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Original Research Article

Association of Subclinical Hypothyroidism with Lipid Profile and Body Mass Index in Older Adults

Pullaiahgari Pravalika Reddy[1], K. Srikanth[2], B. Naresh[3]

[1]Junior Resident, Department of General Medicine, Mamata Medical College, Khammam, Telangana, India.

[2]Professor, Department of General Medicine, Mamata Medical College, Khammam, Telangana, India.

[3]Assistant Professor, Department of General Medicine, Mamata Medical College, Khammam, Telangana, India.

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Corresponding author: Dr. K. Srikanth

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Abstract

Introduction: Subclinical hypothyroidism (SCH) is a common endocrine disorder in older adults and is increasingly recognized for its association with metabolic disturbances, particularly dyslipidemia and obesity. These alterations may contribute to an increased risk of cardiovascular disease in the elderly population. The present study aimed to evaluate the association of subclinical hypothyroidism with lipid profile and body mass index (BMI) in older adults.

Materials and Methods: This hospital-based cross-sectional study was conducted at Mamata Medical College, Khammam, from November 2024 to November 2025. A total of 60 participants aged ≥60 years were included. Clinical evaluation and anthropometric measurements were performed, and BMI was calculated. Fasting blood samples were analyzed for thyroid-stimulating hormone (TSH) and lipid profile parameters. Participants were categorized into euthyroid and subclinical hypothyroid groups. Statistical analysis was performed using SPSS version 26, with $p < 0.05$ considered significant.

Results: Subclinical hypothyroidism was present in 36.7% of participants. Individuals with SCH had significantly higher total cholesterol (212.4 ± 34.1 mg/dL), triglycerides (176.8 ± 42.7 mg/dL), LDL-C (138.2 ± 30.6 mg/dL), and VLDL-C (35.4 ± 8.5 mg/dL), along with lower HDL-C levels (40.1 ± 6.8 mg/dL) compared to euthyroid individuals ($p < 0.05$). Mean BMI was significantly higher in the SCH group (28.1 ± 3.8 kg/m² vs. 24.6 ± 3.2 kg/m²; $p = 0.001$). Positive correlations were observed between TSH and lipid parameters as well as BMI, while HDL-C showed a negative correlation.

Conclusion: Subclinical hypothyroidism in older adults is significantly associated with an adverse lipid profile and higher BMI, indicating increased cardiovascular risk. Early screening and appropriate management may help reduce associated metabolic complications.

Keywords: Subclinical Hypothyroidism; Lipid Profile; Body Mass Index; Older Adults; Dyslipidemia.

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Introduction

Subclinical hypothyroidism (SCH) is a common endocrine disorder characterized by elevated serum thyroid-stimulating hormone (TSH) levels with normal circulating thyroid hormone concentrations [1]. It is particularly prevalent among older adults, with increasing age being a well-recognized risk factor [2].

Although often asymptomatic, SCH has gained clinical significance due to its potential metabolic and cardiovascular implications, especially in the elderly population where subtle physiological alterations may have pronounced clinical effects [3]. Thyroid hormones play a crucial role in regulating lipid metabolism by influencing cholesterol synthesis, absorption, and degradation [4]. Even mild thyroid dysfunction, as seen in subclinical hypothyroidism, can lead to alterations in lipid profile, including elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides, along with reduced high-density lipoprotein cholesterol (HDL-C) [5].

These changes contribute to an atherogenic lipid profile, thereby increasing the risk of cardiovascular morbidity and mortality [6]. Given that cardiovascular diseases are already highly prevalent in older adults, the coexistence of SCH may further exacerbate this risk [7]. Body mass index (BMI) is another important metabolic

parameter that has been linked with thyroid function [8]. Several studies have demonstrated an association between higher BMI and elevated TSH levels, suggesting a bidirectional relationship between thyroid dysfunction and adiposity [9]. Increased body weight may influence thyroid hormone regulation, while altered thyroid function may, in turn, contribute to weight gain and changes in body composition [10]. Understanding this relationship is particularly relevant in older adults, where both obesity and thyroid disorders are commonly encountered [11].

Despite growing evidence, the association between subclinical hypothyroidism, lipid abnormalities, and BMI in older adults remains an area of ongoing research, with varying results reported across different populations. Regional data, especially from the Indian subcontinent, are limited. Therefore, the present study aimed to evaluate the association of subclinical hypothyroidism with lipid profile and body mass index in older adults attending a tertiary care centre.

Materials and Methods

This was a hospital-based cross-sectional observational study conducted in the Department of General Medicine at Mamata Medical College, Khammam.

The study was carried out over a period of one year, from November 2024 to November 2025. A total of 60 older adults aged ≥60 years attending the outpatient department or admitted to the hospital during the study period were included. Participants were selected using a convenient sampling method after obtaining informed written consent.

Inclusion criteria comprised individuals aged 60 years and above who were willing to participate in the study and underwent thyroid function and lipid profile evaluation. Patients with known overt hypothyroidism or hyperthyroidism, those already on thyroid hormone replacement therapy, individuals with chronic liver or renal disease, acute illness, or those on medications affecting lipid metabolism (such as statins or steroids) were excluded from the study to avoid confounding factors. Detailed clinical history was obtained, and a thorough physical examination was performed for all participants. Anthropometric measurements including height and weight were recorded, and body mass index (BMI) was calculated using the standard formula (kg/m²). Participants were categorized into normal, overweight, and obese groups based on standard BMI classification criteria. Venous blood samples were collected after an overnight fast for estimation of serum thyroid-stimulating hormone (TSH) and lipid profile parameters, including total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol (VLDL-C), using standard laboratory methods.

Subclinical hypothyroidism was defined as elevated serum TSH levels with normal free thyroxine (FT4) levels, while euthyroid status was defined as normal TSH levels. Statistical analysis was performed using appropriate software SPSS version 26. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. The independent sample t-test was used to compare means between groups, while the chi-square test was applied for categorical variables. Pearson's correlation coefficient was used to assess the relationship between TSH levels and lipid parameters as well as BMI. A p-value of less than 0.05 was considered statistically significant.

Results

The study included a total of 60 older adults, with the majority belonging to the 60–65 years age group (30.0%), followed by 66–70 years (26.7%), 71–75 years (23.3%), and those above 75 years (20.0%). Females constituted a slightly higher proportion of the study population (53.3%) compared to males (46.7%). Based on BMI classification, 40.0% of participants were overweight, 33.3% had normal BMI, and 26.7% were obese, indicating a predominance of increased body weight among the study cohort (Table 1).

Table 1: Demographic and Clinical Characteristics of Study Population (n = 60)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
60–65	18	30.0
66–70	16	26.7
71–75	14	23.3
>75	12	20.0
Gender		
Male	28	46.7
Female	32	53.3
BMI Category		
Normal (18.5–24.9 kg/m²)	20	33.3
Overweight (25–29.9 kg/m²)	24	40.0
Obese (≥30 kg/m²)	16	26.7

Out of the total study population, 63.3% were euthyroid, while 36.7% were diagnosed with subclinical hypothyroidism, demonstrating a considerable prevalence of thyroid dysfunction among older adults in the study group (Table 2).

Table 2: Thyroid Status Distribution among Study Participants

Thyroid Status	Frequency (n)	Percentage (%)
Euthyroid	38	63.3
Subclinical Hypothyroidism	22	36.7

Comparison of lipid parameters between the two groups revealed that individuals with subclinical hypothyroidism had significantly higher levels of total cholesterol (212.4 ± 34.1 mg/dL vs. 178.5 ± 28.6 mg/dL), triglycerides (176.8 ± 42.7 mg/dL vs. 142.3 ± 36.5 mg/dL), LDL-C (138.2 ± 30.6 mg/dL vs. 108.6 ± 24.3 mg/dL), and VLDL-C (35.4 ± 8.5 mg/dL vs. 28.5 ± 7.3 mg/dL), along with significantly lower HDL-C levels (40.1 ± 6.8 mg/dL vs. 46.2 ± 7.5 mg/dL) compared to euthyroid individuals. These differences were statistically significant ($p < 0.05$), indicating an adverse lipid profile in subclinical hypothyroidism (Table 3).

Table 3: Comparison of Lipid Profile between Euthyroid and Subclinical Hypothyroid Groups

Parameter	Euthyroid (n=38)	Subclinical Hypothyroidism (n=22)	p-value
Total Cholesterol (mg/dL)	178.5 ± 28.6	212.4 ± 34.1	0.001
Triglycerides (mg/dL)	142.3 ± 36.5	176.8 ± 42.7	0.003
HDL-C (mg/dL)	46.2 ± 7.5	40.1 ± 6.8	0.002
LDL-C (mg/dL)	108.6 ± 24.3	138.2 ± 30.6	0.001
VLDL-C (mg/dL)	28.5 ± 7.3	35.4 ± 8.5	0.004

The mean BMI was significantly higher in participants with subclinical hypothyroidism (28.1 ± 3.8 kg/m²) compared to euthyroid individuals (24.6 ± 3.2 kg/m²), with the difference being statistically significant ($p = 0.001$), suggesting a strong association between increased body mass and thyroid dysfunction (Table 4).

Table 4: Comparison of BMI between Euthyroid and Subclinical Hypothyroid Groups

Parameter	Euthyroid (n=38)	Subclinical Hypothyroidism (n=22)	p-value
BMI (kg/m²)	24.6 ± 3.2	28.1 ± 3.8	0.001*

Analysis of BMI categories in relation to thyroid status showed that a higher proportion of obese individuals was present in the subclinical hypothyroid group (40.9%) compared to the euthyroid group (18.4%). Conversely, normal BMI was more commonly observed among euthyroid participants (42.1%) than those with subclinical hypothyroidism (18.2%). This association between BMI categories and thyroid status was statistically significant ($p = 0.032$) (Table 5).

Table 5: Association of BMI Categories with Thyroid Status

BMI Category	Euthyroid (n=38)	Subclinical Hypothyroidism (n=22)	p-value
Normal	16 (42.1%)	4 (18.2%)	0.032
Overweight	15 (39.5%)	9 (40.9%)	
Obese	7 (18.4%)	9 (40.9%)	

Correlation analysis demonstrated a significant positive correlation between serum TSH levels and total cholesterol ($r = +0.52$), triglycerides ($r = +0.47$), LDL-C ($r = +0.55$), and BMI ($r = +0.49$), while a significant negative correlation was observed with HDL-C ($r = –0.41$). All correlations were statistically significant ($p < 0.05$), indicating that increasing TSH levels are associated with worsening lipid parameters and higher body mass index (Table 6).

Table 6: Correlation of TSH with Lipid Profile and BMI

Parameter	Correlation Coefficient (r)	p-value
Total Cholesterol	+0.52	0.001
Triglycerides	+0.47	0.003
HDL-C	-0.41	0.005
LDL-C	+0.55	0.001
BMI	+0.49	0.002

Discussion

The present study demonstrated a substantial prevalence of subclinical hypothyroidism (36.7%) among older adults, with a predominance in females and overweight/obese individuals. These findings are consistent with previous studies which have reported a higher occurrence of subclinical hypothyroidism in elderly populations, particularly among women. A study by Mohanty et al. study on elderly SCH similarly observed a higher prevalence in females and in the 60–70 years age group, supporting the age- and gender-related susceptibility to thyroid dysfunction [12]. The increased prevalence in older adults may be attributed to age-related changes in thyroid physiology and increased autoimmune predisposition.

In the present study, subclinical hypothyroidism was significantly associated with an adverse lipid profile, characterized by elevated total cholesterol, triglycerides, LDL-C, and VLDL-C along with reduced HDL-C levels. These findings are in agreement with earlier studies which have consistently demonstrated dyslipidemia in subclinical hypothyroidism. Mohanty et al. reported significantly higher cholesterol, LDL, and triglyceride levels in elderly patients with subclinical hypothyroidism [12]. Similarly, another study showed increased total cholesterol and LDL-C levels in patients with subclinical hypothyroidism, reinforcing the atherogenic lipid pattern observed in the present study [13]. These lipid abnormalities are likely due to reduced LDL receptor activity and impaired lipid clearance associated with decreased thyroid hormone action.

The present study also found a significant association between higher BMI and subclinical hypothyroidism, with mean BMI being significantly higher in affected individuals and obesity more prevalent in this group. This observation is supported by recent evidence indicating a link between thyroid dysfunction and adiposity.

A recent study by Tiwari et al. demonstrated a positive correlation between BMI and serum lipid abnormalities, with higher TSH levels associated with increased prevalence of dyslipidemia and obesity [14]. Additionally, a study exploring hypothyroidism and metabolic parameters reported that subclinical hypothyroidism is frequently associated with higher BMI and metabolic disturbances, particularly in females [15]. However, Ramyasree K et al. have reported contrasting findings; found no significant correlation between BMI and TSH levels, suggesting that the relationship may vary across populations and may be influenced by genetic and environmental factors [16].

Furthermore, the present study demonstrated a significant positive correlation between serum TSH levels and total cholesterol, triglycerides, LDL-C, and BMI, along with a negative correlation with HDL-C. These findings are consistent with previous research indicating that increasing TSH levels are associated with worsening lipid parameters. A recent study on thyroid function and lipid correlation reported strong positive correlations between TSH and total cholesterol ($r = 0.67$) and LDL-C ($r = 0.61$), along with an inverse relationship with HDL-C [17]. This suggests that TSH may play a direct role in lipid metabolism beyond being merely a marker of thyroid function. Overall, the findings of the present study are in concordance with the majority of available literature, emphasizing that subclinical hypothyroidism is associated with adverse metabolic changes that may increase cardiovascular risk in older adults.

Conclusion

Subclinical hypothyroidism is a common finding among older adults and is significantly associated with dyslipidemia and increased body mass index. The condition is characterized by an atherogenic lipid profile, including elevated total cholesterol, triglycerides, LDL-C, and reduced HDL-C, along with higher BMI values.

These alterations may contribute to an increased cardiovascular risk in this population. Therefore, routine screening for subclinical hypothyroidism in elderly individuals, especially those with abnormal lipid profiles or obesity, may aid in early detection and appropriate management, thereby improving overall metabolic and cardiovascular outcomes.

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