Current Research in Medical Sciences
p ISSN: 3116-0298

Student Research Committee
Babol University of Medical Sciences

Original Article

Investigating the Effect of Levothyroxine on Psychological Symptoms and General Health in Patients with Hypothyroidism

Angela Hamidia[1], Golnaz Bakhshandeh[2], Neda Meftah[3], Sussan Mouodi[1], Azadeh Ramezani[1*]

[1]Department of Development and Clinical Research, Shahid Yahyanejad Hospital, Babol University of Medical Sciences, Babol, Iran
[2] Student Research Committee, Babol University of Medical Sciences, Babol, Iran
[3]Department of Internal Medicine, School of Medicine, Rouhani Hospital, Babol University of Medical Sciences, Babol, Iran

Article Info.

Received: 5 Feb 2026
Accepted: 11 March 2026

*** Corresponding Author:**

Azadeh Ramezani (MD)
E-mail:
azadeh.ramezani@mubabol.ac.ir
Tel: +98 11 32223594

Cite this article
Hamidia A, Bakhshandeh G, Meftah N, Mouodi S, Ramezani A. Investigating the Effect of Levothyroxine on Psychological Symptoms and General Health in Patients with Hypothyroidism. Curr Res Med Sci. 2026; 10: 20-27.
DOI:10.22088/crms.20.1.11

Abstract

Background: Hypothyroidism is associated with a wide range of physical and psychological symptoms, including anxiety and depression. However, the extent to which levothyroxine therapy improves psychological symptoms in patients with clinical hypothyroidism remains unclear. Therefore, this study aimed to evaluate changes in psychological symptoms and general health among patients with hypothyroidism treated with levothyroxine.

Methods: This prospective cohort study was conducted among patients aged 20–45 years who were diagnosed with hypothyroidism and had thyroid-stimulating hormone (TSH) levels above the normal range. Participants completed the Symptom Checklist-25 (SCL-25) and the General Health Questionnaire-28 (GHQ-28) at baseline and again three months after initiating levothyroxine therapy. Data were analyzed using SPSS version 25. A two-tailed p-value < 0.05 was considered statistically significant.

Results: Three months after treatment initiation, significant improvements were observed in SCL-25 symptom severity and GHQ-28 general health measures ($P < 0.001$). Significant differences were also observed in several SCL-25 domains, including anxiety, somatic complaints, depression, obsessive–compulsive symptoms, and interpersonal sensitivity ($P < 0.05$). These associations remained statistically significant after adjustment for potential confounders. Older age was positively associated with several psychological symptom domains, and sex differences were observed in selected domains.

Conclusion: Levothyroxine therapy was associated with significant improvements in psychological symptoms and general health among patients with hypothyroidism. These findings suggest that assessment of thyroid function may be clinically relevant in individuals presenting with psychological distress.

Keywords: hypothyroidism, levothyroxine, psychological symptoms, general health

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

Copyright © 2023 Babol University of Medical Sciences. Published by Babol University of Medical Sciences. This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (https://creativecommons.org/licenses/by-nc/4.0/). Noncommercial uses of the work are permitted, provided the original work is properly cited.

Introduction

Hypothyroidism, also known as an underactive thyroid, is a prevalent thyroid disorder affecting a significant portion of the population [1]. It is characterized by an inadequate production of thyroid hormones, namely triiodothyronine (T3) and thyroxine (T4), which are essential for regulating various bodily functions [2, 3]. When left untreated, hypothyroidism can give rise to a range of severe health complications that significantly impact overall well-being [4]. These complications may include cardiovascular problems, weight gain, fatigue, mental health issues, infertility, and neurological abnormalities [5]. In some cases, the consequences of untreated hypothyroidism can be life-threatening and result in death [1].

The prevalence of this disorder is usually around 1-2% of the population and can increase with age. Studies indicate that the prevalence of this disorder in women is up to 10 times higher than in men [1, 3]. Due to the diverse clinical manifestations and the lack of specific characteristic symptoms, the diagnosis of hypothyroidism is mainly based on biochemical markers [6]. Primary overt or clinical hypothyroidism is defined by an elevated thyroid-stimulating hormone (TSH) concentration above the reference range and a below-reference range for free thyroxine concentration [1, 6]. Additionally, mild or subclinical hypothyroidism, which is often considered a sign of primary thyroid failure, is defined by an elevated TSH concentration above the reference range and a normal range for free thyroxine concentration [6, 7].

Iodine deficiency is the most common and important cause of hypothyroidism in people. Also, autoimmune diseases and iatrogenic causes (hyperthyroidism treatment) are among the most common causes of hypothyroidism [8].

Studies show that thyroid hormones have various effects on neurogenesis, glial growth, myelin, synaptogenesis, and dendritic cell proliferation, therefore, these hormones are essential for normal brain development and function [9]. In hypothyroidism, slow functioning of many internal organs and systems has been reported, leading to a wide range of symptoms. This disease, in addition to physical symptoms, also has many psychological symptoms [10].

It is believed by scientists that thyroid hormone is a major factor in brain chemistry disorders, and if it is disrupted, it can have serious consequences on emotions and behaviors [11]. Clinical reviews and functional imaging studies confirm that overt hypothyroidism is linked to emotional and cognitive disorders [12]. These disorders can include mania, acute psychosis, neuropsychiatric disorders, cognitive disorders, and mood changes. Also, symptoms of depression and anxiety are more common in patients with clinical and subclinical hypothyroidism compared to the general population [10, 11].

Endocrine psychiatric manifestations are reduced by thyroid hormone replacement therapy unless the condition has been prolonged enough to cause irreversible brain damage. This irreversibility necessitates prompt diagnosis and specific hormone replacement therapy [13].

levothyroxine (LT4) is one of the main medications for treating hypothyroidism [14]. Levothyroxine balances thyroid hormones in the body and is structurally very similar to Thyroxine (T4). In the tissues, the drug is converted to T3 and creates a good level of T3, which is the more biologically active thyroid hormone [1, 8, 14].

The effectiveness of levothyroxine in alleviating psychological symptoms remains unclear, as previous studies have reported inconsistent findings [15, 16]. Some studies believe that treating hypothyroidism with levothyroxine reduces symptoms such as anxiety and depression. However, a small proportion of patients treated for hypothyroidism feel that LT4 therapy is not efficient at restoring optimal health [17]. Some studies show that despite patients being euthyroid, they still show symptoms [18, 19]. Therefore, in addition to treatment with levothyroxine, they have suggested the simultaneous treatment of psychological disorders with antidepressants and psychotherapy for these patients [9]. However, the effect of levothyroxine in reducing psychological symptoms in patients with clinical hypothyroidism is still unclear and there are discrepancies between the results of the studies. Therefore, this study was designed and implemented with the aim of evaluating the level of psychological symptoms and general health in hypothyroid patients treated with levothyroxine.

Materials and Methods

Study Design and Setting

This prospective before–after cohort study was conducted in 2022 at Omid Babol Clinic, affiliated with Babol University of Medical Sciences, Babol, Iran. The study evaluated changes in psychological symptoms and general health status among patients with newly diagnosed hypothyroidism following levothyroxine therapy.

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

Participants and Sampling

A total of 83 patients aged 20–45 years with newly diagnosed hypothyroidism were consecutively recruited during the study period. Hypothyroidism was defined as a serum thyroid-stimulating hormone (TSH) level above the laboratory reference range, and the diagnosis was confirmed by an endocrinologist. Both overt and subclinical cases with a clinical indication for levothyroxine therapy were eligible. No randomization was performed.

Inclusion criteria

age between 20 and 45 years, newly diagnosed hypothyroidism, eligibility for levothyroxine treatment, ability to complete the study questionnaires, and provision of written informed consent.

Exclusion criteria

pregnancy, a history of major psychiatric disorders, current use of psychiatric medications, cognitive impairment, illiteracy, and loss to follow-up during the study period.

Treatment Protocol

Levothyroxine therapy was initiated at a dose of 50–100 μg/day, determined according to the patient's age, body weight, and baseline TSH level. Dose adjustments were made after 6–8 weeks based on follow-up serum TSH measurements under endocrinologist supervision, in accordance with the American Thyroid Association guidelines for the treatment of hypothyroidism [20].

Laboratory Measurements

Serum thyroid-stimulating hormone (TSH) levels were measured using a sandwich enzyme-linked immunosorbent assay (ELISA) kit (PISHTAZTEB, Iran), according to the manufacturer's instructions. Venous blood samples were collected from all participants, and analyses were performed using a Stat Fax 4200 microplate reader at the laboratory of Ayatollah Rouhani Hospital, Babol University of Medical Sciences.

Symptom Checklist-25 (SCL-25)

Psychological symptoms were assessed using the Symptom Checklist-25 (SCL-25), a brief form of the SCL-90-R designed to measure general psychological distress across multiple domains. The SCL-25 comprises 25 items rated on a five-point Likert scale (0 = not at all, 4 = extremely), yielding total scores from 0 to 100, with higher scores reflecting greater symptom severity. It evaluates somatic complaints, obsessive–compulsive symptoms, interpersonal sensitivity, depression, anxiety, phobic anxiety, paranoid ideation, psychoticism, and one additional item designated as Additional Items (ADI).

The Persian version has demonstrated acceptable psychometric properties in Iranian populations, with a seven-factor structure, satisfactory construct validity, and Cronbach's alpha coefficients of 0.71–0.95. In this study, total scores were calculated by summing all items. For descriptive purposes in this study, total scores were categorized as normal (0–25), mild (26–50), moderate (51–75), and severe (76–100) [21, 22].

General Health Questionnaire (GHQ-28)

General health status was evaluated using the Persian version of the General Health Questionnaire (GHQ-28), which comprises four subscales: somatic symptoms, anxiety/insomnia, social dysfunction, and severe depression. Items are scored using the Likert method (0–3), yielding a total score ranging from 0 to 84. Based on validation studies in the Iranian population, a total score ≥23 was considered indicative of impaired general health. The Persian GHQ-28 has demonstrated good reliability, with Cronbach's alpha reported at approximately 0.90, and acceptable construct validity confirmed through factor analysis [23]. For descriptive purposes, GHQ-28 total scores were categorized as normal (0–22), mild (23–40), moderate (41–60), and severe (61–84).

Ethical Considerations

The study protocol was approved by the Ethics Committee of Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1400.198). Written informed consent was obtained from all participants prior to enrollment.

Statistical Analysis

Statistical analyses were performed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as frequencies and percentages. Changes in symptom severity categories before and three months after treatment were analyzed using the McNemar test, and associations between variables were assessed using the chi-square test where appropriate. Pearson correlation analysis was performed to assess the relationship between age and psychological symptom dimensions. Differences

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

between men and women were evaluated using the chi-square test for categorical variables. To examine the potential influence of demographic and clinical characteristics, age, sex, and baseline TSH level were considered in supplementary adjustment analyses. Categorical analyses were based on participants with available data for the respective questionnaire. A two-tailed P value of less than 0.05 was considered statistically significant.

Results

In this study, 83 eligible patients with hypothyroidism were evaluated, of whom 66 (79.5%) were women and 17 (20%.5) were men. The mean age of the patients was 33.87 ± 5.6 years. The mean TSH level was 16.10 ± 5.75 mIU/L, with the lowest and highest levels being 8.5 and 33 mIU/L, respectively.

Before treatment, among the 82 patients with available SCL-25 data, 76 (92.7%) had mild psychiatric symptoms and 6 (7.3%) had moderate psychiatric symptoms. After treatment, 5 patients (6.1%) were in the normal range, 75 (91.5%) had mild psychiatric symptoms, and 2 (2.4%) had moderate psychiatric symptoms. No patients were classified as having severe psychiatric symptoms before or after treatment.

Analysis of the distribution of SCL-25 severity categories using the McNemar test showed a statistically significant difference between the pre- and post-treatment assessments ($P < 0.001$). The proportion of patients with moderate mental symptoms decreased after treatment (Figure 1).

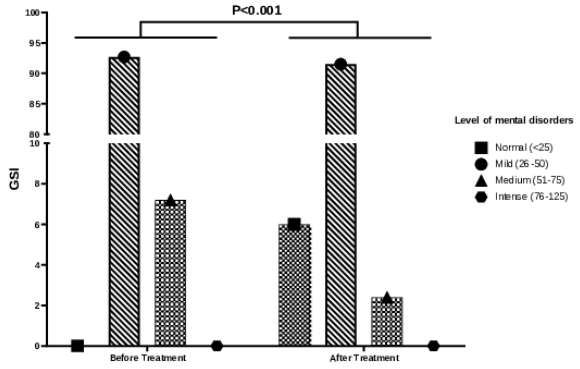

Figure 1: Comparison of the distribution of SCL-25 severity categories before and after treatment in the study sample. Values are presented as percentages (%). Categories are normal (0–25), mild (26–50), moderate (51–75), and severe (76–100).

Comparison of SCL-25 subscale scores before and three months after treatment showed statistically significant differences in anxiety, somatic complaints, depression, obsessive–compulsive symptoms, and interpersonal sensitivity ($P < 0.05$), whereas the other subscales did not show statistically significant differences ($P > 0.05$) (Figure 2). The mean scores of these five subscales decreased after treatment, indicating lower levels of the corresponding psychological symptoms.

To explore the potential influence of age, sex, and baseline TSH level, these variables were entered as covariates in supplementary adjustment analyses. The direction and statistical significance of the treatment effects remained consistent, suggesting that the main findings were robust to these potential confounders ($P < 0.05$).

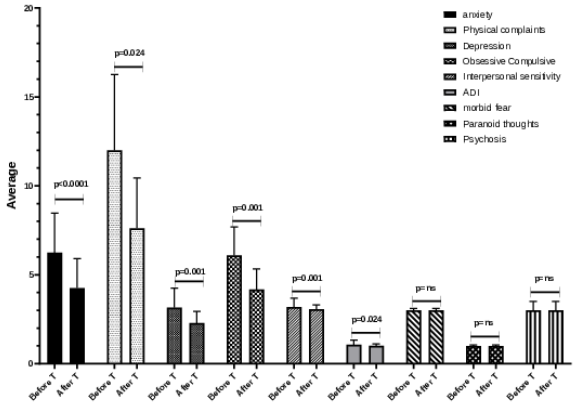

Figure 2: Comparison of SCL-25 subscale scores before and after treatment in the study sample. The y-axis represents mean score. The original patterned symbols in the legend identify the corresponding subscale for each pair of bars. The subscales are anxiety, somatic complaints, depression, obsessive–compulsive symptoms, interpersonal sensitivity, Additional Items (ADI), phobic anxiety, paranoid ideation, and psychoticism. Bars represent mean ± SD. Exact P-values are shown for significant comparisons; $P > 0.05$ indicates a non-significant comparison.

The results of examining the general health level in the sample using the GHQ-28 showed that before treatment, 16 patients (19.3%) had normal general health, 62 (74.5%) had mild impairment, and 5 (6.0%) had moderate impairment. After treatment, the number of patients with mild and moderate impairment decreased. No patient was classified in the severe category before or after treatment. The results of the analysis showed a significant difference in general health scores before and after treatment ($P = 0.0001$) (Figure 3).

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

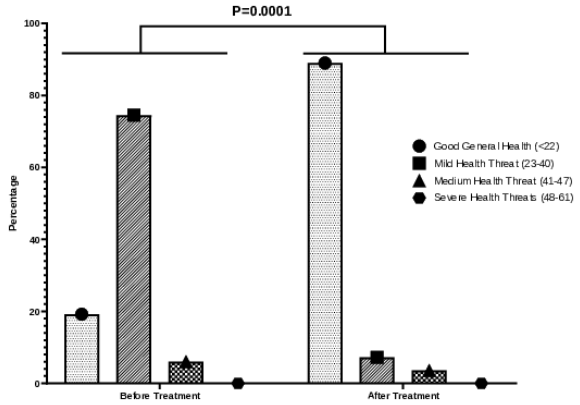

Figure 3: Comparison of the distribution of GHQ-28 general health categories before and after treatment in the study sample. Values are presented as percentages (%). Categories are normal (0–22), mild (23–40), moderate (41–60), and severe (61–84).

The GHQ-28 subscale scores also differed significantly between the pre- and post-treatment assessments (P = 0.0001). The mean scores decreased for somatic symptoms, anxiety/insomnia, and severe depression, while social dysfunction also improved after treatment (Figure 4).

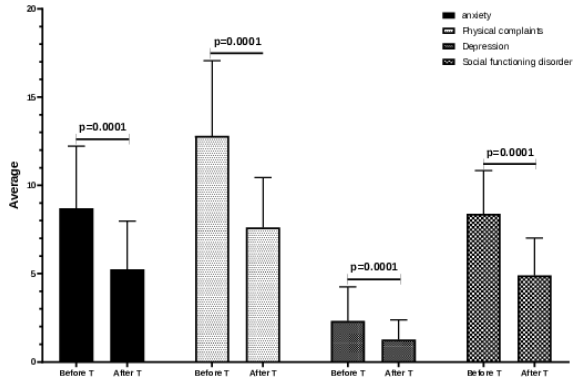

Figure 4: Comparison of GHQ-28 subscale scores before and after treatment. The y-axis represents mean score. The subscales are anxiety/insomnia, somatic symptoms, severe depression, and social dysfunction. Bars represent mean ± SD.

In addition to treatment-related changes, correlational analyses revealed a significant positive association between age and several psychological dimensions, including anxiety ($r = 0.376$, $P < 0.01$), somatic complaints ($r = 0.262$, $P < 0.05$), obsessive–compulsive symptoms ($r = 0.297$, $P < 0.05$), and physical symptoms ($r = 0.221$, $P < 0.05$). These findings indicate that increasing age was associated with higher levels of specific psychological symptoms.

Women exhibited higher levels of anxiety symptoms (P = 0.001), whereas obsessive–compulsive symptoms were more pronounced in men (P = 0.024). Social dysfunction was also significantly higher among men (P = 0.001). No statistically significant sex differences were observed for the remaining variables.

Discussion

The findings of this study showed that psychological symptoms and impaired general health were present among patients with hypothyroidism. Following three months of levothyroxine treatment, improvements were observed in general health and in several psychological symptom domains. Specifically, reductions were observed in anxiety, somatic complaints, depression, obsessive–compulsive symptoms, and interpersonal sensitivity. Improvements were also observed in the GHQ-28 domains of somatic symptoms, anxiety/insomnia, severe depression, and social dysfunction.

In addition, age was positively associated with several psychological symptom dimensions, including anxiety, somatic complaints, and obsessive–compulsive symptoms. Sex differences were also observed, with higher anxiety scores among women and higher obsessive–compulsive symptoms and social dysfunction among men.

Various studies show that, about half of the patients with hypothyroidism reported a decrease in the quality of life and general health, limitations in social activities and emotional problems, most of them complained of fatigue, and a third of them experienced anxiety, cognitive and sexual problems [11]. In the study of Tayde et al., the 33 patients with autoimmune hypothyroidism were evaluated for depression using the Montgomery Asberg Depression Rating Scale (MADRS) and the World Health Organization Quality of Life (QOL) scale. The results show that primary autoimmune hypothyroidism is associated with depression and low quality of life, and treatment of hypothyroidism leads to reduction of depression and improvement of quality of life [24].

In line with our finding, the study of Siddhanta et al., which was conducted with the aim of investigating the effect of levothyroxine replacement on health-related quality of life (QoL) in people with subclinical hypothyroidism aged 18 to 60 years of both sexes treated with levothyroxine, the results showed that in people with hypothyroidism, treatment with levothyroxine leads to a significant improvement of health-related quality of life (QoLHr), general instrument (SF36v2 - all subscales) and specific instruments of thyroid disease (ThySRQ and ThyTSQ) [22]. A study by Bornikowska et al. shows that treatment with liquid levothyroxine, characterized by faster pharmacokinetics, provides better control of thyroid hormones than tablet levothyroxine. Also, the

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

results showed that after 8 weeks of treatment with liquid levothyroxine, there was a significant improvement in the quality of life in hypothyroid patients. Liquid LT4 treatment provides a better thyroid hormone profile and improves the quality of life of patients compared to pill form [25]. Also, in Medici et al.'s study, changes in clinically relevant predictors during initiation of levothyroxine therapy and their ability to predict improvement in quality of life were investigated. The quality of life in patients with newly diagnosed hypothyroidism, during the first 12 months of treatment with levothyroxine, was measured by the Thyroid-specific Patient-Reported Outcome (ThyPRO-39) questionnaire. The results showed that the quality-of-life score of ThyPRO-39 was significantly improved ($p<0.001$) [26].

In this regard, Borson-Chazot et al. conducted review research with the aim of identifying quality of life studies in patients with hypothyroidism treated with levothyroxine, examining the tools used to measure quality of life, determining the effect of restoring normal quality of life by Thyroid Hormone Replace Therapy, and identifying factors related to quality of life. Overt hypothyroidism studies showed improvement in mental and emotional well-being after three to six months of Thyroid Hormone Replace Therapy with levothyroxine [27].

The results of the present study showed that taking levothyroxine can reduce psychological symptoms in hypothyroid patients. This finding has had different results in various studies. In the study of Tayde et al., it was found that the prevalence of mild to moderate depression (MADRS>11) among patients with hypothyroidism was 57% at the beginning of the study, that the 42% of cases showed improvement in depression, with significant improvement in QOL scores, after 6 months of levothyroxine treatment [24]. Also, the results of Bauer et al.'s study showed that the administration of supraphysiological thyroid hormone improves the symptoms of depression in patients with bipolar disorder by modulating the function in the components of the anterior limbic network. Also, additional administration of supraphysiological doses of levothyroxine is a promising strategy in patients with treatment-resistant bipolar mood disorders and depression [28]. The results of Najafi et al.'s study (2015) showed that after 12 weeks of treatment with levothyroxine, there was a significant improvement in the score of the Beck questionnaire in the group treated with levothyroxine, and the score of the Beck depression scale was reduced in the group receiving levothyroxine [29]. Schmidt et al.'s study also noted that psychiatric symptoms associated with hypothyroidism are usually reversible within 4-8 weeks under treatment with levothyroxine [30].

However, the results of L Wildisen et al.'s study showed that levothyroxine treatment has no positive effect on depression symptoms [31]. The difference between this study and the present study is in the sample size, the instrument used and the age of the studied patients, which was conducted using the GDS-15 questionnaire and was conducted on elderly people. Also, a population-based study of more than 1,200 people aged 30–64 years showed that subclinical hypothyroidism was not associated with increased depression compared with a control euthyroid group, regardless of age, sex, and socioeconomic status [32].

The results of our study showed that the average anxiety in women was higher than in men, but obsessive compulsive was less in women than in men. These results were in line with the results of Gorkhali et al.'s study, who stated that anxiety is more in women with thyroid disorders [33].

Studies show that endocrine psychiatric manifestations are reduced with levothyroxine affect, unless the condition has been long enough to cause irreversible brain damage. This irreversibility requires prompt diagnosis and specific hormone replacement therapy [6, 7]. Finally, it can be said that screening patients with hypothyroidism disorders in terms of psychiatric symptoms and disorders and providing timely care can greatly help in improving the quality of life of this population. Therefore, thyroid function screening is recommended for patients with depression, psychosis or organic mental disorder.

This study has several limitations. First, the absence of a euthyroid or untreated control group limits causal inference, and the observed improvements cannot be attributed solely to levothyroxine therapy. Second, the relatively short follow-up period may not reflect long-term psychological outcomes. Third, although age and sex were adjusted in the analysis, residual confounding related to disease severity and psychosocial factors cannot be completely excluded. Future controlled studies are recommended.

Conclusion

The results of this study show that hypothyroidism can cause problems in general health and psychological symptoms. However, taking levothyroxine in people suffering from hypothyroidism can improve general health, social function and reduce physical symptoms. Also, taking levothyroxine can reduce psychological symptoms such as anxiety, physical complaints, depression, obsessive compulsive disorder and interpersonal sensitivity in hypothyroid patients. It

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

seems that the screening of patients with psychological symptoms in terms of the level of thyroid function is a good suggestion to choose the correct treatment for some of these patients.

Acknowledgment

The authors are grateful to all the patients who participated in this study, as well as the staff of Ayatollah Rouhani Hospital of Babol, Babol University of Medical Sciences, Babol, Iran, and Omid Babol Clinic, and Dear Library Manager of Yahyanejad Hospital, Babol University of Medical Sciences, Babol, Iran, for their cooperation in data collection and conducting the experiments.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. Please contact the corresponding author for data requests.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Funding

None declared

Ethical Statement

This study was approved by the Ethics Committee of Babol University of Medical Sciences, Babol, Iran, with the ethical code: IR.MUBABOL.HRI.REC.1400.198

References

1. Yoo WS, Chung HK. Subclinical Hypothyroidism: Prevalence, Health Impact, and Treatment Landscape. Endocrinol Metab (Seoul). 2021;36(3): 500-13.
2. Visser TJ. Regulation of Thyroid Function, Synthesis, and Function of Thyroid Hormones. In: Vitti P, Hegedüs L, editors. Thyroid Diseases: Pathogenesis, Diagnosis, and Treatment. Cham: Springer International Publishing; 2018. p. 3-32.
3. Dev N, Sankar J, Munikoty V. Functions of Thyroid Hormones. In: Imam SK, Ahmad SI, editors. Thyroid Disorders: Basic Science and Clinical Practice. Cham: Springer International Publishing; 2016. p. 11-25.
4. Hegedüs L, Bianco AC, Jonklaas J, Pearce SH, Weetman AP, Perros P. Primary hypothyroidism and quality of life. Nat Rev Endocrinol. 2022;18(4): 230-42.
5. Abid M, Sharma KK, Ali SS, Chandra P, Verma A, Kishore K, et al. Complication and management of hypothyroidism: a review. Ind J Drugs. 2016;4(2): 42-56.
6. Jasem NM, Kadhim SH, Sharba MM. Assessing Thyroid Function: A Review of Biochemical Markers and Testing Strategies. Int J Med Sci Dent Health. 2024;10(2): 130-50.
7. Cooper DS, Biondi B. Subclinical thyroid disease. Lancet. 2012;379(9821): 1142-54.
8. Persani L. Clinical review: Central hypothyroidism: pathogenic, diagnostic, and therapeutic challenges. J Clin Endocrinol Metab. 2012;97(9): 3068-78.
9. Talaei A, Rafee N, Rafei F, Chehrei A. TSH cut off point based on depression in hypothyroid patients. BMC Psychiatry. 2017;17(1): 327.
10. Zavareh AT, Jomhouri R, Bejestani HS, Arshad M, Daneshmand M, Ziaei H, et al. Depression and hypothyroidism in a population-based study of Iranian women. Rom J Intern Med. 2016;54(4): 217-21.
11. Samuels MH. Psychiatric and cognitive manifestations of hypothyroidism. Curr Opin Endocrinol Diabetes Obes. 2014;21(5): 377-83.
12. Feldman AZ, Shrestha RT, Hennessey JV. Neuropsychiatric manifestations of thyroid disease. Endocrinol Metab Clin North Am. 2013;42(3): 453-76.
13. Stagnaro-Green A, Abalovich M, Alexander E, Azizi F, Mestman J, Negro R, et al. Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and postpartum. Thyroid. 2011;21(10): 1081-125.
14. Mateo RCI, Hennessey JV. Thyroxine and treatment of hypothyroidism: seven decades of experience. Endocrine. 2019;66(1): 10-17.
15. Cappelli C, Castello R, Marini F, Paoletta A, Marchetti M, Saullo M, et al. Adherence to Levothyroxine Treatment Among Patients With Hypothyroidism: A Northeastern Italian Survey. Front Endocrinol (Lausanne). 2018;9: 699.
16. Trimboli P, Scappaticcio L, De Bellis A, Maiorino MI, Knappe L, Esposito K, et al. Different Formulations of Levothyroxine for Treating Hypothyroidism: A Real-Life Study. Int J Endocrinol. 2020;2020: 4524759.
17. Wiersinga WM. THERAPY OF ENDOCRINE DISEASE: T4 + T3 combination therapy: is there a true effect? Eur J Endocrinol. 2017;177(6): R287-R96.

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]

18. Krysiak R, Marek B, Okopień BA. Sexual function and depressive symptoms in young men with hypothyroidism receiving levothyroxine/liothyronine combination therapy. Endokrynol Pol. 2018;69(1): 16-22.
19. Escribano-Serrano J, Paya-Giner C, Méndez Esteban MI, Márquez-Ferrando M, Zarallo-Pérez A, Michán-Doña A. Different methods used to estimate the prevalence of hypothyroidism, Cadiz, Spain. Rev Esp Salud Publica. 2014;88(5): 629-38.
20. Jonklaas J, Bianco AC, Bauer AJ, Burman KD, Cappola AR, Celi FS, et al. Guidelines for the Treatment of Hypothyroidism: Prepared by the American Thyroid Association Task Force on Thyroid Hormone Replacement. Thyroid. 2014;24(12): 1670-751.
21. Tanhaye Reshvanloo F, Saadati Shamir A. Construct validity and reliability of Symptom Checklist-25 (SCL-25). J Fundam Ment Health. 2016;18(1): 48-56.
22. Siddhanta S, Sahana PK, Sengupta N, Goswami S. A Prospective Cohort Study on Effect of Levothyroxine Replacement on Health Related Quality of Life in Subjects With Subclinical Hypothyroidism In A Tertiary Care Centre of India. Int J Recent Sci Res. 2022;13(3): 629-37.
23. Taghavi MR. Validity and reliability of the General Health Questionnaire (GHQ-28) in college students of Shiraz University. J Psychol. 2002;5(4): 381-98.
24. Tayde PS, Bhagwat NM, Sharma P, Sharma B, Dalwadi PP, Sonawane A, et al. Hypothyroidism and Depression: Are Cytokines the Link? Indian J Endocrinol Metab. 2017;21(6): 886-92.
25. Bornikowska K, Gietka-Czernel MG, Raczkiewicz D, Glinicki P, Zgliczyński W. Improvements in Quality of Life and Thyroid Parameters in Hypothyroid Patients on Ethanol-Free Formula of Liquid Levothyroxine Therapy in Comparison to Tablet LT4 Form: An Observational Study. J Clin Med. 2021;10(22): 5233.
26. Medici BB, Lerche la Cour J, Knop FK, Krakauer M, Michaelsson LF, Faber J, et al. Predictors of Improvement in Quality of Life When Treating Hypothyroidism. J Thyroid Res. 2021;2021: 5577217.
27. Borson-Chazot F, Terra JL, Goichot B, Caron P. What Is the Quality of Life in Patients Treated with Levothyroxine for Hypothyroidism and How Are We Measuring It? A Critical, Narrative Review. J Clin Med. 2021;10(7): 1386.
28. Bauer M, Berman S, Stamm T, Plotkin M, Adli M, Pilhatsch M, et al. Levothyroxine effects on depressive symptoms and limbic glucose metabolism in bipolar disorder: a randomized, placebo-controlled positron emission tomography study. Mol Psychiatry. 2016;21(2): 229-36.
29. Najafi L, Malek M, Hadian A, Ebrahim Valojerdi A, Khamseh ME, Aghili R. Depressive symptoms in patients with subclinical hypothyroidism--the effect of treatment with levothyroxine: a double-blind randomized clinical trial. Endocr Res. 2015;40(3): 121-26.
30. Schmidt M, Huff W, Dietlein M, Kobe C, Schicha H. Interactions between brain, psyche and thyroid. Nuklearmedizin. 2008;47(6): 225-34.
31. Wildisen L, Feller M, Del Giovane C, Moutzouri E, Du Puy RS, Mooijaart SP, et al. Effect of Levothyroxine Therapy on the Development of Depressive Symptoms in Older Adults With Subclinical Hypothyroidism: An Ancillary Study of a Randomized Clinical Trial. JAMA Netw Open. 2021;4(2): e2036645.
32. Beydoun MA, Beydoun HA, Kitner-Triolo MH, Kaufman JS, Evans MK, Zonderman AB. Thyroid hormones are associated with cognitive function: moderation by sex, race, and depressive symptoms. J Clin Endocrinol Metab. 2013;98(8): 3470-81.
33. Gorkhali B, Sharma S, Amatya M, Acharya D, Sharma M. Anxiety and Depression among Patients with Thyroid Function Disorders. J Nepal Health Res Counc. 2020;18(3): 373-78.

[Downloaded from crms.mubabol.ac.ir on 2026-11-16]