

1- . Background:

The thyroid is a vital endocrine gland of our body which is located superficially in the infra-hyoid compartment of the neck in a space outlined by muscle, trachea, esophagus, carotid arteries and jugular veins (Fig. 1). It lies against C5 to T1 vertebral level [1]. The true measurement of thyroid gland size is important in examination of the thyroid and evaluating pathologies of the thyroid gland. The size of the thyroid can be determined by palpation, scintigraphy or ultrasonography (US). Today ultrasound (US) and scintigraphy (Fig. 2) are used in examining the adult thyroid gland [2-4].

Volumetric evaluation of the thyroid gland is based on the use of an ellipsoid model. Hence, a value is obtained that replaces clinical evaluation of volume. With the ellipsoid model, the height, the width, and the depth of each lobe are measured and multiplied. The obtained result is then multiplied by a correction factor [5].

2. Aim:

This study established with an aim to correlate the effects of body weight, height, and body mass index (BMI) on thyroid volume of Saudi normal undergraduate adult male subjects by using ultrasound.

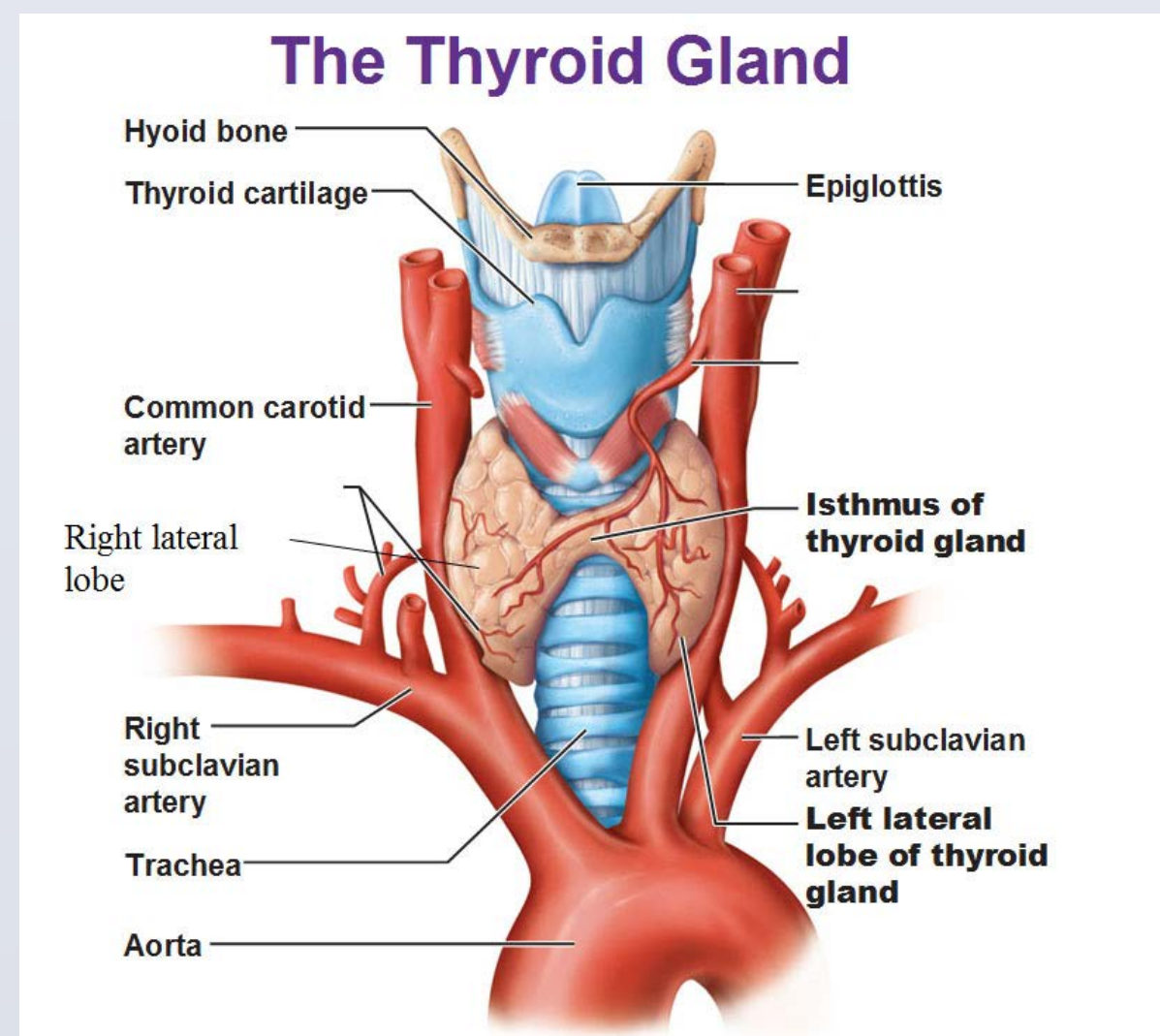


Figure 1. Thyroid gland anatomy.



Figure 2. Ultrasound scanning of the thyroid gland.



Fig. 3 Demonstrate Hitachi (HI vision Avius) ultrasound unit

3. Material and Methods:

After receiving approval from the local ethics committee, a total of 100 [mean age of the subjects was 21.8 ± 1.3 years with a range of 18-22 years] undergraduate Saudi males were recruited in a period of six months between June 2015 and January 2016 in this prospective cohort study. Thyroid measurements were performed using a Hitachi (HI vision Avius) ultrasound unit, equipped with a high frequency direct contact 10 MHz linear array ultrasound probe (Fig.3).

3.1 Selection and Description of Participants:

This study was conducted in the Radiology and Medical Imaging Department of the College of Applied Medical Sciences of King Saud University and Prince Sattam bin Abdulaziz University in Saudi Arabia during the period of 2015 up to 2016. Participants with anterior neck swelling or clinical evidence of thyroid disease were excluded because this may affect the thyroid size.

3.2 US Equipment:

Thyroid measurements were performed using a Hitachi (HI vision Avius) ultrasound unit, equipped with a high frequency direct contact 10 MHz linear array ultrasound probe. Initial examination was performed under high gain (80 dB to 90 dB) and low gain (60 dB to 70 dB) sensitivity for more detailed inspection during ultrasonography. Aquasonic 100 Ultrasound Gel as the coupling material. Hard copies of thyroid sonograms were obtained using an ultrasound digital graphic printer, 100 V; 1.5 A; and 50/60 Hz, with the serial number of 3-619-GBI-01 and made by Sony Corporation, Japan.

3.3 Scanning Technique:

Examinations were made in a supine position of the patient with maximum neck extension. Longitudinal and transverse scans were performed, to obtain length, width and depth in centimeters, of each lobe. The thyroid volume was calculated as a sum of lobe volumes [6,7]. The lobe volume was calculated using the rotation ellipsoid model formula [8,9].

2.4 Data Analysis:

Data were initially summarized as mean \pm SD in a form of comparison tables and graphs. Statistical analysis was performed using the standard Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 20 for windows.

4. Results:

The calculated mean of the total thyroid volume was 7.5 ± 2.4 ml (Table 1). Extremely statistically significant correlation ($P < 0.0001$) found between total thyroid volume (ml) and the participants' weight (Kg), height (cm), and BMI (Fig. 5, Fig. 6, and Fig. 7). The mean height of participants was 172 ± 7.8 cm. Maximum participants' height was 200 cm and minimal height was 140 cm. The calculated mean weight of participants was 79.4 ± 22.2 kg. Maximum participants' weight was 147 Kgs and minimal weight was 46 Kgs. The mean BMI was 26.8 ± 7.4 Kgs/m². Maximum participants' BMI was 49.7 Kgs/m² and minimal BMI was 16.2 Kgs/m².

Table 1. Volume of thyroid gland (ml)

Variables	Right Thyroid	Left Thyroid	Participants
	Lobe Volume	Lobe Volume	
	(ml)	(ml)	Volume (ml)
N	100	100	100
Mean	3.9	3.5	7.5
\pm SD	± 1.6	± 1.2	± 2.4

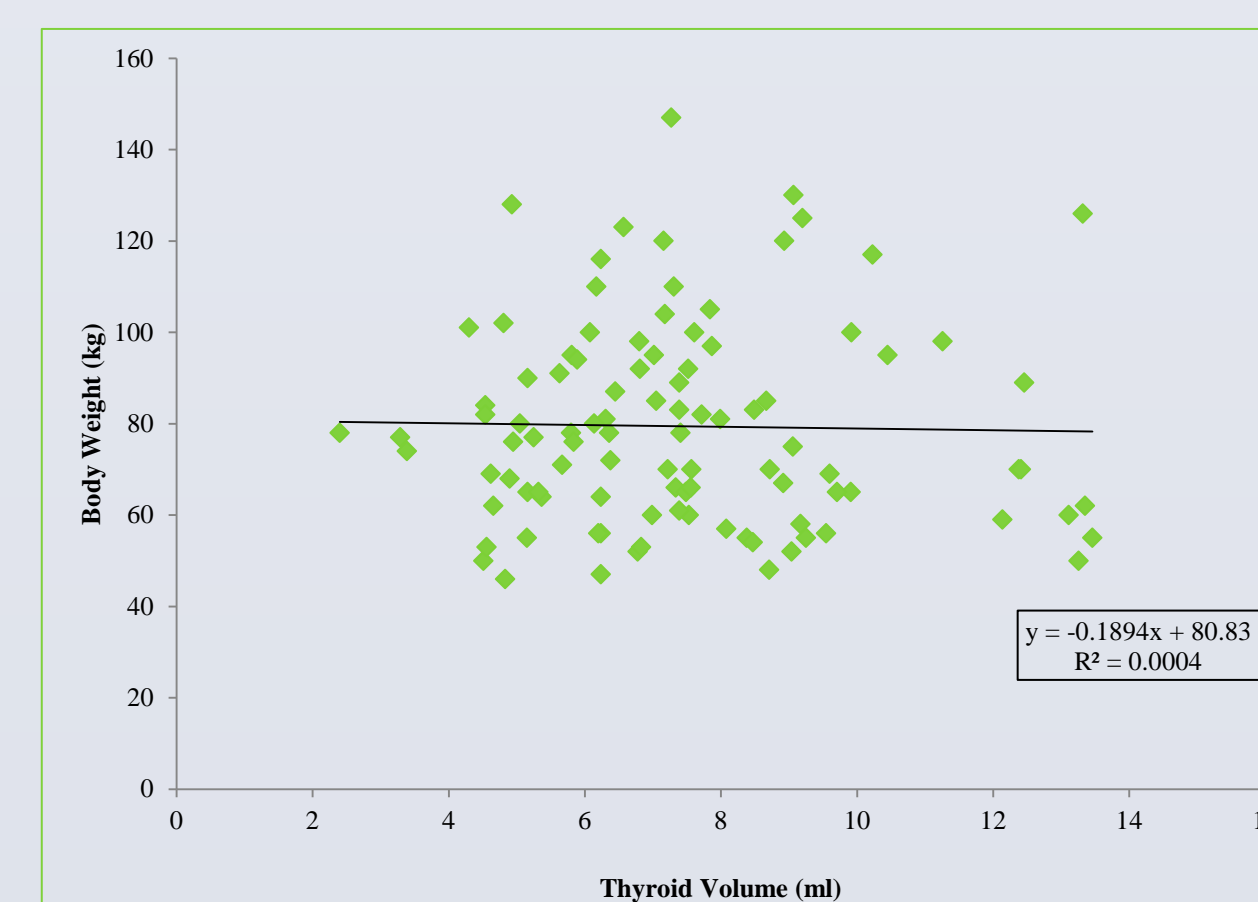


Figure 5. The relationship between thyroid volume (ml) and participants' body weight (kg).

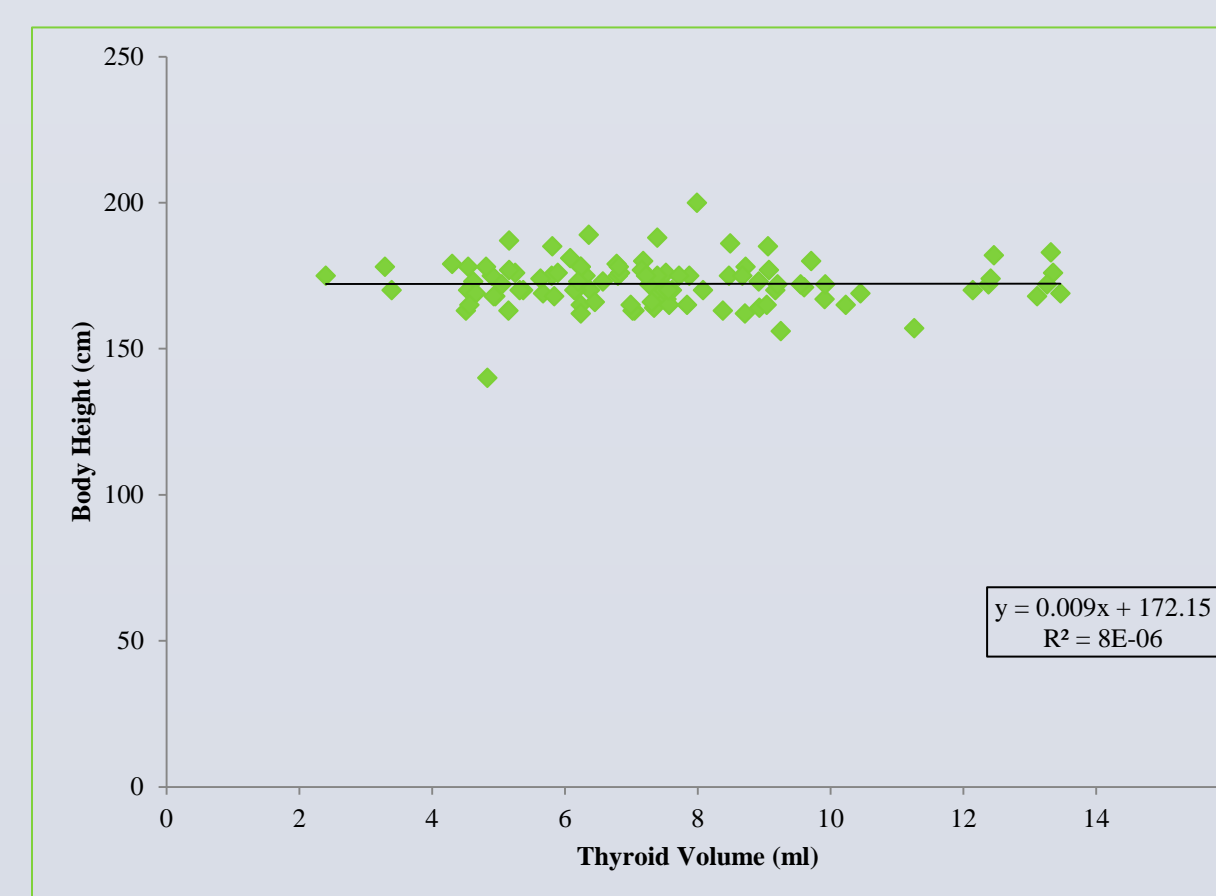


Figure 6. The relationship between thyroid volume (ml) and participants' body height (cm).

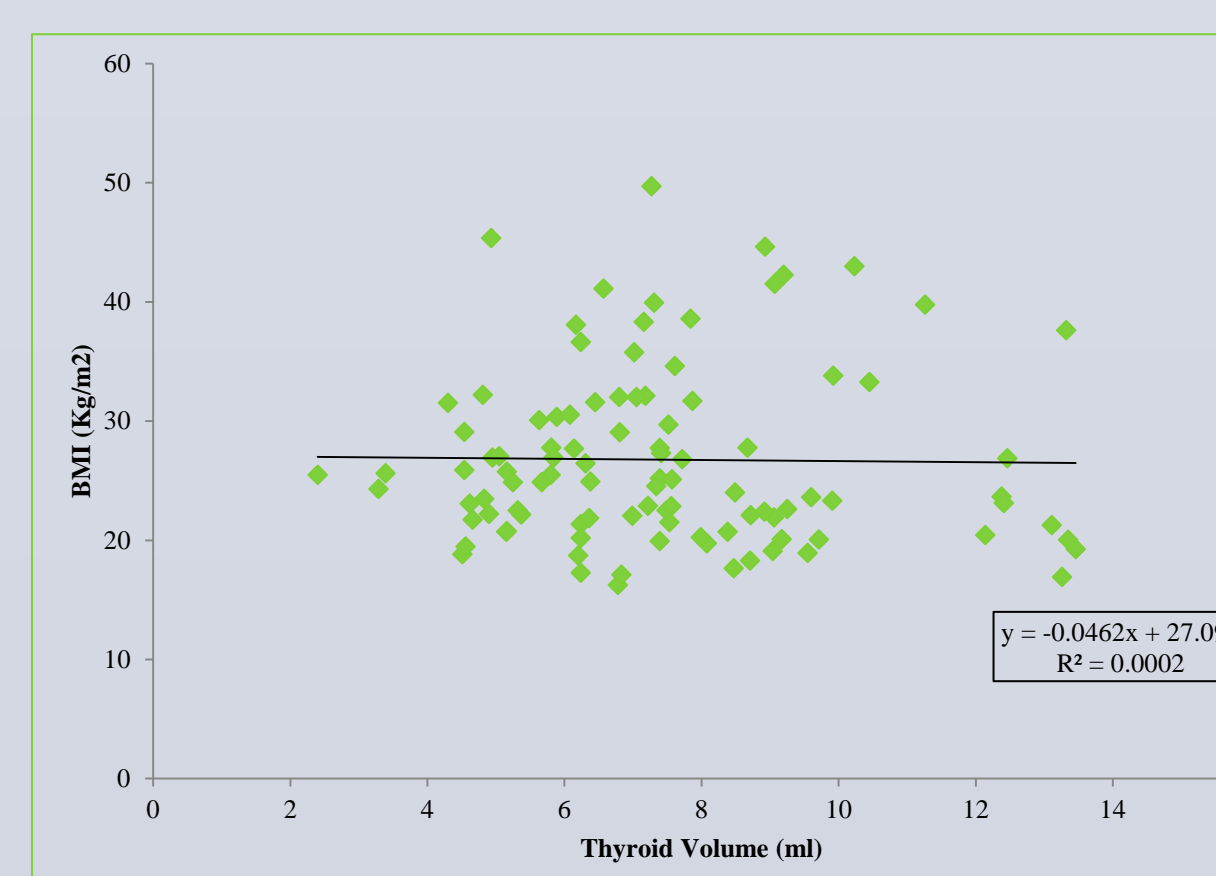


Figure 7. The relationship between thyroid volume (ml) and participants' BMI (kg/m²).

5. Conclusion:

In conclusion, the estimated thyroid volume obtained in this study is seen to be significantly lower compared to the thyroid volume in the western population showed by different studies done in the west and other different countries.

7. References:

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6. Acknowledgment:

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