

A Study to Assess the Relationship Between Hypothyroidism and Serum Calcium Among Population Attending a Tertiary Care Centre in Northern Part of West Bengal, India

Anup Kumar Debsinha¹, Krishna Chandra Sarkar², Tamal Chakraborty³

¹Assistant Professor, Department of Physiology, Jalpaiguri Government Medical College (JGMC), India. ²Professor, Department of Physiology, North Bengal Medical College and Hospital India. ³Associate Professor, department of physiology, North Bengal Medical College and Hospital India

Abstract

Background: Hypothyroidism is a common endocrine disorder known to affect multiple metabolic processes, including calcium homeostasis. Alterations in thyroid hormone levels may influence serum calcium through effects on bone turnover, renal handling, and hormonal regulation. The aim and objective is to assess the association between hypothyroidism and serum calcium levels and to evaluate the correlation between thyroid function parameters and calcium metabolism. **Material and Methods:** This hospital-based case-control study included 120 individuals aged 15–45 years, comprising 60 hypothyroid cases and 60 healthy controls. Hypothyroidism was defined as serum TSH >10 mIU/ml or TSH 6–10 mIU/ml with reduced fT3 and/or fT4 levels. Serum calcium was estimated using the Arsenazo III method. Data were analyzed using IBM SPSS Statistics and GraphPad Prism. Statistical tests included unpaired t-test, paired t-test, and Chi-square test, with $p < 0.05$ considered significant. **Results:** The mean serum calcium level was significantly lower in hypothyroid patients (8.12 ± 0.64 mg/dL) compared to controls (9.26 ± 0.58 mg/dL) ($p < 0.001$). Females showed slightly lower calcium levels than males, though not statistically significant ($p = 0.627$). A significant inverse relationship was observed between TSH levels and serum calcium ($p = 0.031$). Most patients (63.3%) had TSH >10 mIU/ml. **Conclusion:** Hypothyroidism is significantly associated with reduced serum calcium levels, with severity of thyroid dysfunction correlating with degree of hypocalcemia. Routine monitoring of calcium may aid in early detection and management of metabolic complications.

Keywords: Hypothyroidism, Serum Calcium, TSH, fT3, fT4, Hypocalcemia, Thyroid Dysfunction, Arsenazo III Method, Case-control Study.

Received: 10 May 2026

Revised: 30 May 2026

Accepted: 05 June 2026

Published: 26 June 2026

INTRODUCTION

Hypothyroidism is a widespread endocrine dysfunction worldwide and is associated with low levels of thyroid hormones, mainly triiodothyronine (T3) and thyroxine (T4), and a general decrease in the body's metabolic function.^[1] It can occur as a result of primary thyroid gland disease, usually autoimmune thyroiditis or iodine deficiency, or less commonly as a result of pituitary or hypothalamic dysfunction.^[1,2] Clinical symptoms span from biochemical alterations to serious systemic disorders, creating a serious public health problem. Hypothyroidism is a common condition, it is underdiagnosed and needs attention for metabolic effects in India, especially in iodine deficient areas (IDA).^[3,4]

In addition to their involvement in metabolism, thyroid hormones contribute very importantly to maintaining electrolyte and mineral homeostasis, such as calcium balance.^[5] Calcium is a key mineral in critical physiological processes including muscle and nerve conduction, blood clotting, enzyme reactions, and skeletal health.^[6] Ca homeostasis is regulated by a complex interplay of a range of hormones, including parathyroid hormone (PTH), vitamin D and calcitonin, which can be directly or indirectly controlled by thyroid hormones.^[5,6] Any thyroid

dysfunction can therefore result in aberrations of the calcium metabolism thus a clinically significant biochemical disorder may result.

Multiple studies have shown that hypothyroidism has been linked with decreased serum calcium, perhaps because of decreased bone turnover, impaired mobilization of calcium from bone and altered renal handling of calcium.^[7,8] Moreover, hypothyroid conditions may also result in higher concentrations of calcitonin and lower activity of PTH, which may also affect hypocalcemia.^[7] Recent data also indicate a strong inverse relationship between serum thyroid-stimulating hormone (TSH) and serum calcium levels and a positive correlation between T3, T4 and calcium.^[8,9] These observations demonstrate the complex interaction between thyroid function and mineral

Address for correspondence: Dr. Anup Kumar Debsinha, Assistant Professor Department of Physiology, Jalpaiguri Government Medical College (JGMC) India. E-mail: adebsinha@gmail.com

DOI:

10.21276/amit.2026.v13.i2.776

How to cite this article: Debsinha AK, Sarkar KC, Chakraborty T. A Study to Assess the Relationship Between Hypothyroidism and Serum Calcium Among Population Attending a Tertiary Care Centre in Northern Part of West Bengal, India. *Acta Med Int.* 2026;13(2):837-840.

metabolism and confirm the importance of a thorough biochemical assessment of thyroid function in patients with thyroid diseases taking into account both thyroid and mineral parameters.

Although there was an increasing amount of evidence around the world, however, there is not very much evidence related to the association of hypothyroidism with serum calcium levels in the Indian region particularly in the Eastern part of India where tertiary care centers are present. This relationship is of great importance because of the clinical related effects of hypocalcemia such as neuromuscular irritability, cardiovascular disturbances and bone disorders.^[6,10] Further, early diagnosis of calcium imbalance in hypothyroid patients allows for targeted therapy, such as calcium supplementation and monitoring, which can lead to better outcomes for the patients.

This study aimed to evaluate the relationship between serum calcium and hypothyroidism in patients attending tertiary care unit. It is designed to compare changes of serum calcium in patients with hypothyroidism and try to assess the relationship between thyroid hormone and calcium metabolism in order to improve clinical assessment and management strategies.

MATERIALS AND METHODS

Study Design: A hospital-based case-control observational study.

Study Population: Young and adult individuals aged 15–45 years attending OPD and IPD.

Sample Size: Total 120 participants: 60 cases (hypothyroid

patients) and 60 controls (healthy individuals).

- Cases: 24 males, 36 females
- Controls: 26 males, 34 females

Study Duration: One year (July 2014 to June 2015).

Study Place: North Bengal Medical College and Hospital (OPD and IPD).

Inclusion Criteria:

Individuals aged 15–45 years

Diagnosed hypothyroid patients with:

- Serum TSH >10 mIU/ml OR
- Serum TSH 6–10 mIU/ml with decreased serum FT3 and/or FT4

Willing participants providing consent

Exclusion Criteria:

- Patients with known parathyroid disorders
- Patients with renal disease or chronic systemic illness
- Individuals on calcium or vitamin D supplementation
- Patients on medications affecting calcium metabolism
- Pregnant women

Statistical Analysis: Data were entered into Microsoft Excel and subsequently analyzed using IBM SPSS Statistics (SPSS Inc., Chicago, IL, USA) and GraphPad Prism. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The unpaired t-test was applied to compare continuous variables between independent groups, and the paired t-test was used for within-group comparisons. Categorical variables were analyzed using the Chi-square test or Fisher’s exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Comparison of Serum Calcium Levels between Cases and Controls

Group	Number (n)	Mean Serum Calcium (mg/dL)	SD	t-value	p-value
Hypothyroid	60	8.12	0.64	14.669	<0.001
Control	60	9.26	0.58		

Table 2: Gender-wise Comparison of Serum Calcium in Hypothyroid Patients

Gender	Number (n)	Mean Serum Calcium (mg/dL)	SD	t-value	p-value
Male	24	8.18	0.6	0.489	0.627
Female	36	8.08	0.67		

Table 3: Age-wise Distribution of Study Participants

Age Group (years)	Number of Patients	Percentage (%)	p-value
<20	12	10%	0.041
21–30	28	23.30%	
31–40	30	25%	
41–45	50	41.70%	
Total	120	100%	

Table 4: Distribution of Hypothyroid Patients based on TSH Levels

TSH Level (mIU/ml)	Number (n)	Percentage (%)	p-value
6–10	22	36.70%	0.028
>10	38	63.30%	
Total	60	100%	

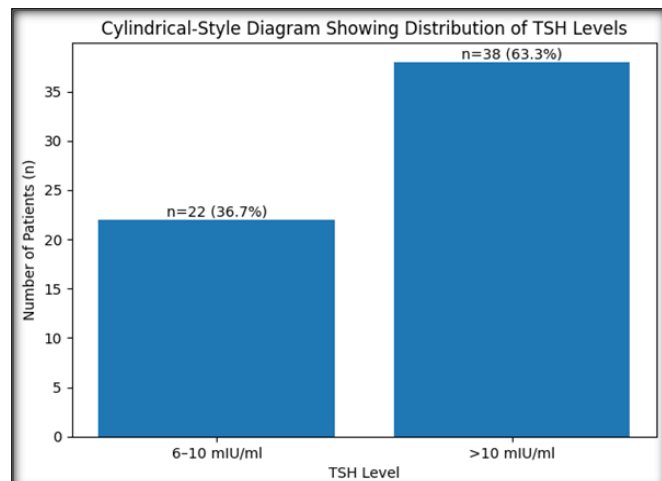
Table 5: Comparison of Serum Calcium based on TSH Severity

TSH Category	Number (n)	Mean Calcium (mg/dL)	SD	t-value	p-value
6–10 mIU/ml	22	8.34	0.59	2.214	0.031

>10 mIU/ml	38	7.98	0.66	
------------	----	------	------	--

Table 6: Gender Distribution of Study Population

Gender	Cases (n=60)	Controls (n=60)	Total (n=120)	Percentage (%)	p-value
Male	24	26	50	41.70%	0.713
Female	36	34	70	58.30%	
Total	60	60	120	100%	

**Figure 1: Cylindrical-Style Diagram Showing Distribution of TSH Levels**

[Table 1] The mean serum calcium level in hypothyroid patients was 8.12 ± 0.64 mg/dL, which was markedly lower compared to the control group (9.26 ± 0.58 mg/dL). This difference was found to be highly statistically significant ($t = 14.669$; $p < 0.001$), indicating a strong association between hypothyroidism and reduced serum calcium levels.

[Table 2] Gender-wise analysis among hypothyroid patients revealed that males had a mean serum calcium level of 8.18 ± 0.60 mg/dL, while females had a slightly lower mean value of 8.08 ± 0.67 mg/dL. However, this difference was not statistically significant ($t = 0.489$; $p = 0.627$), suggesting that gender does not significantly influence serum calcium levels in hypothyroid individuals.

[Table 3] The age-wise distribution of study participants showed that the majority belonged to the 41–45 years age group (41.7%), followed by 31–40 years (25%) and 21–30 years (23.3%), while the least number of participants were in the <20 years group (10%). The variation in age distribution was found to be statistically significant ($p = 0.041$), indicating a higher prevalence of hypothyroidism in middle-aged individuals.

[Table 4] Among hypothyroid patients, 63.3% ($n=38$) had serum TSH levels >10 mIU/ml, while 36.7% ($n=22$) had TSH levels between 6–10 mIU/ml. This distribution was statistically significant ($p = 0.028$), demonstrating that a larger proportion of patients presented with overt hypothyroidism.

[Table 5] Comparison of serum calcium levels based on TSH severity showed that patients with TSH levels >10 mIU/ml had lower mean calcium levels (7.98 ± 0.66 mg/dL) compared to those with TSH levels 6–10 mIU/ml (8.34 ± 0.59 mg/dL). This difference was statistically significant (t

$= 2.214$; $p = 0.031$), suggesting that increasing severity of hypothyroidism is associated with greater reduction in serum calcium levels.

[Table 6] The gender distribution of the study population revealed that females constituted 58.3% ($n=70$) of the total participants, while males accounted for 41.7% ($n=50$). Among cases and controls, the distribution was comparable, and the difference was not statistically significant ($p = 0.713$), indicating no gender bias in group allocation.

DISCUSSION

The present study demonstrated a significantly lower mean serum calcium level in hypothyroid patients compared to controls (8.12 ± 0.64 mg/dL vs 9.26 ± 0.58 mg/dL; $p < 0.001$). This observation is similar to the study conducted by Sultana S et al,^[11] who showed a significant decrease in serum calcium in hypothyroid patients, which was believed to be due to low bone turnover and low mobilization of calcium into the extracellular compartment. In the same way, Reddy PA and co-workers,^[12] found a strong negative correlation between TSH and serum calcium levels. The results are in line with the notion that thyroid hormone deficiency affects calcium homeostasis via its impact on bone metabolism and renal calcium handling.

Females did not have significantly different serum calcium levels from males in the current study, but showed a slight tendency to be lower in females than males when the data was divided by hypothyroidism diagnosis ($p = 0.627$). This is consistent with the results of Kumar V et al,^[13] who found no gender difference in the serum calcium level of hypothyroid individuals. Similarly, Sharma D et al,^[14] observed that, in spite of hypothyroidism occurring more frequently in females, there was no significant difference in the levels of serum calcium between the two genders making it more likely that hormonal differences do not directly impact calcium metabolism during hypothyroid phases.

In the present study, age-wise distribution of patients showed that there were significantly more patients in the age group 41–45 years who were diagnosed as having hypothyroidism ($p = 0.041$). This finding is similar to that of Unnikrishnan AG et al,^[15] who found that hypothyroidism was more common in middle aged adults. Furthermore, Vanderpump MPJ et al,^[16] showed an age dependency of thyroid dysfunction incidence, especially among females. The results have indicated that advanced age is an important risk factor for hypothyroidism.

Most of the subjects with hypothyroidism who were studied in the present study (63.3%) had TSH levels above 10 mIU/ml, suggesting overt hypothyroidism. This is similar to what was reported by Biondi B et al,^[17] who showed that a large percentage of patients have a diagnosis of overt hypothyroidism because hypothyroidism is not detected until later. In a similar way, Hollowell JG et al,^[18] have noted that biochemical

abnormalities are more often more severe with increased TSH concentrations, such as changes in mineral metabolism.

In the present study, patients had significantly lower serum calcium level ($p = 0.031$) if their TSH level was greater than 10 mIU/ml rather than mildly elevated. This finding is similar to the one reported by Singh S et al,^[19] of a negative correlation between TSH and serum calcium concentrations. Moreover, the severity of hypothyroidism was correlated with the degree of hypocalcemia in Jaskiran K et al,^[20] which may be related to decreased bone turnover and altered parathyroid hormone activity.

The gender distribution in this study revealed more females (58.3%) than males (41.7%) without any difference that was statistically significant ($p = 0.713$). The latter is in line with the study conducted by Canaris GJ et al,^[11] that revealed that a higher prevalence was recorded for the females when compared to males. Likewise, Tunbridge WM et al,^[12] had reported a higher prevalence of thyroid diseases among females because of auto-immune susceptibility and hormonal effects.

CONCLUSION

It has been shown in the present study that there is a significant relationship between the hypothyroidism and decrease in serum calcium level, which means that the thyroid hormone deficiency has some effect on the mineral metabolism. The serum calcium level was significantly lower than that of euthyroid controls in the hypothyroid patients, and the level of TSH was inversely related to serum calcium. While females had slightly less calcium than males, there was no significant difference, suggesting low gender effect on calcium status in hypothyroidism. Also, a more severe hypothyroidism was associated with a bigger decrease in serum calcium for those with higher TSH levels, indicating that the severity of hypothyroidism is related to the severity of hypocalcemia. The data stress the significance of frequent serum calcium control in hypothyroid individuals to prevent the possible complicated effects of neuromuscular irritability and bone disorders. Early detection and timely management of the calcium imbalance may be able to optimize clinical results and quality of life in such a population.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. StatPearls Publishing. Hypothyroidism. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
2. Jameson JL, Mandel SJ, Weetman AP. Disorders of the thyroid gland. In: Harrison's Principles of Internal Medicine. New York: McGraw-Hill Education; 2022. p. 2283–2308.
3. Taylor PN, Albrecht D, Scholz A, Gutierrez-Buey G, Lazarus JH, Dayan CM, et al. Global epidemiology of hyperthyroidism and hypothyroidism. *Nat Rev Endocrinol*. 2018;14(5):301–316.
4. Unnikrishnan AG, Menon UV. Thyroid disorders in India: An epidemiological perspective. *Indian J EndocrinolMetab*. 2011;15(Suppl 2):S78–S81.
5. Williams GR. Actions of thyroid hormones in bone. *Endokrynol Pol*. 2009;60(5):380–388.
6. Guyton AC, Hall JE. Parathyroid hormone, calcitonin, calcium and phosphate metabolism. In: *Textbook of Medical Physiology*. Philadelphia: Elsevier; 2016. p. 985–1000.
7. Sultana S, Ahmed ST, Rahman MM. Calcium imbalance and hypothyroidism: Exploring the relationship. *KYAMC J*. 2024;15(2):145–150.
8. Rimpay RC, John M, Kaur P. Evaluation of serum calcium in thyroid dysfunction patients. *Eur J Cardiovasc Med*. 2024;14(2):355–361.
9. D'Sa J, Fernandes S, Naik R. Assessment of serum calcium, phosphorus and thyroid profile in hypothyroid patients. *Indian J Appl Res*. 2025;15(1):45–49.
10. Peacock M. Calcium metabolism in health and disease. *Clin J Am Soc Nephrol*. 2010;5(Suppl 1):S23–S30.
11. Sultana S, Rahman MM, Ahmed ST. Study of serum calcium levels in hypothyroid patients. *KYAMC J*. 2024;15(2):145–150.
12. Reddy PA, Kumar MP, Rao VS. Study of serum calcium levels in patients with thyroid disorders. *Int J Res Med Sci*. 2019;7(6):2154–2158.
13. Kumar V, Singh S, Gupta AK. Evaluation of serum electrolytes in hypothyroid patients. *J ClinDiagn Res*. 2017;11(4):BC01–BC04.
14. Sharma D, Arora S, Kaur G. Assessment of thyroid dysfunction and mineral metabolism. *Int J Med Sci Public Health*. 2018;7(5):356–360.
15. Unnikrishnan AG, Kalra S, Bantwal G, John M, Tewari N. Prevalence of hypothyroidism in adults: An epidemiological study. *Indian J EndocrinolMetab*. 2013;17(4):647–652.
16. Vanderpump MPJ. The epidemiology of thyroid disease. *Br Med Bull*. 2011;99:39–51.
17. Biondi B, Cooper DS. The clinical significance of subclinical thyroid dysfunction. *Lancet*. 2018;379(9821):1142–1154.
18. Hollowell JG, Staehling NW, Flanders WD, Hannon WH, Gunter EW, Spencer CA, et al. Serum TSH, T4, and thyroid antibodies in the United States population (NHANES III). *J ClinEndocrinolMetab*. 2002;87(2):489–499.
19. Singh S, Kumar K, Verma A. Correlation of thyroid hormones with serum calcium levels in hypothyroidism. *Int J Adv Med*. 2020;7(3):450–454.
20. Jaskiran K, Singh H, Kaur J. Study of electrolyte imbalance in thyroid disorders. *J Med SciClin Res*. 2016;4(8):11900–11905.