

REVIEW ARTICLE

Benefit, Procedure and Consideration of the Warm Foot Baths on Type 2 *Diabetes mellitus* (T2DM) Patients: A Review

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ABSTRACT

A warm foot bath is a complementary therapy commonly used by patients with chronic illnesses like Type 2 *Diabetes mellitus* (T2DM). While this therapy offers benefits for T2DM patients, its effectiveness depends on the procedure and the patient's condition. Studies investigating these topics have been conducted independently, resulting in a lack of comprehensive information about warm foot bath therapy for T2DM patients. This study aims to review and synthesize previous studies related to the benefits, procedures, and considerations of warm foot baths for Type 2 *Diabetes mellitus* patients. We conducted a literature review study using the PRISMA approach. Articles were extracted from several databases, namely PubMed, Garuda Rujukan Digital, and Google Scholar. The Mixed Method Appraisal Tool was implemented to assess the eligibility of the articles. A total of 664 articles were harvested from the databases in this study. Twelve eligible articles were identified, and several major themes were mapped. Warm foot bath therapy provided positive physical benefits when considering water temperature, duration, and the physical condition of the patient during therapy. In some cases, adding complementary substances such as aromatherapy, salts, or herbs during therapy may improve the outcomes of warm foot bath therapy for T2DM patients. Our study mapped several benefits of warm foot bath therapy. While procedures may vary, they share similar considerations regarding water temperature, duration, and the physical condition of the patient. Further studies are needed to investigate the correlation of our findings more comprehensively.

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INTRODUCTION

Type 2 *Diabetes mellitus* (T2DM) presents a multifaceted challenge, particularly concerning its complications on foot health. Peripheral neuropathy, impaired circulation, and increased susceptibility to infection commonly afflict individuals with T2DM, heightening the risk of debilitating foot complications such as ulcers and amputations (1). Globally, the prevalence of diabetic foot problems was 30% among *Diabetes mellitus* patients and higher among T2DM patients (2). For the specific population, such as in older patients, the diabetic foot problem was up to 50% appear (3). The combination of neuropathy and compromised circulation can lead to decreased sensation and delayed

wound healing, making T2DM patients vulnerable to developing chronic foot ulcers that are difficult to treat and prone to infection (4–6). Moreover, diabetic foot ulcers significantly increase the risk of lower extremity amputations, further underscoring the urgent need for effective interventions to prevent and manage these complications. As such, addressing foot health in T2DM patients is paramount to mitigating the progression of the disease and improving overall outcomes (7).

In response to the complex challenges posed by diabetic foot complications, there is been a growing emphasis on employing non-pharmacological therapies to support diabetic foot condition. These interventions encompass a diverse range of modalities, including but not limited to, foot care education, regular foot examinations, appropriate footwear selection, and foot-specific exercises. Such approaches aim to empower individuals with T2DM to actively engage in preventive foot care practices, thereby reducing the incidence of

complications such as ulcers and amputations (4,8). Additionally, non-pharmacological therapies focus on addressing the underlying factors contributing to foot health deterioration, such as neuropathy and impaired circulation, through techniques like warm water foot therapy, physical therapy, and lifestyle modifications. By integrating these non-pharmacological interventions into diabetic foot care regimens, healthcare professionals can provide comprehensive and personalized support to T2DM patients, ultimately enhancing their quality of life and minimizing the burden of diabetic foot complications (9).

Various modality therapies are commonly employed in diabetic foot care, including warm water foot therapy, topical treatments, orthotic devices, compression therapy, electrotherapy, low-level laser therapy (LLLT), acupuncture, ultrasound therapy, hyperbaric oxygen therapy (HBOT), and manual therapies (8,10–13). Each modality offers unique benefits, such as improving circulation, reducing inflammation, alleviating pain, and promoting tissue healing. However, determining the most effective therapy presents challenges due to conflicting evidence and individual variability in patient response. These modalities are often integrated with conventional medical treatments and lifestyle interventions to provide comprehensive diabetic foot care, emphasizing the importance of personalized approaches tailored to individual patient needs and characteristics (14–16).

The implications of warm water foot therapy on diabetic foot care are profound, suggesting a potential paradigm shift in the management of diabetic complications. By addressing the multifaceted nature of diabetic foot pathology, including neuropathy, impaired circulation, and psychological well-being, this non-pharmacological intervention offers a holistic approach that complements traditional medical treatments (17). Warm water foot baths offer benefits for individuals with *Diabetes mellitus*, aiding in the management of peripheral neuropathy and enhancing circulation in the feet. This improved circulation supports wound healing and reduces the risk of complications related to poor circulation (18). Additionally, warm water foot baths provide temporary relief from the symptoms of peripheral neuropathy, such as numbness and tingling. Furthermore, these baths promote relaxation, potentially improving stress levels and blood sugar control (19). However, it's crucial for diabetes patients to take precautions, such as testing water temperature, limiting soaking time, and consulting healthcare professionals, to ensure safe and effective foot care. By incorporating these precautions, individuals with diabetes can enjoy the benefits of warm water foot baths as part of their overall foot care routine (20).

The efficacy of various modality therapies for diabetic foot care remains a subject of ongoing debate and scrutiny within the health professional community,

including warm water foot bath therapy. While warm water foot bath therapy offers unique mechanisms of action and potential benefits, determining their comparative efficacy presents a significant challenge due to the heterogeneous nature of diabetic foot complications and the variability in patient response. Some warm water foot therapy and topical treatments, have demonstrated promising results in improving circulation, reducing pain, and promoting wound healing in certain individuals. However, the evidence supporting their efficacy may be limited by factors such as small sample sizes, short-term follow-up, and the lack of standardized protocols (19).

Conflicting findings and inconsistencies in study outcomes further complicate the evaluation of warm water foot bath therapy for diabetic foot care. For example, while some studies suggest that warm water foot baths can effectively manage edema and prevent ulcers, others raise concerns about their potential to exacerbate peripheral neuropathy or compromise arterial circulation in certain patients. Similarly, the optimal parameters for warm water foot baths remain unclear, with studies reporting variable outcomes depending on factors such as treatment duration, water temperature, and the addition of therapeutic agents. Moreover, individual patient characteristics, including the severity of neuropathy, vascular status, and comorbidities, may influence the efficacy and safety of warm water foot baths, highlighting the need for personalized treatment approaches in diabetic foot care (21).

The challenge of identifying the optimal modality therapy for diabetic foot care underscores the complexity of managing Type 2 *Diabetes mellitus* (T2DM) and its associated complications. While warm water foot therapy showed promise in addressing neuropathic symptoms, enhancing circulation, and improving overall foot health, its precise benefits, procedural protocols, and considerations for patient selection remain to be fully elucidated. A literature review study is needed to establish understanding of benefit, procedure and practical consideration in warm water foot therapy to optimize the outcomes of its therapy. By addressing these knowledge gaps and refining our understanding of the benefits, procedures, and practical considerations associated with warm water foot bath therapy, clinicians can better tailor treatment strategies to optimize outcomes and enhance the quality of life for individuals living with T2DM.

MATERIALS AND METHODS

This research embarked on an extensive literature review, leveraging reputable health research databases such as PubMed, Garuda Rujukan Digital, and Google Scholar. Employing the PICO approach, some research questions tailored to the study's context emerged: What are the benefits of warm water foot bath therapy on

type 2 *Diabetes mellitus* patients?, What is the general procedure of the warm water foot bath therapy on type 2 *Diabetes mellitus* patients? And What are the practical considerations of warm water foot bath therapy on type 2 *Diabetes mellitus* patients?

To navigate the vast array of available literature, targeted article searches were conducted using specific keywords like "*Diabetes mellitus*" OR "*Diabetes mellitus* type 2" OR "T2DM" OR "diabetic foot", in combination with terms such as "warm water foot bath" OR "foot bath" OR "foot soak" OR "rendam air hangat, "procedures" alongside "modality therapy". Inclusion criteria were meticulously defined, focusing on articles addressing warm water foot bath therapy for T2DM patients, published in English between 2019 and 2024. However, certain study types like pilot studies, feasibility studies, and literature reviews were excluded to ensure a streamlined focus. Additionally, articles falling below a predetermined threshold score (set at 80) on the Mixed Method Appraisal Tool (MMAT) were excluded from critical appraisal to maintain methodological rigor (22).

The screening and identification process of relevant articles adhered to the PRISMA framework, ensuring a structured and systematic approach (23). Eligible articles underwent thorough examination, with their findings meticulously recorded in a tabular format. Subsequently, a synthesis of these findings was undertaken, narrating and visualizing the results following the typology of literature review research to enhance comprehension. This systematic approach enabled a comprehensive understanding of the existing literature, shedding light on the implications of digital health implementations in decubitus prevention among patients and providing valuable insights for future research and practice in this domain.

RESULTS

After conducting a search across targeted databases, a comprehensive total of 664 articles were initially identified, meeting the inclusion criteria. To ensure the quality and relevance of the articles, a rigorous screening process was undertaken, involving the removal of duplicates and the assessment of titles, abstracts, and content. This meticulous screening procedure resulted in the selection of eligible articles for further analysis. The article selection and screening process are illustrated in (Figure 1), following the PRISMA flow diagram as prescribed by the researchers.

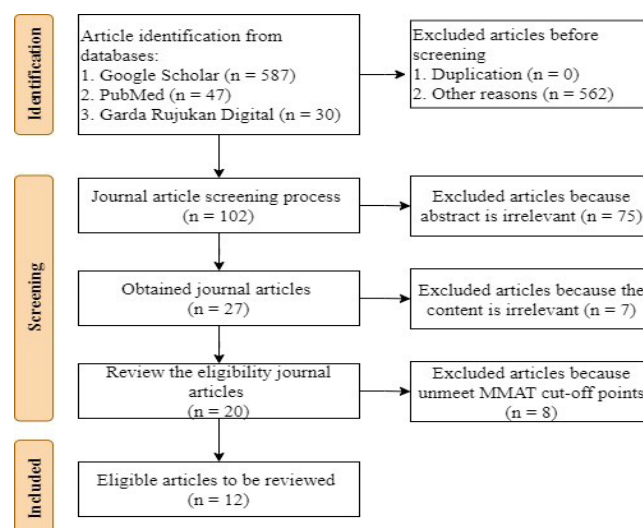


Figure 1: The article selection and screening process

Following the screening process, it was determined that 12 articles met the criteria established by the research team. These selected articles underwent thorough critical appraisal using MMAT, and the resulting information from this assessment is presented in (Table I).

The studies reviewed encompass a variety of interventions aimed at improving foot health and addressing associated complications in patients with Type 2 *Diabetes mellitus* (T2DM). These interventions range from warm water foot baths combined with exercises to music therapy and herbal foot baths. Researchers employed different evaluation methods, such as quasi-experiments, randomized controlled trials (RCTs), and retrospective studies, to assess outcomes including foot sensitivity, blood glucose levels, nerve conduction velocity, and fatigue. Despite the diversity in methodologies and interventions, several consistent findings emerged, indicating the potential efficacy of warm water foot baths in improving foot sensitivity, reducing blood glucose levels, enhancing nerve conduction velocity, and alleviating fatigue among diabetic patients. However, challenges remain in standardizing intervention protocols, identifying optimal parameters for treatment, and addressing individual patient characteristics to ensure personalized and effective care. Further research is needed to elucidate the mechanisms underlying the therapeutic effects of warm water foot baths and to establish evidence-based guidelines for their implementation in diabetic foot care regimens.

Table I: Information from Selected Articles related to Warm Water Foot Bath Therapy for Type 2 Diabetes Mellitus Patients

Authors	Year	Evaluation Aspects	Method	Sampling method	Subjects	Inclusion	Exclusion	Additional treatment	Method of foot bathing	Evaluation Method	Outcomes	MMAT Score
Hasaini et al.	2023	Foot sensitivity	Quasy experiment non-equivalent pretest and post-test between two group	Did not mention	36 subjects	did not explained	did not clearly explained	Buerger Allen exercise	Foot soaking uses warm water with a temperature in the range of 37.7-40.5°C. Patients place their feet into warm water for 20 minutes. This procedure may be repeated 2 times a day for 6 consecutive days.	10 gram monofilament	Foot soaking before and after therapy significantly improves patients' foot sensitivity, with a p-value of 0.000.	80
Wardani et al.	2023	Ankle Brachial Index (ABI), Foot sensitivity, Sleep quality	Quasy experiment	Simple random sampling	150 subjects	Patient with no lower extremity disorders	did not clearly explained	Buerger Allen exercise, Music therapy	Did not explain clearly	Hammer reflex, cotton swab, sphgmomanometer, Pittsburgh Sleep Quality Index (PSQI)	All outcomes exhibited significant improvement after the intervention.	80
Song et al.	2023	Nerve conduction velocity, Blood indicator. TCM symptom score	Retrospective study	Consecutive sampling	120 subjects	Age 18-73, HbA1C <7.5%, and fasting blood glucose (FPG) <7.0 mmol/L without history of TCM	Patient with stroke, neuropathy caused by another factors Received surgery Contraindication to the substances in the study patients with ketoacidosis metabolic patient with lower limb edema or skin diseases patients with retardation	Traditional Chinese Medicine (TCM)	The patients' feet were soaked in warm water for 20 minutes, with the water temperature maintained at 39°C. This treatment lasted for one month. However, the method did not specify the amount of water used.	Electromyography Laboratory testing TCM symptom scoring	This study demonstrated that nerve conduction velocity was significantly higher than that of the control group (p < 0.001). Sensory function was assessed using two indicators: motor nerve conduction velocity and sensory nerve conduction velocity Furthermore, the study found that blood glucose levels were significantly lower in the intervention group compared to the control group (p < 0.001).	100
Savitri & Ratnawati,	2022	Blood Glucose Level	Quasy-experiment pretest and post-test without control group	Consecutive sampling	16 subjects	Did not explained clearly	Did not explained clearly	Buerger Allen exercise therapy	The soak therapy was administered after each Buerger Allen session, totaling 12 sessions over the course of 2 weeks.	Glucometer	The blood glucose levels gradually decreased with each test session. The statistical results indicated that this intervention effectively lowered blood glucose levels in patients with Type 2 Diabetes Mellitus (p < 0.001).	80

CONTINUE

Table I: Information from Selected Articles related to Warm Water Foot Bath Therapy for Type 2 Diabetes Mellitus Patients (CONT.)

Authors	Year	Evaluation Aspects	Method	Sampling method	Subjects	Inclusion	Exclusion	Additional treatment	Method of foot bathing	Evaluation Method	Outcomes	MMAT Score
Ainiyah et al.	2022	Blood Glucose Level	Quasi-experiment pretest and post-test without control group	Purposive sampling	60 subjects	Patients with no complication such as cardiovascular or renal failure	Did not explain	Sauna bathing therapy	Diabetic foot exercises were performed before the foot spa treatment. The feet were then soaked in warm water for 5 minutes, followed by a massage with scrub, rinsing, and application of foot moisturizer. This treatment regimen was repeated three times a week.	Glucometer	The blood glucose levels in the intervention group were significantly lower compared to the control group ($p < 0.001$).	80
Ghosh et al.	2022	Fatigue, quality of sleep and fasting blood sugar level	Quasi-experiment non randomized	Purposive sampling	60 subjects	Did not explain clearly	Did not explain clearly	Bath tub	The patient's feet will be soaked in warm water with a temperature of 40 degrees Celsius ($\pm 2^\circ\text{C}$) for 15 minutes. The volume of water for foot bathing was 6 liters. This intervention was conducted for one week and repeated twice daily.	Modified revised piper fatigue scale, modified Groningen sleep quality scale, glucometer	The fatigue level significantly decreased after foot bathing ($p < 0.001$), and both the quality of sleep and fasting blood glucose level also showed significant improvements ($p < 0.05$).	100
Huang et al.	2024	Toronto Clinical Scoring System total score (TCSS-TS) Bilateral nerves conduction velocity	RCT	Randomized sampling with double-blind	632 subjects	Blood glucose, blood lipid, serum inflammation cytokines	Did not explain clearly	Herbal medicine, thermodynamic foot bath	The patients received foot baths containing 6.69 grams of Tangi Welxing Decocotion daily for 30 minutes, followed by a two-week rest period. The warm water temperature ranged from 38° to 42°C .	TCSS-TS scale, electromyogram, EQ-5D questionnaire	There were no significant differences between the high-dose and low-dose groups in terms of the outcomes in this study. However, the TCSS-TS score was significantly different compared to the control group or the low-dose group.	100
Ainiyah & Wardani	2021	Quality of sleep Blood glucose level	Quasi-experiment	Simple random sampling	128 subjects	Patients with no heart diseases, kidney failure or stroke	Did not explain clearly	Sauna bathing therapy	After the foot spa, soaking was performed for 5 minutes, followed by foot scrubbing, rinsing, and moisturizing. This intervention was repeated three times a week	PSQI Glucometer	Foot bathing can lower blood glucose levels and improve the quality of sleep among Type 2 Diabetes Mellitus (T2DM) patients ($p < 0.001$)	80

CONTINUE

Table 1: Information from Selected Articles related to Warm Water Foot Bath Therapy for Type 2 Diabetes Mellitus Patients (CONT.)

Authors	Year	Evaluation Aspects	Method	Sampling method	Subjects	Inclusion	Exclusion	Additional treatment	Method of foot bathing	Evaluation Method	Outcomes	MMAT Score
Vaghasloo et al.	2020	Pain on peripheral neuropathy	Prospective RCT	Randomized sampling	20 subjects per groups	Age 30-70 HbA1C <10% BG <200 mg/dL	Ulcerations Treatment modalities i.e. massage, cupping etc within a month hypotension use corticosteroid drug History of kidney, heart and brain disorder	Salt solution for water and electric footbath	Each night before bedtime, patients were instructed to sit on a chair with back support and knees held at a comfortable angle, with trousers pulled up 5 cm above the ankles. A 5-liter electronic foot bath was filled with warm water maintained at a temperature of 40-45°C. Patients soaked their feet in the warm water for 15 minutes. After foot bathing, they dried their feet with a towel and wore a pair of socks. In contrast, another group soaked their feet in water to which 250 grams of mineral salt had been added.	Douleur Neuropathique 4 Questionnaire, McGill Pain Questionnaire, WHOC-OL-BREF	Both warm water and warm water + salt solution significantly lowered the DN4 level of patients (p < 0.001). These two treatments effectively reduced pain in peripheral neuropathy associated with Type 2 Diabetes Mellitus (T2DM), with the warm water + salt solution being the most effective. The DN4 levels were significantly different, with the warm water + salt solution showing the greatest reduction. While the McGill scale did not show any differences between the two types of warm water treatment, it was significantly different from the control group. However, there were no differences observed in the WHOQOL-BREF scores among all evaluation results.	100
Permatasari et al.	2020	Foot sensitivity	quasi experiment	Purposive sampling	16 subjects	did not explained	Did not explained clearly	foot exercise	Patients with Type 2 Diabetes Mellitus received foot bathing six times over a two-week period.	10 gram monofilament	Foot sensitivity improved after receiving warm water foot baths and foot exercises.	80
Mataputun et al.	2020	ABI, Blood glucose level	Quasi experiment non-equivalent pretest and post-test and between two group	Block-permutated randomized sampling	150 subjects	age >40 ABI <0.90	Did not explained clearly	Bueger Allen exercise therapy	The foot bathing occurred for 5 consecutive days. The treatment was administered twice daily, with each session lasting 15-20 minutes.	Vascular doppler Glucometer	The Ankle-Brachial Index (ABI) after warm water treatment showed improvement compared to pre-treatment values, with statistically significant results. However, blood glucose levels were not significantly affected by warm water foot bathing therapy.	80
Farnia et al.	2019	Fatigue	RCT	Randomized sampling	35 subjects each group	Controlled T2DM, fatigue score was 4 according to piper scale	Having ulceration, skin disorder, history of venous thrombosis or varicose veins	Did not explained clearly	The patient's feet were soaked in warm water maintained at 40±2°C for 20 minutes. The volume of water for foot bathing was 6 liters. The patient's feet were submerged in the water at least 10 cm above the wrists. This intervention was conducted for 2 weeks, with 8 sessions performed daily.	Piper fatigue scale	The overall fatigue level decreased after foot bathing. Piper's dimensions, including behavioral, affective, sensory, and mood aspects, were significantly different compared to the control group (p < 0.001).	80

DISCUSSION

Benefits

The findings from the compiled data suggested a promising role for warm water foot therapy in managing various aspects of Type 2 *Diabetes mellitus* (T2DM). Across multiple studies, this non-pharmacological intervention exhibited consistent and significant improvements in foot sensitivity (24–26), nerve conduction velocity (27), and blood glucose levels among T2DM patients (27–30). Notably, foot soaking sessions were associated with reduced fatigue levels (30,31), enhanced sleep quality (30,32), and an overall improvement in well-being, underscoring the holistic benefits of this therapy (25,33). Moreover, warm water foot therapy demonstrated efficacy in mitigating pain related to peripheral neuropathy (34), offering a potentially valuable adjunctive treatment for pain management in diabetic individuals. These collective outcomes highlighted the therapeutic potential of warm water foot therapy as a safe and accessible intervention for addressing diabetic foot complications and enhancing the overall health outcomes of T2DM patients.

However, while the evidence consistently supported the positive effects of warm water foot therapy, further research is warranted to elucidate its mechanisms of action and long-term effectiveness. Additionally, future studies should explore optimal treatment protocols, including the frequency, duration, and temperature of foot soaking sessions, to maximize therapeutic benefits. Moreover, considering the diverse nature of diabetic foot complications and individual patient characteristics, personalized approaches to warm water foot therapy may be necessary to optimize outcomes and ensure its efficacy across different patient populations. Overall, the collective findings underscored the potential of warm water foot therapy as a valuable adjunctive therapy in the comprehensive management of T2DM, warranting continued investigation and integration into clinical practice.

Procedures

Warm water foot therapy, as evidenced by various studies, presents a promising adjunctive treatment for managing Type 2 *Diabetes mellitus* (T2DM) and its associated complications. Although the specific protocols varied across studies, a general procedure for warm water foot therapy typically involves soaking the feet in warm water with temperatures ranging from 37.7 to 40.5°C for durations of 15 to 20 minutes per session. This therapy may be repeated multiple times a day for consecutive days, ranging from 6 days to 2 weeks, or even up to a month in some cases. The volume of water used in foot baths is usually not explicitly specified but commonly ranges from 5 to 6 liters, with some studies mentioning the addition of therapeutic agents like herbal decoctions or mineral salts.

Considerations for warm water foot therapy include ensuring the water temperature remains within the specified range to avoid thermal injury or discomfort for patients. Additionally, maintaining proper hygiene standards, such as using clean water and foot baths, is crucial to prevent infections, especially in diabetic individuals who may be more susceptible to foot complications (19). Patients should be advised on the frequency and duration of foot soaking sessions, taking into account individual preferences and tolerances. Moreover, the integration of complementary therapies like foot exercises, massage, or moisturization following foot baths may further enhance the therapeutic benefits of warm water foot therapy. Overall, the standardized implementation of warm water foot therapy, coupled with personalized considerations and adjunctive treatments, holds promise in effectively managing diabetic foot complications and improving the overall well-being of T2DM patients.

Practical Considerations for Warm Water Foot Bath Therapy

From the data presented, it was evident that warm water foot therapy can yield significant benefits for patients with Type 2 *Diabetes mellitus* (T2DM), particularly in improving foot sensitivity, reducing blood glucose levels, and alleviating fatigue. However, several considerations emerge from the findings. Firstly, the effectiveness of warm water foot therapy seems to be enhanced when combined with other treatment modalities, such as herbal medicine or foot exercises (18,27,33). This suggested that a multimodal approach may yield superior outcomes compared to stand-alone therapy. Additionally, the duration and frequency of foot bathing sessions, as well as the temperature of the water, should be carefully considered to optimize therapeutic effects and ensure patient safety.

Moreover, the results underscored the importance of addressing confounding factors and ensuring clarity in methodology when evaluating the efficacy of warm water foot therapy. While some studies demonstrated statistically significant improvements in outcomes such as nerve conduction velocity and blood glucose levels (24), others suggested that the contribution of warm water alone may be less significant when compared to adjunctive treatments or variations in study design. Therefore, future research should aim to standardize protocols and control for potential confounders to provide a clearer understanding of the true benefits of warm water foot therapy for T2DM patients (11).

In summary, while warm water foot therapy showed promise as a non-pharmacological intervention for managing diabetic foot complications, its efficacy may be influenced by various factors, including treatment duration, frequency, temperature, and the inclusion of adjunctive therapies. By addressing these considerations

and conducting well-designed studies, healthcare providers can better harness the therapeutic potential of warm water foot therapy to improve outcomes and enhance the quality of life for individuals living with T2DM.

Limitation

While the literature review on warm water foot therapy for Type 2 *Diabetes mellitus* (T2DM) patients offers valuable insights, several limitations should be acknowledged. Firstly, the review's restriction to articles published in English between 2019 and 2024 may introduce publication bias because probably more articles that discussing warm water foot bath therapy were published before our time restriction, potentially excluding relevant studies in other languages or published earlier. The heterogeneity of interventions, encompassing variations in treatment protocols and outcome measures, may limit comparability and generalizability. By excluding certain study types like pilot and feasibility studies, the review might overlook preliminary evidence or innovative approaches. Methodological biases in study selection and data extraction could also affect the reliability of findings. Furthermore, the limited scope and generalizability of included studies, coupled with short follow-up periods, underscore the need for future research to address these limitations and provide more robust evidence for warm water foot therapy's efficacy in T2DM management.

CONCLUSION

The literature review on warm water foot therapy for Type 2 *Diabetes mellitus* (T2DM) patients provided valuable insights into its potential benefits and procedural considerations. Despite the promising findings indicating improvements in foot sensitivity, nerve conduction velocity, blood glucose levels, and overall well-being among T2DM patients, several limitations should be acknowledged. The restriction to English-language articles published between 2019 and 2024 may introduce publication bias, potentially excluding relevant studies. Additionally, the heterogeneity of interventions, variations in outcome measures, and methodological biases in study selection and data extraction may limit comparability and generalizability. To address these limitations and advance knowledge in this area, future research should adopt a more inclusive approach by considering studies published in languages other than English and including a wider range of publication dates. Transparent criteria for study inclusion and critical appraisal, as well as standardized protocols for warm water foot therapy interventions, would enhance consistency and reliability across studies. Longitudinal studies with larger sample sizes and diverse populations are needed to provide more robust evidence on the efficacy and safety of warm water foot therapy for T2DM management. Furthermore, exploring the synergistic effects of warm water foot therapy with other

treatment modalities and investigating optimal treatment parameters would contribute to optimizing therapeutic outcomes. By addressing these recommendations, researchers can better understand the role of warm water foot therapy in T2DM management and improve the quality of care for individuals living with this condition.

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