Section: Biochemistry

Original Research Article

THYROID DYSFUNCTION AND ITS INFLUENCE ON SERUM LIPID PROFILES: A CROSS-SECTIONAL STUDY IN NORTH KERALA

Rejitha Ramachandran[1], M G Joseraj[2], Udaya Bhaskaran V[3], Saritha C Joseph[4]

[1]*Department of Biochemistry, Govt. Medical College, Manjeri, Kerala, India.*
[2]*Department of Biochemistry, KMCT Medical college, Manassery, Kozhikode, India.*
[3]*Department of Medicine, Malabar medical College, Ulliyeri Modakallur, Kerala, India.*
[4]*Department of Biochemistry, Government Medical College, Thrissur, India.*

Received *: 21/10/2023*
Received in revised form *: 03/12/2023*
Accepted *: 16/12/2023*

Corresponding Author:
Dr. Rejitha Ramachandran
Assistant Professor
Dept of Biochemistry
Govt Medical college,Manjeri
Email: reji.ramchndrn@gmail.com

DOI: 10.5530/ijmedph.2023.4.4

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2023; 13 (4); 19-22

ABSTRACT

Background: Kerala, a southern Indian state, demonstrates a relatively high incidence of thyroid dysfunction. However, there is a lack of studies on dyslipidemia in thyroid disorders specific to Kerala. This study aims to generate data on lipid parameter abnormalities in patients with thyroid disorders, encompassing both hypo- and hyperthyroidism, at a tertiary care teaching institute.

Materials and Methods: A cross-sectional study was carried out on individuals attending the General Medicine and Endocrinology clinic over a one-year period. Sixty patients with newly diagnosed thyroid dysfunction, comprising 30 with hypothyroidism and 30 with hyperthyroidism, were chosen as cases and compared to 30 age-matched healthy controls. Levels of total cholesterol, triglycerides, Low density lipoprotein cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C), very low density lipoprotein cholesterol (VLDL-C) and LDL/HDL ratio were estimated and compared.

Results: Ninety subjects were studied, including 30 with hypothyroidism, 30 with hyperthyroidism, and 30 euthyroid individuals. The majority of patients with thyroid disorders were in the 36-50 age groups, and most individuals with thyroid dysfunction were females. Hypothyroidism was associated with increased total cholesterol and LDL-C, while hyperthyroidism showed decreased total cholesterol, triglycerides, LDL-C, and the LDL/HDL ratio.

Conclusion: Screening for lipid profiles is crucial in all patients with thyroid dysfunction, and it is essential to identify and address underlying lipid abnormalities.

Keywords: Hypothyroidism, Hyperthyroidism, Lipid profile, Kerala.

INTRODUCTION

As in the rest of the world, in India too, thyroid diseases are among the most prevalent endocrine disorders worldwide.[1,2] Thyroid hormones impact various metabolic parameters, influencing the metabolism of lipoproteins and exerting multiple effects on the regulation of lipid metabolism.[3,4] Numerous studies have reported that lipid levels tend to increase with rising TSH levels. A cross-sectional population survey conducted in the urban coastal regions of central Kerala revealed that 19.6% of the subjects had abnormalities in thyroid function.[5] Currently, there is a dearth of studies on dyslipidemia in thyroid disorders in Kerala. This study aims to establish a database on lipid parameter abnormalities in patients with thyroid disorders encompassing both hypo- and hyperthyroid patients at a tertiary care teaching institute in Kerala.

MATERIAL AND METHODS

This cross-sectional study was conducted among subjects who reported to the General Medicine and Endocrinology clinics at Government Medical College (GMC), Kozhikode, over a period of one year from 1st January 2014 to 31st December 2014. The study was approved by the Institutional Ethics

Committee (IEC), GMC Kozhikode. Sixty patients with newly diagnosed thyroid dysfunction, including 30 with hypothyroidism and 30 with hyperthyroidism, were selected as cases and compared with 30 age-matched healthy controls. Patients with acute illness, coronary artery disease, hepatic or renal dysfunction, diabetes, those on treatment for thyroid diseases or dyslipedimia, and pregnant patients were excluded. A history and detailed clinical examination were conducted, and BMI was calculated. The estimation of Free Triiodothyronine (fT3), Thyroxine (T4), Triiodothyronine (T3) and Thyroid-Stimulating Hormone (TSH) was performed using the chemiluminescence method with the Cobas e11 Immunoassay analyzer and Elecsy's reagent kits. A fasting lipid profile was done, including measurements of total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), very low-density lipoprotein cholesterol (VLDL-C), low-density lipoprotein cholesterol (LDL-C), and the LDL/HDL ratio. The results were then documented and compared. All data analysis was performed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS, version 16) software for Windows. The results were statistically analyzed for significance using One-way ANOVA and the chi-square test. Results with a p-value of <0.05 were considered significant.

RESULTS

A total of 90 subjects were studied, that comprised 30 with hypothyroidism, 30 with hyperthyroidism, and 30 euthyroid individuals. The mean age of the study population was 40 years (SD-9.71). Of the participants, 64.4% were females. Most patients with thyroid disorders belonged to the 36-50 age group, and the majority of those with thyroid dysfunction were females. Total cholesterol and LDL-C were seen to be higher in patients with hypothyroidism. In patients with hyperthyroidism, total cholesterol, triglycerides, LDL-C, and the LDL/HDL ratio were found to be lower. Baseline Characteristics of the study population are presented in Table 1, while the relationship between lipid parameters and thyroid status, and comparison of mean values for various parameters are illustrated in Tables 2 & 3 respectively

Table 1: Baseline Characteristics of the study population

	Thyroid Status		
	Euthyroid N (%)	**Hypothyroid N (%)**	**Hyperthyroid N (%)**
Age group			
20-35	12(40)	11(36.7)	9(30)
36-50	14(46.7)	15(50)	18(60)
51-75	4(13.3)	4(13.3)	3(10)
Gender			
Male	11(36.7)	9(30)	12(40)
Female	19(63.3)	21(70)	18(60)
fT3			
0-3.1	0	21(70)	0
3.11-6.8	30(100)	9(30)	8(26.7)
6.81-100	0	0	22(73.3)
T3			
<1.30	3(10.0)	20(66.7)	0
1.30-3.10	27(90.0)	10(33.3)	5(16.7)
>3.10	0	0	25(83.3)
T4			
<66	1(3.3)	20(66.7)	1(3.3)
66-181	29(96.7)	10(33.3)	27(90)
>181	0	0	2(6.7)
TS**H**			
<0.27	0	0	27(90)
0.27-4.2	30(100)	1(3.3)	3(10)
>4.2	0	29(96.7)	0

[fT3-Free Triiodothyronine, T4- Thyroxine, T3- Triiodothyronine, TSH- Thyroid-Stimulating Hormone]

Table 2: Relationship between Serum Lipid Profile and Thyroid Status

	Thyroid Status				
	Euthyroid N(%)	**Hypothyroid N(%)**	**Hyperthyroid N(%)**	**Chi**	**p-Value**
Total Cholesterol (mg/dl)				16.86	0.002
150-200	20(66.7)	11(36.7)	25(83.3)		
200-250	7(23.3)	9(30)	4(13.3)		
>250	3(10)	10(33.3)	1(3.3)		
HDL-C (mg/dl)				0.9	0.638
<30	4(13.3)	4(13.3)	2(6.7)		
30-60	26(86.7)	26(86.7)	28(93.3)		
LDL-C (mg/dl)				29.88	<0.001
<100	5(16.7)	3(10)	18(60)		

100-200	24(80)	19(63.3)	11(36.7)		
>200	8(26.7)	8(26.7)	1(3.3)		
VLDL-C (mg/dl)				15.04	0.005
<20	17(58.7)	16(53.3)	15(50)		
20-40	11(37.9)	11(36.7)	4(13.3)		
>40	1(3.4)	3(10)	11(36.7)		
Triglycerides (mg/dl)				5.51	0.064
50-150	26(86.7)	29(96.7)	30(100)		
150-300	4(13.3)	1(3.3)	0		
LDL/HDL Ratio				14.98	0.005
<3.2	3(10)	4(13.3)	14(46.7)		
3.21-4.58	12(40)	12(40)	10(33.3)		
>4.59	15(50)	14(46.7)	6(20)		
TC/HDL-C ratio				12.96	0.11
<4.85	14(46.7)	12(40)	24(80)		
4.86-6.58	12(40)	10(33.3)	4(13.3)		
>6.58	4(13.3)	8(26.7)	2(6.7)		

[TC - Total cholesterol, TG - Triglycerides, HDL-C - high-density lipoprotein cholesterol, VLDL-C - very low-density lipoprotein cholesterol and LDL-C - low-density lipoprotein cholesterol]

Table 3: Comparison of Lipid Profile Parameters in Hypothyroid, Hyperthyroid, and Euthyroid Patients

	Thyroid Status			
	Euthyroid (N=30) [Mean& SD]	**Hypothyroid (N=30)**	**Hyperthyroid (N=30)**	**p-value**
Age in years	41.20(10.03)	39.57(10.09)	39.73(9.22)	0.78
BMI	25.79(3.65)	24.37(3.96)	25.38(4.06)	0.35
TC (mg/dl)	199.53(33.65)	247.03(85.58)	178.0(33.26)	<0.001
HDL-C(mg/dl)	40.10(7.23)	43.8(8.18)	42.93(8.73)	0.184
LDL-C (mg/dl)	182.86(35.17)	223.21(84.70)	152.02(38.24)	<0.001
VLDL-C (mg/dl)	27.37(18.04)	28.17(13.09)	42.87(28.61)	0.008
TG (mg/dl)	117.13(31.05)	99.9(24.93)	84.80(21.09)	<0.001
LDL/HDL ratio	4.75(1.36)	5.26(2.07)	3.79(1.75)	0.006
TC/HDL ratio	5.15(1.27)	5.79(2.01)	4.37(1.59)	0.006

[BMI - Body Mass Index, TC-Total cholesterol, TG - Triglycerides, HDL-C - high-density lipoprotein cholesterol, VLDL-C - very low-density lipoprotein cholesterol and LDL-C low-density lipoprotein cholesterol]

DISCUSSION

Thyroid diseases are widespread worldwide, including in India, where an estimated 42 million people are affected.[1,2] Kerala, a state in southern India, has a relatively high incidence of thyroid dysfunction. Studies indicate that the prevalence of hypothyroidism, the predominant form of thyroid dysfunction in the state, is notably higher than the national average.[5]

Thyroid hormones stimulate the activity of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, the initial step in cholesterol biosynthesis.[6] Triiodothyronine (T3) up regulates LDL receptors by controlling the activation of the LDL receptor gene. Elevated serum total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) levels in hypothyroid subjects may be attributed to a lower number of cell-surface receptors for LDL, leading to reduced LDL catabolism and decreased fractional clearance of LDL. Conversely, hyperthyroidism is associated with increased cholesterol excretion and enhanced turnover of LDL, resulting in a decrease in both TC and LDL levels.[7] Another effect of T3 is the up regulation of apolipoprotein AV (ApoAV), which plays a major role in regulating triglycerides (TG).[8]

In the current study, the mean serum total cholesterol levels in the hypothyroid group were observed to be higher than those in the euthyroid group. This observation is consistent with findings reported in other studies.[3,9-11] Additionally, the mean serum triglyceride level in the hypothyroid group was slightly lower compared to the normal group in our study. In hypothyroid patients, the synthesis of plasma triglycerides remains normal, but there is a notable reduction in the fractional removal of both endogenous and exogenous triglycerides.[12]

Previous studies have shown a notable decrease in HDL-C levels among the hypothyroid group compared to the control group. However, the current study did not reveal any significant difference, potentially due to the smaller sample size.[12,13] The typical reduction in HDL-C levels is explained by the increased activity of cholesteryl-ester transfer protein (CETP) and lipoprotein lipase in hypothyroid patients. CETP facilitates the exchange of cholesteryl esters from HDL to VLDL and triglycerides in the opposite direction.[10]

In hyperthyroidism, a decrease was observed in total cholesterol, triglycerides, LDL-C, VLDL-C, and the LDL: HDL ratio.[7] The present study showed a significant reduction in LDL-C levels within the hyperthyroid group. The mean value of the LDL-C/HDL-C ratio in the hyperthyroid group was lower than that in the control group, consistent with available literature.[13]

A negative association between thyroid hormone levels and body mass index has been documented in literature.[4,14] However, the present study did not demonstrate any significant change in BMI among the compared groups.

CONCLUSION

The hypothyroid state plays a role in elevated cholesterol levels, which, in turn, may contribute to cardiovascular complications. Biochemical screening for lipid profiles is crucial for all patients with thyroid dysfunction, and underlying lipid abnormalities need to be identified and addressed.

REFERENCES

1. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. Indian J Endocrinol Metab. 2011 Jul;15(Suppl 2):S78-81.
2. Kochupillai N. Clinical endocrinology in India. Current science. 2000 Oct 25;79(8):1061-7.
3. Pearce EN. Hypothyroidism and dyslipidemia: modern concepts and approaches. Curr Cardiol Rep. 2004 Nov;6(6):451-6.
4. Knudsen N, Laurberg P, Rasmussen LB, Bülow I, Perrild H, Ovesen L, Jørgensen T. Small differences in thyroid function may be important for body mass index and the occurrence of obesity in the population. J Clin Endocrinol Metab. 2005 Jul;90(7):4019-24.
5. Usha Menon V, Sundaram KR, Unnikrishnan AG, Jayakumar RV, Nair V, Kumar H. High prevalence of undetected thyroid disorders in an iodine sufficient adult south Indian population. J Indian Med Assoc. 2009 Feb;107(2):72-7.
6. Bakker O, Hudig F, Meijssen S, Wiersinga WM. Effects of triiodothyronine and amiodarone on the promoter of the human LDL receptor gene. Biochem Biophys Res Commun. 1998 Aug 19;249(2):517-21.
7. Rizos CV, Elisaf MS, Liberopoulos EN. Effects of thyroid dysfunction on lipid profile. Open Cardiovasc Med J. 2011;5:76-84.
8. Prieur X, Huby T, Coste H, Schaap FG, Chapman MJ, Rodríguez JC. Thyroid hormone regulates the hypotriglyceridemic gene APOA5. J Biol Chem. 2005 Jul 29;280(30):27533-43.
9. Prakash A, Lal AK. Serum lipids in hypothyroidism: Our experience. Indian J Clin Biochem. 2006 Sep;21(2):153-5.
10. Khan FA, Patil SKB, Thakur AS, Khan MF, Murugan K. Lipid Profile in Thyroid Dysfunction: A Study on Patients of Bastar. J Clin Anal Med. 2014; 5:12-14.
11. Bansal A, Kaushik A, Sarathe H. Effect of thyroid on lipid profile and renal function: an observational study from tertiary care centre of tribal region of bastar. Ann Med Health Sci Res. 2014 Jul;4(Suppl 2):S140-3.
12. Agdeppa D, Macaron C, Mallik T, Schnuda ND. Plasma high density lipoprotein cholesterol in thyroid disease. J Clin Endocrinol Metab. 1979 Nov;49(5):726-9.
13. Bauer DC, Ettinger B, Browner WS. Thyroid functions and serum lipids in older women: a population-based study. Am J Med. 1998 Jun;104(6):546-51.
14. De Pergola G, Ciampolillo A, Paolotti S, Trerotoli P, Giorgino R. Free triiodothyronine and thyroid stimulating hormone are directly associated with waist circumference, independently of insulin resistance, metabolic parameters and blood pressure in overweight and obese women. Clin Endocrinol (Oxf). 2007 Aug;67(2):265-9.