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JOURNAL OF UNIVERSITY OF BABYLON
For Pure and Applied Sciences (JUBPAS)

Vol.31; No.1.| 2023

Hypothyroidism, Hyperthyroidism and its Relationship with Lipid Profile in Thyroid Dysfunction Patients

Adil Mohammed Hashim[1] Ashwak Talip Humadi[2]

1 **DNA Research center, University of Babylon**, adilalmaamury@yahoo.com, Hilla, Babylon, Iraq.

2 College of education for pure Science ,University of Diyala , ashwaqaljubory@gmail.com , Diyala ,Iraq.

***Corresponding author email:** adilalmaamury@yahoo.com; mobile: 07723316933

علاقة قصور الغدة الدرقية وفرط نشاطها مع مستوى الدهون عند مرضى اختلال الوظائف للدرقية

عادل محمد هاشم اشواق طالب حمادي

1 – مركز ابحاث الحمض النووي DNA ،جامعة بابل، adilalmaamury@yahoo.com بابل، العراق

2 – كلية التربية للعلوم الصرفة جامعة ديالى ashwaqaljubory@gmail.com

Received:	5 /11 /2022	Accepted:	15 /2 /2023	Published:	31 /3/2023

ABSTRACT

Background: -

Thyroid hormone synthesis is necessary for the growth, development, and healthy function of all body organs. Because thyroid malfunction causes a considerable shift in lipid levels, It is well known that thyroid hormones influence how lipid and lipoprotein metabolism is regulated. An essential regulator of intermediate metabolism are thyroid hormones. **The purpose** This study's objective was to look at the relationship between thyroid dysfunction patients' lipid profiles, hypothyroidism, and hyperthyroidism ..

Materials and Methods:-

In this study, the EIA method was used to evaluate the levels of T4, thyronine, and TSH in a sample of 50 patients and 50 healthy individuals. When assessing TG, LDL , TC ,and HDL , A fully automated biochemistry analyzer was employed.

Results:-

According to our research, HDL values are much lower in hypothyroidism cases compared to hyperthyroidism and control subjects, whereas TC, LDL, VLDL, and TG levels are significantly greater. When compared to control persons. Serum levels of, TG, TC, LDL, and VLDL are much lower in hyperthyroidism patients On the basis of a clinical examination of thyroid hormone., we found T4,T3 in serum sample wear higher than in control in hyperthyroid group while TSH wear low. In hypothyroid sample we found on the contrary .

Conclusion:-

In this research we found a significant correlation between thyroid dysfunction and lipid profile

Keywords: - Hypothyroidism ,hyperthyroidism , total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides , thyroid Dysfunction.

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الخلاصة

مقدمة:

يتسبب وجود مشاكل الغدة الدرقية في حدوث تحول كبير في مستويات الدهون والتي لها دور حاسم في تنظيم الأيض . تفرز الغدة الدرقية هرمونات (T3) و (T4) الضرورية لنمط حياة الطبيعي والحفاظ على مستويات الطاقة المثلى. هرمون الثايرونين هو هرمون الغدة الدرقية النشط من الناحية الفسيولوجية. وهي مطلوبة للنمو السليم والتطور والوظيفة في جميع الأنسجة تقريبًا . يبلغ عمر النصف T3 حوالي يوم واحد ، بينما يبلغ نصف عمر T4 سبعة أيام. هناك حاجة لهرمونات الغدة الدرقية لتنظيم التمثيل الغذائي للدهون ويرتبط عسر شحميات الدم عادة بضعف الغدة الدرقية.

طرق العمل:

تم استخدام خمسون نموذج دم بشري لكل من النماذج المرضية والكونترول حيث استخدمت تقنية التحليل المناعي الانزيمي لقياس تراكيز هرمونات الغدة الدرقية الثايروكسين والثايرونين وكذلك تم قياس عناصر مستويات الدهون باستخدام جهاز مبرمج لكل من الكوليسترول والدهون الثلاثية والدهون واطئة الكثافة والعالية الكثافة والواطئة جدا .

النتائج:-

اظهرت النتائج ارتفاع ملحوظ في مستويات ال TC,TG, and LDL, بينما انخفضت قيمة ال HDL في مرضى فرط الدرقية مقارنة مع الكونترول . وكذلك انخفاضا في مستويات TC,TG, and LDL بينما ارتفعت قيمة ال HDL في مرضى قصور الدرقية مقارنة مع الكونترول .

الاستنتاجات:

في هذا البحث وجدنا علاقة هامة بين قصور الغدة الدرقية ومستويات الدهون في مرضى فرط وقصور نشاط الدرقية .

الكلمات المفتاحية: -

قصور الغدة الدرقية ، فرط نشاط الغدة الدرقية ، الكوليسترول الكلي ، كوليسترول البروتين الدهني عالي الكثافة ، كوليسترول البروتين الدهني منخفض الكثافة ، الدهون الثلاثية ، اختلال وظائف الغدة الدرقية.

INTRODUCTION

The thyroid gland has a butterfly-like appearance. That is often found at the base of the front neck. Making thyroid hormone is the thyroid's function [1]. The ability of the thyroid gland to create (T3) and (T4) hormones , which are necessary for maintaining a healthy weight and leading an active life , makes the thyroid gland significant to the human body. According to established beliefs [2]. A powerful metabolic stimulant, thyroid hormone is essential for controlling energy consumption and important physiological processes like growth and development [3]. Thyroxin (T4) and triiodothyronine (T3), the most dynamic structure usable, are the real structures of thyroid hormones (THs), which the thyroid gland's follicular cells release [4]. The thyroid hormone controls the body's metabolism, the growth of the nervous system, and other bodily processes. Tetraiodothyronine (T4), also known as thyroxine, and triiodothyronine (T3) are the two metabolically active forms of thyroid hormone. The pituitary and hypothalamus produce thyroid hormones under the control of this system.

causes the thyroid to generate and release thyroid hormone when stimulated. The pituitary gland responds to the secretion of this hormone by releasing thyrotropin stimulating hormone (TSH), which circulates[5, 6]. One of the most common illnesses throughout all stages of life is thyroid dysfunction (TD), which can have effects on multiple organs due to the pleiotropic nature of thyroid hormone action [7]. The most typical clinical signs of thyroid illness are brought by either hyperthyroidism, which is caused by excessive thyroid hormone production with low TSH, or hypothyroidism, which is caused by a normal or high TSH and reduced thyroid hormone production [8]. The clinical state of hypothyroidism, which is brought on by a lack of thyroid hormone, is defined by a broad slowdown of metabolic functions [9]. There are also changes in the immunological response. Reactive oxygen species levels are elevated, proinflammatory molecule expression is upregulated, and there is a decrease in antibody formation, cell migration, and lymphocyte proliferation [10]. Thyroid disorders are among the most common endocrine conditions worldwide, second only to diabetes mellitus [11]. The production of thyroid hormones is predominantly impacted by illnesses that are classified as thyroid diseases. Production that is too high or too low results in hyperthyroidism or hypothyroidism [12].

A clinical condition known as hyperthyroidism (hyperT) is characterised by elevated blood T4 and T3 levels and by TSH inhibition[13].A clinical illness called hypothyroidism (hypoT) is brought on by a lack of HT and causes a broad slowdown of metabolic functions. Primary hypothyroidism is the term used for the majority of instances, which are caused by pathologies of the thyroid gland. In rarer situations, secondary hypothyroidism or tertiary hypothyroidism may result from a lack of TSH stimulation [14]. There are several very particular problems that the thyroid gland is prone to, some of which are rather common. Hypothyroidism and hyperthyroidism are conditions brought on by insufficient or excessive thyroid hormone production, respectively [15]. In terms of biochemistry, a decrease in T4 and T3 levels results in an increase in the pituitary's production of TSH and an excessive rise in blood TSH levels. This lab result is significant, especially for the early identification of thyroid illness. The lack of hormones and the reduced lipoprotein lipase activity encourage hypercholesterolemia [16].Patients with thyroid impairment frequently have altered lipid profiles [17]. Hypercholesterolemia is the most common lipid anomaly in hypothyroid patients, primarily as a result of an elevated level of low density lipoproteins (LDL). There have also been reports of elevated levels of HDL cholesterol and very low-density lipoproteins (VLDL). as a result of increased hepatic fatty acid esterification [18].

The activation of 3-hydroxy-3-methylglutarylcoenzyme A (HMG-CoA) reductase by thyroid hormones is the first step in the production of cholesterol. T3 can activate genes by directly binding to specific thyroid hormone response elements (TREs) [19]. The two main categories of thyroid disorders are hypothyroidism and hyperthyroidism. According to the cause of the condition, each of these classes can be further subdivided: hypothyroidism can be classified as main, secondary, and so on [20]. The

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activation of (HMG-CoA) reductase by thyroid hormones is the first step in the production of cholesterol. Additionally, SH may develop into overt hypothyroidism. When thyroperoxidase antibodies (TPOAb) or TSH levels are present concurrently, the pace of development is accelerated [21]. Increased TC and LDL-C values are linked to SH [22].

Even if (fT4) and (fT3) levels are higher than normal, hyperthyroidism is characterised by decreased blood TSH levels. Thyroid dysfunction is known to present itself in a changed lipid profile. But both overt and subclinical hypothyroidism are linked to hypercholesterolemia, mostly because LDL-c levels are elevated [24].

Materials and Methods

About 5 mL of blood were drawn and tested at a private facility to detect T3, T4, and TSH. TC, TG, LDL, and HDL cholesterol were measured in the blood using a fully automated analyzer. Lipid abnormalities, as well as anomalies in carbohydrate and protein metabolism, are all impacted by thyroid dysfunction. The mean, SD, and P value were determined by statistical analysis of the large amount of data gathered throughout the study. from October 2021 to June 2022. 50 people with thyroid disorders who came to a private lab in Iraq were investigated. Among those who arrived were 50 control samples.

Chemicals :-

All of the chemicals were provided by the (BDH) company. Instrumental samples For quantitative measurements of thyroxin, thyroid stimulating hormone, and threonine hormones kits, the enzyme immunoassay (EIA) method was utilized.

Obtaining samples :-

Following an overnight fast and one hour of room temperature clotting, blood samples were obtained with a disposable syringe from an arm vein. The serum and the clot were separated in a centrifuge for 5 to 10 minutes at a speed of 3000 revolutions per minute. The ante-cubital vein's blood was aseptically drawn and then transferred to a spotless test tube without any metal. without the use of an anticoagulant in order to prevent hemolysis. After 20 minutes at ambient temperature, the test tube was centrifuged at 2500 rpm for 15 minutes. Re-centrifugation was used to spin down any extra erythrocytes before the blood was transferred to a polypropylene container and kept on hand for examination.

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Results and Discussion

Patients with hyperthyroidism have an altered lipid profile. TC, TG, and LDL in hyperthyroidism patients are lower than in controls, while the activity of HDL is higher than in controls, as shown in table 1, figure 1.

Table 1:- lipid profile concentrations in individuals with hyperthyroidism and healthy controls.

	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error
TG	50	76.9	106.7	91.380	5.8127	.8220
TG/control	50	91.5	116.7	104.244	4.8167	.6812
TC	50	121.4	139.1	129.746	5.7285	.8101
TC/control	50	139.7	165.8	153.578	6.2295	.8810
HDL	50	.0	48.4	37.942	7.5140	1.0626
HDL/control	50	15.8	29.9	23.307	3.5855	.5071
LDL	50	49.4	56.2	71.019	71.1524	10.0625
LDL/control	50	74.9	98.9	83.942	4.9864	.7052

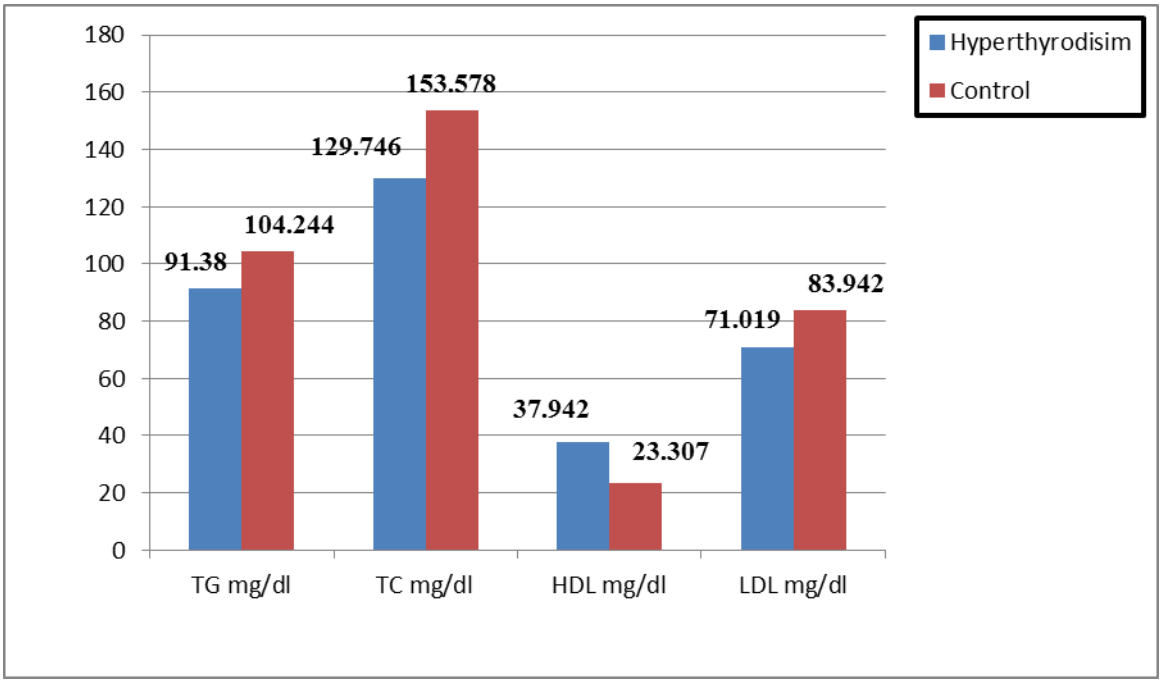

figure 1- demonstrates the mean levels of hyperthyroid patients with control.

Hypothyroidism patients exhibit an aberrant lipid profile when compared to controls, having noticeably higher TC, TG, and LDL values. Conversely, those with hypothyroidism have significantly lower HDL activity than people who are in good condition, as seen in table 2,figer 2.

Table 2- Serum lipid profile in hypothyroidism patients.

The thyroids hormones with lipid	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error
TG	54	95.8	119.7	108.969	5.4394	.7402
C1	54	95.8	112.7	104.306	3.6456	.4961
TC	54	169.9	192.8	182.611	5.1503	.7009
C2	54	140.4	165.4	153.574	5.1541	.7014
HDL	54	13.7	127.9	24.146	47.5981	6.4773
C3	54	15.5	30.8	54.330	3.1854	.4335
LDL	54	85.6	116.8	95.451	4.6170	.6283
C4	54	73.8	96.5	84.883	4.1945	.5708

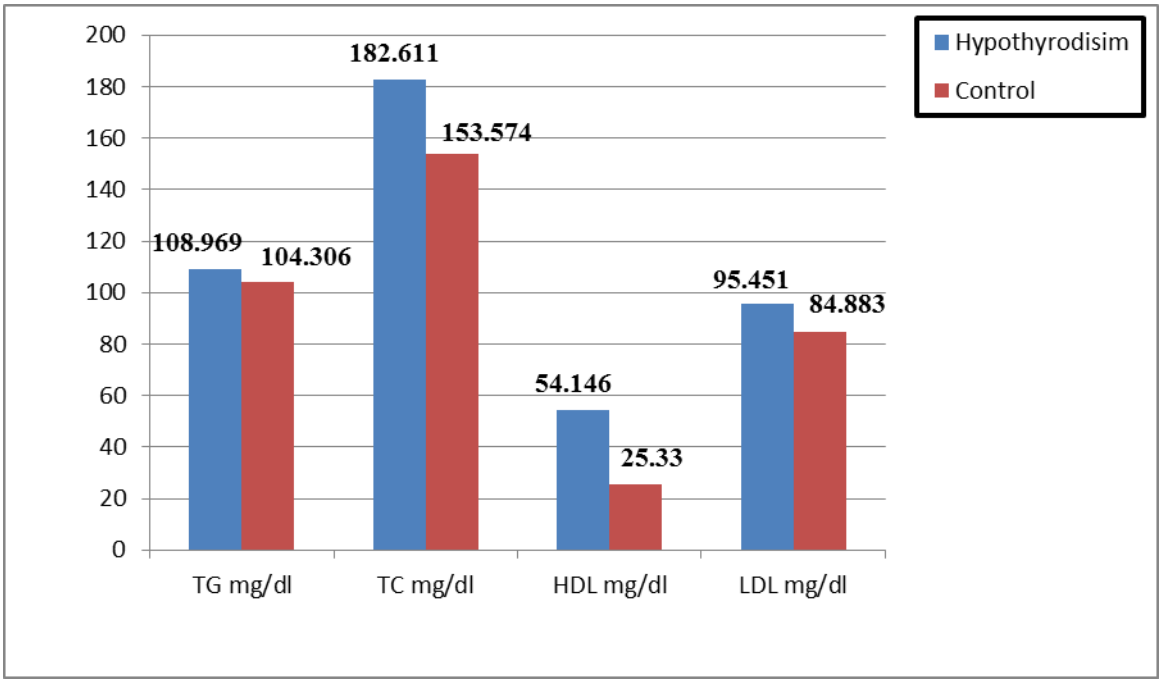

Figure 2 - demonstrates the mean levels of lipid profile patients(hypothyroid) with control.

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Table 3, figure 3 shows the amounts of Hormones T3, T4, and TSH in hyperthyroidism. Patients with hyperthyroidism had significantly lower TSH levels than other patients and controls. T3 and T4 levels in these patients were substantially more than in control patients.

Table 3:- concentration of thyroid hormones levels in hyperthyroidism patients and healthy control .

parameter	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error
T3	49	.0	5.4	3.655	.9520	.1360
T3/control	49	.7	1.9	1.359	.2943	.0420
T4	49	4.3	18.8	13.653	2.6906	.3844
T4/control	49	4.5	12.6	8.347	1.6915	.2416
TSH	49	.4	1.8	1.098	.3443	.0492
TSH/control	49	.6	1.9	1.384	.2633	.0376

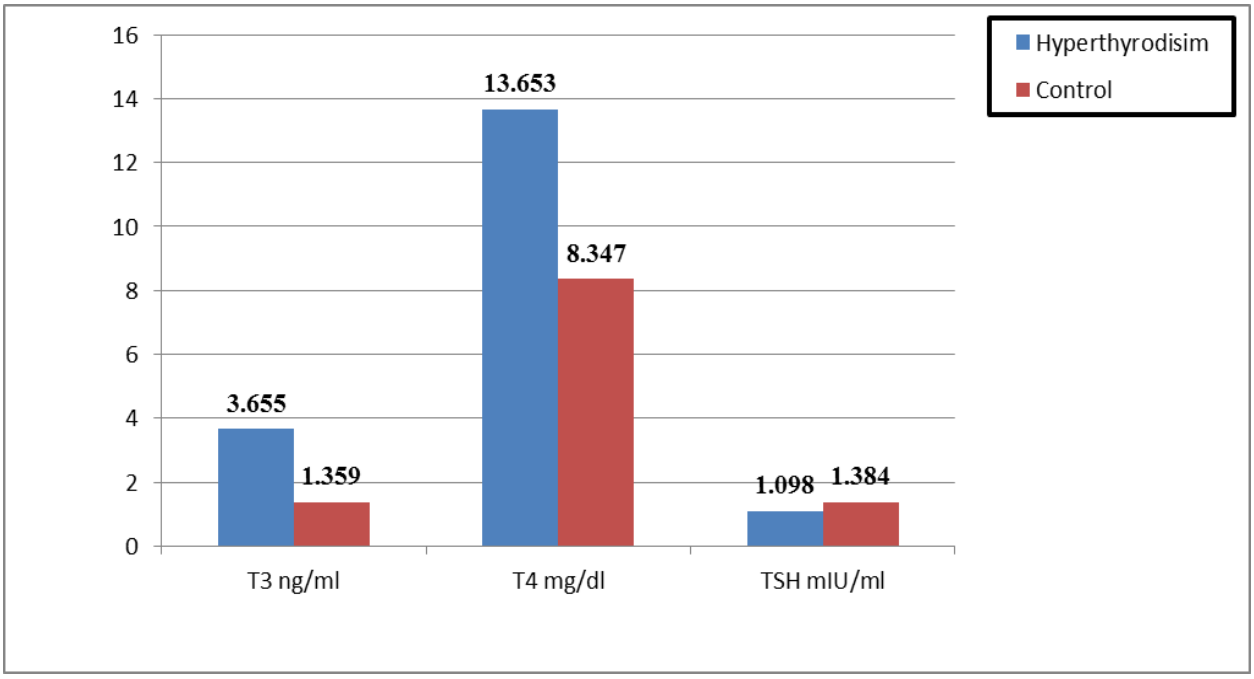

figure 3- demonstrates the mean levels of thyroid hormone(hyperthyroid) patients with control

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Table 4, figure 4. shows the amounts of Hormones T3, T4, and TSH in hypothyroidism. Patients with hypothyroidism had considerably higher TSH levels than patients compared to controls. T3 and T4 levels in these patients were substantially less than in control compared with patients.

Table 4:- shows the amounts of thyroid hormones in hypothyroidism patients versus healthy controls.

parameter	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error
T3	45	.2	1.3	.598	.2426	.0362
T3/control	45	.8	2.4	1.536	.3365	.0502
T4	45	3.5	5.8	4.693	.5458	.0814
T4/control	45	6.7	9.5	8.164	.6671	.0995
TSH	45	.0	15.5	12.129	2.2923	.3417
TSH/control	45	.6	2.3	1.558	.4020	.0599

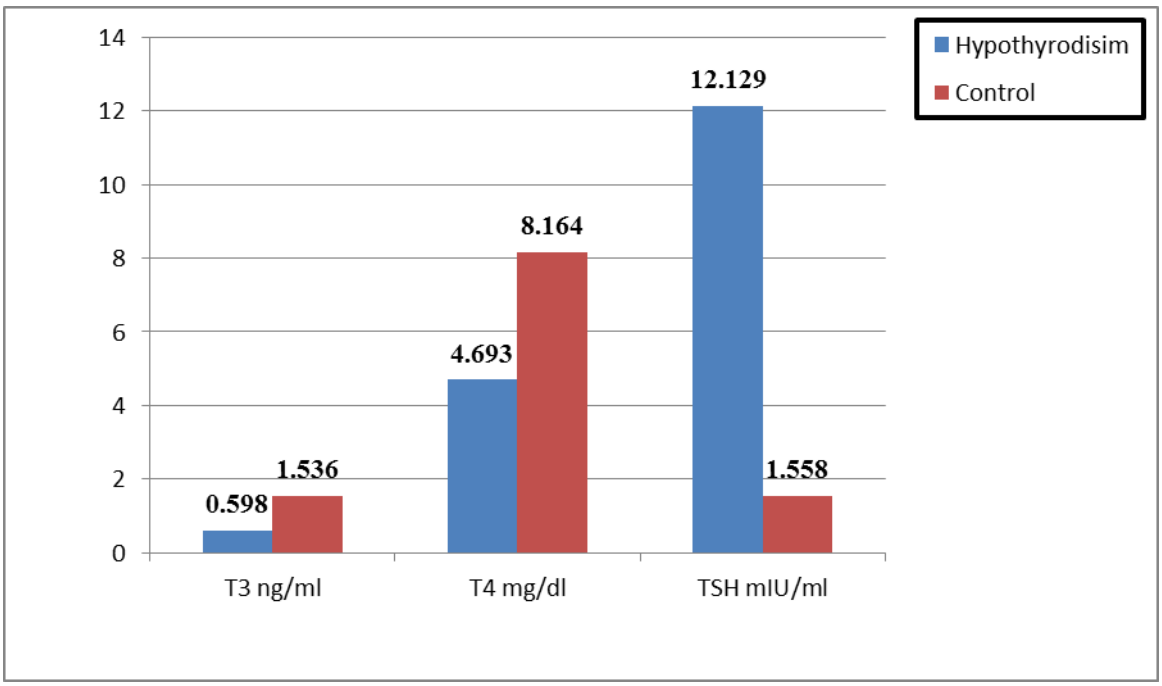

figure 4- demonstrates the mean levels of thyroid hormone(hypothyroid) patients with control.

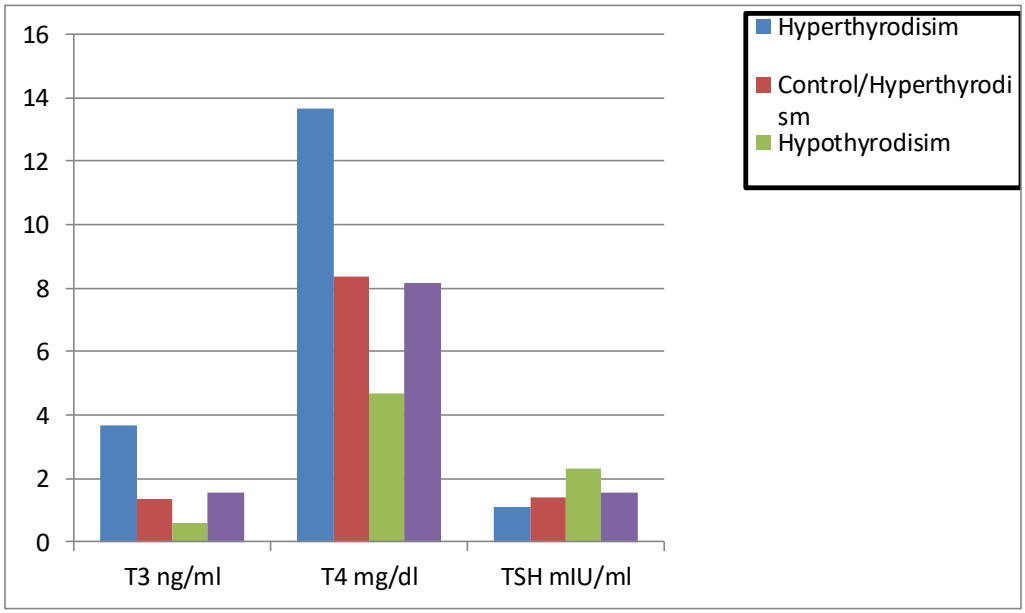

Figure 5:- Relationship between (TG,TC.HDL and LDL (Hypothyroidism and Hyperthyroidism) with Control.

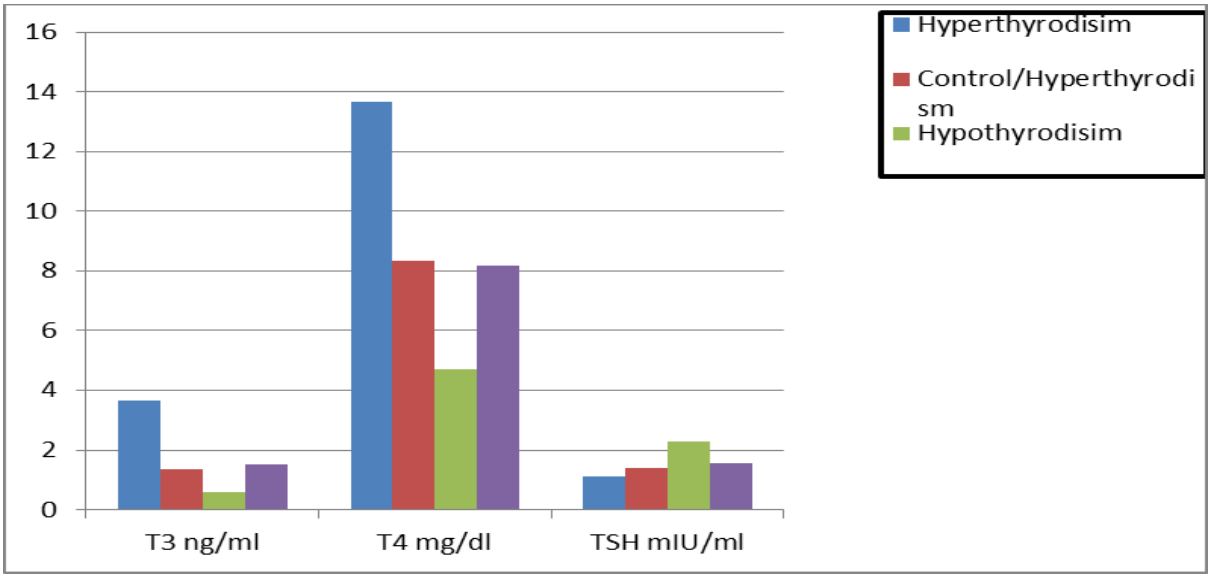

Figure 6:- Relationship between (T3,T4,TSH) of thyroid dysfunction (Hypothyroidism and Hyperthyroidism) with Control.

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DISCUSSION

According to the study, all serum lipid readings in hypothyroidism patients were higher than those in healthy control subjects, with the exception of HDL. The primary enzyme in charge of controlling the synthesis of cholesterol in the liver is hydroxy methyl glutaryal reductase (HMGCR) [25]. The influence of thyroid hormones on LDL receptors, which work to reduce their ratio and as a result slow down LDL removal from the bloodstream, is the most frequently stated explanation for higher LDL levels in hypothyroidism patients. [26]. The lipoprotein lipase enzyme may become less effective due to thyroid hormone impact It causes an elevation in blood TG levels in hypothyroidism patients by delaying the removal of TG from its abundant lipoproteins [27]. (CETP) and hepatic lipase (HL), two enzymes connected to HDL metabolism, are impacted by the effect of thyroid hormones on HDL metabolism. Both the forward transfer of cholesterol esters from HDL2 to VLDL and IDL as well as the transfer of TG into HDL2 occur. [28].

Acknowledgments:-

A particular thank you to the medical staff of Babylon Governorate's Marjan Hospital's Rheumatology Unit, who were credited with aiding in the collection of patient samples and whose work made this study feasible. The staff of Research Center at the University of Babylon, whose labs provided the laboratory equipment needed to complete this study, as well as everyone else who contributed to its review and publishing, are also thanked.

Conflict of interests;-

There are no conflicts of interest.

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