

Original Article:

Association of Serum FT3, FT4, TSH Levels and Acne Severity in Patients with Post-adolescent Acne: A Hospital-Based Study in Bangladesh

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Abstract

Background: Post-adolescent acne is a common chronic inflammatory skin disorder that may persist or develop beyond adolescence. Although several hormonal factors have been implicated in its pathogenesis, the relationship between thyroid function and acne severity remains insufficiently explored. This study aimed to assess the relationship between serum free triiodothyronine (FT3), free thyroxine (FT4), thyroid-stimulating hormone (TSH), and acne severity among patients with post-adolescent acne.

Materials and Methods: This hospital-based cross-sectional study was conducted among 36 clinically diagnosed patients with post-adolescent acne attending the Department of Dermatology and Venereology, Bangladesh Medical University (BMU), Dhaka, Bangladesh. Patients aged 25 years or older who fulfilled the predefined inclusion and exclusion criteria were included. Acne severity was assessed using the Global Acne Grading System (GAGS). Serum FT3, FT4, and TSH levels were measured using the chemiluminescent microparticle immunoassay (CMIA) method. The relationship between serum thyroid hormone levels and acne severity was assessed using Spearman's rank correlation, while thyroid hormone levels across mild, moderate, and severe acne groups were compared using one-way analysis of variance (ANOVA). We considered $p < 0.05$ statistically significant.

Results: Among the 36 participants, the mean age was 29.53 ± 4.24 years, with a range of 25–41 years; 72.2% were female, and 27.8% were male. Based on the GAGS score, 27.8% had mild acne, 55.6% had moderate acne, and 16.7% had severe acne. The mean serum FT3, FT4, and TSH levels were 4.66 ± 0.48 pmol/L, 12.80 ± 1.63 pmol/L, and 0.28 ± 0.33 mIU/L, respectively. None of the thyroid parameters showed a statistically significant correlation with GAGS score. FT3 showed a very weak negative correlation ($r_s = -0.027$, $p=0.875$), FT4 showed a very weak positive correlation ($r_s = 0.035$, $p=0.838$), and TSH showed a weak negative correlation ($r_s = -0.277$, $p=0.102$). Comparison across acne severity groups also showed no statistically significant differences in mean FT3 ($p=0.983$), FT4 ($p=0.247$), or TSH ($p=0.078$) levels.

Conclusion: No statistically significant relationship was observed between serum FT3, FT4, or TSH levels and acne severity among patients with post-adolescent acne. These findings suggest that variations in circulating thyroid hormone levels may not be directly associated with the clinical severity of acne in this study population. Larger studies with longitudinal designs are warranted to further explore the potential role of thyroid function in the pathogenesis and clinical progression of post-adolescent acne.

Keywords: Post-adolescent acne; Acne severity; FT3; FT4; TSH; Global Acne Grading System; Thyroid function.

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Introduction

Acne vulgaris is one of the most common inflammatory disorders of the skin and primarily affects the pilosebaceous unit. It is characterized by a complex interaction of follicular hyperkeratinization, increased sebum production, microbial dysbiosis, and cutaneous inflammation. Acne remains a substantial global health burden; the Global Burden of Disease Study 2019 estimated approximately 231 million prevalent cases worldwide, with the overall burden increasing considerably since 1990.^{1,2}

Although acne is traditionally associated with adolescence, it frequently persists into adulthood or develops after adolescence. Adult acne, commonly defined as acne occurring at or beyond 25 years of age, is particularly common among women. It may present as persistent acne continuing from adolescence or as late-onset acne developing after the age of 25 years.^{3,4} Epidemiological studies have demonstrated that adult acne is an increasingly recognized clinical problem, with women showing a higher prevalence than men in this age group.^{3,5} The clinical burden of adult acne extends beyond the presence of skin lesions, as persistent inflammation and scarring may have considerable psychosocial consequences.⁶

The pathogenesis of acne is multifactorial, with hormonal regulation playing a central role. Androgens stimulate sebaceous gland activity, increase sebum production, and contribute to follicular hyperkeratinization and inflammation.^{7,8} Importantly, acne may develop even in the absence of overt systemic androgen excess because sebocytes and other components of the pilosebaceous unit possess local mechanisms for hormone metabolism and signaling. The sebaceous gland functions as an active endocrine-responsive organ, expressing receptors for several hormones and mediators that regulate sebocyte proliferation, differentiation, lipid synthesis, and inflammatory responses.^{9,10} These mechanisms provide a biological basis for investigating hormonal factors beyond androgens in relation to acne severity.

Thyroid hormones are among the endocrine factors that may influence cutaneous physiology. Thyroid hormone receptors are expressed in various skin cell types, and thyroid hormones have been shown to regulate epidermal growth, differentiation, and other aspects of skin homeostasis.¹¹ The sebaceous gland also expresses receptors for thyroid-related hormonal signals, suggesting that thyroid function may influence sebocyte activity and lipid metabolism.¹² Experimental evidence has further demonstrated that TSH can stimulate sebocyte proliferation, indicating that thyroid-related

signaling may have a direct role in sebaceous gland biology.¹³

The potential relationship between thyroid function and acne has also been investigated clinically, although the available evidence remains inconsistent. A study of adult women with post-adolescent acne found a higher frequency of elevated antithyroglobulin antibodies compared with healthy controls, while serum FT3, FT4, and TSH levels did not differ significantly between the groups.¹⁴ More recent evidence has suggested an association between thyroid-related disorders and acne severity. In a study involving patients with acne and endocrine or metabolic comorbidities, autoimmune thyroiditis and hypothyroidism were associated with a greater prevalence of moderate and severe acne.¹⁵ However, these findings primarily concerned the presence of thyroid disorders or autoimmunity rather than the relationship between circulating thyroid hormone concentrations and the clinical severity of acne. The relationship between thyroid function and acne may also be influenced by treatment and other endocrine factors. For example, systemic isotretinoin therapy has been associated with alterations in serum thyroid function tests, including changes in TSH, FT3, and FT4 levels.¹⁶ This highlights the importance of evaluating thyroid parameters in appropriately selected patients and avoiding potential confounding factors when investigating their relationship with acne severity.

Despite the biological plausibility of thyroid involvement in sebaceous gland function and skin homeostasis, relatively limited evidence is available regarding whether circulating FT3, FT4, and TSH levels are directly related to the clinical severity of post-adolescent acne. Furthermore, much of the existing literature has focused on thyroid disease, thyroid autoimmunity, or comparisons between acne patients and healthy controls rather than examining thyroid hormone levels across a continuous measure of acne severity. Therefore, assessing the relationship between serum thyroid hormone concentrations and GAGS score may provide a more direct evaluation of this potential association.

Accordingly, the present study was designed to assess the relationship between serum FT3, FT4, and TSH levels and acne severity among patients with post-adolescent acne attending a tertiary dermatology center in Bangladesh.

Materials and Methods

Study design: Cross-sectional study

Study population: Patients with post-adolescent acne

Sample size: 36 consecutive eligible participants

Sampling technique: Consecutive sampling
Study Population and Sample Size

A total of 36 consecutive eligible patients with clinically diagnosed post-adolescent acne were included in this analytical cross-sectional study. The study population comprised patients aged 25 years or older who attended the Department of Dermatology and Venereology, BMU, Dhaka, and fulfilled the predefined inclusion and exclusion criteria. All eligible participants available during the study period were consecutively enrolled.

Selection Criteria

The following participants were included in the study: Patients aged 25 years or older with clinically diagnosed post-adolescent acne, of either sex, with normal BMI, who provided informed written consent to participate in the study.

Participants were excluded if they had other types of acne or acneiform disorders, such as steroid acne, acneiform eruption, acne fulminans, or acne conglobata; known thyroid disease or any obvious clinical features suggestive of thyroid dysfunction, including hypothyroidism, hyperthyroidism, Graves' disease, or Hashimoto's thyroiditis; previous thyroidectomy or current treatment for thyroid disease; known systemic diseases such as diabetes mellitus, malignancy, chronic liver disease, or chronic renal disease; pregnancy or lactation; use of drugs known to affect thyroid function or acne severity, including glucocorticoids, amiodarone, lithium, phenytoin, dopamine, isotretinoin, or oral contraceptive pills within the previous three months; smoking or alcohol abuse; or known polyendocrine metabolic ovarian syndrome (PMOS) or clinical features of hyperandrogenism, including hirsutism, virilization, androgenic alopecia, or irregular menstruation.

Study Procedure

This hospital-based cross-sectional study was conducted in the Department of Dermatology and Venereology, BMU, Dhaka, following approval from the Institutional Review Board (IRB). A total of 36 consecutive eligible patients with clinically diagnosed post-adolescent acne were included in the study.

Clinical Assessment

Patients aged 25 years or above who attended the Outpatient Department of Dermatology and Venereology, BMU, with clinically diagnosed post-adolescent acne were assessed for eligibility according to the predefined inclusion and exclusion criteria. Eligible participants were consecutively enrolled until a total of 36 participants were included.

A detailed history was obtained using a semi-structured questionnaire, including demographic characteristics, age at onset of acne, relevant medical history, medication history, menstrual history where applicable, and other relevant clinical information. A general physical and

dermatological examination was performed by the principal investigator, and the diagnosis of post-adolescent acne was confirmed by the supervisor. The severity of acne was assessed using the GAGS. The GAGS score was recorded for each participant and used as the principal clinical measure of acne



Figure 1: Photographs of patients with (A) Mild acne vulgaris, (B) Moderate acne vulgaris, and (C) Severe acne vulgaris.

Blood Sample Collection and Laboratory Procedure Sample Collection

Participants were instructed to fast for 12 hours before blood collection. A 3 mL venous blood sample was collected for estimation of FT3, FT4 and TSH under aseptic conditions using a sterile disposable syringe and transferred into a red-capped tube without anticoagulant. The blood sample was allowed to clot for approximately 1 hour and was then transported in a specimen collection rack from the Department of Dermatology and Venereology to the Department of Biochemistry and Molecular Biology, BMU. The samples were centrifuged at 3000 rpm for 15 minutes, and the separated serum was analyzed using the Alinity ci automated analyzer (Abbott Laboratories, USA) by the CMIA method in the Department of Biochemistry and Molecular Biology, BMU.

Data Processing and Analysis

After completion of data collection, all data were checked, verified for completeness and consistency, coded, and entered into Microsoft Excel 365 and subsequently analyzed using IBM SPSS Statistics version 26.0 for Windows (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean $\pm$ standard deviation (SD). The normality of continuous variables was assessed before selecting the appropriate statistical test. Fisher's exact test was done to analyse the association between acne site and severity. The Spearman's rank-order correlation coefficient was used as the primary analysis to assess the relationship

between GAGS score and serum FT3, FT4, and TSH levels. We considered $p < 0.05$ statistically significant.

Ethical issues

The study was conducted following the principles of the Declaration of Helsinki and after obtaining ethical approval from the IRB of BMU (BSMMU/2024/7122, Date: 01/08/2024; Protocol ID: 5127). Written informed consent was obtained from each participant after providing clear information regarding the purpose and procedures of the study. Participants were informed that participation was voluntary and that they had the right to refuse participation or withdraw from the study at any stage without any consequences. We strictly maintained the confidentiality and privacy of all participants.

Results

A total of 36 eligible patients with post-adolescent acne were included in the study. The mean age of the participants was 29.53 ± 4.24 years, with an age range of 25–41 years. The majority of participants (63.9%) belonged to the 25–30-year age group, followed by 33.3% in the 31–40-year age group and 2.8% in the 41–50-year age group. Females constituted the majority of the study population (72.2%), while males accounted for 27.8%. Table I presents the demographic characteristics of the study participants.

Table I: Distribution of study participants by demographic profile (n=36)

Demographic characteristics	Frequency (n)	Percentage (%)
Age group (years)		
25–30	23	63.9
31–40	12	33.3
41–50	1	2.8
Total	36	100.0
Mean age $\pm$ SD (years)	29.53 $\pm$ 4.24	
Range (min–max)	25–41	
Sex		
Male	10	27.8
Female	26	72.2
Total	36	100.0

Table II summarizes the clinical history and characteristics of post-adolescent acne patients. The majority of patients (61.1%) had an age of onset below 25 years, while 38.9% developed acne at 25 years or older. Most patients (61.1%) had the disease for 5 years or more, whereas 38.9% had a duration of less than 5 years. None of the participants reported a family history of post-adolescent acne.

Table II. Clinical history and characteristics among post-adolescent acne patients (n=36)

Clinical history	Frequency (n)	Percentage (%)
Age of onset (years)		
< 25	22	61.1
$\geq$ 25	14	38.9
Duration of disease (years)		
<5 years	14	38.9
$\geq$ 5 years	22	61.1
Family history of post-adolescent acne		
Yes	0	0.0
No	36	100.0

Among the 36 post-adolescent acne patients, the most common lesion distribution was involvement of the face and neck (33.3%), followed by involvement of the face and back (25.0%) and face alone (25.0%). Face and chest involvement was observed in 16.7% of patients. Overall, multisite involvement was more common than isolated facial involvement. (Table III)

Table III. Distribution of acne lesion sites among post-adolescent acne patients (n=36)

Acne lesion site	Frequency (n)	Percentage (%)
Face and neck	12	33.3
Face and back	9	25.0
Face alone	9	25.0
Face and chest	6	16.7
Total	36	100.0

Table IV presents the severity distribution of post-adolescent acne using the GAGS. The majority of patients had moderate acne (55.6%), followed by mild (27.8%) and severe (16.7%) forms. The overall mean GAGS score was 22.7 ± 6.98 , indicating that most patients experienced moderate disease severity.

Table IV. Severity of post-adolescent acne based on GAGS score (n=36)

Disease severity by GAGS score	Frequency (n)	Percentage (%)	Mean $\pm$ SD
Mild (0–18)	10	27.8	22.7 $\pm$ 6.98
Moderate (19–30)	20	55.6	
Severe (31–38)	6	16.7	
Total	36	100.0	

Table V shows the distribution of acne severity across the different acne lesion sites among the 36 post-adolescent acne patients. Face and neck involvement was the most common presentation ⁽¹²⁾, of which the majority had moderate acne (58.3%), followed by mild (33.3%) and severe (8.3%) disease. Among patients with acne confined to the face alone ⁽⁹⁾ and those with face and back involvement ⁽⁹⁾, moderate severity again predominated (55.6% in both groups), though face and back involvement showed a higher proportion of severe disease (33.3%) compared with face alone (11.1%). Face and chest involvement was the least common site ⁽⁶⁾, with moderate severity in half of these patients (50.0%). Overall, moderate acne was the predominant severity grade across all lesion sites (20/36, 55.6%), followed by mild (10/36, 27.8%) and severe (6/36, 16.7%) disease. On Fisher's exact test, no statistically significant association was found between acne lesion site and disease severity ($p = 0.814$).

Table V: Association between acne site and severity based on GAGS score among post-adolescent acne patients (n=36)

Acne Site	Mild (0–18)	Moderate (19–30)	Severe (31–38)	Total	p-value
Face	3 (33.3%)	5 (55.6%)	1 (11.1%)	9	
Face & Back	1 (11.1%)	5 (55.6%)	3 (33.3%)	9	
Face & Chest	2 (33.3%)	3 (50.0%)	1 (16.7%)	6	0.814
Face & Neck	4 (33.3%)	7 (58.3%)	1 (8.3%)	12	
Total	10	20	6	36	

Note: p-value is from Fisher's exact test. No significant association between acne site and severity ($p = 0.814$).

The mean FT3, FT4, and TSH levels were 4.66 ± 0.48 pmol/L, 12.80 ± 1.63 pmol/L, and 0.28 ± 0.33 mIU/L, respectively. Table VI shows the comparison of serum thyroid hormone levels across different acne severity groups based on the GAGS score. The mean FT3 and FT4 levels did not differ significantly among the mild, moderate, and severe acne groups ($p=0.983$ and $p=0.247$, respectively). Although the mean TSH level was relatively higher in the mild acne group than in the moderate and severe groups, the difference was not statistically significant ($p=0.078$). The majority of participants were euthyroid, with 91.7% showing normal thyroid function. Subclinical hypothyroidism was observed in 8.3% of the participants.

Table VI: Comparison of serum thyroid hormone levels according to acne severity based on GAGS score among post-adolescent acne patients (n=36)

Thyroid parameter	Mild (0–18) (n=10) Mean $\pm$ SD	Moderate (19–30) (n=20) Mean $\pm$ SD	Severe (31–38) (n=6) Mean $\pm$ SD	p-value
FT3 (pmol/L)	4.65 ± 0.67	4.68 ± 0.43	4.64 ± 0.36	0.983
FT4 (pmol/L)	12.30 ± 1.77	13.21 ± 1.60	12.26 ± 1.32	0.247
TSH (mIU/L) (log10)	0.47 ± 0.25	0.23 ± 0.35	0.12 ± 0.24	0.078

Note: p-values were obtained by one-way ANOVA; $p < 0.05$ was considered statistically significant.

Figure 2 presents the correlation between GAGS score and serum thyroid hormone levels among post-adolescent acne patients. None of the thyroid parameters showed a statistically significant correlation with acne severity ($p > 0.05$). FT3 showed a very weak negative correlation with GAGS score ($r_s = -0.027$, $p=0.875$), while FT4 showed a very weak positive correlation ($r_s = 0.035$, $p=0.838$). TSH demonstrated a weak negative correlation with GAGS score ($r_s = -0.277$, $p=0.102$); however, this association was not statistically significant.

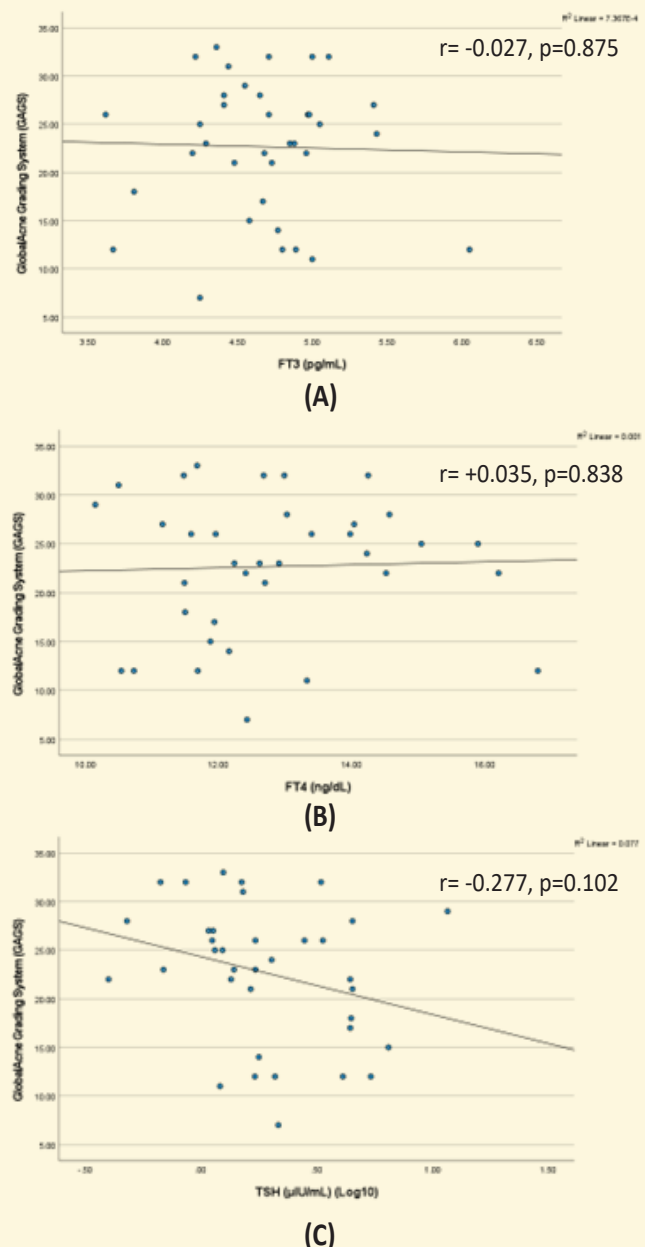


Figure 2. Correlation between GAGS score and serum thyroid function parameters among patients with post-adolescent acne (n=36).

(A) Scatter plot showing the correlation between GAGS score and serum FT3 level. A very weak negative correlation was observed (Spearman's $r_s = -0.027$, $p = 0.875$), indicating no statistically significant association between FT3 level and acne severity.

(B) Scatter plot showing the correlation between GAGS score and serum FT4 level. A very weak positive correlation was observed (Spearman's $r_s = 0.035$, $p = 0.838$), which was not statistically significant, indicating no meaningful association between FT4 level and acne severity.

(C) Scatter plot showing the correlation between GAGS score and serum TSH level. A weak negative correlation was observed (Spearman's $r_s = -0.277$, $p = 0.102$); however, the association did not reach statistical significance.

Discussion

In the present study, the participants had a mean age of 29.53 ± 4.24 years, with most patients (63.9%) belonging to the 25–30-year age group, followed by 33.3% aged 31–40 years and 2.8% aged 41–50 years. The age distribution is consistent with previous studies demonstrating that post-adolescent acne commonly affects individuals in early adulthood. A previous study reported a mean age of 30.4 ± 4.9 years among patients with post-adolescent acne, which is comparable to the mean age observed in the present study.¹⁷ Similarly, another study reported a mean age of 30.5 years among adult acne patients aged over 25 years.¹⁸ These findings support the recognition of post-adolescent acne as a clinically important condition that may persist or present during the third and fourth decades of life rather than being restricted to adolescence.

A marked female predominance was observed in the present study, with females accounting for 72.2% of the participants and males for 27.8%. This finding is consistent with the established epidemiological pattern of adult acne, which is more frequently reported among women. Previous data from a study reported that 82.1% of their adult acne patients were women,¹⁸ while another described adult female acne as a distinct clinical entity that may persist from adolescence or develop after adulthood.¹⁹ Overall, the age and sex distribution of the present study population is broadly comparable with previously published studies of post-adolescent and adult acne. The concentration of cases in early adulthood and the predominance of female patients are consistent with the demographic characteristics reported in the existing literature.

In the present study, the majority of patients (61.1%) reported an age of onset below 25 years, while 38.9%

developed acne at 25 years or older, suggesting that persistent acne is more common than late-onset acne in this group. 61.1% of patients had acne for five years or more, highlighting the chronic nature of post-adolescent acne. These findings are consistent with a study that found that in patients with post-adolescent acne, late-onset acne represented 47.8% and persistent acne represented 52.2%.¹⁷

In the present study, acne severity among post-adolescent patients was assessed using the GAGS, revealing that 55.6% had moderate acne, 27.8% had mild acne, and 16.7% had severe acne, with a mean GAGS score of 22.7 ± 6.98 . This suggests that moderate acne is the most common form in this group, reflecting the chronic and often inflammatory nature of adult acne. A similar pattern was observed, with 20% mild and 51% moderate acne.²⁰ Likewise, others reported that among women with post-adolescent acne, 50% had moderate acne, 33% had mild acne, and 17% had severe acne, which is highly comparable with the findings of the present study.²¹ These findings suggest that patients are more likely to seek medical attention when acne is moderate to severe.

In the present study, the most commonly affected site in post-adolescent acne was the face and neck (33.3%), followed by face and back (25.0%), face only (25%), and face and chest (16.7%). This distribution highlights the multifocal nature of post-adolescent acne, especially involving areas rich in sebaceous glands. These findings are consistent with another studies, which reported that adult acne predominantly affected the lower third of the face, including the jawline, neck, and chin.^{22,23} Another study also observed that acne occurs predominantly on the face and, to a lesser extent, on the neck, back, and chest, which aligns with the pattern seen in the present study.²⁴ The facial predominance may be due to higher pilosebaceous density and increased exposure to cosmetic or environmental triggers. No significant association was found between site and severity. A previous study found significant association that may be due to a larger sample size.²⁵

In the present study, the mean serum FT3, FT4, and TSH levels among post-adolescent acne patients were 4.66 ± 0.48 pmol/L, 12.80 ± 1.63 pmol/L, and 0.28 ± 0.33 mIU/L, respectively. When thyroid hormone levels were compared across acne severity groups, no statistically significant differences were observed for FT3 ($p = 0.983$), FT4 ($p = 0.247$), or TSH ($p = 0.078$). These findings suggest that variations in circulating thyroid hormone levels were not significantly associated with the clinical severity of post-adolescent acne in the present study. The findings are broadly consistent with another study.¹⁷

Their study concluded that thyroid function was not related to post-adolescent acne.

The study had a relatively small sample size and was conducted at a single tertiary-care center, which may limit the generalizability of the findings. Lifestyle and other potentially relevant factors, including stress, diet, sleep, and hormonal influences, were not evaluated. Thyroid assessment was based on serum FT3, FT4, and TSH measurements using a CMIA-based method; structural and functional thyroid assessments such as ultrasonography or radioactive iodine uptake were not performed. Larger multicenter and longitudinal studies are recommended to further investigate the relationship between thyroid function and post-adolescent acne and to clarify whether any temporal or causal association exists. Future research should also consider relevant lifestyle, metabolic, and hormonal factors that may influence acne severity. Routine thyroid screening solely on the basis of post-adolescent acne may not be justified by the present findings; however, thyroid function testing may be considered when clinically indicated, particularly in patients with symptoms or signs suggestive of thyroid dysfunction.

Conclusion

This study found no statistically significant association between serum FT3, FT4, or TSH levels and acne severity among patients with post-adolescent acne. Although a small proportion of participants had subclinical hypothyroidism, the majority were euthyroid. Overall, the findings suggest that thyroid function parameters may not have a significant relationship with the severity of post-adolescent acne in this study population.

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Conflict of Interest

There is no conflict of interest related to the publication of this study.

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