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Depression and anxiety levels among patients with thyroid disorders: A cross-sectional study

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Abstract

The aim of this study was to investigate the association between anxiety and depression among patients diagnosed with different thyroid disorders, as well as to identify the frequency of these comorbid conditions. A total of 181 (female/male; 142/39) patients with different thyroid diseases were assessed in this cross-sectional study. Patients were classified according to the type of thyroid disorder they were diagnosed with. The biochemical parameters were obtained from hospital database. The Beck Anxiety Inventory (BAI) and the Beck Depression Inventory (BDI) were utilized to evaluate the association between thyroid disorders and anxiety/depression among patients. Upon classifying patients according to their thyroid disease, it was found that 24 patients (13.2%) were diagnosed with non-autoimmune hypothyroidism, 40 (22.1%) with autoimmune hyperthyroidism, 85 (47%) with autoimmune hypothyroidism, and 32 (17.7%) with nodular thyroid disease. The average scores for BDI and BAI were 15.50±10.19 and 17.83±12.01 in the whole study group. Anxiety and depression were both quite common among patients, with respective rates of 75.7% and 66.7%. BDI scores were significantly correlated with the levels of anti-TPO and anti-TG in patient groups with autoimmune thyroid diseases. Additionally, there was a significant correlation between the BAI scores and anti-TG levels. Patients with thyroid disorders in this study frequently have high levels of anxiety and depression. There is a relationship between depression and anxiety and the levels of thyroid autoantibodies. The presence of thyroid autoantibodies may be a sign of susceptibility to depression and anxiety in thyroid patients.

Keywords: Anxiety, depression, thyroid disease

Introduction

Thyroid disease exhibits a high frequency in the general population, with its incidence increasing notably as the individuals advance in age globally [1]. Autoimmunity is one of the commonly causes of acquired thyroid diseases, which is mainly has two variants: Graves-Basedow disease, which leads to hyperthyroidism, and Hashimoto's thyroiditis, which results in hypothyroidism [2]. It is estimated that roughly 2% and 1% ofthe general population, respectively, suffer from hyperthyroidism. and hypothyroidism. [3]. There is a long term known connection between thyroid functions and psychiatric diseases, mainly mood disorders [4-6]. Anxiety and depression have been associated with dysregulated thyroid hormones [7]. The objective of this study is to determine the frequency of anxiety and depression among patients with primary thyroid disorders who were admitted to the outpatient clinic of endocrinology.

Material and Methods

This cross-sectional study was conducted at a Tarsus State Hospital, between 01 July and 31 August 2023. A total of 181 individuals were recruited for this study. The study comprised individuals who were 18 years of age or older and had primarily been diagnosed with thyroid dysfunction or had a nodular thyroid disease. Exclusion criteria encompassed patients who expressed lack of willingness to partake, individuals with pre-existing depression or anxiety problems prior to their thyroid diagnosis, as well as those concurrently afflicted with concomitant chronic medical ailments, including diabetes, heart disease, and renal diseases. The biochemical parameters were obtained from hospital database. This study was conducted in accordance with the ethical principles set out in the Declaration of Helsinki, and was granted approval by the Ethics Committee of Mersin University Faculty of Medicine (2022/09-71-125). All participants provided written informed consent.

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Identification of depression and anxiety

The Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI) were used to assess the severity of depression and anxiety. BDI is a self-report rating evaluation that consists of 21 items, designed to assess the typical attitudes and symptoms associated with depression [8]. The BAI is a commonly employed self-report assessment consisting of 21 items, which is utilized for the purpose of evaluating levels of anxiety [9].

Statistical analysis

The data acquired from the study were transferred to a computerized platform and analyzed using the SPSS (Statistical Package for Social Sciences) 16.0 software package. The descriptive analyses provided frequency data in the form of number (n) and percentage (%), while numerical data were presented as arithmetic mean±standard deviation (SD) and median (interquartile range, IQR). The appropriateness of numerical data for normal distribution was tested using the Kolmogorov-Smirnov or Shapiro-Wilk tests where appropriate. The Mann-Whitney U test was employed to analyze numerical data from two separate groups that had non-normal distribution. The distribution of numerical data among several independent groups that did not show a normal distribution was examined using the Kruskal-Wallis test. The variables that were determined to be significant by the Kruskal-Wallis test were subjected to post hoc analysis using the Mann-Whitney U test. Additionally, a Dunn-Bonferroni adjustment was applied. In order to investigate the correlation between two numerical variables that deviate from a normal distribution, the current study used Spearman correlation analysis. Correlation relationships can be categorized based on the magnitude of the correlation coefficient (r). The statistical significance level for all tests was deemed acceptable at a significance level of $p<0.05$.

Results

The study encompassed 181 patients, including 24 (13.2%) with non-autoimmune hypothyroidism due to secondary factors such as surgery, agenesis, or hypoplasia, 40 (22.1%) with autoimmunity-induced hyperthyroidism, 32 (17.7%) with thyroid nodules, and 85 (47%) with autoimmunity-induced hypothyroidism. Table 1 presents the distribution of demographic and biochemical values among patients.

The patients in the study also were classified according to their thyroid function levels at the time of admission (Table 2).

The average BDI score was 15.5±10.2, and the average BAI score was 17.8±12.0. Table 3 presents the distribution of scores for BDI and BAI among the patients.

The distribution of BDI and BAI scores among all patients, categorized by gender and type of thyroid disease, is displayed in Table 4. The study revealed a statistically significant difference in BAI scores between women and men, with women exhibiting higher scores (p=0.017).

Table 1. Demographic characteristics and biochemical parameters of the cases

		n	%
Sex	**Female**	142	78.5
	Male	39	21.5
Disease type	**Non-autoimmune hypothyroidism**	24	13.2
	Autoimmune hyperthyroidism	40	22.1
	Nodular thyroid disease	32	17.7
	Autoimmune hypothyroidism	85	47.0
		Mean±SD	**Median (IQR)**
Age (years)		44.7±12.9	45.0 (36.5-54.0)
Levothyroxine dose (mcg) (n=108)		89.9±44.4	100.0 (50.0-125.0)
Methimazole dose (mg) (n=35)		7.9±4.2	5.0 (5.0-10.0)
Propylthiouracil dose (mg) (n=5)		120.0±67.1	150.0 (50.0-175.0)
TSH (mIU/L)		5.17±13.93	1.7 (0.5-3.8)
FT4 (mIU/L)		1.34±0.96	1.1 (1.0-1.3)
FT3 (mIU/L)		3.29±1.74	2.9 (2.6-3.3)
Creatinine		0.69±0.18	0.6 (0.5-0.7)
ALT (IU/L)		19.3±12.5	15.0 (12.0-23.0)
FPG (mg/dL)		93.2±22.9	89.0 (85.0-97.5)
Anti-TPO (IU/mL)		296.7±428.3	156.0 (65.0-376.5)
Anti-TG (IU/mL)		372.22±642.56	198.0 (30.2-3930)
Nodule diameter (mm) (n=32)		18.0±6.8	16.0 (13.0-20.0)

SD: standard deviation, IQR: interquartile range, TSH: thyroid stimulating hormone, FT4: free thyroxine, FT3: free triiodothyronine, ALT: alanine aminotransferase, FPG: fasting plasma glucose, anti-TPO: anti-thyroid peroxidase, anti-TG: anti-thyroglobulin

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Table 2. Classification of thyroid dysfunctions

	Non-autoimmune hypothyroidism	Autoimmune hyperthyroidism	Nodular thyroid disease	Autoimmune hypothyroidism
Hypothyroidism	0	0	0	4 (4.7%)
Subclinical hypothyroidism	10 (41.7%)	2 (5.0%)	2 (6.2%)	25 (29.4%)
Hyperthyroidism	1 (4.2%)	10 (25.0%)	0	1 (1.2%)
Subclinical hyperthyroidism	4 (16.7%)	18 (45.0%)	0	4 (4.7%)
Euthyroidism	9 (37.4%)	10 (25.0%)	30 (93.8%)	51 (60.0%)

Table 3. Distribution of Beck Depression Inventory and Beck Anxiety Inventory scores

	Mean±SD	Median (IQR)
Beck Depression Inventory score	15.5±10.2	13.0 (8.0-23.5)
	n	**%**
Normal	60	33.1
Mild depressive symptoms	54	29.8
Moderate depressive symptoms	50	27.6
Severe depressive symptoms	17	9.3
	Mean±SD	**Median (IQR)**
Beck Anxiety Inventory score	17.8±12.0	16 (8.0-25.5)
	n	**%**
Normal	44	24.3
Mild anxiety symptoms	44	24.3
Moderate anxiety symptoms	48	26.5
Severe anxiety symptoms	45	24.9

Table 4. The distribution of Beck Depression Inventory and Beck Anxiety Inventory scores by gender and thyroid disease

	Beck Depression Inventory score	Test value	Beck Anxiety Inventory score	Test value
	Mean±SD (Min–Max)	**p-value**	**Mean±SD (Min–Max)**	**p-value**
Gender, (n; %)				
Female	15.8±10.1 (8.0-23.2)	1.069*	18.9±12.0 (8.7-27.0)	2.391*
Male	14.3±10.8 (7.0-24.0)	0.285	14.1±11.3 (5.0-22.0)	**0.017**
Disease type, (n; %)				
Non-autoimmune hypothyroidism	17.2±10.8 (8.5-26.7)		21.4±12.4 (11.2-29.5)	
Autoimmune hyperthyroidism	17.5±10.6 (8.5-25.5)	4.419**	19.1±12.6 (8.7-27.7)	4.014**
Nodular thyroid disease	15.8±9.7 (8.0-23.7)	0.220	18.6±14.5 (6.2-25.5)	0.260
Autoimmune hypothyroidism	14.0±9.9 (6.5-21.0)		16.0±10.4 (7.0-22.5)	

*Mann Whitney U test, **Kruskal Wallis test

Table 5 presents the distribution of age, drug dose, biochemical indicators, and nodule diameters according to BDI scores.

The distribution of anti-TPO (anti-thyroid peroxidase) and anti-TG (anti-thyroglobulin) levels based on the BDI score showed a statistically significant difference (p=0.027). The observed distinction can be attributed to lower levels of anti-TPO and anti-TG in patients without depressive symptoms compared to those with severe depressive symptoms (p=0.048 and p=0.024, respectively).

Table 6 presents the distribution of age, drug dose, biochemical indicators, and nodule diameter according to BAI scores.

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The study aimed to assess the correlation between biochemical parameters and scores of the BDI and BAI across all patients. The levels of anti-TPO and anti-TG antibodies were shown to have weak but significant positive correlations with the BDI scores (r=0.258, p=0.004 and r=0.271, p=0.002). Likewise, a statistically significant positive correlation was discovered between the anti-TG levels and the BAI scores (r=0.222, p=0.013).

No statistically significant relationship was detected between nodule diameter and BDI and BAI scores in patients with thyroid nodules. In patients with non-autoimmune hypothyroidism, moderately positive correlations were found between FPG and BDI and BAI scores (r=0.493, p=0.014 and r=0.480, p=0.018). There was no discernible correlation found between the BDI and BAI scores and any other biochemical parameters.

The relationship between biochemical parameters and BDI and BAI scores in autoimmune thyroid patients is evaluated. Upon analyzing all patients diagnosed with autoimmune thyroid disease, the BDI score and levels of anti-TPO and anti-TG showed statistically significant but weak correlation (r=0.258, p=0.004 and r=0.271, p=0.002). Furthermore, there was a statistically significant association observed between the anti-TG levels and the BAI scores (r=0.222, p=0.013).

When patients with autoimmune thyroid disease are separated into hypothyroidism or hyperthyroidism groups and analyzed, those diagnosed with hyperthyroidism showed a moderate positive correlation between BDI scores and anti-TPO levels, and low significant correlation with anti-TG (r=0.410, p=0.009 and r=0.397, p=0.011, respectively). Additionally, a significant but weak correlation was found between the levels of anti-TG and the scores on BDI and BAI in patients diagnosed with Hashimoto hypothyroidism (r=0.255, p=0.020; r=0.284, p=0.009, respectively) (Table 7).

Table 5. Distribution of parameters according to Beck Depression Inventory score

Variable	Beck Depression Inventory score				p-value
	Normal (n=60)	Mild depressive symptoms (n=54)	Moderate depressive symptoms (n=50)	Severe depressive symptoms (n=17)	
	Mean±SD (Min–Max)				
Age (years)	45.5±13.4 (38.0-54.7)	44.6±11.4 (37.0-52.0)	44.4±13.6 (33.5-55.0)	43.5±14.8 (32.5-49.5)	0.985 0.805
Levothyroxine (mcg)	90.4±47.9 (5.0-125.0)	85.23±44.9 (43.7-106.2)	91.5±45.0 (62.5-112.5)	100.0±26.4 (93.7-106.2)	1.058 0.787
Methimazole (mg)	6.5±3.4 (5.0-6.2)	8.5±4.1 (5.0-10.0)	8.0±5.3 (5.0-10.0)	10.0	2.925 0.403
Propylthiouracil (mg)	-	50	150	133.33±76.37 (50-150)	1.000 0.317
TSH (mIU/L)	3.07±3.74 (0.7-4.2)	6.96±17.27 (0.5-4.3)	5.29±15.49 (0.4-3)	6.54±19.48 (0.1-1.9)	3.911 0.271
FT4 (ng/dL)	1.23±0.30 (1-1.9)	1.45±1.58 (0.9-1.2)	1.38±0.68 (1-1.5)	1.25±0.33 (1-1.3)	2.190 0.534
FT3 (pg/mL)	3.03±1.20 (2.5-3.1)	3.33±1.87 (2.4-3.3)	3.47±2.01 (2.7-3.8)	3.57±2.06 (2.6-3.4)	3.959 0.266
Creatinine (mg/dL)	0.73±0.18 (0.6-0.8)	0.67±0.16 (0.5-0.7)	0.68±0.21 (0.5-0.7)	0.69±0.14 (0.5-0.8)	5.361 0.147
ALT (IU/L)	19.66±10.98 (12.2-25.0)	16.88±12.69 (11-18)	19.86±13.29 (11-24.5)	24.29±13.47 (14.5-27.5)	8.684 **0.034**
FPG (mg/dL)	95.9±32.01 (84.2-100.7)	92.5±15.3 (87.0-98.0)	90.4±17.1 (83.8-96.0)	94.34±20.0 (87.5-94.5)	1.892 0.595
Anti-TPO (IU/mL)	209.4±313.6 (24.2-197.2)	372.0±620.1 (72.0-376.5)	291.7±262.3 (96.0-486.0)	352.3±261.1 (136.5-553.5)	9.184 **0.027**
Anti-TG (IU/mL)	263.0±581.3 (23.9-268.2)	398.2±676.6 (29.0-391.5)	437.0±756.6 (42.6-445.5)	498.8±422.9 (117.0-834.0)	9.175 **0.027**
Nodule diameter (mm)	18.4±7.0 (10.7-21.2)	19.0±10.2 (9.7-30.7)	16.4±5.0 (13.5-19.0)	23.0±7.1 (18.0-23.0)	1.881 0.598

*Kruskal Wallis test, TSH: thyroid stimulating hormone, FT4: free thyroxine, FT3: free triiodothyronine, ALT: alanine aminotransferase, FPG: fasting plasma glucose, anti-TPO: anti-thyroid peroxidase, anti-TGB: anti-thyroglobulin

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Table 6. Distribution of parameters according to Beck Anxiety Inventory scores in study groups

Variable	Beck Anxiety Inventory score				p-value
	Normal (n=44)	Mild anxiety symptoms (n=44)	Moderate anxiety symptoms (n=48)	Severe anxiety symptoms (n=45)	
	Mean±SD (Min-Max)				
Age (years)	45.3±13.3 (38.0-53.5)	46.2±13.5 (37.0-54.7)	42.9±12.2 (32.5-51.7)	44.6±13.0 (35.0-55.0)	0.990 0.804
Levothyroxine dose (mcg)	86.5±49.1 (50.0-125.0)	93.3±46.5 (50.0-125.0)	79.2±39.4 (50.0-100.0)	103.1±41.3 (75.0-125.0)	3.929 0.269
Methimazole dose (mg)	6.4±2.4 (5.0-10.0)	6.0±3.8 (4.3-6.2)	10.0±3.5 (7.5-12.5)	8.9±5.5 (5.0-12.5)	7.186 0.666
Propylthiouracil dose (mg)	50.0	-	-	137.5±62.9 (75.0-187.5)	1.112 0.617
TSH (mIU/L)	3.27±4.01 (0.7-4.9)	5.71±14.05 (0.4-2.8)	4.67±14.46 (0.6-3.6)	137.50±62.91 (75-187.5)	0.922 0.820
FT4 (ng/dL)	1.22±0.28 (1.0-1.3)	1.17±0.30 (1.0-1.3)	1.57±1.71 (1.0-1.3)	7.03±18.81 (0.1-4.6)	2.155 0.541
FT3 (pg/mL)	3.15±1.37 (2.5-3.3)	2.92±0.79 (2.4-3.1)	3.67±2.65 (2.6-3.3)	3.39±1.46 (2.6-3.5)	4.376 0.224
Creatinine (mg/dL)	0.74±0.17 (0.6-0.8)	0.71±0.20 (0.5-0.8)	0.70±0.21 (0.6-0.7)	0.63±0.12 (0.5-0.7)	11.04 **0.012**
ALT (IU/L)	19.2±10.9 (11.2-24.0)	21±12.4 (0.5-0.8)	19.3±13.1 (12.2-23.5)	17.9±10.2 (11.0-21.0)	0.721 0.868
FPG (mg/dL)	96.4±35.6 (83.0-102.5)	91.8±18.9 (85.2-98.7)	91.2±15.9 (86.0-97.0)	93.8±16.5 (86.0-96.0)	0.773 0.856
Anti-TPO (IU/mL)	233.8±341.4 (33.0-310.0)	368.7±687.5 (58.0-374.5)	296.5±227.0 (124.5-417.0)	282.3±282.3 (47.5-534.5)	5.013 0.171
Anti-TG (IU/mL)	287.9±671.5 (17.0-247.0)	405.3±730.6 (64.5-383.0)	323.1±306.5 (48.0-414.5)	478.6±779.6 (25.5-710.5)	7.320 0.062
Nodule diameter (mm)	19.0±6.7 (12.2-23.7)	19.3±10.2 (9.7-30.7)	18.8±6.9 (15.0-24.0)	15.0±3.5 (11.5-18.0)	1.907 0.592

*Kruskal Wallis test, TSH: thyroid stimulating hormone, FT4: free thyroxine, FT3: free triiodothyronine, ALT: alanine aminotransferase, FPG: fasting plasma glucose, anti-TPO: anti-thyroid peroxidase, anti-TGB: anti-thyroglobulin

Table 7. Relationship between biochemical parameters and Beck Depression Inventory and Beck Anxiety Inventory scores in patients with autoimmune thyroidism

Variable		Autoimmune hyperthyroidism		Autoimmune hypothyroidism	
		Beck Depression Inventory score	Beck Anxiety Inventory score	Beck Depression Inventory score	Beck Anxiety Inventory score
Anti-TPO	**r**	**0.410**	0.149	0.204	0.194
	p	**0.009**	0.358	0.065	0.080
Anti-TG	**r**	**0.397**	0.201	**0.255**	**0.284**
	p	**0.011**	0.215	**0.020**	**0.009**

r, Spearman correlation coefficient.

The study assessed the correlation between biochemical parameters and BAI and BDI scores within clinical groups. Patients were categorized based on their present thyroid function levels (as shown in Table 2), regardless of their specific diagnosed disorders. Patients diagnosed with hyperthyroidism showed a positive correlation between their anti-TPO levels and their BDI score. Additionally, a statistically significant positive correlation was found between the BDI score and anti-TG levels in these patients (r=0.718, p=0.013; r=0.782, p=0.004, respectively). Similarly, a significant positive correlation was observed between the BAI score and anti-TPO levels in patients diagnosed with hyperthyroidism. Additionally, a positive correlation was found

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between the anti-TG levels in hyperthyroid patients and their BAI scores (r=0.620, p=0.042; r=0.834, p=0.001, respectively).

Among patients with clinical euthyroidism, irrespective of any underlying thyroid disease, there was a positive correlation between the BDI score and the levels of anti-TPO antibodies, albeit to a low-moderate degree. Similarly, there was a low-moderate positive correlation between the BDI score and the levels of anti-TG antibodies (r=0.309, p=0.015; r=0.251, p=0.049, respectively). A positive, low-moderately significant correlation was determined between BAI and Anti-TPO in patients with clinical euthyroidism (r=0.341, p=0.007).

Discussion

The major findings of our study revealed notable prevalence rates of depression and anxiety among the participants involved in this study. Another of the most striking findings from this study is the demonstration that levels of autoantibodies in autoimmune thyroid disease are associated with depression and anxiety. Autoantibodies in patients diagnosed with autoimmune thyroid disease were found to be associated with depression and anxiety, irrespective of their clinical functional state in our study

The association between disorders of the thyroid gland and depression, as well as anxiety, is well-documented in academic literature. Numerous studies have demonstrated that individuals with thyroid diseases are more susceptible to exhibiting symptoms of depression and anxiety, as well as being diagnosed with clinical depression and anxiety disorders [6,7,10]. Functional deterioration in the hypothalamic–pituitary–thyroid axis forms the basis of this mood disorders [4]. Thyroid hormones play a crucial role in regulating metabolism and influencing various physiological processes, including those related to mood and mental health [11]. Thyroid hormone receptors are widely distributed throughout the brain, with a particularly notable presence in various structures within the limbic system [12]. The limbic system encompasses crucial regions such as the amygdala, hippocampus, and hypothalamus, all of which play significant roles in emotional processing, memory formation, and hormonal regulation. Studies suggest that disruptions in thyroid hormone levels, whether due to hypothyroidism or hyperthyroidism, can impact the functioning of these limbic structures, contributing to the development of mood disorders [12,13]. Imbalances in thyroid hormones can lead to changes in neurotransmitter function, alterations in neuronal activity, and structural modifications within the limbic system. These alterations may be significant factors in the onset or exacerbation of mood disorders, such as depression or anxiety [14-16]

The correlation between autoimmune activity at the thyroid gland and the presence of depression and anxiety is insufficiently elucidated and remains a subject of contention within academic discourse. Although many research have failed to establish a correlation between thyroid autoimmune and depression and anxiety [17,18], further investigations has revealed a noteworthy correlation between thyroid autoimmunity and depression and anxiety [19-21]. Siegmann et al. conducted a comprehensive meta-analysis, which revealed a significant association between autoimmune thyroiditis and the presence of depressive and anxious symptoms, as well as the diagnosis of depression and anxious disorders [6]. Cytokines generated during immune responses can influence the hypothalamic-pituitary-adrenal (HPA) axis, impacting various brain circuits associated with mood regulation. Given the reciprocal relationship between neuroendocrine secretory systems and immune responses, a shared neuroendocrine dysregulation may contribute to the development of both autoimmune diseases and affective disorders [20,22,23]. In our study, we observed the presence of typical depressive and anxious symptoms among patients diagnosed with autoimmune thyroid disease, which is consistent with the existing body of literature.

The relationship between autoantibodies and their impact on depression and anxiety remains uncertain. While some studies have failed to establish a connection between thyroid autoantibodies and depression [17], several other studies have identified a significant association between thyroid antibodies and both depression and anxiety [19,24,25]. Previous research indicates that the presence of thyroid autoantibodies may serve as a reliable indicator for the occurrence of depression [21,26]. Our study has revealed a correlation between depression and anxiety and the existence of thyroid autoantibodies in patients who have been diagnosed with autoimmune hyperthyroidism and autoimmune hypothyroidism.

There was no significant correlation found in our study between the levels of FT4, FT3, and TSH and the BDI, BAI scores among the thyroid disorder patients' cohort. This was equally true for patients with both autoimmune and non-autoimmune thyroid disorders. The findings of our investigation concur with the prevailing academic discourse. The HUNT-research, a comprehensive population study undertaken in Norway, similarly found no discernible relationship between thyroid function and depression [27]. Similarly, in the FIN-D2D Population Based Study conducted in Finland, a lack of association was observed between thyroid function and depression [28]. Nevertheless, there exist studies that present contrasting results to both aforementioned studies and our own research findings. Based on a study conducted on a cohort of older individuals in the Netherlands, it was found that individuals with low-normal levels of TSH had a higher prevalence of concurrent depressive symptoms than individuals with normal TSH levels. Furthermore, their likelihood of acquiring a depressive condition in the subsequent years was notably elevated [29]. Upon reviewing the existing literature, it was determined that mood disturbances in thyroid diseases are primarily associated with thyroid autoantibodies rather than thyroid functions, as highlighted by Pop et al. [30].

In the present investigation, no significant correlation was seen between the dosage of Levothyroxine administered to patients with hypothyroidism and their levels of depression and

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anxious symptoms. Similarly, no significant association was found between the doses of methimazole and propylthiouracil administered to patients with hyperthyroidism and their levels of depressive and anxious symptoms.

Previous studies has investigated the relationship between thyroid nodules and mood disorders, specifically examining the correlation between anxiety, depression, and the morbidity rate of thyroid nodules [31]. The objective of the current study was to investigate the relationship between thyroid nodule size and the occurrence of symptoms of depression and anxiety in thyroid nodule patients. Although there was an observation of heightened depressive and anxious symptoms among individuals with thyroid nodules, our analysis did not yield any statistically substantial relationship between the size of the nodules and these symptoms.

Depression and anxiety have been found to be correlated with demographic variables, such as age and gender [32]. It is widely recognized that females have a higher frequency of depression or anxiety disorders throughout their lifetime compared to males [33]. This scenario is attributed to various variables, with particular emphasis on hormonal and environmental influences [32,33]. This study revealed a higher frequency of anxiety and depression among female patients. Among the patient groups, there was no statistically significant relationship found between the participants' ages and their anxiety and depression levels.

Our present study has some limitations. Initially, the study featured a comparatively limited number of participants, aiming to investigate the correlation between thyroid diseases and affective disorders. This study has a cross-sectional design, which limits its ability to establish a causal association between thyroid disorders and depression and anxiety. Additionally, it is important to note that the terminology "depression disorder" and "anxiety disorder" employed in this research does not pertain to clinically recognized illnesses. Instead, these words encompass a spectrum of symptoms that were evaluated through the utilization of the BAI and BDI assessment tools. The study's analysis should take into account numerous demographic factors, including educational background, occupation, marital status, and other pertinent attributes that may display links with anxiety and depression. However, obtaining comprehensive data on these variables from all participants within the outpatient clinics of secondary care hospitals proved to be significantly challenging.

Conclusion

In conclusion, this study presents findings that indicate a heightened occurrence of depression and anxiety among individuals diagnosed with thyroid disease. Furthermore, it establishes a correlation between the presence of thyroid autoantibodies and the manifestation of these mental health conditions in patients with autoimmune thyroid disease. Longitudinal studies are essential for establishing the impact of thyroid antibodies on depression and anxiety in individuals with thyroid dysfunction.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This study was conducted in accordance with the ethical principles set out in the Declaration of Helsinki, and was granted approval by the Ethics Committee of Mersin University Faculty of Medicine (2022/09-71-125).

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