Original Article

Thyroid Dysfunction and Dyslipidemia in Obese Individuals: A Cross-Sectional Study

I Vani Raj[1], N R Ambili[2], P B Balavan[3]

[1]Junior Resident, Department of General Medicine, Government T D Medical College, Alappuzha, Kerala, India. [2]Associate Professor, Department of General Medicine, Government T D Medical College, Alappuzha, Kerala, India. [3]Assistant Professor, Department of General Medicine, Government T D Medical College, Alappuzha, Kerala, India

Abstract

Background: Kerala has the highest number of thyroid cases among females. Obesity is also rising rapidly in men and women. Thyroid dysfunction, obesity, and dyslipidemia are individual risk factors for cardiovascular diseases. The present study was carried out to assess thyroid dysfunction among obese people and its relationship with dyslipidemia. **Material and Methods:** A hospital-based cross-sectional study was conducted on 100 obese patients. BMI was calculated using anthropometric measurements. Thyroid function, lipid profiles, and body fat percentage were assessed. Statistical analyses included chi-square tests for categorical associations and regression models to evaluate the relationships between TSH levels, BMI, body fat percentage, and lipid profiles. **Results:** Around 39% of the obese people were found to have hypothyroidism. There was a strong relationship between rising BMI and thyroid dysfunction ($p = 0.002$). Of all participants, 56% were dyslipidemic. Around 76% of patients with thyroid dysfunction had dyslipidemia. Multiple regression analysis confirmed that TSH and BMI were independent predictors for dyslipidemia ($R^2 = 0.42$, $p < 0.001$). **Conclusion:** This study confirms a strong correlation between obesity, thyroid dysfunction, and dyslipidemia. Hypothyroidism was the most prevalent thyroid disorder and was significantly associated with dyslipidemia.

Keywords: Thyroid dysfunction, obesity, dyslipidemia, BMI, lipid metabolism.

Received: 22August 2025 **Revised: 20 September 2025** **Accepted: 07 October 2025** **Published: 15 October 2025**

Introduction

The thyroid hormone affects almost every organ system, including the heart, central nervous system and gastrointestinal tract. The thyroid hormone increases the basal metabolic rate and can induce either lipolysis or lipid synthesis.[1] The prevalence of goiter/thyroid disorder went up from 2.2% in 2015-16 to 2.9% in 2019-21, according to the National Family Health Survey (NFHS).[2] The prevalence was around 2% in females and less than 1% in males, which increased with age in women. Kerala had the highest number of thyroid cases among females – 8696 cases among 100,000 population.[3] Obesity has also risen rapidly from 18.9% in 2015-16 to 22.9% in 2019-21 among men and from 20.6% 2015-16 to 24% in 2019-21 among women.[2] The World Health Organization has estimated that in 2019 alone, 5 million deaths were linked to increased body mass index (BMI).[4]

Thyroid dysfunction has various effects on the body, including dyslipidemia.[5] Dyslipidemia can be described as an imbalance between the different circulating lipids, that is: total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL).[6] Hypothyroidism leads to decreased hepatic cholesterol synthesis and decreased cholesterol excretion and plasma triglyceride clearance, resulting in increased levels of total cholesterol and LDL, a slight increase in HDL levels, and triglyceride accumulation in the liver, which further may lead to the development of non-alcoholic fatty liver disease.[7,8] It is well-established in literature that thyroid dysfunction, obesity, and dyslipidemia in themselves are individual risk factors for cardiovascular diseases.[9]

Hence, the present study was carried out to assess thyroid dysfunction among obese people and its relationship with dyslipidemia. These findings will be significant for the identification of early markers for complications due to obesity, mainly cardiovascular diseases. By analyzing the interaction between thyroid hormones, obesity, and lipid metabolism, medical practitioners can plan appropriate interventions that could improve the metabolic health of obese individuals.

Materials and Methods

Study Design: An observational study.

Study population: Patients attending the Out Patient Department (OPD) of a tertiary hospital in Kerala

Source of data: Patient interview and hospital records.

Study Period: 12 months (July 2023 to July 2024)

Address for correspondence: Dr. P B Balavan, Assistant Professor, Department of General Medicine, Government T D Medical College, Alappuzha, Kerala, India.
E-mail: pbbalavan@gmail.com

DOI:
10.21276/amit.2025.v12.i3.127

How to cite this article: Raj IV, Ambili NR, Balavan PB.Thyroid Dysfunction and Dyslipidemia in Obese Individuals: A Cross-Sectional Study. Acta Med Int. 2025;12(3):521-524.

Inclusion Criteria:
- Patients above the age of 18 years
- Having a BMI >/= 25 kg/ m²

Exclusion Criteria:
- Preexisting thyroid dysfunction and/or undergone thyroid surgery
- Preexisting dyslipidemia and/or on hypolipidemic drugs
- Patients with terminal illnesses
- Patients who are pregnant

Sample size calculation: Assuming the prevalence of thyroid dysfunction among obese individuals as 44% (according to Verma A et al. 10), the minimum required sample size for the study was estimated as 95 (94.6) with a confidence interval of 95% and an absolute precision of 10%, using the formula, $n = Z\ \alpha^2pq/d^2$ where $Z\ \alpha = 1.96$, p = 44%, q = 56% and d = 10. The minimum required sample size = 95 (94.6), and the sample size was rounded to 100. The consecutive sampling method was used.

Data Collection Procedure: Data was collected using a proforma containing questions on socio-demographic details. Height was measured using a portable stadiometer, which was 2 metres (Atom stature). Body fat and subcutaneous fat percentages were calculated using the body fat analyser beatXP Infinity. BMI was calculated using the formula [weight in kg/ height in m2], classified according to the Asian BMI Classification.[11]

Data Processing and Analysis: Data was coded and entered into Microsoft Excel. Data was analysed using SPSS 22.0 software. Proportion of thyroid dysfunction was expressed as frequencies and percentages, and quantitative variables such as BMI, TSH, and FT4 were expressed as mean and standard deviation. The association between BMI groups and the proportion of thyroid dysfunction was tested using the Chi-square test. Correlation between TSH and BMI was done by using Spearman's correlation. Significance level was fixed at a p-value of <0.05.

Ethical Clearance: Approval was obtained from the Institutional Ethics Committee (ECR/122/Inst/KL/2013/RR-19). The date and certificate number of IEC clearance are 04/07/2023 and 88/2023. Informed consent was taken from each participant.

Results

Most of the study population was between 40 and 59 (55%), and most were female (55%). Over half the study population had a BMI of ≥ 30 kg/m2 [Table 1]. Chi-square test was used to assess the correlation between thyroid dysfunction and BMI categories. A statistically significant association was found with a $\chi^2 = 12.45$ and p = 0.002 [Table 2]. Dyslipidemia was present in 76% of patients with thyroid dysfunction (p<0.05). Of the patients diagnosed with dyslipidemia, a high percentage (16 out of 56 patients, 28.5%) also had hypothyroidism. [Table 3]. About 86% of patients with thyroid dysfunction had increased body fat percentage. Patients with hypothyroidism had a greater body fat percentage and BMI than euthyroid subjects [Table 4].

Table 1: Basic characteristics of study participants

Parameter	Frequency	Percentage
Age		
20-39	15	15%
40-59	55	55%
>60	30	30%
Gender		
Male	45	45%
Female	55	55%
BMI Category		
25-29.9 (Obese Class I)	40	40%
≥ 30 (Obese Class II)	60	60%
Condition		
Hypothyroidism	39	39%
Hyperthyroidism	7	7%
Dyslipidemia	56	56%
Both Hypothyroidism & Dyslipidemia	16	16%
Body fat percentage		
<25%	5	5%
25-30%	63	63%
≥30%	32	32%

Table 2: Crosstabulation between thyroid dysfunction and obesity

Grade of Obesity	Thyroid Dysfunction Present	Thyroid Dysfunction Absent
Class I	15	25
Class II	24	36

Table 3: Cross-tabulation between thyroid dysfunction and dyslipidemia

Thyroid Dysfunction	Dyslipidemia Present	Dyslipidemia Absent
Present	35	11
Absent	21	33

Table 4: Cross-tabulation between thyroid status and body fat percentage

Thyroid status	Mean Body Fat %
Hypothyroid Patients	32.5%
Hyperthyroid Patients	24.8%
Normal Thyroid Function	27.1%

Discussion

The present study found that 39% of obese participants also had hypothyroidism, and 7% of them had hyperthyroidism. This is in line with the meta-analysis of Song et al,[12] which reports a high correlation of obesity with high risk for hypothyroidism (RR = 1.86, P < 0.001). Walczak et al,[13] also noted the relationship between thyroid function and obesity, adding that thyroid hormones control energy expenditure, thermogenesis, and lipid turnover. Obesity, however, can impact thyroid function through adipokine secretion and chronic inflammation, thus creating a two-way relationship of thyroid dysfunction and adiposity.

In the present study, dyslipidemia was detected in 56% of participants, and hypothyroidism was present in 28.5% of dyslipidemic patients. Regression analysis also confirmed this relationship, which revealed BMI and TSH as independent determinants of dyslipidemia ($R^2 = 0.42$, $p < 0.001$). The interrelationship between thyroid dysfunction and lipids has been well-researched and documented. Hypothyroidism was found to be related to unfavorable alterations in lipid metabolism, involving increased levels of total cholesterol, LDL, and triglycerides, and decreased levels of HDL. Also, Chen et al,[14] proved that patients who underwent bariatric surgery showed a remarkable decrease in TSH and LDL levels, further corroborating the metabolic relationship between thyroid function and lipid metabolism.

In addition, Borges-Canha et al,[15] found that increased TSH levels were linked to an increased risk of NAFLD in obese subjects, which proves the metabolic interaction between thyroid function, dyslipidemia, and liver health.

Body fat percentage is also an important indicator of metabolic health and has been associated with thyroid dysfunction. The present study identified that 32.5% of patients with hypothyroidism had an increased body fat percentage. In the available literature, opinions vary regarding the association between body fat percentage and thyroid dysfunction. Yang et al. established that higher body fat percentage positively correlated with TSH levels.[16] Leptin resistance in obese individuals has also been linked with hypothyroidism.[13] Hassan et al. reported that it is the visceral adiposity, and not subcutaneous fat, which is associated with thyroid dysfunction, proving that the distribution of fat, and not the amount of adiposity, is the determining factor in metabolic dysregulation.[17]

In contrast to the present study's findings, a survey by Amouzegar et al,[18] suggested that thyroid dysfunction is not associated with body fat percentage. Rather, it is influenced by the individual's overall metabolic status. They reported that higher FT4 levels were associated with metabolically healthy normal-weight individuals. In contrast, lower FT4 levels were linked to metabolically unhealthy obesity, indicating that metabolic disturbances mediate this relationship.

Based on a comprehensive analysis of these findings, body fat percentage measurement in thyroid dysfunction patients who are also obese is a valuable tool in the general metabolic evaluation of the patient. However, future studies should seek to establish whether weight loss interventions guided by a tailored program, such as organized exercise and diet, can improve thyroid function and correct metabolic derangements in individuals with high body fat percentages.

Although standard instruments were used in the present study to maintain validity, the study has limitations. The cross-sectional nature of the research and the relatively low sample size limit the generalizability of the results. Also, lifestyle, nutrition, and genetic factors, thyroid autoimmunity status, a robust medical history, and examination, which might have a confounding effect, were out of the scope of the present study and hence were not evaluated. Further large-scale studies incorporating these factors are needed to establish the relationship between thyroid dysfunction and dyslipidemia in obese individuals.

Conclusion

This study adds to the evidence that a correlation exists among obesity, thyroid disease, and dyslipidemia. The most common thyroid abnormality is hypothyroidism. Additionally, a raised BMI level is highly correlated with thyroid dysfunction.

Recommendation

Early identification and tailored interventions, especially in women, are essential to prevent metabolic and cardiovascular diseases. To effectively treat these disorders, a multidisciplinary approach, including thyroid function monitoring, weight management, and lifestyle modification, is recommended.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. StatPearls. Physiology, Immune Response. [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2025 Apr 20]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK
2. Ministry of Health and Family Welfare, National Family Health Survey. Available from: https://mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf Accessed on 20.04.2025
3. Ministry of Health and Family Welfare, Status of Goitre or Thyroid Disorders in India. Available from: https://pib.gov.in/PressReleasePage.aspx?PRID=1796440 Accessed on 20.04.2025
4. World Health Organization Health Topics, Obesity. Available from: https://www.who.int/health-topics/obesity#tab=tab_1 Accessed on 20.04.2025
5. Asvold BO, Vatten LJ, Nilsen TIL and Bjøro T: The association between TSH within the reference range and serum lipid

concentrations in a population-based study. The HUNT study. Eur J Endocrinol. 156:181–186. 2007.
6. Pappan N and Rehman A: Dyslipidemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing, 2022. Accessed on 20.04.2025
7. Mavromati M, Jornayvaz FR. Hypothyroidism-Associated Dyslipidemia: Potential Molecular Mechanisms Leading to NAFLD. Int J Mol Sci. 2021;22(23):12797. Published 2021 Nov 26. doi:10.3390/ijms222312797
8. Duntas L.H. Thyroid disease and lipids. Thyroid. 2002;12:287–293. doi: 10.1089/10507250252949405.
9. Neves C, Alves M, Medina JL and Delgado JL: Thyroid diseases, dyslipidemia and cardiovascular pathology. Rev Port Cardiol. 27:1211–1236. 2008.
10. Verma A, Jayaraman M, Kumar HK et al. Hypothyroidism and obesity. Cause or effect? Saudi Med J. 2008 Aug;29(8):1135-8. PMID: 18690306.
11. Misra A, Chowbey P, Makkar BM, et al. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. J Assoc Physicians India. 2009;57:163-170.
12. Song RH, Wang B, Yao QM, Li Q, Jia X, Zhang JA. The Impact of Obesity on Thyroid Autoimmunity and Dysfunction: A Systematic Review and Meta-Analysis. Front Immunol. 2019 Oct 1;10:2349. doi: 10.3389/fimmu.2019.02349. PMID: 31681268; PMCID: PMC6797838.
13. Walczak K, Sieminska L. Obesity and Thyroid Axis. Int J Environ Res Public Health. 2021 Sep 7;18(18):9434. doi: 10.3390/ijerph18189434. PMID: 34574358; PMCID: PMC8467528.
14. Chen Y, Zhang W, Pan Y et al; Chinese Obesity, Metabolic Surgery Collaborative. Thyroid Function Before and After Laparoscopic Sleeve Gastrectomy in Patients with Obesity. Obes Surg. 2022 Jun;32(6):1954-1961. doi: 10.1007/s11695-022-06035-7. Epub 2022 Apr 1. PMID: 35364797.
15. Borges-Canha M, Neves JS, Mendonça F et al. Thyroid Function and the Risk of Non-Alcoholic Fatty Liver Disease in Morbid Obesity. Front Endocrinol (Lausanne). 2020 Oct 28;11:572128. doi: 10.3389/fendo.2020.572128. PMID: 33193088; PMCID: PMC7655985.
16. Yang L, Sun X, Tao H et al. The association between thyroid homeostasis parameters and obesity in subjects with euthyroidism. J PhysiolPharmacol. 2023 Feb;74(1). doi: 10.26402/jpp.2023.1.07. Epub 2023 May 23. PMID: 37245234.
17. Hassan SS, Hosny SS, Makboul KM et al. Study of the relationship between thyroid autoimmunity, obesity and serum leptin level in a sample of Egyptian individuals. Egypt J Immunol. 2024 Oct;31(4):136-144. PMID: 39427241.
18. Amouzegar A, Kazemian E, Abdi H et al. Association Between Thyroid Function and Development of Different Obesity Phenotypes in Euthyroid Adults: A Nine-Year Follow-Up. Thyroid. 2018 Apr;28(4):458-464. doi: 10.1089/thy.2017.0454. Epub 2018 Apr 5. PMID: 29620968.