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Morphological Variations of Mandibular Lingula in Dried Adult Nigerian Bones

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Abstract **Original Research Article**

The lingula of the mandible (also known as Spix spine) is a finger like bony projection or ridge on the medial surface of the ramus of the mandible, immediately superior to the mandibular foramen. This study aims to determine the morphology and precise location of mandibular lingula in dry adult mandibles. A total number of 42 dry adult mandible gotten from the Department of Anatomy University of Port-Harcourt were used for this study. The four various shapes of lingula were bilaterally determined, classified, measured with Vernier calipers and statistically analyzed. The most predominate found was truncated shape (41.6%), followed by triangular shape (39.27%), while the nodular and assimilated were less prevalent having (9.52%) respectively. Bilateralism were observed in the various shapes but more evident in the truncated and triangular shape. There was no statistically significant difference in the mean right and left values. The right and left mean lingula height were 7.00±1.03 and 7.14±1.11 respectively. The right and left mean lingula distance from anterior were 17.13±3.27 and 17.26±3.44 while the right and left lingula distance from the posterior ramus of the mandible were 17.46± 3.12 and 17.58± 3.03. The right and left mandibular ratio were 0.30±0.25 and 0.52±0.04 respectively. The study has provided a useful data which may give clue of the relevant anatomical structures to dental surgeons during surgical procedures. However, establishment morphological variations of mandibular lingula is very necessary in every population considering it clinical significance in oral and maxillofacial surgical procedures.

Keywords: Lingula, Mandible, Morphology, Nigeria Population.

INTRODUCTION

Mandible is one of the strongest bones in the body and is useful in human identification and has a unique tongue shaped- bony prominence called the Lingula, which is present on the medial surface of the mandibular ramus. It is closely related to the mandibular foramen through which the inferior alveolar nerve and artery pass and enter the mandibular canal (Tsuji *et al*., 2005).

According to standard text books, the shape of the lingula is said to be triangular (Sinnatamby, 2006, Standring *et al*., 2008). Nicholson, 1985 reported variation of height and shape of lingula upon examination of adult mandibles of East Indian ethnic origin, but no description was mentioned other than triangular shape. Truncated type was described by (Hollinshead, 1962) nodular type was described by (Berkovitz *et al*., 1978,) and the assimilated type shown by (Morgan *et al*., 1982). Different morphological shapes of the lingual were first classified by (Tuli *et al*., 2000) into triangular, truncated, nodular and assimilated types in adult human mandibles of Indian origin. Various studies done by (Hossain *et al*., 2001) reported three types of lingula namely triangular, truncated, and assimilated types in Bangladeshi skulls. Fabian (2006) classified lingula into five major types based on shape and size in the Tanzanian population. Lingula is used as an important anatomical guide to inject local anaesthetics during dental surgical procedures. The different locations of the lingula could be one of the reasons for failure of an inferior alveolar nerve block.

Jansisyanont *et al*., 2009, have studied the shape and position of the lingula in adult mandibles of Thai origin. Berry, (1975), studied the variant shape of lingula which can also be used as anthropological marker to assess different population along with other

non-metric variants of skull. Lopes *et al*., 2010 found triangular shape of lingula, followed by truncated, then nodular and assimilated in a study on 80 dry mandibles of south Brazil. Woo *et al*., 2002 studied the height of Lingula on Korean population. In one other study on 80 dried adult human mandibles of Indian population, Nicholson *et al*., reported the height of lingula.

There is no documented literature on the morphological variations of mandibula lingula in Nigeria population, considering the overwhelming importance of the lingula in medicolegal studies. This study therefore aims to evaluate the various morphological shapes and variations of mandibula lingula to create a data base for Nigeria population.

MATERIALS AND METHODS

A total number of 42 dry adult human mandibles, obtained from the Department of Anatomy University of Port-Harcourt, were carefully selected and used for this study.

INCLUSION CRITERIA FOR DATA COLLECTION

Macerated dry adult mandibular bones
Bones with normal physical appearance
Bones without any pathological damage

EXCLUSION CRITERIA FOR DATA COLLECTION

Pathological damaged dry adult mandibular bones
Bones without normal physical appearance
Under aged dry macerated bone

Procedure

The bones that met the criteria were selected and classified into four types, triangular, truncated, nodular, and assimilated according to Tuli *et al.*, (2000). Osteometric measurements of the height, anterior and posterior ramus were performed on both sides using a digital caliper with the following parameters

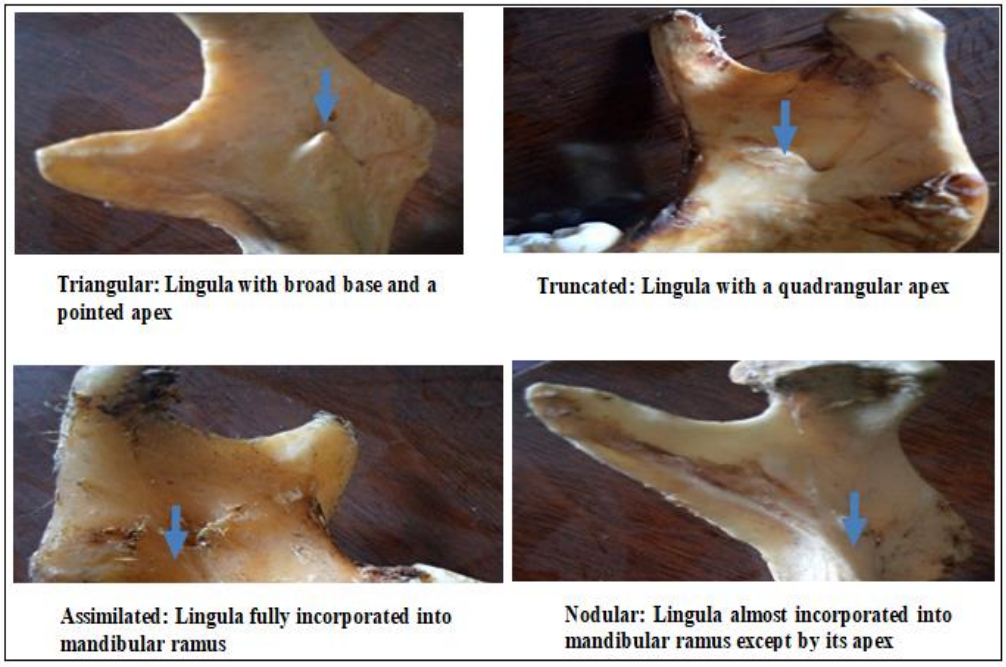

Figure 1: Images showing different shapes of Lingula

LINGULA HEIGHT

The height and position of lingula were noted by measuring the following distances using Vernier calipers.

1. Height of lingula- Tip of lingula to inferior border of mandibular foramen
2. Position of lingula

a. Tip of lingula to the anterior border of the ramus
b. Tip of lingula to the posterior border of ramus

RESULT

A total of 42 mandibles with 84 corresponding sides (right and left) collected from University of Port-Harcourt Nigeria, were analyzed for shape and position of lingula of the mandible.

The values for the measured parameter were expressed in percentages and mean±SD in descriptive statistics. Independent sample t-test was used to determine side differences in measured parameters and Confidence interval was set at 95%, for $p < 0.05$ to be considered significant.

Table 1: Percentage distribution of various shapes of the Lingula

Shapes	Percentage	Bilateral	Unilateral	
			Right	Left
Truncated (n =35)	41.67%	18	7	10
Triangular (n = 33)	39.27%	22	7	4
Nodular (n =8)	9.52%	2	4	2
Assimilated (n=8)	9.52%	2	2	4

Truncated: The truncated shape was the next commonly dominated shape, with (35 sides), of which 18 (90.9%) were bilateral, 7 (3.1%) were on the right side and 10 (6%) on the left side

Triangular: The triangular shape was the most predominant shape, with (33 sides) which was distributed as 22 (84.4%) bilaterally, 7 (8.9%) on the right side and 4(6.7%) on the left side (table 4.1).

Nodular: the nodular shape was the least type of shape that was observed which has (8 sides), of which 2(4.5%) were bilateral, 4(81.8%) were on the right side and 2 (13.7%) on the left side.

Assimilated: the assimilated shape has (8 sides) which was distributed as 2 (6.7%) bilaterally, 2(8.9%) on the right side and 4 (84.4%) on the left side (table 4.1).

Lingula Height and Position

Table 2: Descriptive characteristic of the left and right lingula and test of mean differences

Parameters	Descriptive Characteristics		Test of mean difference			
	Right (mean±S.D)	Left (mean±S.D)	t-value	df	P-value	Inference
	Total [n=42]	Total [n=42]				
Height	7.00±1.03	7.14±1.11	-0.588	82	0.558	Not Significant
A. Ramus	17.13±3.27	17.26±3.44	-0.185	82	0.854	Not Significant
P. Ramus	17.46±3.12	17.58±3.03	-0.171	82	0.865	Not Significant
Lingula Ratio	0.48±0.08	0.49±0.04	-0.797	82	0.428	Not Significant

Height of the lingula: The height of the right and left of Lingula in the study population was 7.00±1.03mm and 7.14±1.11mm respectively. No significant variation in height of the lingula was noted between right and left sides of the mandibles.

Anterior Ramus: The anterior ramus (A. ramus) of the right and left of lingula of the mandible in the study population was 17.13±3.27mm and 17.26±3.44mm respectively. The A. ramus of the lingula was slightly greater on left side by 0.10mm when compared with the right side. There was no significant difference statistically at (p-value 0.05). No significant variation in A. ramus between right and left sides of the mandibles.

Posterior Ramus: The posterior ramus (P. ramus) of the right and left of lingula of the mandible in this study was 17.46±3.12mm in the right and 17.58±3.03mm in the left. The P. ramus of the lingula was slightly greater on left side by 1.95mm when compared with the right side. There was no significant difference statistically at (p-value 0.05). No significant variation in P. ramus between right and left sides of the mandibles.

Lingula Ratio: The mean and standard deviation value of the lingula ratio was found to be 0.48±0.08mm in the right and 0.49±0.04mm in the left. The ratio of the lingula was slightly greater on left side by 0.01mm when compared with the right side. There was no significant difference statistically at (p-value 0.05). No significant variation of the lingula ratio was noted between right and left sides of the mandibles.

Distribution of the Lingular Shapes and Size

Table 3: Descriptive characteristic of the left and right triangular type of the lingula and test of mean differences

Parameters	Descriptive Characteristics		Test of mean difference			
	Right (Mean±S.D)	Left (Mean±S.D)	t-value	df	P-value	Inference
	Triangular (n=18) 42.9	Triangular (n=22) 33.3				
Height	6.68±1.07	7.34±1.15	-1.677	30	0.104	Not Significant
A. Ramus	17.33±3.41	16.55±2.83	0.690	30	0.495	Not Significant
P. Ramus	17.38±3.10	17.36±1.55	0.021	30	0.984	Not Significant
Lingula Ratio	0.50±0.03	0.49±0.05	1.042	30	0.306	Not Significant

Triangular: The dimensions for right and left triangular type of the lingual were as follows; height (R=6.68±1.07mm, L=7.34±1.15mm), Anterior Ramus (R=17.33±3.41mm, L=16.55±2.83mm), Posterior Ramus (R=17.38±3.10mm, L=17.36±1.55mm), Lingula Ratio (R=0.50±0.03mm, L=0.49±0.05mm). The differences for all measured dimensions for the right

and left lingula were not significantly different (P>0.05).

Table 4: Descriptive characteristic of the left and right truncated type of the lingula and test of mean differences

Parameters	Descriptive Characteristics		Test of mean difference			
	Right (mean±S.D)	Left (mean±S.D)	t-value	df	P-value	Inference
	Truncated (n=16) 38.1	Truncated (n=19) 45.2				
Height	7.28±0.98	7.07±1.16	0.576	33	0.568	Not Significant
A. Ramus	17.02±2.82	16.94±3.74	0.075	33	0.941	Not Significant
P. Ramus	17.28±3.01	17.31±3.84	-0.026	33	0.980	Not Significant
Lingula Ratio	0.50±0.01	0.49±0.01	0.067	32.2	0.947	Not Significant

Truncated: The dimensions for right and left truncated type of the lingual were as follows; height (R=7.28±0.98mm, L=7.07±1.16mm), Anterior Ramus (R=17.02±2.82mm, L=16.94±3.74mm), Posterior Ramus (R=17.28±3.01mm, L=17.31±3.84mm), Lingula Ratio (R=0.50±0.01mm, L=0.49±0.01mm). The differences for all measured dimensions for the right and left lingula were not significantly different (P>0.05).

Table 5: Descriptive characteristic of the left and right nodular type of the lingula and test of mean differences

Parameters	Descriptive Characteristics		Test of mean difference			
	Right (mean±S.D)	Left mean±S.D)	t-value	df	P-value	Inference
	Nodular (n=5; [11.9])	Nodular (n=3; [7.1])				
Height	7.07±0.81	7.83±0.18	-2.027	4.62	0.103	Not Significant
A. Ramus	17.68±4.88	16.88±1.31	0.270	6	0.796	Not Significant
P. Ramus	18.10±4.84	17.77±0.35	0.115	6	0.912	Not Significant
Lingula Ratio	0.49±0.01	0.49±0.03	0.617	6	0.560	Not Significant

Nodular: The dimensions for right and left nodular type of the lingual were as follows; height (R=7.07±0.81mm, L=7.83±0.18mm), Anterior Ramus (R=17.68±4.88mm, L=16.88±1.31mm), Posterior Ramus (R=18.10±4.84mm, L=17.77±0.35mm), Lingula Ratio (R=0.49±0.01mm, L=0.49±0.03mm). The differences for all measured dimensions for the right and left lingula were not significantly different (P>0.05).

Table 6: Descriptive characteristic of the left and right assimilated type of the lingula process and test of mean differences

Parameters	Descriptive Characteristics		Test of mean difference			
	Right (mean±S.D)	Left (mean±S.D)	t-value	df	P-value	Inference
	Assimilated (n=3; [7.1])	Assimilated (n=6; [14.0])				
Height	7.32±1.40	6.53±0.96	1.005	7	0.348	Not Significant
A. Ramus	15.53±2.98	20.14±3.66	-1.871	7	0.104	Not Significant
P. Ramus	17.86±1.14	18.83±3.72	-0.426	7	0.683	Not Significant
Lingula Ratio	0.30±0.25	0.52±0.04	-1.450	2.05	0.282	Not Significant

Assimilated: The dimensions for right and left assimilated type of the lingual were as follows; height (R=7.32±1.40mm, L=6.53±0.96mm), Anterior Ramus (R=15.53±2.98mm, L=20.14±3.66mm), Posterior Ramus (R=17.86±1.14mm, L=18.83±3.72mm), Lingula Ratio (R=0.30±0.25mm, L=0.52±0.04mm). The differences for all measured dimensions for the right and left lingula were not significantly different (P>0.05).

Table 7: Test of multiple comparison for the different shapes of the right lingula

Variable	(I) Shape	(J) Shape	Mean Difference (I-J)	Std. Error	P-value	Inference
Height	**Assimilated**	**Nodular**	0.251	0.885	1.000	Not significant
		Triangular	0.638	0.845	0.947	Not significant
		Truncated	0.039	0.843	1.000	Not significant
	Nodular	**Triangular**	0.388	0.443	0.930	Not significant
		Truncated	-0.212	0.438	0.996	Not significant
	Triangular	**Truncated**	-0.600	0.351	0.443	Not significant
A. Ramus	**Assimilated**	**Nodular**	-2.145	2.776	0.956	Not significant
		Triangular	-1.797	1.897	0.889	Not significant
		Truncated	-1.487	1.858	0.936	Not significant

	Nodular	**Triangular**	0.347	2.324	1.000	Not significant
		Truncated	0.657	2.291	1.000	Not significant
	Triangular	**Truncated**	0.310	1.068	1.000	Not significant
P. Ramus	**Assimilated**	**Nodular**	-0.240	2.261	1.000	Not significant
		Triangular	0.481	0.984	0.996	Not significant
		Truncated	0.580	1.000	0.990	Not significant
	Nodular	**Triangular**	0.721	2.283	0.999	Not significant
		Truncated	0.820	2.290	0.999	Not significant
	Triangular	**Truncated**	0.099	1.049	1.000	Not significant
Lingula Ratio	**Assimilated**	**Nodular**	-0.191	0.145	0.733	Not significant
		Triangular	-0.197	0.145	0.716	Not significant
		Truncated	-0.192	0.145	0.730	Not significant
	Nodular	**Triangular**	-0.006	0.008	0.962	Not significant
		Truncated	-0.001	0.005	1.000	Not significant
	Triangular	**Truncated**	0.005	0.007	0.978	Not significant

Table 7 Compared the dimensions of the different shapes of the right lingula. For the height, the assimilated type was 0.251mm, 0.638mm, and 0.039mm greater than the nodular, triangular, and truncated types respectively. The nodular was 0.388mm greater than the triangular, while the truncated 0.212mm and 0.60mm greater than the nodular and triangular respectively. For the anterior ramus, the assimilated type was 2.145mm, 1.797mm, and 1.487mm smaller than the nodular, triangular, and truncated types respectively. The nodular was 0.347mm and 0.657mm greater than the triangular and truncated types, while the triangular was 0.212mm greater than the truncated type. For the posterior ramus, the assimilated type was 0.240mmsmaller than the nodular type, but 0.481mm and 0.580mm greater than the triangular, and truncated types respectively. The nodular was 0.721mm and 0.820mm greater than the triangular and truncated types, and the triangular was 0.212mm greater than the truncated type.

For the lingula ratio, the assimilated type was 0.191mm, 0.197mm, and 0.192mmsmaller than the nodular, triangular, and truncated types respectively. The nodular, triangular and truncated types had similar dimensions (<0.01mm differences). The differences for all measured dimensions for the right and left lingula were not significantly different (P>0.05).

Table 8: Test of multiple comparison for the different shapes of the left lingula

Variable	(I) Shape	(J) Shape	Mean Difference (I-J)	Std. Error	P-value	Inference
Height	**Assimilated**	**Nodular**	-1.30	0.41	0.091	Not significant
		Triangular	-0.81	0.50	0.523	Not significant
		Truncated	-0.53	0.47	0.826	Not significant
	Nodular	**Triangular**	0.49	0.33	0.582	Not significant
		Truncated	0.77	0.29	0.080	Not significant
	Triangular	**Truncated**	0.27	0.41	0.983	Not significant
A. Ramus	**Assimilated**	**Nodular**	3.26	1.68	0.377	Not significant
		Triangular	3.59	1.68	0.285	Not significant
		Truncated	3.20	1.73	0.402	Not significant
	Nodular	**Triangular**	0.33	1.07	1.000	Not significant
		Truncated	-0.06	1.15	1.000	Not significant
	Triangular	**Truncated**	-0.39	1.14	1.000	Not significant
P. Ramus	**Assimilated**	**Nodular**	1.06	1.53	0.972	Not significant
		Triangular	1.47	1.57	0.906	Not significant
		Truncated	1.51	1.75	0.935	Not significant
	Nodular	**Triangular**	0.41	0.46	0.933	Not significant
		Truncated	0.46	0.90	0.996	Not significant
	Triangular	**Truncated**	0.05	0.97	1.000	Not significant
Lingula Ratio	**Assimilated**	**Nodular**	0.03	0.02	0.706	Not significant
		Triangular	0.03	0.02	0.637	Not significant
		Truncated	0.02	0.02	0.731	Not significant
	Nodular	**Triangular**	0.00	0.02	1.000	Not significant
		Truncated	-0.01	0.01	0.985	Not significant
	Triangular	**Truncated**	-0.01	0.01	0.980	Not significant

Table 8 Compared the dimensions of the different shapes of the left lingual. For the height, the assimilated type was 1.30mm, 0.81mm, 0.53mm, smaller than the nodular, triangular, and truncated types respectively. The nodular was 0.49mm and 0.77mm greater than the triangular and truncated types respectively, while the triangular was 0.27mm greater than the truncated type.

For the anterior ramus, the assimilated type was 3.26mm, 3.59mm, 3.20mmgreater than the nodular, triangular, and truncated types respectively. The nodular was 0.33mm greater than the triangular, while the truncated 0.06mm and 0.39mm greater than the nodular and triangular respectively.

For the posterior ramus, the assimilated type was 1.06mm, 1.47mm, 1.51mm greater than the nodular, triangular, and truncated types respectively. The nodular was 0.41mm and 0.46mm greater than the triangular and truncated types respectively, while the triangular was 0.05mm greater than the truncated type.

The differences in the lingula ratio for the nodular, triangular and truncated types was less than 0.05mm. The differences for all observed dimensions for the right and left lingula were not significantly different (P>0.05).

Table 9: Correlation between variables for the left and right side of the lingular

Variable	Pearson Correlation	Side = Right			Side = left		
		A. Ramus	P. Ramus	Lingula Ratio	A. Ramus	P. Ramus	Lingula Ratio
Height	r	-0.223	-0.102	-0.214	-0.171	-0.245	0.019
	P-value (Inf)	0.156 (NS)	0.521 (NS)	0.174 (NS)	0.280 (NS)	0.118 (NS)	0.907 (NS)
A. Ramus	r		.834**	0.143		.726**	.549**
	P-value (Inf)		<0.001 (S)	0.368 (NS)		<0.001 (S)	<0.001 (S)
P. Ramus	r			-0.030			-0.166
	P-value (Inf)			0.853 (NS)			0.294 (NS)

The correlation between the dimensions of the lingula of the mandible showed that for the right side, height had no significant correlation with other dimensions (P>0.05), while the anterior ramus had significant, positive high correlation with the posterior ramus (r=0.834; P<0.001).

The correlation between the dimensions of the lingula of the lingula of the mandible showed that for the left side, height had no significant correlation with other dimensions (P>0.05), while the anterior ramus had significant, positive high correlation with the posterior ramus (r=0.726; P<0.001), and the lingula ratio (r=0.549; P<0.001).

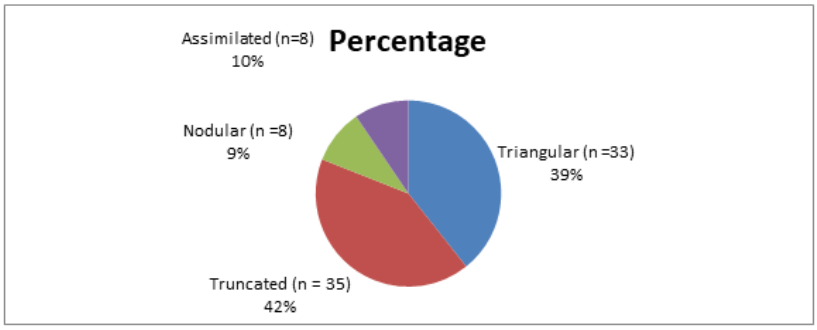

Figure 2: Pie chart showing percentage distribution of the lingula shape prevalence

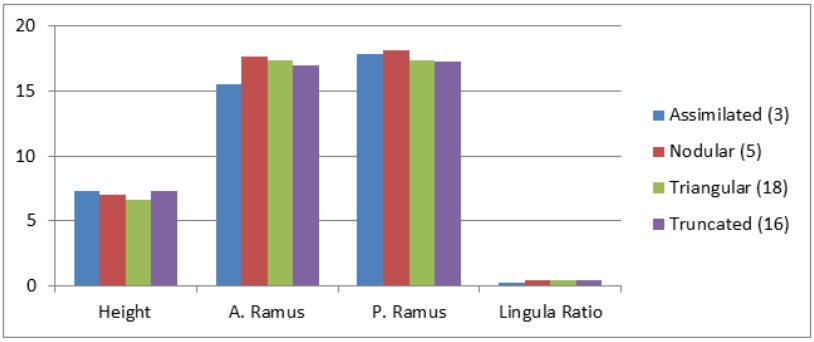

Figure 3: Bar chart showing percentage distribution of the size with the various Shapes on the right side of the lingula

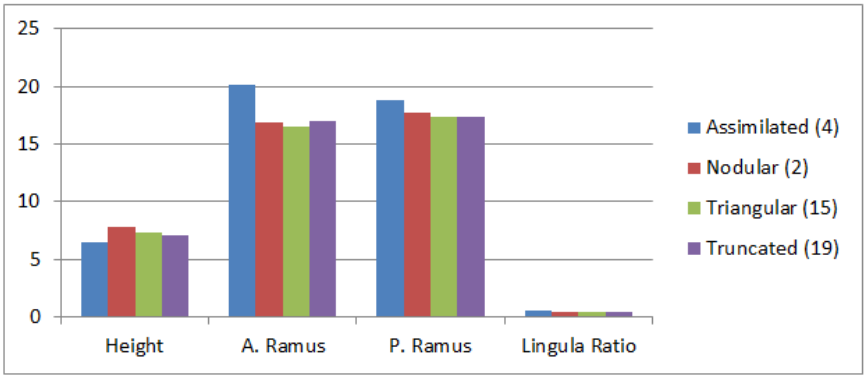

Figure 4: Bar chart showing percentage distribution of the size with the various Shapes on the left side of the lingula

Comparison of various studies regarding shapes of lingula

Author	No.of Specimens	Triangular (%)	Nodular (%)	Truncated (%)	Assimilated (%)
Tuli *et al*., 2000 [7]	165	68.5	10.9	15.8	4.8
Kosithowornchai *et al.*, 2007 [14]	144	17	23	47	13
Jansisyanont *et al*., 2009 [10]	92	29.9	19.6	46.2	4.3
Lopez *et al*., 2010 [12]	80 41.	41.3	10.5	36.3	11.9
Samanta *et al.*, 2012 [15]	124	61.6	31.6	46.6	11.6
Nirmale *et al*., 2012 [16]	84	47.6	27.97	13.6	10.71
Varma *et al*., 2013 [17]	193	13	42	29	6
Smita, 2013 [18]	50	42	10	36	12
Padmavathi *et al*., 2014 [19]	65	29.23	19.23	33.84	17.70
Smrity *et al*., 2014 [20]	102	50	11.76	33.82	2.9
Sophia *et al*., 2015 [21]	50	49	23	18	10
Umesh *et al*., 2018 [22]	90	15.55	21.67	42.22	20.56
Present Study	42	39.27	41.67	9.52	9.52

Comparison of measurements of height, position of lingula with previous studies

Author	No. of specimens	Height of lingula (mm)	Lingula to anterior border of ramus (mm)	Lingula to posterior border of ramus(mm)	Lingula Ratio
Suwadee *et al*., 2007 [23]	72	-	20.70 ± 2.27	18.88 ± 3.03	-
Jansisyanont *et al.*, 2009 [10]	92	8.2 ± 2.3	20.6 ± 2.4	18.0 ± 2.6	-
Sophia *et al.*, 2015 [21]	50	7.45 ±1.48	17.11± 2.32	14.86 ±2.54	-
Samanta *et al.*, 2012 [15]	100	-	20.0 ± 2.4	15.0 ± 2.7	-
Padmavathi *et al.*, 2014 [19]	65	7.41 ± 2.23	21.32 ± 4.12	19.61 ± 3.30	-
Present Study	42	7.07±1.07	17.25±3.36	17.52±3.08	049±0.06

DISCUSSION

The mandible which is the one of the strongest and durable bone in the human body has some usefully variations and clinical landmarks that are of medico legal relevant**.** Various studies from different population have reported morphological variations in the shape and position of the lingula. The frequency of different morphological shapes of lingula studied by different authors also varied among different population and races.

The present study observed the truncated shape of the lingula to be the most predominant followed by triangular shape and the least are nodular and Assimilated shape, though our findings did follow the pattern of (Tuli *et al*., 2000) , who reported the most common type was triangular (68.5%) followed by truncated (15.8%), nodular (10.9%) and assimilated(4.8%) in Indian population, Nirmale *et al*., (2012) who studied 84 adult dry mandibles and found triangular shape in 47.6%, nodular in 27.97%, truncated in 10.7% and assimilated in 13.69%. Lopes *et al.*, (2010) who reported the triangular shape as the most common and assimilated type the least common variety of shape of lingula in the Eastern Brazil population and a study on South Indian population, by (Murlimanju *et al.*, 2012) also observed the triangular and nodular shapes to be most predominant shape. Also, a study on 50 adult dry human mandibles of South Indian Population by Sophia *et al*., 2015, reported that the most frequent type observed was triangular (49%) followed by nodular (23%), truncated (18%) and the least prevalent type found was assimilated (10%).

However, our study is in accordance with a study by (Devi *et al.*, 2003) which described truncated to be most predominant. This study corroborates with studies in Thai mandibles which was observed that the truncated shape is the most common but disagrees with the nodular been the next while in this study it was triangular then followed by nodular and assimilated types (Jansisyanont *et al.*, 2009). Another study by (Kosithowornchoi *et al.*, 2007) on 144 adult dry mandibles, the most frequent type observed was truncated (47%) followed by nodular (23%), triangular (17%) and assimilated (13%).

Height of lingula varies in different population. A study on Thai mandibles showed height of lingula to be 8.2 ± 2.3 mm which is slightly higher than the mean in this research work 7.07 ± 1.07 mm. Another study in Thai population by (Viravudth and Plakornkul 1989) reported that the lingula height on the right and left sides were 8.7 ± 2.0 mm and 8.2 ± 2.1 mm, which also did not correspond with this study with mean value 7.00 ± 1.03 mm and 7.14 ± 1.11 mm. In Koreans, the height of lingula was found to be more, 10.51 ± 3.84 mm which is relatively higher when compared with the value of this study (Woo *et al.*, 2002). The lingula height in this present study was found to be comparatively less than that reported in other population groups. The morphometric studies to locate the position of lingula are few and location of lingula also varied among ethnic and racial groups (Sophia *et al.*, 2015).

In the present study, we discovered variations in the position of Lingula. The right and left anterior ramus were found to be 17.13± 3.27 and 17.26± 3.44 while the right and left posterior ramus were 17.46±3.12 and 17.58±3.03 respectively. Sophia et al., 2015 in their study reported that the position of lingula was found 17.11 ± 2.32 mm, 14.86 ± 2.54, 18.71 ± 3.18 mm and 30.30 ± 5.11 mm from the anterior and posterior border of ramus, mandibular notch and the base of mandible respectively and the height of the lingula found to be 7.45 ± 1.48 mm.

In the study done by (Suwadee *et al.*, 200) on 72 adult dry human mandibles of Thai Population, the position of lingula was found 20.70 ± 2.27 mm from the anterior border of ramus, 18.88 ± 3.03 from the posterior border of ramus, 16.41 ± 3.60 from the mandibular notch and 35.79 ± 3.38 from the base of mandible. In the study done by (Samantha *et al.*, 2012) on 124 dry mandibles of North Indian population, the position of lingula was observed 20.0 ± 2.4 mm from the anterior border of ramus, 15.0 ± 2.7 mm from the posterior border of ramus and 15.4 ± 2.7 mm from the mandibular notch. In yet another study of (Padmavathi *et al.*, 2014) on 65 adult mandibles of South Indian Population, the lingula was located 21.32 ± 4.12 mm, 19.61 ± 3.30 mm, 18.62 ± 3.71 mm and 36.05 ± 4.12 mm from the anterior border of ramus, posterior border of ramus, mandibular notch and base of mandible respectively and the height of the lingula was 7.41±2.23 mm. Morphometric studies to locate the position of the lingula are few and regional variations among races are noted.

Data regarding the location of lingula and lingula ratio in dry adult mandibles of Nigerian origin are limited. Location of lingula varies among the various ethnic and racial groups. The lingula ratio in the present study was found to be 0.49± 0.06 which appears to be the smallest when compared with other studies. The lingula ratio determines the position of lingula on the mandibular ramus. The lingula ratio gives us an idea of the position of lingula and lingual nerve on the mandibular ramus (Lopes *et al.*, 2010), (Hölzle and Wolff 2001). According to (Behnia, 2000) the Lesser the lingula ratio, more anteriorly placed would be the lingula. If the lingula ratio is less, the lingula and the anteriorly related lingual nerve will be positioned more closely to the anterior border of the mandibular ramus there by increasing the risk of nerve injury (Lopes *et al.*, 2010), Samanta *et al*., 2012). The positive relationship between the lingula and lingual nerve position may aid in risk stratification of impacted mandibular third molar.

CONCLUSION

This study observed huge variations in the morphology of mandibular lingula as reported by many researchers, and this shows that lingula is a very useful to in forensic human identification and a good landmark in medical practices. The clinicians in this field of study should take note of these variations for proper anatomical landmark differentiation during surgical procedures.

REFERENCES

1. Tsuji, Y., Muto, T., Kawakami, T., & Takeda, S. (2005). Computed tomographic analysis of the position and course of the mandibular canal: Relevance to the sagittal split ramus osteotomy, *International Journal of Oral Maxillofacial Surgery*, 34, 243-246.
2. Sinnatamby, C. S. (2006). Mandible, Osteology of skull and hyoid bone. Last's Anatomy, Regional and Applied. Eleventh edition. Churchill Livingstone, Elsevier. p. 532-533.
3. Standring, S., Collins, P., Healy, J.C., Wigley, C., & Beale, T. J. (2008). Mandible: Infratemporal and pterygopalatine fossae and temporomandibular joint. Gray's Anatomy - The Anatomical Basis of Clinical Practice, Fortieth edition. Churchill Livingstone, Elsevier. p. 530-532.
4. Hollinshead, W. H. (1962). Textbook of Anatomy. First edition. Calcutta, India: Harper and Row. p: 855- 856.
5. Berkovitz, B. K. B., Holland, G. R., & Moxham, B. J. (1978). Colour atlas and textbook of oral

anatomy. Second edition. London: Wolfe Medical Publication; Pp:15.
6. Morgan, D. H., House, L. R., Hall, W. P., & Vamuas, S. J. (1982). Diseases of temporomandibular apparatus. Second edition. Saint Louis: CV Mosby.; Pp: 19.
7. Tuli, A., Choudhry, R., Choudhry, S., Raheja. S., & Agarwal, S. (2000). Variation in shape of the lingula in the adult human mandible. *J Anatomy*, 197(2), 313-317.
8. Hossain, S. M., Patwary, S. I., & Karim, M. (2001). Variation in shape of the lingulae in the adult human mandibles of Bangladeshi skulls. *Pakistan Journal of Medical Science*, 17, 233-236.
9. Fabian, F. M. (2006). Observation of the position of the lingula in relation to the mandibular foramen and the mylohyoid groove. *Italian journal of Anatomy and Embryology*, 111(3), 151-158.
10. Jansisyanont, P., Apihasmit, S., & Chompoopong. (2009). Shape, height and location of the lingula forsagittal ramus osteotomy in Thais. *Clinical Anatomy*, 22, 787-793.
11. Berry, A. C. (1975) Factors affecting the incidence of non-metrical skeletal variants. *Journal of Anatomical sciences*, 120, 519-535.
12. Lopes, P. T. C., Periera, G. A. M., & Santos, A. M. P. V. (2010). Morphological Analysis of the lingula in dry mandibles of individuals in Southern Brazil. *Journal of Morphological Sciences*, 27(3-4), 136-138.
13. Woo, S. S., Cho, J. Y., Park, W. H., Yoo, I. H., Lee, Y. S., & Shim, K. S. (2002). A study of mandibular anatomy for orthognathic surgery in Koreans. *Journal of Korean Association of Oral and Maxillofacial Surgery*, 28, 126-131.
14. Kositbowornchai, S., Siritapetawee, Damrongrungruang, T., Khongkankong, W., Chatrchaiwiwatana, S., Khamanarong, K., & Chanthaooplee, T. (2007). Shape of the lingula and its localization by panoramic radiograph versus dry mandibular measurement. *Surgical Radiological Anatomy*, 29(8), 689-694.
15. Samanta, P. P., & Kharab, P. (2012). Morphological Analysis of Lingula in Dry Adult Human Mandibles of North Indian Population. *Journal of Cranio Maxillary Diseases*, 1, 7-11.
16. Nirmale, V. K., Mane, U. W., Sukre, S. B., & Diwan, C. V. (2012). Morphological Features of Human Mandible. International Journal of Recent Trends in Science and Technology, 3(2), 38-43.
17. Varma, C. L., & Sameer, P. A. (2013). Morphological variants of Lingula in south Indian Mandibles. *Research and Review: Journal of Medical & Health Sciences*, 2(1), 31-34.
18. Smita, T. (2013). Variations in the Morphological appearance of lingula in dry adult human mandibles, *International Journal of Current Research and Review*, 5(24), 41-45.
19. Padmavathi, G., Varalakshmi, K. J., Suman, T., & Roopashree, K. (2014). A Morphological and morphometric study of the lingula in dry adult human mandibles of South Indian origin and its clinical significance. *International Journal of Health Sciences and Research*, 4(6), 56-61.
20. Smrity, G., & Krishna, P. (2014). Morphological analysis of the lingula in dry mandibles of individuals in North India. *Journal of Dental and Medical Sciences*, 13(1), 4-6.
21. Sophia, M.M., Alagesan, A., & Ramchandran, K. (2015). A Morphometric and Morphological Study of mandibular lingula and its Clinical Significance. *International Journal of Medical Research and Review*, 3(2), 141-148.
22. Modasiya, U. P., & Kanani, S. D. (2018). Study of The Lingula In Dry Human Mandibles And Its Clinical Significance. *International Journal of and Research*, 6(2.2), 5218-5221.
23. Suwadee, K., Mookdha, S., Teerasak, D., Waranyoo, K., Supaporn, C., Kimaporn, K., & Tanarat, C. (2007). Shape of the lingula and its localisation by panaromic radiograph versus dry mandibular measurements. *Surgical Radiological Anatomy*, 29, 689-694.
24. Murlimanju, B. V., Prabhu, L. V., Pai, M. M., Paul, M. T., Saralaya, V. V., & Kumar, C. G. (2012). Morphological study of lingula of the mandibles in South Indian population. *Morphologie*, 96(312), 16-20.
25. Devi, R., Aruna, N., Manjunath, K.Y., & Balasubramanyam, M. (2003). Incidence of morphological variants of mandibular lingula. *Indian Journal of Dental Research*, 14, 210-213.
26. Viravudth, Y., & Plakornkul, V. (1989). The mandibular foramen in Thais. *Siriraj Hospital Gazette*, 41, 551-554.
27. HölzleF, W., & Wolff, K. D. (2001). Anatomic position of the lingual nerve in the mandibular Third molar region with special consideration of an atrophied mandibular crest: Anatomical study. *International Journal Oral Maxillofacial Surgical*, 30, 333.
28. Behnia, H., Kheradvar, A., & Shahrokhi, M. (2000). An anatomical study of the lingual nerve in the third molar region. *Journal of Oral Maxillofacial Surgery*, 58, 649-651.