

## Review of Cardiovascular Manifestations of Hyperthyroidism: Main Triggered Heart Diseases and Clinical Implications

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### ABSTRACT

**Introduction:** Hyperthyroidism, a common endocrinological condition characterized by excess production of thyroid hormones, has profound and varied effects on the cardiovascular system. The thyroid hormones, triiodothyronine (T3) and thyroxine (T4), play essential roles in regulating basal metabolism and cardiovascular function.

**Objective:** To provide a comprehensive understanding of the various cardiac complications associated with hyperthyroidism and their clinical implications.

**Methods:** This study constitutes a systematic review, classified as exploratory and descriptive. The preparation of the research was a bibliographical search in electronic databases on methods associated with RSL (Systematic Literature Review) and the applications of SMARTER (*Simple Multi-Attribute Rating Technique using Exploiting Rankings*).

**Results:** A comprehensive systematic search of the literature yielded a total of 5689 articles referring to the incidence of obesity and overweight in adolescents, of which 20 articles were eligible to be included in this systematic review.

**Conclusion:** Continuous research and therapeutic innovation play vital roles in the evolution of the treatment of hyperthyroidism and its cardiovascular complications. The development of personalized approaches that consider the genetic and clinical particularities of each patient can significantly improve quality of life and reduce associated morbidity and mortality.

**KEYWORDS:** Cardiovascular Manifestations, Hyperthyroidism, Heart Diseases, Clinical Implications

### ARTICLE DETAILS

**Published On:**  
**07 June 2024**

**Available on:**  
<https://ijmscr.org/>

### INTRODUCTION

Hyperthyroidism, a common endocrinological condition characterized by excess production of thyroid hormones, has profound and varied effects on the cardiovascular system (DUGGIRALA et al., 2023). The thyroid hormones, triiodothyronine (T3) and thyroxine (T4), play essential roles in regulating basal metabolism and cardiovascular function (GELEN; ŞENGÜL; KÜKÜRT, 2023; RASOOL et al., 2023). When produced in excess, these hormones can lead to various cardiac manifestations that

significantly complicate the clinical picture of affected patients (LISCO et al., 2022; NAVARRO-NAVAJAS et al., 2022).

Among the cardiovascular manifestations of hyperthyroidism, sinus tachycardia is one of the most frequent (PASCHOU et al., 2022). The increase in basal heart rate can result in significant discomfort and a feeling of palpitations, symptoms commonly reported by patients with hyperthyroidism (WATANABE et al., 2023). Furthermore, atrial fibrillation is a serious complication (which can also

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occur in individuals with hyperthyroidism), especially in older individuals, and is associated with an increased risk of thromboembolic events, including stroke (ANTONIJEVIC et al., 2024; KOSTOPOULOS; EFFRAIMIDIS, 2024).

Systolic arterial hypertension is also a common consequence of hyperthyroidism, resulting from increased cardiac output and reduced peripheral vascular resistance. This hypertensive state can exacerbate the burden on the heart, leading to other cardiac complications (OLANREWAJU et al., 2024; SZWARCBARD; TOPLISS, 2023). Hypertrophic cardiomyopathy, a condition in which the heart muscle thickens abnormally, may arise in response to chronic work overload imposed by hyperthyroidism (GARBERN; QUIAT, 2025).

Heart failure is a serious complication that can occur in patients with untreated or inadequately controlled hyperthyroidism. The heart's ability to pump blood effectively is compromised, resulting in symptoms of pulmonary congestion and peripheral edema. This condition requires immediate medical intervention to stabilize cardiac function and correct the underlying hormonal imbalance (ELMENYAR et al., 2023).

From a clinical point of view, identification and management of the cardiovascular manifestations of hyperthyroidism are crucial. Early diagnosis, through laboratory and imaging tests, and the implementation of targeted treatments, such as beta-blockers to control heart rate and antithyroid medications to reduce hormone production, are fundamental to improving patients' prognosis (NAVARRO-NAVAJAS et al., 2022).

The effects of thyroid hormones on the cardiovascular system are not limited to the mechanical functions of the heart, but also involve changes in endothelial function and blood clotting. (VYAS; RAYTHATHA; PRAJAPATI, 2024). Studies show that hyperthyroidism can increase arterial stiffness and vascular reactivity, contributing to endothelial dysfunction (STUDEN et al., 2024). Furthermore, there is an increased risk of hypercoagulability, which may predispose patients to thromboembolic events, such as deep vein thrombosis and pulmonary embolism (ALSAIDAN; ALRUWIALI, 2023; ANTONIJEVIC et al., 2024). These changes expand the spectrum of cardiovascular complications associated with hyperthyroidism.

Another critical aspect is the interaction between hyperthyroidism and other comorbidities. Patients with pre-existing cardiovascular diseases, such as coronary insufficiency or chronic hypertension, may experience a significant worsening of their symptoms due to the hypermetabolic state induced by hyperthyroidism (OLANREWAJU et al., 2024). Therefore, the therapeutic approach must be broad, taking into account not only the correction of excess thyroid hormones, but also the careful management of associated comorbidities. This integrated

approach is essential to reduce cardiovascular morbidity and mortality in patients with hyperthyroidism.

Hyperthyroidism presents a significant challenge to cardiovascular health, with a range of potential complications that can profoundly impact patients' quality of life. A detailed understanding of these manifestations and their clinical implications is essential for healthcare professionals, allowing the adoption of effective therapeutic strategies that aim to minimize risks and improve clinical outcomes.

In this context, the aim of the study is to provide a comprehensive understanding of the various cardiac complications associated with hyperthyroidism and their clinical implications.

### METHODS

This study constitutes a systematic review, classified as exploratory and descriptive. The preparation of the research was a bibliographical search in electronic databases on methods associated with RSL (Systematic Literature Review) and the applications of SMARTER (*Simple Multi-Attribute Rating Technique using Exploiting Rankings*). The work carried out is of a qualitative and quantitative nature. Qualitative data analysis was carried out intuitively and inductively during the survey of the theoretical framework. It is also quantitative through the use of the multi-criteria method. In addition, there is also a numerical experimental study in order to simulate an article selection situation based on the observed criteria.

The bibliographical research was carried out in the following databases: *Web of Science; Science Direct; Wiley; SpringerLink; Taylor and Francis; PubMed and EBSCO*. In addition, searches were carried out using bibliographical references of studies that relevantly addressed the topic on the *Google Scholar search platform*.

The search in the databases was carried out using the terminologies registered in the Health Sciences Descriptors created by the Virtual Health Library developed from the *Medical Subject Headings of the US National Library of Medicine*, which allows the use of common terminology in Portuguese, English and Spanish. The present study sought to investigate the literature on the cardiovascular manifestations of hyperthyroidism. To this end, the descriptors "Cardiovascular Manifestations", "Hyperthyroidism", "Heart Diseases", "Clinical Implications" were used, initially in English, and in a complementary manner in Spanish and Portuguese.

As a tool to support decision-making in the selection and prioritization of articles, a set of criteria were considered essential to represent the state of the art of the topic under study. This method has the following characteristics: (i) rigorous logic allows the method to be accepted as a decision support tool; (ii) simple to understand and apply with easy-to-interpret results.

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References from selected works were also searched for other documents of potential interest. Once qualified for full text in the evaluation, articles were included in the qualitative review if they met the following inclusion criteria: a) contained data on hyperthyroidism; b) contained data on cardiovascular manifestations. Articles were excluded if they were reports, banners or conference abstracts. There was no review of confidential health information and the study was non-interventional. Therefore, ethics committee approval was not necessary. In the end, the result obtained totaled 20 articles that covered the desired characteristics for the study.

Three independent researchers extracted data from articles that met the inclusion criteria and recorded them in a “Data Extraction Form” generated in Microsoft Excel on cardiovascular manifestations in hyperthyroidism.

## RESULTS

A comprehensive systematic search of the literature yielded a total of 5689 articles referring to the incidence of overweight and obesity in adolescents. Of these, 1327 studies were excluded due to data overlap. From this, the SMARTER method (*Simple Multi-Attribute Rating Technique using Exploiting Rankings*) was chosen and 1079 articles were selected that were suitable for full-text screening, of which 297 articles were included for data extraction, of which 277 were excluded by the exclusion criteria, making 20 articles eligible and included for systematic review. In Figure 1, we describe the strategy for selecting articles on the topic in question.

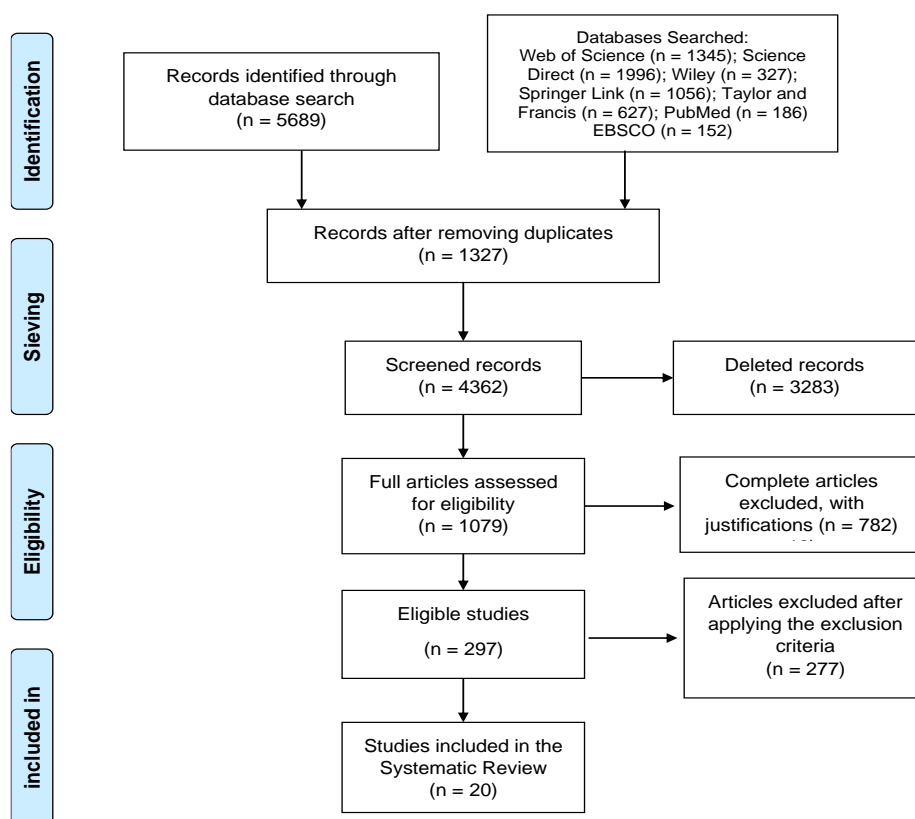


Figure 1. Article search strategy

Source: Authors (2024)

## DISCUSSION

Discussions about the cardiovascular manifestations of hyperthyroidism and their clinical implications have been a significant focus of recent research (GENCER et al., 2022). Hyperthyroidism, through excess thyroid hormones, profoundly affects the cardiovascular system, leading to several cardiac complications (VYAS; RAYTTATHA; PRAJAPATI, 2024). Among the most common manifestations is sinus tachycardia, a direct result of increased basal metabolism and sympathetic activity, which increases basal heart rate and can cause significant palpitations. Recent studies confirm the prevalence of this

condition and emphasize the need for effective management to prevent additional complications (PASCHOU et al., 2022; WATANABE et al., 2023).

Atrial fibrillation (AF) is another common and serious complication, especially in the elderly, associated with an increased risk of thromboembolic events such as stroke. Recent research shows that strict management of thyroid hormone levels can reduce the incidence of AF, improving clinical outcomes (CHO et al., 2022; KUMARI et al., 2023).

Systolic hypertension is another common manifestation of hyperthyroidism, resulting from increased

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cardiac output and reduced peripheral vascular resistance. This condition can worsen the burden on the heart, potentially leading to other serious complications, such as heart failure (OLANREWAJU et al., 2024; SZWARCBARD; TOPLISS, 2023). The importance of ongoing monitoring and intervention to manage hypertension in hyperthyroid patients is widely recognized (YAMAKAWA et al., 2021).

Hypertrophic cardiomyopathy, characterized by abnormal thickening of the heart muscle, is another potential complication of hyperthyroidism. This condition can result in diastolic dysfunction and heart failure. Early interventions and strict control of hormone levels are essential to prevent the progression of hypertrophic cardiomyopathy in patients with hyperthyroidism (GARBERN; QUIAT, 2025).

Heart failure in patients with hyperthyroidism represents a serious complication resulting from the heart's inability to pump blood effectively. Recent studies emphasize that treating underlying hyperthyroidism can significantly improve outcomes in patients with heart failure, highlighting the importance of prompt medical intervention (ELMENYAR et al., 2023).

In addition to mechanical complications, hyperthyroidism affects endothelial function and blood clotting, increasing arterial stiffness and hypercoagulability. These changes can predispose patients to thromboembolic events, such as deep vein thrombosis and pulmonary embolism, expanding the spectrum of cardiovascular complications associated with hyperthyroidism. Comprehensive assessment of these effects is essential for effective management (ALSAIDAN; ALRUWIALI, 2023; ANTONIJEVIC et al., 2024).

The interaction between hyperthyroidism and other cardiovascular comorbidities is also crucial. Patients with preexisting conditions, such as coronary insufficiency or chronic hypertension, may experience a significant worsening of their symptoms due to the hypermetabolic state induced by hyperthyroidism. Recent studies suggest that a multifaceted therapeutic approach, which includes the management of comorbidities, is vital to improving clinical outcomes (OLANREWAJU et al., 2024).

Management of the cardiovascular manifestations of hyperthyroidism requires an integrated approach that combines early diagnosis, personalized therapeutic interventions and comprehensive public health policies. Continuous research and therapeutic innovation are critical to developing effective treatment strategies. Collaboration between researchers, clinicians and policymakers is essential to improve patients' quality of life and reduce the morbidity and mortality associated with hyperthyroidism.

### FINAL CONSIDERATIONS

Research has shown that hyperthyroidism can lead to a variety of significant heart diseases, including tachycardia, atrial fibrillation, systolic hypertension,

hypertrophic cardiomyopathy and heart failure. These complications result from complex mechanisms, such as increased basal metabolism and sympathetic hyperactivity, which negatively impact cardiovascular health.

Early identification and appropriate management of these manifestations are crucial to improving patients' clinical outcomes. Diagnostic strategies, such as laboratory and imaging tests, along with therapeutic interventions, such as the use of beta-blockers and antithyroid medications, are essential. Furthermore, implementing public health policies that promote healthy environments and awareness about hyperthyroidism are essential for effective prevention and treatment.

Continuous research and therapeutic innovation play vital roles in the evolution of the treatment of hyperthyroidism and its cardiovascular complications. The development of personalized approaches that consider the genetic and clinical particularities of each patient can significantly improve quality of life and reduce associated morbidity and mortality. A coordinated effort between researchers, healthcare professionals, policy makers and the community are needed to address the challenges posed by hyperthyroidism in the context of cardiovascular disease.

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