Chapter One

(Introduction)

Chapter one

1.1. Introduction

Thyroid is one of the major glands of the body and plays a vital role in the Metabolism. The main objective of this study was to measure the thyroid gland. The thyroid gland, or simply the thyroid, is the endocrine gland in the neck, consisting of two lobules connected to the isthmus. Found in the front of the neck, under Adam's apple. Thyroid gland secretes thyroid hormones, which primarily affect metabolic rate and protein synthesis. The hormones also have many other effects including those related to development. Thyroid hormones (T3) and thyroxine (T4) are created from iodine and tyrosine.

The hormonal output of the thyroid gland regulates the thyroid stimulating hormone (CH) secreted from the anterior pituitary, regulated by the Thyrotropin (TRE) release hormone produced by the hypothalamus.

Thyroid may be affected by many diseases. Hyperthyroidism occurs when the gland produces excessive amounts of thyroid hormones, and the most common cause is grave disease - an autoimmune disorder. In contrast, hypothyroidism is a condition of inadequate production of thyroid hormone. Worldwide, the most common cause is iodine deficiency. Thyroid hormones are important for development, and secondary hypothyroidism of iodine deficiency remains the main cause of preventable mental retardation. In areas where iodine is sufficient, the most common cause of hypothyroidism is Hashimoto's thyroiditis.

In Sudan, many university studies have dealt with the issue of thyroid hormone and its diagnosis. The study sought to study the size of thyroid in elderly Sudanese using ultrasound devices.

1.2. Problem of the study

The thyroid more than once encountered a problem mostly due to iodine deficiency or hormone stimulation problems.

Variation of the thyroid volume among Sudanese adult due the variation evidence race and ethnic no reference volume factors for Sudanese to measure thyroid volume in Sudanese using ultrasound.

Therefore, this study was conducted to detect the size of the thyroid gland in Sudanese adults using medical ultrasound to find a measurement of the size of the thyroid gland.

1.3. Objectives of the study

The overall goal of this study was to find thyroid measurements Lobes and volume in adult Sudan using a selected sample of 109 volunteers. And to evaluate thyroid nodules using ultrasound.

1.4. Specific Objectives of the study

1. Measurement of thyroid dimensions. Length, depth, width and volume of the lobe of the thyroid.
2. Find differences in the size of the gland between males and females.
3. Establishing relationship between the thyroid gland and age.

1.5. Significant of the study

This study provides a measure of the size of the thyroid gland in healthy Sudanese adults. It also provides the possibility of relying on medical ultrasound devices to diagnose thyroid size.

1.6. Overview of the study

This study is divided into five chapters. Chapter One is an introduction, which briefly presents this thesis and contains a "general introduction, the problem of the study also contains general and specific objectives and overview of the study). Chapter Tow is a literature review that contains (thyroid dissection, physiology,

ultrasound and thyroid measurement and previous study). Chapter Three Description of the methodology (article, method) used in this study. Chapter Four presents the results of the study. Chapter Five contains discussion, conclusion and recommendation for future scope, as well as references and annexes.

Chapter two

(Literature Review)

Chapter two

Background and Literature

The thyroid is a butterfly-shaped gland that sits low on the front of the neck. Your thyroid lies below your Adam's apple, along the front of the windpipe. The thyroid has two side lobes, connected by a bridge (isthmus) in the middle. When the thyroid is its normal size, you can't feel it. Brownish-red in color, the thyroid is rich with blood vessels. Nerves important for voice quality also pass through the thyroid. The thyroid secretes several hormones, collectively called thyroid hormones. The main hormone is thyroxine, also called T4. Thyroid hormones act throughout the body, influencing metabolism, growth and development, and body temperature. During infancy and childhood, adequate thyroid hormone is crucial for brain development.

2.1.1. Thyroid Gland

Derived from the Greek word meaning shield, the thyroid is a butterfly-shaped gland located in front of the windpipe (called the trachea) and just below the larynx or Adam's apple in the neck. It is comprised of two halves, known as lobes, which are attached by a band of thyroid tissue called the isthmus.

During development, the thyroid is actually located in the back of the tongue and has to migrate to the front of the neck before birth. There are rare instances when the thyroid migrates too far or too little. There are even cases when the thyroid remains in the back of the tongue, this is known as lingual thyroid. [1]

The thyroid gland is a butterfly-shaped endocrine gland that is normally located in the lower front of the neck. The thyroid's job is to make thyroid hormones, which are secreted into the blood and then carried to every tissue in the body. Thyroid hormone helps the body use energy, stay warm and keep the brain, heart, muscles, and other organs working as they should.

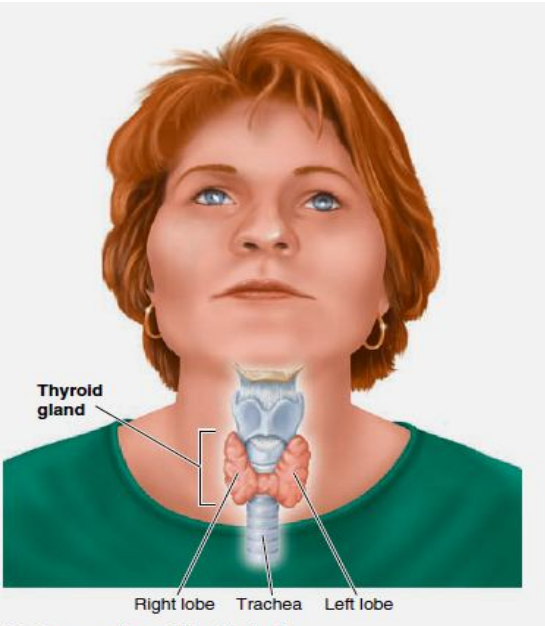
A gland that makes and stores hormones that help regulate the heart rate, blood pressure, body temperature, and the rate at which food is converted into energy.

Thyroid hormones are essential for the function of every cell in the body. They help regulate growth and the rate of chemical reactions (metabolism) in the body.

2.1.2. Thyroid gland Anatomy:

The **thyroid gland** consists of two lobes of endocrine tissue joined in the middle by a narrow portion of the gland, giving it a bow-tie shape.

The gland is even located in the appropriate place for a bow tie, lying over the trachea in the neck. The major thyroid secretory cells, known as **follicular cells,** are arranged into hollow spheres, each of which forms a functional unit called a **follicle.** On microscopic section, the follicles appear as rings consisting of a single layer of follicular cells enclosing an inner lumen filled with **colloid,** a substance that serves as an extracellular storage site for thyroid hormone. Note that the colloid within the follicular lumen is extracellular (that is, outside the thyroid cells), even though it is located within the interior of the follicle. Colloid is not in direct contact with the extracellular fluid (ECF) that surrounds the follicle, similar to an inland lake that is not in direct contact with the constituent



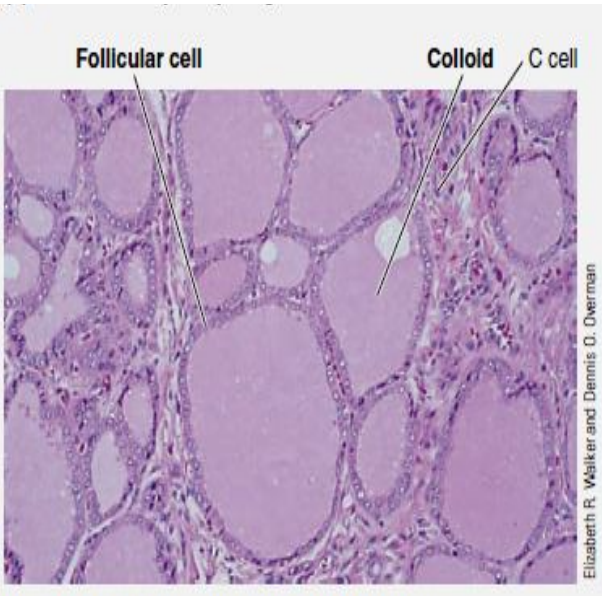
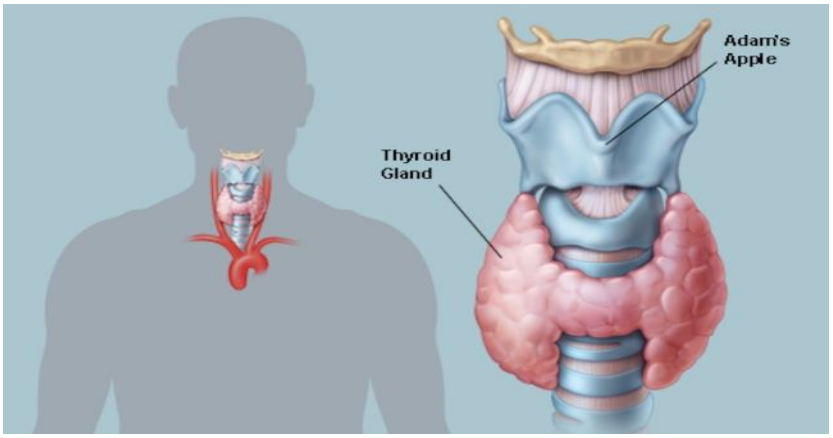


Figure (2.1) Gross anatomy of thyroid gland Figure (2.2) Microscopic appearance of thyroid gland.(Snell,2012)

2.1.3. Thyroid Gland Shape and Location

The thyroid is a butterfly-shaped gland that sits low on the front of the neck. Your thyroid lies below your Adam's apple, along the front of the windpipe. The thyroid has two side lobes, connected by a bridge (isthmus) in the middle. When the thyroid is its normal size, you can't feel it.

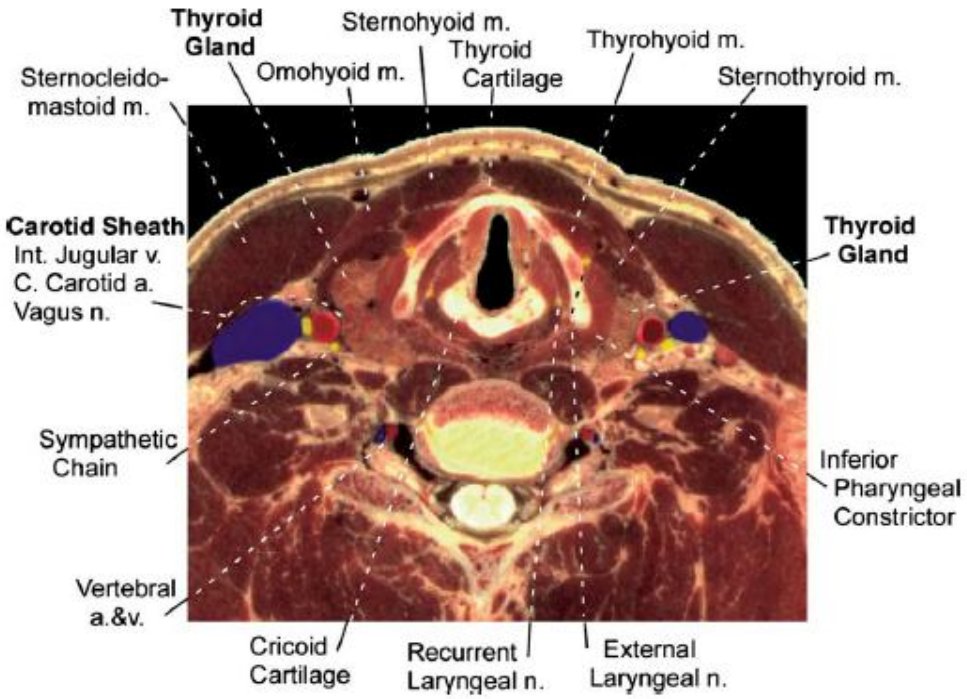
Brownish-red in color, the thyroid is rich with blood vessels. Nerves important for voice quality also pass through the thyroid.



Figure(2.3) Thyroid gland location (Snell, 2012).

The right and left lobes of the thyroid are connected at the midline by the isthmus of the gland. A pyramidal lobe may extend superiorly from the isthmus or from the medial portions of the left or right lobes. The thyroid extends from the level of the fifth cervical vertebra to the first thoracic vertebra. The gland weighs about 30 g, being somewhat heavier in females than in males. The thyroid is surrounded by a sleeve of PR tracheal fascia sometimes called the parathyroid sheath. Posteriorly, a thickening of this fascia attaches the gland to the cricoid cartilage. This fascia is the lateral ligament of the thyroid (ligament of Berry). The anterior surface of the thyroid is related to the deep surface of the stern thyroid, stern hyoid, and omohyoid muscles. Where these muscles are absent in the midline, the isthmus of the gland is subcutaneous. Laterally the gland is related to the carotid sheath, which contains the

common carotid artery, the internal jugular vein, and the vagus nerve. Posteriorly, the superior parts of the lobes of the thyroid are related to the longus coli and longus capitis muscles. Medially, the superior part of the thyroid is related to the larynx and laryngopharynx, which includes the cricothyroid and inferior pharyngeal constrictor muscles and the thyroid and cricoids cartilages. Medially, the inferior part of the thyroid is related to the trachea and the esophagus. The isthmus of the thyroid lies anterior to the second and third tracheal rings. The description of relationships to important neural structures will be deferred to that section. [5]



Figure(2.4) Thyroid gland and its relations at the level of the thyroid cartilage (Snell, 2012).

The thyroid gland is located in the **anterior neck**, spanning between the C5 and T1 vertebrae. It is an **endocrine** gland, divided into two lobes which are connected by an **isthmus**. It is said to have a butterfly shape. It lies behind the stern hyoid and stern thyroid muscles, **wrapping** around the cricoids cartilage and superior tracheal rings. It is inferior to the thyroid cartilage of the **larynx**. The gland is in **visceral**

compartment of the neck, along with the trachea, esophagus and pharynx. The compartment is bound by pretracheal fascia.

During **development,** the thyroid gland initially forms in the floor of the primitive pharynx, near the base of the tongue. It **descends** down the neck to lie in its adult anatomical position.

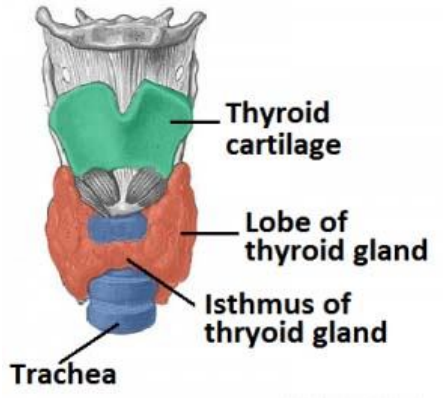


Figure (2.5) Anatomical-Position-of-the-Thyroid-Gland-in-the-Anterior-Neck.

(http://cdn1.teachmeseries.com, 2013)

The thyroid is a butterfly-shaped gland located in the front of the neck just below the Adams apple. The gland wraps around the windpipe (trachea) and has a shape that is similar to a butterfly formed by two wings (lobes) and attached by a middle part (isthmus).

The thyroid gland works like a tiny factory that uses iodine (mostly from the diet in foods such as seafood and salt) to produce thyroid hormones. These hormones help to regulate the body's metabolism and effects processes, such as growth and other important functions of the body.

The two most important thyroid hormones are thyroxine (T4) and triiodothyronine (T3), representing 99.9% and 0.1% of thyroid hormones respectively. The hormone with the most biological power is actually T3. Once released from the thyroid gland into the blood, a large amount of T4 is converted to T3 - the active hormone that affects the metabolism of cells throughout our body.

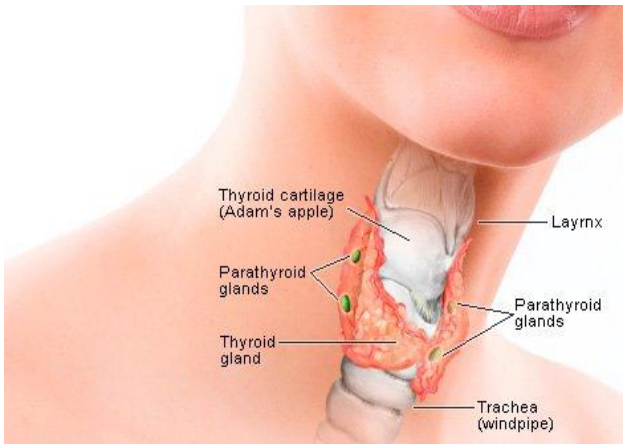


Figure (2.6) Thyroid-function (https://www.thyroid.com, 2013)

The gland is enclosed in the pretracheal fascia, covered by the strap muscles and overlapped by the sternocleidomastoids. The anterior jugular veins course over the isthmus. When the thyroid enlarges, the strap muscles stretch and adhere to the gland so that, at operation, they often appear to be thin layers of fascia.

2.1.4. Thyroid Gland Function

The function of the thyroid gland is to take iodine, found in many foods, and convert it into thyroid hormones: thyroxine (T4) and triiodothyronine (T3).Thyroid cells are the only cells in the body which can absorb iodine. These cells combine iodine and the amino acid tyrosine to make T3 and T4. T3 and T4 are then released into the blood stream and are transported throughout the body where they control metabolism (conversion of oxygen and calories to energy).

Every cell in the body depends upon thyroid hormones for regulation of their metabolism. The normal thyroid gland produces about 80% T4 and about 20% T3, however, T3 possesses about four times the hormone "strength" as T4.

However, there is one other controlling factor. The gland cannot produce hormones on its own. It needs the assistance of the pituitary gland, which creates thyroid stimulating hormone (TSH). As a result, a nonfunctional pituitary gland will eventually lead to thyroid-gland-related issues. TSH will either trigger the production of thyroxine or triiodothyronine. If TSH is not present at the right levels, too much or too little of either hormone will be made.

2.1.5. Thyroid Gland Hormones

The thyroid gland produces thyroxine, which is a relatively inactive pro-hormone and lower amounts of the active hormone, triiodothyronine. Collectively, thyroxine and triiodothyronine are referred to as the thyroid hormones. Twenty percent of the body's triiodothyronine is made by the thyroid gland; the other 80% comes from thyroxine converted by organs such as the liver or kidneys. The thyroid gland also produces calcitonin from cells called C-cells. Calcitonin is understood to play a role in regulating calcium levels in the body, but its exact function in humans remains unclear.

The two main hormones the thyroid produces and releases are T3 (tri-iodothyronine) and T4 (thyroxine). A thyroid that is functioning normally produces approximately 80% T4 and about 20% T3, though T3 is the strongest of the pair. To a lesser extent, the thyroid also produces calcitonin, which helps control blood calcium levels.

2.1.6. Blood Supply

As with other endocrine organs, the thyroid gland has a rich blood supply with abundant anastomoses. The arterial supply is bilateral from both the external carotid system, through the superior thyroid artery, and the subclavian system, through the inferior thyroid branch of the thyrocervical trunk. There may be a single thyroid ima artery that arises from the brachiocephalic artery. The superior thyroid artery is normally the first branch of the external carotid artery, though frequently it may arise more inferiorly from the common carotid artery.

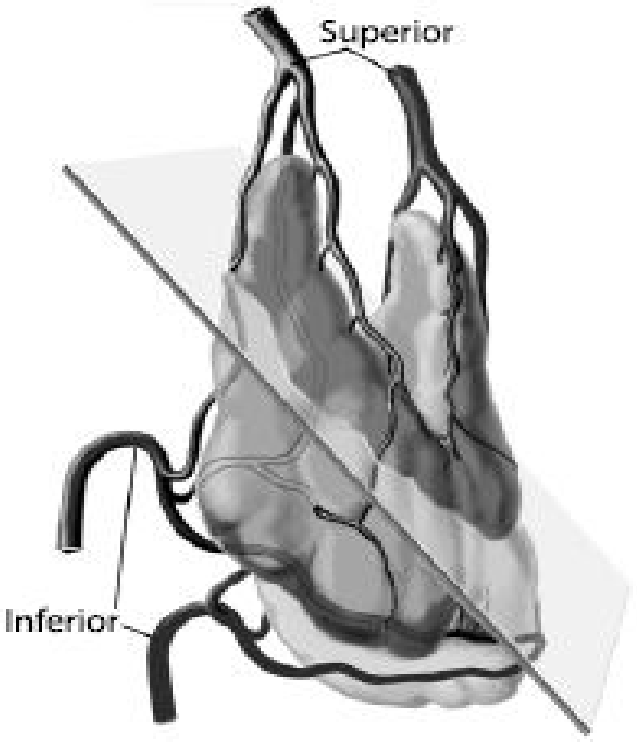


Figure (2.7) Thyroid gland shape. (http://1.bp.blogspot.com, 2010)

The superior thyroid artery is normally the first branch of the external carotid artery, though frequently it may arise more inferiorly from the common carotid artery. This vessel descends to the superior pole of the thyroid along with the external laryngeal nerve. As it reaches the thyroid, the artery divides into anterior and posterior branches.

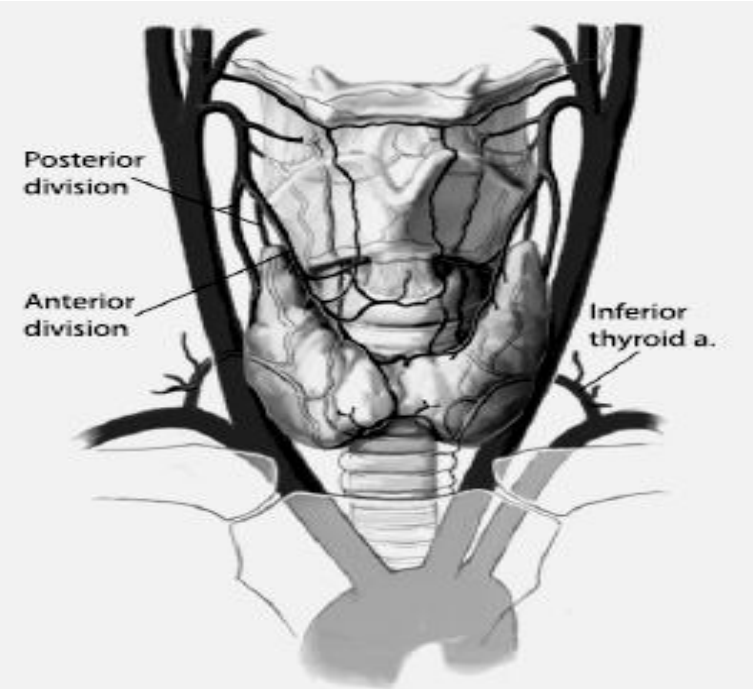


Figure (2.8) Arterial supply of thyroid and parathyroid glands
(https://cdn1.medicine.yale.edu, 2010)

There are three main venous pathways from the thyroid: the superior, middle, and inferior thyroid veins. The superior thyroid vein accompanies the superior thyroid artery and drains into the internal jugular vein. The middle thyroid vein is unaccompanied and drains directly into the internal jugular vein. Because of its posterior course, it is at risk when forward traction is applied to the gland, as in a thyroidectomy.

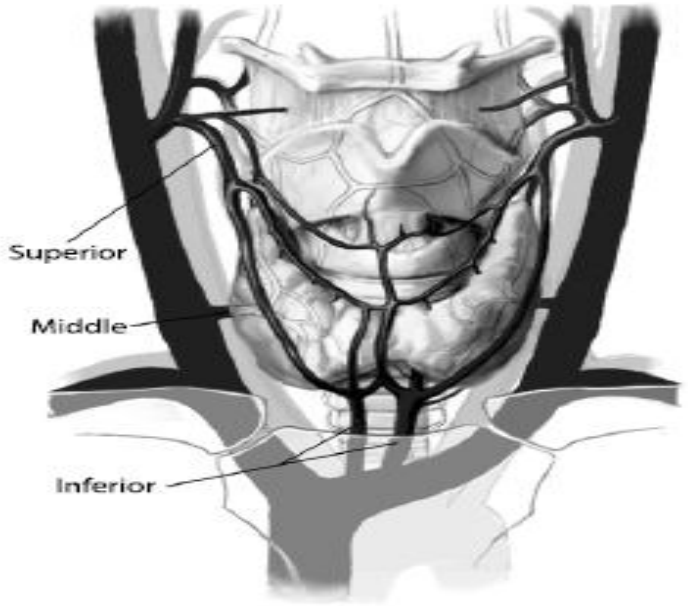


Figure (2.9) Blood supply of the gland (https://upload.wikimedia.org, 2010)

Three arteries supply and three veins drain the thyroid gland:

•the *superior thyroid artery*—arises from the external carotid and passes to the upper pole;

•the *inferior thyroid artery*—arises from the thyrocervical trunk of the 1st part of the subclavian artery and passes behind the carotid sheath to the back of the gland;

•the *thyroidea ima artery*—is inconstant; when present, it arises from the aortic arch or the brachiocephalic artery;

•the *superior thyroid vein*— drains the upper pole to the internal jugular vein;

•the *middle thyroid vein*—drains from the lateral side of the gland to the internal jugular;

•the *inferior thyroid veins*—often several—drain the lower pole to the brachiocephalic veins.

As well as these named branches, numerous small vessels pass to the thyroid from the pharynx and trachea so that even when all the main vessels are tied, the gland still bleeds when cut across during a partial thyroidectomy.

2.1.7. Ultrastructure and Histology:

The gland consists of varying sized follicles, which are bounded by a single layer of cuboidal epithelial cells (follicular cells) and a basement membrane, urrounding a central lumen filled with a homogenous protein rich colloid (thyrogloblin). The apical surface of the cell membranes is covered with numerous micovilli to increase surface area. The follicular cells are connected by tight junctions, and have a dense capillary network. The colloid is a store of thyroid hormones prior to secretion. The thyroid gland is the only endocrine gland to store its hormone in large quantities. In the active gland colloid is diminished and epithelial cells are tall and columnar. Within the connective tissue close to the follicles are C-cells alternatively known as parafollicularcells. They are found in clusters in the interfollicular space and are also known as clear cells as their cytoplasm doesn't stain with H and E. They secrete calcitonin, a hormone which acts to lower plasma Ca2+levels (peccin S, etal2005).

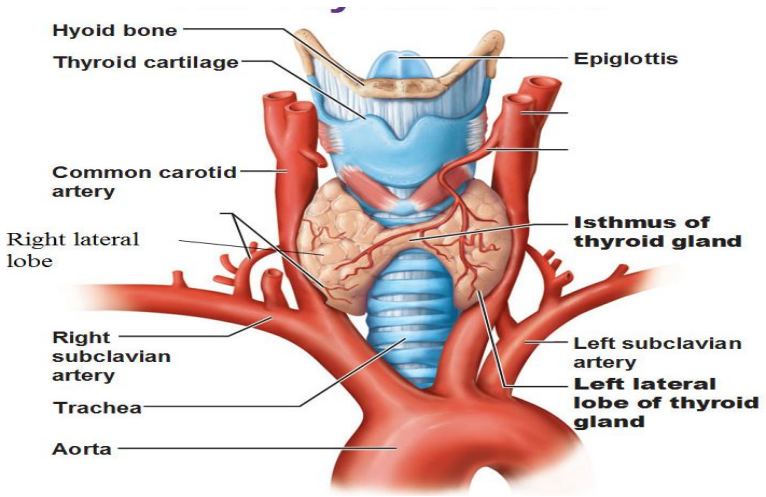


Figure (2.10) The relationship between the thyroid and the aorta (Snell, 2012)

2.1.8. Thyroid gland Physiology:

The thyroid is the largest exclusively endocrine gland in the body. The endocrine system is the body's communication hub, controlling cell, and therefore organ, function. A primary goal of the endocrine system is to maintain homeostasis within the organism, despite external fluctuations of any sort. Hormones, which act as chemical messengers, are the mechanism for this communication. The two types of hormones secreted by the thyroid gland which are the iodine containing hormones; tri-iodothyronine(T3) and thyroxine (T4), are essential in this process, targeting almost every cell in the body (only the adult brain, spleen, testes, and uterus are immune to their effects.)

Goiters: thyroid goiter is a dramatic enlargement of the thyroid gland. Goiters are often removed because of cosmetic reasons or, more commonly, because they compress other vital structures of the neck including the trachea and the esophagus making breathing and swallowing difficult. Sometimes goiters will actually grow into the chest where they can cause trouble as well (Cai XJ, et al. (2006).

Hyperthyroidism: hyperthyroidism means too much thyroid hormone. Current methods used for treating a hyperthyroid patient are radioactive iodine, anti-thyroid drugs, or surgery. Each method has advantages and disadvantages and is selected for individual patients. Many times the situation will suggest that all three methods are appropriate, while other circumstances will dictate a single best therapeutic option. Surgery is the least common treatment selected for hyperthyroidism (Cai XJ, et al. (2006).

***Hypothyroidism*:** hypothyroidism means too little thyroid hormone and is a common problem. In fact, hypothyroidism is often present for a number of years before it is recognized and treated. Hypothyroidism can even be associated with pregnancy. Treatment for all types of hypothyroidism is usually straightforward.

Thyroiditis: thyroiditis is an inflammatory process ongoing within the thyroid gland. Thyroiditis can present with a number of symptoms such as fever and pain, but it can also present as subtle findings of hypo or hyper-thyroidism (Cai XJ, et al. (2006).

***Thyroid nodules*:** thyroid nodules are lumps that commonly arise within an otherwise normal thyroid gland. Often these abnormal growths of thyroid tissue are located at the edge of the thyroid gland, so they can be felt as a lump in the throat. When they are large or when they occur in very thin individuals, they can even sometimes be seen as a lump in the front of the neck. Thyroid nodules increase with age and are present in almost 10% of the adult population. Autopsy studies reveal the presence of thyroid nodules in 50% of the population, so they are fairly common. 95% of solitary thyroid nodules are benign, and therefore, only 5% of thyroid nodules are malignant. The common types of the benign thyroid nodules are adenomas (overgrowths of normal thyroid tissue), thyroid cysts, and Hashimoto's thyroiditis. Uncommon types of benign thyroid nodules are due to sub acute thyroiditis, painless thyroiditis, unilateral lobe agenesis, or Riedel's struma (Wu HH, Jones JN, 2006).

2.2 Ultrasound

Some characteristics of returning echoes from tissue can be selected out to provide additional information beyond a grayscale image. Doppler ultrasound, for instance, can detect a frequency shift in echoes, and determine whether the tissue is moving toward or away from the transducer. This is invaluable for evaluation of some structures such as blood vessels or the heart (echocardiography).

Ultrasound continues to evolve additional functions, including 3D ultrasound imaging, elastography, and contrast-enhanced ultrasound using micro bubbles.

2.2.1. Ultrasound Artifacts

Artifacts are echoes that appear on the image that do not correspond in location or intensity to actual interfaces in the patient.

They can be of two types:

1. Good Artifacts - which are helpful
2. Bad Artifacts - which are disturbing

Good Artifacts

Acoustic shadowing

Acoustic enhancement

Comet tail

Bad Artifacts

Refraction

Reverberation

Mirror Image artifacts

Beam width artifacts

Movement artifacts

Operator pressure artifacts

1. Ultrasound examination is less expensive to conduct than CT or MRI.
2. There are few (if any) contraindications to use of ultrasound, compared with MRI or contrast-enhanced CT.
3. The real-time nature of ultrasound imaging is useful for the evaluation of physiology as well as anatomy (e.g. fetal heart rate).
4. Doppler evaluation of organs and vessels adds a dimension of physiologic data, not available on other modalities (with the exception of some MRI sequences).

2.2.2. Disadvantages of ultrasound

1. Training is required to accurately and efficiently conduct an ultrasound exam and there is no uniformity in the quality of examinations ("operator dependence").
2. Ultrasound is not capable of evaluating tissue types with high acoustical impedance (e.g. bone, air). It is also limited in evaluating structures encased in bone (e.g. cerebral parenchyma inside the calvaria).
3. The high frequencies of ultrasound result in a potential risk of thermal heating or mechanical injury to tissue at a micro level. This is of most concern in fetal imaging.

Previous Studies

NgEetal (2004)

Studies three dimensional ultrasound measurement of thyroid volume in symptomatic male Chinese. This study was undertaken to determine the accuracy and reliability of volume measurements using 3-D ultrasound (US). Investigated.

. In each subject, the volume of the left and right lobes and the isthmus of the thyroid gland were measured with 3-D US, and any variation with age was evaluated.

The range of thyroid volume of the subjects was 8.81 to 17.25 mL (mean 12.78 +/- SD 2.483), and there was no significant difference in thyroid volume between subjects of different age groups ($p > 0.05$). 3-D US is an accurate and reliable method by which to measure thyroid volume.

Mohamed Yousef, Abdelmoneim, Sulieman, Bushra hmed, Alsafi Abdella, and Khaled Eltom (2011),

A study of total 103 healthy subjects were studied, 28 (27.18%) females and 75 (72.82%) males. Thyroid volume was estimated using *ellipsoid formula*. The mean age and range of the subjects was 21.8 (19–29) years; the mean body mass index (BMI) was 22.3 (16.46–26.07) kg/m^2. The overall mean volume ± SD volume of the thyroid gland for both lobes in all the patients studied was 6.44 ± 2.44 mL. The mean volume for both lobes in females and males were 5.78 ± 1.96 mL and 6.69 ± 2.56 mL, respectively. The males thyroid volume was greater than the females'. The mean volume of the right and left lobes of the thyroid gland in males and females were 3.38 ± 1.37 mL and 3.09 ± 1.24 mL, respectively. The right thyroid lobe volume was greater than the left. The values obtained in this study were lower than those reported from previous studies.

SAMAH (2013),

Measure the thyroid volume in normal adult Sudanese female over 40 years old 100 normal adult Sudanese female over 40 years old were scanned ultrasound. The mean ages and ranges was 1.66±41.87 years old the overall mean volume ±SDml of thyroid gland was 0.93±6.40ml the mean volume of right lobe was0.26±3.41ml the mean volume of left lobe was 0.27±2.98ml the right lobe is greater than the left lobe.

Chapter three

Materials and Methods

3.1. Material

The data of this study was collected using Toshiba with 7.5 MHZ linear Transducer.

3.2. Population of the study

The sample of this study included 100 male and female healthy adult volunteers with normal thyroid. This study was done in the Faculty of Radiology Sudan University of Science and Technology. The Data collection period was from September 2015 to November 2015.

3.3. Exclusion Criteria

All subjects with anterior neck swelling or if there is any clinical evidence of Thyroid disease.

3.4. Sample Size And Type

The sample is taken from students of the University of Sudan as students represent the adult community. The information was taken from a sample of 100 volunteers, 46 males and 54 females. And the sample selected conveniently.

3.5. Method Of Data Collection

All the individuals were examined in the supine position with the neck Hyper Extended. Using a linear 7.5 MHZ probe in Toshiba machine, transverse and Longitudinal section of both lobes of thyroid gland were scanned. Measurement Of the maximum length of lobe from the sagittal images were recorded. The Maximum transverse diameter (breadth) and the maximum depth of each lobe Were recorded from the transverse images. To ensure that the probe was in the Same position each time, anatomical landmarks were used. For measurement of the thyroid lengths, The probe was placed longitudinally in the midline of the neck to obtain sagittal view find the maximum s of larynx; the probe was then moved obliquely to find the maximum length of thyroid gland, just medial to the carotid vessels.

3.6. Variable Of Data Collection

The data in this study were collected using the following variable: Age, Gender, thyroid lobes measurement; length, width, depth and volume of Right and Left lobe, and thyroid volume as well as isthmus.

3.7. Method Of Data Analysis

Data was analyzed by used statistical package for social studies (SPSS) and excel under windows.

3.8. Ethical Consideration

All data concern to population of the study written by their verbal agreement.

Chapter four

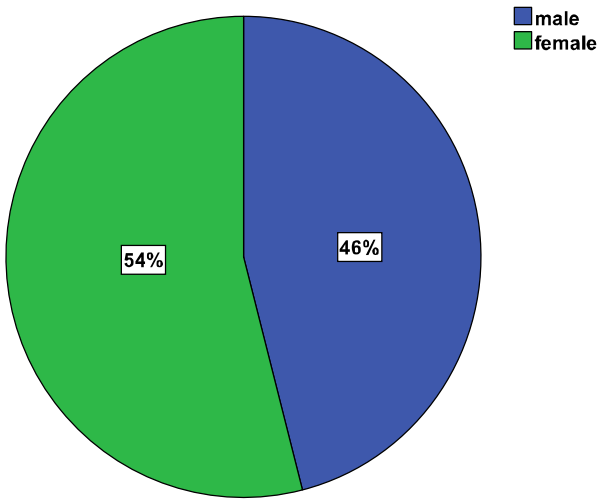
The Results

The following tables and figures presented the data obtained from 100 male and female Sudanese adult aged from 16 to 37 years old all were examined by ultrasound for thyroid gland volume and right and left lobes.

Method

A total of 100 volunteers were examined in this study. In the process of gathering research data, we found that some cases have missing value. So we remove from the research group. And results remaining 100 valid samples. The 100 subjects studied consist of 54 (54%) females and 46 (46%) males. The age group 16-21 represented 64% of the sample size, the age group 27-31 represented 5%, the age group 32-36 represented 1%, while the age group 37 years and older accounted for 4% of the studied sample.

Table (1): Classification of volunteers according to gender:



Sex		
sex	Frequency	Percent
male	46	46.0
female	54	54.0
Total	100	100.0

Table (2): Classification of volunteers according to age:

age		
Age category	**Frequency**	**Percent**
16-21	64	64.0
22-26	26	26.0
27-31	5	5.0
32-36	1	1.0
37+	4	4.0
Total	100	100.0

Table 3. The thyroid volume with sex**.**

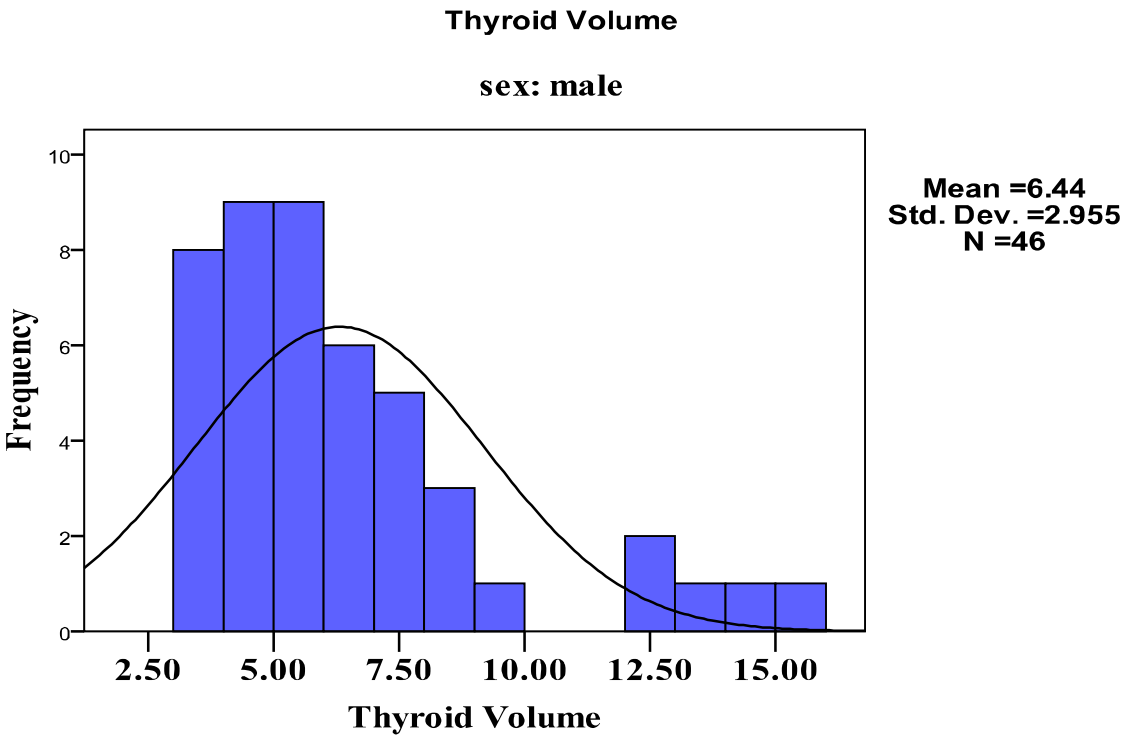
Table 1: The thyroid volume with sex (n = 100).

Sex		N	Minimum	Maximum	Mean	Std. Deviation
Male	Thyroid Volume	46	3.190	15.120	6.44065	2.955485
	Valid N (listwise)	46				
Female	Thyroid Volume	54	0.900	9.560	4.55981	1.566447
	Valid N (listwise)	54				

Table 3 above shows the mean volume of male was 6.44 ± 2.96 ml for female it was 4.56 ±1.57 ml. The thyroid volumes of male have a greater tendency of female.

Table 4. The volume of the thyroid glands in females, males and all cases.

Subjects (number)	Thyroid volume (mL)	Right lobe volume (mL)	Left lobe volume (mL)
Females (54)	4.560± 1.566	2.492±0.884	2.068±0.916
Males (46)	6.441± 2.955	3.575±2.336	2.867±1.097
All (100)	5.425± 2.484	2.990± 1.787	2.435± 1.076


Thyroid Volume
sex: male
Mean =6.44
Std. Dev. =2.955
N =46
Frequency
10
8
6
4
2
0
2.50
5.00
7.50
10.00
12.50
15.00
Thyroid Volume

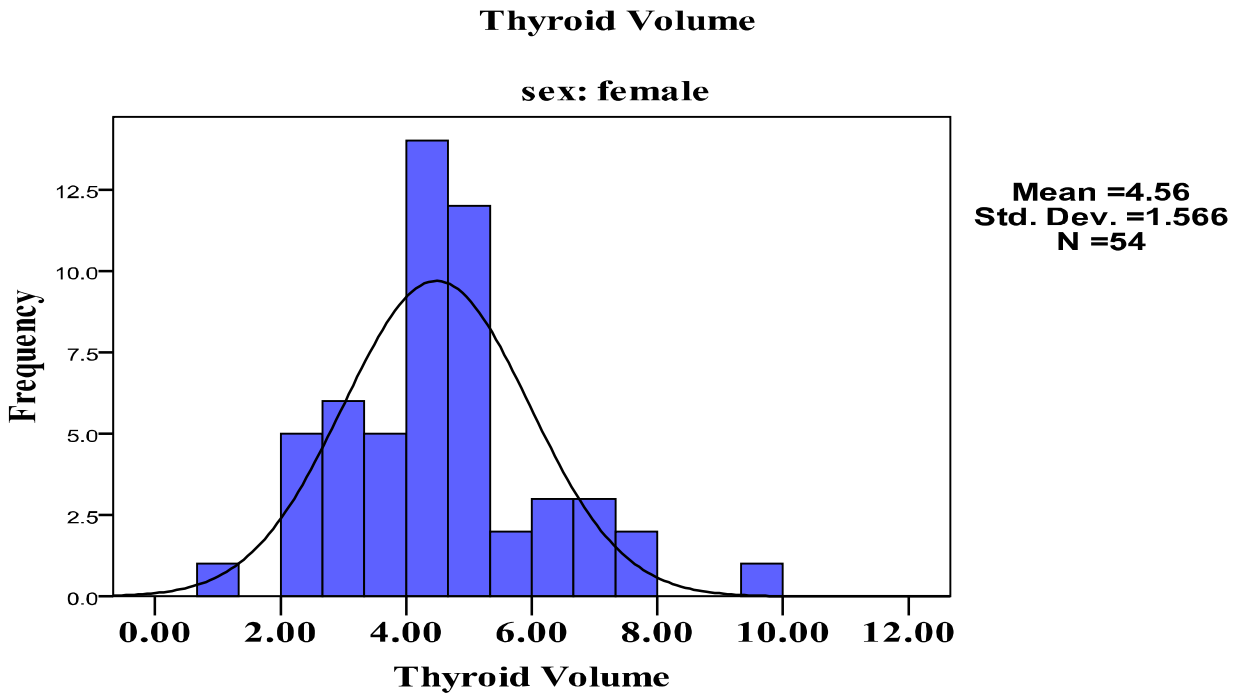

Thyroid Volume
sex: female
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
Thyroid Volume
Mean =4.56
Std. Dev. =1.566
N =54

Table (5): the mean and standard deviation of the variables. Descriptive Statistics:

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Thyroid Volume	100	.900	15.120	5.42500	2.484278
Right Lobe Length	100	.51	5.76	3.0093	.59718
Right Lobe volume	100	.160	13.370	2.99040	1.786916
Left Lobe Length	100	1.000	3.810	2.89960	.518311
Left Lobe volume	100	.750	7.030	2.43520	1.075518
Right Lobe Thickness	100	.640	3.180	1.46260	.345501
Left Lobe Width	100	.700	2.910	1.27460	.308366
Left Lobe Thickness	100	.640	2.210	1.24220	.279923
Right Lobe Width	100	.590	2.150	1.23660	.294722
Valid N (listwise)	100				

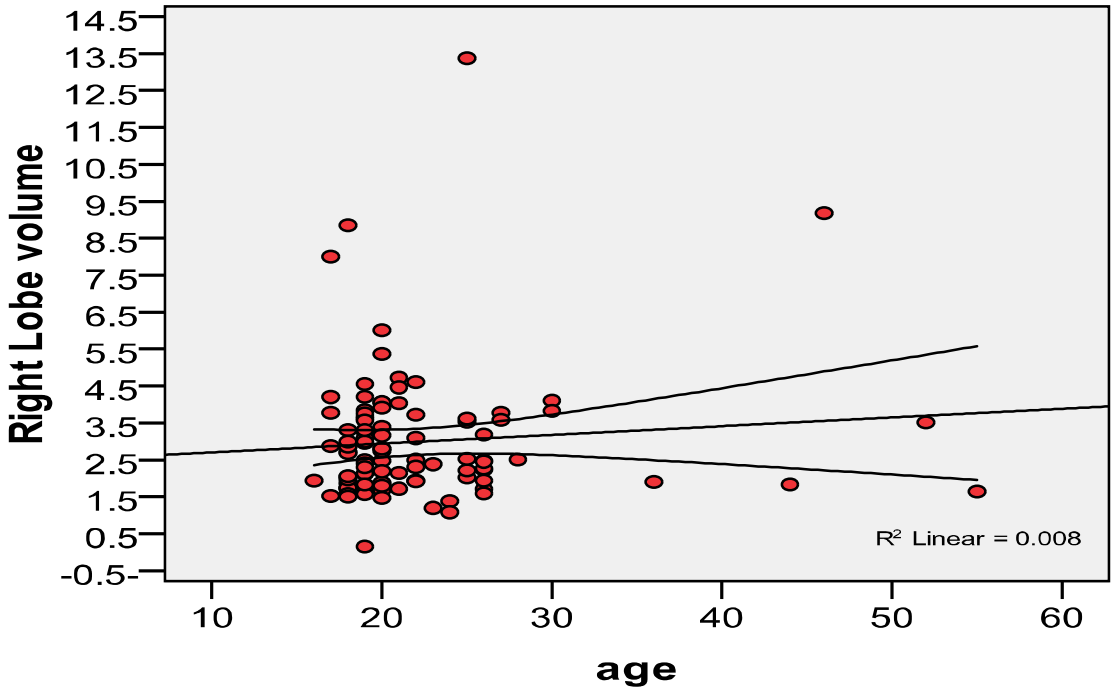

Right Lobe volume
14.5
13.5
12.5
11.5
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5-
10
20
30
40
50
60
age
R² Linear = 0.008

Figure 4.3 shows relationship between left lobe of volume and age.

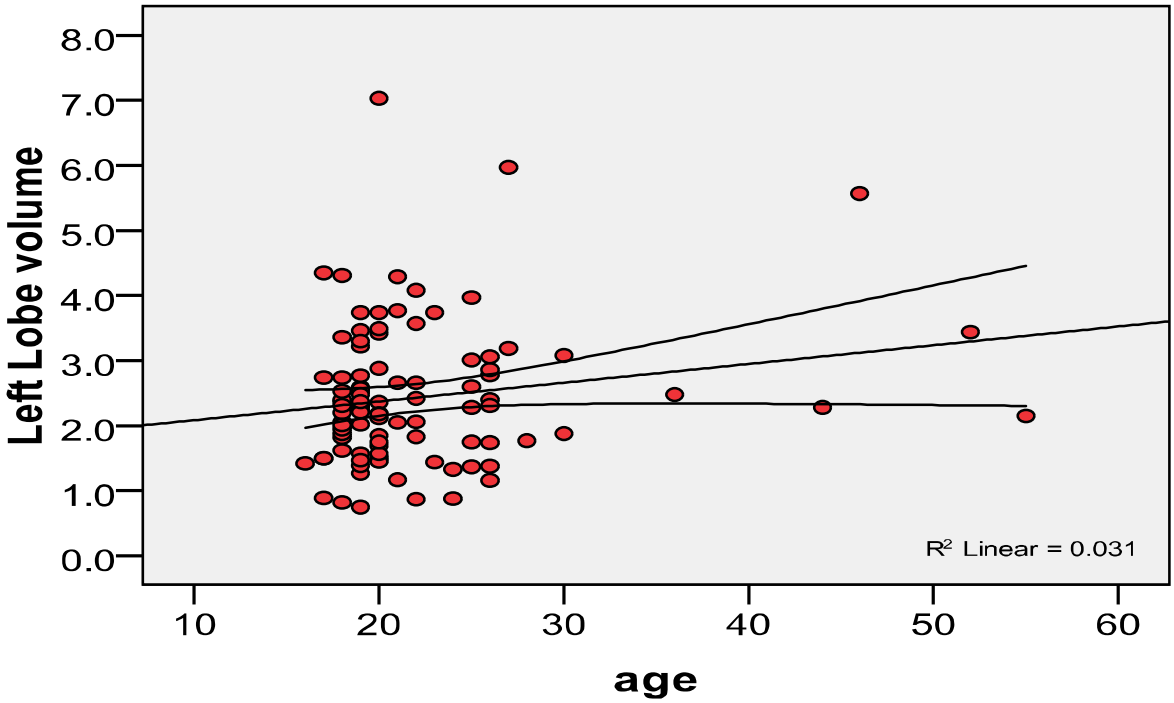


Figure 4.3 shows relationship between left lobe of volume and age

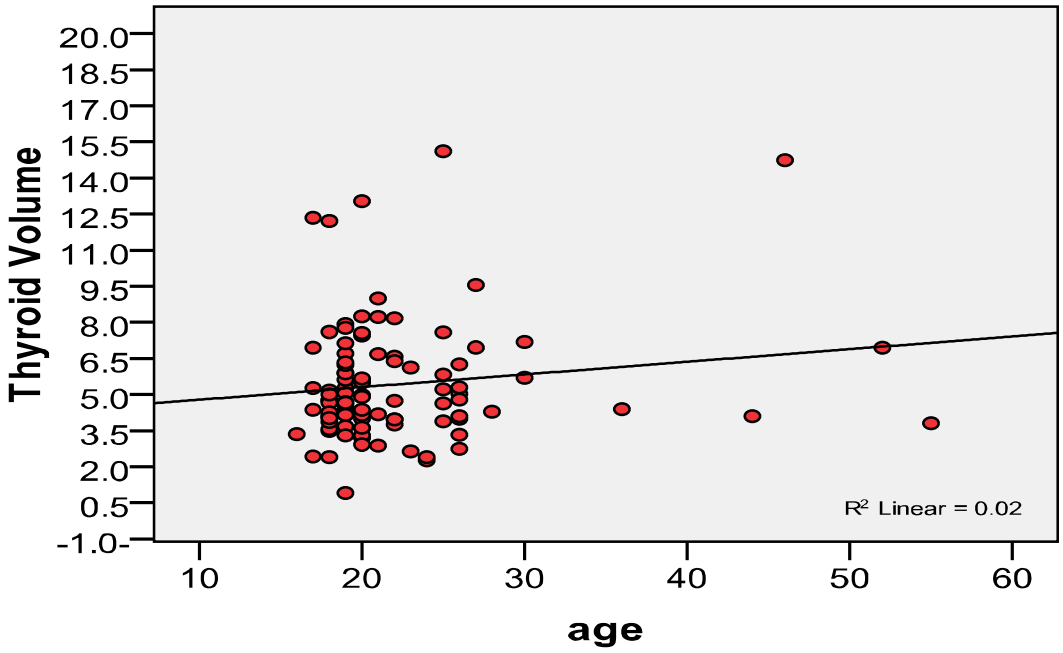


Table 6: shows correlation between age, Right lobe volume, left lobe volume and total thyroid volume:

Correlations					
		Age	**Right Lobe volume**	**Left Lobe volume**	**Thyroid Volume**
Age	Pearson Correlation	1	.087	.177	.140
	Sig. (2-tailed)		.388	.078	.166
	Sum of Squares and Cross-products	4315.440	101.974	124.287	226.820
	Covariance	43.590	1.030	1.255	2.291
	N	100	100	100	100
Right Lobe volume	Pearson Correlation	.087	1	.474**	.925**
	Sig. (2-tailed)	.388		.000	.000
	Sum of Squares and Cross-products	101.974	316.114	90.273	406.365
	Covariance	1.030	3.193	.912	4.105
	N	100	100	100	100
Left Lobe volume	Pearson Correlation	.177	.474**	1	.774**
	Sig. (2-tailed)	.078	.000		.000
	Sum of Squares and Cross-products	124.287	90.273	114.517	204.719
	Covariance	1.255	.912	1.157	2.068
	N	100	100	100	100
Thyroid Volume	Pearson Correlation	.140	.925**	.774**	1
	Sig. (2-tailed)	.166	.000	.000	
	Sum of Squares and Cross-products	226.820	406.365	204.719	610.992
	Covariance	2.291	4.105	2.068	6.172
	N	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).					

Chapter Five

Discussion, Conclusion and Recommendation

5.1. Discussion:

Our study has shown that the right thyroid lobe volume (2.990ml) was higher than the left (2.435ml) with significant statistical difference between the right and left lobe volumes in both sexes (p = 0.000). Our finding is in agreement with previous studies done locally and among the Nigerian.

The total mean values for the males and females thyroid gland to be larger in males compared to females (p = 0.000). A Tahir, M Tukur (2005), has found that the males thyroid volume was higher than the females (p = 0.000), and the right thyroid lobe volume was higher than the left (p = 0.000). These findings support the results of our research and most of the previous studies. Mohamed Yousef, Abdelmoneim, Sulieman, Bushra hmed, Alsafi Abdella, and Khaled Eltom (2011), our study of the thyroid volume among Sudanese normal subjects using ultrasound agree with Mr. Altahir and mohmed yousef and found that the males thyroid volume was greater than the females' and The right thyroid lobe volume was greater than the left.

The results showed that the average size of the total thyroid was 2.42 ± 5.425 ml2 and that the maximum size of the thyroid gland was 15.120 mg and was found in males and the minimum was 0.0000 ml in females. The study found that the size of the right lobe in the whole sample was 1.787 ± 2.990 while the left lobe size was ml1.076 ± 2.435. The study found that the right lobe size was higher than the left lobe in both sexes. The study found that the size of the right lobe in males was higher than that of the right lobe in females (0.884 ± 2.492 <2.336 ± 3.575). The size of the left lobe in males was higher than that of the left lobe in females (0.916 ± 2.068 <1.097 ± 2.867).

Table 4 shows the volume of the thyroid glands in females, males and all cases. In our study, thyroid volume (mL). The overall mean thyroid volume in all the patients who were studied was 5.425± 2.484 mL. The mean thyroid volume in males and

females was 6.441± 2.955 mL and 4.560± 1.566 mL, respectively ($p<0.05$). The mean volume of the right and left lobes of the thyroid gland in all of the patients were 2.990± 1.787 mL and 2.435± 1.076 mL, respectively. In females, the right and the left lobes of the thyroid gland volumes were 2.492±0.884 mL and 2.068±0.916 mL. In males, the right and the left lobes of the thyroid gland volumes were 3.575±2.336 mL and 2.867±1.097 mL. The right thyroid lobe volume was greater than the left in all patients of both sexes ($p<0.05$).

5.2. Conclusion:

This study aim to establish a local reference of thyroid volume in normal adult Sudanese female which will be useful in the clinical practice especially for the diagnosis of goiter.

In conclusion, the size of thyroid gland obtained in our study was in the lower range of values reported in previous studies among Sudanese adults. This is consistent with the previous study conducted in the same subject. The size of the right lobe of the gland was larger than the left in both sexes. The average thyroid size in males is higher than in females.

5.3. Recommendations:-

Study recommended that scanning of thyroid gland should be done routinely to measure it is size because it is save, cheep and accurate.

Conduct comprehensive studies to measure the size of the thyroid gland in all states and cities of Sudan and apply research on larger samples to reach the most accurate results and more studies should be done in deferent places in Sudan to see the effect of the iodine deficiency among the children and adults.

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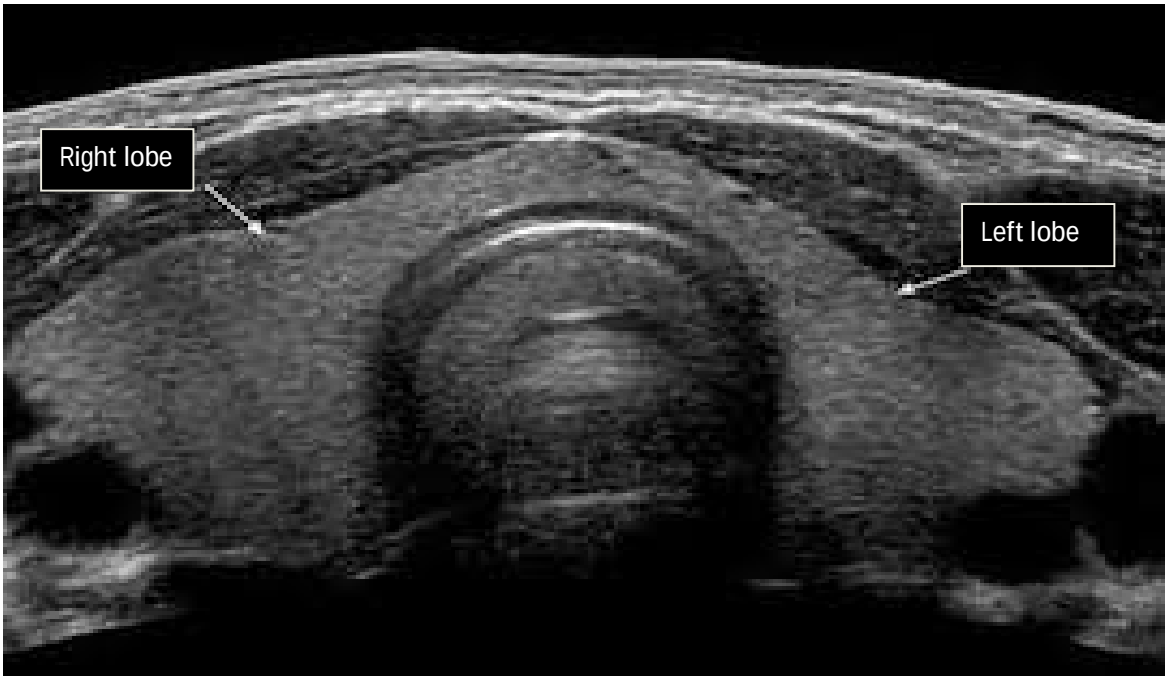
Appendix (A) Ultrasound Thyroid Image



http://www.iudmed.com/Tools/Portfolio/Upload/Project4/2420_H5_CL15_7_SMPRTS_PSCT.jpg

Sudan University of Science and Technology
Radiology College

Thyroid volume in Sudanese adult people

case		sex	Thyroid Length	Thyroid Width	Thickness	X0.52
1	Right					
	Left					
2	Right					
	Left					
3	Right					
	Left					
4	Right					
	Left					
5	Right					
	Left					
6	Right					
	Left					
7	Right					
	Left					
8	Right					
	Left					