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Serum Lipid Profile among Sudanese Patients Diagnosed with Hyperthyroidism

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Abstract

Hyperthyroidism is a term for overactive tissue within the thyroid gland, human hyperthyroidism is accompanied by multiple abnormalities with increased energy expenditure and excessive mobilization and utilization of metabolic substrates. The aim of this study is to investigate the concentration of serum lipid profiles in Sudanese patient with hyperthyroidism in Khartoum state. Analytical case control hospital base study recruited 50 patients diagnosed with hyperthyroidism compare with 50 control group, attended at Military Hospital, Khartoum state from January to April 2021. The results data show that the ages of hyperthyroidism were ranging (20-72 years). TSH and T3 were significantly increased in hyperthyroidism patients compared with control group. T4 on the other hand show no significant difference between hyperthyroidism patients (p=0.353) and control group. Total Cholesterol show significant increase in hyperthyroid patients when compared to control group, while the remaining Lipid profile (triglycerides (T.G), LDL-c HDL-c and VLDL) show no significant increase in hyperthyroidism patients compared to control group, T.G (p= .107), HDL-c (p= .189), and LDL-c (P=.113), VLDL-c (P=.506).The study show significant positive correlation between the levels of TSH and VLDL (r=0.396, P= 0.004). Positive correlation between the levels of T3 and total cholesterol (r=0.406, P= 0.003), positive correlation between the levels of T3 and LDL-c (r=0.296, P= 0.037). In conclusions, the hyperthyroidism causes significant increases of serum total Cholesterol, and other lipid profile remains normal.

Keywords: Hyperthyroidism, Lipid profile, Total cholesterol, Sudanese, TSH, VLDL, LDL

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Introduction

Thyroid disease is usually described in terms of circulating hormone levels. Clinically, conditions that affect thyroid hormone levels are much more common than conditions that affect calcitonin [1]. Asymptomatic disease is identified before a patient develops signs or symptoms and before thyroid hormone levels become abnormal as resulting from over-utilization of thyroid hormones [2]. General term thyrotoxicosis to hyperthyroidism was preferred to define a hyper-metabolic conjugated with elevated circulating levels of thyroid hormone [3]. Symptoms of hyperthyroidism depend on the degree of thyroid hormone elevation and the condition of the affected person [4]. Diagnosis of hyperthyroidism by physical examination usually detects an enlarged thyroid gland and an elevated heart rate [5].

A laboratory-confirmed diagnosis measures blood levels of total or free thyroid hormones thyroxine (T4), triiodothyronine (T3), and thyroid-stimulating hormone (TSH) [6]. It may also measure thyroid stimulating hormone receptor antibody (TRAb) levels, which, when elevated, confirm the diagnosis of Graves' disease [7]. Some cholesterol converted into steroid hormones by some tissues e. g. adrenal glands, testicles, and ovaries [8]. Low density lipoproteins contain mainly apo B100, are high in cholesterol and are formed as a result of lipolysis of very low-density lipoproteins [9]. Low-density particles are so small that they penetrate the extracellular space of the vessel wall, where they are oxidized and taken up by macrophages, which fill with intracellular lipid droplets and become foam cells [10].

A heart attack occurs when a blockage completely cuts off the blood supply to part of the heart. High-density lipoproteins are the smallest and densest lipoprotein particles synthesized in both the liver and testes [11]. High-density lipoproteins typically contain two ApoaI molecules that form a ring around a central lipid bilayer composed of phospholipids and cholesterol [12].

The function of high-density lipoproteins is to remove excess cholesterol from peripheral cells [13]. Thyroid hormones influences lipoprotein metabolism by induces 3-hydroxy-3-methylglutaric coenzyme A (HMG-CoA) reductase, which is the basis of cholesterol biosynthesis [14]. Adipose tissue is a highly active endocrine organ, secreting a variety of soluble products called adipokines [15]. Thyroid hormones and adipokines share several physiological functions, such as the organization of energy expenditure, lipid, and glucose metabolism, suggesting links between their effects on adipose tissue and the thyroid axis [16]. Thyroid disease affects how adipose tissue works and contributes to other metabolic disorders [17]. Thyroid disease is associated with a variety of metabolic disorders because thyroid hormones affect key metabolic pathways [18]. Thyroid hormones affect basal energy expenditure by regulating protein, lipid, and carbohydrate metabolism [19].

Materials and Methods

Study population

Analytical case control study conducted in Military hospital in Khartoum state from January to April 2021 and included 100 individual 50 hyperthyroidism patients with both sex and 50 apparently healthy individual serve as control.

Inclusion and exclusion criteria

Any hyperthyroidism patients and healthy volunteers were included as case and control, respectively. On the other hand, any patients with chronic diseases, familiar history, cardiovascular diseases, hypothyroidism, smoking, pregnant women, and any drug affect lipids metabolism were excluding.

Data collection and Sampling

The demographic clinical and laboratory investigation of patients were obtained as data and record by using questionnaire sheet. Four ml of blood was collected in plain container by standard venipuncture method, then serum was separated after centrifugation and used immediately for estimation of thyroid hormones (T3, T4 and TSH)and lipid profile (total cholesterol, triglycerides, and HDL-c, calculated VLDL and LDL).A spectrophotometer was used for lipid profiles measurement, whereas, COBAS-e (411 P) was used to determination of thyroid hormones level.

Ethical consideration

Permission of this study will be obtained from Alneelain University faculty of medical laboratory sciences. Oral consent was obtained from all the participants at the start of the study. And had been informed with the objectives, benefits and expected outcomes of the study. The participants were assured that the collected information will be kept confidential and will not be used for any other purpose than this study.

Quality control

Instrument calibrated, control positive and control negative used.

Data analysis

The data obtained were analyzed by Statistical Package of Social Science (SPSS) version (25) software program. The characteristics of the study groups (age, sex, treatment, and duration of disease) were presented by percentage. The result was expressed as mean ± SD student T test was used to compare between mean and test were utilized. Coloration was used to show the effect of age, duration of disease and sex on lipid profiles. The level of significant was detected at P. value less than 0.05.

Results

Table 1.

Demographic data of the patients and normal control group.

	Hyperthyroidism	Control
Number of subjects	50	50
Age	20-72 years	20-68 years
Duration of disease	1-20 years	-

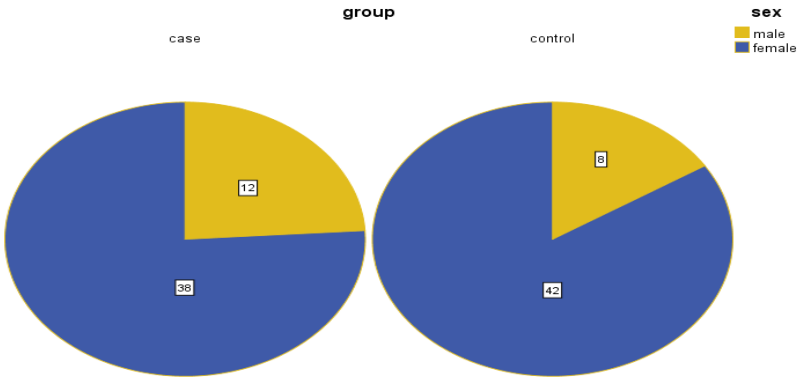

Figure 1.

Gender distribution in study group

Table 2.

The mean of serum triglyceride, cholesterol, and cholesterol profile (mg/dl) and thyroid profile of patients and control group

	Patients	Control	*P value*
TG	118.3 ± 24.6	110.9 ± 20.4	0.107
HDL	54.5 ±21.3	50.5 ± 2.2	0.189
LDL	47± 10.3	52.5 ± 21.9	0.113
VLDL	23.5 ±4.9	26.4 ± 30.2	0.506
T. cholesterol	126.1 ± 21.3	122.7 ±14.3	0.300
TSH	3.3 ± 2.6	2.5 ± 1.4	0.000
T3	4.4 ± .9	1.1 ± .2	0.000
T4	12.3 ± 2.8	5± 2.8	0.353

- Results given in mean ± SD.
- P-value ≤ 0.05 consider significant.

Table 3.

Comparison of thyroid hormones and lipoprotein in females and males with hyperthyroidism

	Sex		P value
	Male 12	**Female 38**	
TSH	5.525 ± 2.6324	2.684 ± 2.3287	**0.004**
T3	4.217 ± 1.4377	4.563 ± .8218	0.299
T4	11.842 ± 3.5336	12.550 ± 2.5587	0.451
TCH	127.25 ± 17.710	125.74 ± 22.627	0.812
TG	115.42 ± 28.647	119.26 ± 23.587	0.679
LDL	51.783 ± 25.7688	55.379 ±20.1067	0.664
HDL	47.75 ± 13.758	46.79 ± 9.289	0.783
VLDL	26.567 ± 5.1295	22.605 ± 4.5523	**0.029**

Table 4.

Comparison of thyroid hormones and lipid profile in hyperthyroid patients according to duration of disease

	Duration of disease		P value
	1-10 years (33)	11-20 years (14)	
TSH	3.4 ± 2.6	3.4 ± 2.8	0.991
T3	4.45 ± .9	4.52 ± 1.1	0.828
T4	12.1 ± 2.6	12.8 ± 3.4	0.458
Total Cholesterol	126.5 ± 23.3	125.2 ± 16.8	0.832
Triglyceride	114.58 ± 24.7	130.5± 22.1	0.238
LDL	55.824 ± 21.8	51.957± 21.1	0.575
HDL	48.1 ± 11.1	44.9 ± 8.4	0.291
VLDL	23.9 ± 5.5	23 ± 3.7	0.547

Table 5.

The correlation between thyroid hormones and lipids profile in hyperthyroidism patients

		TCH	TG	LDL	HDL	VLDL
TSH	R	-0.213	0.238	-0.207	-0.024	0.396**
	P	0.137	0.096	0.150	0.866	0.004
T3	R	0.406**	-0.068	0.296*	0.044	-0.086
	P	.003	.640	0.037	0.761	0.554
T4	R	0.081	-0.099	0.143	-0.111	-0.164
	P	0.574	0.496	0.321	0.443	0.254

**Correlation is significant at <0.01 level. *Correlation is significant at 0.05 levels (2-)

Discussion

This study was carried out at Military Hospital, Khartoum state among 50 hyperthyroidism patients and another sex/age matched 50 participants as control group, their ages ranged from 20 – 70 years old, with predominance of females gender (76%) among study population (Figure 1), which may give indication of raised incidence of hyperthyroidism among females which is agree with the results provided by Medani KE at 2020 which aimed to calculate the prevalence of thyroid dysfunctions related to sex and other factors among Sudanese; in which they found 85.2% of the hyperthyroidism patients were female [20].

Results of this study reflect that status of thyroid hormones concentrations was as expected elevated TSH and T3 concentration while T4 was normal. This creates a significance difference in concentrations of both TSH and T3 between cases and controls P value < 0.05 (table 2).

Study of lipid profile parameters through hyperthyroidism patients and control group revealed there were no significant variation in the means of triglyceride, HDL, LDL, VLDL and total cholesterol p value < 0.05 (table 2). Which may be attributed to treatment effect, in study done by Bhat and Srinagar at 2021was found that lipid profile parameters of hyperthyroidism patients were low and corrected to normal ranges after treatment [21]. Another study done in 2018 by Alsalmiet was study the relationship between hyperthyroidism and lipid profile in 20 participant as case group and another 51as control group, the found elevation in total cholesterol and LDL, low HDL and VLDL triglycerides no difference, which disagree with our results may be due to sample size variations [22].

The variation between current study results and other study had done by Musa and Akuyam the found that TC, HDL-C, LDL-C and TG levels were significantly lower in patients than in controls, may be the effect of racial variation and gender variation [23].

Regarding the correlation between lipid profile parameters and thyroid hormones positive significant correlation observed between T3 and Total cholesterol, TSH and VLDL table (5). These results dis-agree with results extracted by (Musa and Akuyam); negative significant correlation between T3 and TC T3 and TG, TSH and TG in patients (r=~0.292 p<0.05, r=-0.529 p<0.001 and r-0.487 p<0.001 respectively), while there was positive and significant correlation between serum T4 and LDL-C in controls (r=0.426, p<0.05) [23].

Other several studies done by Omer et al they found reduction in the lipid's concentration [24], while some researchers like those done by Yahaya et al and Wu et al that found hyperlipidemia among study population [25, 26]. Only study done by Maskey et al in 2018 which they found total cholesterol (mean ± standard deviation) was 103 ± 33.14 mg/dL, serum triglyceride was 106.43 ± 35.47 mg/dL, serum VLDL was 72.08 ± 14.90 mg/dL, serum

LDL was 81.45 ± 15.49 mg/dL, and serum HDL was 43.32 ± 4.80 mg/dL, which were normal [27].

The relationship between thyroid hormones and lipid profile governed by a lot of factors including ethnicity, gender, metabolic status of patients, thyroid hormones lowering drugs usage, etc. These factors bring the diversity in concentrations of lipid profile parameters as reviewed above.

Conflict of interest

The authors declare no conflict of interest, financial or otherwise.

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