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Anthropometry of thyromental distance of adult Ibibios and Annangs in Akwa Ibom State, Nigeria

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Abstract

The thyromental distance (TMD) is defined as the distance from the thyroid notch to mental prominence with the head fully extended. The objective of this study was to investigate thyromental distance among adults of Ibibio and Annang Ethnic groups of southern Nigeria. A total of 600 volunteers consisting of 313 (52.2%) males and 287 (47.8%) females, aged between 21-50 years were measured. Annang males and females had higher thyromental distance of (7.27 ± 0.06 cm; 6.91±0.05 cm) compared to the Ibibio males and females (7.13±0.06cm; 6.82±0.05 cm), respectively. The mean thyromental distance of the Annang subjects was significantly higher at $p< 0.03$ than that of the Ibibio adults. In most cases the highest mean thyromental distance was recorded within the 31-40 years age range.

Key words: Annangs, Ibibios, Nigeria, Thyromental distance.

Introduction

The thyroid cartilage is the largest cartilage of the larynx. It lies at the level between 4th and 5th cervical vertebrae. Thyroid cartilage forms anterior wall of larynx and protects the vocal cords. The right and left laminae of the thyroid cartilage unite anteriorly to form laryngeal prominence called Adam's apple. Superior to this prominence, the laminae diverge to form a V-shaped thyroid notch.[1]

The thyroid cartilage is a hyaline cartilage which may undergo endochondral ossification and calcification as an aging process.[1] The mineralization of human thyroid cartilage occurs usually after the end of adolescence.[2] The ossification of thyroid cartilage commences about the 25th year and by the 65th year the cartilage may be completely converted into bone in males. In females, thyroid cartilage never ossifies completely and it leaves the ventral half as cartilaginous part.[3]

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The chin (*Mentun osseum*) is a distinctive feature of the anterior mandibular symphysis found only in the species, *Homo sapiens*.[4–6] It is characterized by a mental protuberance, a raised vertical structure that lies along the symphyseal midline, along with paired bulbous margin (mental tubercles). The presence of *Mentum osseum* is already noticeable in the 5th fetal month and the mandible retains these characteristics into adult life.[4,7] Thus, the mandibular symphysis is the region where the two halves of the human mandible corpus are fused.[8]

The thyromental distance (TMD) is the distance from the thyroid notch to mental prominence with the head fully extended. It is considered a test of mandibular space and reflects the ease by which the tongue may be displaced using a standard laryngoscope blade.[9] A distance greater than 6.5cm is rarely associated with difficulty. Distance between 6cm to 6.5cm may be associated with difficult laryngoscopy though intubation is possible. A thyromental distance of less than 6.0cm suggests that endotracheal intubation using conventional, direct laryngoscopy may be very difficult or impossible.[10,11] These cut-off values however, are disputed and widely studied.[12] Both short and long thyromental distance measurements

may be associated with difficult intubation, but accuracy may be improved by correcting for patient's height and weight.[13] Important structures are located between the thyroid cartilage and mental symphysis. Compression of these structures may be fatal, which makes the TMD an important landmark in the neck region. Such structures between the thyroid cartilage and mental symphysis include muscles plus those of the tongue, hyoid bone, nerves, vessels, salivary organs, lymph nodes and lymph vessels.[14–16] Thus, knowledge of the TMD is of utmost importance to the clinician, particularly anaesthetist, ENT surgeon and emergency health worker. The current study was therefore, carried out to investigate thyromental distance among adults of Ibibio and Annang Ethnic groups in Akwa Ibom State, southern Nigeria.

Figure 1: The landmarks for measurement of thyromental distance (TMD)

Materials and Method

Study Design: This was a community based, cross sectional prospective study. Ethical approval was obtained from the Department of Human Anatomy, University of Uyo for the research work.

Study Population: A total of 600 consenting adults within Uyo metropolis, randomly drawn from the two ethnic groups in Nigeria (Ibibio and Annang) were recruited for the study. Both males and females were duly considered for wide representation.

All the subjects were apparently healthy adults, aged 21 to 50 years, from either the Ibibio or Annang Ethnic groups of Nigeria. Only subjects who met the inclusion criteria and consented to participate in the study were recruited using simple random sampling method. Excluded from the study were those with previous history of cervical spine injury, neck pain, deep neck space infection; subjects unable to sit or stand; those with gross anatomical abnormality of the head and neck; pregnant women and obese subjects.

Procedure for Measurement of Thyromental Distance: The subject sat or stood at erect position with the head fully extended on the neck. This was to enable the researcher to identify the visible prominence of the thyroid notch. For subjects that the thyroid notch was not visible enough, the neck region was palpated to locate the thyroid notch. The tip of the thyroid notch and tip of the mental symphysis were identified and marked as points of distance to be measured (Figure 1). The standard rigid meter rule was placed against the distance from one marked point to the other to obtain the initial measurement. For accuracy, a compass was placed against the meter rule and the measurement retaken and recorded. All measurements were rounded off to one decimal place.

Data Collection: The bio-data of subjects including age, sex and ethnicity were obtained.

Data Analysis: Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 20.0 computer package for windows. Descriptive statistics of mean and standard error were used for quantitative variables, with level of significance at $p<0.05$.

3. Results

Six hundred subjects (600) were recruited in the study. The age range of the subjects was between 21-50 years (Figure 2). The Ibibio ethnic group accounted for 320 (53.3%) of the studied samples while the Annang ethnic group accounted for 280 (46.7%). Males constituted 313 (52.2%) and 287 (47.8%) were females.

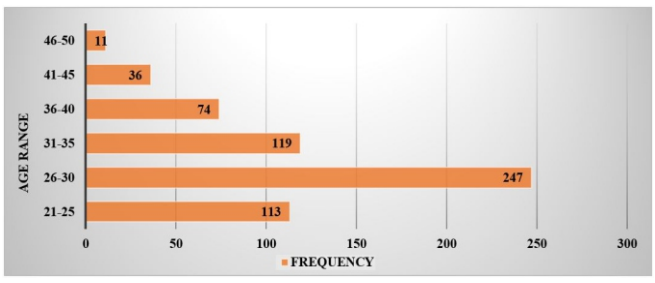

Figure 2: Age Distribution of Subjects in the Study

Thyromental Distance in Relation to Ethnicity and Age Groups

Table 1 shows the mean ± S.E.M. values of thyromental distance of Ibibio males and females in relation to age groups. The males and females from the 31-35 year age group had the highest thyromental distance of 7.50 ± 0.08 cm, and 7.22 ± 0.11 cm, respectively. The females from the 21-25, 26-30 and 46-50 year age groups recorded the lowest thyromental distance (TMD less than 6 cm) at 5.60 ± 0.00 cm; 5.60 ± 0.10 cm and 5.60 ± 0.00 cm, respectively.

Table 1: Thyromental Distance of Ibibio Males and Females in Relation to Age

Age group	Sex	TMD > 6.5cm	TMD 6.0-6.5cm	TMD < 6.0cm
21-25	M	7.45± 0.17	6.39± 0.07	_
	F	7.15± 0.08	6.33± 0.5	5.60± 0.00
26-30	M	7.40± 0.09	6.35± 0.12	5.70± 0.10
	F	7.12± 0.05	6.28± 0.05	5.60± 0.10
31-35	M	7.50± 0.08	6.33± 0.09	5.60± 0.10
	F	7.22± 0.11	6.35± 0.12	_
36-40	M	7.27± 0.11	6.20± 0.12	_
	F	6.90± 0.00	6.00± 0.00	_
41-45	M	7.27± 0.11	6.35± 0.15	5.75± 0.05
	F	6.85± 0.25	6.00± 0.00	5.75± 0.00
46-50	M	7.06± 0.09	_	_
	F	6.80± 0.00	6.50± 0.00	5.60± 0.00

Table 2 shows the mean + S.E.M of Annang males and females in the different age groups. In males, the 21-25 year age group had the highest thyromental distance of 7.83± 0.25 cm while the 26-30 year age group had the lowest thyromental distance of 5.43± 0.15 cm. The females of Annang ethnicity within the 46-50 year age group had the highest thyromental distance at 7.75± 0.25 cm, while those from the 26-30 year age bracket had the lowest thyromental distance of less than 6 cm (5.55± 0.15 cm).

Table 2: Thyromental Distance of Annang Males and Females in Relation to Age

Age group	Sex	TMD > 6.5cm	TMD 6.0-6.5cm	TMD < 6.0cm
21-25	M	7.85 ± 0.25	6.50 ± 0.00	_
	F	7.12 ± 0.14	6.34 ± 0.08	_
26-30	M	7.84 ± 0.09	6.48 ± 0.02	5.43 ± 0.15
	F	7.08 ± 0.05	6.31 ± 0.08	5.55 ± 0.15
31-35	M	7.39 ± 0.10	6.43 ± 0.06	5.60 ± 0.00
	F	7.32 ± 0.09	6.48 ± 0.02	_
36-40	M	7.53 ± 0.09	6.00 ± 0.00	5.60 ± 0.00
	F	7.19 ± 0.13	6.30 ± 0.00	_
41-45	M	7.35 ± 0.17	6.00 ± 0.00	_
	F	6.90 ± 0.00	_	_
46-50	M	7.70 ± 0.00	_	_
	F	7.75 ± 0.25	_	_

Comparison of Thyromental Distance between Ibibios and Annangs

Table 3: Descriptive Statistics and ANOVA Results of Mean Thyromental Distance

	Total (Mean±SEM cm)	Female (Mean±SEM cm)	Male (Mean±SEM cm)
Ibibio	6.98± 0.04	6.82± 0.05	7.13± 0.06
Annang	7.11± 0.04	6.91± 0.05	7.27± 0.06
P- value	0.03*	0.17NS	0.10NS

Key: Asterisk* means significant at p? 0.05; NS is not significant

The results from the ANOVA generally showed that the mean thyromental distance was significantly higher ($p< 0.03$) in the Annangs when compared with that of the Ibibios. The mean thyromental distance of the Annangs was 7.11±0.04 cm while that of the Ibibios was 6.98± 0.04 cm (Table 3). In relation to sex, the Annang male subjects had a mean thyromental distance of 7.27 ± 0.06 cm while the Ibibio males had a mean value of 7.13 ± 0.06 cm. Although the TMD was seen to be higher in the Annang males, the difference was not significantly higher than the distance in Ibibio males. The result of the mean thyromental distance in the females was also higher in the Annangs when compared with the Ibibio females (Table 3).

The mean thyromental distance increased to a pick (7.20 cm) during the 36-40 year age group then reduced to 6.83 cm during the 46-50 year age group, when all subjects investigated were considered. However, among all the Annangs the highest TMD of 7.73 cm came from the 46-50 year age group. Among all the females and males, and the Ibibios in the study the highest mean thyromental distance was from either the 31-35 or 36-40 year age groups, while the males from both ethnic groups tended to have the highest mean thyromental distance in most of the age groups (Table 4).

In the two populations, 462 (77%) have a thyromental distance greater than 6.5 cm, followed by 118 (19.7%) that had a thyromental distance ranging from 6.0 cm to 6.5 cm. Twenty (3.3%) out of the 600 subjects studied had a thyromental distance less than 6.0cm.

Table 4: Comparison of Mean Thyromental Distance (cm) by Age Groups

Samples	Age Group (years)					
	21-25	26-30	31-35	36-40	41-45	46-50
All Females	6.80	6.86	7.02	6.88	6.65	6.88
All Males	7.23	7.21	7.17	7.24	7.14	7.23
Annangs (M+F)	7.02	7.03	7.11	7.27	7.25	7.73
Ibibios (M+F)	6.95	6.93	7.13	7.07	6.96	6.68
Combined Sample	6.97	6.98	7.12	7.20	7.09	6.83

Discussion

The universal bench mark for thyromental distance in a normal adult is 6.5cm.[17] In the present study populations, 462 (77%) have a thyromental distance greater than 6.5cm and 118 (19.7%) have a thyromental distance ranging from 6.0cm to 6.5cm. Twenty (3.33%) out the 600 subjects investigated have a thyromental distance less than 6.0cm. These percentages indicate that the least number of subjects from the two ethnic groups may be exposed to difficult intubation. The thyromental distance greater than 6.5cm (TMD > 6.5cm) indicates normal, easy intubation. Thyromental distance ranging from 6.0cm to 6.5cm indicates slightly difficult laryngoscopy, but difficult intubation may be possible and thyromental distance less than 6.0cm (TMD < 6.0cm) indicate difficult laryngoscopy and intubation impossible.[17] However, different researchers have suggested variable cut-off points for different populations, and they include TMD of 7.0 cm, 5.5 cm, 4.0 cm and 6.0 cm respectively.[10,18–20] Studies have also shown that in some circumstances wrongful localization of the landmarks of the front of the neck or very low positioning of cricothyroid membrane may result in difficult intubation.[21]

In airway management, thyromental distance is regarded as an estimate of the submandibular space that has to accommodate the tongue during laryngoscopy.[22] It can be represented by a straight line drawn between the symphysis mentum and thyroid cartilage and is measured at full head extension. This implies that the magnitude of the thyromental distance is dependent on three factors, mandibular growth, laryngeal descent in the neck and the extent of full head extension.[23] Thyromental distance is a frequently used airway assessment test. However, its role as a predictive test for identifying patients with a difficult airway is limited, as other maneuvers can be employed intra-operatively to achieve intubation of difficult airways.

Both the large and small thyromental distance can result in difficult intubation[11,24] A large thyromental distance equates with an anterior larynx that is at a more obtuse angle, giving rise to too much space for the tongue to be compressed in a laryngoscopy

blade. Thus, a large thyromental distance may be an indicator of difficult intubation and can mask ventilation, as well as act as a risk factor for obstructive sleep apnoea.[25] In some individuals, the caudal descent of the larynx is relatively long, and causes a large part of the tongue to be in the hypopharynx. This also leads to a long thyromental distance which in this case will be an indicator of difficult laryngeal intubation.[26]

A small thyromental distance equates with an anterior larynx that is at a more acute angle which results in a less space for the tongue to be compressed in a laryngoscopy blade. However, a small thyromental distance has been correlated with difficult direct laryngoscopy intubation in adult patients, or the smaller the thyromental distance, the greater the probability of a difficult airway.[27] This small thyromental distance can be seen in individuals with short or long neck.[28]

In the present study when comparing the mean thyromental distance between subjects from the two ethnic groups it was observed that the Annang males and females have a higher thyromental distance than Ibibio males and females. Analysis of variance also shows that the Annangs have mean thyromental distance of 7.11± 0.04 cm while the Ibibios have a mean value of 6.98± 0.04 cm. This difference is significantly higher at $p< 0.05$. There is therefore, need to investigate the possible influence of factors such as height and weight of the subjects, which may help to explain this difference in the mean thyromental distance between the two closely related ethnic groups.

Conclusion

In the present study, there was a difference in the thyromental distance of male and female indigenes of Ibibio and Annang ethnic groups of southern Nigeria, with the Annangs having a higher thyromental distance than the Ibibios.

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