

Original Research Article

Association Of Thyroid And Lipids Profile In Euthyroid, Hypothyroidism And Hyperthyroidism Subjects

Soni Ravikant ^{1*}, Ankur Kumar Bichhwaliya² Nand Kishor Tak³ Jai Prakash Yogi⁴ Ram Kishan Jat⁵ Shrikant Choudhary⁶

^{1*} Associate Professor, Department Of Biochemistry, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

² Assistant Professor, Department Of Anatomy, Mahatma Gandhi Medical College And Hospital, Jaipur, Rajasthan, India Email: bichhwalia04ankur@gmail.com Mob: 8104401929

³ Associate Professor, Department Of Psychiatry, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

⁴ Assistant Professor, Department Of Biochemistry, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

⁵ Associate Professor, Department Of Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

⁶ Assistant Professor, Department Of Medicine, Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan, India

***Corresponding Author:** Ankur Kumar Bichhwaliya

*Assistant Professor, Department Of Anatomy, Mahatma Gandhi Medical College And Hospital, Jaipur, Rajasthan, India Email: bichhwalia04ankur@gmail.com Mob: 8104401929

ABSTRACT:

Background- Thyroid hormones play important role in normal growth and maturation of skeletal system. Thyroid function regulates a wide array of metabolic parameters. Thyroid gland produce two important hormones triiodothyronine (T3) and thyroxine (T4) which are known as T3 and T4. Hypothyroidism and hyperthyroidism are two primary pathological conditions that involve thyroid glands. Disorder of thyroid gland are among the most abundant endocrine disorders in India

Aims and Objectives- To investigate the association of Lipid profile in thyroid dysfunction patients.

Materials And Methods- A total of 100 thyroid dysfunction patients visiting the outpatient Department of General Medicine of Mahatma Gandhi Medical College & Hospital, Jaipur was enrolled for the study. Age up to 60 years, either gender and Patients who were willing to participate and sign consent document. Blood samples after overnight fasting were collected by standard aseptic techniques. The samples collected were subjected to following investigations: Serum T3, T4, TSH and Serum Lipid profile (Serum cholesterol, Triglycerides, HDL cholesterol, LDL cholesterol, & VLDL).

Results- In this study the mean serum T3, T4 and TSH levels among the three groups. Mean Serum T3 levels were reported low as 0.89 ng/ml in the hypothyroid group and as high as 2.13 ng/ml in the hyperthyroid group. The mean T4 levels were reported low as 3.22 µg/dl in the hypothyroid group while it was as high as 17.39 µg/dl in the hyperthyroid group. Mean serum TSH was reported 68.93 µIU/ml in hypothyroid group and 0.22 µIU/ml in hyperthyroid group

Conclusion-The present study suggests that TSH was positively associated with serum TC and LDL. Increase the rate of metabolism in hyper secretion of thyroid besides serum lipid levels decrease. Caused by increased hepatic uptake due to an enhanced affinity for the LDL receptor, and regulatory protein of TG. Independent risk marker of CVD is dyslipidemia

Keywords: - Lipids Profile, Hypothyroidism, Hyperthyroidism

INTRODUCTION:

Thyroid hormones play important role in normal growth and maturation of skeletal system.¹ Thyroid function regulates a wide array of metabolic parameters. Thyroid function significantly affects lipoprotein metabolism as well as some cardiovascular disease (CVD) risk factors, thus influencing over all CVD risk.²⁻⁴ Thyroid gland produce two important hormones triiodothyronine (T3) and thyroxine (T4) which are known as T3 and T4. T3 is biologically more active form of thyroid hormone.⁵ The secretion of thyroid hormones is controlled by the hypothalamus-pituitary-thyroid axis. Plasma levels of T4 and T3 are regulated by a feedback mechanism, in which hypothalamic thyrotropin-releasing hormone (TRH) stimulates the synthesis and release of thyrotropin (TSH) by the anterior pituitary, thus stimulating the secretion of T4 and T3 by the thyroid gland.⁶ Disorder of thyroid gland are among the most abundant endocrine disorders in India. It has been estimated that about 42 million people in India suffer from thyroid disease. Compare to other diseases thyroid diseases are different from in terms of their ease of diagnosis, accessibility of medical treatment, and the relative visibility that even a small swelling of the thyroid offers to the treating physician. Early diagnosis and treatment remain the cornerstone of management. The prevalence of thyroid disorders differs with regional iodine intake, age, gender, ethnicity and topographical.⁷ Hypothyroidism and hyperthyroidism are two primary pathological conditions that involve thyroid glands. The thyroid-stimulating hormone (TSH) is the most sensitive test for diagnosing primary hypothyroidism and hyperthyroidism in OPD.⁸⁻⁹ Hypothyroidism is a most common metabolic disorder in the general population. Indeed, data from the third National Health and Nutrition Examination Survey (NHANES III) showed a 4.6% prevalence of hypothyroidism in the general population, while 9.5% of the Colorado prevalence study participants had elevated levels of TSH.¹⁰ Triiodothyronine and thyroxine decrease concentration levels leads to hyper secretion of pituitary TSH and an amplified increase in serum thyroid-stimulating hormone levels.¹¹⁻¹² This is the best indicator laboratory finding in diagnosis of hypothyroidism. Autoimmune thyroiditis is the commonest cause of hypothyroidism. It can cause many symptoms of such as poor ability to tolerate cold, constipation, depression, a feeling of tiredness and weight gain.¹³⁻¹⁴ Hyperthyroidism is less common than hypothyroidism. Hyperthyroidism (Thyrotoxicosis) occurs due to excessive secretion of thyroid hormone, resulting in increased metabolism.¹⁵ Graves's disease accounts for 80% of hyperthyroidism in iodine-replete areas, it is due to the production of anti-TSH receptor antibodies that stimulate the thyroid gland, resulting in overproduction of thyroid hormone.¹⁶ Signs and symptoms vary between people and may include irritability, muscle weakness, sleeping problems, a fast heartbeat, poor tolerance of heat, weight loss.¹⁷ Thyroid hormones were recognized as catabolic hormones and they control several processes of metabolism, mobilization, including the synthesis and breakdown of lipids. In the metabolism of lipids which include almost all aspects of lipid metabolism like lipid digestion, biosynthesis, transport and catabolism thyroid hormones play an major role.¹⁸ Thyroid hormones stimulate the enzymes involved in the lipid metabolism such as lipoprotein lipase, hepatic lipase, lecithin cholesterol acyltransferase (LCAT) and cholesterol ester transfer protein (CETP).¹⁹ The dyslipidemia is main cause of hypothyroidism by a shift to increased synthesis over degradation rate, with the elevated levels of TC, chiefly LDL-C, providing the substrate for lipid peroxidation by reactive oxygen species (ROS), this resulting in oxidative stress.²⁰ Moreover, the synthesis and rate of catabolism of fatty acids in hypothyroidism is decreased and the lipolytic sensitivity of white fat cells is blunted.²¹ Crucially, the coexistence of dyslipidemia and

hypothyroidism is closely linked to the development of CHD, which is the leading cause of death in the world.²² Therefore, the present study was planned to investigate the association of Lipid profile in thyroid dysfunction patients.

METHODOLOGY

A total of 100 thyroid dysfunction patients visiting the outpatient Department of General Medicine of Mahatma Gandhi Medical College & Hospital, Jaipur was enrolled for the study. Inclusion Criteria: Age up to 60 years, either gender and Patients who were willing to participate and sign consent document. Exclusion criteria: Paediatric age group, type 1 diabetes, latent immune diabetes of the adults, gestational diabetes, and pregnancy, neoplasms, as well as any major medical condition in the 6 months preceding the study (i.e., liver, kidney, and heart failure). Blood samples after overnight fasting were collected by standard aseptic techniques. The samples collected were subjected to following investigations: Serum T3, T4, TSH and Serum Lipid profile (Serum cholesterol, Triglycerides, HDL cholesterol, LDL cholesterol, & VLDL). 100 thyroid dysfunction subjects were grouped on the basis of thyroid function viz. euthyroid, hypothyroidism and hyperthyroidism. The results obtained were presented as mean \pm SD and subjected to statistical evaluation. On applying one way ANOVA among the three groups. A p-value of <0.05 was considered as statistically significant.

RESULTS:

Parameters	Euthyroid (n=34)	Hypothyroidism (n=33)	Hyperthyroidism (n=33)	F-value	P-value
T3 (ng/ml)	1.31 \pm 0.16	0.89 \pm 1.22	2.13 \pm 0.55	21.91	0.000
T4 (μ g/dl)	8.54 \pm 1.86	3.22 \pm 1.77	17.39 \pm 3.17	306.11	0.000
TSH (μ IU/ml)	2.85 \pm 1.30	68.93 \pm 28.12	0.22 \pm 0.19	192.17	0.000
Cholesterol (mg/dl)	155.42 \pm 28.38	166.62 \pm 34.29	140.26 \pm 29.48	6.09	0.003
Triglycerides mg/dl)	129.80 \pm 14.08	177.81 \pm 32.56	121.10 \pm 21.12	54.70	0.000
HDL (mg/dl)	49.64 \pm 6.56	38.82 \pm 5.11	44.10 \pm 9.49	18.52	0.000
LDL (mg/dl)	73.79 \pm 14.24	95.69 \pm 19.02	66.19 \pm 27.64	17.61	0.000
VLDL (mg/dl)	25.96 \pm 2.82	35.56 \pm 6.51	24.22 \pm 4.22	54.70	0.000

DISCUSSION

Tables 1 shows the mean serum T3, T4 and TSH levels among the three groups. Mean Serum T3 levels were reported low as 0.89 ng/ml in the hypothyroid group and as high as 2.13 ng/ml in the hyperthyroid group. Similarly mean T4 levels were reported low as 3.22 μ g/dl in the hypothyroid group while it was as high as 17.39 μ g/dl in the hyperthyroid group. Mean serum TSH was reported 68.93 μ IU/ml in hypothyroid group and 0.22 μ IU/ml in hyperthyroid group. Serum TSH assay is considered as a reliable and accurate test for detection of abnormal levels of thyroid hormones for hypothyroid and hyperthyroid. Thyroid dysfunction was a risk factor for cardiovascular disease mediated by the effects of thyroid hormones on lipids metabolism and blood pressure, yet most subjects at risk for cardiovascular disease were euthyroid in the clinical setting. The relationship between thyroid hormones and atherosclerosis in the euthyroid population had garnered much interest recently.²³⁻²⁵ The mean Serum cholesterol levels were found significantly high (170.70 mg/dl) in hypothyroid patients as compared to euthyroid and hyperthyroid patients. Similar findings were also reported in the mean serum triglycerides and LDL levels. However, F value (54.70) was higher for triglycerides levels as compared to serum cholesterol and LDL levels. It was observed that there was a significant variation in the mean serum HDL levels among the three groups. Serum cholesterol levels were higher in the euthyroid & hypothyroid group whereas the levels were significantly lower in the hyperthyroid group. Alterihy F A et al., 2012 reported hyperthyroidism is associated with decrease levels of lipoprotein. Total cholesterol, LDL cholesterol, Apo B and Lp (a) tend to decrease in these patients. Yun Zhang 2015 conclude TSH was positively associated with serum Total cholesterol and LDL cholesterol.²³⁻²⁴ Singh B M. Goswami B and Mallika., 2010

finding Total cholesterol, TG and LDL cholesterol were significantly high and low HDL level in hypothyroidism as compared with euthyroid. Sigal GA et. al., 2011, it was observed that increased serum Lipoproteins in hypothyroid patients with reduced triglycerides in the subclinical and overt hyperthyroid groups.²⁵⁻²⁶ Rizos CV et. al., 2011 and Risal P et. al., 2010 reported hypothyroidism is known to cause hypercholesterolemia, elevated low-density lipoprotein (LDL), and hypertriglyceridemia and increased activity of the HMG-CoA reductase, levels of total cholesterol, Low density lipoprotein cholesterol, tend to decrease in patients with clinical or subclinical hyperthyroidism.²⁷⁻²⁸ The abnormal serum TSH level influence serum lipid profile level. The study therefore suggests evaluations of serum lipid profile levels is essential for patients suffering from thyroid disorders.

CONCLUSION

The present study suggests that TSH was positively associated with serum TC and LDL. Increase the rate of metabolism in hyper secretion of thyroid besides serum lipid levels decrease. Caused by increased hepatic uptake due to an enhanced affinity for the LDL receptor, and regulatory protein of TG. Independent risk marker of CVD is dyslipidemia There is a need for large studies designed to answer the question whether thyroid abnormalities are associated with CVD and whether restoration of euthyroidism might influence morbidity and mortality.

REFERENCES

1. Kavitha MM, Chandrashekharyya SH, Kashinakunti SV, Sunita H, Neela BM, Sanjeev R. Alteration in levels of Serum Calcium, phosphorus and magnesium in patients of Hypothyroidism. *International journal of Biological & Medical Research*. 2014;5(4):4594-6.
2. Duntas LH. Thyroid disease and lipids. *Thyroid* 2002; 12: 287-93.
3. Friis T, Pedersen LR. Serum lipids in hyper- and hypothyroidism before and after treatment. *Clin Chim Acta* 1987; 162: 155-63.
4. Canaris GJ, Manowitz NR, Mayor G, Ridgway EC. The Colorado thyroid disease prevalence study. *Arch Intern Med* 2000; 160: 526- 34
5. Susanna TY, Sagayaraj A, Shashidhar KN, Gomathi M, Mahesh V. A Correlative study of Thyroid profile and Mineral status in patients with Hypothyroidism - A hospital based case control study. *Asian journal of Pharmaceutical & clinical Research*. 2016;9(3):403-8.
6. Woeber KA. Treatment of hypothyroidism. In: Braverman LE, Utiger RD (eds). *Werner and Ingbar's the Thyroid, a Fundamental and Clinical Text*, 9th edn. Philadelphia, USA: Lippincott Williams & Wilkins. 2005:864-9.
7. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. *Indian J Endocr Metab* 2011;15:S78-81.
8. Reed P, Terry FD, Martin JS, Ian DH. Thyroid physiology and diagnostic evaluation of patients with thyroid disorders. In: Henry MK, Shlomo M, Kenneth SP, P Reed, editors. *Williams Textbook of Endocrinology*. 11th ed. Philadelphia: Saunders Elsevier; 2008 pp.1002.
9. Nouh AM, Ibrahim AM, Basher MA. Prevalence of thyroid dysfunction and its effect on serum lipid profiles in a Murzok, Libya Population. *Thy Sci* 2008;3(1):1-6.

10. Taylor PK. Thyroid disease: Hypothyroidism and Goitre. *Medicine Update* 1993;1:357-9.
11. Rizos CV, Elisaf MS, Liberopoulos EN. Effects of thyroid dysfunction on lipid profile. *Open Cardiovasc Med J.* 2011;5:76-84.
12. Vanderpump MPJ. Epidemiology of thyroid disease. *British Medical Journal.* 2011;99(1):39-51.
13. Galesanu C, Linsic N, Teslaru R, Apostu L, Zbranca E. Lipid profile in a group of hypothyroid patients vs treated hypothyroid patients. *Rev Med ChirSoc Med Nat Lasi* 2004;108(3):554-560.
14. Wijsman L et. al. subclinical thyroid dysfunction and cognitive decline in old age. *PloS ONE* 2013;8(3):e59199.
15. Bahn RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I, Laurberg P, McDougall IR, Montori VM, Rivkees SA, Ross DS. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Thyroid.* 2011 Jun 1;21(6):593-646.
16. Franklyn J, Boelaert K, Thyrotoxicosis. *Lancet* 2012; 379: 1155-66.
17. Devereaux D, Tewelde SZ. Hyperthyroidism and thyrotoxicosis. *Emergency medicine clinics of North America.* 2014 May 31;32(2): 277-92.
18. Ladenson PW, Singer PA, Ain KB, Bagchi N, Bigos ST, Levy EG, et. al. American Thyroid Association guidelines for detection of thyroid dysfunction. *Arch Intern Med.* 2000;160(11):1573-5.
19. Asvold BO, Vatten LJ, Nilsen TI, Bjoro T. The association between TSH within the reference range and serum lipid concentrations in a population based study. The HUNT study. *Eur J Endocrinol.* 2007;156:181-6.
20. Duntas LH. Thyroid disease and lipids. *Thyroid* (2002) 12:287–93. doi: 10.1089/10507250252949405
21. Malbon CC, Moreno FJ, Cabelli RJ, Fain JN. Fat cell adenylate cyclase and beta-adrenergic receptors in altered thyroid states. *J Biol Chem.* (1978) 253:671–8.
22. Gobal FA, Mehta JL. Management of dyslipidemia in the elderly population. *Ther Adv Cardiovasc Dis.* (2010) 4:375–83. doi: 10.1177/1753944710385048
23. Alterihy F A et al. The Association between Thyroid Hormones and Lipid Profile in Patients with Primary Hyperthyroidism. *Medical Journal of Babylon-Vol. 9- No. 4 -2012*
24. Zhang et al. *BMC Endocrine Disorders* (2015) 15:12 DOI 10.1186/s12902-015-0008-3
25. Singh BM, Goswami B and Mallika V. Association between insulin resistance and hypothyroidism in females attending a tertiary care hospital. *Indian Journal of Clinical Biochemistry,* 2010 ; 25 (2) 141-145.

26. Sigal GA, Medeiros-Neto G, Vinagre JC, Diament J, Maranhão RC 2011 Lipid metabolism in subclinical hypothyroidism: plasma kinetics of triglyceride-rich lipoproteins and lipid transfers to highdensity lipoprotein before and after levothyroxine treatment. *Thyroid* 21:347–353
27. Rizos CV, Elisaf MS, Liberopoulos EN. Effects of thyroid dysfunction on lipid profile. *Open Cardiovasc Med J.* 2011;5:76-84.
28. Risal P, Maharjan BR, Koju R, Makaju RK, Gautam M. Variation of total serum cholesterol among the patient with thyroid dysfunction. *Kathmandu Univ. Med J* 2010;8: 265-8.