Influence of Physiological Factors on Thyroid Size Determined by Ultrasound

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Abstract- According to its superficial anatomical location, the thyroid gland is easily accessible by sonography. Sonography allows an exact documentation of the size and thyroid volume. The relationship between thyroid volume and anthropometric characteristics is a matter of controversy. The aim of this study was to investigate thyroid volume and its determinants in healthy adult. A cross-sectional study was performed from June2003 until April 2005 in 314 healthy adults aged over 18 years old in Yazd, Iran. Data were collected on age, sex, and weight and thyroid size by sonoraphy. Mean of thyroid volume in male and female was 9.08 ± 2.49 and 7.93 ± 3.2 milliliter which the differences was significant (P<0.003).Differences between thyroid volume and weight was significant (P=0.001). Mean of female weight and proportion of thyroid volume to their weight was 61.83 ± 12.09kg and 0.130 ± 0.33. Mean of male weight and proportion of thyroid volume to their weight was 71.41 ± 9.05kg and 0.126 ± 0.028 (P<0.003). Results of study is similar to other studies .Mean of thyroid volume in Yazd citizens is not differ from other Iranian but is different from other countries. This difference could be related to food intake habit, geographical region and daily oral iodine consumption.

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Keywords: Thyroid volume; Sonography; Body mass index; Age; Sex

Introduction

According to its superficial anatomical location, the thyroid gland is easily accessible by sonography. Ultrasound is a reliable examination to detect various pathologies of the thyroid gland. Sonography allows an exact documentation of the size, volume and parenchymal echostructure of the thyroid gland as well as detection of various diffuse and focal abnormalities of the gland itself and of the surrounding structures (1). In addition, it is widely available, relatively rapid and cheap, visualizes the whole anterior neck, and does not involve ionizing irradiation; therefore it can be used for children and pregnant women (2). Using ultrasound the image of foci of disease within the gland are easily identified, especially using high frequency probes which enable solid nodules up to approx 3 mm to be revealed with 10 MHz probes (3). In selected patients, volume measurements may be helpful to confirm or quantify clinically suspected thyromegaly (4,5). The volume of each lobe may be approximated using the formula for an ellipsoid: $V = a \times b \times c \times \pi/6$, where a, b, and c are the longitudinal, transverse, and anteroposterior dimensions of the lobe. Thyroid volume is affected by physiological factors (age, sex, and body weight), genetic factors and daily iodine intake (6,7).

The relationship between thyroid volume and anthropometric characteristics is a matter of controversy. The aim of this study was to investigate thyroid volume and its determinants in healthy adult subjects from Yazd city, Iran.

Material and Methods

A cross-sectional study was performed from June 2003 until April 2005 in 314 healthy adults aged over 18 years old in Yazd city, Iran. Ethical approval for the study was obtained from the Human Subjects

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Committee of the Yazd University of Medical Sciences. Written consent was obtained from all participants.

Data were collected on age, sex, weight, thyroid size by sonography. Height and weight were measured using standard anthropometric techniques. For the measurements, subjects removed their shoes, emptied their pockets and wore light indoor summer clothing. Height was recorded to the nearest cm and weight to the nearest 100 g. Body surface area (BSA) was calculated from weight and height measurements using the formula: BSA=weight (kg)$^{0.425}$× height (cm)$^{0.725}$ × 71.84 ×10^{-4} .

Thyroid gland volume was measured using a Piemedical ultrasound device (260 crus) with a 7.5MHz linear transducer. Measurements were performed on subjects in the supine position with the neck slightly hyperextended. Volume of each lobe was calculated according to the formula: width × length × thickness × 0.479 and the lobe volumes were summed. The volume of the isthmus was not included. Exclusion criteria was having singe and symptoms of hypothyroidism and hyperthyroidism according to Endocrinologist examination ,having nodularity in thyroid gland ,consumption of lithium, phenytoin ,oral contraceptive drugs, pregnancy and any systemic disorder.

Data processing and statistics were carried out by SPSS software (Ver 12). Data of continuous variables are expressed as mean ± Standard Deviation. Differences of continuous variables between groups were assessed by the paired sample tests and variance analysis. Statistical significance was set at P<0.05.

Results

A total of 314 people (208 female and 106 male) were studied. Mean of thyroid volume was 8.34±2.37 milliliter (ml).Thyroid volume was 8.01-8.67 ml in 95 % of studied persons. The maximum and minimum of thyroid volume was 13.4 and 2.67 ml respectively. Mean of thyroid volume in male and female was 9.08±2.49 and 7.93±3.2 ml which the differences between them was significant (P<0.003).

People were divided to four age groups (<25, 25-40, 41-55, >55 years old) and mean of thyroid volume was measured in each subgroup which was 8.27±3.25, 9±2.14, 8.5±3.15 and 7.57±2.32 ml. Differences between thyroid volume and age was not significant (P=0.079).

Studied people were divided to four groups according to weight and mean of thyroid volume was detected (Table 1) and differences between thyroid volume and weight was significant (P=0.001).

Table 1. Mean of thyroid volume in different weight group

Weight (kg)	Frequency	Thyroid volume (ml)	S.D
≤50	55	6.26	2.36
65-51	119	7.98	1.75
80-66	123	9.14	2.07
≥81	17	11.85	1.47

Proportion of thyroid volume (ml) and weight (kg) was evaluated for both male and female separately in order to omit the weight effect on mean thyroid volume. Mean of female body weight and proportion of thyroid volume to their body weight was 61.83±12.09 kg and 0.130±0.33 respectively. Mean of male body weight and proportion of thyroid volume to their body weight was 71.41±9.05 kg and 0.126±0.028 respectively (P<0.003). Differences between the male and female proportion was significant according to T-test (P<0.001). Mean of thyroid volume in patients with BSA<1.45 and BSA>1.89 was 5.73±3.07 ml and 9.90±2.26 ml respectively. The difference between groups that are showed in (Table 2) was significant (P<0.001).

Discussion

Thyroid volume is affected by geographic region, genetic and iodine intake. So we tried to detect thyroid volume in Yazd Iran to have basic information about it. Consumption of oral iodine is one of the important factors in thyroid volume and function so it is necessary to measure the daily oral iodine consumption and urinary iodine in studies which evaluated the thyroid volume.

A study on 1989 students in Yazd province showed that urinary iodine is in normal range in this population (8) according to the mentioned study Yazd is free of iodine deficiency after salt iodization.

Table 2. Mean of thyroid volume in different BSA group

BSA	Frequency	Thyroid volume	S.D
<1.45	21	5.73	3.05
1.45-1.54	25	7.29	1.78
1.55-1.64	47	7.36	1.67
1.65-1.74	75	8.04	1.98
1.75-1.84	90	9.09	2.13
>1.84	56	9.90	2.26

Endocrinologist consultation proposed no need to evaluate the urinary iodine due to normal iodine intake.

In present study mean of thyroid volume in 314 people was 8.34±2.37 ml which was 9.08±2.49 in male and 7.93±3.2 ml in female (P<0.003). Male thyroid volume was more than female which is related to differences in weight and muscle mass of them (7). Increasing body weight lead to increasing mean of thyroid volume which a statistically significant difference was seen between thyroid volume and weight (P<0.001) but differences between thyroid volume and age was not significant (P=0.079). Other similar surveys showed the relationship between weight and thyroid volume (9).

The results of Azizi study indicated that a thyroid volume reference based on weight alone would perform as well as the one based on BSA (10).Maximum and minimum of thyroid volume was seen in people with 1.85 and 1.44 BSA. So thyroid volume increased with BSA (P<0.001). In Wesche FM study 44 non-obese healthy adults and 20 adults with marked obesity were studied. In healthy adults, lean body mass rather than body weight explains the differences in thyroid volume between males and females and between obese and non-obese subjects. Lean body mass appears to be a major determinant of thyroid size (7). Other similar studies in different studies showed that thyroid volume increased by increasing the BSA (11-13).

In conclusion ,results of present study about the effect of sex, weight and BSA on thyroid volume is similar to other studies. Mean of thyroid volume in Yazd citizens is not differ from other cities in Iran but is different from other countries .This difference could be related to food intake habit, geographical region and daily oral iodine consumption .

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