Original Research Article

Serum lipids in sub clinical hypothyroidism: A retrospective study

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A B S T R A C T

Background: Thyroid hormones are a potent regulator of metabolism, playing a crucial role in regulating energy expenditure and in key physiological mechanisms. Their prominent and well-known role is an increase in basal energy expenditure obtained by acting on carbohydrate, protein and lipid-metabolism. Hypothyroidism is relatively common and is associated with an unfavorable effect on lipid metabolism. Few studies reveal subclinical hypothyroidism to be a risk factor for increased incidence of lipid abnormalities and resulting in cardiovascular abnormalities.

Aim: Hence study was taken up to find the association of serum lipids with subclinical hypothyroidism.

Methodology: This was a retrospective study conducted in the department of Biochemistry, Malla Reddy hospital. Biochemically identified 102 subjects of Subclinical hypothyroidism subjects between 15-50 years and evaluated for lipid profile were included in the study. In our study, the mean serum total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol expressed in mg/dl were 189.98 ±24.16, 166.48 ±17.4, 37.62±2.89 and 121.34 ±27.31mg/dl respectively. 41 subjects out of 102 had higher total cholesterol, triglycerides and LDL cholesterol with lesser HDL cholesterol from the acceptable limits.

Conclusion: We conclude that impaired lipid parameters are associated with subclinical hypothyroidism. Hence a regular screening for lipid profile should be considered in subclinical hypothyroidism for early diagnosis, prevention and management of cardiovascular complications.

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1. Introduction

The thyroid gland is vital in the human body because of its ability to synthesize the hormones triiodothyronine (T3) and teta iodothyronine (T4), necessary for appropriate energy level and an active life.1

Thyroid hormones are a potent regulator of metabolism, playing a crucial role in regulating energy expenditure and in key physiological mechanisms, such as growth and development.2 It influences all major metabolic pathways. Their prominent and well-known role is an increase in basal energy expenditure obtained by acting on carbohydrate, protein and lipid-metabolism.

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The significant effects on lipid metabolism include: (a) increased utilization of lipid substrates; (b) increase in the synthesis, mobilization and storage in adipose tissue; (c) increase in the concentration of non esterified fatty acids (NEFA); and (d) increase of lipoprotein-lipase activity.3

Hypothyroidism is the most commonly occurring thyroid disorders worldwide. It is defined as an insufficiency of thyroid activity. It results from reduced secretion of both T4 and T3. Hypothyroidism is relatively common and is associated with an unfavorable effect on lipid metabolism. Hypothyroidism, characterized by low serum thyroid hormone levels, is associated with reduced metabolism, reduced lipolysis, weight gain, reduced cholesterol clearance, and elevated serum cholesterol.3

Alteration in lipid profile is a common observation in subjects with thyroid dysfunction.1 Hypercholesterolemia
is favored due to the hormone deficit and to the decreased activity of the lipoprotein lipase. In hypothyroid patients the most frequent lipid abnormality is increased serum cholesterol, mainly due to an increased concentration of low density lipoproteins (LDL). Elevation of very low-density lipoproteins (VLDL) and high density lipoproteins (HDL Cholesterol) have also been reported.

Subclinical hypothyroidism is a asymptomatic condition with serum thyroid stimulating hormone level above the upper limit of normal in presence of normal level of serum thyroxine and tri iodothyronine. Subclinical hypothyroidism if left untreated leads to overt hypothyroidism.

Few studies have revealed subclinical hypothyroidism to be a risk factor for increased incidence of lipid abnormalities and resulting in cardiovascular abnormalities. However, in Indian context, there is very less literature to substantiate the association of subclinical hypothyroidism with biochemical derangements in lipids. Hence this study was taken up to find the association of serum lipids with subclinical hypothyroidism.

2. Materials and Methods

This was a retrospective study conducted in the department of Biochemistry, Malla Reddy hospital from September 2018 to August 2019 after obtaining ethical clearance from the institutional ethics committee. The data was collected from the records of clinical biochemistry laboratory and medical records department of the hospital. Biochemically identified 102 subjects of Subclinical hypothyroidism subjects between 15-50 years and evaluated for lipid profile were included in the study. Serum Total T3, Total T4 and TSH were evaluated by Chemiluminescence immunoassay using fully automated Beckman Access 2 CLIA. The following methods were employed to estimate serum lipid parameters.

- Total Cholesterol: Cholesterol Oxidase Peroxidase
- HDL: Direct enzymatic method
- LDL: Direct enzymatic method
- Triglycerides: Glycerol phosphate oxidase- peroxidase method
- VLDL: By calculation [Total cholesterol-HDL-VLDL]

2.1. Inclusion criteria

Asymptomatic subjects of 15-50 years age group with normal Total T3 (0.87-1.78ng/ml), normal Total T4 (6.09-12.23 micro grams/dl) and TSH values between 5.5-10 micro IU/L and evaluated for fasting lipid profile

Exclusion criteria: Cases of overt hypothyroidism, Diabetes mellitus, Cardio vascular diseases, hepatic and renal impairment, on medication for thyroid disorders and patients on drugs impairing lipid profile.

The data were recorded and expressed as mean and standard deviation. Data was analyzed with SPSS package version 17 by calculating percentage analysis.

3. Results

In our study, out of 102 subjects 15 were male and 87 were female. The mean age of the subjects was 39.73±5.78 years. The mean age of males and female were 43.86±3.4 and 35.6±4.81 years respectively.

On analysis, the mean serum TSH, Total T3 and Total T4 were 7.61±1.34 micro IU/L, 0.97±0.28 ng/ml and 8.14±1.98 micro grams/dl respectively.

In our study, the mean serum total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol expressed in mg/dl were 189.98±24.16, 166.48±17.4, 37.62±2.89 and 121.34±27.31mg/dl respectively.

In the study, 46 subjects had serum total cholesterol above the normal range. 61 subjects had higher triglyceride value and 72 subjects had higher LDL cholesterol value.

10 subjects had HDL cholesterol below the normal range and 11 had higher VLDL cholesterol value. 41 subjects out of 102 had higher total cholesterol, triglycerides and LDL cholesterol with lesser HDL cholesterol from the acceptable limits.

Table 1: ATP III Reference range for serum total cholesterol, triglycerides, LDL cholesterol and HDL Cholesterol (mg/dL)

| Parameter               | Value expressed as mean and SD       |
|-------------------------|--------------------------------------|
| Total Cholesterol       | <200 Desirable 200-239 Borderline high ≥240 High |
| LDL Cholesterol         | <100 Optimal 100-129 Near optimal/above optimal 130-159 Borderline high 160-189 High ≥190 Very high |
| HDL Cholesterol         | <40 Low ≥60 High                     |

Table 2: Gender wise distribution of subjects and mean age in both gender

|                          | Male | Female |
|--------------------------|------|--------|
| Total subjects(100)      | 15   | 87     |
| Mean age(in years)       | 43.86±3.4 years | 35.6±4.81 years |

Table 3: Different biochemical parameters and their serum values expressed as Mean and Standard Deviation

| Parameters               | Value expressed as mean and SD       |
|--------------------------|--------------------------------------|
| TSH                      | 7.61±1.34 micro IU/L                 |
| Total T3                 | 0.97±0.28 ng/ml                      |
| Total T4                 | 8.14±1.98 micro grams/dl             |
| Total cholesterol        | 189.98±24.16mg/dl                    |
| Triglycerides            | 166.48±17.4mg/dl                     |
| High Density Lipoprotein | 37.62±2.89mg/dl                      |
| Low Density Lipoprotein  | 121.34±27.31mg/dl                    |
Thyroid hormones regulate the expression of enzymes involved in steps of lipid metabolism leading to the development of alteration of lipids in thyroid disease. Increase in serum total cholesterol and low-density lipoprotein cholesterol (LDL) in hypothyroidism might be due to several changes in the synthesis, metabolism, and mobilization of fat. Thyroid hormones modulate 3-hydroxy-3-methyl-glutaryl-coenzyme A (HMG-CoA) reductase activity in the liver and, thus, decrease serum cholesterol. In addition, thyroid hormones increase LDL receptors on fibroblasts, liver, and other tissue, and they increase absorption of cholesterol from the intestine. These hormones also alter levels of high-density lipoprotein (HDL) cholesterol and hepatic lipase activity, and affect the excretion of cholesterol from the intestine by bile acids. 17

Lin et al. in 2005 proposed that the thyroid hormones stimulate expression of uncoupling proteins in the mitochondria of fat and skeletal muscle through modulated adrenergic receptors by enhancing the responsiveness of catecholamines. Thereby thyroid hormones influence the body weight, thermogenesis, lipolysis and fat metabolism indirectly culminating in atherogenic risk. 18

5. Conclusion

In the present study, even though the mean total cholesterol was not above the normal range still a majority of the subjects had impaired lipid parameters. We conclude that impaired lipid parameters are associated with subclinical hypothyroidism. Hence a regular screening for lipid profile should be considered in subclinical hypothyroidism for early diagnosis, prevention and management of cardiovascular complications.

Limitation of our study was that we did not evaluate the parameters in comparison with euthyroid subjects. Further an associated analysis by matching with age, gender and other demographic factors would have provided the results eliminating possible confounders.

6. Sources of Funding

Nil.

7. Conflict of Interest

None.

References

1. Alsalmi WM, Shaglouf LHF, Azab AE. Correlation between hypothyroidism, hyperthyroidism and lipid profile in thyroid dysfunction patients. Clin Med J. 2018;4(2):6–14.
2. Alfadda A, Benabdellakamel H, Masood A, Jammah A, Elkhaimy A. Differences in the Plasma Proteome of Patients with Hypothyroidism before and after Thyroid Hormone Replacement: A Proteomic Analysis. Int J Mol Sci. 2018;19(1):88.
3. Pucci E, Chiovato L, Pinchera A. Thyroid and lipid metabolism. Int J Obes. 2000;24(52):S109–12.
4. Galesanu C, Lisnic N, Teslaru R, Apostu L, E Z. Lipid profile in a group of hypothyroid patients Vs treated hypothyroid patients. Rev Med Chir Soc Med Nat Iasi. 2004;108(3):554–60.
5. Tumbanatham A, Jayasingh K, Vijayan VV. Comparative study of lipid profile between clinical and subclinical hypothyroidism. Inte J Adv Med. 2018;5(4):978–82.
6. Kumar H, Singh V, Meena B, Gaur S, Singla R, Sisodiya MS. Clinical profile of thyroid dysfunction in elderly: An overview. Thyroid Res Pract. 2016;13(3):101.
7. Saric MS, Jurasicmij, Sovic S, Kranjecb, Glivetic T, Demarin V. Dyslipidemia in SCH requires assessment of small dense low density lipoprotein cholesterol. Rom J Intern Med. 2017;26;55(3):159–66.
8. Luboshitzky R, Aviv A, Herer P, Lavie L. Risk Factors for Cardiovascular Disease in Women with Subclinical Hypothyroidism. Thyroid. 2002;12(5):421–5.
9. Qasim B, Arif S, Ayad Mohammed and Rezvan Abdul jabbar. Dyslipidemia in Subclinical Hypothyroidism: A Case-Control Study. J Endocrinol Diab. 2018;5(1):1–6.
10. Haghi MAR, Solhjoo, Mohammad Hossein Tavakoli.Correlation Between Subclinical Hypothyroidism and Dyslipidemia. Iran J Pathol. 2017;12(2):106–11.
11. Sayed AA, Ali NA, Abbas YB, AlFaadheli E. Subclinical Hypothyroidism Is Associated with Early Insulin Resistance in Kuwaiti Women. Endocr J. 2006;53(5):65–7.
12. Monzani F, Caraccei N, Kozakow M, Dardano A, Vitton F, Virdis A, et al. Effect of Levothyroxine Replacement on Lipid Profile and Intima-Media Thickness in Subclinical Hypothyroidism: A Double-Blind, Placebo-Controlled Study. J Clin Endocrinol Metab. 2004;89(5):2099–2106.
13. Kvetn J, Heldgaard PE, Bladbjerg EM, Gram J. Subclinical hypothyroidism is associated with a low-grade inflammation, increased triglyceride levels and predicts cardiovascular disease in males below 50 years. Clin Endocrinol. 2004;61(2):232–8.
14. Hak AE, Pols HAP, Visser TJ, Drexhage HA, Hofman A, Witteman JCM. Subclinical Hypothyroidism Is an Independent Risk Factor for Atherosclerosis and Myocardial Infarction in Elderly Women: The Rotterdam Study. Ann Intern Med. 2000;132(4):270–8.
15. Maichael T, Dermott EM, Chester R. SCH in mild thyroid failure and should be treated. JCEM. 2001;86(10):4585–90.
16. Khan MA, Ahsan T, Rehman U, Jabeen R, Farooq S. SCH; Frequency clinical presentations and treatment indications. Pak J Med sci. 2017;33(4):818–22.
17. Kutty KM, Bryant DG, Farid NR. Serum Lipids in Hypothyroidism—A Re-evaluation*. J Clin Endocrinol Metab. 1978;46(1):55–6.
18. Lin SY, Wang YY, Liu PH, Lai WA, Sheu WH. Lower serum free thyroxine levels are associated with metabolic syndrome in a Chinese population. Metab. 2005;54(11):1524–8.

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