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Sex and Stature Estimation from Odontometric Parameters in Eleme Ethnic Group in Rivers State of Nigeria.

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ABSTRACT
Sex and stature estimation are important criteria in identifying unknown human skeletal remains. The aim of the study is to generate predictive model for the estimation of sex and stature from odontometry parameters of Eleme ethnic group of Rivers State of Nigeria. This cross-sectional descriptive study involved 100 volunteers between the ages of 15 to 30 years (50 males and 50 females). The measured parameters were crown height (HT), maximum mesiodistal width (MD) and buccolingual dimension (BL) of the right maxillary and mandibular incisors, canines and premolars and height of the volunteers. The teeth were measured using a pair of sterile divider and electronic digital vernier caliper to the nearest 0.01mm and 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 and Multivariate Regression Analysis was used to design a predictive model for stature. The results showed that the mean values of all teeth variables were larger in males than in females except crown height of maxillary premolar 2 (CH5), crown height of mandibular incisor 1 (CH6), buccolingual and mesiodistal of mandibular incisor 2 (BL7, MD7) and crown height of mandibular premolar 2 (CH10). Discriminant Function Analysis showed that scores that predict male is 0.895 while -0.895 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 derived. Multivariate regression analysis showed significant ($p < 0.05$) correlation of height with all measured parameters and was used to derived equation for stature estimation. This study showed that the combination of the teeth could be used for sex and stature estimation.

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

INTRODUCTION
The teeth are used for breaking down food materials and also for defence.[1] Outside these roles, some studies has shown that it could also be used in sex and stature estimation for archaeological, anthropological and forensic studies [2,3,4,5]. Sex estimation is an important criteria 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 bony remnant is important and various hard-tissue parameters in the body have been used. [3] Among skeletal parameters used are the pelvic and skull bones which have been reported to give 100% success in sex identification.[4,5]

Stature has also 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] Although, bones are durable, they may be affected by taphonomic factors that renders them unsituable for use in identification of persons.

Unlike the bones, teeth are stronger and could withstanding high level of environmental degradation. In addition, the 32 teeth are hardly absent when the skull and jaw are present, making suitable for use in identification of skeletal remains in medico-legal context. Several studies have been done in different population to estimate sex using the teeth. [2,3,4,5]. 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 with the stature in an individual.

Currently, there is dearth of literature predictive models for sex and stature using the teeth in most Africa population especially Nigeria. Therefore, the object of

the study is to ascertain if the teeth could be used to estimate stature and sex, and to also generate a predictive model for this purpose.

MATERIALS AND METHODS

This cross-sectional descriptive study involved 100 volunteers within the ages of 15 to 30 years. A Stratified random sampling method was used to select the subjects. 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 briefed 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). The was 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).

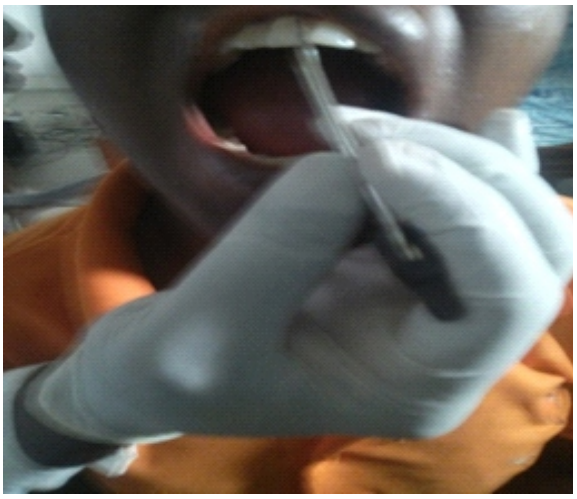

Figure 2: Buccolingual diameter of the teeth

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 measured were 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). The was done also for the right mandibular teeth and 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 vertical distance from the vertex to the floor with the volunteer standing barefooted using anthropometric meter rule. An L-shaped standiometer, 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 was utilized 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 gender.

RESULTS

The results of the study are presented in the tables and bar charts 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 irrespective of sex with the CH1, BL4, BL5 and MD1 showed to have the greatest mean value ranging from 9.25, 9.11, 8.75 and 8.70 respectively while MD6, BL5, BL7 and BL6 was shown to have the least mean value ranging from 6.09, 5.97, 5.71 and 5.38 respectively.

Table 1: Descriptive statistics of measured parameters irrespective of sex

	N	Range	Minimum value	Maximum value	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
HT	100	0.32	1.50	1.82	1.67	0.01	0.07	0.00
Age	100	5.00	15.00	20.00	16.60	0.11	1.15	1.31
BL1	100	4.88	4.63	9.51	6.51	0.09	0.91	0.83
MD1	100	4.86	6.04	10.90	8.70	0.10	0.95	0.91
CH1	100	6.27	5.32	11.59	9.25	0.11	1.07	1.13
BL2	100	7.18	3.15	10.33	5.97	0.13	1.30	1.70
MD2	100	3.66	5.66	9.32	7.21	0.07	0.71	0.50
CH2	100	5.20	4.56	9.76	7.79	0.10	1.02	1.05
BL3	100	4.68	4.88	9.56	7.68	0.09	0.92	0.84
MD3	100	3.94	6.16	10.10	8.24	0.08	0.75	0.57
CH3	100	5.39	5.76	11.15	8.62	0.12	1.18	1.39
BL4	100	7.04	4.16	11.20	9.11	0.11	1.09	1.20
MD4	100	3.69	6.02	9.71	7.70	0.07	0.68	0.47
CH4	100	4.58	5.12	9.70	7.40	0.09	0.92	0.85
BL5	100	6.50	4.32	10.82	8.75	0.12	1.16	1.35
MD5	100	5.17	4.77	9.94	6.75	0.09	0.92	0.85
CH5	100	5.46	3.42	8.88	6.25	0.10	1.00	1.01
BL6	100	4.32	3.29	7.61	5.38	0.08	0.85	0.72
MD6	100	5.34	4.30	9.64	6.09	0.09	0.86	0.73
CH6	100	4.03	5.71	9.74	7.54	0.09	0.87	0.75
BL7	100	5.88	4.03	9.91	5.71	0.09	0.91	0.83
MD7	100	4.69	4.53	9.22	6.58	0.08	0.80	0.64
CH7	100	4.38	5.89	10.27	7.76	0.09	0.89	0.79
BL8	100	3.91	5.07	8.98	7.17	0.09	0.86	0.75
MD8	100	4.53	4.69	9.22	7.35	0.08	0.81	0.65
CH8	100	5.18	6.22	11.40	8.62	0.10	0.98	0.97
BL9	100	4.78	5.29	10.07	7.87	0.08	0.84	0.70
MD9	100	3.70	5.90	9.60	7.43	0.07	0.72	0.52
CH9	100	4.63	5.24	9.87	7.76	0.09	0.91	0.82
BL10	100	3.74	6.21	9.95	8.31	0.09	0.92	0.84
MD10	100	3.78	5.85	9.63	7.40	0.07	0.71	0.51
CH10	100	3.52	5.33	8.85	6.83	0.08	0.80	0.64

Table 2 showed result of 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 CH8 showed to have the greatest mean value ranging from 9.09, 8.84, 8.54 and 8.54 respectively while MD6, BL2, BL7 and BL6 were shown to have the least mean value ranging from 6.07, 5.88, 5.81 and 5.27 respectively. Figure 4 showed the bar chart of the mean values of all the odontometric parameters for the female.

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	50	0.29	1.50	1.79	1.65	0.01	0.07	0.00
Age	50	4.00	15.00	19.00	16.74	0.14	0.99	0.97
BL1	50	4.06	4.63	8.69	6.33	0.11	0.76	0.57
MD1	50	4.59	6.04	10.63	8.47	0.12	0.83	0.70
CH1	50	3.80	6.74	10.54	9.09	0.11	0.81	0.66
BL2	50	6.43	3.15	9.58	5.88	0.17	1.23	1.51
MD2	50	3.66	5.66	9.32	7.13	0.10	0.74	0.54
CH2	50	5.03	4.56	9.59	7.55	0.15	1.09	1.19
BL3	50	4.43	4.88	9.31	7.57	0.13	0.91	0.83
MD3	50	3.94	6.16	10.10	8.06	0.10	0.70	0.48
CH3	50	5.24	5.76	11.00	8.29	0.17	1.17	1.37
BL4	50	6.60	4.16	10.76	8.84	0.16	1.14	1.30
MD4	50	3.69	6.02	9.71	7.62	0.11	0.76	0.58
CH4	50	4.20	5.25	9.45	7.34	0.12	0.87	0.75
BL5	50	6.41	4.32	10.73	8.54	0.18	1.29	1.66
MD5	50	5.17	4.77	9.94	6.53	0.13	0.92	0.85
CH5	50	4.15	4.71	8.86	6.26	0.15	1.07	1.14
BL6	50	4.32	3.29	7.61	5.27	0.13	0.90	0.81
MD6	50	3.93	4.30	8.23	6.07	0.13	0.91	0.83
CH6	50	3.78	5.71	9.49	7.59	0.14	0.98	0.96
BL7	50	5.57	4.34	9.91	5.81	0.14	0.99	0.98
MD7	50	3.83	5.39	9.22	6.63	0.13	0.90	0.82
CH7	50	4.38	5.89	10.27	7.61	0.13	0.91	0.83
BL8	50	3.12	5.86	8.98	7.04	0.11	0.79	0.63
MD8	50	4.50	4.69	9.19	7.14	0.12	0.88	0.77
CH8	50	3.52	6.47	9.99	8.54	0.11	0.78	0.61
BL9	50	4.78	5.29	10.07	7.83	0.12	0.88	0.78
MD9	50	3.70	5.90	9.60	7.38	0.11	0.74	0.55
CH9	50	4.57	5.24	9.81	7.73	0.14	0.96	0.93
BL10	50	3.74	6.21	9.95	8.23	0.13	0.92	0.84
MD10	50	3.23	5.85	9.08	7.27	0.10	0.70	0.49
CH10	50	3.52	5.33	8.85	6.86	0.12	0.82	0.67

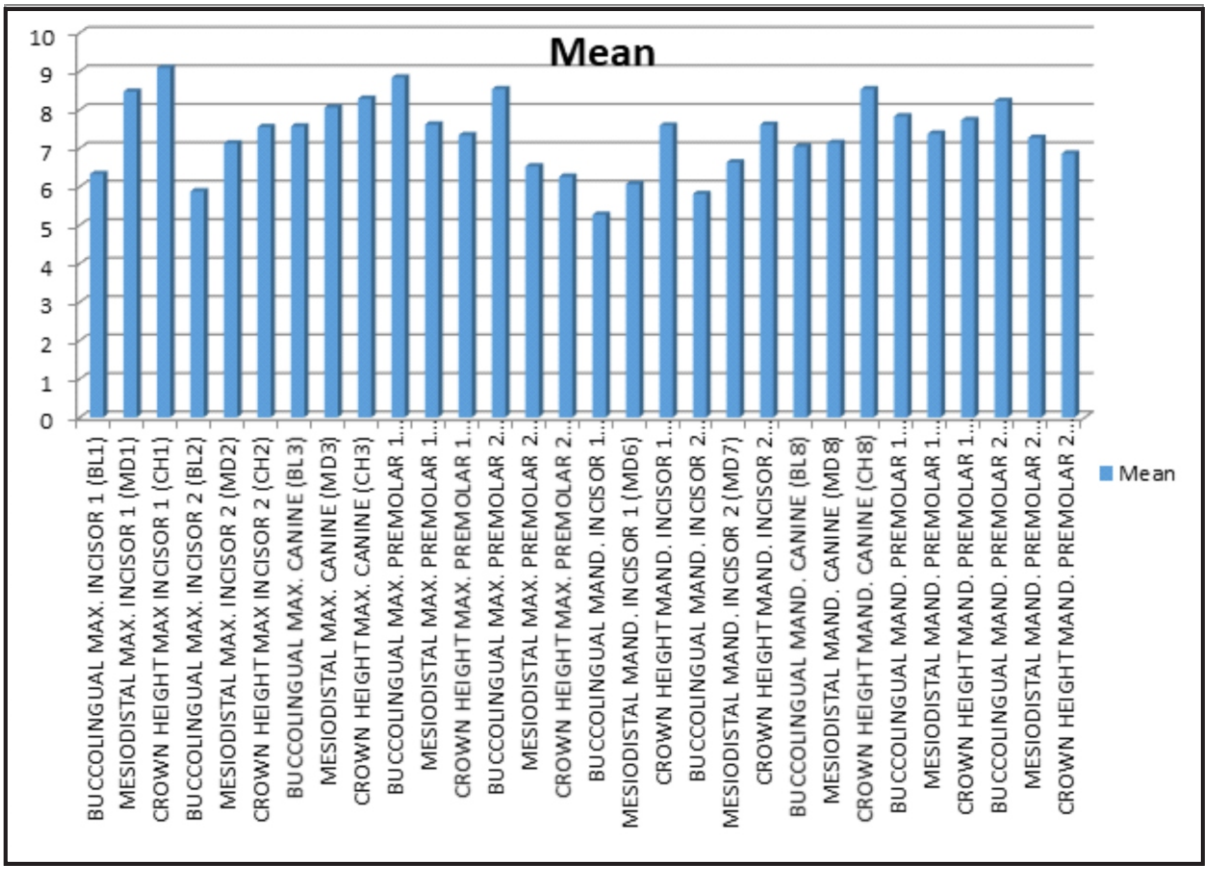

Figure 4: Mean values of measured parameters for Female volunteers

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 CH1, BL4, BL5 and CH3 showed to have the greatest mean value ranging from 9.42, 9.38, 8.97 and 8.94 respectively while MD6, BL2, BL7 and BL6 were shown to have the least mean value ranging from 6.12, 6.07, 5.62 and 5.50 respectively. Figure 5 showed the bar chart of the mean values of the odontometric parameters for the male.

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	50	0.32	1.50	1.82	1.68	0.01	0.06	0.00
Age	50	5.00	15.00	20.00	16.46	0.18	1.28	1.64
BL1	50	4.81	4.70	9.51	6.69	0.14	1.02	1.04
MD1	50	4.72	6.18	10.90	8.92	0.14	1.01	1.03
CH1	50	6.27	5.32	11.59	9.42	0.18	1.26	1.58
BL2	50	6.67	3.66	10.33	6.07	0.19	1.38	1.90
MD2	50	2.56	6.00	8.56	7.29	0.10	0.68	0.46
CH2	50	4.11	5.65	9.76	8.04	0.13	0.89	0.80
BL3	50	4.47	5.09	9.56	7.78	0.13	0.92	0.85
MD3	50	2.79	7.29	10.08	8.41	0.11	0.78	0.60
CH3	50	5.10	6.05	11.15	8.94	0.16	1.10	1.21
BL4	50	5.36	5.84	11.20	9.38	0.14	0.99	0.98
MD4	50	2.82	6.33	9.15	7.77	0.08	0.59	0.35
CH4	50	4.58	5.12	9.70	7.46	0.14	0.98	0.97
BL5	50	3.57	7.25	10.82	8.97	0.14	0.99	0.98
MD5	50	4.42	5.46	9.88	6.97	0.12	0.88	0.77
CH5	50	5.46	3.42	8.88	6.24	0.13	0.95	0.90
BL6	50	3.16	3.81	6.97	5.50	0.11	0.78	0.61
MD6	50	4.83	4.81	9.64	6.12	0.11	0.80	0.65
CH6	50	3.63	6.11	9.74	7.48	0.11	0.75	0.56
BL7	50	3.76	4.03	7.79	5.62	0.12	0.83	0.68
MD7	50	3.72	4.53	8.25	6.52	0.10	0.69	0.48
CH7	50	3.81	6.17	9.98	7.92	0.12	0.84	0.71
BL8	50	3.66	5.07	8.73	7.31	0.13	0.92	0.84
MD8	50	3.01	6.21	9.22	7.56	0.10	0.67	0.45
CH8	50	5.18	6.22	11.40	8.70	0.16	1.15	1.33
BL9	50	3.44	5.55	8.99	7.90	0.11	0.80	0.64
MD9	50	3.57	6.03	9.60	7.49	0.10	0.70	0.48
CH9	50	3.76	6.11	9.87	7.79	0.12	0.85	0.73
BL10	50	3.56	6.31	9.87	8.40	0.13	0.92	0.84
MD10	50	3.37	6.26	9.63	7.52	0.10	0.71	0.51
CH10	50	3.29	5.35	8.64	6.80	0.11	0.79	0.63

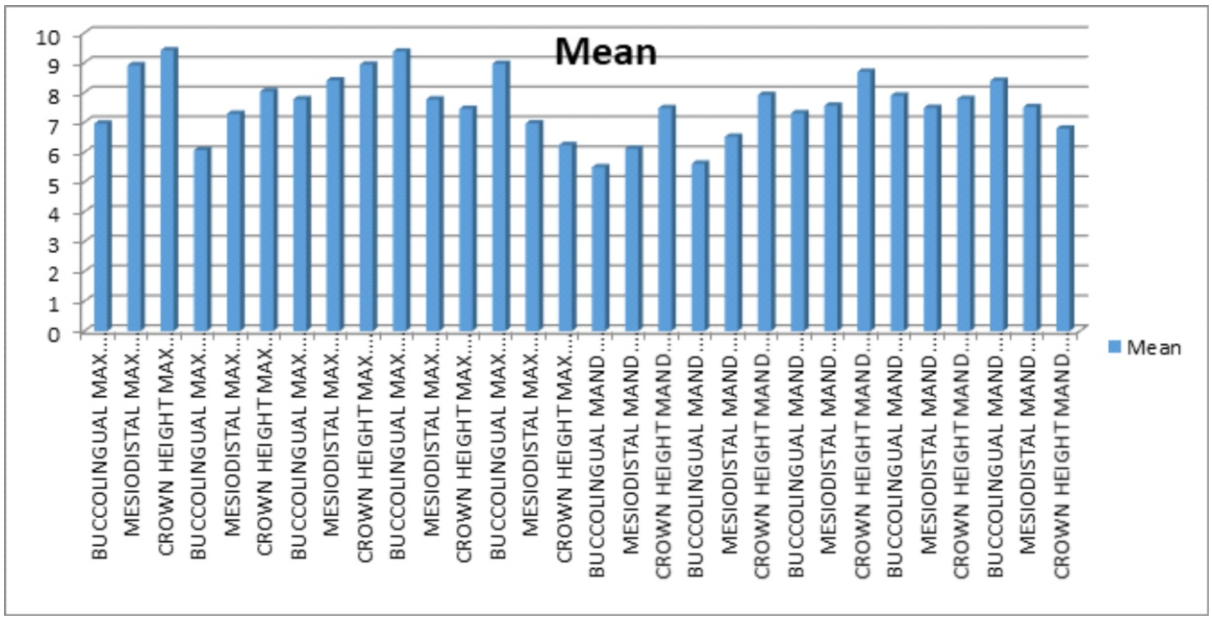

Figure 5: Mean values of measured parameters for male volunteers

The crown height of maxillary incisor 1 (CH1) has the greatest mean value for both females and males while buccolingual of mandibular incisor 1 (BL6) has the least mean value for both females and males of Eleme ethnic group.

The mean values of the buccolingual (BL), mesiodistal (MD) and crown height (CH) of males are higher unlikened to those of females in Eleme except in the maxillary crown height of premolar 2 (CH5), crown height of mandibular incisor 1 (CH6), buccolingual and mesiodistal of mandibular incisor 2 (BL7, MD7) and crown height of mandibular premolar 2 (CH10).

Result of Discriminant function analysis (DFA): Results in Table 4 showed the Wilks' Lambda test to determine if the measured parameters can be used to generate DFA model needed for prediction of sex for Eleme ethnic group with p-value = 0.014 which was significant. The result showed it was a good fit for the DFA model for Eleme ethnic group ($p<0.05$).

Table 4: Wilks Lambda Test of Significance Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	0.550	49.581	30	0.014

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 for Eleme ethnic group. The values calculated is the co-efficient of each measured variable for both sexes which stand to be constant for calculating the Discriminant function score (DF score) for Eleme ethnic group.

Table 5: Standardize canonical discriminant function

Parameters	Function 1	Parameters	Function 1
BL1	0.221	BL6	0.426
MD1	0.084	MD6	-0.339
CH1	0.178	CH6	-0.466
BL2	-0.051	BL7	-0.608
MD2	0.391	MD7	-0.211
CH2	0.29	CH7	0.443
BL3	0.008	BL8	0.425
MD3	0.372	MD8	0.385
CH3	0.045	CH8	-0.136
BL4	0.328	BL9	-0.083
MD4	-0.478	MD9	0.188
CH4	-0.124	CH9	-0.12
BL5	-0.009	BL10	-0.178
MD5	0.516	MD10	0.274
CH5	-0.504	CH10	-0.245

Equation for Discriminant Function score: Discriminant function [DF] = [0.221×BL1] + [0.084×MD1] + [0.178×CH1]- [0.051×BL2]+ [0.391×MD2] + [0.290×CH2] - [0.008×BL3] + [0.037×MD3] + [0.045×CH3] - [0.328×BL4] - [0.478×MD4] - [0.124×CH4] - [0.009×BL5] +[0.0516×MD5] - [0.504×CH5] +[0.426×BL6] - [0.339×MD6] - [0.466×CH6] - [0.608×BL7] - [0.211×MD7] + [0.443×CH7] + [0.425×BL8] + [0.385×MD8] - [0.136×CH8] - [0.083×BL9] + [0.188×MD9] - [0.120×CH9] - [0.178×BL10] + [0.274×MD10]- [0.245×CH10]

The group centroid for Eleme ethnic group is shown in Table 6. This showed that the DF score at or close to -0.895 indicates female while value at or close to +0.895 indicates male.

Table 6: Functions at group centroids

Sex	Function 1
Female	-0.895
Male	0.895

Indication: DF score at or close -0.895 indicate female while 0.895 indicate male

The result in table 7 showed the actual group membership versus the predicted group membership for Eleme ethnic group. Out of the 50 female volunteers evaluated, 84% of them were classified as female when the DF score equation was applied while 84% out of the 50 male volunteers were classified male when the DF score was also applied.

Table 7: Classification Results

			Predicted Group Membership		
Sex			1.00	2.00	Total
Original	Count	Female	42	8	50
		Male	8	42	50
	%	Female	84.0	16.0	100.0
		Male	16.0	84.0	100.0
Cross-validated[b]	Count	Female	33	17	50
		Male	20	30	50
	%	Female	66.0	34.0	100.0
		Male	40.0	60.0	100.0

84.0% of original group cases correctly classified

Therefore the original group membership $= \frac{84\% + 84\%}{2} = 84\%$

This showed that 84% of the original group cases were correctly classified as female or male.
Results in Table 8 showed the step-wise statistics for best predictor of sex with crown height of maxillary canine CH3 (0.922) being the best predictor of sex followed by mesiodistal of mandibular canine MD8 (0.866) and mesiodistal of maxillary premolar two MD5 (0.828), respectively.
Therefore, the best predictors of sex in Eleme ethnic group are CH3, MD8 and MD5 respectively.

Table 8: Stepwise statistics for best predictors of sex Variables Entered/Removed

		Wilks' Lambda							
						Exact F			
Step	Entered	Statistic	df1	df2	df3	Statistic	df1	df2	Sig.
1	CH3	0.922	1	1	98.000	8.302	1	98.000	0.005
2	MD8	0.866	2	1	98.000	7.519	2	97.000	0.001
3	MD5	0.828	3	1	98.000	6.648	3	96.000	0.000

Indication: CH3 is the best predictor of sex followed by MD8 and MD5 respectively.

Stature Prediction Model and Multivariate Regression: Table 9 showed multivariate regression analysis for Eleme female volunteers with correlation value (R) 0.897. The value showed strong correlation of height with the evaluated parameters.

Table 9: Multivariate Regression analysis for female volunteers Eleme ethnic group Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.897	0.805	0.497	0.04901	0.805	2.615	30	19	0.016	2.032

R = correlation value. [correlation of height to parameters is very high]

Multivariate Regression Equation For Stature Estimation In Female volunteers Eleme ethnic group - Height [Stature m] = 0.958 - [0.031×BL1] - [0.012×MD1] + [0.008×CH1]-[0.010×BL2]- [0.021×MD2] + [0.007×CH2] - [0.040×BL3] + [0.011×MD3] + [0.019×CH3] - [0.003×BL4] + [0.042×MD4] - [0.037×CH4] - [0.001×BL5] - [0.006×MD5] + [0.009×CH5] - [0.032×BL6] + [0.026×MD6] - [0.016×CH6] +[0.013×BL7] - [0.002×MD7] + [0.021×CH7] + [0.015×BL8] + [0.041×MD8] + [0.050×CH8] - [0.007×BL9] - [0.014×MD9] + [0.014×CH9]+ [0.036×BL10] + [0.019×MD10]- [0.043×CH10]

Table 10 showed multivariate regression analysis for Eleme male volunteers with correlation value (R) 0.696. 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	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.696	0.485	-0.328	0.07308	0.485	0.596	30	19	0.900	2.025

R = correlation value. [correlation of height to parameters is very high]

Multivariate Regression Equation for Stature Estimation for Males volunteers
Height [Stature m] = 1.95 - [0.012×BL1] - [0.016×MD1] + [0.012×CH1] +[0.002×BL2] - [0.018×MD2]+[0.008×CH2]-[0.013×BL3] + [0.015×MD3] +[0.0023×CH3] - [0.002×BL4]+[0.001×MD4] +[0.001×CH4]+[0.00×BL5] -[0.008×MD5]+[0.013×CH5] - [0.026×BL6]+ [0.008×MD6] + [0.018×CH6] + [0.045×BL7] - [0.044×MD7] - [0.002×CH7] - [0.010×BL8] + [0.00×MD8] - [0.005×CH8] - [0.009×BL9] - [0.007×MD9] - [0.013×CH9] - [0.018×BL10] + [0.012×MD10]- [0.002×CH10]

DISCUSSION

This study has evaluated odontometric parameters and their application in sex and stature estimation in Eleme ethnic group. It showed that the buccolingual (BL), mesiodistal (MD) and crown height (CH) of males have greater 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 crown height of maxillary premolar 2 (CH5), crown height of mandibular incisor 1(CH6), buccolingual (BL7) and mesiodistal of mandibular incisors 2 (MD7) and crown height of mandibular premolar 2 (CH10). (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 dimorphism, i.e. female dimensions being larger than those of males. [3]

The crown height of maxillary canine (CH3) of the teeth was shown to be best predictor of sex followed by mesiodistal of the mandibular canine (MD8) and mesiodistal of the maxillary premolar 2 (MD5) respectively. 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. 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] Study 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 showed 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 fuction is said to have been transferred to the arms and fingers in human males. This important function which 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]
Some factors can be the cause of variation in the level of sexual dimorphism. Some authors have explained that such variation could be due to environmental influence on the tooth size. [13] Variation in food resources consumed by different populations has also been explained as one of such environmental causes. Others have suggested the interference of cultural factors with biological factors.[13]There can be as a result of complex interaction between a variety of genetic and environmental factors that are responsible for the variation in the level of dimorphism. [13]
Various methods have been used to predict 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. Use of odontometric parameters for stature estimation is limited in Nigeria. However, the buccolingual (BL), mesiodistal (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 Eleme ethnic group of Nigeria. Multivariate regression analysis was performed for the dentition which revealed a moderate but statistically significant correlation to stature (R = 0.897, 0.696) for female and male of Eleme ethnic group respectively. A prediction model for stature estimation for this ethnic group was established. These correlations are weak 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 moderate-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 dentition 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.

CONCLUSION

This study was carried out to evaluate the possibility of predicting sex and estimating stature using odontometry among the Eleme ethnic group in Rivers state of Nigeria. The crown height of maxillary canine (CH3) of the teeth was shown to be best predictor of sex followed by mesiodistal of the mandibular canine (MD8) and mesiodistal of the maxillary premolar 2 (MD5) respectively. Therefore, Maxillary canine is the best predictor of sex among Eleme ethnic group. Prediction model for sex determination was established.

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

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