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The effects of physical activity on metabolic health, body composition and quality of life in patients with hypothyroidism: a narartive review

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Abstract

Background. Hypothyroidism, including Hashimoto's thyroiditis, is characterized by metabolic slowing, altered body composition, and persistent fatigue, which frequently undermine patient wellness even after biochemical euthyroidism is obtained with optimal levothyroxine therapy.

Aim. To evaluate the evidence regarding the role of physical activity, specifically aerobic, resistance, and combined training, on metabolic health, body composition, and quality of life (QoL) in patients with clinical and subclinical hypothyroidism.

Material and methods. A thorough narrative review of the literature was performed using PubMed, focusing on randomized controlled trials, cohort studies, and cross-sectional analyses published predominantly over the last decade. Variables analyzed included thyroid function tests, lipid profiles, anthropometric markers, and psychometric QoL assessments.

Results. Current empirical evidence demonstrates that physical activity significantly improves physical and mental QoL components among patients with hypothyroidism. Recreational exercise improves systemic thyroid function profiles and may enhance levothyroxine

absorption. While standard pharmacological treatment primarily reduces water weight, structured exercise is required for meaningful shifts in fat mass and to mitigate metabolic syndrome risks. Combined aerobic and resistance training yields the greatest improvements in mental health scores and TSH normalization.

Conclusions. Physical activity acts as a useful adjunctive therapy in managing hypothyroidism. Structured exercise safely lessens the myopathic and metabolic detriments of the disease, potentially improving functional capacity and QoL.

Key words: hypothyroidism, Hashimoto's thyroiditis, physical activity, body composition, metabolic syndrome, quality of life

1. Introduction

Primary hypothyroidism ranks as the second most prevalent endocrine disorder globally, following diabetes mellitus. It results from a deficiency of thyroid hormones. Hypothyroidism may be classified according to the time of onset, either congenital or acquired,and by severity, including overt (clinical), subclinical, and mild forms of the disease. The standard therapy of hypothyroidism is hormone replacement therapy with levothyroxine (LT4)(Biondi et al., 2014). However, maintaining laboratory euthyroidism does not always resolve the systemic burden of the disease. A number of patients continue to experience muscular weakness, impaired exercise tolerance, and psychological distress.

The cause of those symptoms is the peripheral impact of thyroid hormone deficiency. Hypothyroidism induces a distinct metabolic myopathy with impaired mitochondrial metabolism, smaller energy production, and alterations in substrate oxidation (Kaminsky, 1992). Research has also shown an increased lactate accumulation during physical exertion, which functionally limits the patient's capacity for activity (Monzani, 1997). As a consequence, patients with hypothyroidism frequently complain of consistent fatigue and diminished quality of life (QoL) (Werneck et al., 2018). Given the link between decreased resting energy expenditure and a sedentary lifestyle forced by fatigue, these patients are uniquely predisposed to metabolic comorbidities and changes in body composition (Li et al., 2020).

Optimally structured physical activity and exercise, considered adjunctive therapies, are currently of increasing interest. (Personius, 2024). Physical exercise is well known to provide cardiovascular and metabolic benefits to many patients, but the exact interaction with thyroid autoantibodies, absorption of exogenous hormones, or hypothyroid myopathy awaits closer examination. This review summarizes recent clinical evidence to present the impact of physical activity on metabolic health, body composition, and QoL in patients with hypothyroidism.

2. Methodology

2.1 Database Search Strategy

We performed a targeted literature search within the PubMed database to identify relevant clinical studies published over the past two decades, with a strong emphasis on research published within the last 10 years. Key search terms included combinations of "hypothyroidism", "Hashimoto's thyroiditis", "physical activity", "exercise", "aerobic training", "resistance training", “sports”, "metabolic health", "body composition", and "quality of life".

2.2 Criteria for Study Selection and Inclusion

We prioritized original scientific investigations, with particular emphasis on randomized controlled trials (RCTs), prospective and retrospective cohort studies, and longitudinal observational studies (Werneck et al., 2018; Ahmad et al., 2023; Sheikh et al., 2018). We also included cross-sectional studies that reported relevant metabolic and anthropometric data (Karavelioglu, 2025; Vuletić, 2024). Additionally, we selectively included reviews and meta-analyses to provide synthesis and conceptual background (Skrzypiec-Spring, 2025; Duñabeitia et al., 2023).

2.3 Variables Measured

The primary variables assessed across the selected literature included metrics of thyroid function (TSH, free T3, free T4), systemic inflammation (cytokine profiles, TPO-Ab, TgAb), metabolic parameters (resting energy expenditure, lipid profiles, oxygen uptake), anthropometric changes (fat mass, body weight, lean mass), and subjective parameters of well-being monitored with proper scales (SF-36, SF-12, MEDLIFE).

3. Literature review

3.1 Physical activity and metabolic health in hypothyroidism

Hypothyroidism and subclinical hypothyroidism are associated with multiple metabolic and cardiovascular complications, such as elevated serum total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG), in addition to an increased risk of cardiovascular disease and cognitive impairment. (Biondi B et al., 2019) Moreover, population-level observations indicated sHT as at risk factor for the development of full metabolic syndrome, indicating the need for screening and early pharmacological intervention. (Li et al., 2020).

Physical activity reduces the risk of metabolic dysfunctions related to hypothyroidism, including increased cardiovascular risk. Analysis of NHANES data shows that higher levels of moderate-to-vigorous physical activity (MVPA) are associated with up to a 33% reduction in the likelihood of developing subclinical hypothyroidism (sHT) (Li, 2025). Additionally, lower physical activity energy expenditure is directly linked to unfavorable lipid profiles and elevated blood pressure in individuals with high-normal thyroid-stimulating hormone (TSH) levels (Rondeau et al., 2010).

The timing as well as context of exercise are key determinants of metabolic outcomes. A recent clinical trial reported that a 30-minute morning walk immediately after oral levothyroxine administration significantly reduced serum TSH levels, suggesting that acute aerobic activity may enhance gastrointestinal absorption and the hormone's efficacy (Gezer, 2024). In contrast, research revealed a "Physical Activity Paradox" in patients with Hashimoto's disease. It was found that recreational exercise reduces TSH and thyroid autoantibodies, whereas sustained, intensive occupational physical activity is associated with increased autoimmunity and impaired thyroid function (Vuletić et al., 2024).

3.2 Physical activity and body composition

Weight gain and difficulty losing weight are hallmark complaints of hypothyroid patients. Clinical observations indicate that while LT4 treatment corrects serum hormone deficit and increases resting energy expenditure, the accompanying weight loss is predominantly driven by the excretion of excess body water (myxedema) rather than reductions in adipose tissue (Karmisholt et al., 2011).

Accordingly, physical activity is a non-negotiable component for actual body composition changes. Cross-sectional data reveal that patients diagnosed with HT who exhibit higher adherence to active Mediterranean lifestyles, which include a holistic approach to health that promote a balance of adequate rest, quality sleep, and moderate physical activity, achieve lower body weight, body fat percentages, and waist-to-hip ratios (Karavelioglu, 2025). The lack of structured physical activity, often resulting from disease-induced fatigue, perpetuates poor body composition (Aguilar-Aguilar et al., 2018). Because LT4 primarily resolves myxedematous water retention, regular exercise regimens are medically necessary to instigate lipolysis and rebuild lean mass lost to hypothyroid myopathy (Karmisholt et al., 2011).

3.3 Physical activity and quality of life

Hypothyroidism may result in significant psychological and functional burdens. Patients commonly experience functional impairments, including severe cramping and muscle weakness. In rare and severe cases, Hoffman's syndrome may occur, which is characterized by muscular stiffness and pseudohypertrophy (Mastropasqua et al., 2003; Reuters et al., 2009). These neuromuscular symptoms substantially limit functional capacity.

Physical exercise has been shown to substantially improve quality-of-life (QoL) deficits associated with hypothyroidism. In a randomized controlled trial (RCT) involving women with subclinical hypothyroidism (sHT), 16 weeks of continuous aerobic exercise led to considerable improvements in health-related QoL (Werneck et al., 2018). The study assessed patient wellness using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36), which evaluates QoL across eight domains: Functional capacity (physical functioning), Physical aspects (role limitations due to physical health), Pain (bodily pain), General health, Vitality, Social functioning, Emotional aspects, Mental health.

Each SF-36 domain is scored on a standardized scale from 0 to 100, where higher scores indicate a more favorable health state. Following the 16-week intervention, the exercising group demonstrated statistically significant numerical increases ($p<0.05$) in their scores, particularly in functional capacity, general health, emotional aspects, and the overall mental health component, whereas the sedentary control group showed no such gains. Based on these quantitative improvements, the authors concluded that supervised aerobic exercise is a highly effective and safe non-pharmacological strategy. It directly mitigates both the physical and psychological detriments of sHT, making it a key tool for restoring overall quality of life in this patient population (Wernecket al., 2018)

Additionally, engaging in recreational exercise might alter the systemic inflammatory state. In levothyroxine-treated HT patients, recreational physical activity is connected to a favorable increase in anti-inflammatory markers and improved muscle metabolic proteins (Vuletić, 2024). By reducing systemic inflammation, exercise relieves the chronic fatigue that conventionally impairs the patients' QoL.

3.4 Comparison of aerobic, resistance and combined training

Identifying the most effective exercise modality is essential for informing clinical recommendations. Patients with untreated or subclinical hypothyroidism frequently experience reduced maximal oxygen uptake and impaired ventilation, which gradually improve following chemical normalization with levothyroxine (LT4) (Mainenti et al., 2009). Structured exercise training may commence once patients achieve stabilization.

A landmark randomized controlled trial (RCT) compared aerobic training (AT), resistance training (RT), and combined aerobic and resistance training (AT/RT) over a 12-week period in women treated with levothyroxine (Ahmad et al., 2023). The findings demonstrated that all three exercise modalities similarly improved T4 levels, lipid profiles, and physical quality of life (QoL). AT resulted in the greatest increase in maximal oxygen consumption (VO2 max), thereby addressing the aerobic deficits associated with hypothyroidism. In contrast, combined AT/RT was most effective at normalizing t TSH levels and presented the largest improvements in mental health-related QoL (Ahmad et al., 2023). Meta-analytical reviews further confirm that these exercise interventions are safe and do not adversely affect thyroid function, providing support for a combined exercise recommendation. (Duñabeitia et al., 2023).

3.5 Barriers to physical activity

Engaging in regular physical activity remains a significant challenge for patients suffering from hypothyroidism. Clinical observations reveal that even women with subclinical hypothyroidism present significantly lower physical activity levels, reduced functional capacity, and higher baseline fatigue in comparison with healthy controls. As their symptoms contribute to a rather inactive lifestyle, the pateints should be enrolled in exercise programs to reduce the risk of adverse effects and developing comorbidities. (Tanriverdi et al., 2018).

Crucially, these barriers tend to continue existing even after pharmacological intervention. Research focusing on adult women with primary hypothyroidism treated with levothyroxine demonstrates that despite achieving laboratory euthyroidism, patients continue to face specific exercise-related constraints. Frequent physical complaints during and after participating in exercises include muscle pain, joint stiffness, and disproportionately long recovery times(Lankhaar et al., 2021).

A more nuanced exploration of limiting factors reveals that systemic fatigue and a lack of energy are the most commonly perceived barriers to initiating and maintaining a physical activity. Interestingly, affected patients were aware of the benefits of exercise, especially weight management, improved fitness, and improved mental health. This indicates that the low physical activity levels observed in women suffering from hypothyroidism might not be caused by a lack of motivation, but rather the persistent, unaddressed physiological symptoms of the disease itself. (Lankhaar et al., 2021)

Table 1. Synthesis of Key Empirical Studies

Author (Year)	Study Design	Sample Size & Characteristics	Measurement Modalities	Primary Outcomes & Findings
Karavelioglu et al. (2025)	Cross-sectional study	120 Mediterranean women with	Anthropometric measurements, MEDAS, and	Higher adherence to active Mediterranean

		Hashimoto's thyroiditis	MEDLIFE scores.	lifestyles resulted in significantly lower body weight, body fat percentages, and waist-to-hip ratios.
Werneck et al. (2018)	Randomized clinical trial	22 women with subclinical hypothyroidism	SF-36 questionnaire	16 weeks of continuous aerobic exercise significantly improved functional capacity, general health, and emotional state
Ahmad et al. (2023)	Randomized controlled trial	60 levothyroxine-treated women divided into training groups	Comparison of aerobic, resistance, and combined training over 12 weeks; lipid profiles, T4, QoL	Combined AT/RT training was uniquely superior at normalizing TSH levels and inducing the greatest improvements in mental health components of QoL

Li Z. et al. (2025)	Cross-sectional analysis	NHANES 2007-2012 cohort	Tracking volumes of moderate-to-vigorous physical activity (MVPA)	Higher volumes of MVPA correlated with up to a 33% reduction in the odds of presenting with subclinical hypothyroidism
Gezer (2024)	Clinical trial (pilot	Patients taking oral levothyroxine	Monitoring of serum TSH levels after acute aerobic activity	Morning exercise significantly improved oral levothyroxine absorption, lowering TSH.

4. Discussion

The integration of physical activity into the clinical management of hypothyroidism represents a shift from purely pharmacological management to a holistic metabolic approach. (Personius, 2024; Ettleson et al., 2024). LT4 therapy is undeniably the foundation of treatment, although the empirical evidence reviewed here indicates that it may not be sufficient for full metabolic and physical restoration (Karmisholt et al., 2011).

A synthesis of the evidence reveals a synergistic mechanism: LT4 restores baseline cellular metabolism and improves submaximal cardiopulmonary capacity (Mainenti et al., 2009), thereby permitting the patient to engage in physical activity without the premature lactate accumulation observed in untreated states (Monzani, 1997). When the patient is active, structured exercise, particularly combined resistance and aerobic training, may modulate systemic inflammation (Vuletić, 2024), limit the progression of metabolic syndrome (Li et al., 2020), and actually improve the absorption kinetics of the oral medication itself (Gezer, 2024). Additionally, controlled exercise appears to possess mild immunomodulatory effects, likely

reducing the autoantibody load in Hashimoto's thyroiditis (Skrzypiec-Spring, 2025; Vuletić et al., 2024).

5. Limitations of current evidence

Although current literature provides considerable evidence supporting the benefits of exercise as an adjunctive therapy for hypothyroidism, several limitations remain. Most clinical trials use relatively small sample sizes and primarily focus on female cohorts, which reflects the epidemiological distribution of the disease but limits generalization toward broader populations. Furthermore, considerable heterogeneity in exercise protocols, including variations in intensity, duration, and supervision, complicates the establishment of universal, standardized dosing guidelines for physical activity in this population. Additional large-scale, long-term randomized controlled trials are necessary to clarify the intensity-response relationship between exercise intensity and modulation of TSH or autoantibodies.

6. Conclusions and future research directions

Physical activity is an important, non-pharmacological intervention in the management of clinical and subclinical hypothyroidism. While levothyroxine effectively restores the hormonal deficit and clears myxedematous fluid, structured exercise is crucial to reverse hypothyroid myopathy, reduce actual fat mass, and protect against metabolic syndrome. Clinicians should consider prescribing combined aerobic and resistance training, as it potentially provides the most profound improvements in thyroid-stimulating hormone regulation and overall quality of life.

While current literature underscores the profound benefits of physical activity for hypothyroid patients, several specific avenues for future research remain to be explored. To address the epidemiological skew of existing data, future investigations should prioritize large-scale, multi-center longitudinal studies that include more diverse cohorts, particularly incorporating male participants to identify potential sex-specific metabolic and immunological responses to exercise. Furthermore, there is a critical need to elucidate the precise molecular mechanisms by which different exercise modalities such as high-intensity interval training (HIIT) versus steady-state aerobic or resistance training modulate thyroid autoantibodies (TPO-Ab, TgAb) and influence levothyroxine absorption kinetics As it comes to methodology, future trials

should transition from relying heavily on subjective self-report questionnaires to incorporating objective, continuous tracking technologies, such as wearable actigraphy and metabolic monitors, to precisely assess physical exertion, sleep architecture, and energy expenditure. Ultimately, mapping these highly controlled, objective variables will enable the development of standardized, evidence-based FITT (Frequency, Intensity, Time, Type) training clinical guidelines tailored specifically for the progressive stages of clinical and subclinical hypothyroidism.

Disclossure

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In preparing this work, the authors used Google Gemini and Grammarly for the purpose of text analysis of the literature to identify patterns and categorize evidence and assistance in refining

the academic language of the manuscript, ensuring readability and adherence to scientific writing standard. After using these tools and services, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication

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