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RESEARCH ARTICLE

Study of Lipids Profile Levels in Patients with Hypothyroidism in Al-Muthanna Province

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Abstract

The objective of this study was to investigate the changes that occurred on lipids profile levels of patients with hypothyroidism in al-muthanna province. The current study is carried out in the 'specialized center of endocrinology and diabetes' in Al- Muthanna province. The study included 200 individuals (100 patients with hypothyroidism and 100 controls).The patients and control divided to three groups according to ages. The ages were between (20-49) years. The results show a significant increase at($P<0.05$) in (Total cholesterol (TC), Triglyceride (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and very low density lipoproteins (VLDL) levels of patients comparing with control group in all age groups .In this study concluded that hyperlipidemia is associated with hypothyroidism. These enhance the risk for development of atherosclerosis and coronary artery disease.

Keywords: *Hypothyroidism, Total cholesterol, Triglyceride, High-density lipoprotein, Low-density lipoprotein, Very low density lipoproteins.*

Introduction

Hypothyroidism is definite by a decline in thyroid hormone (triiodothyronine T3 and tetraiodothyronine T4) production and thyroid gland function [1]. Hypothyroidism happens when there are inadequate levels of thyroid hormones to provide metabolic needs at the cellular level [2].Symptoms of hypothyroidism include: fatigue, weight increase, loss of energy, declined appetite, cold intolerance, dry skin, loosed of hair, pain of muscle and joint, mental weakening; weak memory, menstrual disorders.

The physical signs of hypothyroidism include: hypothermia, goiter, brady cardia, myxedema, metabolic abnormalities associate with hypothyroidism include anemia; dilutional hyponatremia; hyponatremia reversible increase in creatinine [3]. It is the most communal pathologic hormone deficiency among the endocrine disorders.

It may be due to disorder of thyroid gland or absence of thyroid stimulating hormone from pituitary gland [4]. Biochemically decrease in T4 and T3 levels lead to increased secretion of thyroid stimulating hormone (TSH) from pituitary gland and increase TSH level in serum. [5,6] .Thyroid hormones (T4 and T3) control of metabolism, affect growth, and modify energy consumption by increasing the basal metabolic rate, increasing oxygen consumption, and helping heat production [7]. Thyroid hormones have important effects on synthesis, utilization and metabolism of lipids. Overt hypothyroidism is related with significant increase in circulating concentrations of total cholesterol leading to coronary artery disease [8, 9].The present study aims to evaluate the association of hypothyroidism with lipid profile abnormalities.

Materials and Methods

Patients and Study Location

This study included (100) patients with hypothyroidism the patients groups ages were ranged (20-49) years old. The current study is carried out in the 'specialized center of endocrinology and diabetes' in Al-Muthanna province.

Blood Samples

(5) Ml of fasting venous was drawn from each patients and control. The blood samples allowed to coagulate at room temperature for (15-20) minutes then centrifuged at 3000 rpm for 10 min for separation of serum. The

serum was used directly for estimation of the profile lipids by Spectrophotometer.

Assessment of Lipids Profile Levels

Assessment of Total Cholesterol (TC)

Principle

According to the method described by [10] as shown in the following Cholesterol concentration was determined enzymatically reactions:

Reactions:

$$\text{Cholesterol esters} + H_2O \xrightarrow[\text{Cholesterol oxidase}]{\text{Cholesterol esterase}} \text{Cholesterol} + \text{Fatty acids}$$

$$\text{Cholesterol} + O_2 \longrightarrow \text{Cholesten 4- one- 3} + H_2O_2$$

$$H_2O_2 + \text{Phenol} + \text{PAP} \xrightarrow{\text{Peroxidase}} \text{Quinonimine (pink)} + 4\ H_2O$$

Calculation of Results

$$\text{Cholesterol (mg/dL)} = \frac{\text{Sample absorbance (at 500 nm)}}{\text{Standard absorbance}} \times \text{Standard concentration}$$

Assessment of Triglyceride (TG)

Principle

Triglyceride (TG) concentration determined enzymatically according to the method described by (11), as shown in the following reactions:

$$\text{Triglycerides} \xrightarrow{\text{Lipase}} \text{Glycerol} + \text{free fatty acids}$$

$$\text{Glycerol} + \text{ATP} \underset{}{\overset{\text{Glycerol Kinase}}{\rightleftharpoons}} \text{Glycerol-3-phosphate} + \text{ADP}$$

$$\text{Glycerol-3-P} + O_2 \underset{}{\overset{\text{Glycerol-3- phosphate Oxidase}}{\rightleftharpoons}} \text{Dihydroxyacetone-p} + H_2O_2$$

$$H_2O_2 + \text{4-chlorophenol} + \text{PAP} \xrightarrow{\text{Peroxidase}} \text{Quinonimine (pink)} + 4\ H_2O$$

The absorption of the colored complex (quinonimine) proportional to the amount of triglycerides in the specimen.

Calculation of Results

$$\text{Triglyceride (mg/dl)} = \frac{\text{Sample absorbance (at 500 nm)}}{\text{Standard absorbance}} \times \text{Standard concentration}$$

Assessment of High Density Lipoprotein-cholesterol

Principle

LDL, VLDL and chylomicron from specimens are precipitated by the addition of phosphor tungstic acid and magnesium chloride. After centrifugation the cholesterol concentration in HDL which remains in the supernatant is determined. HDL concentration determined

enzymatically using specterophoto- meter according to the method described by [12].

Calculation of Results

$$\text{HDL-cholesterol (mg/dl)} = \frac{\text{Sample absorbance (at 500 nm)}}{\text{Standard absorbance}} \times \text{Standard concentration}$$

Calculation of LDL-Cholesterol and VLDL [13]

LDL-cholesterol estimated indirectly using formula as follow:

VLDL (mg/dl) = TG/5

LDL-c (mg/dl) = TC– (HDL-c + VLDL)

Statistical Analysis

In this study, several statistical tests were used to find the significant differences among the studied parameters of patients with hypothyroidism and control group at ($P<0.05$) level of significance. This study designed by Completely randomized design (CRD) that used in the analysis of variance for data by using one way ANOVA test, independent *t*-test and treatment means were compared using the least significant difference (LSD) at ($P<0.05$)level of significance. Data were processed and analyzed by using statistical program social science (SPSS 22) and the results were expressed as Mean± SD [14].

Results and Discussion

The results of this study showed that mean serum Cholesterol 167.39 ± 16.5 mg/dl for patients and 115.3 ± 28.2 mg/dl for control, mean serum Triglycerides 270.5 ±58.9 mg/dl for patients and 121.21 ±11.7 mg/dl for control, mean serum HDL 59.7 ±2.9(mg/dl) in patients and 48.6 ±4.5 (mg/dl) in controls. Mean serum LDL 53, 59 ±5, 1 (mg/dl) in patients and 42, 48 ± 9 (mg/dl) in control .

Mean serum VLDL 54.1 ±10,2 (mg/dl) in patients and 24.22 ± 3.7 (mg/dl) in control, , these results of age group (20-29)years old .also the results showed that mean serum Cholesterol 218,6± 32.3 mg/dl for patients and 127.1±19.7 mg/dl for controls, mean serum Triglycerides 301.6±32.4 mg/dl for patients and 105 ± 40.8 mg/dl for control, mean serum HDL 63.3 ± 12.5(mg/dl) in patients and 51.11 ± 7.2 (mg/dl) in controls. Mean serum LDL 94, 98 ±22.01 (mg/dl) in patients and 54.99 ± 12.3(mg/dl) in controls.

Mean serum VLDL 60.32 ±8.3 (mg/dl) in patients and 21± 9.3(mg/dl) in control, these results of age group(30-39) years old while in age group (40-49) the results showed that mean serum Cholesterol 235.8±56.6 mg/dl for patients and 148.39 ± 17.2 mg/dl for control, mean serum Triglycerides 215.16 ± 42.1mg/dl for patients and 163.5 ± 38.9 mg/dl for controls, mean serum HDL 55.38 ±3.4 (mg/dl) in patients and 47.20 ±3.80(mg/dl) in control. Mean serum LDL 129.47 ±19,5 (mg/dl) in patients and 68.49± 16.7 (mg/dl) in control, mean serum VLDL 43.03 ±7.84 (mg/dl) in patients and 32.7 ± 6,9(mg/dl) in control, Table (1).

Table 1: The change in lipids profile parameters of patients groups as compared with control group

Lipids parameters	Age (years)	Patients group Mean± SD	Control group Mean± SD
TC mg/dl	20 - 29	167,39 ± 16.5 *	115.3 ± 28.2
	30 – 39	218,6± 32.3 *	127.1±19.7
	40 – 49	235.8±56.6*	148.39 ± 17.2
TG mg/dl	20 - 29	270.5 ±58.9*	121.21 ±11.7
	30 – 39	301.6±32.4*	105 ± 40.8
	40 – 49	215.16 ± 42.1*	163.5 ± 38.9
HDL mg/dl	20 - 29	59.7 ±2.9 *	48.6 ±4.5
	30 – 39	63.3 ± 12.5*	51.11 ± 7.2
	40 – 49	55.38 ±3.4 *	47.20 ±3.80
LDL mg/dl	20 - 29	53.59±5.1*	42,48 ±9
	30 – 39	94,98 ±22.01 *	54.99 ± 12.3
	40 – 49	129.47 ±19,5 *	68.49± 16.7
VLDL mg/dl	20 - 29	54.1 ±10,2*	24.22 ± 3.7
	30 – 39	60,32 ±8,3*	21± 9.3
	40 – 49	43.03 ±7.84*	32.7 ± 6,9

***represent significant difference between patients with hypothyroidism groups and control groups ($p<0.05$), the results are shown as a Mean± SD**

The results of this study indicated a significant increase at($P<0.05$) in (TC, TG, HDL, LDL, VLDL) of patients as compared with control in all age groups ,and occurrence hyperlipidemia in patients with hypothyroidism because Thyroid hormones(T4 and T3)play an important role in regulated the lipids metabolism, where any deficiency of thyroid hormones levels lead to cause hyperlipidemia, which is a known risk factor for development of atherosclerotic disease [15].This study is agree with [16] who demonstrated that a significant increase in total cholesterol and LDL in patients with hypothyroidism. A study conducted by [17] has found that a significant increase in LDL, total cholesterol and decrease in HDL that enhance the risk for development of atherosclerosis and coronary artery disease. The catabolism of cholesterol into bile is mediated by the enzyme cholesterol 7α-hydroxylase.

This liver-specific enzyme is regulating by thyroid hormones (T4 and T3). Therefore decrease in thyroid hormones in patients lead to decreased the activity of cholesterol 7α-hydroxylase, this lead to decrease the catabolism of cholesterol into bile and increased levels of serum cholesterol [18]. Thyroid hormones stimulated the lipoprotein lipase (LPL).This enzyme responsible for the degradation of the TG, therefore the decrease in Thyroid hormones in patients lead to decreased activity of lipoprotein lipase and increased triglyceride [19]. A significant increase in Triglycerid and VLDL in patients with hypothyroidism may be due to the fact that there is a poor clearance of exogenous and endogenous triglycerides from circulation in hypothyroidism [20]. In this study found that LDL increase in patients, who have low thyroid hormones levels may be due to thyroid hormones (T4 and T3) induced hepatic lipase (HL), this enzyme hydrolyses HDL. Therefore the decreases in thyroid hormones lead to decreased activity of (HL) and increased HDL [21, 22]. The rise in LDL levels in patients who have low thyroid hormones levels may be due to thyroid hormones (T4 and T3) regulates LDL receptors by controlling the LDL receptor gene activation , therefore reduced number of LDL receptors in the liver in addition to decreased receptor activity .This leads to increased LDL in patients with hypothyroidism [22,23].

Conclusion

It has been shown in this study there is a relationship between the abnormal increase of lipids profile (TC, TG, HDL, LDL, VLDL) and occurrence hyperlipidemia with hypothyroidism. These lead to high risk for development of atherosclerosis and coronary disease.

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