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Original Article

Effect of Hypothyroidism on Lipid Profile in Women at Misan City/Iraq

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Abstract

Background: Hypothyroidism is a common endocrine disorder resulting from insufficient production of thyroid hormones, which have significant effects on the synthesis, mobilization, and metabolism of lipids. **Objective:** The present study aimed to measure some hormonal and biochemical parameters in women suffering from hypothyroidism in Misan province. **Materials and Methods:** This study included 88 women aged 20–35 years. 5–7 ml of blood was drawn, and serum was obtained. Thyroid and lipid profile tests were performed on all women. **Results:** The values of thyroid-stimulating hormone increased statistically significantly ($P < 0.05$) in the C (hypothyroidism women) and D (hypothyroidism and infertility women) groups, whereas triiodothyronine and thyroxin results decreased statistically significantly ($P < 0.05$) in the C (hypothyroidism women) and D (hypothyroidism and infertility women) groups. Triglycerides and very low-density lipoprotein (LDL)-cholesterol increased statistically significantly ($P < 0.05$) in the B (infertility women) and C (hypothyroidism women) groups compared to A (healthy women) and D (hypothyroidism and infertility women) groups, whereas LDL cholesterol (LDL-C increased statistically significantly ($P < 0.05$) in C (hypothyroidism women) and D (hypothyroidism and infertility women) groups compared with A (healthy women) and B (infertility women) groups. There were no statistically significant differences ($P < 0.05$) in total cholesterol and high-density lipoprotein-cholesterol among the study groups. **Conclusions:** Hypothyroidism causes increasing level of LDL. Indeed, it is a common cause of secondary dyslipidemia.

Keywords: Hypothyroidism, lipid profile, Misan, women

Introduction

The thyroid is one of the largest endocrine glands found in the body; this gland is located in the neck in front of the thyroid cartilage (in men, it is also known the Adam's apple) and at about the same level as the cricoid cartilage.[1] Thyroid hormones (THs) are released by thyroid gland's follicular cells whose true structure is thyroxin (T4) and triiodothyronine (T3), which is the overwhelming dynamic structure accessible for use.[2] Disorders of the thyroid are usually acquired and can occur at any time in life. Thyroid autoimmunity is the most prevalent cause of thyroid disorder in the reproductive age of females.[3,4] Hypothyroidism in females is five to eight times higher than that in males.[5] The incidence of thyroid disorders increases with age, following exposure to radiation, and females are ten times more probable to have thyroid issues than males; the most prevalent endocrine defects in both the Kingdom of Saudi Arabia and the Middle East are thyroid gland disorders.[6,7] According to the American Association of Clinical Endocrinologists, approximately three million individuals or 4.78% of the United States population have undiagnosed thyroid dysfunction and according to the American Thyroid Association (ATA), one in eight women will develop thyroid problems during her lifetime.[8]

Thyroid hormones can affect high-density lipoprotein (HDL) metabolism by enhancing protein transfer of cholesterol ester transfer protein, exchanging cholesterol esters from HDL2 to very small lipoproteins (very low-density lipoprotein [VLDL]) and triglycerides (TGs) in the reverse direction.[9] Furthermore, thyroid hormones enhance lipoprotein lipase (LPL), which catabolizes TG-rich lipoproteins, and hepatic

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Submission: 19-11-2019 **Accepted:** 30-12-2019 **Published Online:** 17-03-2020

Access this article online

Quick Response Code:

Website: www.medjbabylon.org

DOI: 10.4103/MJBL.MJBL_86_19

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How to cite this article: Aati EK, Al-Ali ZA. Effect of hypothyroidism on Lipid profile in women at Misan City/Iraq. Med J Babylon 2020;17:1-5.

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lipase, which hydrolyzes HDL2 to HDL3 and helps to convert intermediate-density lipoproteins to low-density lipoprotein (LDL) and, in turn, LDL to small-density LDL.[10,11] In addition, there is a reduction in LPL activity in overt hypothyroidism, which decreases the clearance of TG-rich lipoproteins.[12] Overt hypothyroid patients may, therefore, also have high concentrations of TG associated with enhanced concentrations of VLDL and sometimes fasting chylomicronemia.[13-15]

Materials and Methods

This study was conducted on 88 women in reproductive age group (20–35 years) who attended Al-Sader Teaching Hospital and the Diabetes and Endocrine Center in Misan city/Iraq from December 2018 to June 2019. The women were divided into four groups and each group comprised 22 women as follows: first group (control group), second group (infertility women), third group (women with hypothyroidism), and fourth group (women with hypothyroidism and infertility). 5–7 ml of whole blood was obtained by a medical syringe of each participant (patients and controls). The blood sample was put in a gel tube for 20 min at room temperature for clotting. Then, it was centrifuged at 3000 rpm for 10 min to collect the serum; a part of the serum was used for the purpose of lipid profile tests (total cholesterol [TC], TG, HDL, LDL, and VLDL) by using spectrophotometric methods, and another part of the serum was used for the estimation of thyroid-stimulating hormones (TSH, T3, and T4) by using Cobas e411, Roche diagnostics, Germany.

Ethical considerations

Permission to conduct this study was issued by the Health Institutional Committee at Al-Sader Teaching Hospital and the Diabetes and Endocrine Center in Maysan province, and the samples were taken from patients under the supervision of professional health-care workers.

Statistical analysis

The data obtained during the current study were analyzed statistically to determine the significance of the different parameters by ANOVA. The comparisons between means were made using least significant differences, and the data were presented as mean ± standard deviation.

Results

The values of TSH in Group D (13.61 ± 2.37 μlU/mL) increased statistically significantly ($P < 0.05$) in comparison with Groups A (1.85 ± 0.50 μlU/mL), B (1.86 ± 1.03 μlU/mL), and C (3.31 ± 1.06 μlU/mL). Group C differed significantly in comparison with Groups A and B. However, there were no significant differences between Groups A and B [Figure 1].

The values of T3 in Group A (2.009 ± 0.50 nmoL/L) increased statistically significantly ($P < 0.05$) in comparison with Groups C (1.67 ± 0.41 nmoL/L) and D (1.67 ± 0.45 nmoL/L). Group A did not differ significantly in comparison with Group B (1.95 ± 0.33 nmoL/L). There were no significant differences between Groups C and D [Figure 2].

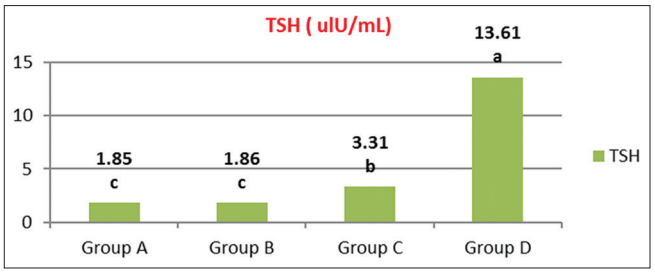

Figure 1: The thyroid-stimulating hormone concentration in women with control, infertility, and hypothyroidism. Values represent mean ± standard deviation. Different letters refer to significant difference among groups at level ($P < 0.05$). Similar letters refer to nonsignificant difference among groups

The values of T4 in Group A (102.23 ± 25.85 nmoL/L) increased statistically significantly ($P < 0.05$) in comparison with Groups C (94.75 ± 21.62 nmoL/L) and D (87.81 ± 22.81 nmoL/L), but Group A did not differ significantly in comparison with Group B (109.29 ± 16.46 nmoL/L). There were no significant differences between Groups C and D [Figure 3].

The TC values did not differ statistically significantly ($P < 0.05$) in Groups A (138.03 ± 24.54 mg/dL), B (157.56 ± 36.64 mg/dL), C (161.34 ± 28.72 mg/dL), and D (155.25 ± 31.74 mg/dL) [Table 1].

The values of TG in Group B (134.22 ± 4.39 mg/dL) increased statistically significantly ($P < 0.05$) in comparison with Groups A (113.25 ± 4.77 mg/dL), C (122.55 ± 5.45 mg/dL), and D (99.27 ± 4.59 mg/dL). Group C differed significantly in comparison with Groups A and D. There were no significant differences between Groups A and D [Table 1].

The values of HDL-C did not differ statistically significantly ($P < 0.05$) in Groups A (50.48 ± 4.06 mg/dL), B (48.50 ± 4.67 mg/dL), C (44.86 ± 3.35 mg/dL), and D (47.72 ± 3.72 mg/dL) [Table 1].

The values of LDL-C in Group D (104.74 ± 4.95 mg/dL) increased statistically significantly ($P < 0.05$) in comparison with Groups A (68.90 ± 5.45 mg/dL) and B (81.35 ± 6.18 mg/dL), whereas they did not differ significantly compared to Group C (99.36 ± 5.81 mg/dL) [Table 1].

The values of VLDL-C in Group B (28.39 ± 2.88 mg/dL) increased statistically significantly ($P < 0.05$) in comparison with Groups A (22.17 ± 3.16 mg/dL) and D (19.85 ± 2.63 mg/dL), whereas they did not differ significantly in comparison with Group C (25.60 ± 3.15 mg/dL). There were no significant differences between Groups A and D [Table 1].

Discussion

In the present study, TSH level increased statistically significantly ($P < 0.05$) in Groups C (hypothyroidism women) and D (hypothyroidism and infertility women), whereas the T3

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Table 1: Lipid profile concentrations in women with fertility, infertility, and hypothyroidism

Groups	TC (mg/dL)	TG (mg/dL)	HDL-C (mg/dL)	LDL-C (mg/dL)	VLDL (mg/dL)
Group-A	138.03±24.54	113.25±4.77^{c}	50.48±4.06	68.90±5.45^{c}	22.17±3.16^{b}
Group-B	157.56±36.64	134.22±4.39^{a}	48.50±4.67	81.35±6.18^{b}	28.39±2.88^{a}
Group-C	161.34±28.72	122.55±5.45^{b}	44.86±3.35	99.36±5.81^{a}	25.60±3.15^{a}
Group-D	155.25±31.74	99.27±4.59^{c}	47.72±3.72	104.74±4.95^{a}	19.85±2.63^{b}
LSD	NS	9.3	NS	12.45	3.43

n=22 women in each group, Values represent mean±SD. Group A: (control group) healthy women, Group B: Infertility women, Group C: Women with hypothyroidism, Group D: Women with hypothyroidism and Infertility, SD: Standard deviation, TG: Triglycerides, HDL-C: High-density lipoprotein-cholesterol, LDL-C: Low-density lipoprotein-cholesterol, VLDL: Very-low density lipoprotein-cholesterol, TC: Total cholesterol

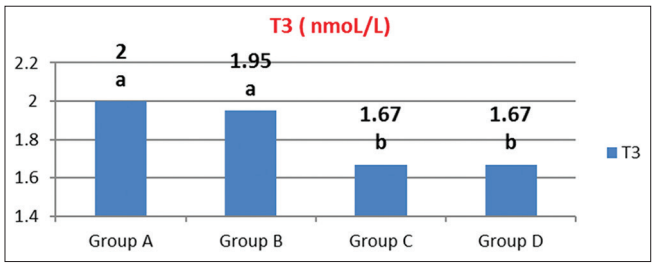

Figure 2: The triiodothyronine concentration in control, infertility, and hypothyroidism women. Values represent mean ± standard deviation. Different letters refer to significant differences among groups at level ($P < 0.05$). Similar letters refer to nonsignificant among groups

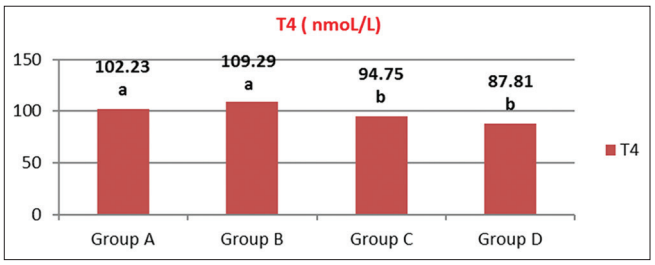

Figure 3: The thyroxin concentration in control, infertility, and hypothyroidism women. Values represent mean ± standard deviation. Different letters refer to significant differences among groups at level ($P < 0.05$). Similar letters refer to non-significant difference among groups

and T4 levels decreased statistically significantly ($P < 0.05$) in Groups C and D. The present study findings agree with the study done by,[16] which found that T3 and T4 levels significantly decreased and TSH levels significantly increased in clinical hypothyroid females compared to controls. These biochemical decreases in T4 and T3 lead to hypersecretion of TSH from the pituitary gland and amplified increases of their concentrations in serum.[17]

The present study findings agree with those of the study by Elzobir *et al*.[18] which found that serum TSH concentration highly significantly increased in primary hypothyroidism group as compared to the control group. In addition, the current study findings agree with those of the study carried out by Hussein *et al*.[19] where they found higher significant rise in serum TSH level in the infertility women group compared to the control group.

Our study findings agree with those of the study done by Kaushik *et al*.[20] which found that serum TSH level was higher in infertile women than fertile women. In general, serum TSH measurement in infertile females is used for hypothyroidism detection as TSH is a major thyroid function hormone.[21]

In a study, hypothyroidism was diagnosed on the basis of history, physical examination findings (symptoms and signs of hypothyroidism), and thyroid function tests showing high serum levels of TSH and low serum levels of T3 and T4.[22] Women with elevated serum TSH concentrations above 2.5 mIU/L had more menstrual disturbances and ovulatory cycles, reduced oocyte fertilization and pregnancy rates, increased risk of *in-vitro* fertilization failure, and greater recurrent miscarriage rates.[23-26] In a research conducted on 299 infertile females in Finland by Arojoki *et al*.,[27] it was found that TSH was found to increase by 4% and overt hypothyroidism was identified in 3.3% of cases; in these cases, ovulatory dysfunction was found to be dominant compared to other cases of infertility.

The prevalence of hypothyroidism differs in different studies; in infertile females, especially subclinical hypothyroidism (SCH) was found to increase from 0.7% to 43%; this broad prevalence range was attributed to the variations in serum TSH measurement sensitivity.[23,26,28,29] In another study done by Orazulike and Odum,[30] the authors found that 0.9% of infertile women had overt hypothyroidism, but none had SCH.

The results of the present study showed that the TC and HDL-C levels did not differ statistically significantly ($P<0.05$) among the four groups, whereas the level of LDL-C increased statistically significantly ($P<0.05$) in Groups C (hypothyroidism women) and D (hypothyroidism and infertility women), and VLDL-C and TG levels increased statistically significantly ($P<0.05$) in Groups B (infertility women) and C (hypothyroidism women) in comparison to Group A (control).

The current study findings agree with those of the study done by Alsalmi *et al*.[31] which found significantly increased LDL-C, VLDL-C, and TG values in hypothyroidism patients compared to normal thyroid group. Moreover, the present study findings did not agree with those of the above study with regard to TC and HDL-C.

The present study findings agree with the study done by Hiregoudar *et al*.[32] which found that the HDL-C value was

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normal in hypothyroid patients and also this value did not differ significantly between overt and SCH patients. While, the LDL value elevated in overt hypothyroidism patients significantly. However, the present study findings did not agree with those of the above study with regard to TC and TG values.

The present study findings did not agree with those of the study done by Satyajit and Arindam[33] which found high prevalence of hypercholesterolemia in hypothyroid females with significant positive correlation with TSH when compared to control group.

The increase in LDL-C, VLDL-C and TG because to the decreasing in TG-rich lipoprotein clearance, the high concentrations of TG in overt hypothyroidism patients may associated with increasing concentrations of VLDL and sometimes fasting chylomicronemia.[13]

The normal levels of TC in the present study may be due to the T4 therapy, in a TSH suppressive dose, which usually leads to a considerable improvement of the lipid profile.[34]

THs induce the 3-hydroxy-3 methylglutaryl coenzyme A (HMG-CoA) reductase, the first step in the biosynthesis of cholesterol. Moreover, T3 upregulates LDL receptors by controlling the activation of the LDL receptor gene; this activation of T3-mediated gene is performed by directly binding T3 to specific thyroid hormone-responsive elements.[35]

Conclusions

From the results of the present study, it can be found that hypothyroidism causes increased LDL. Indeed, it is a common cause of secondary dyslipidemia.

Acknowledgment

We would like to thank the staff of AL-Sadder Teaching Hospital and Center for Endocrinology and Diabetes Specialist in Misan province for helping us in the collection of specimens.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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