

Original Research Article

A comparative assessment of thyroid hormones and lipid profile among hypothyroid patients: A hospital based case control study

Aruna Bandi¹, Nagababu Pyadala^{2, 3, 4*}, Srivani N⁵, Rajaneesh Borugadda⁶, Soumendhra Nath Maity⁷, Ravi Kumar B.N.⁸, Rathnagiri Polavarapu⁹

¹Assistant Professor, Department of Biochemistry, Maheshwara Medical College and Hospital, Isnapur, Telangana, India

²Assistant Professor, Department of Biochemistry, MNR Medical Collage, Sangareddy, Telangana, India

³QC Manager, Genomix Molecular Diagnostics Pvt. Ltd., Kukatpally, Hyderabad, Telangana, India

⁴Research Scholar, Genomix CARL Pvt. Ltd., Pulivendula, Andhra Pradesh, India

⁵Tutor, Department of Biochemistry, Maheshwara Medical College and Hospital, Chitkul, Isnapur, Telangana, India

⁶Junior Resident, Department of Medicine, MNR Medical College and Hospital, Sangareddy, Telangana State, India

⁷Tutor, Department of Microbiology, Malla Reddy Institute of Medical Sciences, Suraram, Hyderabad, India

⁸Professor, Department of Biochemistry, MNR Medical Collage, Sangareddy, Telangana, India

⁹Director, MNR Research Foundation, MNR Educational Trust, Hyderabad, India

*Corresponding author email: nagababu00799@gmail.com

	International Archives of Integrated Medicine, Vol. 3, Issue 9, September, 2016.	
	Copy right © 2016, IAIM, All Rights Reserved.	
	Available online at http://iaimjournal.com/	
	ISSN: 2394-0026 (P)	ISSN: 2394-0034 (O)
	Received on: 26-08-2016	Accepted on: 02-09-2016
	Source of support: Nil	Conflict of interest: None declared.
How to cite this article: Bandi A, Pyadala N, Srivani N, Borugadda R, Maity SN, Ravi Kumar BN, Polavarapu R. A comparative assessment of thyroid hormones and lipid profile among hypothyroid patients: A hospital based case control study. IAIM, 2016; 3(9): 108-114.		

Abstract

Background: In India, thyroid disorders are the most common among all the endocrine disorders and hypothyroidism being more common than hyperthyroid state and carcinoma.

Objectives: The present study was undertaken to assess the association of dyslipidemia in hypothyroid patients.

Materials and methods: A total of 50 study subjects of both gender groups were selected from the medicine ward of Maheshwara Hospital during the period from January 2016 to April 2016. Fasting venous blood sample were analysed for Thyroid hormones like, T3, T4, TSH and lipid profile. Statistical analysis was done using student unpaired t test.

Result: The thyroid stimulating hormone (TSH) and total cholesterol, LDL, VLDL values were significantly higher, whereas T3, T4 and HDL values were in a decreasing order with that of control group.

Conclusion: The present study concludes that hypothyroidism is associated with dyslipidemia having raise in all lipid parameters, which may increase the risk of cardiovascular diseases. Finally regular assessment of thyroid hormones and lipid profile among hypothyroid patients can prevent progression of the disease to severity.

Key words

Hypothyroidism, Thyroid Profile, Cardiovascular disease, Euthyroid, Dyslipidemia, Thyroid stimulating hormone (TSH), Triiodothyronine (T3), Tetraiodothyronine (T4).

Introduction

Globally, thyroid gland diseases are the commonest endocrine disorder and most abundant public health problems. Worldwide, approximately 42 million people were suffering from thyroid dysfunction with a prevalence of 4-5%. In India, thyroid disorders are the most common among all the endocrine disorders and hypothyroidism being more common than hyperthyroid state and carcinoma [1, 2].

Hypothyroidism is a common disorder in which thyroid activity is reduced and does not produce enough thyroid hormones. It leads to hyper secretion of pituitary thyroid stimulating hormone (TSH) and an increased serum level of TSH is observed. This is a key biochemical finding, particularly in the early detection of thyroid dysfunction [3, 4, 5]. Hypothyroidism can cause a number of symptoms such as depression, weight gain, feeling tiredness, and affects the reproductive, nervous, renal, pulmonary, neuromuscular and cardiovascular system. Thyroid hormones regulate and show significant effects on the mobilization, synthesis, and metabolism of lipids [6, 7]. So derangement in lipid metabolism is associated with signs and symptoms of cardiovascular diseases.

So, the present study was undertaken to assess the association of dyslipidemia in hypothyroid patients as early detection and treatment will help to prevent progression of the disease to severity.

Materials and methods

The present study was carried out at Maheshwara Medical College and Hospital situated in Patancheru, part of Medak District, Telangana state. A total of 50 study subjects of both gender groups were selected from the medicine ward of Maheshwara Hospital during the period from January 2016 to April 2016. This study was approved by institutional ethical committee and investigations were carried out in the biochemistry laboratory, Maheshwara Medical College and Hospital, Patancheru.

Inclusion criteria

- A criterion of primary hypothyroidism was defined by clinical features of hypothyroidism.
- Hypothyroid patients of age group 30-70 years.

Exclusion criteria

All the patients with past history of thyroid disease, drugs, malignancy, radiotherapy to chest and neck areas, pregnant, patients with chronic illness and familial lipid disorders, were excluded from the study.

Collection of blood sample

Blood samples were collected, after 12 hours fast from the above study subjects. 5ml of blood from the cubital vein was collected in a plain bottle after explaining the procedure to the study subjects. Serum was separated from the blood samples by a centrifuged machine at 3000 rpm for 10 minutes in the biochemistry department. Following estimations are carried out on the serum samples by standard kit methods and analyses were performed on COBAS e411 auto analyzer.

Parameters measured

In the present study following parameters were measured:

- Triiodothyronine (T3)
- Tetraiodothyronine (T4)
- Thyroid stimulating hormone (TSH)
- Total Cholesterol (TC)
- Triglycerides (TG)
- High Density Lipoprotein – Cholesterol (HDL-C)

The Serum total cholesterol was measured by CHOD – PAP method [8], Triglycerides were measured by GPO-Trinder method [9], HDL-Cholesterol measured by Phosphotungstic acid method [10] and the values of Low Density

Lipoprotein cholesterol (LDL-C) and Very-low-density lipoprotein cholesterol (VLDL-C) can be calculated by using Friedewald's equation [11, 12] as follows;

- $LDL - Cholesterol = total\ cholesterol - (HDL - cholesterol + triglycerides / 5)$
- $VLDL - C = Triglycerides / 5.$

Reference range

The normal reference ranges according to the kits are: TSH (0.7-6.4 μ IU/ml), T3 (0.52-1.85 ng/ml), T4 (4.0-11.0 μ g/dl. Normal values for lipid profile parameters are total cholesterol (< 200 mg/dl), triglycerides (< 150mg/ dl), HDL-Cholesterol (30-60 mg/dl), LDL- Cholesterol (< 100 mg/ dl), and VLDL-Cholesterol (20-40 mg/dl).

Statistical analysis

The collected data were analyzed by SPSS software version 16.0. All results were presented as mean \pm standard deviation (SD). A p-value of less than 0.0001 was considered significant.

Results

In the present study, total 50 subjects were divided into two groups, 25 controls (Euthyroid subjects) and 25 cases (Hypothyroid patients) with the age range of 30 –70 years. Out of 25 controls, 12 were males and 13 females and in 25 hypothyroid patients, 09 were males and 16 females as per **Table - 1**. The mean \pm SD of age in years was 49.12 \pm 15.26 in cases and 47.56 \pm 13.41 in healthy controls as per **Table - 1**.

Table - 1: Age and Gender wise distribution of Cases and Controls.

Age (Years)	Controls (n=25)		Cases (n=25)	
	Males	Females	Males	Females
30- 40	02	09	02	05
41-50	02	03	02	04
51-60	03	01	03	04
61-70	05	00	02	03
Total	12	13	09	16
Mean \pm SD	47.56 \pm 13.41		49.12 \pm 15.26	

The mean \pm SDs of T3 (ng/ml), T4 (μ g/dl), and TSH (μ IU/ml), in controls were in the range of 1.32 ± 0.30 , 9.26 ± 1.82 , 2.17 ± 1.07 , respectively. It was observed that the mean \pm SDs of T3 (ng/ml), T4 (μ g/dl), and TSH (μ IU/ml), in cases were in the range of 0.77 ± 0.33 , 6.94 ± 1.53 , and 10.61 ± 3.20 , respectively. It was evident that T3 and T4 levels were decreased in cases as compared to controls and TSH levels were increased in cases as compared to controls and the increase was statistically highly significant ($p < 0.0001$) as per **Table - 2**.

The mean \pm SDs of TC, TG, HDL-C, LDL-C and VLDL-C, in controls were in the range of 177.48 ± 15.01 , 126.92 ± 20.16 , 45.12 ± 3.96 , 106.9 ± 13.41 , and 25.38 ± 4.03 , respectively. It is observed that the mean \pm SDs of TC, TG, HDL-C, LDL-C and VLDL-C, in cases were in the range of 236 ± 38.96 , 229.96 ± 56.69 , 39.68 ± 2.78 , 150.3 ± 34.97 , and 45.99 ± 11.33 , respectively. It was evident that TC, TG, LDL-C and VLDL-C levels were increased in cases as compared to controls. The mean \pm SD level of serum HDL was statistically significantly decreased in hypothyroid cases compared to healthy controls ($P < 0.0001$) as per **Table - 2**.

Table - 2: Comparison of T3, T4, TSH and Lipid Profile between controls and hypothyroid patients

Parameters	Controls (n=25)	Cases (n=25)	t- value	p-value
	Mean \pm SD	Mean \pm SD		
T3 (ng/ml)	1.32 ± 0.30	0.77 ± 0.33	5.94	< 0.0001 *S
T4 (μg/dl)	9.26 ± 1.82	6.94 ± 1.53	4.87	< 0.0001 *S
TSH (μIU/ml)	2.17 ± 1.07	10.61 ± 3.20	12.50	< 0.0001 *S
TC (mg/dl)	177.48 ± 15.01	236 ± 38.96	7.00	< 0.0001 *S
TG (mg/dl)	126.92 ± 20.16	229.96 ± 56.69	8.56	< 0.0001 *S
HDL-C (mg/dl)	45.12 ± 3.96	39.68 ± 2.78	5.62	< 0.0001 *S
LDL-C (mg/dl)	106.9 ± 13.41	150.3 ± 34.97	5.78	< 0.0001 *S
VLDL-C (mg/dl)	25.38 ± 4.03	45.99 ± 11.33	8.56	< 0.0001 *S

S* = Statistically Significant.

Discussion

In the present study, we evaluated the relationship between thyroid hormones and serum lipid profile. The present study reveals that the mean \pm SD of the TSH and total cholesterol, TG, LDL, and VLDL were significantly higher in hypothyroid patients compared to healthy euthyroid subjects.

In the present study, the mean \pm SD of age in cases was 49.12 ± 15.26 and 47.56 ± 13.41 in healthy controls and higher numbers of cases were seen in 40- 60 years age group. Similar studies were reported by Desai JP et al. and Luboshitzky, et al. [13, 14]. In the present study female predominance is more than the male of total cases. Similar findings were reported by Bhandopadhyay, et al., and Desai JP, et al. [15,

13]. The incidence and prevalence of thyroid disease are more prevalent in women than men and the percentage of thyroid dysfunction among women was 13% among men was 5% [16].

In the present study, the mean \pm SD levels of cholesterol were significantly higher in hypothyroid patients than that of healthy euthyroid subjects. Similar findings were reported by Evangelos N, et al. [17], Dalmacio A, et al. [18], Abrams JJ, et al. [19]. In hypothyroid patients, the activity of β -hydroxy β methyl glutaryl Co A (HMG-CoA) reductase is reduced, there is often an increase in the serum cholesterol, mainly due to increased levels of serum LDL and intermediate density lipoprotein (IDL) [17]. In addition, incompletely degraded VLDL particles enriched in TC and

apolipoprotein E, which is accumulating in the thyroid subjects and decreased activities of hepatic lipase and lipoprotein lipase, seems to contribute to those alterations [20, 21].

In the present study, the mean \pm SD levels of TSH 10.61 ± 3.20 μ IU/ml, were significantly higher in hypothyroid patients than that of healthy euthyroid subjects. Similar findings were reported by Singh BM, et al. [22] and Prakash A, et al. [23]. In our study, there was a highly significant difference between normal and abnormal values of T3 and T4 ($p < 0.0001$) similar findings were observed by Singh PA, et al. [24], who found that the (T3, T4) level significantly decrease when compared to control.

In the present study we observed a significant increase in mean \pm SD levels of and LDL and TG in study group compared with controls. Similar findings were observed by Al-Hakeim HK, et al. [25] and Archana Prakash, et al. [26] in hypothyroid patients showing significant increase in TC and LDL-C with decrease in HDL levels [26].

In the present study, we evaluated the relationship between thyroid hormones and serum lipid profile. The present study reveals that the mean \pm SD of the TSH and total cholesterol, TG, LDL, and VLDL were significantly higher in hypothyroid patients compared to healthy euthyroid subjects.

In our study, we evaluated the relationship between thyroid hormones and serum lipid profile among hypothyroid patients. To some extent, we have succeeded in correlating hypothyroid with the altered lipid profile. However, our study involved in small sample size due to limited period and therefore the results inferred may not be considered as the reflection of larger population. Regular evaluation of T3, T4, TSH and lipid profile is must in all hypothyroid cases to stop further aggravation and risk of cardiovascular diseases.

Conclusion

The present study concludes that hypothyroidism is associated with dyslipidemia having raise in all lipid parameters, which may increase the risk of cardiovascular diseases. Finally regular assessment of thyroid hormones and lipid profile among hypothyroid patients can prevent progression of the disease to severity.

Acknowledgement

We are thankful to Genomix Molecular Diagnostics Pvt. Ltd. and Maheshwara Medical College and Hospital for their invaluable help and support.

References

1. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T (4), and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). *J Clin Endocrinol Metab.*, 2002; 87: 489-99.
2. N. Kochupillai. *Clinical endocrinology in India*. Current science, 2000; 79(8).
3. Hypothyroidism. National Institute of Diabetes and Digestive and Kidney Diseases. March 2013. Retrieved 5 March 2016.
4. Galesanu C, Lisnic N, Teslara R, Apotsa L, Zbranca E. Lipid profile in a group of hypothyroid patients vs treated hypothyroid patients. *Rev Med Chir Soc Med Nat Lasi.*, 2004; 108(3): 554-560.
5. Golden SH, Robinson KA, Saldanha I, Anton B, Ladenson PW. Prevalence and incidence of endocrine and metabolic disorders in the United States: a comprehensive review. *Journal of Clinical Endocrinology & Metabolism*, 2009; 94(6): 1853-1878.
6. Toft A. Hypothyroidism. Study of lipid profile in hypothyroidism. *Med Intern*, 1989; 8: 2596-2600.

7. Erem C. Blood coagulation, fibrinolytic activity and lipid profile in subclinical thyroid disease: subclinical hyperthyroidism increase plasma factor X activity. *Clin Endocrinol.*, 2006; 64(3): 323-329.
8. Roeschlau P, Bernt E, Gruber WA. Enzymatic determination of total cholesterol in serum. *Z. Klin. Chem.*, 1974; 12(5): 226.
9. McGowan MW, Trinder P., et al. A peroxidase coupled method for the colorimetric determination of serum triglycerides. *Clin Biochem.*, 1983; 29: 538.
10. Burstein M, Scholnick HR, Morfin R. Rapid method for the isolation of lipoproteins from human serum by precipitation with polyanions. *J. Lipid Res.*, 1970; 11(6): 583-595.
11. Friedwald WT, Levy RI, Fredrichseon DS. Estimation of the concentration of low density lipoproteins in plasma without ultracentrifuge. *Clin Chem.*, 1972; 18: 499-502.
12. Pyadala N, Bobbiti RR, Borugadda R, Bitinti S, Maity SN, Mallepaddi PC, Polavarapu R. Assessment of lipid profile among hypertensive patients attending to a rural teaching hospital, Sangareddy. *Int J Med Sci Public Health*, 2016; 5.
13. Desai JP, Vachhani UN, Modi G, Chauhan K. A study of correlation of serum lipid profile in patients with hypothyroidism. *Int J Med Sci Public Health*, 2015; 4: 1108-1112.
14. Luboshitzky R, Aviv A, Herer P, Lavie L. Risk factors for cardiovascular disease in women with subclinical hypothyroidism. *Thyroid*, 2002; 12: 421-5.
15. Bhandopadhyay SK, Basu AK, Pal SK, Roy P, Chakrabarti S, Pathak HS, et al. Study of dyslipidemia in subclinical hypothyroidism. *J Indian Med Assoc.*, 2006; 104: 622-6.
16. Aminorroaya A, Janghorbani M, Amiri A, et al. the prevalence of thyroid dysfunction in an iodine sufficient area in Iran. *Arch Iranian Med.*, 2009; 12: 262-270.
17. Evagelos N Liberopoulos, Moses S Elisaf. Dyslipidemia in patients with thyroid disorders. *Hormones*, 2002; 1(4): 218 – 223.
18. Dalmacio Agedeppa, Chamel Macaron, Tilak Mallik, N. D. Schnuda. Plasma high density lipoprotein cholesterol in thyroid disease. *J. Clin. Endocrinol. Metab*, 1979; 49: 726-729.
19. Abrams JJ, Grundy SM. Cholesterol metabolism in hypothyroidism and hyperthyroidism in man. *J. Lipid. Res.*, 1981; 22: 323 – 338.
20. Muls E, M Rosseneu, G Lamberigts, P Demoor. Changes in the distribution and composition of high –density lipoproteins in primary hypothyroidism. *Metabolism*, 1985; 34(4): 345 – 353.
21. Kutty M Kutty, David G. Brayant, Nador R. Farid, Serum lipids in Hypothyroidism-A Re-evaluation. *J. Clin. Endocrinol. Metabol.*, 1978; 46(1): 55 – 60.
22. Singh BM, Goswami B, Mallika V. Association between insulin resistance and hypothyroidism in females attending a tertiary care hospital. *IJCB*, 2010; 25(2): 141-5.
23. Prakash A, Lal AK. Serum lipids in hypothyroidism: our experience. *IJCB*, 2006; 21(2): 153-5.
24. Singh PA, Bobby Z, Selvaraj N, Vinayagamoorthi R. An evaluation of thyroid hormone status and oxidative stress in undialyzed chronic renal failure patients. *Indian Journal of Physiology and Pharmacology*, 2006; 50: 279-284.
25. Al-Hakeim HK. Serum levels of lipids, calcium and magnesium in women with hypothyroidism and cardiovascular diseases *J. Lab Physicians*, 2009; 1(2): 49 - 52.

Bandi A, Pyadala N, Srivani N, Borugadda R, Maity SN, Ravi Kumar BN, Polavarapu R. A comparative assessment of thyroid hormones and lipid profile among hypothyroid patients: A hospital based case control study. IAIM, 2016; 3(9): 108-114.

26. Archana Prakash, Ashok kumar Lal. Serum lipids in hypothyroidism: our experience. Indian J. Clinical Biochemistry, 2006; 21(2): 153 – 155.