



Trends and Future Directions in Hydrotherapy Research for Menopausal Women: A Bibliometric and Thematic Mapping

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Abstract

The progression from the reproductive phase to the post-reproductive stage represents a critical component of the female life cycle, significantly influencing overall well-being, with menopause serving as a pivotal milestone. It is imperative to promote regular physical activity to alleviate menopausal symptoms and avert age-related health issues. Hydrotherapy emerges as a viable alternative to mitigate menopausal manifestations and prevent health complications associated with aging. However, with the increasing number and diversity of research in this area, a quantitative approach is necessary to map out current themes and identify potential areas for future research. This study aimed to provide a comprehensive overview of research on hydrotherapy in menopausal women, identifying current themes and future research opportunities. A bibliometric and content analysis of 116 Scopus-indexed studies was performed using VOSviewer and Tableau Public to visualize co-occurrence and thematic maps. Content analysis was conducted to explore emerging topics. Publications on hydrotherapy for menopausal women have grown significantly. Key topics include hydrotherapy, aquatic training, bone loss, insulin resistance, metabolic syndrome, and non-drug therapies. Future research may focus on factors influencing hydrotherapy, bone mineral density, insomnia, agility, and electromyography. This study provides valuable insights into the current landscape of hydrotherapy research in menopausal women and highlights promising areas for future exploration. By addressing these research gaps and improving methodological approaches, researchers can enhance efforts to improve the quality of life of menopausal women, ultimately leading to more effective therapy.

Introduction

Climacterium is not a pathology, but a normal transitional period that lasts several years before and several years after menopause. Climacterium is a significant phase in a woman's life, characterised by various symptoms that can greatly affect daily life (Astuti *et al.*, 2023; Febriyanti *et al.*, 2023). The progression from the reproductive phase to the post-reproductive stage represents a critical component of the female life cycle, significantly influencing overall well-being, with menopause serving as a pivotal milestone. Menopausal women experience many physiological and

psychological transformations due to the cessation of ovarian function, which can greatly affect their overall quality of life (Febriyanti *et al.*, 2023; Trisetiyaningsih *et al.*, 2023). Research indicates that most participants experienced a decline in quality of life, with climacteric symptoms varying from mild to severe; specifically, 55.56% of women reported mild symptoms, while 41.27% reported moderate symptoms, which correlated with diminished quality of life metrics (Nogueira *et al.*, 2022).

The symptoms felt during the climacterium are often accompanied by various physical and psychological changes

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that are difficult for many women. The predominant physiological manifestations encompass vasomotor symptoms such as hot flashes, nocturnal perspiration, disruptions in sleep patterns, diminished sexual desire, urinary leakage, reduced dermal elasticity, vaginal atrophy, and musculoskeletal issues characterized by arthralgia and rigidity. The psychological symptoms experienced by many women during this period are mood swings, anxiety, depression, and cognitive difficulties such as poor concentration and memory lapses. These symptoms can be exacerbated by work-related stress and can lead to decreased confidence and productivity (Hooper and Marshall, 2022; Norton and Tremayne, 2020).

Understanding the symptoms and implications of this period is essential to effectively managing the transition. Proper management of the symptoms and signs is crucial to maintain and improve the woman's quality of life (Nguyen *et al.*, 2020). This encourages the search for safer non-pharmacological alternatives, one of which is hydrotherapy. It is imperative to promote regular physical activity to alleviate menopausal symptoms and avert age-related health issues. Hydrotherapy emerges as a viable alternative to mitigate menopausal manifestations and prevent health complications associated with aging. Hydrotherapy, or water therapy, has long been used as a natural treatment method that involves using hot and cold water to improve blood circulation, relieve pain, and reduce stress (Backes *et al.*, 2022).

The growing body of research concerning hydrotherapy in menopause necessitates a comprehensive evaluation of the prevailing literature and prospective avenues for exploration. Employing quantitative methodologies, particularly bibliometric analysis, is deemed suitable for assessing the current state of research and delineating future investigative trajectories related to hydrotherapy in menopausal women (Saputro *et al.*, 2023). Nonetheless, the infrequent utilization of bibliometric analysis in examining this subject highlights the imperative for heightened attention to this field (Khairul *et al.*, 2023). The application of bibliometric analysis enables scholars to discern trends,

patterns, and deficiencies within hydrotherapy research focused on menopausal women, thereby facilitating the formulation of targeted interventions to tackle these urgent women's health concerns.

This investigation endeavors to furnish a thorough synthesis of the existing research on hydrotherapy pertaining to contemporary menopausal women, addressing pivotal inquiries to illuminate the present circumstances and advancements within this domain. Through the amalgamation of bibliometric scrutiny and content analysis, we aspire to delineate prospective pathways for forthcoming inquiries and furnish critical insights for both researchers and practitioners operating within the sphere of hydrotherapy, particularly concerning menopausal women. To realize this objective, we have articulated three specific research questions (RQs):

- RQ1. What are the predominant themes and research subjects associated with hydrotherapy in menopausal women?
- RQ2. What emerging areas of investigation are manifesting within the hydrotherapy research focused on menopausal women?
- RQ3. What current initiatives and prospective trajectories can be identified in the exploration of hydrotherapy for menopausal women?

By addressing the aforementioned inquiries, this study aspires to render a clear and comprehensive depiction of hydrotherapy in menopausal women. Furthermore, through the integration of bibliometric analysis and content elaboration, we aim to pinpoint potential domains for future research and offer significant insights for researchers and practitioners in the management of hydrotherapy for menopausal women via a multifaceted methodology. The incorporation of these methodologies facilitates an enhanced comprehension of the extant knowledge and lays the groundwork for additional exploration in this vital area of inquiry.

Methods

This review employed a bibliometric and content analysis approach to map research

themes and identify future directions in hydrotherapy interventions for menopausal women. The study involved a systematic search and selection of relevant publications, followed by quantitative bibliometric analysis and qualitative content analysis to explore research trends, thematic focuses, and gaps in the literature. We opted to exclusively employ the Scopus database for our literature review owing to its esteemed, extensive coverage, with the intention of minimizing potential discrepancies in data and field tags that may emerge from the utilization of multiple databases. Furthermore, the Scopus database provides a significantly larger volume of publications and citations (32–34). We posit that this will yield sufficient data for an in-depth understanding of the scientific landscape, the identification of research focal points, and relevant information (Wijaya *et al.*, 2023; Zakaria *et al.*, 2022).

A comprehensive literature search was conducted in Scopus, Web of Science, PubMed, and Google Scholar to retrieve relevant studies on hydrotherapy interventions for menopausal women. The search was performed using a combination of Medical Subject Headings (MeSH) terms and keywords such as “hydrotherapy,” “water therapy,” “menopausal symptoms,” “menopausal women,” “quality of life,” and “hormonal changes.” Boolean operators (AND, OR) were applied to refine search results, implementing filters for document type (exclusive to journal articles) and papers published in the English language, culminating in a total of 116 bibliographic citations (Rodríguez-Ruiz *et al.*, 2019). Search terminology was employed within the contexts of titles, keywords, and abstracts.

Studies were included in this review if they were peer-reviewed articles published in English and focused on hydrotherapy interventions specifically for menopausal women. Eligible studies encompassed clinical trials, observational research, systematic reviews, meta-analyses, and experimental studies that assessed physiological, psychological, or quality-of-life outcomes. Only articles with full-text availability were considered. Studies were excluded if they did not specifically address menopausal women, such as research on hydrotherapy in general

female health or other age groups. Additionally, studies that focused solely on the mechanisms of hydrotherapy without clinical application were not included. Case reports, opinion pieces, editorials, and abstracts without full-text access were excluded. Non-English publications were also omitted due to translation constraints.

Relevant data from the selected studies were systematically extracted using a structured data extraction form. The extracted information included author(s) and publication year, study design, and sample size. Details regarding hydrotherapy interventions, such as duration, frequency, and type of hydrotherapy, were recorded. Outcome measures related to physiological changes, psychological well-being, symptom relief, and quality of life were also documented. Additionally, key findings and conclusions from each study were synthesized to facilitate analysis. Figure 1 represents the methodological framework for a bibliometric and content analysis of hydrotherapy research on menopausal women. It consists of three primary analytical components: descriptive analysis, bibliometric analysis, and content analysis.

Descriptive analysis examines trends in publications, citations, and publication outlets to assess the growth and distribution of research in this field. The bibliometric analysis was conducted using VOSviewer software to identify research trends, citation patterns, and author collaborations. Key topics such as battery management systems and charging infrastructure have been identified as focal points of research (Ullah *et al.*, 2023). Similarly, in ophthalmology, bibliometric analysis of systematic reviews and meta-analyses has shown a rapid increase in publications, with China and the United States being the most productive countries. This analysis also highlighted the importance of pre-registration and guideline compliance in ensuring the quality of research (Fu *et al.*, 2023). The paper selection process is meticulously guided by trending and influential topics, taking into account factors like occurrence, average publication year, and citations, as illustrated in the VOSviewer output (Taşkın *et al.*, 2023). VOSviewer was employed for the purpose of data processing, providing accessible and

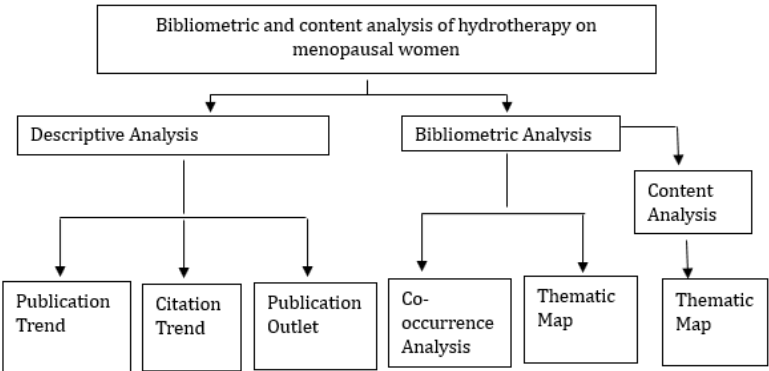


Figure 1. Research Structure to Answer RQs (Kent Baker *et al.*, 2020)

effective instruments for bibliometric analysis. This methodology yields significant insights into research trajectories, collaborative efforts, and the impact of publications, thus facilitating academic research initiatives. (Aypay and Ertem, 2023; Kamil *et al.*, 2023). For content analysis, thematic coding was applied to extract recurring themes, interventions, and outcome measures from the selected studies. Thematic synthesis methods were used to structure findings into key research directions and gaps in hydrotherapy for menopausal women.

Result and Discussion

The identification, screening, and inclusion process for the bibliometric analysis on hydrotherapy for menopausal women is presented in Figure 2. The search strategy was conducted using the Scopus database with specific keywords related to menopause and hydrotherapy. The search was performed on December 21, 2024, yielding 116 records. All identified records were screened and assessed for eligibility to ensure they met the inclusion criteria. The diagram follows a systematic review framework, ensuring a transparent and

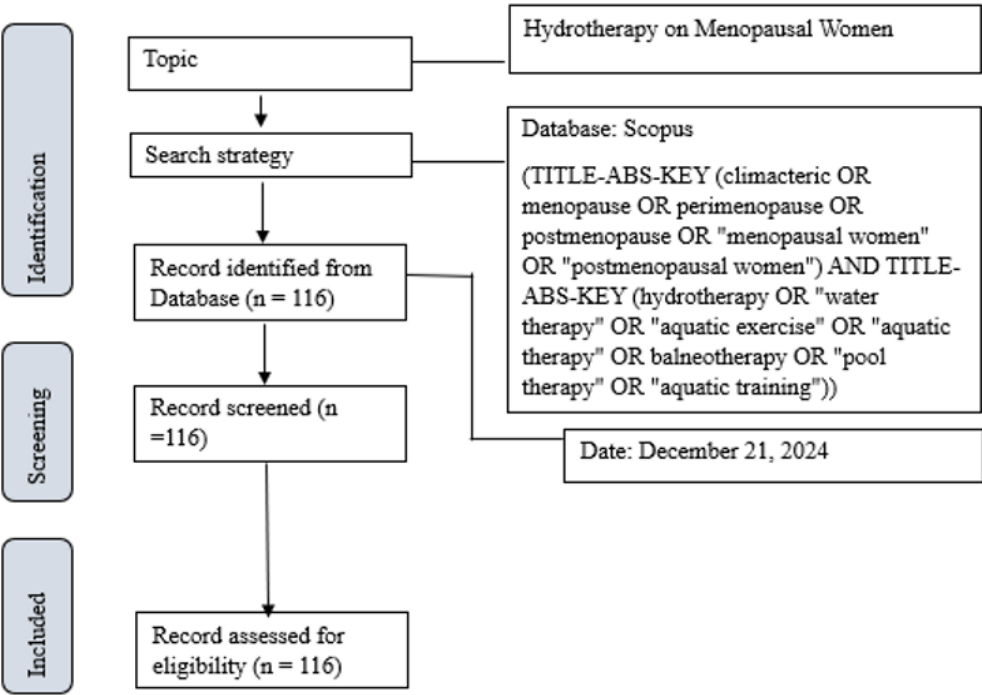


Figure 2. Search Strategy Adapted from the PRISMA flow Diagram (Page *et al.*, 2021)

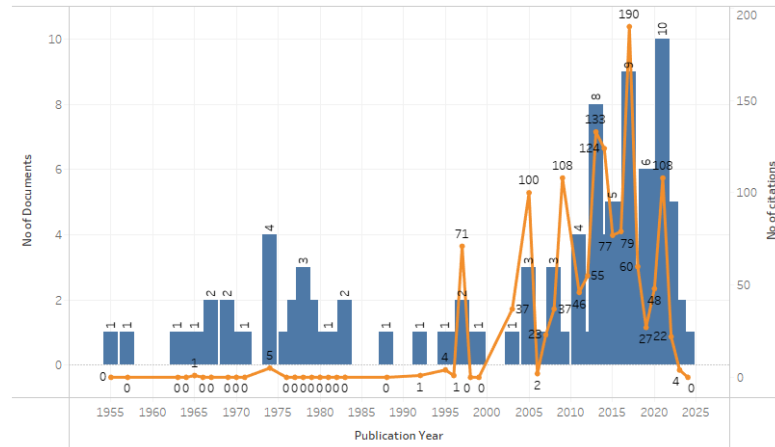


Figure 3. Publishing Over Time with the Blue Bar Charts Represents the Number of Documents, While the Orange Line Represents the Number of Citations.

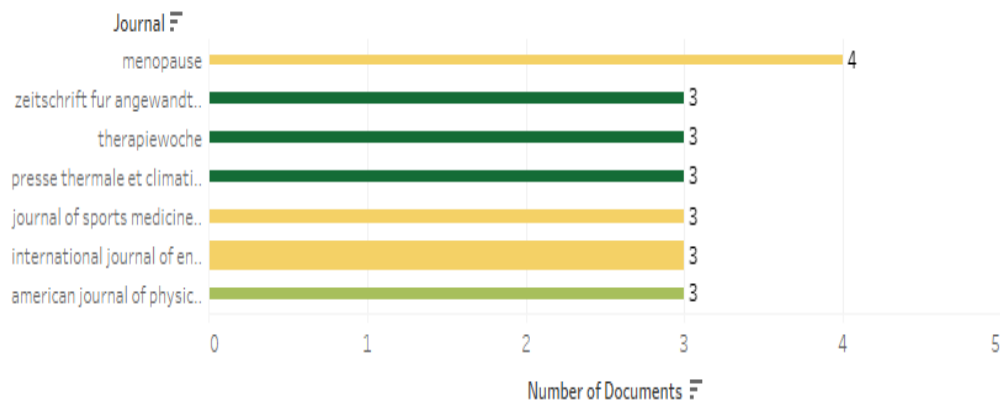


Figure 4. Top 7 Journals as Outlets for Publication

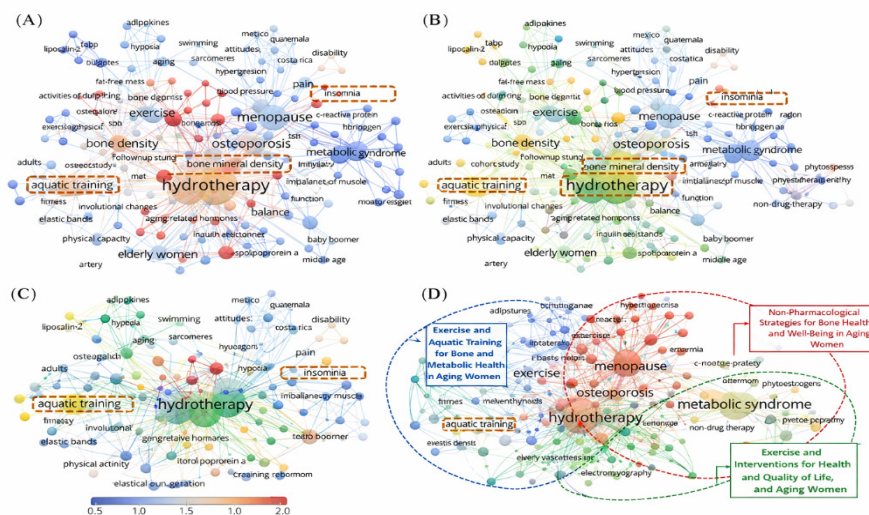


Figure 5. VOSviewer visualization results: (A) overlay visualization for high/low citation. (B) overlay visualization for novel/old topics. (C) overlay visualization between occurrence and average publication year with green to yellow indicating emerging topics and blue indicating older topics, and (D) network visualization from co-occurrence analysis showing three thematic clusters.

Figure 5. Combined VOSviewer Visualization of Research Trends on Hydrotherapy and Menopausal Women

reproducible selection of studies for analysis (Page *et al.*, 2021).

The publication trend on hydrotherapy for menopausal women shows notable fluctuations over time (Figure 3). From 1955 to the 1970s, publications were sparse, averaging one to two per year, with a peak of four publications in 1974. The trend remained sporadic in the 1980s and 1990s, with occasional increases in 2005 and 2008. A significant rise occurred in the 2010s, peaking at ten publications in 2021. However, after 2021, there was a decline, with five publications in 2022, two in 2023, and one in 2024. The citation trend also showed considerable variation, with minimal citations in earlier decades, followed by a surge in 1997 and continued growth until the highest citation count was recorded in 2017. Afterward, citations declined, indicating potential shifts in research focus.

The distribution of documents across journals demonstrates that Menopause published the highest number of articles, followed by several multidisciplinary journals (Figure 4). This indicates that research on hydrotherapy for menopausal women is dispersed across various disciplines, reflecting the multidimensional nature of this topic.

The VOSviewer visualization further illustrates research trends, citation patterns, and thematic evolution (Figure 5). Central themes such as hydrotherapy, osteoporosis, menopause, and bone mineral density consistently receive strong citations. Emerging topics include aquatic training, electromyography, agility, and insomnia, suggesting expanding research interest. The temporal distribution indicates that earlier studies focused on bone health and aging, while recent research emphasizes chronic disease management, including diabetes, hypertension, and functional capacity. Network visualization revealed three thematic clusters representing non-pharmacological strategies for bone health, exercise and aquatic training for metabolic and physical outcomes, and interventions targeting quality of life in aging women.

The thematic analysis identified three major areas of research. First, non-pharmacological interventions, including hydrotherapy (Charsouei *et al.*, 2021;

Pourghane, 2017), acupuncture (Roberts *et al.*, 2017), and exercise therapies (Aboarrage Junior *et al.*, 2018), were shown to improve physical function and reduce pain while preventing osteoporosis and metabolic syndrome. Second, exercise interventions such as aerobic training, resistance exercise, and aquatic training improved functional capacity, cardiovascular health, and psychological well-being (Pernambuco *et al.*, 2013; Lopez *et al.*, 2021). Third, structured aquatic exercise programs enhanced bone density, muscle strength, and cardiorespiratory fitness while supporting autonomy and daily functioning (Casilda-López *et al.*, 2017; Saquetto *et al.*, 2022; Moreira *et al.*, 2014).

Several studies reported improvements in bone mineral density and functional fitness following aquatic exercise interventions (Aboarrage Junior *et al.*, 2018; Murtezani *et al.*, 2014). Strength improvements were also observed through water-based training and neuromuscular adaptations (Araújo *et al.*, 2015; Pinto *et al.*, 2015). Pain reduction and improved physical function were demonstrated in obese postmenopausal women with knee osteoarthritis (Casilda-López *et al.*, 2017), while hydrotherapy reduced symptoms related to vascular and inflammatory conditions (Charsouei *et al.*, 2021; Chen *et al.*, 2019). Improvements in metabolic health, respiratory function, and functional autonomy were also reported across multiple studies (Babaei Bonab & Dastah, 2023; Sobczak *et al.*, 2021; Pernambuco *et al.*, 2013). These findings collectively indicate that hydrotherapy and aquatic exercise interventions contribute to musculoskeletal health, metabolic regulation, and quality of life.

Despite these benefits, further research is needed to evaluate long-term effects and combined lifestyle interventions. Modifications in daily activities, nutritional strategies, and improved physical activity may enhance cardiovascular risk profiles and overall well-being in postmenopausal women (Kim *et al.*, 2021; Nguyen *et al.*, 2023; Saquetto *et al.*, 2022; Nishiwaki *et al.*, 2016). Integration of technology, such as mobile health applications, may improve adherence to lifestyle interventions, while community-based programs and peer support

Table 1. The Effects of Hydrotherapy and Aquatic Exercises on Menopausal Women

Authors (Year)	Country	Study Design	Sample	Instrument	Intervention	Outcome
Aboarrage Junior <i>et al.</i> (2018)	Brazil	Randomized Controlled Trial	Postmenopausal women (n = 30)	Bone mineral density (BMD), functional fitness tests	High-intensity jump-based aquatic exercise program	Improved BMD and functional fitness
Araújo <i>et al.</i> (2015)	Brazil	Randomized Controlled Trial	Postmenopausal women (n = 20)	Strength and functional capacity tests	Water-based exercise with blood flow restriction	Increased strength and functional capacity
Babaei Bonab & Dastah (2023)	Iran	Randomized Controlled Trial	Women with type 2 diabetes (n = 40)	Glucose homeostasis, lipocalin levels	Aquatic exercise program	Improved glucose homeostasis and lipocalin levels
Berikhanova & Minenko (2019)	Russia	Observational Study	Women with metabolic syndrome (n = 60)	Prothrombotic potential, pro-inflammatory status	Non-drug correction (hydrotherapy)	Reduced prothrombotic potential and inflammation
Casilda-López <i>et al.</i> (2017)	Spain	Randomized Controlled Trial	Obese postmenopausal women with knee osteoarthritis (n = 50)	Pain, physical function, quality of life	Aquatic exercise program	Reduced pain and improved physical function
Charsouei <i>et al.</i> (2021)	Iran	Quasi-experimental Study	Postmenopausal women with multiple sclerosis (n = 30)	Pain levels	Hydrotherapy exercises	Reduced pain from varicose veins
Chen <i>et al.</i> (2019)	China	Meta-analysis	Postmenopausal women with knee osteoarthritis (n = 500 across studies)	Pain, physical function	Aquatic exercises	Improved pain and physical function
Colado <i>et al.</i> (2012)	Spain	Randomized Controlled Trial	Postmenopausal women (n = 40)	Body composition, physical capacity	Aquatic and dry land resistance training	Improved body composition and physical capacity
Denise <i>et al.</i> (2013)	Brazil	Randomized Controlled Trial	Postmenopausal women (n = 60)	Physical function, fall risk	High-intensity aquatic exercises (HydrOS)	Improved physical function and reduced fall risk
Moreira <i>et al.</i> (2014)	Brazil	Randomized Controlled Trial	Postmenopausal women (n = 60)	Bone metabolism, bone mass	High-intensity aquatic exercise program (HydrOS)	Improved bone metabolism and bone mass
Murtezani <i>et al.</i> (2014)	Kosovo	Randomized Controlled Trial	Postmenopausal women with osteoporosis (n = 40)	Bone mineral density (BMD), physical function	Land vs. aquatic exercise program	Improved BMD and physical function

Authors (Year)	Country	Study Design	Sample	Instrument	Intervention	Outcome
Pernambuco <i>et al.</i> (2013)	Brazil	Randomized Controlled Trial	Older women (n = 30)	Functional autonomy, bone mineral density (BMD), serum osteocalcin levels	Aquatic exercise program	Improved functional autonomy and BMD
Pinto <i>et al.</i> (2015)	Brazil	Randomized Controlled Trial	Postmenopausal women (n = 40)	Neuromuscular adaptations	Water-based concurrent training	Improved neuro muscular adaptations
Saquetto <i>et al.</i> (2022)	Brazil	Systematic Review	Postmenopausal women (n = 500 across studies)	Physical function, quality of life	Water-based exercises	Improved physical function and quality of life
Sobczak <i>et al.</i> (2021)	Poland	Observational Study	Postmenopausal women (n = 25)	Respiratory function, aerobic capacity	Water aerobics classes	Improved respiratory function and aerobic capacity
Wochna <i>et al.</i> (2019)	Poland	Randomized Controlled Trial	Postmenopausal women (n = 30)	Bone mineral density (BMD), bone turnover markers	Aqua fitness training program	Improved BMD and bone turnover markers

could sustain behavioral changes (Febriyanti *et al.*, 2023; Trisetiyaningsih *et al.*, 2023; Nogueira *et al.*, 2022).

Future studies should also examine combined interventions involving aquatic exercise, nutrition, and pharmacological therapy to improve bone mineral density and metabolic outcomes (Pernambuco *et al.*, 2013; Rossi *et al.*, 2024; Liu *et al.*, 2024). Additionally, investigations on dietary patterns and inflammatory markers may provide insights into chronic disease prevention (Aboarrage Junior *et al.*, 2018; Silva *et al.*, 2024). Expanding access to hydrotherapy through community-based programs and policy support may further promote healthy aging and reduce chronic disease burden. This study has several limitations. The exclusive use of the Scopus database may have resulted in the omission of relevant studies indexed elsewhere. The focus on English-language publications may introduce language bias. Citation-based metrics may not fully capture qualitative research impact, and content analysis depends on the reporting quality of included studies. Future research should integrate multiple databases, include

non-English studies, and apply complementary qualitative approaches to strengthen evidence in hydrotherapy research for menopausal women.

Conclusion

The study evaluates the current research on hydrotherapy for menopausal women, identifying key topics such as hydrotherapy, aquatic training, bone mineral density, electromyography, agility, and insomnia. It emphasizes the growing interest in non-pharmacological interventions for improving health outcomes in postmenopausal women. The findings emphasize the need for further research to identify effective strategies for enhancing functional capacity, quality of life, and overall health. Future studies should explore the synergistic effects of physical activity, dietary interventions, and medications on functional autonomy, bone mineral density, and inflammatory markers. Integrating water-based exercises with blood flow restriction training can improve muscle strength and mitigate age-related declines in functional capacity. A multidisciplinary

approach integrating physical, metabolic, and functional aspects is essential for supporting healthy aging and optimizing quality of life for postmenopausal women.

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