MINH
MALAHAYATI INTERNATIONAL JOURNAL OF NURSING AND HEALTH SCIENCE
ISSN 2620-9152 (Print)
ISSN 2621-4083 (Online)
DOI: 10.33024
Nomor: 79/E/KPT/2023

ARTICLE INFORMATION
Received: January, 22, 2026
Revised: April, 24, 2026
Available online: April, 25, 2026
at : https://e-jurnal.iphorr.com/index.php/minh

Hydrotherapy as an evidence-based nursing intervention for managing type 2 diabetes mellitus: An integrative review

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding author: *E-mail: yutika24001@mail.unpad.ac.id

Abstract

Background: Type 2 *diabetes mellitus* (DM) is a major global health challenge. Effective management requires non pharmacological interventions in addition to medication. Hydrotherapy, a non invasive and affordable water-based therapy, shows promise in improving blood glucose, insulin sensitivity, and vascular function. This review identifies hydrotherapy interventions for type 2 DM and evaluates their clinical impact.
Purpose: To analyze how to improve adherence in type 2 *diabetes mellitus* patients in implementing the five pillars of *diabetes mellitus* management.
Method: This integrative reviews the size devidence on hydrotherapy for type 2 DM, guided by two questions: "what forms of hydrotherapy intervention are used in the management of type 2 *diabetes mellitus*?" and "What is the impact of hydrotherapy on clinical out comes for patients with type 2 *diabetes mellitus*?". The *population, intervention, outcome* (PIO) frame work was used. A systematic literature search was conducted across major electronic data bases (PubMed, Scopus, Web of Science, EBSCO host: Medline). Seventeen relevant studies were included after screening.
Results: Hydrotherapy interventions include hot water baths/immersions, aquaticexercise, hot/cold compression, and oral water consumption. Aquatic exercise can lower HbA1c, fasting glucose, and insulin levels. Hot baths may reduce poor glycemic control and decrease fasting plasma glucose. The tests revealed animmediate decrease in blood glucose. Oral hydrotherapy improved the *ankle brachial index.* Hydrotherapy also improved quality of life, physical health and reduced stress. The benefits extend to lipid profiles and obesity , as well as blood flow, vascular function, pain, and mobility.
Conclusion: Hydrotherapy is a potential complementary intervention for type 2 DM, offering benefits interms of glycemic control, vascular function, quality of life, and physical symptoms. Its non pharmacological, non invasive, afford able, and safe nature make sit a viable nursing option, especially in resource-limited are as. While nurses are crucial in its implementation, current studies have limitations interms of methodology, standardization, and long-term data. Further robust research is needed for widerad option.

Keywords: Evidence-Basedpractice; Glycemic Control; Hydrotherapy; Type 2 Diabetes Mellitus.

DOI: https://doi.org/10.33024/minh.v9i2.2373

INTRODUCTION

Type 2 *diabetes mellitus* (DM) is an urgent global health challenge due to its steadily increasing prevalence, severe health impacts, and significant social and economic burden. As the most common form of diabetes, type 2 DM accounts for more than 90% of diabetes cases world wide and affected more than 462 million people in 2017, a figure projected to rises harply in the coming decades (Abdul Basith Khan, Hashim, King, Govender, Mustafa, & Al Kaabi, 2020 ; Lin, Xu, Pan, Xu, Ding, Sun, Song, Ren, & Shan, 2020 ; Ye, Wu, Yang, Zhu, Chen, Chen, Ji, & Hou, 2023 ; Zheng, Ley, & Hu, 2018). This disease is nolonger limited to the elderly population, as recent data show an increase in cases among adolescents and young adults, particularly in low and middle income countries with limited health care systems (Rob, Hoque, Asaduzzaman, Khatoon, Khalil, Thomas, Ilyas, Mahmood, & Chowdhury, 2025 ; Xu, Sun, & Xiang, 2025).

Clinically, type 2 DM has a significant effect on morbidity and mortality rates. This disease is one of the leading causes of death and disability globally, with more than one million death seach year, and ranks ninth as the leading cause of death world wide (Abdul Basith et al., 2019 ; Lin et al., 2020 ; Ye et al., 2023). Chronic hyperglycemia in type 2 DM patients can causes erious complications such as cardiovascular disease, kidney failure, neuropathy, and blind ness, which significantly reduce quality of life and increase treatment costs (De Fronzo, Ferrannini, Groop, Henry, Herman, Holst, Hu, Kahn, Raz, Shulman, & Simonson, 2015 ; Młynarska, Czarnik, Dzieża, Jędraszak, Majchrowicz, Prusinowski, Stabrawa, Rysz, & Franczyk, 2025 ; Zhou, Sun, Yu, & Zhu, 2022). These complications generally stem from modifiable risk factors, such as inactive life styles, un healthy diets, obesity, and urban lifestyles (Forray, Coman, Simonescu-Colan, Mazga, Cherecheș, & Borzan, 2023 ; Huang, Wu, Ni, Xu, & He, 2025 ; Zheng et al., 2018).

Although pharmacological therapy plays animportant role, effective management of type 2 DM is highly dependent on non pharmacological approaches, particularly life style changes. However, the implementation and sustainability of these changes face many challenges. Many patients experienced ifficulties main taining changes in diet and physical activity in the long term because of behavioral, educational, socio economic, and environmental barriers (Leite, Banzato, Galendi, Mendes, Bolfi, Veroniki, Thabane, & Nunes-Nogueira, 2020 ; Młynarska et al., 2025 ; Raveendran, 2018). Limited accesst ostructured educationan dbehavioral supportal so hinders the achievement of glycemic control through life style interventions (Blahova, Martiniakova, Babikova, Kovacova, Mondockova, & Omelka, 2021). ; Wang, Kang, Liu, Tong, & Quan, 2020). This situation high lights the need for additional interventions that are complementary, safe, affordable, and *evidence-based.* One complementary approach that is beginning to gain attention is hydrotherapy, which is the therapeutic use of water in various forms, such as baths, hot/cold therapy, and the oral consumption of water. Various studies have shown that hydrotherapy has the potential to lower blood glucose levels, increase insulin sensitivity, improve vascular function, and (Chidambaram, Vijayakumar, Ravi, Boopalan, Anandhan, & Kuppusamy, 2024 ; Endang, Rizki, Ah, Bisepta, & Ifa, 2024 ; Sirait, Said, & Mohamad, 2025 ; Vijay, Nivethitha, Mooventhan, & Manavalan, 2025).

In addition, hydrotherapy is generally non invasive, low cost, and can be applied in various health care and community settings, making it an attractive option as a complement to standard care (Andriati, Pratiwi, Muthoinah, Yudiatma, & Poddar, 2025. ; Mooventhan, Gowthami, Krishnamurthy, & Nivethitha, 2024 ; Setiawan & Pribadi, 2024). However, evidence regarding the effectiveness of hydrotherapy in the management of diabetes is still scattered and varied, so a systematic literature syn thesis is needed. There fore, this integrative review aims to identify the various hydrotherapy intervention sused in the management of type 2 DM and evaluate their impact on clinical out comes. Further more, this study is an chored with in the the oretical frame work of holistic nursing and self-care, which emphasizes the use of accessible, non-pharmacological interventions to empower patients in managing their chronic conditions. By synthesizing and analyzing relevant primary studies, this reviewis expected to elucidate the potential role of hydrotherapy as an evidence-based nursing intervention in improving patient out comes and supporting more holistic diabetes management strategies.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

RESEARCH METHOD

This integrative review was conducted to synthesize the available evidence on hydrotherapy as an evidence-based nursing intervention in the management of type 2 DM. The method used followed the integrative review frame work described in whittemore & knafl (Whittemore & Knafl, 2005). This design was chosen forit sability to synthe size literature from various research methodologies (quantitative, qualitative, ormixed) to produce a comprehensive understanding of a phenomenon, in this case, the application of hydrotherapy in the management of type 2 DM. The problem identification phase of this review began with clearly formulating there search questions and defining the key concepts to be examined. This process aimed to ensure that the focus of the review remained focused and relevant to there search objectives. The two main questions guiding the conduct of this review are as follows: "What forms of hydrotherapy intervention are used in the management of type 2 diabetes mellitus?"and"What is the impact of hydrotherapy on clinical out comes for patients with type 2 diabetes mellitus?"

Based on to clarification hes cope and direction of the literature search, the population, intervention, comparison, and outcome (PICO) frame work was used with modification stop population, intervention, and outcome (PIO), given the absen ceof a comparison group that was explicitly the focus of this study. This adaptation of the frame work aims to better align with the characteristics of the reviewed studies and the approach used.The details of the PIO elements in the context of this review can be found. This matter with this approach, this review is expected to provide an in-depth understanding of the potential of hydrotherapy in the management of type 2 DM from both a clinical and nursing perspective.

The literature search in this review was conducted systematic all in August 2025 via several major electronic data bases, namely PubMed, Scopus, and Web of Science. Although, to ensure maximum coverage of relevant literature, the search strategy was designed carefully by combining *medical subject headings terms* (MSHT) and relevant free keywords. The selection and adjust ment of keywords were performed specifically for each database to align with the characteristics of the search system used. In the PubMed and EBSCO host: medline databases, the search strategy uses a combination of"(type 2 diabetes mellitus ([MSHT]) AND ((hydrotherapy [MSHT]) OR (balneo therapy [MSHT]) OR (aquatic therapy [MSHT]))". Moreover, in scopus, the search formula appliedis:"(TITLE-ABS-KEY ("diabetes mellitus type 2") OR TITLE-ABS-KEY (T2DM)) AND (TITLE-ABS-KEY (hydrotherapy) OR TITLE-ABS-KEY (balneo therapy) OR TITLE-ABS-KEY ("aquatic therapy"))". In Web of Science (WOS), the search approach is carried out in stages through several structured steps: "#1 = ALL = (diabetes mellitus type 2), #2 = ALL = (T2DM), #3 = ALL = (hydrotherapy), #4 = ALL = (balneo therapy), #5 = ALL = (aquatic therapy), #6 = #1 OR #2, #7 = #3 OR #4 OR #5, #8 = #6 AND #7. The initial search of the entire database yielded a total of 130 articles, with the following details: 48 articles from PubMed, 31 from Scopus, 28 from Web of Science, and an additional 23 from EBSCO host: Medline. After removing duplicates, 84 unique articles were selected on the basis of the inclusion and exclusion criteria.The inclusion and exclusion criteria can be found.

However, with this systematic search and selection approach, it is hoped that all the literature used in the review is truly relevant, of high quality, and supports the accuracy and dept hof the analysis. The study selection process consists of two stages: (1) selection of titles and abstracts; and (2) *full-text review*. This process is documented via a PRISMA flow diagram (

Figure). Among the 84 unique results, 19 primary studies focuse don't type 2 DM patients and hydrotherapy interventions. The reasons for exclusion included 3 articles due to language, 7 not primary studies, 55 not relevant, and 2 articles in accessible. Finally, 15 articles were reviewed.

The quality of studies was assessed via tools from the Joanna Briggs Institute (JBI) appropriate for the type of study (RCT, quasi experiment, cross-sectional).

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

RESEARCH RESULTS

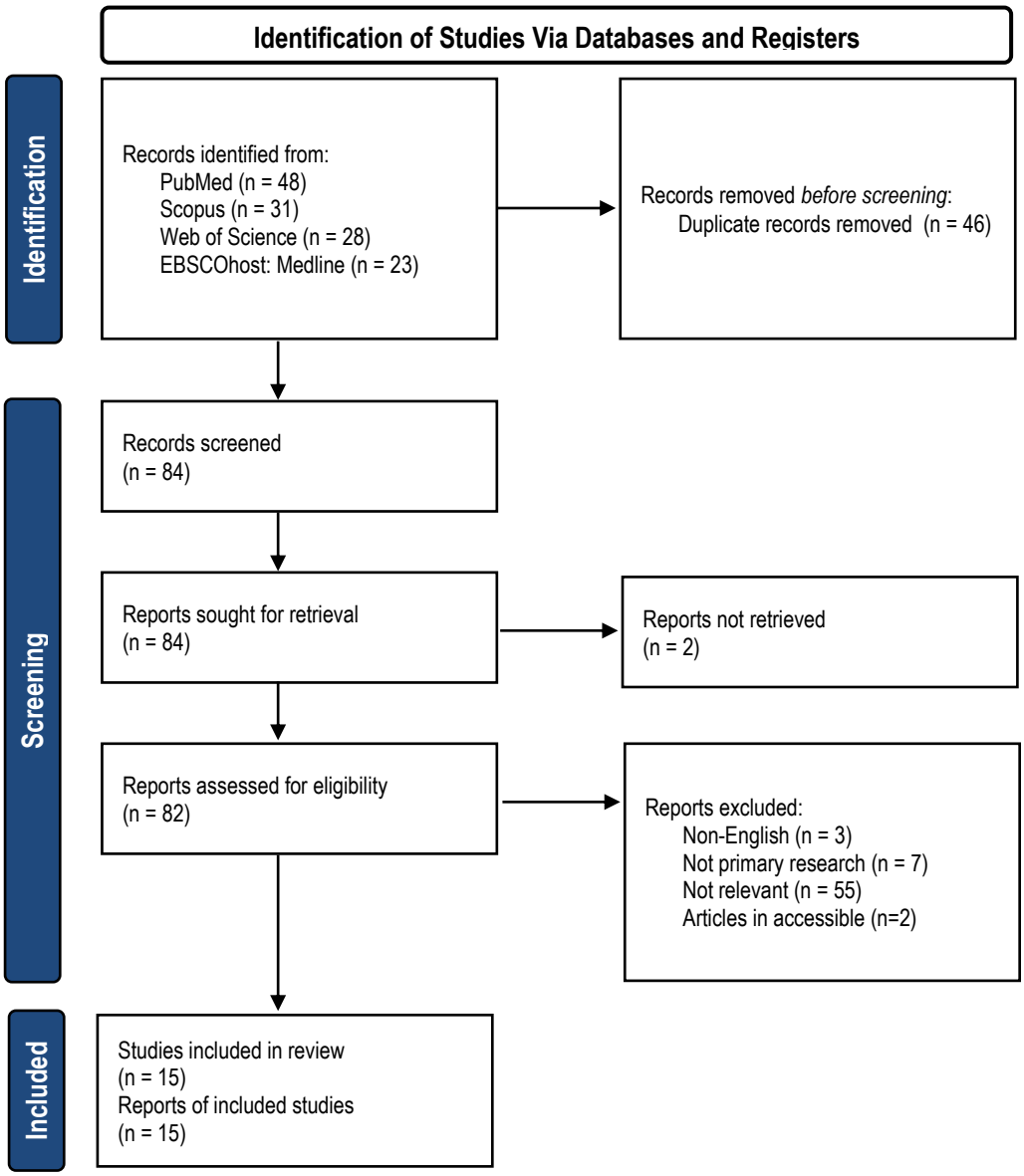

Figure PRISMA Diagram Literature Search

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

Table Summary of Article Reviews

(Author, Year) (Country)	Purpose	Method	Results
(Asa et al., 2012) (New York)	To evaluate the efficacy and applicability of eight-week aquatic exercise in patients with the combination of CHF and type 2 DM.	True-eksperimental (pretest-posttest control group)	1. The training programme was well tolerated. 2. Work rate (+11.7 ± 6.6 versus −6.4 ± 8.1 watt, $P < 0.001$) and VO_{2peak} (+2.1 ± 0.8 versus −0.9 ± 1.4 $mL \cdot kg^{-1} \cdot min^{-1}$, $P < 0.001$) and walking capacity ($P = 0.01$) increased significantly in the training group. 3. Muscle function was also significantly improved and Hba1c decreased significantly ($P < 0.01$) during training, while fasting glucose, insulin, c-peptide, and lipids were unchanged. 4. Based on training also increased vitality measured by SF-36 significantly ($p = 0.05$).
(Bonab et al., 2023) (Iran)	To examine whether performing training in water improves glucose homeostasis and lipocalins in women with type 2 diabetes mellitus (T2DM).	True-eksperimental (pretest-posttest control group)	1. These findings indicated that after 12 weeks of exercise, TC, TG, LDL-C, FABP, LCN-2, and RBP4 were significantly reduced in the experimental group ($p < 0.05$). 2. Performing training in water seems to reduce the FBS, insulin, and HbA1 C to a higher degree as compared to the control group.
(Das et al., 2018) (Indian)	To evaluate the immediate effect of CAP on blood glucose level and cardiovascular functions in patients with type 2 diabetes mellitus (T2DM).	Pre-Experimental (*single group pretest-posttest*)	This study showed a significant reduction in random blood glucose level (p=0.011), pulse rate/heart rate (p=0.028), systolic blood pressure (p=0.023), mean arterial pressure (p=0.010), rate pressure product (p=0.006), and double product (p=0.003) compared to its respective pre test and no such significant changes were observed in diastolic blood pressure (p=0.095) and pulse pressure (p=0.306).
(Kamioka et al., 2020) (Japan)	To clarify the relationship between daily hot water bathing (HWB) at home and glycemic control in middle-aged and elderly ambulatory patients with type 2 diabetes mellitus (T2DM).	Cross Sectional	1. Among 838 patients, there was a significant difference (p<0.001) in age between males (n=528, 62.8±8.7 years) and females (n=310, 65.0±8.1 years). 2. Based on model 1, compared with participants who used HWB more than seven times a week, those with poorly controlled HbA1c were significantly associated with low frequency of HWB: four to six times a week (OR 1.32, 95% CI 0.87–1.99) and less than three times a week (OR 1.43, 95% CI 0.98–2.10); p-value for overall trend was 0.041. In model 2, p-value for overall trend was 0.138.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

(Author, Year) (Country)	Purpose	Method	Results
(Mooventhan et al., 2020) (Indian)	To examining what precise effect on blood glucose levels (BGL) this treatment may have. The present study examines the effect of GHP on BGL in patients with type 2 diabetes ellitus (T2DM).	Pre-Experimental (*single group pretest-posttest*)	The study showed a significant reduction in BGL, immediately (p = 0.013) and 15 min (p = 0.006) after GHP application compared to the baseline value.
(Ohtsuka et al., 1996) (Japan)	To effects of balneotherapy on platelet glutathione metabolism were investigated in 12 type II (non-insulin-dependent) diabetic patients.	True-eksperimental (pretest-posttest control group)	1. There was a negative correlation between glutathione peroxidase (GPX) activities and the levels of FPG (r = -0.430, P0.05). 2. After balneotherapy, the activity increased in 5 patients, decreased in 3 patients and showed no changes (alteration within +/- 3%) in all the other patients.
(Schenaarts et al., 2024) (Germany)	To improve glycemic control in individuals with type 2 diabetes mellitus (T2DM).	True-eksperimental (pretest-posttest control group)	1. Based on body core and leg skin temperature were higher following the heated condition compared to the thermoneutral condition (38.0 ± 0.3 vs. 36.6 ± 0.2 °C and 39.4 ± 0.8 vs. 31.3 ± 0.8 °C, respectively; P < 0.001 for both). 2. The incremental area under the curve (iAUC) of plasma glucose concentrations during the OGTT was higher after the heated condition compared to the thermoneutral condition (17.7±3.1 vs. 14.8±2.8 mmol/L/ 120 min; P < 0.001). 3. However, no differences were observed in plasma insulin concentrations (heated: 380 ± 194 vs. thermoneutral: 376±210 pmol/L/120 min; P=0.93) or whole-body composite insulin sensitivity indexes (4.5 ± 2.8 vs. 4.5 ± 2.1; P = 0.67)
(Sunaryo et al., 2020) (Indonesian)	To find out the effect of oral hydrotherapy on risk reduction of diabetic feet ulcer in patients with type-2 diabetes mellitus.	True-eksperimental (pretest-posttest control group)	Based on shows that oral hydrotherapy can minimize risk reduction of diabetic feet ulcer in patients with type-2 diabetes mellitus significantly with p-value of 000.0 (α = 0.005).

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

(Author, Year) (Country)	Purpose	Method	Results
(Fioravanti et al., 2015) (Italy)	To assess the clinical efficacy of a 3-week program of diet combined with spa therapy in obese patients with and without type 2 diabetes. Although to examine whether this combined program influences the response of serum levels of leptin, adiponectin, visfatin, and high-sensitivity C-reactive protein.	Qualitative group	The evaluation of weight before and after therapy demonstrated a significant reduction (P<0.0010 in all the population and in each of the two subgroups (obesity with and without diabetes) of patients considered (about 7% of their initial weight).
(Petrofsky et et al., 2006) (Europe)	To examine the relationship between sympathetic outflow on the magnitude of the change of blood flow (BF) during contrast baths in controls and with people diabetes.	True-eksperimental (pretest-posttest control group)	1. When subjects were exposed to global heating (warm room) there is a greater response to CB than when subjects were initially in a cooler room. 2. However, for both temperatures, subjects with diabetes had a response that was over 50% less than that seen in control subjects..
(Petrosky et al., 2007) (Europe)	To alternate warm and cool water baths during a treatment session.	True-eksperimental (pretest-posttest control group)	Based on control subjects, warm and cold contrast baths with the ratio 3 minutes warm to 1 minute cold elicited significantly ($p < 0.01$) greater BF than placing the limb continuously in warm water or using a 6:2 ratio of warm to cold bath time.
(Qui et al., 2014) (China)	To investigate the effect of spa adjuvant therapy on diabetic lower extremity arterial disease (LEAD).	Quantitative design	1. After adjuvant therapy with spa, patients' pain, numbness, and cold sensation were significantly improved compared with control groups ($P < 0.05$). 2. However, Spa adjuvant therapy also significantly increased the dorsalis pedis pulse and systolic peak velocity ratio of patients with mild lower extremity vascular stenosis compared with control groups ($P < 0.05$), 3. While there were no significant differences between the two groups for patients with moderate and severe stenosis ($P > 0.05$). 4. Based on both in the spa and control groups, there were no significant differences before and after medication for fasting, 2-h postprandial blood glucose and glycosylated hemoglobin (HbA1C) analyses ($P > 0.05$).

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

(Author, Year) (Country)	Purpose	Method	Results
(Bakaliuk et al., 2022) (Ukraine)	To evaluation of the effect of hydrogen sulfide baths on the quality of life of patients with diabetic polyneuropathy.	True-eksperimental (pretest-posttest control group)	Although positive changes in physical, psychological and social condition were noted in all studied patients, and the patients who took hydrogen sulfide baths managed to achieve statistically significant positive changes and maintain positive dynamics for 3 months.
(Dogaru et al., 2025) (Romania)	To evaluate the efect of comprehensive medical rehabilitation programs that include natural therapeutic factors (carbonated natural mineral water) on pain, gait, and functional status in these patients.	Quantitative design	However, showed a statistically signifcant reduction in pain assessed by VAS at the end of the treatment, persisting for three months (p-values<0.001 between the two groups), with a greater reduction in the DZ-CMW group.
(Beever et al., 2010) (Canada)	To determine whether FIRS have a beneficial effect on mental and physical quality of life in people with type II diabetes mellitus.	Cross Sectional	1. Although physical health, general health, and social functioning indices of the SF-36v2 improved. 2. Based on visual analogue scales for stress and fatigue improved.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

DISCUSSION

The results of this review indicate that hydrotherapy, in its various forms, has potential as an effective complementary intervention in the management of type 2 DM. This intervention not only affects glycemic control but also provides benefits in terms of vascular function, metabolic profile, quality of life, and physical symptoms such as pain and mobility limitations. A quati cexercise is a form of hydrotherapy that has consistently shown benefits in lowering HbA1c levels, fasting blood glucose and improving insulin sensitivity. This finding is consistent with the literature, which states that water-based exercise offers a safe and effective resistive load for patients at riskof falling or with limited mobility (Åsa, Maria, Katharina, & Bert, 2012 ; Bonab & Dastah, 2023 ; Scheer, Naylor, Gan, Charlesworth, Benjanuvatra, Green, & Maiorana, 2020). Mechanistically, the hydrostatic pressure and water resistance enhance muscle glucose up take and improve end ot helial function, as evidenced by increased flow-mediated dilation of the brachial artery. Moreover, heat therapies such as warm bath so rinfrared saun as have produced more varied results. Several studies have reported benefits in terms of quality of life and stress (Kamioka, Mori, Horiuchi, Hayashi, Ohmura, Yamaguchi, & Kato, 2020 ; Ohtsuka, Yabunaka, Watanabe, Noro, & Agishi, 1996 ; Schenaarts et al., 2024). However, it is crucial tonote the existence of contradictory findings in the literature. For instance, a single session of infrared sauna was provenin effective in improving post prandial blood glucose hand ling and could even acutely increase plasma glucose curves. Similarly, water-based exercises performed in a vertical position did not yield significant changes in anthropometric parameters like BMI or waist circumference, high lighting that the efficacy of hydrotherapy heavily depend son the specific modality and duration.

Other interventions such as cold/heat compresses (CAP and GHP) have also shown positive results in loweringr and om blood glucose. The physiological mechanis munder lying this relationship is believed to involve the pro found stimulation of local circulation and the autonomic nervous system, which consequently influences metabolic organs with in the abdominal cavity, including the liver. Furthermore, oral hydrotherapy through regular consumption of warm water can reduce the risk of diabetic fo otulcersby improving peripheral circulation (DAS, Mooventhan, & Manjunath, 2018 ; Mooventhan, Venugopal, & Chaudari, 2020 ; Sunaryo, Lestari, & Khor, 2020). From a socio economic and cultural context, these specific modal it iese specially oral hydrotherapy and localized compresses hold immense value. Type 2 DM prevalence is rapidly rising in low- and middle-income countries where health care resources are heavily strained. Because these interventions are non invasive, virtually cost-free, and can be easily self-administered at home with out specialized equipment, they over come the typical socio economic barriers associated with long-term diabetes management.

The Role Of Nurses In Implementing Hydrotherapy As A Part Of Evidence-Based Practice

In the context of nursing, the role of nurses in the application of hydrotherapy is crucial as part of evidence-based practice. First, nurses can act as patient educators, providing information about the types of hydrotherapy, such as warm baths, water exercises, compresses, and oral hydrotherapy, as well as their benefits in controlling glycemia and improving quality of life (Bonab et al., 2023 ; Sunaryo et al., 2020). Second, nurses also play a role in the initial assessment and monitoring of patient's clinical status to determine the appropriat eness of interventions and monitor responses, in terms of glucose levels, blood pressure, pain, and comfort (Mooventhan et al., 2020). In addition, nurses can adjust treatment on the basis of patient response, including adjusting the duration and frequency of therapy, and working with the medical team to adjust pharmaco therapy doses to prevent hypoglycemia (Asa et al., 2012). In an effort to promote compliance, nurses can also help patients integrate hydrotherapy into their daily routines, especially in more accept able forms of intervention, such as sauna sor water baths (Das et al., 2018 ; Scheer et al., 2020). Finally, the implementation of hydrotherapy requires multi disciplinary collaboration among nurses, doctors, physio therapists, and other professionals toen sure that interventions are

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

comprehensive and integrated (Dogaru, Ciubean, Marinescu, Pop, Pașca, & Ciumărnean, 2025).

Challenges In Implementing Hydrotherapy In The Context Of Nursing

Although it has potential, the implementation of hydrotherapy in nursing practice faces several challenges. Some of the reviewed studies had small sample sizes and non randomized designs, limiting the strength of inference and generalizability (Mooventhan, Chaudhari, & Venugopal, 2019 ; Mooventhan, et al., 2020 ; Petrofsky, Lohman, Lee, De La Cuesta, Labial, Iouciulescu, Moseley, Korson, & Al Malty, 2006 ; Qiu, Zhu, Jia, Chen, & Meng, 2014 ; Scheer et al., 2020). Additionally, there was heterogeneity in the form of interventions and out comes assessed, such as variations in water temperature, intervention duration, and type of therapy (hot, cold, oral), as well as a focus on different out comes, such as glycemia, vascularization, or quality of life. Further more, this integrative review it self has limitations, including a potential selection bias because the literature search was restricted to English-language articles (which excluded three non-English articles) andl imited to four specific databases. It is also important to note that because this study is an integrative review guided by the whitte more & knafl frame work, standard primary research metrics such as post-hoc power analysis, response rates, and probability sampling are not applic able to the design of this synthesis.

The short duration of the studies is another limitation, as most studies only evaluate short-term effects with out addressing long-term impacts or the biological mechanism sunderlying the benefits (Das et al., 2018 ; Dogaru et al., 2025 ; Mooventhan et al., 2020 ; Scheer et al., 2020 ; Schenaarts et al., 2024). Some studies also lack control for confounding variables such as daily activity or nutritional intake, which may influence the results (Bonab et al., 2023). Clinically, the effectiveness of hydrotherapy may be limited to certain stages of disease; for example, the benefits of spa therapy may besignifi can't only in patients with mild at her osclerosis (Petrofsky et al., 2006 ; Qiu et al., 2014). The circulatory response of diabetic patients to temperature may also be impaired, and global climate change may affect the comfort and safety of heat therapy. Additionally, many interventions are conducted in specialized settings such as sanatoriums or spa therapy centers, which may be difficult to replicate in the context of general hospital sor primary care settings (Bakaliuk, Makarchuk, & Stelmakh, 2022). The lack of standardization in temperature, duration, and type of water (e.g., mineral vs. regular) also makes it challenging to consistently replicate interventions (Kamioka et al., 2020).

Implications And Future Research Directions

Overall, hydrotherapy has potential as a safe, afford able, and supportive additional nursing intervention for the holistic care of patients with type 2 DM. However, to be widely recommended in evidence-based nursing practice, further standardized, randomized controlled studies with longer durations and larger sample sizes are needed. Such research should also explore the physiological mechanism sund erlying the effects of hydrotherapy in greater depth and develop practical and adaptive implementation guide lines for various health care settings.

CONCLUSION

This integrative review demonstrated that hydrotherapy, in various forms, such as water exercises, hot baths, compresses, and oral hydrotherapy, has potential as a complementary intervention in the management of type 2 DM. These interventions have generally been shown to provide benefits in terms of glycemic control, vascular function, quality of life, and clinical symptoms such as pain and mobility impairments. The advantages of hydrotherapy lie in its non pharmacological, non invasive, affordable, and relatively safe nature, making it a viable option in a holistic nursing approach, particularly in are as with limited resources. The role of nurses in implementing hydrotherapy iscrucial, particularly in patient education, clinical assessment and monitoring, intervention adjustments, and multidisciplinary collaboration. However, several challenges still need to be addressed, including methodological limitations in existing studies, lack of standardization in hydrotherapy protocols, and gaps in evidence regarding long-term effects and the underlying physiological mechanisms. The role of nurses in implementing hydrotherapy iscrucial, particularly in

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

patient education, clinical assessment and monitoring, intervention adjustments, and multidisciplinary collaboration. However, several challenges still need to be addressed, including methodological limitations in existing studies, lack of standardization in hydrotherapy protocols, and gaps in evidence regarding long-term effects and the underlying physiological mechanisms.

REFERENCES

Abdul Basith Khan, M., Hashim, M. J., King, J. K., Govender, R. D., Mustafa, H., & Al Kaabi, J. (2020). Epidemiology of type 2 diabetes—global burden of disease and forecasted trends. *Journal of epidemiology and global health*, *10*(1), 107-111.

Andriati, R., Pratiwi, R. D., Muthoinah, L., Yudiatma, M. F., & Poddar, S. (2025). Hydrotherapy on Reducing Blood Sugar Levels in Patients with Type II Diabetes Mellitus in Ciputat Village, South of Tangerang City. *Window of Health: Jurnal Kesehatan*, 40-48.

Åsa, C., Maria, S., Katharina, S. S., & Bert, A. (2012). Aquatic exercise is effective in improving exercise performance in patients with heart failure and type 2 diabetes mellitus. *Evidence-Based Complementary and Alternative Medicine*, *2012*(1), 349209.

Bakaliuk, T. G., Makarchuk, N. R., & Stelmakh, H. O. (2022). Assessment of the Quality of Life of Patients with Diabetic Polyneuropathy Using Hydrogen Sulphide Baths. *Acta Balneologica*, *170*(4).

Beever, R. (2010). The effects of repeated thermal therapy on quality of life in patients with type II diabetes mellitus. *The Journal of Alternative and Complementary Medicine: Paradigm, Practice, and Policy Advancing Integrative Health*, *16*(6), 677-681.

Blahova, J., Martiniakova, M., Babikova, M., Kovacova, V., Mondockova, V., & Omelka, R. (2021). Pharmaceutical drugs and natural therapeutic products for the treatment of type 2 diabetes mellitus. *Pharmaceuticals*, *14*(8), 806.

Bonab, S. B., & Dastah, S. (2023). Performing training in water improves glucose homeostasis and lipocalins in women with type 2 diabetes mellitus. *Science & Sports*, *38*(1), 34-41.

Chidambaram, Y., Vijayakumar, V., Ravi, P., Boopalan, D., Anandhan, A., & Kuppusamy, M. (2024). Does hydrotherapy influence plasma glucose levels in type 2 diabetes?–A scoping review. *Journal of Complementary and Integrative Medicine*, *21*(1), 14-18.

Das, S. V., Mooventhan, A., & Manjunath, N. K. (2018). A Study on Immediate Effect of Cold Abdominal Pack on Blood Glucose Level and Cardiovascular Functions in Patients with Type 2 Diabetes Mellitus. *Journal of Clinical & Diagnostic Research*, *12*(3).

De Fronzo, R. A., Ferrannini, E., Groop, L., Henry, R. R., Herman, W. H., Holst, J. J., Hu, F. B., Kahn, C. R., Raz, I., Shulman, G. I., & Simonson, D.C. (2015). Type 2 diabetes mellitus. *Nature reviews Disease primers*, *1*(1), 15019.

Dogaru, G., Ciubean, A. D., Marinescu, L., Pop, B. M., Pașca, G. S., & Ciumărnean, L. (2025). The effectiveness of balneotherapy on pain, walking, and function in patients with diabetic neuropathy: a prospective observational study. *International Journal of Biometeorology*, *69*(2), 319-329.

Endang, S. P. N., Rizki, F., Ah, Y., Bisepta, P., & Ifa, H. (2024). Factors Associated with Positive Religious Coping in Diabetic Foot Ulcer Patients in Indonesia. *Journal of Korean Academy of psychiatric and Mental Health Nursing*, *33*(3), 221-228.

Fioravanti, A., Adamczyk, P., Pascarelli, N. A., Giannitti, C., Urso, R., Tołodziecki, M., & Ponikowska, I. (2015). Clinical and biochemical effects of a 3-week program of diet combined with spa therapy in obese and diabetic patients: a pilot open study. *International journal of biometeorology*, *59*(7), 783-789.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

Forray, A. I., Coman, M. A., Simonescu-Colan, R., Mazga, A. I., Chereches, R. M., & Borzan, C. M. (2023). The global burden of type 2 diabetes attributable to dietary risks: insights from the global burden of disease study 2019. *Nutrients*, *15*(21), 4613.

Huang, X., Wu, Y., Ni, Y., Xu, H., & He, Y. (2025). Global, regional, and national burden of type 2 diabetes mellitus caused by high BMI from 1990 to 2021, and forecasts to 2045: analysis from the global burden of disease study 2021. *Frontiers in public health*, *13*, 1515797.

Kamioka, H., Mori, Y., Horiuchi, T., Hayashi, T., Ohmura, K., Yamaguchi, S., & Kato, M. (2020). Association of daily home-based hot water bathing and glycemic control in ambulatory Japanese patients with type 2 diabetes mellitus during the COVID-19 pandemic: A multicenter cross-sectional study. *Diabetes, Metabolic Syndrome and Obesity*, 5059-5069.

Leite, R. G. O. F., Banzato, L. R., Galendi, J. S. C., Mendes, A. L., Bolfi, F., Veroniki, A. A., Thabane, L, & Nunes-Nogueira, V. D. S. (2020). Effectiveness of non-pharmacological strategies in the management of type 2 diabetes in primary care: a protocol for a systematic review and network meta-analysis. *BMJ open*, *10*(1), e034481.

Lin, X., Xu, Y., Pan, X., Xu, J., Ding, Y., Sun, X., Song, X., Ren, Y., & Shan, P. F. (2020). Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Scientific reports*, *10*(1), 14790.

Młynarska, E., Czarnik, W., Dzieża, N., Jędraszak, W., Majchrowicz, G., Prusinowski, F., Stabrawa, M., Rysz, J., & Franczyk, B. (2025). Type 2 diabetes mellitus: new pathogenetic mechanisms, treatment and the most important complications. *International journal of molecular sciences*, *26*(3), 1094.

Mooventhan, A., Chaudhari, S. S., & Venugopal, V. (2019). Effect of cold hip bath on blood glucose levels in patients with type 2 diabetes mellitus: A pilot study. *Diabetes & Metabolism*, *46*(5), 411-412.

Mooventhan, A., Gowthami, R., Krishnamurthy, D., & Nivethitha, L. (2024). A narrative review on the role of naturopathy in the management of diabetes mellitus. *Journal of Integrative Medicine and Research*, *2*(4), 229-234.

Mooventhan, A., Venugopal, V., & Chaudari, S. S. (2020). Twenty minutes of gastro-hepatic pack reduces blood glucose levels in patients with type 2 diabetes mellitus: A pilot single group pre-post study. *Advances in Integrative Medicine*, *7*(3), 148-151.

Ohtsuka, Y., Yabunaka, N., Watanabe, I., Noro, H., & Agishi, Y. (1996). Balneotherapy and platelet glutathione metabolism in type II diabetic patients. *International Journal of Biometeorology*, *39*(3), 156-159.

Petrofsky, J. S., Lohman 3rd, E., Lee, S., De La Cuesta, Z., Labial, L., Iouciulescu, R., Moseley, B., Korson, R., & Al Malty, A. (2006). The influence of alterations in room temperature on skin blood flow during contrast baths in patients with diabetes. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*, *12*(7), CR290-5.

Petrofsky, J., Lohman III, E., Lee, S., Cuesta, Z. D. L., Labial, L., Iouciulescu, R., Moseley, B., Korson, R., & Malty, A. A. (2007). Effects of contrast baths on skin blood flow on the dorsal and plantar foot in people with type 2 diabetes and age-matched controls. *Physiotherapy Theory and Practice*, *23*(4), 189-197.

Qiu, Y., Zhu, Y., Jia, W., Chen, S., & Meng, Q. (2014). Spa adjuvant therapy improves diabetic lower extremity arterial disease. *Complementary Therapies in Medicine*, *22*(4), 655-661.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373

Raveendran, A. V. (2018). Non-pharmacological Treatment Options in the Management of Diabetes Mellitus. *European Endocrinology*, *14*(2), 31.

Rob, A., Hoque, A., Asaduzzaman, M. M., Khatoon, M. A. A., Khalil, R., Thomas, D., Ilyas, M., Mahmood, H., & Chowdhury, T. A. (2025). The global challenges of type 2 diabetes. *Bangladesh Journal of Medicine*, *36*(2), 92-98.

Scheer, A. S., Naylor, L. H., Gan, S. K., Charlesworth, J., Benjanuvatra, N., Green, D. J., & Maiorana, A. J. (2020). The effects of water-based exercise training in people with type 2 diabetes. *Medicine and science in sports and exercise*, *52*(2), 417-424.

Schenaarts, L., Hendriks, F. K., Fuchs, C. J., Sluijsmans, W. E., Snijders, T., & van Loon, L. J. (2024). A single sauna session does not improve postprandial blood glucose handling in individuals with type 2 diabetes mellitus: a cross-over, randomized, controlled trial. *Experimental and Clinical Endocrinology & Diabetes*, *132*(11), 622-630.

Setiawan, A., & Pribadi, D. R. A. (2024). The Effect of Hydrotherapy on Reducing Blood Sugar Levels in Patients with Diabetes Mellitus. *Journal of Health Sciences*, *17*(02), 100-106.

Sirait, H. S., Said, F. M., & Mohamad, N. A. (2025). Non-Pharmacology Therapy For Reducing Vascular Inflammation Among Type 2 Diabetes Mellitus Patient: A Literature Review. *Holistic Nursing Plus*, *3*(1), 90-106.

Sunaryo, T., Lestari, S., & Khor, B. F. A. S. (2020). The effect of oral hydrotherapy on risk reduction of diabetic feet ulcer among people with type-2 diabetes mellitus. *Enfermeria Clinica*, *30*, 192-195.

Vijay, A., Nivethitha, L., Mooventhan, A., & Manavalan, N. (2025). The impact of cold hydrotherapy applications on insulin resistance in patients with type 2 diabetes mellitus: A protocol for a single group pre post test study. *Bangladesh Journal of Endocrinology and Metabolism*, *4*(2), 61-66.

Wang, X., Kang, J., Liu, Q., Tong, T., & Quan, H. (2020). Fighting diabetes mellitus: Pharmacological and non-pharmacological approaches. *Current pharmaceutical design*, *26*(39), 4992-5001.

Whittemore, R., & Knafl, K. (2005). The integrative review: updated methodology. *Journal of advanced nursing*, *52*(5), 546-553.

Xu, S. T., Sun, M., & Xiang, Y. (2025). Global, regional, and national trends in type 2 diabetes mellitus burden among adolescents and young adults aged 10–24 years from 1990 to 2021: a trend analysis from the Global Burden of Disease Study 2021. *World Journal of Pediatrics*, *21*(1), 73-89.

Ye, J., Wu, Y., Yang, S., Zhu, D., Chen, F., Chen, J., Ji, X., & Hou, K. (2023). The global, regional and national burden of type 2 diabetes mellitus in the past, present and future: a systematic analysis of the Global Burden of Disease Study 2019. *Frontiers in endocrinology*, *14*, 1192629.

Zheng, Y., Ley, S. H., & Hu, F. B. (2018). Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nature reviews endocrinology*, *14*(2), 88-98.

Zhou, Z., Sun, B., Yu, D., & Zhu, C. (2022). Gut microbiota: an important player in type 2 diabetes mellitus. *Frontiers in cellular and infection microbiology*, *12*, 834485.

Yutika Wiguna*, Nursiswati, Kusman Ibrahim

Fakultas Keperawatan Universitas Padjadjaran
Corresponding Author: Yutika Wiguna. *E-mail: yutika24001@mail.unpad.ac.id

DOI: https://doi.org/10.33024/minh.v9i2.2373