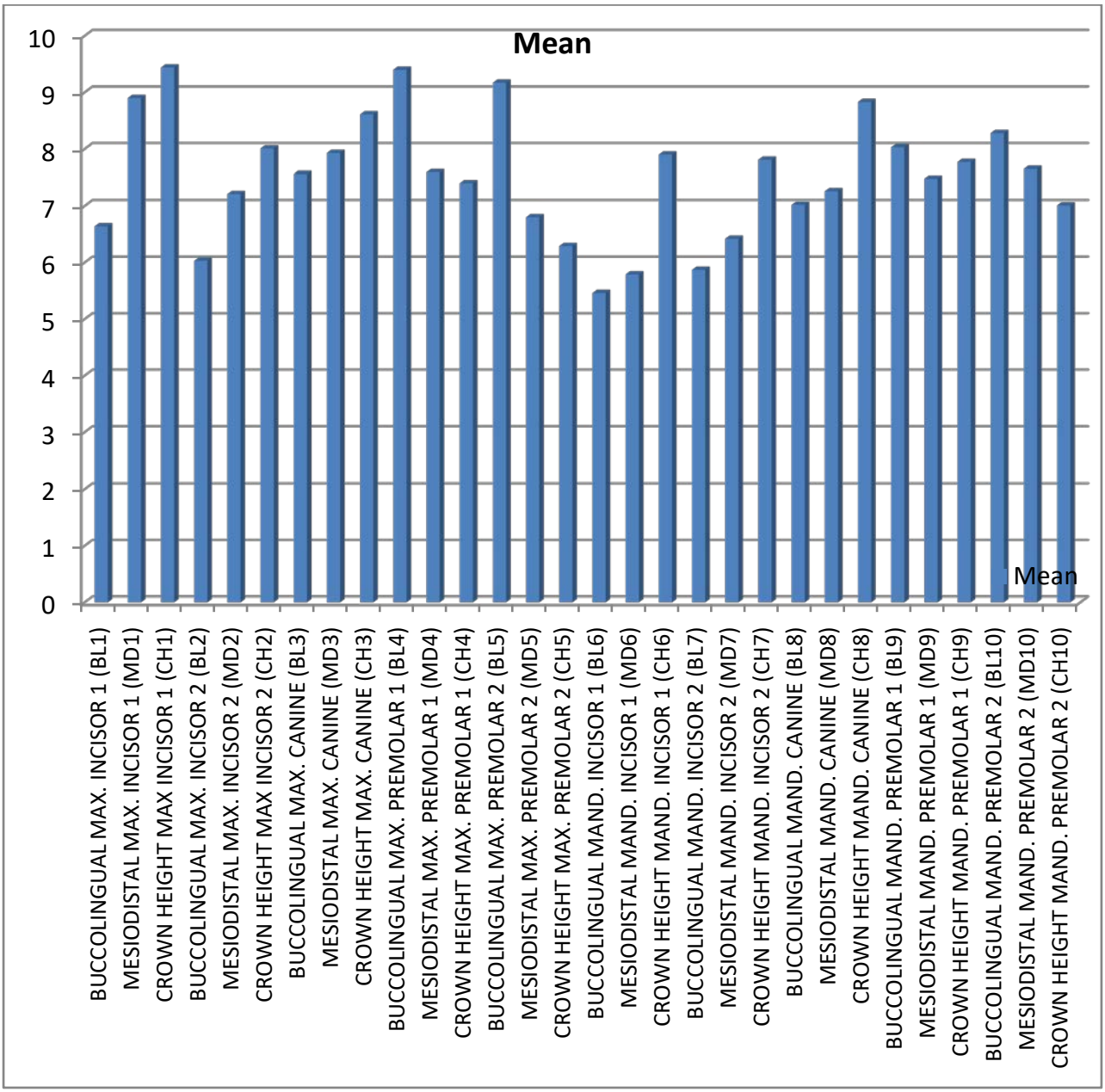

Figure 4: Mean values of measured parameters for female volunteers

Results in table 3 showed the mean value, standard error, range, standard deviation, variance, minimum value and maximum value of all the measured parameters for male volunteers with the BL4, BL5, CH1 and MD1 showed to have the highest mean values ranging from 11.70, 10.26, 9.60 and 9.30 respectively while MD6, BL7, BL2 and BL6 was shown to have the least mean value ranging from 6.16, 5.96, 5.96 and 5.76 respectively. Figure 5 showed the bar chart of the mean value of the odontometric parameters in the male with the BL4 having the highest mean value and BL6 having the smallest mean value.

Table 3: Descriptive statistics of measured parameters for male volunteers

	N	Range	Minimum value	Maximum value	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
HT	100	0.38	1.47	1.85	1.67	0.01	0.08	0.01
Age	100	5.00	15.00	20.00	16.34	0.11	1.06	1.12
BL1	100	6.53	3.70	10.23	6.81	0.09	0.85	0.73
MD1	100	5.72	5.09	10.81	9.30	0.09	0.86	0.75
CH1	100	5.55	6.24	11.79	9.60	0.11	1.10	1.20
BL2	100	6.84	4.46	11.30	5.96	0.10	1.04	1.08
MD2	100	3.60	5.62	9.22	7.49	0.07	0.75	0.56
CH2	100	5.69	4.50	10.19	8.09	0.10	1.03	1.05
BL3	100	5.33	4.31	9.64	7.82	0.10	1.04	1.07
MD3	100	3.53	6.44	9.97	8.42	0.06	0.64	0.41
CH3	100	5.52	5.61	11.13	8.95	0.11	1.13	1.28
BL4	100	3.84	7.24	11.08	11.70	1.41	1.07	0.98
MD4	100	3.56	5.60	9.16	7.89	0.07	0.65	0.43
CH4	100	4.26	6.42	10.68	7.73	0.08	0.84	0.71
BL5	100	4.70	5.53	10.70	10.26	0.98	0.82	0.96
MD5	100	4.55	5.43	9.98	7.17	0.08	0.79	0.62
CH5	100	4.18	4.69	8.87	6.51	0.08	0.82	0.68
BL6	100	4.57	4.12	8.69	5.76	0.09	0.87	0.76
MD6	100	4.40	5.13	9.53	6.16	0.07	0.68	0.46
CH6	100	3.61	6.08	9.69	7.76	0.09	0.85	0.72
BL7	100	3.65	4.16	7.81	5.96	0.07	0.72	0.52
MD7	100	2.91	5.09	8.00	6.63	0.05	0.54	0.29
CH7	100	4.74	5.09	9.83	7.93	0.09	0.88	0.77
BL8	100	6.17	5.19	11.36	7.50	0.09	0.91	0.82
MD8	100	3.75	6.20	9.95	7.69	0.07	0.70	0.49
CH8	100	4.90	6.50	11.40	9.19	0.10	1.04	1.09
BL9	100	3.54	6.61	10.15	8.19	0.07	0.72	0.51
MD9	100	3.52	6.70	10.22	7.82	0.06	0.63	0.40
CH9	100	5.79	4.19	9.98	8.01	0.09	0.88	0.77
BL10	100	4.39	5.60	9.99	8.22	0.09	0.94	0.89
MD10	100	3.05	6.45	9.50	7.74	0.07	0.67	0.45
CH10	100	5.44	5.56	7.31	7.47	0.07	0.72	0.47

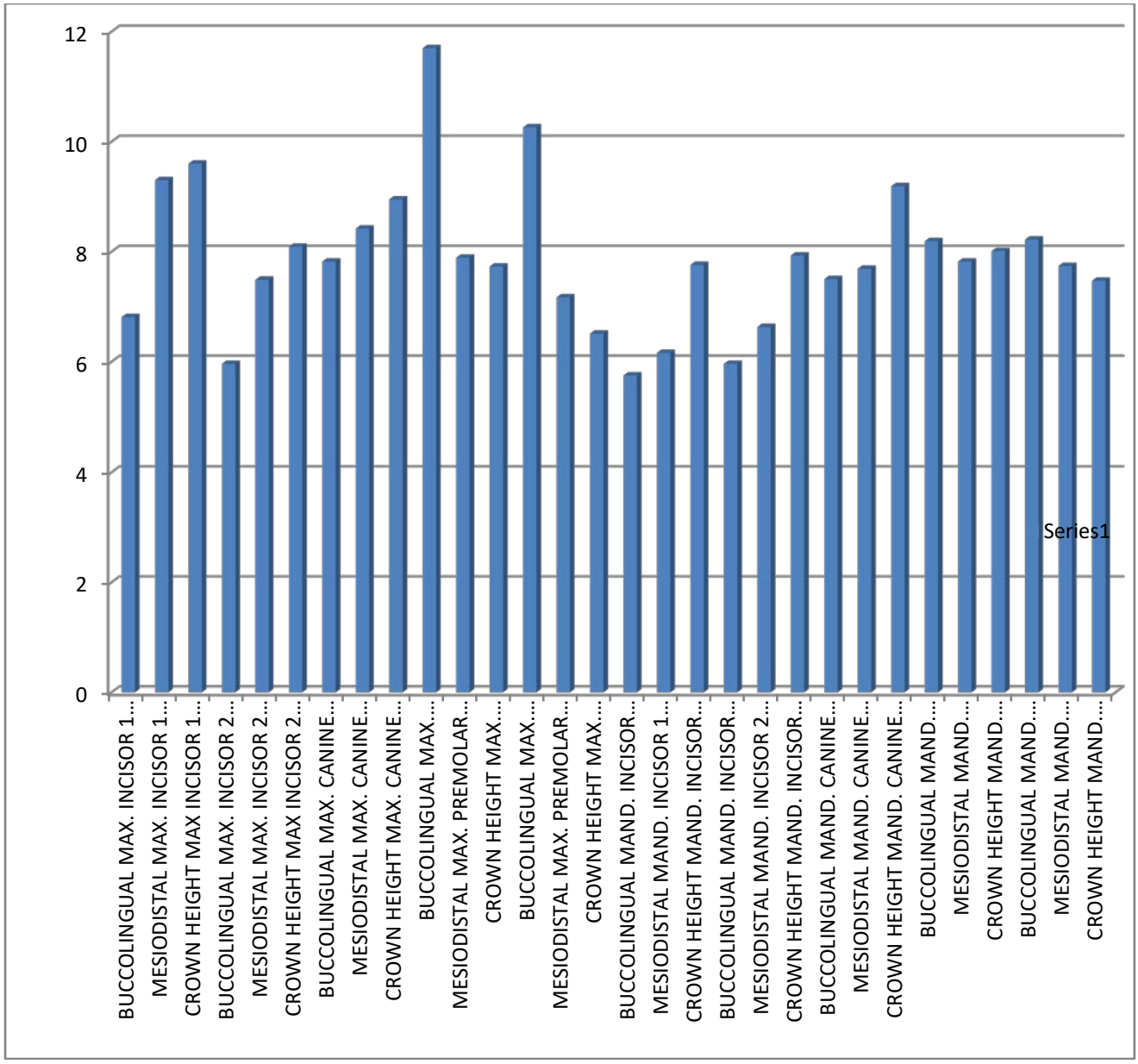

Figure 5: Mean values of measured parameters for male volunteers

The crown height of first maxillary incisor (CH1) has the greatest mean value for female while buccolingual of first maxillary premolar (BL4) for male but buccolingual of first mandibular incisor (BL6) has the least value in both sexes.

The buccolingual dimension (BL), mesiodistal width (MD) and crown height (CH) of males are higher unlike those of females except in the buccolingual of second maxillary incisor (BL2) , crown height of first mandibular incisor (CH6) and buccolingual of second mandibular premolar (BL10).

Results in Table 4 showed the Wilks' Lambda test for significance with p-value = 0 which was significant. The data gotten was shown to be a good fit for the Discriminant function analysis model for Ikwerre ethnic group.

Discriminant function analysis for Ikwerre

Table 4: Wilks Lambda test for significance

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	0.662	75.406	30	0.000

Wilks Lambda test is significant [p<0.05].

Indication: The data is a good fit for the DFA model

Results in Table 5 showed standardize canonical discriminant function analysis which was used to derive the equation for Discriminant function score. The values calculated were the co-efficient of each measured variable for both sexes which stands to be a constant for calculating the Discriminant function score (DF score).

Table 5: Standardize canonical discriminant function

	Function 1		Function 1
BL1	0.04	BL6	0.38
MD1	0.20	MD6	0.20
CH1	-0.11	CH6	-0.49
BL2	-0.30	BL7	-0.35
MD2	0.11	MD7	-0.10
CH2	-0.08	CH7	-0.06
BL3	0.22	BL8	0.30
MD3	0.17	MD8	0.19
CH3	0.15	CH8	0.21
BL4	0.07	BL9	0.08
MD4	0.02	MD9	0.26
CH4	0.23	CH9	0.17
BL5	0.01	BL10	-0.25
MD5	0.26	MD10	-0.34
CH5	-0.05	CH10	0.10

Equation for Discriminant Function score

Discriminant function [DF] = [0.04×BL1] + [0.20×MD1] - [0.11×CH1] - [0.30×BL2] + [0.11×MD2] - [0.08×CH2] + [0.22×BL3] + [0.17×MD3] + [0.15×CH3] + [0.07×BL4] + [0.02×MD4] + [0.23×CH4] + [0.01×BL5] + [0.26×MD5] - [0.05×CH5] + [0.38×BL6] + [0.20×MD6] - [0.46×CH6] + [0.35×BL7] - [0.06×MD7] - [0.06×CH7] + [0.30×BL8] + [0.19×MD8] + [0.21×CH8] + [0.08×BL9] + [0.26×MD9] + [0.17×CH9] - [0.25×BL10] -[0.34×MD10]+ [0.10×CH10]

The group centroid for Ikwerre ethnic group is shown in Table 6. This showed that the DF scores at or close to -0.711 indicate female while values at or close to 0.711 indicate male.

Table 6: Functions at group centroids

	Function
Sex	1
Female	-0.711
Male	0.711

Indication: DF score at or close to -0.711 indicate female while 0.711 indicate male

The result in table 7 showed the actual group membership versus the predicted group membership. Out of the 100 female volunteers evaluated, 78 of them were classified as female when the DF score equation was applied while 72 out of the 100 male volunteers were classified male when the DF score was also applied.
This showed that 75% of the original group cases were correctly classified as female or male.

Table 7: Classification Results

			Predicted Group Membership		
Sex			Female	Male	Total
Original	Count	Female	78	22	100
		Male	28	72	100
	%	Female	78.0	22.0	100.0
		Male	28.0	72.0	100.0

75.0% of original group cases correctly classified

Results in Table 8 showed the step-wise statistics for best predictor of sex with mesiodistal of maxillary canine (MD3) (0.891) being the best predictor of sex followed by mesiodistal of mandibular canine (MD8) (0.844) and mesiodistal of second maxillary premolar (MD5) (0.817) respectively.

Therefore, the best predictors of sex in Ikwerre ethnic group are MD3 followed by MD8 and MD5.

Table 8: Step-wise statistics for best predictors of sex

Variables Entered/Removed

		Wilks' Lambda							
						Exact F			
Step	Entered	Statistic	df1	df2	df3	Statistic	df1	df2	Sig.
1	MD3	0.891	1	1	198.000	24.226	1	198.000	0.000
2	MD8	0.844	2	1	198.000	18.140	2	197.000	0.000
3	MD5	0.817	3	1	198.000	14.658	3	196.000	0.000

Indication: MD3 is the best predictor of sex followed by MD8 and MD5 respectively

STATURE PREDICTION MODEL AND MULTIVARIATE REGRESSION ANALYSIS

Table 9 showed multivariate regression analysis for the female volunteers with correlation value (R) 0.479. The value showed moderate correlation of height with the evaluated parameters

Table 9: Multivariate regression analysis for female volunteers

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Females	0.479	0.229	-0.106	0.05684	2.025

R = correlation value

Equation for Stature Estimation from All Parameters for Ikwerre Female Volunteers.
Height (m) = 1.49- [0.02×BL1] + [0.00×MD1] - [0.01×CH1] -[0.00×BL2] - [0.01×MD2] + [0.00×CH2] + [0.01×BL3] + [0.00×MD3] + [0.00×CH3] - [0.00×BL4] + [0.01×MD4] + [0.00×CH4] + [0.00×BL5] - [0.01×MD5] + [0.00×CH5] - [0.02×BL6] + [0.02×MD6] + [0.01×CH6] + [0.00×BL7] -[0.01×MD7] + [0.00×CH7] + [0.00×BL8] + [0.01×MD8] - [0.01×CH8] + [0.00×BL9] + [0.00×MD9] - [0.00×CH9] + [0.01×BL10] + [0.01×MD10] - [0.1×CH10]

Table 10 showed multivariate regression analysis for Ikwerre male volunteers with correlation value (R) 0.693. The value showed strong correlation of height with the evaluated parameters.

Table 10: Multivariate regression analysis for male volunteers

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Males	0.693	0.48	0.25	0.07	1.84

R = correlation value

Equation for Stature Estimation from All Parameters for Ikwerre male Volunteers.

Height (m) = 1.49 - [0.02×BL1] + [0.01×MD1] + [0.02×CH1] + [0.01×BL2] + [0.00×MD2] - [0.01×CH2] + [0.00×BL3] + [0.05×MD3] - [0.02×CH3] + [0.00×BL4] + [0.01×MD4] + [0.02×CH4] + [0.00×BL5] - [0.01×MD5] + [0.02×CH5] - [0.02×BL6] - [0.01×MD6] + [0.03×CH6] - [0.01×BL7] -[0.00×MD7] + [0.02×CH7] + [0.01×BL8] - [0.01×MD8] - [0.01×CH8] + [0.00×BL9] + [0.02×MD9] - [0.01×CH9] - [0.01×BL10] - [0.03×MD10] - [0.00×CH10]

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DISCUSSION

This study has evaluated odontometric parameters and their application in sex and stature estimation. It showed that the buccolingual (BL), mesiodistal (MD) and crown height (CH) of males have highest mean value than those of females which are in agreement with the studies done by other researchers.[2,13,14]

The mean value of male dentition is greater than that of female, except in the buccolingual of second maxillary incisor (BL2), crown height of first mandibular incisor (CH6) and buccolingual of second mandibular premolar (BL10) (see Table 2 and Table 3). This result was in line with the study done by Prahbu and Acharya in Indian population where nine tooth variables exhibited reversed sexual dimorphism, i.e. female dimensions being larger than those of males.[3]

The mesiodistal dimension of the teeth was shown to be best predictor of sex with the mesiodistal of the maxillary canine (MD3), followed by mesiodistal of the mandibular canine (MD8) and mesiodistal of the second maxillary premolar (MD5). Therefore the canine is the most sexually dimorphic with the maxillary canine exhibiting the higher sexual dimorphism than the mandibular canine.

Canines have conventionally shown to have the greatest degree of sexual dimorphism across many populations. The study carried out by Khamis *et al.* showed that the mesiodistal diameter of the lower canine was the most sexually dimorphic among the Malaysians.[15] Angadi *et al.* studied a population in India which revealed that canines were the most sexually dimorphic teeth, followed by molars.[2] The research carried out by Prabhu and Acharya showed that mandibular first molar was found to be the most dimorphic tooth, followed by the canine and the buccolingual dimension of maxillary first and second molars.[8]

Our study showed that the mean values of male odontometric parameters are greater than those of female. The mitotic activity of the cells in the inner dental epithelium and the dental papilla are believed to be under the influence of the Y-chromosome and to be a determining factor of the size of the dentino-enamel junction and the thickness of dentine.[16] This finding showing that the dentine thickness is a key determinant of sexual dimorphism has been reported by other researchers.[17,18] Generally, skeletal growth in females stops earlier than in male due to oestrogen effect.

Our study showed that maxillary canine is the most sexually dimorphic. The following reasons can be deduced why the canine is found to be more sexually dimorphic than other teeth. It is considered to be an evolutionary remnant of aggressive function and threat in male primates.[2] This function is said to have been transferred to the arms and fingers in human males. This important function the canine possessed through evolution is still reflected to some extent in men in the form of larger canines.[2] Also, sexual dimorphism may be influenced by genes involved in the timing of canine formation.[12]

Other factors have also been attributed to be the cause of variation in the level of sexual dimorphism. Some authors have explained that such variation could be due to environmental influence which includes variation in food resources consumed by different populations.[13] Others have suggested the interference of cultural factors with biological factors. [13] There can also be complex interaction between a variety of genetic and environmental factors that are responsible for the variation in the level of dimorphism.[13]

Different methods have been applied to estimate stature of unknown human skeletal remains. The reliability of each method varies. Estimation of stature as part of identification process has a long history in physical anthropology. The introduction of regression formulae developed in the modern population has enhanced the accuracy of stature estimation.
The method of using teeth measurements has several advantages as the anatomical landmarks are standard, well defined and easy to locate. The use of odontometric parameters for stature estimation is limited in Africa especially Nigeria, hence the aim. The buccolingual dimension (BL), mesiodistal width (MD) and crown height (CH) of both maxillary and mandibular incisors, canines and premolars

were evaluated to determine if there is a significant correlation between these parameters and the heights of individuals in Ikwerre ethnic group of Nigeria. Multivariate regression analysis was performed for the teeth which showed a moderate but statistically significant correlation to stature (R = 0.479, 0.693) for female and male of Ikwerre ethnicity respectively. A prediction model for stature estimation for this ethnic group was established. These correlations are weak to moderate suggesting that they are not 100% reliable in estimating stature. Therefore teeth were found to have moderate correlation to stature which is in contrast to the high correlation of individual parameters of the skull and long bones.

Prabhu *et al.* did a study to ascertain the usefulness of tooth crown measurements in stature prediction. Ridge regression was used for the teeth which revealed a moderate but statistically significant correlation to stature ($R = 0.68$; $P < 0.0001$). They concluded that the dentition may be used only as a supplement to more robust indicators of stature.[8]

CONCLUSION

This study was carried out to evaluate the possibility of estimating sex and stature using odontometric parameters in the Ikwerre ethnic group in Rivers state of Nigeria. The mesiodistal dimension of the maxillary canine (MD3), followed by mesiodistal dimension of the mandibular canine (MD8) and mesiodistal dimension of second maxillary premolar (MD5) are best predictors of sex respectively. Therefore, Maxillary canine is the best predictor of sex among Ikwerre ethnic group. Prediction model for sex determination was generated.

The teeth has also been shown to have a weak to moderate correlation with stature estimation, therefore can be used to estimate stature of individuals. Prediction models for stature estimation were also generated.

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