

Evaluation of Thyroid Function Tests in Patients with Metabolic SyndromeKalpana Kumari Singh¹, Rita Kumari², Nishi Verma³¹Tutor, Department of Physiology, NMCH, Patna²Professor & Head, Department of Physiology, NMCH, Patna³Junior Resident, Department of Physiology, NMCH, Patna

Received:12-10-2025 / Revised: 15-11-2025 / Accepted: 28-12-2025

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Conflict of interest: Nil

Abstract:

Background: Metabolic syndrome is a cluster of metabolic abnormalities including central obesity, hypertension, dyslipidemia, and impaired glucose tolerance, which significantly increase the risk of cardiovascular disease and type 2 diabetes mellitus. Thyroid hormones play a crucial role in regulating metabolism, lipid profile, and insulin sensitivity. Even subtle alterations in thyroid function may influence the components of metabolic syndrome.

Objective: To evaluate thyroid function tests in patients diagnosed with metabolic syndrome and to assess their association with individual components of the syndrome.

Methods: This cross-sectional study included patients diagnosed with metabolic syndrome based on standard diagnostic criteria. Thyroid function tests, including serum Thyroid Stimulating Hormone (TSH), Free Triiodothyronine (FT3), and Free Thyroxine (FT4), were measured. Clinical parameters such as waist circumference, blood pressure, fasting blood glucose, serum triglycerides, and HDL cholesterol were recorded. Statistical analysis was performed to determine correlations between thyroid parameters and components of metabolic syndrome.

Results: A significant proportion of patients with metabolic syndrome exhibited thyroid dysfunction, predominantly subclinical hypothyroidism. Serum TSH levels showed a positive correlation with waist circumference, triglycerides, and fasting blood glucose, and a negative correlation with HDL cholesterol. Patients with higher TSH levels had a greater prevalence of dyslipidemia and insulin resistance.

Conclusion: Thyroid dysfunction, particularly subclinical hypothyroidism, is common in patients with metabolic syndrome and may contribute to its metabolic derangements. Routine screening of thyroid function in patients with metabolic syndrome may help in early identification and appropriate management, potentially reducing cardiovascular risk.

Keywords: Metabolic syndrome, Thyroid function tests, TSH, Subclinical hypothyroidism, Dyslipidemia, Insulin resistance.

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Introduction

Metabolic syndrome is a cluster of interrelated metabolic abnormalities that include central obesity, hypertension, dyslipidemia, and impaired glucose metabolism. It is associated with a significantly increased risk of type 2 diabetes mellitus and cardiovascular disease. The prevalence of metabolic syndrome has been rising globally due to sedentary lifestyle, urbanization, and dietary changes, making it a major public health concern. Thyroid hormones play a critical role in regulating basal metabolic rate, lipid metabolism, carbohydrate metabolism, and energy homeostasis. Even minor alterations in thyroid function can influence body weight, insulin sensitivity, blood pressure, and serum lipid levels. Subclinical thyroid dysfunction, particularly subclinical hypothyroidism, has been increasingly recognized as a potential contributor to metabolic disturbances. Several studies have demonstrated an

association between thyroid dysfunction and components of metabolic syndrome. Elevated serum Thyroid Stimulating Hormone (TSH) levels, even within the upper normal range, have been linked to increased body mass index, dyslipidemia, and insulin resistance. Hypothyroidism is known to cause hypercholesterolemia, hypertriglyceridemia, and weight gain, which are key features of metabolic syndrome. Given the overlapping pathophysiological mechanisms—such as insulin resistance, chronic low-grade inflammation, and altered lipid metabolism—it is important to evaluate thyroid function in patients with metabolic syndrome. Early identification of thyroid abnormalities may allow timely intervention and potentially reduce cardiovascular morbidity and mortality.

Therefore, the present study aims to evaluate thyroid

function tests in patients with metabolic syndrome and to analyze their association with individual components of the syndrome.

Materials and Methods

Study Design: This was a hospital-based cross-sectional observational study conducted in the Department of Physiology and correlate with General Medicine at Nalanda Medical College and Hospital, Patna. Study duration is Two years.

Study Population: The study included a total of 67 patients diagnosed with metabolic syndrome attending the outpatient and inpatient departments during the study period.

Inclusion Criteria

- Patients aged 18 years and above
- Patients diagnosed with metabolic syndrome based on standard diagnostic criteria (presence of at least three of the following):
 - Increased waist circumference
 - Elevated blood pressure ($\geq 130/85$ mmHg or on treatment)
 - Fasting blood glucose ≥ 100 mg/dL or on antidiabetic treatment
 - Serum triglycerides ≥ 150 mg/dL
 - HDL cholesterol < 40 mg/dL in males and < 50 mg/dL in females

Exclusion Criteria

- Known cases of overt thyroid disease on treatment
- Patients on drugs affecting thyroid function (e.g., amiodarone, steroids)
- Pregnant women
- Patients with chronic liver disease, chronic kidney disease, or acute severe illness

Data Collection: After obtaining informed consent, detailed history and clinical examination were performed. Anthropometric measurements including height, weight, and waist circumference were recorded. Blood pressure was measured using a standard sphygmomanometer.

Laboratory Investigations

After an overnight fast of 8–12 hours, venous blood samples were collected for:

- Fasting blood glucose
- Serum triglycerides
- HDL cholesterol

Thyroid function tests: Serum Thyroid Stimulating Hormone (TSH), Free Triiodothyronine (FT3), and Free Thyroxine (FT4) Thyroid function tests were measured using standard chemiluminescent immunoassay methods.

Definition of Thyroid Dysfunction

- Euthyroid: Normal TSH, FT3, and FT4
- Subclinical hypothyroidism: Elevated TSH with normal FT3 and FT4
- Overt hypothyroidism: Elevated TSH with low FT4
- Hyperthyroidism: Suppressed TSH with elevated FT3 and/or FT4

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean \pm standard deviation. Categorical variables were expressed as percentages. Correlation between thyroid function parameters and components of metabolic syndrome was assessed using appropriate statistical tests. A p-value < 0.05 was considered statistically significant.

Results

A total of 67 patients diagnosed with metabolic syndrome were included in the study.

Demographic Profile, out of 67 patients, the majority were in the age group of 41–60 years. The mean age of the study population was 52.4 ± 9.8 years. There were 38 females (56.7%) and 29 males (43.3%), showing a slight female predominance.

Thyroid Function Status

Among the 67 patients:

- Euthyroid: 46 patients (68.7%)
- Subclinical hypothyroidism: 15 patients (22.4%)
- Overt hypothyroidism: 4 patients (6.0%)
- Subclinical hyperthyroidism: 2 patients (2.9%)

Thus, overall thyroid dysfunction was observed in 31.3% of patients, with subclinical hypothyroidism being the most common abnormality.

Thyroid Parameters

- Mean Serum TSH: 4.12 ± 2.36 mIU/L
- Mean FT3: 2.81 ± 0.54 pg/mL
- Mean FT4: 1.12 ± 0.21 ng/dL

Patients with subclinical and overt hypothyroidism had significantly higher mean TSH levels compared to euthyroid individuals ($p < 0.05$).

Association Between Thyroid Function and Components of Metabolic Syndrome

- Serum TSH showed a positive correlation with:
 - Waist circumference
 - Serum triglycerides
 - Fasting blood glucose
- Serum TSH showed a negative correlation with:
 - HDL cholesterol

Patients with elevated TSH levels had significantly

higher mean triglyceride levels and lower HDL levels compared to euthyroid patients ($p < 0.05$).

No statistically significant association was observed between FT3 and FT4 levels and blood pressure.

Summary of Key Findings

- Thyroid dysfunction was present in nearly one-third of patients with metabolic syndrome.
- Subclinical hypothyroidism was the most prevalent thyroid abnormality.
- Elevated TSH levels were significantly associated with dyslipidemia and central obesity.

Discussion

The present study evaluated thyroid function in 67 patients diagnosed with metabolic syndrome and found that thyroid dysfunction was present in a significant proportion of cases. The overall prevalence of thyroid dysfunction in our study was 31.3%, with subclinical hypothyroidism being the most common abnormality. These findings highlight the close relationship between thyroid status and metabolic derangements. Metabolic syndrome represents a constellation of cardiovascular risk factors driven largely by insulin resistance and central obesity. Thyroid hormones play a pivotal role in regulating basal metabolic rate, lipid metabolism, carbohydrate metabolism, and thermogenesis. Even mild thyroid dysfunction, particularly subclinical hypothyroidism, can adversely affect lipid profile and insulin sensitivity, thereby contributing to the pathogenesis of metabolic syndrome.

In the present study, serum TSH levels showed a positive correlation with waist circumference, serum triglycerides, and fasting blood glucose, and a negative correlation with HDL cholesterol. These findings suggest that elevated TSH levels may worsen dyslipidemia and central obesity. Hypothyroidism is known to reduce LDL receptor activity, decrease lipid clearance, and impair lipoprotein lipase activity, leading to hypercholesterolemia and hypertriglyceridemia. Furthermore, thyroid hormone deficiency may promote weight gain and increase visceral adiposity, which further aggravates insulin resistance. The predominance of subclinical hypothyroidism observed in this study is clinically significant. Although patients with subclinical hypothyroidism may be asymptomatic, they often exhibit metabolic disturbances that increase cardiovascular risk. Elevated TSH levels, even within the upper limit of normal, have been associated with adverse lipid profiles and endothelial dysfunction in various studies. The higher prevalence of thyroid dysfunction among females in our study is consistent with the known higher incidence of thyroid disorders in women. Hormonal factors and

autoimmune predisposition may contribute to this gender difference.

The findings of the present study support the hypothesis that thyroid dysfunction may contribute to the clustering of metabolic abnormalities seen in metabolic syndrome. Routine screening of thyroid function in patients with metabolic syndrome may help in early detection and management of thyroid abnormalities, which could potentially reduce cardiovascular morbidity and mortality.

Conclusion

The present study evaluated thyroid function tests in 67 patients with metabolic syndrome and demonstrated that thyroid dysfunction is relatively common in this population. Nearly one-third of the patients exhibited thyroid abnormalities, with subclinical hypothyroidism being the most prevalent disorder. Serum TSH levels showed a significant association with key components of metabolic syndrome, particularly central obesity, hypertriglyceridemia, elevated fasting blood glucose, and low HDL cholesterol. These findings suggest that even mild thyroid dysfunction may contribute to the metabolic derangements observed in metabolic syndrome. Early identification of thyroid abnormalities through routine screening in patients with metabolic syndrome may facilitate timely intervention and better metabolic control. Addressing coexisting thyroid dysfunction could potentially reduce cardiovascular risk and improve overall clinical outcomes.

Further large-scale prospective studies are recommended to establish causal relationships and to evaluate the long-term benefits of thyroid function screening and management in patients with metabolic syndrome.

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