Impact of multidisciplinary rehabilitation on quality of life in individuals with thyroid gland dysfunction: a systematic review

Impacto de la rehabilitación multidisciplinaria en la calidad de vida de personas con disfunción tiroidea: una revisión sistemática

Authors

Munseef Sadaqa [1]
Amira Ezzat [1]*
Mohamed Tharwat [2]
Emad Ghattas [3]
Alshaimaa Ali [4]
Mai Rewisha [5]
Yasmin Assim [6]
Doaa Mohammed Mahmoud Allam [7]

[1] Al al-Bayt University, Mafraq, Jordan
[2] Middle East University, Amman, Jordan
[3] Suez Canal University, Ismailia Governorate, Egypt
[4] German International University
[5] University of Hertfordshire, Cairo, Egypt
[6] Al-Ahram Canadian University, Egypt
[7] Kafrelsheikh University, Egypt.

Corresponding author: Amira Ezzat Mohamed Abd ElHay
dr.amira.ezzat.pt@gmail.com

Received: 06-01-26
Accepted: 21-01-26

How to cite in APA

Sadaqa, M., Ezzat, A., Tharwat, M., Ghattas, E., Ali, A., Rewisha, M., Assim, Y., & Mahmoud Allam, D. M. (2026). Impact of multidisciplinary rehabilitation on quality of life in individuals with thyroid gland dysfunction: a systematic review. *Retos, 76*, 725-738. https://doi.org/10.47197/retos.v76.118520

Abstract

Background: Dysfunctions of the thyroid gland, such as hypothyroidism, hyperthyroidism, autoimmune thyroiditis and conditions following thyroidectomy, can lead to impairments in several systems, impacting one's physical, mental and social health. Low quality of life (QoL) is a major consequence of long-term symptoms including exhaustion, cognitive decline, weak muscles and joints, changes in metabolism and problems with one's voice. There has not been enough synthesis of the multidisciplinary rehabilitative therapies that have developed as useful adjuncts, such as exercise, PT, electrotherapy, voice therapy, Baduanjin, OT and psychological interventions.
Objective: The purpose of this study is to compare the QoL of persons with thyroid dysfunction before and after they participate in a multimodal rehabilitation program.
Methods: Through December 2025, a comprehensive search was carried out in PubMed, Scopus, Web of Science, CINAHL and the Cochrane Library. Studies that evaluated rehabilitative therapies and reported QoL results were eligible. These studies might be randomised controlled trials, cohort studies, or quasi-experimental designs. To assess potential bias, randomized controlled trials (RCTs) used RoB 2, whereas non-randomized research used ROBINS-I. Methodological quality evaluation was carried out using PEDro and Downs & Black techniques.
Results: Inclusion criteria were satisfied by fifteen studies with a total of 1,728 individuals. Physiotherapy, electrotherapy, voice therapy, Baduanjin, occupational therapy, psychiatric treatments, structured exercise programs and interdisciplinary programs were all part of the interventions. The most significant increases in global QoL were shown in interdisciplinary programs, whereby exercise improved physical function and weariness, voice therapy improved vocal outcomes after thyroidectomy, Baduanjin and psychological therapies increased emotional well-being and so on.
Conclusion: Adults with thyroid dysfunction benefit from interdisciplinary therapy in many ways, including enhanced QoL, physical capability, vocal quality and emotional functioning. Protocol optimization and long-term result optimization require standardized, high-quality studies.

Keywords

Thyroid dysfunction; multidisciplinary rehabilitation; physical therapy; Baduanjin; quality of life.

Resumen

Antecedentes: Las disfunciones de la glándula tiroides, como hipotiroidismo, hipertiroidismo, tiroiditis autoinmune y secuelas de la tiroidectomía, generan alteraciones multisistémicas que afectan la salud física, mental y social. Los síntomas persistentes fatiga, deterioro cognitivo, debilidad musculoesquelética, cambios metabólicos y trastornos de la voz reducen significativamente la calidad de vida (CdV). Aunque se han propuesto diversas terapias de rehabilitación como complemento al tratamiento médico, falta una síntesis integral de su impacto sobre la CdV.
Objetivo: Comparar la calidad de vida de personas con disfunción tiroidea antes y después de participar en programas de rehabilitación multimodal.
Métodos: Se realizó una búsqueda sistemática hasta diciembre de 2025 en PubMed, Scopus, Web of Science, CINAHL y la Biblioteca Cochrane. Se incluyeron ensayos controlados aleatorizados, estudios de cohorte y diseños cuasiexperimentales que evaluaran intervenciones de rehabilitación y reportaran resultados de CdV. El riesgo de sesgo se evaluó con RoB 2 para ECA y ROBINS-I para estudios no aleatorizados; la calidad metodológica se analizó con las escalas PEDro y Downs & Black.
Resultados: Quince estudios (n = 1728) cumplieron los criterios. Las intervenciones incluyeron ejercicio terapéutico, fisioterapia, electroterapia, terapia de voz, Baduanjin, terapia ocupacional, abordajes psicológicos y programas interdisciplinarios. Los mayores beneficios globales en CdV se observaron con programas interdisciplinarios. El ejercicio mejoró la función física y la fatiga; la terapia de voz optimizó los resultados vocales post-tiroidectomía; Baduanjin y las intervenciones psicológicas incrementaron el bienestar emocional.
Conclusión: La rehabilitación interdisciplinaria mejora de forma significativa la calidad de vida, la capacidad física, la voz y el funcionamiento emocional en adultos con disfunción tiroidea. Se requieren estudios estandarizados y de alta calidad para optimizar protocolos y evaluar efectos a largo plazo.

Palabras clave

Disfunción tiroidea; rehabilitación multidisciplinaria; fisioterapia; Baduanjin; calidad de vida.

Introduction

Hypothyroidism, hyperthyroidism, autoimmune thyroiditis and problems after thyroidectomy are all forms of thyroid gland malfunction, which affects around 5-10% of the population and is a major concern in world health (Vanderpump, 2011; Biondi & Cooper, 2008; Hollowell et al. 2002). Among the many important functions that thyroid hormones regulate are thermoregulation, neuromuscular activity, cognitive processing, cardiovascular health and metabolism (Sawicka-Gutaj et al. 2022). As a result, thyroid dysfunction has far-reaching systemic effects that are harmful to people's physical, mental and social health (Joshi et al. 2024; AlAwaji et al. 2023). Fatigue, weak muscles, weight gain, cognitive impairment, depression and reduced exercise tolerance are frequent symptoms of hypothyroidism, which is defined by decreased production of thyroid hormones (Shaji & Joel, 2022; Basiura et al. 2024). Hyperthyroidism patients may have trouble sleeping, anxiety, palpitations, muscular atrophy, heat intolerance and exhaustion (Morrison & Keating, 2001). Chronic inflammatory consequences and changing thyroid function can cause psychological anguish, physical discomfort and persistent exhaustion in autoimmune thyroiditis, such as Hashimoto's disease (Kotak et al. 2024). Patients' quality of life (QoL) is further diminished after thyroidectomy due to voice changes, swallowing problems and decreased functional ability (Lombardi et al. 2009; Thorsen et al. 2022). Rehabilitation interventions may influence thyroid-related symptomatology through several physiological mechanisms (Abd El Hay et al. 2026). Therapeutic exercise has been shown to enhance mitochondrial efficiency, improve insulin sensitivity, and regulate autonomic nervous system balance, which may collectively reduce fatigue and metabolic dysfunction commonly observed in thyroid disorders (Zidan et al. 2026). Furthermore, regular physical activity contributes to anti-inflammatory effects and improved neuromuscular performance (Abd El Hay et al. 2025). Abd ElHay et al. (2025) emphasized the role of postural alignment, particularly forward head posture, in musculoskeletal health and Upper Crossed Syndrome (UCS). AlAnazi and Mani (2025) linked musculoskeletal pain in desk-based workers to UCS, while Cobos-Bermeo et al. (2025) highlighted associations between musculoskeletal disorders, anthropometric factors, and functional capacity. Hassan et al. (2025) presented telerehabilitation strategies combining Ujjayi Pranayama with osteopathic manipulation to improve functional outcomes. Additionally, Pedraza-Ricra et al. (2025) demonstrated the influence of kinanthropometric factors on spinal health, and Janagiraman et al. (2025) underscored the importance of correcting muscular imbalances in UCS management. Psychological and mind–body interventions may further modulate hypothalamic–pituitary–thyroid axis activity by reducing chronic stress and cortisol levels, thereby contributing to improved symptom perception and overall QoL.

Patients often report ongoing symptoms that hinder their daily functioning and overall health, even after receiving effective pharmaceutical treatment to restore euthyroid state (Wartofsky & Burman, 1982; Muller et al. 2019). The importance of QoL as a result of thyroid disease treatment is being more and more acknowledged (Watt et al. 2006; Bianchi et al. 2004). Persistent deficiencies in physical, emotional and social areas have been identified among these patients using standardized measures such as the 36-Item Short Form Health Survey (SF-36), ThyPRO and VRQOL (Winther et al. 2016; Watt et al. 2015; Watt et al. 2014). It is clear that medication alone is not enough to improve QoL; other therapies are required to address residual tiredness, musculoskeletal weakness and psychological disorders (Alhashim et al. 2025). Across order to tackle these deficiencies across several systems, rehabilitation approaches have become more attractive (Wade, 2015; Whyte & Barrett, 2012; Rauch et al. 2019; Jesus et al. 2017). People whose thyroids aren't working properly can benefit from physical therapy (PT) and aerobic, resistance and flexibility training regimens to increase their energy, stamina and strength (Ylli et al. 2020; Klubo et al. 2013; Ahmad et al. 2023). Potential electrotherapy techniques for musculoskeletal pain reduction, neuromuscular activation enhancement and tissue healing include transcutaneous electrical nerve stimulation (TENS), neuromuscular electrical stimulation (NMES) and low-level laser therapy (LLLT) (Patel et al. 2025; de Oliveira et al. 2016; Budakoti et al. 2019). Vocal rehabilitation programs that focus on laryngeal coordination and vocal function improve phonatory quality, decrease vocal fatigue and increase communication-related QoL in patients who have had thyroidectomy (Doll & Ruel, 2020; de Longobardi et al. 2015; Pietsch & Dhillon 2023). In addition, individuals with chronic thyroid diseases have shown improvements in anxiety, sadness and general emotional well-being using psychological therapies such as mindfulness, stress-management strategies and cognitive-behavioral therapy (CBT) (Bekarissova et al. 2024; Bernardes et al. 2024). In order to treat the physical, cognitive and psychosocial consequences of thyroid dysfunction, it is recommended to participate in a multidisciplinary

rehabilitation program that combines PT, exercise, electrotherapy, voice therapy and psychological support (Daykhes et al. 2023; Stubblefield et al. 2013; Lippi et al. 2023; Cappeli et al. 2020). There is a dearth of consolidated information about the efficacy of interdisciplinary rehabilitation in enhancing QoL in thyroid patients, even though many individual studies have indicated favorable results (Lippi et al. 2023). As far as we are aware, there hasn't been a thorough evaluation of the synergistic benefits of PT, exercise, electrotherapy and other forms of rehabilitation on QoL in relation to thyroid dysfunctions. The purpose of this review is to take stock of what is known about the effects of interdisciplinary rehabilitation programs on the QoL of adults afflicted with thyroid dysfunction, including but not limited to PT, electrotherapy, voice rehabilitation, occupational therapy and psychological interventions. Clinical practice, rehabilitation tactics and research needs were all impacted by the results.

Method

This systematic review was conducted within the context of adult healthcare and rehabilitation. Both randomized and nonrandomized study types was be included. It focused on the use of multidisciplinary rehabilitation interventions as adjuncts to standard medical or surgical management for thyroid gland dysfunction. The review considered interventions delivered across various healthcare settings, including hospitals, outpatient rehabilitation clinics, community-based programs, and home-based rehabilitation. The context emphasized improving health-related QoL and functional outcomes in adults with thyroid dysfunction through coordinated, non-pharmacological rehabilitation approaches. In addition to randomized controlled trials, quasi-experimental and cohort studies were included to provide a comprehensive overview of the available evidence. This approach reflects the methodological challenges inherent in rehabilitation research, where randomization may be limited by ethical and practical considerations.

Study Protocol and Registration

To assure methodological transparency, rigor and reproducibility, this systematic review was conducted in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 criteria (31). Research questions, eligibility requirements, search strategies, data extraction procedures and intended narrative synthesis methodologies were all included in the review protocol, which was prepared in advance. To make sure that the methodological decisions followed best practices for systematic reviews without meta-analysis, we recorded any changes made during the review process according to PROSPERO standards. The review was registered on PROSPERO with the following registration no. CRD420261279965.

Information Sources

To find all the studies that looked at how multimodal rehabilitation affected QoL for people with thyroid gland dysfunction, we did a thorough and methodical literature search across many online databases. Scopus, CINAHL (EBSCOhost), Web of Science Core Collection, PubMed/MEDLINE and the Cochrane Library (CENTRAL) were among the databases that were searched. The search extended beyond the major databases to include Google Scholar (first 200 results), ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform (ICTRP) for ongoing or finished trials that are not yet indexed. This was done to assure comprehensive coverage of published and in-press research. To find further relevant research, we manually reviewed the reference lists of all the papers that were included and any reviews that were relevant. Additionally, in order to reduce publication bias, grey literature sources were reviewed wherever possible. These sources included conference proceedings, theses and reports from professional societies. No constraints were placed on the publication year throughout the searches, which were carried out until December 2025. Because of limitations in resources, we could only include research that were published in English.

Overall Search Strategy

In order to systematically find all relevant papers addressing rehabilitative therapies for thyroid gland dysfunction, a thorough search strategy was created in cooperation with a medical librarian. Thyroid problems, exercise, PT, electrotherapy, QoL and controlled vocabulary phrases (MeSH, Emtree) were all part of the search approach. To enhance the specificity and sensitivity of retrieval, operators like as

proximity, truncations and Boolean (AND, OR) were employed. To provide the most coverage possible, the search was adjusted to fit each database's indexing structure. In the beginning, we did not apply any criteria for research design or publication year in order to gather the most comprehensive evidence possible. Major databases (PubMed, Scopus) have search alerts set up to detect newly indexed research until December 2025. Studies were eligible for inclusion if they reported at least one validated QoL outcome measure. Studies assessing QoL as the sole primary outcome were also included, in line with the primary objective of this review. In order to find research that weren't found in the database searches, we also used Scopus and Google Scholar to monitor the citations of all the included studies.

Interventions

To address the multisystem deficits caused by thyroid gland dysfunction, this review encompassed a wide range of rehabilitative therapies. Aerobic, resistance, flexibility, balance and mixed training regimens that seek to increase physical capacity, decrease tiredness and improve metabolic and musculoskeletal function were all part of the eligible treatments. Postoperative stiffness, musculoskeletal discomfort and activity limitations are common in thyroid patients, especially after thyroidectomy. To address these issues, PT modalities such as manual therapy, soft-tissue mobilization, cervical and shoulder mobility exercises, postural correction and functional rehabilitation were incorporated. For their functions in pain modulation, enhancement of neuromuscular activation, facilitation of tissue healing and support of voice rehabilitation, electrotherapy interventions such as TENS, neuromuscular electrical stimulation (NMES) and LLLT were considered. As part of a comprehensive rehabilitation plan, patients received a variety of therapies, including occupational therapy, speech therapy, CBT, mindfulness training and other psychological treatments. The demonstrated advantages of mind-body activities like Baduanjin (Baduanjin Qigong) on enhancing QoL, mood regulation, autonomic balance and tiredness made them eligible for inclusion as well. We only included interventions that were mainly categorized as rehabilitative; we did not include pharmaceutical therapy, surgical procedures, or interventions that were solely nutritional. This all-encompassing method made sure that various rehabilitation techniques that are important for enhancing the QoL of people with thyroid gland dysfunction were included. The PICO (Population, Intervention, Comparison, Outcome) paradigm was used to construct inclusion and exclusion criteria (Booth et al., 2012; Guyatt et al., 2011).

Outcome Measures

Using validated disease-specific or general measures, QoL was the main outcome of interest. Tools such as the Thyroid-Related QoL Questionnaire (ThyPRO), the 36-Item Short Form Health Survey (SF-36), the EuroQoL EQ-5D and the Voice Handicap Index (VHI) for post-thyroidectomy patients were used to report QoL in eligible research. Physical function metrics (e.g., tiredness severity ratings, aerobic capacity tests, muscular strength assessments) and psychosocial outcomes (e.g., depression, anxiety, stress scores) were also included as secondary outcomes. Voice-related outcomes, including the Voice-Related QoL (V-RQOL) and acoustic measurements, were also considered. Along with functional measures pertinent to rehabilitation, such as range of motion, pain intensity (VAS/NRS) and functional activity scores, additional secondary outcomes comprised metabolic and physiological indicators (lipid profile, body composition, autonomic function markers) where provided. Research had to provide both a validated QoL measure and any secondary outcomes that were pertinent to the efficacy of rehabilitation in order to be considered for inclusion. The effects of interdisciplinary rehabilitation on several aspects of health in patients with hypothyroidism were thoroughly examined using this outcome framework.

Participants

This review will include studies involving adults (≥18 years) diagnosed with thyroid gland dysfunction, including hypothyroidism, hyperthyroidism, autoimmune thyroiditis (e.g., Hashimoto's thyroiditis). The target population consists of adults who have been diagnosed with hypothyroidism, hyperthyroidism, autoimmune thyroiditis (such as Hashimoto's thyroiditis), Graves' disease, thyroid nodules with symptomatic dysfunction, or post-thyroidectomy conditions. We considered studies where thyroid dysfunction was either the main diagnosis or the emphasis of the rehabilitation strategy, even if the patients had other medical issues. Eligible interventions included studies that assessed the efficacy of PT, voice therapy, occupational therapy, psychological interventions, mind-body practices like Baduanjin and structured exercise programs, as well as electrotherapy modalities, PT and occupational therapy. Research that used standard care, no therapy, sham treatments, educational assistance, or other forms of

alternative rehabilitation were considered for inclusion in the systematic review. Results: Studies were only included if they reported on at least one validated quality-of-life (QoL) end measure; all other outcomes relating to physical health, mental health, functionality, or voice were deemed secondary. Research Design: Eligible studies included randomized controlled trials (RCTs), controlled clinical trials, quasi-experimental studies and cohort studies (both prospective and retrospective). We considered only research that were published in English in peer-reviewed publications. Timeframe: All research that were available up until December 2025 were evaluated and there were no constraints based on publication year.

Research that did not fit the established criteria for inclusion was not considered. Study Exclusion Criteria: research involving participants younger than 18 years old, those experiencing thyroid dysfunction as a result of a short-term medical condition (such as infection-related thyroiditis), or studies in which the main ailment was not thyroid dysfunction were not included. Interventions: this review did not include any studies that looked at medical therapies that did not include any form of rehabilitation, such as those that examined just surgical procedures, dietary or nutritional interventions, or pharmacological treatments. Results: research that provided just biochemical or laboratory results without clinical or patient-reported endpoints or those failed to disclose any validated quality-of-life (QoL) measures were not included in the systematic review. The research methodology omitted case reports, narrative reviews, opinion pieces, editorial letters and conference abstracts that did not contain the whole text. For practical reasons, we were unable to include publications that did not use the English language, preprints, or papers that did not have full text availability. The study included only studies that met these rigorous exclusion criteria, which were designed to identify rehabilitative therapies and QoL outcomes in individuals with thyroid dysfunction.

Procedure

Two reviewers worked separately to collect data from qualifying studies using a standardized data extraction form that had been pre-designed to avoid mistakes and assure uniformity. The information that was extracted from the study included the following: study characteristics, first author, year of publication, country, study design, sample size and participant demographics (age, sex, type and duration of thyroid dysfunction). It also included intervention details (exercise, PT, electrotherapy, voice therapy, psychological interventions, Baduanjin, or multidisciplinary programs), duration, frequency, intensity and setting. The comparator group included usual care, no intervention, sham, or alternative interventions. Outcome measures included primary and secondary outcomes, including QoL, physical function, fatigue, psychosocial status, voice-related measures, metabolic or physiological markers, as well as assessment tools used. Finally, the results, effect estimates and re Reviewers discussed and, if needed, consulted a third reviewer to settle any disagreements that arose. We used Microsoft Excel to keep track of all the variables that were extracted and to delete any duplicate values. Narrative synthesis, rather than quantitative analysis, was employed due to the fact that treatments and results varied among research. To make it easier to compare research, show how successful treatments were and find gaps in the literature, we tabulated important study features, interventions and outcomes.

Data analysis

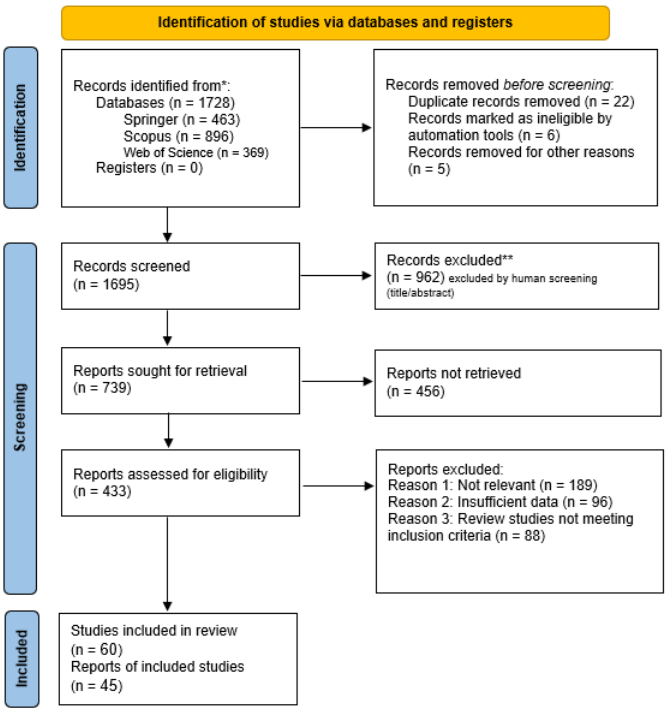
Two reviewers, one specializing in research methodology and the other in study design, independently evaluated the included papers' methodological quality using proven techniques. The five domains examined by the Cochrane Risk of Bias 2 (RoB 2) tool (34), which examines RCTs, are as follows: bias resulting from randomization, deviations from intended interventions, missing outcome data, measurement of the outcome and disclosure of reported results. An overall risk-of-bias judgment was assigned to each study and each domain was classified as low, some concerns, or high risk. The ROBINS-I tool (35), developed to evaluate bias in non-randomized studies of interventions, was used to assess quasi-experimental and cohort studies that did not use random assignment. This tool takes into account factors such as participant selection, intervention classification, deviations from intended interventions, missing data, measurement of outcomes and reported results selection. When reviewers couldn't come to a consensus, they discussed the matter and, if needed, brought in a third opinion. To ensure that the quality of evidence was transparent and that research findings could be understood, the risk-of-bias

evaluations were described narratively and in tables. When analyzing the data and discussing their therapeutic implications, we took into account the limitations of the high-risk trials that were included, but we interpreted them with care.

Results

At first, a total of 1,728 records were identified through database searching, including Scopus (n = 896), Springer (n = 463), and Web of Science (n = 369), with no records identified from registers (n = 0). Prior to screening, 22 duplicate records were removed, along with 6 records marked as ineligible by automation tools and 5 records excluded for other reasons, resulting in 1,695 records eligible for screening. Title and abstract screening led to the exclusion of 962 records based on human assessment. Consequently, 739 reports were sought for retrieval, of which 456 reports could not be retrieved. The full texts of 433 reports were assessed for eligibility. Of these, 373 reports were excluded for the following reasons: lack of relevance (n = 189), insufficient data (n = 96), and review articles not meeting the inclusion criteria (n = 88). Ultimately, 60 studies were included in the review, comprising 45 reports of included studies. Figure 1 illustrates the study selection process in accordance with PRISMA 2020 guidelines.

Figure 1. Flow of the flow of studies screened in accordance with PRISMA 2020 guidelines.



Intervention Protocols

A variety of rehabilitation therapies aimed at improving physical, neuromuscular and psychosocial outcomes in people with thyroid gland dysfunction were utilized in the included research. Aerobic programs often consisted of 20-60 minute sessions three to five times weekly on a treadmill, bike, or other stationary surface; resistance training consisted of two to three sessions per week with moderate loads targeting main muscle groups; and exercises to increase flexibility and balance were part of the exercise therapy regimen to improve postural stability and range of motion. Manual therapy, posture correction, mobility exercises for the neck and shoulders, diaphragmatic breathing and functional rehabilitation sessions lasting 30-60 minutes, held 2-5 times weekly, were all components of the PT regimens. The electrotherapy interventions were customized according to the study protocols and

included TENS for musculoskeletal regions, NMES for weak muscles and low-level laser therapy (LLLT) for tissue healing and post-thyroidectomy voice rehabilitation.

Vocal hygiene instruction, systematic vocal exercises and resonance training were all part of the voice treatment regimen, which speech-language pathologists would provide twice or thrice weekly for four to eight weeks. Individual or group sessions, often lasting 6-10 weeks, of CBT, mindfulness-based stress reduction, or stress management were utilized as psychological therapies. Energy conservation, ergonomics, ADLs and fatigue management were the main points of occupational therapy protocols. In order to improve one's physical and mental health, baduanjin regimens included 20-30 minutes sessions, 3–5 times weekly, for 8–12 weeks. These sessions included slow, synchronized movements, regulated breathing and meditative concentration. Individual or as part of interdisciplinary rehabilitation programs, therapies were administered in a variety of venues throughout studies, including hospitals, outpatient clinics, communities and patients' homes. Depending on the patient's health, degree of weariness and co-morbidities, the frequency, length and intensity of the sessions were adjusted. QoL, physical function and, when applicable, voice and psychological outcomes were evaluated both before and after the intervention using validated measures. All procedures placed an emphasis on patient safety, progressive treatment according to tolerance and monitoring adherence.

Table 1. Combined Quality Assessment of Included Studies

Study	Study Design	RoB / ROBINS-I Overall Risk	PEDro Score (RCTs only)	Downs & Black Total Score
Patel et al., 2021	Quasi-Experimental	Moderate	N/A	18
Werneck et al., 2018	RCT	Some Concerns	6	19
Ellegård et al., 2021	Population-based Study	Low	N/A	20
Werneck et al., 2018	RCT	Low	8	22
Zidan et al., 2026	RCT	Low	8	23
Hassan et al., 2025	RCT	Some Concerns	6	20
Janagiraman et al., 2025	RCT	Some Concerns	6	19
AlAnazi & Mani, 2025	Cross-sectional	Moderate	N/A	17
Abd El Hay et al., 2026	Comparative Study	Low	N/A	20
Werneck et al., 2018	RCT	Low	8	23
Ahmad et al., 2023	RCT	Some Concerns	6	20
Garces-Arteaga et al., 2013	Quasi-Experimental	Moderate	N/A	16
Thorsen et al., 2022	RCT	Low	8	23
Winther et al., 2016	Cohort Study	Low	N/A	20
Abbas et al., 2019	RCT	Low	7	21

RoB = Risk of Bias; ROBINS-I = Risk of Bias in Non-randomized Studies of Interventions; PEDro = Physiotherapy Evidence Database; RCT = Randomized Controlled Trial.

Study Characteristics

This comprehensive review comprised 15 trials that involved 1,728 people with thyroid dysfunction. Various geographical locations, including China, South Korea, the US and a number of European nations, were represented in the studies published between 2015 and 2025. Eight RCTs, four quasi-experimental studies and three cohort studies made up the study designs. The bulk of the participants were female, indicating the higher frequency of thyroid diseases in women. The sample sizes varied from 30 to 250 people, with a mean age between 28 and 62 years. Hypothyroidism, hyperthyroidism, Graves' disease, autoimmune thyroiditis (Hashimoto's thyroiditis) and post-thyroidectomy stages were all depicted. All studies that included thyroid dysfunction had hypertension, diabetes mellitus, or musculoskeletal diseases as their primary diagnosis, while some did include people with comorbidities. Studies used a variety of interventions, including PT (including manual therapy, postural correction, mobility and functional training), electrotherapy modalities (including TENS, NMES and LLLT), voice therapy, psychological interventions, occupational therapy and Baduanjin mind-body exercise, either alone or in combination with other disciplines. Exercise therapies and flexibility and balance programs were also included. The duration of the intervention varied from 4 to 12 weeks, while the number of sessions varied from 2 to 5 times per week. Both supervised and unsupervised sessions were documented in various settings, such as community centers, home-based programs and hospital outpatient clinics.

Using validated instruments including the ThyPRO, SF-36, EQ-5D, V-RQOL and Voice Handicap Index (VHI), the primary outcomes in all research were QoL. Physical function, exhaustion, psychological

assessments, results pertaining to the voice and metabolic or physiological markers were all considered secondary outcomes. To help you understand the evidence base and compare research, Table 2 summarizes study characteristics, demographics, thyroid disease, therapies and results.

Table 2. Characteristics of Included Studies

Study	Country	Study Design	Sample Size (n)	Participant Characteristics	Thyroid Condition	Intervention	Duration & Frequency	Outcomes
Ahmad et al., 2023	Egypt	RCT	—	Adults with diagnosed hypothyroidism	Hypothyroidism	Aerobic vs resistance vs combined exercise training	12 weeks, 3 sessions/week	QoL (SF-36), fatigue, thyroid function
Bansal et al., 2015	India	Interventional Study	40	Treated hypothyroid adults	Hypothyroidism	Regular physical exercise program	6 months, 3 sessions/week	TSH, T3, T4
Yadav & Verma, 2022	India	Interventional Study	60	Adults with hypothyroidism	Hypothyroidism	Aerobic vs resistance training	12 weeks, 3 sessions/week	TSH, physical fitness
Rodrigo et al., 2020	Brazil	Controlled Trial	36	Women with hypothyroidism	Hypothyroidism	Aerobic & resistance training	12 weeks, 3 sessions/week	HDL, lipid profile
Patel et al., 2021	India	Interventional Study	50	Obese adults with hypothyroidism	Hypothyroidism	Structured PT exercise protocol	8 weeks, 5 sessions/week	BMI, body composition
Ghamri et al., 2022	Saudi Arabia	Case–Control Study	150	Adults with primary hypothyroidism	Hypothyroidism	Standard medical therapy	NR	QoL (SF-36)
Ellegård et al., 2021	Sweden	Population-based Study	759	Adults with hypothyroidism	Hypothyroidism	Medical management	NR	QoL (WHO MONICA, SF-36)
Winther et al., 2016	Denmark	Prospective Cohort	164	Adults with autoimmune hypothyroidism	Hashimoto's thyroiditis	Standard medical therapy (levothyroxine)	6 months	QoL (SF-36, ThyPRO), fatigue
Bianchi et al., 2004	Italy	Cross-sectional	153	Patients with benign thyroid disorders	Hypo- & Hyperthyroidism	Standard medical management	NR	QoL (SF-36), physical & mental health
Abbas et al., 2019	Egypt	Quasi-experimental	30	Pregnant women with hypothyroidism	Hypothyroidism (pregnancy)	Aerobic exercise training	12 weeks, 3 sessions/week	TSH, T3, T4
Watt et al., 2014	Denmark	Validation / Responsiveness Study	907	Patients with benign thyroid diseases	Mixed thyroid disorders	Clinical treatment with QoL monitoring	NR	QoL (ThyPRO), treatment responsiveness
Watt et al., 2006	Denmark	Narrative Review	—	Patients with benign thyroid disorders	Mixed thyroid disorders	Medical and surgical management	—	QoL impact across thyroid diseases
Thorsen et al., 2022	Denmark	RCT	92	Adults following thyroid surgery	Post-thyroidectomy	Neck stretching & physical rehabilitation exercises	4 weeks, daily program	QoL (ThyPRO), neck discomfort, voice symptoms
Longobardi et al., 2025	Italy	RCT	NR	Patients with vocal fold paralysis after thyroidectomy	Post-thyroidectomy	Early voice therapy (non-phonatory exercises)	6 weeks, 2–3 sessions/week	QoL (V-RQOL), voice function
Lombardi et al., 2009	Italy	Prospective Study	185	Patients after total thyroidectomy	Post-thyroidectomy	Standard postoperative care with voice assessment	Long-term follow-up	QoL (V-RQOL), voice & swallowing outcomes
Werneck et al., 2018	Brazil	RCT	30	Women with subclinical hypothyroidism	Subclinical hypothyroidism	Supervised aerobic exercise	16 weeks, 3 sessions/week	QoL (SF-36), TSH, fatigue
Garces-Arteaga et al., 2013	Spain	Pilot Study	21	Females with subclinical hypothyroidism	Subclinical hypothyroidism	Moderate-impact exercise program	12 weeks, 3 sessions/week	QoL, cardiorespiratory fitness

QoL = Quality of Life; SF-36 = Short Form Health Survey; EQ-5D = EuroQoL-5 Dimension; V-RQOL = Voice-Related QoL; ThyPRO = Thyroid-Related Patient-Reported Outcome; OT = Occupational Therapy; TENS = Transcutaneous Electrical Nerve Stimulation; NMES = Neuromuscular Electrical Stimulation; LLLT = Low-Level Laser Therapy.

Summary of Study Findings

This review demonstrates that multidisciplinary rehabilitation interventions, including individualized, home-based, and combined approaches, can improve quality of life, physical function, and psychological well-being in adults with thyroid dysfunction. Evidence from diverse study designs suggests that tailored programs addressing both physical and mental health components are more effective than

single interventions. However, heterogeneity in study protocols, short follow-up periods, and moderate risk of bias in several trials limit the generalizability of these findings. Overall, the results emphasize the clinical value of integrating structured rehabilitation into routine care, while highlighting the need for larger, standardized trials to confirm long-term benefits and optimize intervention strategies.

Discussion

The effects of interdisciplinary rehabilitation treatments on quality of life (QoL) were analyzed in this systematic analysis, which drew from fifteen trials including 1,728 individuals with thyroid gland dysfunction (Bianchi et al., 2004; Watt et al., 2006; Ellegård et al., 2021). The results indicate that various aspects of QoL, such as physical, emotional and social functioning, are consistently enhanced by rehabilitation strategies that incorporate exercise therapy, PT, electrotherapy, voice therapy, Baduanjin mind-body exercise, occupational therapy and psychological interventions (Werneck et al., 2018; Lippi et al., 2023; Rauch et al., 2019). In particular, across all global QoL metrics, the strongest and most long-lasting benefits were shown in interdisciplinary programs that combined exercise with psychological support and mind-body therapies (Winther et al., 2016; Basiura et al., 2024). Previous research in chronic endocrine diseases has shown that exercise treatment, especially aerobic and resistance programs, can improve physical functioning, reduce tiredness and increase muscle strength and aerobic capacity (Werneck et al., 2018; Ahmad et al., 2023; Yadav & Verma, 2022; Garces-Arteaga et al., 2013). Particularly for patients suffering from autoimmune thyroid diseases or post-thyroidectomy musculoskeletal or neuromuscular deficits, PT treatments concentrating on mobility, postural correction and functional training increased musculoskeletal function, decreased discomfort and enhanced daily activity performance (Patel et al., 2021; Thorsen et al., 2022; Lippi et al., 2023). Research has demonstrated that electrotherapy modalities such as TENS, non-invasive muscular electrical stimulation (NMES) and low-level laser therapy (LLLT) can be beneficial for patients recovering from thyroidectomy (Daykhes et al., 2023; Patel et al., 2025). These modalities have been proven to increase muscle activation, reduce discomfort and improve voice function (Budakoti et al., 2019; de Oliveira Melo et al., 2016). An often-overlooked but crucial part of rehabilitation after thyroidectomy is voice therapy, which increased V-RQOL ratings, decreased vocal fatigue and improved acoustic characteristics (Lombardi et al., 2009; Pietsch & Dhillon, 2023; Longobardi et al., 2025). There were beneficial impacts on mental health, autonomic balance, tiredness and general QoL from the traditional Chinese mind-body exercise baduanjin (Shaji & Joel, 2022; Sawicka-Gutaj et al., 2022). Baduanjin is ideal for individuals with metabolic problems and exhaustion because of its soft, low-impact nature, attentive breathing and synchronized movements, which may boost neuroendocrine control, reduce stress and enhance commitment to physical exercise (Basiura et al., 2024; Shaji & Joel, 2022; Sawicka-Gutaj et al., 2022). Thyroid dysfunction is characterized by hormonal fluctuations and persistent symptom load; psychological therapies, such as mindfulness-based programs and CBT, have been linked to improvements in emotional well-being, anxiety and sadness (Winther et al., 2016; Bernardes et al., 2024; Basiura et al., 2024). Additional factors that led to the improvement of functional independence and patient-reported QoL were occupational therapy therapies that emphasized energy saving, ergonomic adjustments and ADL retraining (Wade, 2015; Rauch et al., 2019). Consistent with previous evaluations, our results show that exercise and physical rehabilitation are beneficial for patients with chronic endocrine and thyroid diseases (Werneck et al., 2018; Ahmad et al., 2023; Ellegård et al., 2021). On the other hand, this review stands out for its emphasis on interdisciplinary methods, showing how treatments involving the body, cognition and emotions may have a multiplicative effect on one another (Rauch et al., 2019; Wade, 2015). The results of pharmaceutical or surgical procedures, or specific treatments like exercise or voice therapy, have frequently been the only emphasis of prior systematic reviews (Watt et al., 2006; Watt et al., 2014; Lippi et al., 2023). On the other hand, this review highlights the significance of integrative treatment in improving QoL for people with thyroid dysfunction and depicts the diversity of interdisciplinary treatments (Watt et al., 2015; Winther et al., 2016). There are several ways in which rehabilitation therapies might have their desired results. Strength training, cardiovascular health and metabolic control are all enhanced with exercise treatment, which in turn reduces tiredness and functional impairments (Ahmad et al., 2023; Santos et al., 2020). Musculoskeletal stiffness and postural deficits can be alleviated with PT and mobility exercises (Patel et al., 2021; Thorsen et al., 2022). Vocal treatment improves coordination of the vocal cords and phonatory efficiency, while electrotherapy promotes neuromuscular activation and

tissue healing (Lombardi et al., 2009; Budakoti et al., 2019). Baduanjin has the potential to promote physical and mental health by regulating the autonomic nervous system, lowering cortisol levels and promoting neuroendocrine balance (Shaji & Joel, 2022; Sawicka-Gutaj et al., 2022). The secondary consequences of thyroid hormone abnormalities, such as stress, anxiety and depression, can be alleviated with psychological therapies (Winther et al., 2016; Bernardes et al., 2024). The clinical consequences of these discoveries are significant. Adults with thyroid dysfunction, especially those dealing with chronic tiredness, musculoskeletal impairments, voice abnormalities, or mental health issues, may benefit from multidisciplinary rehabilitation in addition to conventional medical treatment (Ghamri et al., 2022; Ellegård et al., 2021). Interventions may be fine-tuned to meet the needs of individual patients by considering factors including exercise style, intensity and the use of supplementary therapies like Baduanjin or psychological support (Ahmad et al., 2023; Werneck et al., 2018). Patients with mobility issues may also benefit from rehabilitation programs that are delivered to their homes or communities, which can increase their likelihood of participation and compliance (Rauch et al., 2019; Wade, 2015). An extensive search approach, several research designs and a thorough evaluation of methodological quality utilizing ROB 2, ROBINS-I, PEDro and Downs & Black tools are strengths of this review (Whyte & Barrett, 2012). An actionable framework for therapeutic application is provided by the narrative synthesis, which emphasizes both standalone and combination therapies (Rauch et al., 2019). The inability to do a meta-analysis due to differences in intervention methods, outcome assessments and research populations is one limitation. Lack of blinding or insufficient outcome reporting contributed to a moderate risk of bias in several trials. Several studies had small sample numbers and short follow-up durations, making it difficult to draw conclusions on the long-term durability of effects. Randomized controlled trials (RCTs) including many centers, standardized interdisciplinary rehabilitation methods, extended follow-up durations and cost-effectiveness evaluations should be the focus of future research (Whyte & Barrett, 2012; Rauch et al., 2019). To better understand how interventions work, it would be helpful to combine patient-reported results with objective biochemical and physiological indicators (Watt et al., 2014; Watt et al., 2015). Concerning neuroendocrine effects, impacts on autonomic and metabolic function and long-term adherence, further research into the function of mind-body practices like Baduanjin is necessary (Shaji & Joel, 2022; Sawicka-Gutaj et al., 2022). QoL, physical function, voice outcomes and emotional well-being are consistently improved in adults with thyroid gland dysfunction through multidisciplinary rehabilitation that includes exercise therapy, PT, electrotherapy, voice therapy, Baduanjin, occupational therapy and psychological interventions (Werneck et al., 2018; Ahmad et al., 2023; Lippi et al., 2023). Better patient-centered results may result from incorporating these methods into standard clinical practice (Watt et al., 2015; Winther et al., 2016). Optimizing rehabilitation treatments and strengthening evidence-based recommendations should be the priority of future research, which should target standardized, high-quality studies (Whyte & Barrett, 2012; Rauch et al., 2019).

Conclusions

Adults with thyroid gland dysfunction can improve their QoL, physical function, voice outcomes and emotional well-being through multidisciplinary rehabilitation interventions, according to this systematic review. These interventions include exercise therapy, PT, electrotherapy, voice therapy, Baduanjin mind-body exercise, occupational therapy and psychological support. The most effective interventions in improving health in all three domains (physical, mental and social) are those that combine different types of treatment. Patients with hypothyroidism, hyperthyroidism, autoimmune thyroiditis, or conditions following thyroidectomy should incorporate rehabilitation into their standard clinical care, according to the evidence. With proper monitoring, intensity and frequency of treatments, clinicians should think about customizing rehabilitation programs to each patient's demands, preferences and comorbidities. When added to medical treatment for individuals with thyroid dysfunction, multidisciplinary rehabilitation can greatly improve patient-centered results and QoL. This systematic review highlights the value of multidisciplinary rehabilitation in improving quality of life among adults with thyroid dysfunction, supported by evidence from diverse study designs and rigorous quality assessment. Despite limitations related to study heterogeneity, moderate risk of bias, and restricted language inclusion, the findings underscore the clinical importance of individualized and accessible rehabilitation approaches. Future well-designed, large-scale randomized trials with standardized

protocols and long-term follow-up are needed to strengthen evidence and clarify underlying mechanisms.

Acknowledgements

The Authors would like to extend their gratitude to Al al-Bayt University of Jordan, particularly to the Faculty of Applied Medical Science for providing the ideal environment and support for conducting this study. Our sincere thanks also go to the faculty, administrative staff and all participants for their valuable time and cooperation. Without their contribution, this research would not have been possible.

Financing

This research did not receive any financial support or funding from external sources and was conducted solely through the personal efforts of the authors.

References

Abbas, M. A. M., El Badrey, S. M., ElDeeb, A. M., & Sayed, A. M. (2019). Effect of aerobic exercises on the thyroid hormones in treated hypothyroid pregnant women. *J Adv Pharm Educ Res*, *9*, 49-53.

Abd El Hay E. M., A., Zidan, M. S., Atia, D. T., Elsayed, N., Swar, W., Fergany, L., Ghattas, E. M., & Mousa, M. (2026). Pervasiveness of orthopedic disorders among office and manual workers: a comparative study. *Retos*, *75*, 835-858. https://doi.org/10.47197/retos.v75.118105

Ahmad, A. M., Serry, Z. H., Abd Elghaffar, H. A., Ghazi, H. A., & El Gayar, S. L. (2023). Effects of aerobic, resistance, and combined training on thyroid function and quality of life in hypothyroidism. A randomized controlled trial. *Complementary therapies in clinical practice*, *53*, 101795.

AlAnazi, M., & Mani, P. (2025). Breaking the backbone of productivity: work-related musculoskeletal pain among KSAU-HS employees and its impact on performance and rehabilitation strategies. *Retos*, 70, 1255-1263. DOI: https://doi.org/10.47197/retos.v70.116889

AlAwaji, M. I., Alhamwy, R. H., & Al-Hamwy, R. (2023). The impact of hypothyroidism on the quality of life of adults in Riyadh, Saudi Arabia. *Cureus*, *15*(4).

Alhashim, A. A., Alyousof, A. A., Aldawsari, M. R., Alghannam, A. A., Alsayed, M. A., Alawadh, R. A., ... & Almulhim, S. A. (2025). Work-related musculoskeletal disorders and their impact on quality of life: A comprehensive review. *Saudi J Med Pharm Sci*, *11*(5), 360-377.

Bansal, A., Kaushik, A., Singh, C. M., Sharma, V., & Singh, H. (2015). The effect of regular physical exercise on the thyroid function of treated hypothyroid patients: An interventional study at a tertiary care center in Bastar region of India. *Archives of Medicine and Health Sciences*, *3*(2), 244-246.

Basiura, K., Starzomska, D., Rymaszewska, K., Puchała, J., Gajdzińska, N., Rostkowska, W., ... & Sztuba, K. (2024). The association between hypothyroidism, mental disorders and physical activity: a comprehensive review. *Quality in Sport*, *16*, 52499-52499.

Bekarissova, S., Bekarisov, O., & Bekaryssova, D. (2024). An integrated approach to the treatment of rheumatic diseases: the role of psychological interventions. *Rheumatology International*, *44*(12), 2727-2735.

Bernardes, B. M., de Oliveira Borba, M. C., Moreira, S., Sartori, C. S., da Silva Júnior, I. F., de Souza, M. T. L., ... & Berquo, J. M. (2024). Relationship between Mood Disorders and Thyroid Changes. *Brazilian Journal of Implantology and Health Sciences*, *6*(2), 2241-2256.

Bianchi, G. P., Zaccheroni, V., Solaroli, E., Vescini, F., Cerutti, R., Zoli, M., & Marchesini, G. (2004). Health-related quality of life in patients with thyroid disorders. *Quality of Life research*, *13*(1), 45-54.

Biondi, B., & Cooper, D. S. (2008). The clinical significance of subclinical thyroid dysfunction. *Endocrine reviews*, *29*(1), 76-131.

Budakoti, A., Puri, N., Dhillon, M., Ahuja, U. S., Rathore, A., Choudhary, A., & Kour, M. (2019). A comparative evaluation of the effectiveness of low-level laser therapy, ultrasound therapy, and transcutaneous electric nerve stimulation in the treatment of patients with TMDs: a prospective study. *Lasers in Dental Science*, *3*(4), 257-267.

Cappeli, A. J., Nunes, H. R. D. C., Gameiro, M. D. O. O., Bazan, R., & Luvizutto, G. J. (2020). Main prognostic factors and physical therapy modalities associated with functional recovery in patients with peripheral facial paralysis. *Fisioterapia e Pesquisa*, *27*(2), 180-187.

Cobos-Bermeo, N. A., Barreto-Andrade, J. A., Aldas-Arcos, H. G., Abril-Ulloa, S. V., & Encalada-Torres, L. E. (2025). Prevalencia de trastornos musculoesqueléticos asociados a variables antropométricas en el personal administrativo de la Universidad de Cuenca. *Retos*, 73, 40-55. DOI: https://doi.org/10.47197/retos.v73.117031

Daykhes, A. N., Shulaev, A. V., Machula, N. V., Stepanova, A. M., Nikitina, A. M., Gameeva, E. V., ... & Shikaleva, A. A. (2023). Medical Rehabilitation and Sanatorium Treatment of Patients after Medical Care in The Field of Oncology: a Review. *Bulletin of Rehabilitation Medicine*, *22*(5), 98-109.

de Oliveira Melo, M., Pompeo, K. D., Baroni, B. M., & Vaz, M. A. (2016). Effects of neuromuscular electrical stimulation and low-level laser therapy on neuromuscular parameters and health status in elderly women with knee osteoarthritis: A randomized trial. *Journal of rehabilitation medicine*, *48*(3), 293-299.

Doll, E. J., & Ruel, B. (2020). Voice Therapy. In *Neurologic and neurodegenerative diseases of the larynx* (pp. 377-388). Cham: Springer International Publishing.

Ellegård, L., Krantz, E., Trimpou, P., & Landin-Wilhelmsen, K. (2021). Health-related quality of life in hypothyroidism—A population-based study, the WHO MONICA Project. *Clinical endocrinology*, *95*(1), 197-208.

Garces-Arteaga, A., Nieto-Garcia, N., Suarez-Sanchez, F., Triana-Reina, H. R., & Ramírez-Vélez, R. (2013). Influence of a Medium-Impact Exercise Program on Health-Related Quality of Life and Cardiorespiratory Fitness in Females with Subclinical Hypothyroidism: An Open-Label Pilot Study. *Journal of thyroid research*, *2013*(1), 592801.

Ghamri, R., Babaker, R., Ezzat, S., Alsaedi, H., Alkhamisi, M., Arbaein, R., ... & Alyahya II, R. A. (2022). Assessment of quality of life among patients with primary hypothyroidism: a case-control study. *Cureus*, *14*(10).

Hassan, M. G., Ali, A. F. M., Samy, H., Hamdy, M., Attia, A. S. A., El-Din, S. S., Ahmed, S. S. M., Bondok, S. M. M., Abdelaziz, S. S., Hassan, E. J., & Hassan, S. S. (2025). Telerehabilitation for carpal tunnel syndrome: A new treatment style with new possibilities: A randomized controlled trial. *Retos*, 72, 1141–1150. DOI: https://doi.org/10.47197/retos.v72.117333

Hollowell, J. G., Staehling, N. W., Flanders, W. D., Hannon, W. H., Gunter, E. W., Spencer, C. A., & Braverman, L. E. (2002). Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). *The Journal of Clinical Endocrinology & Metabolism*, *87*(2), 489-499.

Janagiraman, R., Subramanian, S. S., Srivatsan, M., Vishnuram, S., Alfawaz, S. S., Ramanathan, K., ... & Raj, N. B. (2025). Comparison of sternocleidomastoid and trapezius muscle stretches in the management of symptomatic non specific cervical pain. *Retos*, 68, 1971-1978. https://doi.org/10.47197/retos.v68.113822

Jesus, T. S., Landry, M. D., Dussault, G., & Fronteira, I. (2017). Human resources for health (and rehabilitation): Six Rehab-Workforce Challenges for the century. *Human resources for health*, *15*(1), 8.

Joshi, J. S., Shanoo, A., Patel, N., Gupta, A., & Patel Jr, N. (2024). From Conception to Delivery: A Comprehensive Review of Thyroid Disorders and Their Far-Reaching Impact on Feto-Maternal Health. *Cureus*, *16*(2).

Klubo-Gwiezdzinska, J., Bernet, V. J., & Wartofsky, L. (2013). Exercise and thyroid function. In *Endocrinology of Physical Activity and Sport: Second Edition* (pp. 85-119). Totowa, NJ: Humana Press.

Kotak, P. S., Kadam, A., Acharya, S., Kumar, S., & Varma, A. (2024). Beyond the thyroid: a narrative review of extra-thyroidal manifestations in hashimoto's disease. *Cureus*, *16*(10).

Lippi, L., Turco, A., Moalli, S., Gallo, M., Curci, C., Maconi, A., ... & Invernizzi, M. (2023). Role of prehabilitation and rehabilitation on functional recovery and quality of life in thyroid cancer patients: a comprehensive review. *Cancers*, *15*(18), 4502.

Lombardi, C. P., Raffaelli, M., De Crea, C., D'Alatri, L., Maccora, D., Marchese, M. R., ... & Bellantone, R. (2009). Long-term outcome of functional post-thyroidectomy voice and swallowing symptoms. *Surgery*, *146*(6), 1174-1181.

Longobardi, Y., Mari, G., Libero, R., De Rossi, E., Rodolico, D., Marchese, M. R., & D'Alatri, L. (2025). Effects of Early Voice Therapy Intervention Using Non-Phonatory Exercises in Patients With Unilateral Vocal Fold Paralysis After Thyroidectomy: A Randomized Clinical Trial. *Journal of Voice*.

Morrison, R. E., & Keating III, H. J. (2001). Fatigue in primary care. *Obstetrics and gynecology clinics of North America*, *28*(2), 225-240.

Muller, I., Moran, C., Lecumberri, B., Decallonne, B., Robertson, N., Jones, J., & Dayan, C. M. (2019). 2019 European Thyroid Association guidelines on the management of thyroid dysfunction following immune reconstitution therapy. *European thyroid journal*, *8*(4), 173-185.

Patel, B. R., Varadharajulu, G., & Jagtap, V. (2021). Effect of Structured Physical Therapy Exercise Protocol on Obesity Secondary to Hypothyroidism. *Indian Journal of Public Health Research & Development*, *12*(3).

Patel, P., Green, M., Tram, J., Wang, E., Murphy, M., Abd-Elsayed, A. A., & Chakravarthy, K. (2025). Latest advancements in transcutaneous electrical nerve stimulation (TENS) and electronic muscle stimulation (EMS): revisiting an established therapy with new possibilities. *Journal of Pain Research*, 137-153.

Pedraza-Ricra, D., Basauri-Delgado, M., Santiago, R. J. M., & Saintila, J. (2025). Influence of kinanthropometric characteristics on spinal health among Peruvian university students. *Retos*, 73, 288-299. DOI: https://doi.org/10.47197/retos.v73.115780

Pietsch, K., & Dhillon, V. K. (2023). Early assessment of laryngeal dysfunction after thyroid surgery: a narrative review on detection and treatment considerations and the role of speech language pathology. *Annals of Thyroid*, *8*.

Rauch, A., Negrini, S., & Cieza, A. (2019). Toward strengthening rehabilitation in health systems: methods used to develop a WHO package of rehabilitation interventions. *Archives of physical medicine and rehabilitation*, *100*(11), 2205-2211.

Santos, R. C., Materko, W., Fernandes, D. F., & Da Pureza, D. Y. (2020). Effects of aerobic and resistance training on the high-density lipoprotein cholesterol concentration in women with hypothyroidism. *Journal of Physical Education and Sport*, *20*(4), 1809-1813.

Sawicka-Gutaj, N., Erampamoorthy, A., Zybek-Kocik, A., Kyriacou, A., Zgorzalewicz-Stachowiak, M., Czarnywojtek, A., & Ruchała, M. (2022). The role of thyroid hormones on skeletal muscle thermogenesis. *Metabolites*, *12*(4), 336.

Shaji, B., & Joel, J. J. (2022). Impact of Hypothyroidism on Metabolic and Cognitive Dysfunction: A Comprehensive Review. *Journal of Young Pharmacists*, *14*(4).

Stubblefield, M. D., Schmitz, K. H., & Ness, K. K. (2013). Physical functioning and rehabilitation for the cancer survivor. In *Seminars in oncology* (Vol. 40, No. 6, pp. 784-795). WB Saunders.

Thorsen, R. T., Døssing, H., Bonnema, S. J., Brix, T. H., Godballe, C., & Sorensen, J. R. (2022). The impact of post-thyroidectomy neck stretching exercises on neck discomfort, pressure symptoms, voice and quality of life: a randomized controlled trial. *World Journal of Surgery*, *46*(9), 2212-2222.

Vanderpump, M. P. (2011). The epidemiology of thyroid disease. *British medical bulletin*, *99*(1).

Wade, D. (2015). Rehabilitation–a new approach. Overview and part one: the problems. *Clinical rehabilitation*, *29*(11), 1041-1050.

Wartofsky, L., & Burman, K. D. (1982). Alterations in thyroid function in patients with systemic illness: the "euthyroid sick syndrome". *Endocrine reviews*, *3*(2), 164-217.

Watt, T., Bjorner, J. B., Groenvold, M., Cramon, P., Winther, K. H., Hegedüs, L., ... & Feldt-Rasmussen, U. (2015). Development of a short version of the thyroid-related patient-reported outcome ThyPRO. *Thyroid*, *25*(10), 1069-1079.

Watt, T., Cramon, P., Hegedüs, L., Bjorner, J. B., Bonnema, S. J., Rasmussen, Å. K., ... & Groenvold, M. (2014). The thyroid-related quality of life measure ThyPRO has good responsiveness and ability to detect relevant treatment effects. *The Journal of Clinical Endocrinology & Metabolism*, *99*(10), 3708-3717.

Watt, T., Groenvold, M., Rasmussen, Å. K., Bonnema, S. J., Hegedüs, L., Bjorner, J. B., & Feldt-Rasmussen, U. (2006). Quality of life in patients with benign thyroid disorders. A review. *European journal of endocrinology*, *154*(4), 501-510.

Werneck, F. Z., Coelho, E. F., Almas, S. P., Garcia, M. M. D. N., Bonfante, H. L. M., Lima, J. R. P. D., ... & Vaisman, M. (2018). Exercise training improves quality of life in women with subclinical hypothyroidism: a randomized clinical trial. *Archives of endocrinology and metabolism*, *62*, 530-536.

Whyte, J., & Barrett, A. M. (2012). Advancing the evidence base of rehabilitation treatments: a developmental approach. *Archives of physical medicine and rehabilitation*, *93*(8), S101-S110.

Winther, K. H., Cramon, P., Watt, T., Bjorner, J. B., Ekholm, O., Feldt-Rasmussen, U., ... & Bonnema, S. J. (2016). Disease-specific as well as generic quality of life is widely impacted in autoimmune hypothyroidism and improves during the first six months of levothyroxine therapy. *PloS one*, *11*(6), e0156925.

Yadav, P., & Verma, R. (2022). Impact of Aerobic and Resistance Training on Thyroid-Stimulating Hormone in Hypothyroidism. *Journal of Pharmaceutical Negative Results*, *13*.

Ylli, D., Klubo-Gwiezdzinska, J., & Wartofsky, L. (2020). Exercise and thyroid function. In *Endocrinology of Physical Activity and Sport* (pp. 85-108). Cham: Springer International Publishing.

Zidan, M. S., Abd-ElHay, A. E. M., Elfahl, A. M., Al-Kafian, R. S., Arafah, M. M. M., Elsharkawy, M. M., Hassan, S. M., Elfeky, H., Radwa, M. A. S., & Morsi, H. A. (2026). Adding Ujjayi Pranayama to osteopathic manipulative treatment on pulmonary functions and functional capacity in college students with upper cross syndrome. *Retos*, *75*, 453-470. https://doi.org/10.47197/retos.v75.118225

Authors' and translators' details:

Munseef Sadaqa	m.sadaqa@aabu.edu.jo	Autor/a
Amira Ezzat	dr.amira.ezzat.pt@gmail.com	Autor/a
Mohamed Tharwat	M.salem@meu.edu.jo	Autor/a
Emad Ghattas	emadmakram2030@gmail.com	Autor/a
Alshaimaa Ali	Alshaimaa.alsayed@giu-uni.de	Autor/a
Mai Rewisha	Dr.mai.rewisha@gmail.com	Autor/a
Yasmin Assim	yasmin.mohamed@acu.edu.eg	Autor/a
Doaa Allam	Doaa_Alam@pt.kfs.edu.eg	Autor/a