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The Relationship Between Thyroid Function and Menstrual-related Migraine in Women: A Cross-sectional Analysis

Kadınlarda Tiroid Fonksiyonu ve Menstrüasyon Dönemiyle İlişkili Migren Arasındaki İlişki: Kesitsel Bir Analiz

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Abstract

Objective: Migraine is a common and disabling neurological disorder, particularly in women, and its menstrual subtypes-menstrual migraine (MM) and menstruation-related migraine (MRM)-highlight the influence of hormonal fluctuations. Estrogen withdrawal is a recognized trigger, but the influence of thyroid function remains unclear. The aim of this research was to investigate the association between thyroid hormone levels and migraine phenotypes in women.

Methods: This cross-sectional study included 175 women categorized by migraine type: chronic migraine (n=54), MRM [n=56; including 12 with pure MM (PMM)], and a control group (n=65). Participants with known thyroid disease were excluded. Serum thyroid-stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) were measured, and hematologic indices were examined. Migraine severity and related disability were measured using the visual analog scale and the migraine disability assessment (MIDAS). Group comparisons were performed using one-way analysis of variance, Kruskal-Wallis, and chi-square tests.

Results: TSH, T3, T4, and T3/T4 ratio did not differ significantly between groups (all $p>0.05$). The PMM and MRM subgroups also showed similar thyroid values. However, patients with chronic migraine had significantly higher MIDAS scores and a higher frequency of prophylactic drug use (both $p<0.001$). Hypertension was more common among patients with migraine, but the difference was not statistically significant.

Conclusion: There were no differences in thyroid hormone levels between migraine types and controls, indicating that thyroid changes are not a key factor in migraine among women with normal thyroid function. Further longitudinal research is needed to explore potential subclinical or autoimmune thyroid contributions to hormonally mediated migraine.

Keywords: Migraine, menstruation-related migraine, thyroid function tests, women's health

Öz

Amaç: Migren, özellikle kadınlarda yaygın ve sakatlayıcı bir nörolojik hastalıktır ve menstrüel alt tipleri-menstrüel migren (MM) ve menstrüasyonla ilişkili migren (MİM)-hormonal dalgalanmaların etkisini vurgular. Östrojen yoksunluğu bilinen bir tetikleyicidir, ancak tiroid fonksiyonunun etkisi henüz net değildir. Bu araştırmanın amacı, kadınlarda tiroid hormon seviyeleri ile migren fenotipleri arasındaki ilişkiyi araştırmaktır.

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Öz

Yöntem: Bu kesitsel çalışmaya, migren tipine göre kategorize edilmiş 175 kadın dahil edilmiştir: kronik migren (n=54), MİM [n=56; 12 saf MM (SMM) dahil] ve kontrol (n=65). Bilinen tiroid hastalığı olan katılımcılar çalışma dışı bırakılmıştır. Serum tiroid uyarıcı hormon (TSH), triiyodotironin (T3), tiroksin (T4) ve hematolojik indeksler incelenmiştir. Migrenle ilişkili şiddet ve engellilik, görsel analog skala ve migren engellilik değerlendirmesi (MIDAS) kullanılarak ölçüldü. Grup karşılaştırmaları tek yönlü varyans analizi, Kruskal-Wallis ve ki-kare testleri ile yapıldı.

Bulgular: TSH, T3, T4 ve T3/T4 oranları gruplar arasında anlamlı farklılık göstermedi (tümü p>0,05). SMM ve MİM alt grupları da benzer tiroid değerleri gösterdi. Ancak, kronik migrenli hastalarda anlamlı olarak daha yüksek MIDAS skorları ve daha sık profilaktik ilaç kullanımı vardı (her ikisi de p<0,001). Hipertansiyon migren hastalarında daha yaygındı, ancak istatistiksel olarak anlamlı değildi.

Sonuç: Migren tipleri veya kontroller arasında tiroid hormonu seviyelerinde farklılık bulunmaması, tiroid değişiminin normal tiroid fonksiyonuna sahip kadınlar için önemli bir migren faktörü olmadığını göstermektedir. Hormonal aracılı migrene olası subklinik veya otoimmün tiroid katkılarını araştırmak için daha fazla uzunlamasına araştırmaya ihtiyaç vardır.

Anahtar Kelimeler: Migren, menstrüasyon ile ilişkili migren, tiroid fonksiyon testleri, kadın sağlığı

Introduction

Migraine is a prevalent and disabling primary headache disorder characterized by recurrent episodes of moderate-to-severe headaches, often accompanied by nausea, photophobia, and phonophobia[1]. Approximately 12% of people worldwide are affected, and it occurs about three times more frequently in women than in men, particularly during women's reproductive years[2]. Among its subtypes, menstrual migraine (MM) and menstruation-related migraine (MRM) are especially challenging, as attacks occur in close temporal relation to the menstrual cycle-typically from two days before to three days after onset of menstruation[3]. Estrogen withdrawal is thought to be the key hormonal trigger; however, the underlying mechanisms remain incompletely understood[4].

Other than sex hormones, there is growing interest in how the endocrine system, especially the thyroid, affects migraine pathophysiology. Thyroid hormones-triiodothyronine (T3) and thyroxine (T4)-are key regulators of metabolism, vascular tone, and neurochemical balance. Altered levels of these hormones can change neuronal excitability, cerebral metabolism, and pain processing, potentially increasing migraine risk[5]. Epidemiological studies indicate that migraine and thyroid dysfunction co-occur more often than expected by chance, suggesting shared pathophysiological pathways or potential causal interactions[5-7]. Importantly, both conditions appear more frequently in women, indicating that estrogen might modulate thyroid activity, which could potentially affect migraine severity[8].

Several studies have explored this association. A systematic review by Michalik et al.[5] found that individuals with hypothyroidism frequently report headaches, supporting the notion of a hormonal contribution to migraine genesis. A longitudinal study suggested that headache disorders may precede new-onset hypothyroidism, implying a possible bidirectional relationship[9]. Likewise, Starikova et al.[10] discovered that lower thyroid-stimulating hormone (TSH) levels correlated with more severe migraine symptoms, although other studies showed no significant differences in TSH or free T4 between migraine and control groups[11]. The inconsistency emphasizes the need for greater clarity, particularly within hormonally sensitive populations.

The association between thyroid disorders and migraines in women with MRM or pure MM (PMM) remains poorly understood. Fluctuations in estrogen levels during the menstrual cycle may affect thyroid hormone activity, potentially altering headache timing and intensity[7,12]. However, it is difficult to draw definitive conclusions from the currently incomplete and contradictory data. The research indicated that women of reproductive age with migraines may particularly benefit from thyroid screening, given the correlation between increased headache frequency and subclinical hypothyroidism characterized by elevated TSH with normal T4[8,9].

Given these uncertainties, the present study aimed to comprehensively assess thyroid hormone profiles (T3, T4, and TSH) and related hematologic indices among women with chronic migraine, MRM, or PMM, and healthy controls. This research used clinical, endocrine, and hematologic parameters to investigate whether variations in thyroid function contribute to migraine burden, particularly in hormonally influenced subtypes.

Materials and Methods

Study Design and Participants

This cross-sectional study involved 190 premenopausal women who visited the neurology clinic between April and June 2025. The participants were divided into three groups: chronic migraine (n=54), MRM (n=56), and healthy controls (n=65). The MRM group included 12 patients diagnosed with PMM. Definitive diagnoses of migraine were made according to the International Classification of Headache Disorders, 3rd edition[1], based on a clinical interview conducted by a neurologist specializing in headache disorders. Participants with a history of thyroid disease (n=15; 7.9%) were excluded to minimize potential endocrine confounding factors. Consequently, the final analyses included 175 participants.

Data Collection and Variables

Structured forms were used to collect clinical and demographic data. Age, menstrual status, presence of hypertension (HT), and migraine characteristics were documented. The migraine disability assessment (MIDAS) questionnaire[13] and visual analog scale (VAS) were used to assess headache disability and pain severity, respectively. The number of prophylactic drugs in current use was also recorded.

Blood samples were collected from the veins after an 8-hour fast. An automated hematology analyzer (Sysmex Corporation, Kobe, Japan) was used to measure hematological parameters, including hemoglobin (Hb), hematocrit (Hct), mean corpuscular volume (MCV), red cell distribution width (RDW), platelet distribution width (PDW), platelet count (PLT), and neutrophil and lymphocyte counts. The neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, Hb/RDW ratio, PDW/PLT ratio, and RDW/MCV ratio were calculated. Thyroid hormone measurements included TSH, T3, and T4. All assays were performed using standardized chemiluminescent immunoassay techniques at the same laboratory.

Ethical Approval and Informed Consent

This research adhered to the Declaration of Helsinki and was ethically approved by the University of Health Sciences Türkiye, İzmir City Hospital Ethics Committee (approval no: 2025/52, date: 19.03.2025). Before joining the study, all participants provided written informed consent.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration Regarding the Use of Artificial Intelligence and Artificial Intelligence-assisted Technologies

During the preparation of this work, the author used Grammarly to assist with linguistic editing and improve phrasing. The final content was reviewed and approved by the author, who takes full responsibility for the manuscript's scientific integrity.

Statistical Analysis

All statistical analyses were conducted using R version 4.4.2. Hypothesis testing was performed using the rstatix package; flextable was used for tables; and R6 was used for modular data and workflow automation. The Shapiro-Wilk test was used to assess the normality of continuous variables. Normally distributed variables were expressed as mean±standard deviation (SD), whereas non-normally distributed variables were summarized as median (minimum-maximum).

The independent samples t-test or Mann-Whitney U test was used to compare two independent groups, as appropriate. When comparing three or more groups, one-way analysis of variance or the Kruskal-Wallis test was applied, followed by Bonferroni-corrected post-hoc tests. Categorical variables were compared using the chi-square test or Fisher's exact test when necessary, and were presented as counts and percentages. Statistical significance was determined by a two-tailed p-value below 0.05.

Results

A total of 190 participants were initially enrolled in the study. Fifteen participants were excluded owing to known thyroid disease (9.1% in the chronic migraine group, 8.9% in the MRM group, 16.7% in the PMM subgroup, and 5.8% in the control group). Hence, the final analysis comprised 175 participants: 56 in the MRM group, 54 in the chronic migraine group, and 65 in the control group (Table 1). With a mean age of 36.4±8.8 years, 113 participants (64.6%) were aged 40 years or younger. HT was present in 11 individuals (6.3%). The overall mean Hb was 12.6±1.4 g/dL, and the mean Hct was 37.6±3.7%. The median values for TSH, T3, and T4 were 1.7 mIU/L (0.1-18.9), 3.4 ng/dL (2.4-4.6), and 0.8 ng/dL (0.5-2.0), respectively.

As shown in Table 2, demographic and thyroid-related variables did not differ significantly between the chronic migraine (including MRM) group and the control group. Mean age was similar between groups (mean±SD: 36.5±8.1 vs. 36.2±9.8 years; p=0.874). In the chronic migraine group, 69.1% of participants were ≤40 years old, compared with 56.9% of controls (p=0.144). No significant group differences were observed in T3, T4, TSH, or the T3/T4 ratio (all p>0.05).

Table 1. Baseline demographic, hematological, and thyroid parameters of the participants without thyroid disease population

	Overall, n (%) n=175		**Overall, n (%) n=175**
Age (years)*	36.4±8.8	**RDW (%)***	14.4±1.9
Age		**Neutrophil (x10³/µL)***	4.4 (1.6-16.2)
≤40 years old	113 (64.6)	**Lymphocyte (x10³/µL)***	2.1 (0.3-4.3)
>40 years old	62 (35)	**Platelets (x10³/µL)***	271 (140-516)
Study group		**PDW (%)***	16.8±0.5
MRM	56 (32.0)	**T3 (ng/dL)***	3.4 (2.4-4.6)
Chronic migraine	54 (30.9)	**T4 (ng/dL)***	0.8 (0.5-2.0)
Control	65 (37.1)	**TSH (mIU/L)***	1.7 (0.1-18.9)
MIDAS score*	18 (5-46)	**T3/T4 ratio***	4.1 (0.0-7.3)
VAS score*	8 (7-9)	**RDW/MCV ratio***	0.2 (0.1-0.5)
Number of prophylactic drugs*	0 (0-6)	**NLR***	2.1 (0.6-38.7)
HT	11 (6.3)	**PLR***	130.7 (68.6-1076.7)
Hb (g/dL)*	12.6±1.4	**PDW/PLT ratio***	0.1 (0.0-0.1)
Hematocrit (%)*	37.6±3.7	**Hb/RDW ratio***	0.9 (0.4-1.2)
MCV (fL)*	83.1±9.5		

*: Numeric variables were presented as medians (minimum-maximum) or mean±standard deviation, Hb: Hemoglobin, HT: Hypertension, MCV: Mean corpuscular volume, MIDAS: Migraine disability assessment, MRM: Mensturation-related migraine, NLR: Neutrophil-to-lymphocyte ratio, RDW: Red cell distribution width, PDW: Platelet distribution width, PLT: Platelet count, PLR: Platelet-to-lymphocyte ratio, T3: Triiodothyronine, T4: Thyroxine, TSH: Thyroid-stimulating hormone, VAS: Visual analog scale

Table 2. Comparison of parameters between the MRM+chronic migraine and control groups

	MRM€+chronic migraine, n (%) n=110	**Control, n (%) n=65**	**p-value**
Age (years)*	36.5±8.1	36.2±9.8	0.874
Age			0.144
≤40 years old	76 (69.1)	37 (56.9)	
>40 years old	34 (30.9)	28 (43.1)	
MIDAS score*	18 (5-46)	NA	**NA**
VAS score*	8 (7-9)	NA	**NA**
Number of prophylactic drugs*	2 (0-6)	NA	**NA**
HT	9 (8.2)	2 (3.1)	0.215
PDW (%)*	16.8±0.5	16.8±0.6	0.861
T3 (ng/dL)*	3.4 (2.6-4.5)	3.5 (2.4-4.6)	0.199
T4 (ng/dL)*	0.8 (0.5-1.2)	0.9 (0.5-2.0)	0.152
TSH (mIU/L)*	1.7 (0.1-19.0)	1.7 (0.1-6.5)	0.914
T3/T4 ratio*	4.2 (0-7.3)	4.0 (1.6-6.1)	0.425

*: Numeric variables were presented as median (minimum-maximum) or mean±standard deviation, €: PMM and MRM patients were evaluated in the same group within MRM, PMM: Pure menstrual migraine, MRM: Menstruation-related migraine, MIDAS: Migraine disability assessment, NA: Not applicable, VAS: Visual analog scale, HT: Hypertension, PDW: Platelet distribution width, T3: Triiodothyronine, T4: Thyroxine, TSH: Thyroid-stimulating hormone

Table 3 provides a comparison of the MRM, chronic migraine, and control groups. Age distribution (p=0.231) and thyroid function parameters (all p>0.05) did not differ significantly. Nevertheless, the chronic migraine group had considerably higher MIDAS scores than the MRM group (31 vs. 13, p<0.001). Use of preventive drugs was higher in the chronic migraine group than in the MRM group (0 vs. 4; p<0.001). HT was more common in chronic migraine (13.0%) than in MRM (3.6%) or in controls (3.1%); however, this difference did not reach statistical significance (p=0.052).

A subgroup analysis comparing PMM and MRM participants (Table 4) revealed that the PMM group was significantly younger than the MRM group (mean age 29.6 vs. 36.7 years; p=0.002). The MIDAS score was significantly lower in PMM than in MRM (8.6 vs. 12.6; p=0.002). VAS scores, prophylactic medication use, and thyroid-related values (T3, T4, TSH, and T3/T4 ratio) did not differ significantly between PMM and MRM (all p>0.50).

Age-stratified comparisons in Table 5 show that participants aged >40 years had a higher prevalence of HT (14.5%) compared with younger individuals (1.8; p=0.002). The mean VAS scores were slightly but significantly lower in the older group (7.5 vs. 8.0; p<0.001). However, other blood and thyroid measures showed no significant differences across age groups (all p>0.05). Age group showed no significant differences in study group distribution or menstrual status (p=0.061 and p=0.095, respectively).

Discussion

In this cross-sectional study of 175 women-comprising MRM, chronic migraine, and healthy controls-we observed no statistically significant differences in serum thyroid hormone parameters (T3, T4, TSH, and the T3/T4 ratio) among groups. Likewise, comparison of PMM and MRM subtypes found no significant difference in thyroid hormone levels. Stratification by age showed a higher prevalence of HT among older participants, consistent with epidemiological expectations, yet thyroid and hematologic measures remained comparable between age groups. These results indicate that thyroid hormone levels do not distinguish migraine types or severity in an otherwise euthyroid population.

Our findings align with previous research that has not demonstrated a robust relationship between thyroid hormones and migraine features. Starikova et al.[10] reported no significant association between TSH/free T4 and headache frequency, and another study[11] found no intergroup differences in thyroid parameters. Comparable results reinforce the notion that routine biochemical assays of thyroid hormones may not fully detect subtle endocrine-neurological interactions in patients with migraine.

Nevertheless, other evidence points toward a more complex and possibly indirect thyroid-migraine connection. According to Michalik et al.[5] systematic review, there was a higher-than-expected co-occurrence of migraine and

Table 3. Comparison of parameters among the MRM, chronic migraine, and control groups

	MRM€, n (%) n=56	Chronic migraine, n (%) n=54	Control, n (%) n=65	p-value
Age (years)*	35.4±7.0	37.7±9.0	36.2±9.8	0.231
Age				0.061
≤40 years old	43 (76.8)	33 (61.1)	37 (56.9)	
>40 years old	13 (23.2)	21 (38.9)	28 (43.1)	
MIDAS score*	13 (5-19)	31 (18-46)	NA	**<0.001**
VAS score*	8 (7-9)	8 (7-9)	NA	0.913
Number of prophylactic drugs*	0 (0-6)	4 (1-6)	NA	**<0.001**
HT	2 (3.6)	7 (13.0)	2 (3.1)	0.052
T3 (ng/dL)*	3.3 (2.6-4.3)	3.5 (2.6-4.5)	3.5 (2.4-4.6)	0.439
T4 (ng/dL)*	0.8 (0.5-1.1)	0.8 (0.5-1.2)	0.9 (0.5-2.0)	0.271
TSH (mIU/L)*	1.7 (0.4-5.2)	1.7 (0.1-18.9)	1.7 (0.1-6.5)	0.942
T3/T4 ratio*	4.0 (0.0- 7.3)	4.3 (2.5-6.1)	4.0 (1.6-6.1)	0.131

*: Numeric variables were presented as median (minimum-maximum) or mean±standard deviation, €: PMM and MRM patients were evaluated in the same group within MRM, PMM: Pure menstrual migraine, MRM: Menstruation-related migraine, MIDAS: Migraine disability assessment, VAS: Visual analog scale, HT: Hypertension, NA: not applicable, T3: Triiodothyronine, T4: Thyroxine, TSH: Thyroid-stimulating hormone

Table 4. MRM, migraine, and control group evaluation of clinical, hematological, and thyroid parameters

	PMM, n (%) n=10	MRM, n (%) n=46	p-value
Age (years)*	29.6±6.2	36.7±6.5	**0.002**
Age			
≤40 years old	10 (100.0)	33 (71.7)	0.095
>40 years old	0 (0.0)	13 (28.3)	
MIDAS score*	8.6±1.8	12.6±3.6	**0.002**
VAS score*	8 (7.5-8.5)	8 (7-9)	0.350
Number of prophylactic drugs*	0 (0-2)	0 (0-6)	0.738
HT	0 (0.0)	2 (4.4)	>0.999
Hb (g/dL)*	12.2±1.3	12.5±1.3	0.335
Hematocrit (%)*	36.5±3.0	37.3±3.0	0.653
MCV (fL)*	71.0±24.6	83.7±7.9	0.164
RDW (%)*	14.8±2.2	14.5±2.0	0.716
Neutrophil (x10^3/µL)*	4.2 (3.1-8.6)	4.2 (1.6-10.9)	0.991
Lymphocyte (x10^3/µL)*	2.8 (1.5-4.3)	2.1 (1.1-4.3)	0.125
Platelets (x10^3/µL)*	271 (194-383)	281 (175-437)	0.881
PDW (%)*	17.0±0.4	16.8±0.5	0.262
T3 (ng/dL)*	3.7 (3.0-4.0)	3.3 (2.6-4.3)	0.131
T4 (ng/dL)*	0.9 (0.8-1.0)	0.8 (0.5-1.1)	0.218
TSH (mIU/L)*	1.1 (0.4-5.2)	1.8 (0.7-4.6)	0.063
T3/T4 ratio*	4.0 (3.4-4.7)	4.0 (0.0-7.3)	0.623
RDW/MCV ratio*	0.2 (0.1-0.5)	0.2 (0.1-0.4)	0.392
NLR*	1.7 (1.2-3.1)	2.4 (0.6-5.7)	0.185
PLR*	130.7 (68.6-152.0)	134.9 (68.6-264.6)	0.325
PDW/PLT ratio*	0.1 (0.1-0.1)	0.1 (0.0-0.1)	0.115
Hb/RDW ratio*	0.9 (0.5-1.0)	0.9 (0.4-1.1)	0.454

*: Numeric variables were presented as median (minimum-maximum) or mean±standard deviation, PMM: Pure menstrual migraine, MRM: Menstruation-related migraine, MIDAS: Migraine disability assessment, VAS: Visual analog scale, HT: Hypertension, Hb: Hemoglobin, MCV: Mean corpuscular volume, RDW: Red cell distribution width, PDW: Platelet distribution width, T3: Triiodothyronine, T4: Thyroxine, TSH: Thyroid-stimulating hormone, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, PLT: Platelet count

hypothyroidism, especially Hashimoto's thyroiditis, although a causal relationship was not established. Another study[6] found that overlapping genetic loci associated with both migraine and thyroid traits imply shared neuroendocrine regulatory pathways. Moreover, a Mendelian randomization analysis found an association between autoimmune thyroid disease and migraine risk[14]. These data collectively suggest that thyroid involvement in migraine may be subclinical, genetic, or immune-mediated-mechanisms that would not necessarily manifest as abnormal TSH or T4 levels in biochemically euthyroid individuals.

In contrast to prior smaller studies[7,12], the MRM and PMM subgroups showed no differences in thyroid parameters. Albay and Tütüncü[12] observed a lower mean T4 in the MM group compared with the chronic migraine and control groups, suggesting that thyroid fluctuations could affect hormone-related migraines. Nonetheless, our inability to replicate these findings might be due to several interrelated factors. First, our cohort was deliberately restricted to euthyroid participants, excluding those with overt dysfunction; thus, any subtle endocrine influence would likely fall within reference ranges and below the detection threshold. Additionally, blood sample timing was not aligned with the menstrual cycle phase. Because thyroid hormones exhibit circadian and menstrual-phase variations and interact with estrogen and progesterone[3], unscheduled timing could have masked transient shifts. Thirdly, tests for anti-thyroid

Table 5. Baseline characteristics by age group			
	≤40 years old, n (%) n=113	**>40 years old, n (%) n=62**	**p-value**
Age (years)*	31.5±6.9	45.3±2.9	**<0.001**
Study group			
MRM	43 (38.1)	13 (21.0)	0.061
Chronic migraine	33 (29.2)	21 (33.9)	
Control	37 (32.7)	28 (45.2)	
Menstrual status			
PMM	10 (23.3)	0 (0.0)	0.095
MRM	33 (76.7)	13 (100.0)	
MIDAS score*	16 (5-46)	22 (8-42)	0.675
VAS score*	8 (7-9)	7.5 (7-8.5)	**<0.001**
Number of prophylactic drugs*	0 (0-6)	0 (0-6)	0.824
HT	2 (1.8)	9 (14.5)	**0.002**
Hb (g/dL)*	12.7±1.3	12.5±1.4	0.253
Hematocrit (%)*	37.8±3.4	37.1±4.1	0.109
MCV (fL)*	83.4±10.2	82.4±8.3	0.337
RDW (%)*	14.3±1.8	14.6±2.0	0.178
Neutrophil (x10³/µL)*	4.3 (1.6-16.2)	5.0 (2.3-11.6)	0.054
Lymphocyte (x10³/µL)*	2.1 (0.8-4.3)	2.1 (0.3-4.3)	0.930
Platelets (x10³/µL)*	265 (143-516)	287 (140-458)	0.589
PDW (%)*	16.8±0.5	16.8±0.6	0.779
T3 (ng/dL)*	3.4 (2.6-4.5)	3.4 (2.4-4.6)	0.942
T4 (ng/dL)*	0.8 (0.5-1.3)	0.9 (0.5-2.0)	0.154
TSH (mIU/L)*	1.7 (0.1-6.8)	1.8 (0.3-18.9)	0.365
T3/T4 ratio*	4.2 (0.0-7.3)	3.8 (1.6-6.2)	0.196
RDW/MCV ratio*	0.2 (0.1-0.5)	0.2 (0.1-0.4)	0.229
NLR*	2.1 (0.6-13.3)	2.5 (0.9-38.7)	0.121
PLR*	133.1 (68.6-339.2)	129.8 (71.9-1076.7)	0.975
PDW/PLT ratio*	0.1 (0.1-0.1)	0.1 (0.1-0.1)	**<0.001**
Hb/RDW ratio*	0.9 (0.4-1.2)	0.9 (0.4-1.2)	0.112

*: Numeric variables were presented as median (minimum-maximum) or mean±standard deviation, MRM: Menstruation-related migraine, PMM: Pure menstrual migraine, MIDAS: Migraine disability assessment, VAS: Visual analog scale, HT: Hypertension, Hb: Hemoglobin, MCV: Mean corpuscular volume, RDW: Red cell distribution width, PDW: Platelet distribution width, T3: Triiodothyronine, T4: Thyroxine, TSH: Thyroid-stimulating hormone, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, PLT: Platelet count

peroxidase antibodies or anti-thyroglobulin antibodies were not used to evaluate autoimmune thyroiditis in the current study, which has been identified as a key mediator in earlier reports. Migraine has been associated with systemic immune activation[14]; thus, unrecognized early autoimmunity could represent a missing mechanistic link. The homogeneous thyroid profiles among our euthyroid group, despite variable migraine symptoms, could be attributed to these combined methodological and biological factors.

Migraine is a heterogeneous condition that involves vascular, neuronal, inflammatory, and hormonal dimensions. The thyroid axis may influence only selected pathways-for instance, modulating cerebral metabolism or vascular tone-rather than serving as a universal driver. This heterogeneity might also explain the inconsistent results in different studies. Thyroid issues may worsen neurovascular sensitivity through inflammation or changes in nitric oxide in those with genetic risk factors or autoimmune comorbidities[6]. In

contrast, in physiologically stable individuals, compensatory mechanisms of the hypothalamic-pituitary-thyroid axis might neutralize small hormonal changes, thereby precluding measurable biochemical differences. Hence, the thyroid's contribution is likely to be circumstantial, appearing only under specific biological conditions.

Patients with migraines, particularly those with MRM, exhibited considerably higher MIDAS scores and more frequent use of prophylactic medication than the control group, which is consistent with prior research indicating increased disability in hormonally influenced migraine[15]. The persistence of clinical burden despite normal thyroid status underscores that migraine severity is determined primarily by migraine-specific neurovascular mechanisms rather than systemic thyroid factors.

A modest, though non-significant, increase in HT prevalence was also noted in the migraine group (13% vs. 3% in the controls), echoing the recognized comorbidity between migraine and vascular dysfunction[16]. Vascular aging and hormonal shifts contribute to an increased prevalence of HT after age 40. Importantly, neither HT nor hematologic indices correlated with thyroid measures, suggesting that vascular alterations observed in migraine are not mediated by thyroid activity in euthyroid women.

In a clinical context, these results discourage routine thyroid screening in euthyroid migraine patients, even those with MMs, unless other symptoms indicate endocrine problems. However, the thyroid-migraine hypothesis should not be dismissed altogether. Thyroid autoantibody testing may be useful in patients presenting with fatigue, weight changes, menstrual irregularities, or a personal history of autoimmune disease. Furthermore, therapeutic adjustment of thyroid function may warrant investigation in patients with subclinical or autoimmune thyroid disease; a recent pilot trial found that low-dose T4 supplementation reduced migraine frequency in patients with subclinical hypothyroidism[17].

Study Limitations

The present study's strengths include well-defined diagnostic criteria, exclusion of confounding thyroid disease, inclusion of multiple migraine phenotypes, and analysis of hematologic indices alongside hormonal data. Nonetheless, several limitations may be acknowledged. The cross-sectional design prevents causal conclusions, and early thyroid autoimmunity could be missed due to a lack of autoantibody testing. The timing of blood samples was not aligned with circadian and menstrual cycles, which potentially masked subtle phase-dependent shifts. The sample size was sufficient to detect moderate effects, but may have been too small to identify small differences between subgroups, such as PMM.

Future investigations should employ longitudinal, cycle-synchronized sampling, incorporating both hormonal and immune parameters. A more complete picture of endocrine-immune-neurovascular interactions could be achieved by measuring thyroid autoantibodies and neuropeptide markers. Genomic studies may clarify shared predispositions by linking migraine susceptibility loci with thyroid trait variants[6]. Ultimately, interventional research on adjusting thyroid hormones, with a focus on subclinical or autoimmune subgroups, might determine whether endocrine correction confers therapeutic benefit.

Conclusion

In this study, Thyroid hormone levels were comparable among women with MRM, chronic migraine, and healthy controls. These results imply that thyroid hormone changes are unlikely to be the main factor in the migraine presentation in people with normal thyroid function. Nonetheless, given mounting evidence for genetic, autoimmune, and hormonal interplay, further studies integrating immunologic, genetic, and longitudinal data are warranted. Understanding these subtle links between the endocrine-neurological systems might lead to more tailored approaches for preventing and managing migraines.

Ethics

Ethics Committee Approval: This research adhered to the Declaration of Helsinki and was ethically approved by the University of Health Sciences Türkiye, İzmir City Hospital Ethics Committee (approval no: 2025/52, date: 19.03.2025).

Informed Consent: Before joining the study, all participants provided written informed consent.

Footnotes

Authorship Contributions

Surgical and Medical Practises: E.C.Y., Concept: E.C.Y., Design: E.C.Y., D.A., Data Collection or Processing: E.C.Y., D.A., Analysis or Interpretation: E.C.Y., D.A., Literature Search: E.C.Y., D.A., Writing: E.C.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Headache classification committee of the International Headache Society (IHS). The International Classification of headache disorders, 3rd edition. Cephalalgia. 2018;38:1-211.
2. Steiner TJ, Stovner LJ, Jensen R, Uluduz D, Katsarava Z; Lifting The Burden: the global campaign against headache. Migraine remains second among the world's causes of disability, and first among young women: findings from GBD2019. J Headache Pain. 2020;21:137.
3. MacGregor EA. Menstrual and perimenopausal migraine: a narrative review. Maturitas. 2020;142:24-30.
4. Parashar R, Bhalla P, Rai NK, Pakhare A, Babbar R. Migraine: is it related to hormonal disturbances or stress? Int J Womens Health. 2014;6:921-5.
5. Michalik M, Łapicka J, Sota M, Zawieska J, Grodzka O, Kępczyńska K. What is the link between migraine and hypothyroidism? A systematic literature review. J Clin Med. 2025;14:4645.
6. Tasnim S, Nyholt DR. Migraine and thyroid dysfunction: co-occurrence, shared genes and biological mechanisms. Eur J Neurol. 2023;30:1815-27.
7. Seo JG. Menstrual migraine: a review of current research and clinical challenges. Headache Pain Res. 2024;25:16-23.
8. Tasnim S, Wilson SG, Walsh JP, Nyholt DR; International Headache Genetics Consortium (IHGC). Shared genetics and causal relationships between migraine and thyroid function traits. Cephalalgia. 2023;43:3331024221139253.
9. Martin AT, Pinney SM, Xie C, et al. Headache disorders may be a risk factor for the development of new-onset hypothyroidism. Headache. 2017;57:21-30.
10. Starikova NL, Baidina TV, Kalashnikova TP. Thyrotropin levels and severity of symptoms in migraine patients of tertiary headache center. Cephalalgia. 2019;39:148-52.
11. Altaş M, Burgucu HÇ, Yarar Z. Evaluation of serum TSH and free T4 levels in migraine patients. Namik Kemal Med J. 2023;11:22-6.
12. Albay VB, Tütüncü M. Evaluation of the relationship between thyroid dysfunction and menstrual migraine in adult females. Med Bull Haseki. 2020;58:110-4.
13. Stewart WF, Lipton RB, Kolodner K, Liberman J, Sawyer J. Reliability of the migraine disability assessment score in a population-based sample of headache sufferers. Cephalalgia. 1999;19:107-14.
14. Biscetti L, De Vanna G, Cresta E, et al. Headache and immunological/autoimmune disorders: a comprehensive review of available epidemiological evidence with insights on potential underlying mechanisms. J Neuroinflammation. 2021;18:259.
15. Chao S, Na L, Libin J, Guiran Y. Analysis of thyroid autoantibodies and thyroid stimulating hormone expression in patients with thyroid diseases in high iodine areas of Cangzhou. Am J Biomed Life Sci. 2024;12:12-5.
16. Sayiner ZA, Eraydın A, Metin T, Özkaya M. Interferon alpha-induced non-immune thyrotoxicosis treated by plasmapheresis. BMJ Case Rep. 2017;2017:bcr2017221347.
17. Alokley A, ALNasser MN, Alabdulqader RA, et al. Effectiveness of low dose thyroxine in patients with subclinical hypothyroidism and migraine: a systematic review and meta-analysis. BMC Neurol. 2025;25:198.