



Received on 23 November, 2016; received in revised form, 16 January, 2017; accepted, 17 February, 2017; published 01 June, 2017

MORPHOMETRY OF THE THYROID GLAND IN DIFFERENT AGE GROUPS IN NORTH INDIAN POPULATION: A CADAVERIC STUDY

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Keywords:

Thyroid Gland,
Length, Width, Thickness

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ABSTRACT: Aims and Objectives: The present study was conducted to find out morphometry of thyroid gland in different age groups. **Material and Methods:** The study was conducted on 60 human thyroid glands in the Department of Anatomy, Pt. B. D. Sharma, PGIMS, Rohtak in North Indian population. **Results:** In present study, mean length of right and left lobe of thyroid gland was found to be 29.88±7.03 mm and 29.45±5.44 mm in Group A, 41.33±6.95 mm and 38.87±5.04 mm in Group B, 35.02±3.98 mm and 31.77±3.27 mm in Group C respectively. The mean width was observed as 18.76±4.23 mm and 20.77±6.01 mm in Group A, 24.13±4.77 mm and 22.47±2.72 mm in Group B, 21.54±2.05 mm and 20.72±2.53 mm in Group C respectively in right and left lobes. The mean thickness was 13.70±4.69 mm and 13.60±4.51 mm in Group A, 15.19±1.99 mm and 15.01±2.29 mm in Group B, 14.73±1.99 mm and 14.09±2.33 mm in Group C respectively in right and left lobes. The mean length and height of the isthmus of thyroid gland was found to be 12.38±4.19 mm and 10.85±5.34 mm in group A, 14.67±2.17 mm and 13.24±5.06 mm in group B, 13.51±1.89 mm and 9.72±2.40 mm in group C respectively. **Conclusion:** The study concluded that mean length and width of right lobe and mean length of left lobe of the thyroid gland was higher in Group B>Group C>Group A. The change in mean height of isthmus of thyroid gland was found to be significant in all the experimental groups.

INTRODUCTION: The thyroid gland is a brownish-red and highly vascular endocrine gland and is placed anteriorly in the lower part of neck at the level with the 5th cervical to the first thoracic vertebrae. It is ensheathed by the pre-tracheal layer of deep cervical fascia forming a capsule. The thyroid gland consists of right and left lobes connected by a narrow, median isthmus. The isthmus connects the lobes of the thyroid gland in the median plane.

Sometimes it is absent; its position and size greatly vary in humans. ^{1, 2, 3} As the isthmus is closely attached to the thyroid cartilage by the pre-tracheal fascia, the thyroid gland moves upwards on swallowing and thereby any thyroid swelling is clinically distinguished from the other swellings of the neck. ^{4, 5} The isthmus measures 1.25 cm transversely and vertically, and is usually anterior to the 2nd and 3rd tracheal cartilages.

The lobes of the thyroid gland are approximately conical. Their ascending apices diverge laterally to the level of the oblique lines on the lamina of the thyroid cartilage, and their bases are in level with the 4th or 5th tracheal cartilages. Each lobe is usually 5 cm long, its greatest transverse and antero-posterior extents being 3 cm and 2 cm respectively.

QUICK RESPONSE CODE 	DOI: 10.13040/IJPSR.0975-8232.8(6).2545-50
	Article can be accessed online on: www.ijpsr.com
DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.8(6).2545-50	

The postero-medial aspects of the lobes are attached to the side of the cricoid cartilage by a lateral thyroid ligament or cricothyroid ligament.

Estimation of the size of the thyroid gland is clinically important in the evaluation and management of thyroid disorders and can be achieved non-invasively by means of diagnostic ultrasound.

MATERIAL AND METHODS: The present study was conducted in the Department of Anatomy in collaboration with the Department of Forensic Medicine, Pt. B.D. Sharma, Postgraduate Institute of Medical Sciences, Rohtak from year 2011 to 2014. This study was done on 60 human thyroid glands.

Selection of cases:

Inclusion Criteria: These samples were collected from autopsied bodies from the mortuary of Department of Forensic Medicine undergoing post-mortem in routine, after obtaining proper consent of the relatives, wherever required. Samples were collected from cases within 24 hours after death before appearance of signs of putrefaction.

Exclusion Criteria:

The following cases were excluded from the study:

- Hanging
- Poisoning
- Any cutting or crushing injury to thyroid gland
- Known case of thyroid disease
- Burnt
- Decomposed

Grouping of the Samples:

Grouping of the samples were done according to age.

- ❖ Group A - ≤ 20 years
- ❖ Group B - 21 - 50 years
- ❖ Group C - above 50 years

The human thyroid gland with related structures was collected en-mass. The collected samples were washed gently with tap water. Blood and blood clots were removed. Each sample was tagged with a piece of cloth which bear an identification number along with age and sex of the victim. Then the samples were fixed and preserved in 10% formal saline solution.

Morphometry of the Thyroid Gland: The length, width and thickness of the lobes of gland were measured with the help of Digital Vernier Caliper with least count 0.01 mm. The length and height of the isthmus were also measured with the help of Digital Vernier Caliper.

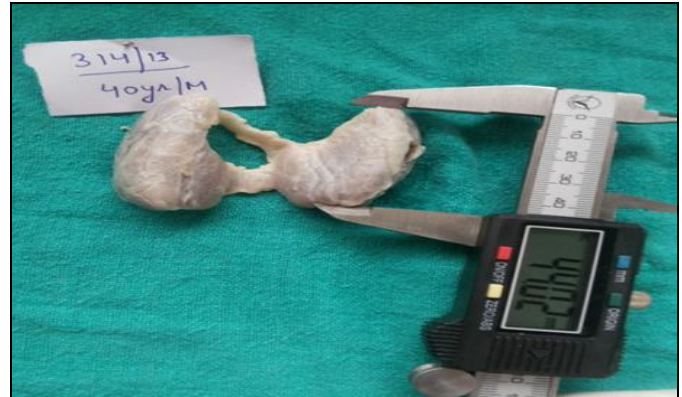


FIG. 1: SHOWING MEASUREMENT OF LENGTH OF LEFT LOBE OF THYROID GLAND WITH DIGITAL VERNIER CALIPER



FIG. 2: SHOWING MEASUREMENT OF WIDTH OF LEFT LOBE OF THE THYROID GLAND WITH DIGITAL VERNIER CALIPER



FIG. 3: SHOWING MEASUREMENT OF LENGTH OF ISTHMUS OF THE THYROID GLAND WITH DIGITAL VERNIER CALIPER



FIG. 4: SHOWING MEASUREMENT OF HEIGHT OF ISTHMUS THE THYROID GLAND WITH DIGITAL VERNIER CALIPER

Statistical Analysis: The data obtained was analyzed using SPSS 17.1 software. The One Way Anova test was applied to compare the age related changes in the morphometry of the thyroid gland. The p-value ≤ 0.05 was considered as significant.

RESULTS: In the present study, the average size of the thyroid gland in different age groups was observed as follows:

Measurements of Right lobe of Thyroid Gland with relation to age:

TABLE 1: AGE-WISE DISTRIBUTION OF MEASUREMENTS OF RIGHT LOBE OF THYROID GLAND

Right lobe of Thyroid Gland (mm)	Age Groups (years)	Number of specimens	Mean±SD	Significance (p-value)
Length	A(≤ 20)	20	29.88±7.03	0.00*
	B(21-50)	20	41.33±6.95	
	C(>50)	20	35.02±3.98	
	Total	60	35.41±7.67	
Width	A(≤ 20)	20	18.76±4.23	0.00*
	B(21-50)	20	24.13±4.77	
	C(>50)	20	21.54±2.05	
	Total	60	21.48±4.40	
Thickness	A(≤ 20)	20	13.70±4.69	0.31**
	B(21-50)	20	15.19±1.99	
	C(>50)	20	14.73±1.99	
	Total	60	14.54±3.17	

* Significant ** Non Significant

Length of Right lobe of the thyroid gland in group A varied from 17.64 mm to 45.30 mm (mean value 29.88 ± 7.03 mm), in group B varied from 32.45 mm to 54.84 mm (mean value 41.33 ± 6.95 mm) and in

group C varied from 25.82 mm to 43.46 mm (mean value 35.02 ± 3.98 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be significant (p-value < 0.05). (**Table 1**)

Width of Right lobe of the thyroid gland in group A varied from 10.47 mm to 25.94 mm (mean value 18.76 ± 4.23 mm), in group B varied from 17.50 mm to 32.32 mm (mean value 24.13 ± 4.77 mm) and in group C varied from 16.74 mm to 24.94 mm (mean value 21.54 ± 2.05 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be significant (p-value < 0.05). (**Table 1**).

Thickness of Right lobe of the thyroid gland in group A varied from 6.38 mm to 29.18 mm (mean value 13.70 ± 4.69 mm), in group B varied from 12.24 mm to 19.26 mm (mean value 15.19 ± 1.99 mm) and in group C varied from 11.08 mm to 17.85 mm (mean value 14.73 ± 1.99 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be non significant (p-value > 0.05). (**Table 1**).

Measurements of Left lobe of Thyroid Gland with relation to age:

TABLE 2: AGE-WISE DISTRIBUTION OF MEASUREMENTS OF LEFT LOBE OF THYROID GLAND

Left lobe of thyroid gland (mm)	Age Groups (years)	Number	Mean±SD	Significance (p-value)
Length	A(≤ 20)	20	29.45±5.44	0.00*
	B(21-50)	20	38.87±5.04	
	C(>50)	20	31.77±3.27	
	Total	60	33.36±6.12	
Width	A(≤ 20)	20	20.77±6.01	0.31**
	B(21-50)	20	22.47±2.72	
	C(>50)	20	20.72±2.53	
	Total	60	21.32±4.09	
Thickness	A(≤ 20)	20	13.60±4.51	0.37**
	B(21-50)	20	15.01±2.29	
	C(>50)	20	14.09±2.33	
	Total	60	14.23±3.22	

* Significant ** Non Significant

Length of Left lobe of the thyroid gland in group A varied from 14.52 mm to 37.46 mm (mean value

29.45±5.44 mm), in group B varied from 31.46 mm to 50.68 mm (mean value 38.87±5.04 mm) and in group C varied from 24.94 mm to 40.17 mm (mean value 31.77±3.27 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be significant (p-value <0.05). (Table 2)

Width of Left lobe of the thyroid gland in group A varied from 10.42 mm to 30.65 mm (mean value 20.77±6.01 mm), in group B varied from 17.28 mm to 27.32 mm (mean value 22.47±2.72 mm) and in group C varied from 15.22 mm to 27.86 mm (mean value 20.72±2.53 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be non significant (p-value >0.05). (Table 2)

Thickness of Left lobe of the thyroid gland in group A varied from 5.76 mm to 28.76 mm (mean value 13.60±4.51 mm), in group B varied from 11.14 mm to 20.76 mm (mean value 15.01±2.29 mm) and in group C varied from 9.34 mm to 18.60 mm (mean value 14.09±2.33 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be non significant (p-value >0.05). (Table 2)

Measurements of Isthmus of Thyroid Gland with relation to age:

TABLE 3: AGE-WISE DISTRIBUTION OF MEASUREMENTS OF ISTHMUS OF THYROID GLAND

Isthmus of thyroid gland (mm)	Age Groups (years)	Number	Mean±SD	Significance (p-value)
Length	A(≤20)	20	12.38±4.19	0.05**
	B(21-50)	20	14.67±2.17	
	C(>50)	20	13.51±1.89	
	Total	60	13.52±3.03	
Height	A(≤20)	20	10.85±5.34	0.04*
	B(21-50)	20	13.24±5.06	
	C(>50)	20	9.72±2.40	
	Total	60	11.27±4.63	

* Significant ** Non Significant

Length of isthmus of the thyroid gland in group A varied from 4.58 mm to 23.42 mm (mean value 12.38±4.19 mm), in group B varied from 11.28 mm to 20.85 mm (mean value 14.67±2.17 mm) and in

group C varied from 10.48 mm to 17.26 mm (mean value 13.51±1.89 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be non significant (p-value= 0.05). (Table 3).

Height of isthmus of the thyroid gland in group A varied from 3.85 mm to 29.35 mm (mean value 10.85±5.34 mm), in group B varied from 7.64 mm to 31.14 mm (mean value 13.24±5.06 mm) and in group C varied from 5.86 mm to 16.25 mm (mean value 9.72±2.40 mm). When the mean values of group A, B and C were compared with each other, the difference was found to be significant (p-value <0.05). (Table 3).

DISCUSSION: Thyroid gland is a very important endocrine gland which is concerned with rate of metabolism, blood calcium level and affects the growth and development in mammals.⁶

The estimation of the size of the thyroid gland is important for evaluation and management of the thyroid disorders.⁷

Sonography allows an exact documentation of the size, volume and parenchymal echo structure of the thyroid gland as well as detection of various diffuse and focal abnormalities of the gland itself and of the surrounding structures.⁸

Each lateral lobe is about 4cm in length, 2-2.5 cm in width, and 1.5-2 cm in thickness.^{9, 10} Keith as reported that the maximum length of thyroid gland lobes reached during the 3rd decade and then it decreased (1-3mm) per decade.¹¹

The length of the right lobe of thyroid gland in the present study was lower than other population reported in the literature. The width of right lobe of thyroid gland in the present study was almost similar to that of Patricia M⁹ and Alan S, Lowe JS¹⁰ in UK population. The thickness of right lobe of thyroid gland in the present study was almost similar to that of Patricia M⁹ and Alan S, Lowe JS¹⁰ in UK population but more than Maharashtra population reported by Joshi *et al.*,¹⁵

The length of the left lobe of thyroid gland in the present study was almost similar to that of Harjeet *et al.*,¹² in Northwest Indian population and lower than other population reported in other studies. The

width of left lobe of thyroid gland in the present study was almost similar to that of Patrica M⁹ and Alan S, Lowe JS¹⁰ in UK population. The thickness of left lobe of thyroid gland in the present study was almost similar to that of Patrica M⁹ and Alan S, Lowe JS¹⁰ in UK population but more than Maharashtrian population reported by Joshi et al.,¹⁵.

The length of the isthmus of thyroid gland in the present study was lower than Maharashtrian

population reported by Joshi et al.,¹⁵ and the length was lower than Bangladeshi people reported by Begum M¹³ and more than Bangladeshi people reported by Sultana et al.,¹⁶ in Group A, B and C. The height of the isthmus of thyroid gland in the present study was similar to that of Maharashtrian population reported by Joshi et al.,¹⁵ and the height was lower than Bangladeshi population reported by Begum M¹³ and Sultana et al.,¹⁶ in Group A, B and C.

TABLE 4: COMPARISON OF MEASUREMENTS OF THYROID GLAND IN DIFFERENT POPULATIONS

Author	Year	Population	Measurements		
			Right lobe	Left lobe	Isthmus
Harjeet et al., ¹²	2004	Northwest Indians	4.04 cm	3.82 cm	
Begum M ¹³	2004	Bangladesh			Length 1.34±0.40 cm- Gp A 1.62±0.43 cm- Gp B 1.65±0.45 cm- Gp C Height 1.46±0.46 cm- Gp A 1.55±0.47 cm- Gp B 1.41±0.40 cm- Gp C
Patrica M ⁹ and Alan S, Lowe JS ¹⁰	2004 2005	UK	4 cm-Length 2-2.5cm-Width 1.5-2cm-Thickness	4 cm-Length 2-2.5cm-Width 1.5-2cm-Thickness	
Berkovitz et al., ¹⁴ Joshi et al., ¹⁵	2005 2010	Maharashtra	4.32±0.69 cm Length 1.13±0.39 cm Thickness	4.22±0.62 cm Length 1.18±0.33 cm Thickness	1.25 cm Length & Height 1.85 cm Length 1.1 cm Height
Sultana et al., ¹⁶	2011	Bangladesh			Length 10.42±7.49 mm- Gp A (upto 18 yr) 10.17±5.70 mm- Gp B (19-45 yr) 9.33±6.64 mm- Gp C (>45 yr) Height 13.66±5.06 mm- Gp A 14±5.41 mm- Gp B 12.27±3.97 mm- Gp C
Present Study	2014	North Indian population	Length (mm) Gp A 29.88±7.03 Gp B 41.33±6.95 Gp C 35.02±3.98 Total 35.41±7.67 Width (mm) Gp A 18.76±4.23 Gp B 24.13±4.77 Gp C 21.54±2.05 Total 21.48±4.40 Thickness(mm) Gp A 13.70±4.69 Gp B 15.19±1.99 Gp C 14.73±1.99 Total 14.54±3.17	Length (mm) 29.45±5.44 38.87±5.04 31.77±3.27 33.36±6.12 Width (mm) 20.77±6.01 22.47±2.72 20.72±2.53 21.32±4.09 Thickness(mm) 13.60±4.51 15.01±2.29 14.09±2.33 14.23±3.22	Length(mm) 12.38±4.19 14.67±2.17 13.51±1.89 13.52±3.03 Height(mm) 10.85±5.34 13.24±5.06 9.72±2.40 11.27±4.63

CONCLUSION: The broad objective of the present study was to assess age related changes in the morphometry of the thyroid gland in North Indian population, as these changes are not reported in this population so far.

The study concluded that the mean length and width of the right lobe and mean length of the left lobe of the thyroid gland was higher in Group B followed by Group C followed by Group A. No statistically significant difference in the mean thickness of right lobe and mean width and thickness of the left lobe of the thyroid gland in different age groups was observed. The change in mean height of the isthmus of the thyroid gland was significant but in length it was non-significant.

Surgeons will get benefitted by the study as they will be aware of the normal size of the thyroid gland and help them to give an accurate diagnosis about any abnormality of the gland.

ACKNOWLEDGEMENT: Praise is to the Almighty God, who made me able to carry out the work successfully. Thanks-giving is a pleasant job, but it is nonetheless difficult where one sincerely tries to put them in words. I find myself short of words while expressing my sense of gratitude and indebtedness towards Dr. Sushil Kumar Srivastava, Senior Professor, Department of Anatomy, Pt. B.D. Sharma Post Graduate Institute of Medical Sciences, Rohtak. Despite the other important responsibilities, he obliged me to encroach over his precious time and guided me with his invaluable suggestions and affectionate help. His immense knowledge of the subject, analytic gaze, farsightedness and perseverance were a constant source of inspiration during the course of this work.

CONFLICTS OF INTEREST: None

REFERENCES:

1. Sinnatamby CS. Last's Anatomy: regional and applied. 11th ed. Edinburgh: Elsevier Churchill Livingstone 2006. p. 351-2.
2. Marshall CF. Variations in the form of the thyroid gland in man, *Journal of Anatomy & Physiology* 1895; 29: 234-9.
3. Tong ECK, Rubenfeld S. Scan measurement of normal and enlarged thyroid glands. *American Journal of Roentgenol Radium Thermal & Nuclear Medicine* 1972; 115: 706-8.
4. Chatterjee CC. Human physiology. Vol.2. 10th ed. Calcutta: Medical Allied Agency, 1994. p. 65-9.
5. Swash M. Hutchison's clinical methods. 21st ed. Edinburgh: WB Saunders, 2002. p. 327.
6. Ganong WF. Review of Medical physiology. 22nd ed. Singapore: McGraw-Hill, 2005. p. 317-32.
7. Greenwood RM, Daly JG, Himsforth RL. Hyperthyroidism and the impalpable thyroid gland. *Journal of Clinical Endocrinology* 1985; 22(5): 583-7.
8. Weisner W, Engel H, Steinbrich W, Oertli D. Sonography of the thyroid. *Praxis (Bern 1994)* 2006; 95(15): 575-80.
9. Patrica M. Endocrine physiology, McGraw-Hill. 2004. p.73-83.
10. Alan S, Lowe JS. Human Histology 3rd ed. Elsevier Mosby. 2005. p.276-9.
11. Keith EF. Body growth considerations in age - specific dosimetry. *Journal of Health Sciences & Research Division*. 1993; 8: 123-7.
12. Harjeet A, Sahni D, Jit I, Aggarwal AK. Shape, measurements and weight of the thyroid gland in northwest Indians. *Surgical & Radiological Anatomy*. 2004; 26(2): 91-5.
13. Begum M. Gross and Histomorphological study of human postmortem thyroid gland in Bangladeshi people (thesis). University of Dhaka; 2004. p. 75-8.
14. Standring S, Berkovitz BK editor. Head & Neck. In: Standring S, Ellis H, Healy JC, Johnson D, Williams A, Collins P *et al.* Gray's Anatomy: The anatomical basis of clinical practice, 39th ed. Edinburgh: Elsevier Churchill Livingstone; 2005. p. 560-4.
15. Joshi SD, Joshi SS, Diami SR, Athavale SA. The Thyroid gland and its variations: a cadaveric study. *Folia Morphology*. 2010; 69(1): 47-50.
16. Sultana SZ, Khalil M, Khan MK. Morphometry of isthmus of thyroid gland in Bangladeshi cadaver. *Mymensingh Medical Journal*. 2011; 20: 366-70.

How to cite this article:

Malik P, Srivastava SK, Dhatarwal SK, Verma U, Singroha R, Yadav S: Morphometry of the thyroid gland in different age groups in north Indian population: a cadaveric study. *Int J Pharm Sci Res* 2017; 8(6): 2545-50. doi: 10.13040/IJPSR.0975-8232.8(6).2545-50.

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