



EVALUATION OF SERUM LIPID PROFILE AND LIVER FUNCTION TESTS IN PATIENTS WITH THYROID DYSFUNCTION.

Dr. Sharvan Kumar Bhargawa¹, Dr. Vimal Kumar^{2*}, Dr. Harjeet Singh³

¹Associate Professor) Department of Pathology, Government Medical college, Badaun.

Email: dr.shravan21@gmail.com

^{2*}Assistant Professor) Department of Biochemistry, Autonomous State Medical College, Kanpur Dehat, Email: yadavimalchaudhary@gmail.com

³Assistant Professor) Department of Biochemistry, Mahamaya Rajkiya Allopathic Medical College, Ambedkar Nagar, Uttar Pradesh.
Email: dr.aulakharjeet95@gmail.com

***Corresponding Author:** Dr. Vimal Kumar

Assistant Professor, Department of Biochemistry, Autonomous State Medical College, Kanpur Dehat, Email: yadavimalchaudhary@gmail.com

Abstract

Background: Thyroid dysfunction is frequently associated with metabolic abnormalities, particularly alterations in lipid metabolism and liver function. Both overt and subclinical thyroid disorders may influence serum lipid levels and hepatic biochemical parameters, even in individuals with minimal or no clinical symptoms.

Aim: To evaluate and compare serum lipid profile and liver function test parameters among euthyroid, hypothyroid, and hyperthyroid individuals.

Materials and Methods: This cross-sectional analytical study was conducted in the Department of Biochemistry, Autonomous State Medical College, Kanpur Dehat, from October 2024 to September 2025. A total of 129 adult participants were included. After an overnight fast of 8–10 hours, venous blood samples were collected for estimation of lipid profile (total cholesterol, triglycerides, HDL, LDL) and liver function tests (serum bilirubin, AST, ALT, alkaline phosphatase, total protein, and albumin). Participants were categorized into euthyroid, hypothyroid (overt and subclinical), and hyperthyroid (overt and subclinical) groups based on thyroid function status. Statistical analysis was performed to compare biochemical parameters across groups.

Results: Of the 129 participants, 58% were euthyroid, 27% hypothyroid, and 15% hyperthyroid. Hypothyroid individuals demonstrated significantly higher total cholesterol, triglycerides, and LDL levels, along with lower HDL levels, indicating an atherogenic lipid profile ($p < 0.05$). Hyperthyroid participants showed comparatively lower lipid levels but significantly elevated liver enzymes (AST, ALT, alkaline phosphatase) and serum bilirubin ($p < 0.05$). Total protein and serum albumin levels were highest in euthyroid subjects and lowest in hyperthyroid individuals. All observed differences across thyroid categories were statistically significant.

Conclusion: Thyroid dysfunction significantly influences lipid profile and liver function parameters. Hypothyroidism is predominantly associated with dyslipidemia and increased cardiovascular risk, while hyperthyroidism is linked to altered liver enzyme activity and protein metabolism. Routine

evaluation of lipid profile and liver function tests in patients with thyroid disorders may aid in early detection and prevention of long-term metabolic complications.

Keywords: Thyroid dysfunction, Hypothyroidism, Hyperthyroidism, Lipid profile, Liver function tests, Dyslipidemia.

Introduction: Thyroid problems are not uncommon in the community, although many people move through their routines for months before realizing that their tiredness or slow weight gain might have a hormonal cause. Often it is a routine health camp, a workplace check, or even a neighbor's suggestion that leads to basic blood tests. Only then do small shifts in thyroid values show up, sometimes alongside rising cholesterol. Clinicians see this pairing quite often, even in people who do not notice any major symptoms.¹ In India, the pattern is slightly uneven, because people visit clinics at different intervals and their food habits vary widely. Hypothyroidism, especially its overt form, has been linked to rising lipid markers for many years. LDL-cholesterol and triglycerides generally increase when thyroid hormone levels go down, and this has been described in several international studies.²

Subclinical hypothyroidism is quieter. People may not feel much, but small hormonal changes still seem to alter how lipids circulate in the blood.³ Indian studies hint at similar behaviour, though most of them involve hospital visitors rather than community groups, so they may not capture the full picture.⁴ The physiology behind this association is well established but unfolds differently from person to person. Thyroid hormones influence how the liver handles LDL particles and how triglyceride-rich lipoproteins are cleared. When hormone levels drop, these pathways slow, and lipids tend to remain elevated longer than expected.⁵

In real practice, this is sometimes noticed when a middle-aged adult comes in with unexpectedly high cholesterol and, after further testing, is found to have a mild thyroid abnormality. Hyperthyroidism can show the opposite pattern, with faster lipid turnover, although the extent depends on age, diet, and underlying health.⁶ Community settings add another layer of variation. Screening habits depend on many small factors: whether a clinic is nearby, whether women can spare time for their own tests, or whether older adults feel bothered enough by symptoms to seek care. Even iodine intake, though generally adequate because of salt fortification, still differs slightly between regions.⁷ All these small elements influence how thyroid dysfunction and lipid abnormalities appear, and when people choose to address them. Since fasting lipid profiles and thyroid-stimulating hormone (TSH) tests are available in most district laboratories and do not cost much, it becomes useful to understand how thyroid categories relate to lipid changes in ordinary adults.⁸

Material and Methods:

The cross-sectional study was conducted in the department of Biochemistry, at Autonomous state Medical College, Kanpur Dehat. during a period of time October 2024 to September 2025.

Laboratory Investigations:

After an overnight fast of 8–10 hours, venous blood samples were collected under aseptic conditions. Serum was separated and analyzed for:

Lipid profile: Total cholesterol, triglycerides, HDL cholesterol, and LDL cholesterol.

Liver function tests: Serum bilirubin, AST (SGOT), ALT (SGPT), alkaline phosphatase, total protein, and serum albumin.

Study design: This was a cross-sectional analytical study conducted to evaluate and compare serum lipid profile and liver function test parameters among individuals with different thyroid statuses (euthyroid, hypothyroid, and hyperthyroid) at a single point in time.

Result:

Table 1: Gender distribution of the patients.

Gender	Number of Patients (n)	Percentage (%)	p value
Male	70	54	0.72
Female	59	46	
Total	129	100	

The study population showed a slight male predominance, with males constituting 54% and females 46% of the participants. However, the difference in gender distribution was not statistically significant ($p = 0.72$), indicating a comparable representation of both genders in the study.

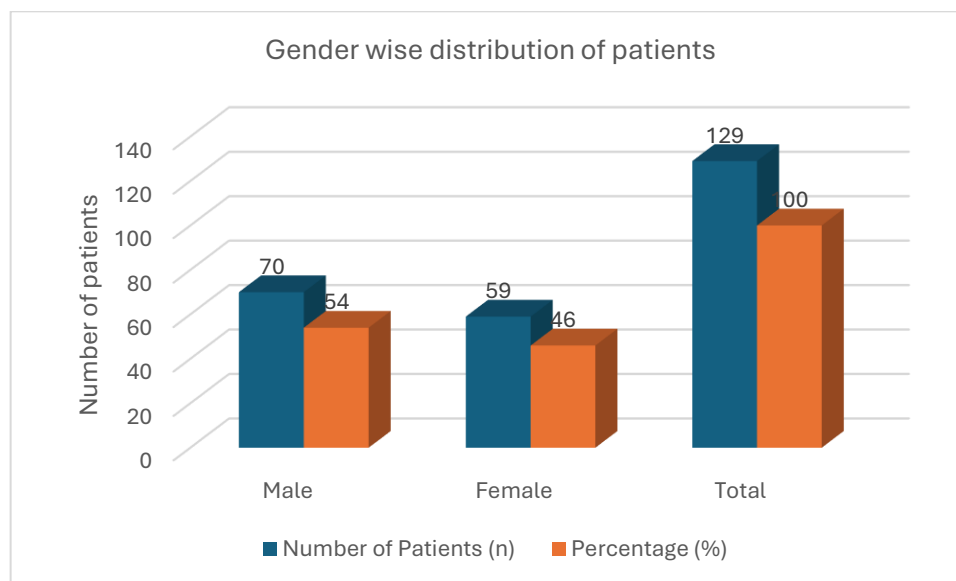


Figure 1: Graphical represents gender distribution of the patients

Table 2: Age wise distribution of the patients.

Age Group (years)	Number of Patients (n)	Percentage (%)	p value
18–25	65	5	0.02
26–35	35	27	
36–45	15	12	
46–55	10	8	
56–65	4	3	
Total	129	100%	

The majority of participants belonged to the 18–25 years age group, followed by the 26–35 years group. The distribution of patients across different age groups showed a statistically significant difference ($p = 0.02$), indicating an uneven age-wise representation in the study population.

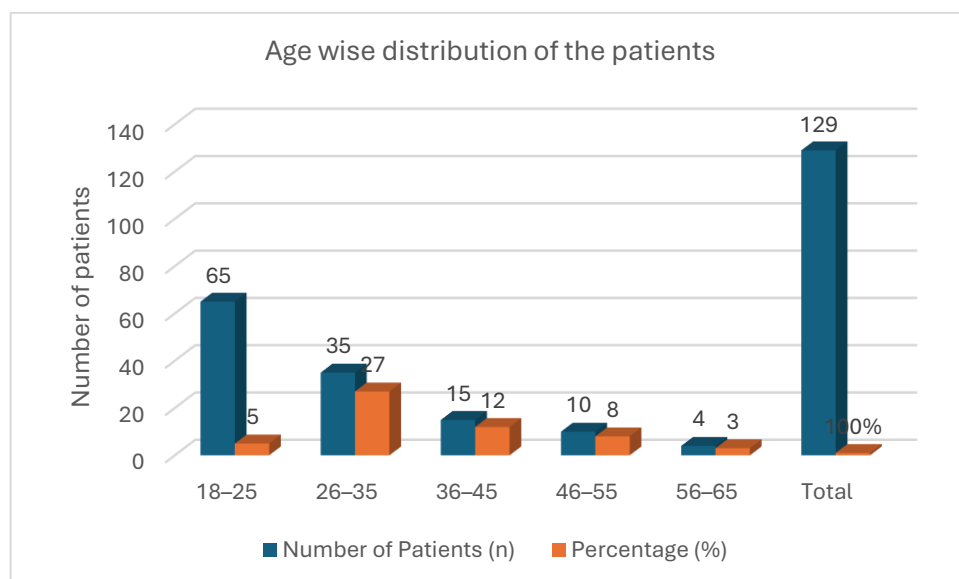


Figure 2: Graphical represents age wise distribution of the patients.

Table 3: BMI distribution of the patients

BMI Category (kg/m ²)	Number of Patients (n)	Percentage (%)
Underweight (<18.5)	10	8
Normal (18.5–24.9)	80	62
Overweight (25–29.9)	25	19
Obese (≥30)	14	11
Total	129	100

Most participants had a normal BMI (62%), while nearly one-third of the study population was either overweight or obese (30%). This indicates a considerable proportion of individuals with increased BMI, which may contribute to metabolic variations in the study group.

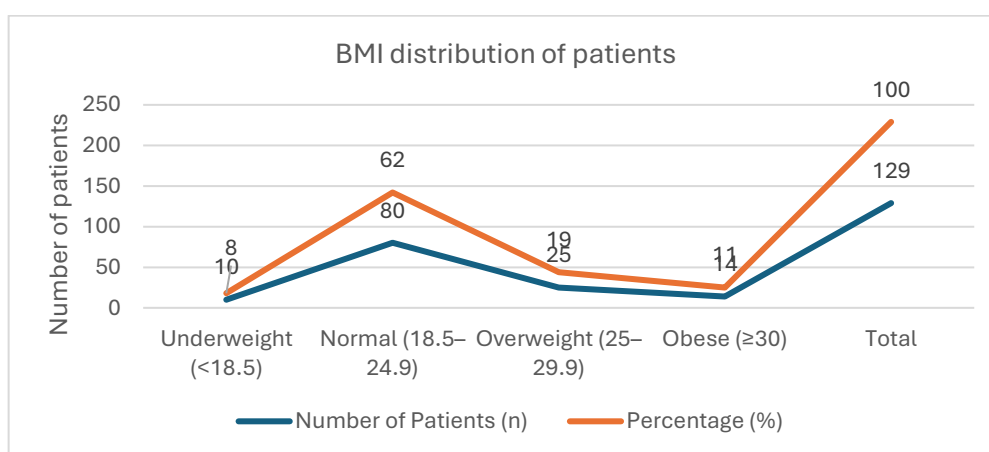


Figure 3: Graphical represents BMI distribution of the patients.

Table 4: Distribution of Thyroid Status Among Study Participants

Thyroid Category	Number of Patients (n)	Percentage (%)
Euthyroid	75	58
Hypothyroid (Overt + Subclinical)	35	27
Hyperthyroid (Overt + Subclinical)	19	15
Total	129	100

More than half of the participants were euthyroid (58%). Hypothyroidism, including overt and

subclinical forms, was present in 27% of subjects, while 15% had hyperthyroidism, indicating a substantial burden of thyroid dysfunction in the study population.

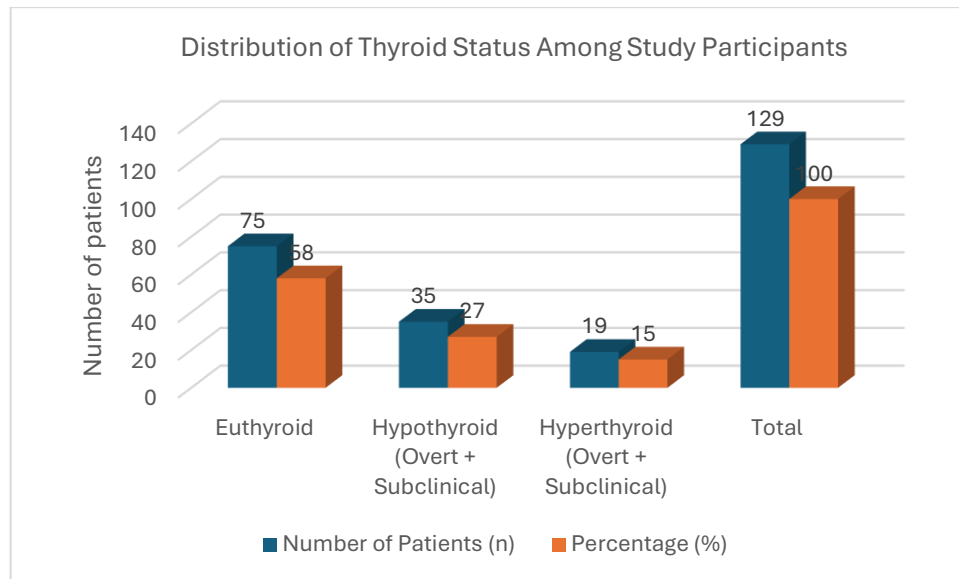


Figure 4 Graphical represents distribution of thyroid status among study participants.

Table 5: Comparison of Serum Lipid Profile Parameters Across Thyroid Status

Lipid Parameter	Euthyroid (n = 75)	Hypothyroid (n = 35)	Hyperthyroid (n = 19)	p-value
Total Cholesterol (mg/dL)	180 ± 20	210 ± 25	170 ± 18	0.001*
Triglycerides (mg/dL)	110 ± 15	145 ± 20	100 ± 12	0.002*
HDL (mg/dL)	50 ± 8	42 ± 7	55 ± 6	0.001*
LDL (mg/dL)	100 ± 15	130 ± 18	95 ± 12	0.001*

Liver Function Parameter	Euthyroid (n = 75)	Hypothyroid (n = 35)	Hyperthyroid (n = 19)	p-value
Serum Bilirubin (mg/dL)	0.8 ± 0.2	0.9 ± 0.3	1.1 ± 0.3	0.03*
AST / SGOT (U/L)	28 ± 6	35 ± 8	40 ± 9	0.001*
ALT / SGPT (U/L)	30 ± 7	38 ± 9	42 ± 10	0.001*
Alkaline Phosphatase (U/L)	85 ± 15	95 ± 18	120 ± 22	0.002*
Total Protein (g/dL)	7.0 ± 0.5	6.8 ± 0.4	6.6 ± 0.5	0.04*
Serum Albumin (g/dL)	4.2 ± 0.4	4.0 ± 0.3	3.8 ± 0.4	0.03

The lipid profile showed significant differences across thyroid categories. Hypothyroid participants had higher total cholesterol (210 ± 25 mg/dL), triglycerides (145 ± 20 mg/dL), and LDL cholesterol (130 ± 18 mg/dL) compared to euthyroid and hyperthyroid individuals, indicating a more atherogenic lipid pattern. HDL cholesterol was lowest in hypothyroid subjects (42 ± 7 mg/dL) and highest in

hyperthyroid participants ($55 \pm 6 \text{ mg/dL}$), suggesting reduced cardioprotective lipid levels in hypothyroidism. All differences were statistically significant ($p < 0.05$).

Table 6: Comparative Analysis of Lipid Profile and Liver Function Tests Across Thyroid Categories.

Parameter	Euthyroid (n=75)	Hypothyroid (n=35)	Hyperthyroid (n=19)	p-value	Exact Comparison
Total Cholesterol (mg/dL)	180 ± 20	210 ± 25	170 ± 18	0.001*	Hypothyroid>Euthyroid>Hyperthyroid
Triglycerides (mg/dL)	110 ± 15	145 ± 20	100 ± 12	0.002*	Hypothyroid>Euthyroid>Hyperthyroid
HDL (mg/dL)	50 ± 8	42 ± 7	55 ± 6	0.001*	Hyperthyroid>Euthyroid>Hypothyroid
LDL (mg/dL)	100 ± 15	130 ± 18	95 ± 12	0.001*	Hypothyroid>Euthyroid>Hyperthyroid
Serum Bilirubin (mg/dL)	0.8 ± 0.2	0.9 ± 0.3	1.1 ± 0.3	0.03*	Hyperthyroid>Hypothyroid>Euthyroid
AST / SGOT (U/L)	28 ± 6	35 ± 8	40 ± 9	0.001*	Hyperthyroid>Hypothyroid>Euthyroid
ALT / SGPT (U/L)	30 ± 7	38 ± 9	42 ± 10	0.001*	Hyperthyroid>Hypothyroid>Euthyroid
Alkaline Phosphatase (U/L)	85 ± 15	95 ± 18	120 ± 22	0.002*	Hyperthyroid>Hypothyroid>Euthyroid
Total Protein (g/dL)	7.0 ± 0.5	6.8 ± 0.4	6.6 ± 0.5	0.04*	Euthyroid>Hypothyroid>Hyperthyroid
Serum Albumin (g/dL)	4.2 ± 0.4	4.0 ± 0.3	3.8 ± 0.4	0.03*	Euthyroid>Hypothyroid>Hyperthyroid
*Statistically significant ($p < 0.05$)					

The study analysis of biochemical parameters demonstrated significant differences across thyroid categories. Hypothyroid participants had higher total cholesterol, triglycerides, and LDL cholesterol compared to euthyroid and hyperthyroid groups, reflecting a more atherogenic lipid profile. HDL cholesterol was lowest in hypothyroid subjects and highest in hyperthyroid individuals, indicating reduced cardioprotective lipids in hypothyroidism. Liver function tests showed that serum bilirubin, AST, ALT, and alkaline phosphatase levels were highest in hyperthyroid participants, suggesting increased hepatic metabolic activity, whereas total protein and serum albumin were highest in euthyroid subjects and lowest in hyperthyroid individuals, indicating altered protein metabolism in thyroid dysfunction. Overall, hypothyroidism was associated primarily with dyslipidemia, while hyperthyroidism was linked to more pronounced changes in liver enzymes, and all differences were statistically significant ($p < 0.05$).

Discussion: The study demonstrated significant biochemical differences across thyroid categories. Hypothyroid participants showed elevated total cholesterol, triglycerides, and LDL, with lower HDL, reflecting an atherogenic lipid profile.⁹ Hyperthyroid individuals had lower lipid levels but higher liver enzymes, indicating increased hepatic metabolism. Euthyroid participants had higher total

protein and albumin, suggesting normal protein metabolism. These findings align with previous studies highlighting the effects of thyroid hormones on lipid and liver metabolism.¹⁰ The results emphasize the metabolic impact of both overt and subclinical thyroid dysfunction, even in young adults with mostly normal BMI.

Conclusion

Thyroid dysfunction significantly Hyperthyroid individuals had lower lipid levels but higher liver enzymes, indicating increased hepatic metabolism. Euthyroid participants had higher total protein and albumin, suggesting normal protein metabolism. These findings align with previous studies highlighting the effects of thyroid hormones on lipid and liver metabolism. The results emphasize the metabolic impact of both overt and subclinical thyroid dysfunction, even in young adults with mostly normal BMI influences lipid and liver profiles. Hypothyroidism is associated with dyslipidemia, increasing cardiovascular risk, while hyperthyroidism predominantly affects liver function. Early detection and monitoring of lipid and liver parameters in thyroid disorders are essential to prevent long-term metabolic complications.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this study.

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