



Original Article

Thyroid Volume Measurements in Normal Adult Females of Gujrat, Pakistan

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ABSTRACT

Thyroid gland volume assessment is considered crucial in a variety of pathological circumstances including thyroiditis, iodine deficiency, and goiter, and may vary with age and weight. **Objective:** To evaluate the normal adult female's thyroid volume using ultrasonography.

Methods: It is a cross-sectional descriptive study conducted at the private healthcare setup of Gujrat Pakistan. After informed consent data was collected over four months. A sample size of 42 patients was calculated via a convenient sampling approach by taking the mean from previous related studies. The data was entered and analyzed by using SPSS version 20. The study included normal adult females and excluded thyroid diseases, neck swelling, and atypical thyroid volumes. **Results:** This study included 42 females who had a standard thyroid gland. Findings of thyroid volume showed a positive strong correlation between thyroid volume, age, and weight. The mean weight of patients was 67.66 ± 10.3 Kg and the mean age of patients was 42.07 ± 14.5 years. The mean volume of the right lobe of the thyroid was 3.70 ± 0.96 ml, mean volume of left lobe of thyroid was 3.51 ± 0.94 ml and mean volume of total thyroid was 7.22 ± 1.90 ml. Paired Sample *t*-test of right and left thyroid lobes volume was calculated having with the significance of (.000). **Conclusions:** It is concluded that ultrasound is the preferred approach for the evaluation of thyroid volume. The thyroid volume had a positive strong correlation with weight and age.

INTRODUCTION

The thyroid is a gland of the endocrine system that is structured like a butterfly and secrete hormones [1]. It is composed of two right and left lateral lobes which are linked via isthmus [2]. It is positioned in the neck region anterior to trachea just below to larynx [3]. Thyroid produces hormones such as T3 (tri-iodothyronine), thyroxin, calcitonin, and T4 (tetra-iodothyronine) that are characterized by their content of iodine [4]. Thyroid hormones affect heart function in a variety of ways including genomic and non-genomic effects. The overabundance of thyroid hormones is likely to cause significant alterations in heart function and blood oxygenation [5]. The function of thyroid hormones is to maintain metabolic rate, it aids in the regulation of various physiological processes by continuously releasing hormones into the blood circulation [6]. The dimensions

for a normal thyroid gland are longitudinal, transverse, and anteroposterior which shows an accurate volume in adults [7]. The anterior and posterior relations of the thyroid with sternocleidomastoid and strap muscles, blood vessels such as carotid arteries, and internal jugular veins used as a landmark to properly evaluate it [8]. Arterial supply to the thyroid gland is by two main inferior and superior thyroid arteries [9]. Thyroid gland volume assessment is considered crucial in a variety of pathological circumstances including thyroiditis, iodine deficiency, and goiter [10]. Thyroid volume may vary with age and weight in different regions [11]. There is a significant relationship of age, weight with thyroid volume, as the weight and age of individual increases thyroid volume also increase [12,13]. The right thyroid lobe volume is greater as compared to left thyroid lobe volume [14]. According to the previous

literature the average thyroid weight was between 25 to 30 g [15]. The Superficially located thyroid gland can easily be evaluated via ultrasound using a linear probe with the highest frequency of 7.5 to 15 MHz [16]. Proper techniques and knowledge are required for a radiologist to examine the thyroid on ultrasound [17]. CT and MRI are best in their diagnosis but relatively expensive in comparison to ultrasound [18]. There are no side effects of ultrasound as it is a non-invasive approach that uses sound waves and does not emit any harmful radiations [19]. In assessing and monitoring the thyroid nodules, ultrasound imaging is the most reliable and cost-effective procedure [20]. For the assessment of the thyroid, the patient must be in a supine posture with a hyperextended neck then a gel is applied to the patient's neck [21]. The thyroid gland is homogenous sonographically and normally each lobe measures 4-7cm in length, < 2cm in-depth, the isthmus is around 2.5cm deep [22]. The parenchyma of the thyroid must be more homogenous than the nearby muscles [23]. Parathyroid glands or thymus may frequently be seen in an intra-thyroidal position [24]. The vascularity of the thyroid gland can be evaluated via color and power Doppler sonography [25]. This study will provide accurate measurements of thyroid volume in females to help understand about thyroid diseases related to abnormal thyroid volumes. This study will create awareness among the general public and provides the evident importance of ultrasound in the measurement of thyroid volume.

METHODS

A cross-sectional descriptive study was conducted at the private healthcare setup of Gujrat Pakistan. A sample size of 42 patients was calculated via a convenient sampling approach by taking the mean from three previous related studies [4,10,14]. Data was collected after informed consent via a Toshiba ultrasound machine with a linear probe highest frequency of 7.5 to 15 MHz. The patient was scanned in the supine posture with the hyperextended neck. The scan was carried out in three dimensions longitudinal, transverse, and anteroposterior. The data was entered and analyzed by using SPSS version 20. This current study included normal adult females and excluded thyroid diseases, neck swelling, and atypical thyroid volumes.

RESULTS

This study included 42 females who had a standard thyroid gland. Volume of right and left thyroid lobes, age, and weight of the respondents were the variables evaluated in this study. Table 1 shows the frequency of age groups such as group (21-30) has a frequency of 9, group (31-40) has 14, group (41-50) has 5, group (51-60) has 8, and group (61-70) has the frequency of 6 respectively. Table 2 shows the

mean weight of patients 67.66 ± 10.3 and the mean age of patients 42.07 ± 14.5 . Table 3 shows the mean volume of right thyroid lobe 3.70 ± 0.96 ml, mean volume of left thyroid lobe 3.51 ± 0.94 ml, and mean volume of total thyroid 7.22 ± 1.90 ml. Table 4 shows the Paired Sample t-test of right and left thyroid lobes volume that has the significance of (.000). Table 5 shows a positive strong correlation between thyroid volume, age, and weight.

Age groups	Frequency	Percentage	Valid %	Cumulative %
Valid	21-30	9	21.4	21.4
	31-40	14	33.3	54.8
	41-50	5	11.9	66.7
	51-60	8	19.0	85.7
	61-70	6	14.3	100.0
	Total	42	100.0	100.0

Table 1: Frequency of age groups

Statistics		Weight of patients	Age of patients
N	Valid	42	42
	Missing	0	0
Arithmetic mean		67.6667	42.0714
Median		67.5000	38.0000
Std. Deviation		10.31378	14.56088
Range		34.00	48.00
Minimum		51.00	22.00
Maximum		85.00	70.00

Table 2: Summation of statistics for age and weight

Statistics		Volume of Rt thyroid lobe	Volume of Lt thyroid lobe	Overall volume of thyroid
N	Valid	42	42	42
	Missing	0	0	0
Arithmetic mean		3.7095	3.5143	7.2238
Median		3.5000	3.2000	6.8000
Std. Deviation		.96621	.94548	1.90824
Range		4.40	4.40	8.80
Minimum		2.40	2.20	4.60
Maximum		6.80	6.60	13.40

Table 3: Summation of statistics for the volume of right and left thyroid lobes and overall volume of thyroid

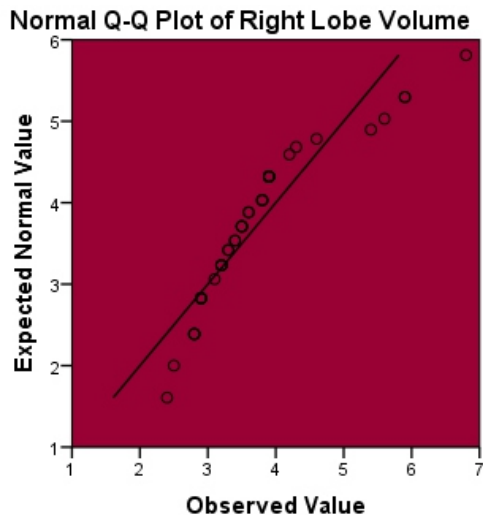


Figure 1: A scatter-gram depicts the normality test for the volume of right thyroid lobe

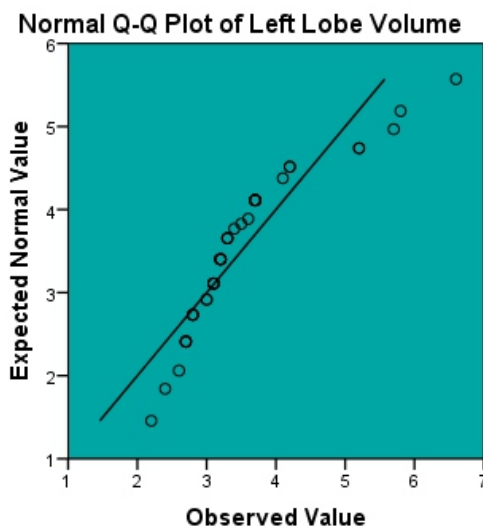


Figure 2: A scatter-gram depicts the normality test for the volume of left thyroid lobe

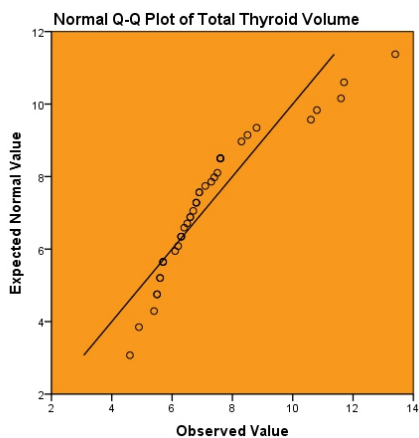


Figure 3: A scatter-gram depicts the normality test for the volume of total thyroid

Paired Sample t-test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	SD	SE Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Volume of Rt and Lt thyroid lobes	.19524	.11677	.01802	.15885	.23163	10.836	41	.000

Table 4: Paired Sample T- test of right and left thyroid lobes volume

Correlation of variables		Age of patients	Weight of patients	Volume of Rt thyroid lobe	Volume of Lt thyroid lobe	Volume of overall thyroid
Patients age group	Pearson Correlation	1	.720**	.487**	.508**	.502**
	Sig. (2-tailed)		.000	.001	.001	.001
	N	42	42	42	42	42
Weight of patients	Pearson Correlation	.720**	1	.482**	.458**	.471**
	Sig. (2-tailed)	.000		.001	.002	.002
	N	42	42	42	42	42
Rt thyroid lobe volume	Pearson Correlation	.487**	.482**	1	.983**	.988**
	Sig. (2-tailed)	.001	.001		.000	.000
	N	42	42	42	42	42
Lt thyroid lobe volume	Pearson Correlation	.508**	.458**	.983**	1	.988**
	Sig. (2-tailed)	.001	.002	.000		.000
	N	42	42	42	42	42
Overall thyroid volume	Pearson Correlation	.502**	.471**	.988**	.988**	1
	Sig. (2-tailed)	.001	.002	.000	.000	
	N	42	42	42	42	42

** Correlation is significant at the 0.01 level (2-tailed).

Table 5: Depicts the correlation between age, weight, volume of Rt and Lt thyroid lobes, and volume of overall thyroid

DISCUSSION

In the current study, thyroid volume assessment was performed on females. The superficial thyroid gland is examined in supine posture via ultrasonography in transverse and longitudinal approaches. Right and left thyroid lobes volume was automatically calculated using an ultrasound machine by ellipsoid formula (Volume = length x width x depth x 0.479), and overall thyroid volume was determined by taking the sum of both right and left thyroid lobes volume. A study by Amani Adam Malik Aldoma published in 2021 also evaluated thyroid volumes by using the ellipsoid formula in the ultrasound machine with the same approaches and patient positioning and he also proved ultrasonography is the preferred approach for the thyroid volume evaluation [4]. The thyroid volumes were evaluated in the current study because thyroid volume assessment is considered crucial in a wide range of pathological conditions such as thyroiditis, iodine deficiency, and goiter. Thus four variables; age, weight, the volume of right, and left thyroid lobes were considered and this study proved that there is a positive strong correlation between these variables. The findings show the mean weight of patients 67.66±10.3 Kg, mean age of patients 42.07±14.5 years, mean volume of right thyroid lobe 3.70+0.96ml, mean volume of left thyroid lobe 3.51+0.94ml, and mean volume of total thyroid of patients 7.22+1.90ml. In 2017, Rashid Ali Mohammad Musa published a study in Sudan, he examined the thyroid volumes of females and he also proved that there is a noteworthy relationship between age, weight, and thyroid volume [10]. The values obtained in the current study were significantly higher as compared to the previous study. This current study's findings proved that there is a noticeable difference between the volume of right and left lobes. The volume of the right thyroid lobe was greater than the volume of the left thyroid lobe. This was also found by Mohamad Yusef's study published on 26 Sep 2011 in Sudan he also calculate thyroid volume via ellipsoid formula and

he proved through his findings that the mean volume of right lobe 1.813 ± 0.4296 ml is significantly higher than the mean volume of left lobe $1.733 \pm .4617$ ml [14].

CONCLUSIONS

It is concluded that ultrasonography is the preferred approach for the thyroid volume evaluation. The current study concludes that thyroid volume had a positive strong correlation with age and weight. The volume of the right thyroid lobe is greater than the volume of the left thyroid lobe.

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