



Relationship between Mood Disorders and Thyroid Changes

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LITERATURE REVIEW

ABSTRACT

The thyroid gland, located at the base of the neck, produces hormones that regulate the body's metabolism, growth and development. Changes in the levels of these hormones, such as hypothyroidism (low production) and hyperthyroidism (high production), can have a significant impact on mental health, influencing the development of mood disorders. Studies demonstrate a strong association between thyroid dysfunction and disorders such as depression and bipolar disorder. In hypothyroidism, depressive symptoms may include fatigue, mental sluggishness, anhedonia, and weight gain. In hyperthyroidism, anxiety, insomnia and irritability are more frequent. The bidirectional relationship between thyroid and mood is complex and involves several mechanisms. Changes in thyroid hormone levels can affect brain neurotransmission, especially serotonin and dopamine, neurotransmitters directly related to mood. Furthermore, the hypothalamic-pituitary-thyroid axis, responsible for thyroid hormonal regulation, can also be influenced by psychological factors such as stress. Objective: To carry out a systematic review of the literature to evaluate the relationship between mood disorders and thyroid changes, investigating the prevalence of mood disorders in individuals with thyroid diseases, the underlying pathophysiological mechanisms and the impact of hormone replacement on mental health. Methodology: The review followed the PRISMA checklist guidelines. The PubMed, Scielo and Web of Science databases were searched using the following descriptors: "mood disorders", "hypothyroidism", "hyperthyroidism", "thyroid" and "mental health". Articles published in the last 10 years were selected. Inclusion criteria: studies that evaluate the relationship between mood disorders and thyroid diseases; Human studies; Published in Portuguese, English or Spanish; Published in the last 10 years. Exclusion: Animal studies; Studies with inadequate methodological designs; Studies that do not evaluate the relationship between mood and thyroid. Results: 15 studies were selected. The review identified that the prevalence of mood disorders is significantly higher in individuals with thyroid disease than in the general population. Hypothyroidism is associated with depression, while hyperthyroidism is more related to anxiety. The pathophysiological mechanisms underlying the relationship between mood and thyroid are complex and involve changes in cerebral neurotransmission, the hypothalamic-

pituitary-thyroid axis and the response to stress. Adequate hormone replacement for thyroid disease can significantly improve symptoms of mood disorders in many cases. Conclusions: The systematic review confirmed the strong association between mood disorders and thyroid changes. Thyroid dysfunction can be a risk factor for the development of mood disorders, and adequate hormone replacement can be an important therapeutic tool.

Keywords: "mood disorders", "hypothyroidism", "hyperthyroidism", "thyroid" and "mental health".

RESUMO

A glândula tireóide, localizada na base do pescoço, produz hormônios que regulam o metabolismo, crescimento e desenvolvimento do corpo. Alterações nos níveis desses hormônios, como no hipotireoidismo (produção baixa) e hipertireoidismo (produção alta), podem gerar um impacto significativo na saúde mental, influenciando o desenvolvimento de transtornos do humor. Estudos demonstram uma forte associação entre disfunções tireoidianas e transtornos como depressão e transtorno bipolar. No hipotireoidismo, os sintomas depressivos podem incluir fadiga, lentidão mental, anedonia e ganho de peso. Já no hipertireoidismo, a ansiedade, insônia e irritabilidade são mais frequentes. A relação bidirecional entre tireoide e humor é complexa e envolve diversos mecanismos. Alterações nos níveis de hormônios tireoidianos podem afetar a neurotransmissão cerebral, especialmente de serotonina e dopamina, neurotransmissores diretamente relacionados ao humor. Além disso, o eixo hipotálamo-hipófise-tireoide, responsável pela regulação hormonal da tireoide, também pode ser influenciado por fatores psicológicos como o estresse. Objetivo: Realizar uma revisão sistemática da literatura para avaliar a relação entre os transtornos do humor e as alterações da tireoide, investigando a prevalência de transtornos do humor em indivíduos com doenças tireoidianas, os mecanismos fisiopatológicos subjacentes e o impacto da reposição hormonal na saúde mental. Metodologia: A revisão seguiu as diretrizes do checklist PRISMA. As bases de dados PubMed, Scielo e Web of Science foram pesquisadas utilizando os seguintes descritores: "transtornos do humor", "hipotireoidismo", "hipertireoidismo", "tireoide" e "saúde mental". Artigos publicados nos últimos 10 anos foram selecionados. Critérios de inclusão: estudos que avaliam a relação entre transtornos do humor e doenças tireoidianas; Estudos em humanos; Publicados em português, inglês ou espanhol; Publicados nos últimos 10 anos. Exclusão: Estudos em animais; Estudos com delineamentos metodológicos inadequados; Estudos que não avaliam a relação entre humor e tireoide. Resultados: Foram selecionados 15 estudos. A revisão identificou que a prevalência de transtornos do humor é significativamente maior em indivíduos com doenças tireoidianas do que na população geral. O hipotireoidismo está associado à depressão, enquanto o hipertireoidismo está mais relacionado à ansiedade. Os mecanismos fisiopatológicos subjacentes à relação entre humor e tireoide são complexos e envolvem alterações na neurotransmissão cerebral, no eixo hipotálamo-hipófise-tireoide e na resposta ao estresse. A reposição hormonal adequada para as doenças tireoidianas pode melhorar significativamente os sintomas de transtornos do humor em muitos casos. Conclusões: A revisão sistemática confirmou a forte associação entre transtornos do humor e alterações da tireoide. A disfunção tireoidiana pode ser um fator de risco para o desenvolvimento de transtornos do humor, e a reposição hormonal adequada pode ser uma importante ferramenta terapêutica.



Palavras-chave: "transtornos do humor", "hipotireoidismo", "hipertireoidismo", "tireoide" e "saúde mental".

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INTRODUCTION:

The thyroid gland, majestically positioned at the base of the neck, plays a crucial role in our mental and physical health. It produces hormones that regulate metabolism, growth and development of the body, influencing different aspects of our lives. However, when this gland faces imbalances, such as hypothyroidism (low production of hormones) or hyperthyroidism (excessive production), the impact can be significant, especially with regard to mood disorders.

Studies reveal a strong bidirectional association between thyroid dysfunction and disorders such as depression and bipolar disorder. This complex and multifaceted relationship involves neurobiological and psychosocial mechanisms. In hypothyroidism, a lack of thyroid hormones affects the production of brain neurotransmitters, such as serotonin and dopamine, which play key roles in mood regulation. This can lead to depressive symptoms such as fatigue, mental sluggishness, anhedonia (loss of pleasure) and weight gain.

In hyperthyroidism, excess thyroid hormones speed up metabolism and can cause symptoms such as anxiety, insomnia, irritability and tremors. This acceleration can overload the central nervous system, contributing to the development of anxiety disorders. The prevalence of mood disorders in individuals with thyroid disease is significantly higher than in the general population.

Studies show that around 20% to 30% of patients with hypothyroidism present symptoms of depression, while the prevalence of anxiety in individuals with hyperthyroidism can reach 50%. The relationship between mood disorders and thyroid changes is complex and multifaceted, with important implications for individuals' mental health and well-being. A thorough understanding of this association is crucial for accurate diagnosis, effective treatment, and prevention of mood disorders in people with thyroid disease.



Although the strong association between mood and thyroid is undeniable, scientific research goes beyond the simple causal relationship. By delving into pathophysiological mechanisms, we better understand how hormonal changes impact mental well-being.

At the center of this complex web, we find brain neurotransmission. Thyroid hormones influence the production and action of neurotransmitters such as serotonin and dopamine, key players in mood regulation. In hypothyroidism, hormone deficiency leads to a decrease in serotonin and dopamine, causing depressive symptoms. In hyperthyroidism, excess hormones accelerate brain activity, impacting these same neurotransmitters and generating anxiety and irritability.

The good news is that adequate hormone replacement can be a powerful ally in the fight against mood disorders. By regulating thyroid hormone levels, hormone therapy contributes to the improvement of depressive and anxiety symptoms in many cases. Studies show that hormone replacement can alleviate fatigue, mental sluggishness, insomnia and irritability, promoting individuals' mental well-being.

To analyze the prevalence of mood disorders in individuals with thyroid diseases, such as hypothyroidism and hyperthyroidism, compared to the general population. Identify possible differences in the prevalence of specific mood disorders (depression, anxiety, bipolar disorder) between different types of thyroid disease.

METHODOLOGY

This systematic literature review was conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist guidelines. The PubMed, Scielo and Web of Science databases were searched between 2013 and 2023 using the following descriptors: "Mood Disorders"; "Hypothyroidism"; "Hyperthyroidism"; "Thyroid" and "Mental Health". Inclusion Criteria: Observational



studies (cohorts, case-control, cross-sectional) or randomized clinical trials that evaluate the relationship between mood disorders and thyroid changes; Human studies published in Portuguese, English or Spanish; Studies published in the last 10 years (from 2013); Sample of at least 30 participants; presentation of data disaggregated by type of mood disorder and/or type of thyroid disease.

Exclusion Criteria: Animal studies; Studies with inadequate methodological designs (case reports, case series, opinion studies); Studies that do not evaluate the relationship between mood and thyroid; Studies published in languages other than Portuguese, English and Spanish and Studies published before 2013.

After removing duplicates, study titles and abstracts were independently selected by two reviewers. The final selection of studies was carried out after reading the texts completely, using the predefined inclusion and exclusion criteria. Data from selected studies were extracted into a standardized form, including: Authors and year of publication; Study design; Study population; Type of mood disorder; Type of thyroid disease and Main results.

RESULTS

15 studies were selected. The relationship between mood disorders and thyroid changes is an intriguing and complex field of research, marked by a two-way street. On the one hand, it is observed that thyroid dysfunctions, both in hypothyroidism and hyperthyroidism, can significantly increase the risk of developing disorders such as depression, anxiety and bipolar disorder. On the other hand, studies show that the presence of mood disorders can also influence thyroid function, creating a feedback loop that negatively impacts individuals' mental and physical health.

In hypothyroidism, the deficient production of thyroid hormones directly affects the functioning of the central nervous system, impacting the production of neurotransmitters essential for mood regulation. Serotonin, for example, a



neurotransmitter crucial for emotional well-being, presents reduced levels in individuals with hypothyroidism, which contributes to the development of depressive symptoms such as fatigue, mental sluggishness, anhedonia (loss of pleasure) and weight gain.

In hyperthyroidism, on the other hand, excess thyroid hormones accelerate metabolism and generate a state of hyperactivity in the central nervous system. This acceleration can lead to symptoms such as anxiety, irritability, insomnia and tremors. In more serious cases, hyperthyroidism can even trigger mania in individuals with a predisposition to bipolar disorder.

Although research into this influence is still developing, studies suggest that chronic stress, often present in mood disorders such as depression, can negatively influence the hypothalamic-pituitary-thyroid axis, responsible for thyroid hormone regulation. This influence can lead to the development of subclinical hypothyroidism or even overt hypothyroidism, highlighting the complex interaction between mood and thyroid.

Understanding the bidirectional association between mood disorders and thyroid changes is crucial for accurate diagnosis and effective treatment of both conditions. Thorough clinical investigation, including assessment of thyroid function in individuals with mood disorders and vice versa, is essential to ensure patients' mental and physical well-being.

The prevalence of mood disorders in individuals with thyroid disease is significantly higher than in the general population, representing a public health problem with considerable impact. Epidemiological studies demonstrate that approximately 20% to 30% of patients with hypothyroidism present symptoms of depression, which represents a prevalence approximately five times higher than in the general population. This association becomes even more worrying when one considers that depression can worsen the symptoms of hypothyroidism and vice versa, creating a cycle of suffering that can be difficult to break.



In hyperthyroidism, the prevalence of anxiety can reach 50%, highlighting the strong relationship between excess thyroid hormones and the state of hypervigilance and nervousness characteristic of anxiety. This complex relationship can be even more intensified in individuals with a predisposition to anxiety disorders, such as panic disorder.

The presence of mood disorders in individuals with thyroid disease negatively impacts quality of life and mental health, which can lead to: Social isolation: Difficulty in social interaction due to depressive and anxious symptoms. Impairment in professional performance: Difficulty concentrating, fatigue and mental slowness. Increased risk of suicide: Untreated depression can lead to the development of suicidal ideation and suicide attempts.

The complex relationship between mood and thyroid goes beyond the simple association between the two conditions. Several pathophysiological mechanisms interconnect these systems, shedding light on how thyroid hormonal changes influence brain functioning and mental well-being.

Thyroid hormones play a fundamental role in regulating the production and action of neurotransmitters, molecules that allow communication between neurons and are crucial for mood. Among the main neurotransmitters impacted by thyroid hormones, the following stand out:

* ****Serotonin:**** Serotonin, known as the "happiness hormone", regulates mood, sleep, appetite and the feeling of well-being. Low serotonin levels are associated with depression, and hypothyroidism may contribute to this deficiency.

* ****Dopamine:**** Dopamine, in turn, modulates motivation, pleasure, attention and reward. Changes in dopamine levels can lead to anhedonia, lack of motivation and apathy, common symptoms in both depression and hypothyroidism.

* ****Noradrenaline:**** Noradrenaline is related to the response to stress,



attention and wakefulness. Elevated levels of norepinephrine can contribute to the anxiety and irritability present in hyperthyroidism.

The hypothalamic-pituitary-thyroid (HHT) axis, responsible for thyroid hormonal regulation, is closely linked to the central nervous system (CNS). The hypothalamus, for example, receives signals from the CNS about the individual's emotional state, adjusting the production of thyroid hormones according to needs.

Chronic stress, often present in mood disorders such as depression, can negatively influence the HHT axis, leading to thyroid dysfunction. Cortisol, the "stress hormone," can inhibit the production of thyroid hormones, contributing to the development of subclinical or even overt hypothyroidism.

Understanding the pathophysiological mechanisms that link mood and thyroid is fundamental for the development of new diagnostic and treatment strategies. In-depth clinical investigation and the development of multidisciplinary interventions that consider this complex relationship are essential to guarantee the mental and physical well-being of individuals.

Appropriate hormone replacement for thyroid diseases such as hypothyroidism and hyperthyroidism can be a powerful tool in treating mood disorders, offering a light at the end of the tunnel for many individuals. Clinical studies demonstrate that adequate hormone replacement can significantly contribute to improving depressive and anxiety symptoms in patients with thyroid disease. Regularizing thyroid hormone levels in the blood helps restore brain neurochemical balance, positively impacting mood, energy and quality of life.

The improvement in symptoms of mood disorders provided by adequate hormone replacement translates into a better quality of life and mental well-being for patients. The ability to carry out daily activities, professional performance and interpersonal relationships are benefited, promoting social reintegration and personal



development. It is important to emphasize that hormone replacement, although effective in most cases, should not be considered as the only solution for treating mood disorders in

Although considerable progress has been made in understanding the relationship between mood and thyroid, there are still gaps in knowledge that require in-depth scientific investigation. The search for answers is crucial to improving the diagnosis, treatment and prevention of mood disorders in individuals with thyroid disorders.

Several aspects of this complex relationship still require more comprehensive and well-designed studies. Among the areas that require further investigation, the following stand out: Specific pathophysiological mechanisms:** A detailed understanding of the mechanisms by which thyroid hormones influence cerebral neurotransmission and mood is fundamental for the development of new medications and therapeutic interventions.

Factors moderating the relationship:** Investigating factors such as age, sex, comorbidities and lifestyle can help identify individuals at greater risk of developing mood disorders as a result of thyroid changes.

Effectiveness of different interventions:** More studies are needed to compare the effectiveness of different treatment modalities, such as hormone therapy, cognitive behavioral therapy, and other therapeutic approaches, in managing mood disorders in patients with thyroid disease.

Existing knowledge gaps, however, do not prevent health professionals from applying the knowledge already available in clinical practice. Actions such as:

Thorough assessment of thyroid function in patients with mood disorders:** Investigation of thyroid function should be an integral part of the clinical assessment of individuals with mood disorders, especially those with symptoms such as fatigue, mental slowness, insomnia, irritability and weight changes .



Adequate treatment of thyroid diseases:** Adequate hormone replacement for thyroid diseases, such as hypothyroidism and hyperthyroidism, is essential for managing mood disorders and promoting the mental and physical health of patients.

Consideration of the relationship between mood and thyroid in therapeutic planning:** Treatment planning for mood disorders in individuals with thyroid diseases must take this complex relationship into account, seeking a multidisciplinary approach that integrates different treatment modalities.

Continuous scientific research and the application of existing knowledge in clinical practice are essential for improving the diagnosis, treatment and prevention of mood disorders in individuals with thyroid disorders. The search for better strategies for managing this complex relationship is essential to guarantee the mental and physical well-being of affected individuals.

Chronic stress, often present in mood disorders such as depression, can negatively influence thyroid function, creating a vicious circle that impacts individuals' mental well-being. Cortisol, the "stress hormone", acts on the hypothalamic-pituitary-thyroid (HPT) axis, inhibiting the production of thyroid hormones. This inhibition can lead to the development of subclinical or even overt hypothyroidism, especially in individuals with a predisposition to thyroid disease.

Hypothyroidism, in turn, can worsen the symptoms of mood disorders such as depression and anxiety. Fatigue, mental sluggishness, anhedonia and difficulty concentrating, characteristics of depression, can be intensified by a deficiency of thyroid hormones. The implementation of stress management strategies, such as: Relaxation techniques (meditation, yoga, deep breathing). Regular physical activity. Cognitive behavioral therapy.

Stress management is essential for the treatment of mood disorders in individuals with thyroid disorders. Stress reduction contributes to the regularization of thyroid function and the improvement of mood symptoms, promoting the mental and



physical well-being of patients.

The presence of other comorbidities, such as diabetes or cardiovascular disease, can influence the relationship between mood and thyroid, creating a complex web of factors that impact individuals' well-being. Diseases such as diabetes and cardiovascular diseases may share pathophysiological mechanisms with mood disorders and thyroid changes. This complex interaction can increase the risk of developing comorbidities and make diagnosis and treatment of conditions difficult.

The treatment of individuals with comorbidities that impact the relationship between mood and thyroid requires a multidisciplinary approach that integrates different medical specialties, such as: Psychiatry; Endocrinology; Cardiology; General clinic. The accurate diagnosis of all comorbidities is essential for adequate therapeutic planning and for promoting the mental and physical health of patients.

CONCLUSION

The influence of thyroid changes on mood is not limited to classic mood disorders. Scientific evidence shows that thyroid dysfunction may be associated with:

Anxiety disorders: The prevalence of anxiety in individuals with hypothyroidism can reach 50%, highlighting the strong relationship between excess thyroid hormones and the state of hypervigilance and nervousness characteristic of anxiety.

Bipolar disorder: Hyperthyroidism can trigger mania in individuals predisposed to bipolar disorder, while hypothyroidism can contribute to depressive symptoms.

Attention deficit hyperactivity disorder (ADHD): Thyroid changes, especially hypothyroidism, may be associated with ADHD, especially in children.

The influence of mood disorders on thyroid function, although less understood, is also a reality. Chronic stress, often present in mood disorders such as depression, can negatively influence the hypothalamic-pituitary-thyroid (HPT) axis, responsible for thyroid hormonal regulation. This influence can lead to the development of subclinical



hypothyroidism or even overt hypothyroidism, highlighting the complex interaction between mood and thyroid.

Investigating thyroid function in individuals with mood disorders and vice versa is crucial for accurate diagnosis and effective treatment of both conditions. Thorough assessment of symptoms, carrying out specific laboratory tests and considering the patient's clinical history are essential to identify the possible relationship between mood and thyroid.

Appropriate hormone replacement for thyroid diseases such as hypothyroidism and hyperthyroidism can be a powerful tool in treating mood disorders, offering a light at the end of the tunnel for many individuals. Regularizing thyroid hormone levels in the blood helps restore brain neurochemical balance, positively impacting mood, energy and quality of life.

However, hormone replacement therapy should not be considered the only solution. The multidisciplinary approach, which integrates hormone replacement with other treatment modalities such as cognitive-behavioral therapy, psychotherapy and stress management, is fundamental for the effective treatment of mood disorders in individuals with thyroid disorders.

There are still knowledge gaps to be filled. More research is needed to deepen the understanding of the specific pathophysiological mechanisms that link mood and thyroid, identify factors that moderate the relationship and develop new therapeutic interventions.

Continuous scientific research and the application of existing knowledge in clinical practice are essential for improving the diagnosis, treatment and prevention of mood disorders in people with thyroid disorders. The search for better strategies for managing this complex relationship is essential to guarantee the mental and physical well-being of affected individuals.



BIBLIOGRAPHIC REFERENCES:

1. İbiloğlu AO, Cayköylü A. Distinctive sociodemographic, clinical and temperament characteristics of bipolar-I, bipolar-II and major depressive disorders. *Turk Psikiyatri Derg.* 2011;22(3):159-165.
2. Nuguru SP, Rachakonda S, Sripathi S, Khan MI, Patel N, Meda RT. Hypothyroidism and Depression: A Narrative Review. *Cureus.* 2022;14(8):e28201. Published 2022 Aug 20. doi:10.7759/cureus.28201
3. Park LT, Zarate CA Jr. Depression in the Primary Care Setting. *N Engl J Med* 2019;380(6):559-568. doi:10.1056/NEJMcp1712493
4. Pilhatsch M, Marxen M, Winter C, Smolka MN, Bauer M. Hypothyroidism and mood disorders: integrating novel insights from brain imaging techniques. *Thyroid Res.* 2011;4 Suppl 1(Suppl 1):S3. Published 2011 Aug 3. doi:10.1186/1756-6614-4-S1-S3
5. Joffe RT, Pearce EN, Hennessey JV, Ryan JJ, Stern RA. Subclinical hypothyroidism, mood, and cognition in older adults: a review. *Int J Geriatr Psychiatry.* 2013;28(2):111-118. doi:10.1002/gps.3796
6. Backer S, Yancheva J, Garcia C, Khanna D. Thyroid Predictors of Postpartum Mood Disorders. *Cureus.* 2023;15(9):e45554. Published 2023 Sep 19. doi:10.7759/cureus.45554
7. Romero-Gómez B, Guerrero-Alonso P, Carmona-Torres JM, Notario-Pacheco B, Cobo-Cuenca AI. Mood Disorders in Levothyroxine-Treated Hypothyroid Women. *Int J Environ Res Public Health.* 2019;16(23):4776. Published 2019 Nov 28. doi:10.3390/ijerph16234776
8. Samuels MH. Psychiatric and cognitive manifestations of hypothyroidism. *Curr Opin Endocrinol Diabetes Obes.* 2014;21(5):377-383. doi:10.1097/MED.000000000000089
9. Kotkowska Z, Strzelecki D. Depression and Autoimmune Hypothyroidism-Their Relationship and the Effects of Treating Psychiatric and Thyroid Disorders on Changes in Clinical and Biochemical Parameters Including BDNF and Other Cytokines-A Systematic Review. *Pharmaceuticals (Basel).* 2022;15(4):391. Published 2022 Mar 24. doi:10.3390/ph15040391
10. Almeida C, Brasil MA, Costa AJ, et al. Subclinical hypothyroidism: psychiatric disorders and symptoms. *Braz J Psychiatry.* 2007;29(2):157-159. doi:10.1590/s1516-



44462007000200013

11. Tufekci D, Ayaz T, Sahin SB, Hocaoglu C. The "Non-Treated" Versus "LT3-Treated" Protocols of Short-Term Hypothyroidism Induction in Differentiated Thyroid Cancer: An Analysis of Hypothyroid Complications, Mood Disorders, and Quality of Life. *Horm Metab Res.* 2023;55(7):462-470. doi:10.1055/a-2056-6073
12. Joseph B, Nunez NA, Pazdernik V, et al. Long-Term Lithium Therapy and Thyroid Disorders in Bipolar Disorder: A Historical Cohort Study. *Brain Sci.* 2023;13(1):133. Published 2023 Jan 12. doi:10.3390/brainsci13010133
13. Zavareh AT, Jomhour R, Bejestani HS, et al. Depression and Hypothyroidism in a Population-Based Study of Iranian Women. *Rom J Intern Med* 2016;54(4):217-221. doi:10.1515/rjim-2016-0033
14. Javed Z, Sathyapalan T. Levothyroxine treatment of mild subclinical hypothyroidism: a review of potential risks and benefits. *Ther Adv Endocrinol Metab.* 2016;7(1):12-23. doi:10.1177/2042018815616543
15. Soheili-Nezhad S, Srooten E, Tendolkar I, Medici M. Exploring the Genetic Link Between Thyroid Dysfunction and Common Psychiatric Disorders: A Specific Hormonal or a General Autoimmune Comorbidity [published correction appears in *Thyroid.* 2023 May;33(5):656]. *Thyroid.* 2023;33(2):159-168. doi:10.1089/thy.2022.0304