


Foot Exercise and Related Outcomes in Patient With Diabetes Mellitus: A Literature Review

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Article info	Abstract
<p>Article history: Received: August 16th, 2022 Revised: August 31th, 2022 Accepted: September 15th, 2022</p> <hr/> <p>Correspondent author: Name: Theodehild M. Theresia Dee Address: Baumata Barat, Taebenu, Kupang Regency, East Nusa Tenggara, Indonesia E-mail: ersidee@gmail.com</p> <hr/> <p>International Journal of Nursing and Health Services (IJNHS) Volume 5, Issue 5, October 20th, 2022 DOI: 10.35654/ijnhs.v5i5.638 E-ISSN: 2654-6310</p>	<p>Background: Diabetic foot ulcer is one of the most common complications in patients with diabetes mellitus. The incidence of diabetes foot ulcers affects morbidity, mortality, and financing. Foot exercise is one of the recommendations for a patient with diabetes to prevent dan accelerate the healing of the diabetic wound. Objective: This paper aims to review the literature on foot exercise and its effect. Method: A literature review was conducted in this study. Search literature used predefined keywords through several databases, namely Scopus, ProQuest, PubMed, and CINAHL. The selection of journals is based on the inclusion and exclusion criteria. Results: Seven articles met the inclusion criteria. The review showed the effect of foot exercise on diabetic foot ulcer risk factors, wound healing, and recurrence of ulcers. Recommendation: Foot exercise can be used as an option for the patient with diabetes mellitus to prevent or treat the complications related to diabetic foot ulcers.</p> <p>Keywords: foot exercise, diabetes mellitus, foot ulcer</p>
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INTRODUCTION

Diabetes mellitus (DM) is one of the global health focus issues (1). Diabetic foot ulcers (DFU) are a common complication in people with diabetes mellitus. It occurs in 15-25% of patients with diabetes mellitus and more than 2% per year, between 5% and 7.5% with neuropathy (2). The incidence of diabetic foot ulcers is associated with increased morbidity, mortality, and costs. This problem is not only faced by patients but also by families, healthcare workers, and health facilities (3).

Diabetic foot ulcers increase the risk of amputation, causing physical disability in patients (4,5). In addition to the physical aspect, the incidence of diabetic foot ulcers can lead to mental problems. The physical and psychological issues faced causing poor quality of life (6). As a result of the high rate of diabetic foot ulcers and their complications, patients require costly treatment (7).

Neuropathy and peripheral arterial disease predispose factors for diabetic foot ulcers (8). Generally, the goals of DM management include controlling blood glucose levels with medical nutrition therapy, physical exercise, pharmacological therapy, and blood glucose monitoring (9,10). Besides general treatment, there is secondary prevention to prevent complications such as diabetic ulcers, namely understanding risk factors, early screening, foot care, and treatment of risk factors for diabetic ulcers. Physical exercise is essential in preventing diabetic foot ulcers (11).

Foot exercise can be done to avoid diabetic foot disease (3). Several studies have shown that foot-related exercises can reduce the risk of diabetic foot ulcers by improving peripheral sensory and vascular status (12,13). Other studies have demonstrated the effect of foot exercises on wound healing (14). Based on previous research, foot exercise impacts DM with or without ulcers. Therefore, this paper reviewed related foot exercises and their effects on people living with diabetes mellitus.

OBJECTIVE

This study aimed to review the literature on foot exercise and its effect on a patient with diabetes mellitus.

METHODS

Search articles used the predefined keywords such as "Foot exercise" OR "Diabetic foot exercise" AND "Foot ulcer" OR "Diabetic foot ulcer" OR "Diabetes mellitus" through four online databases such as Scopus, ProQuest, PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO. The determination of inclusion and exclusion criteria was based on the PICOS format. This format was used to gain the proper journal to review (Table 1).

Table 1. The PICOS Format

Criteria	Inclusion	Exclusion
Population	Patients with diabetes mellitus with or without DFU	Not a diabetes mellitus patient
Intervention	Foot exercise	Not a foot exercise
Comparators	No comparator	-
Outcomes	All variables related to the effect of foot exercise	It doesn't describe the impact of foot exercise
Research design, publication type	Experiment research. Published in full text	Not experiment research, review, not-full text article
Publication year	After 2017	Before 2017
Language	English	Non-English article

RESULTS

Based on Figure 1, seven selected articles met inclusion (14-20). In the seven selected articles, three studies with a randomized controlled trial approach (14-16) and four studies with a quasi-experimental design (17-20).

The total sample is 484 people. The research samples were patients with diabetes mellitus with or without diabetic ulcers and patients with diabetes mellitus who had just recovered from diabetic ulcers. The type of foot exercise was foot ankle exercise, Buerger Allen exercise, and short foot exercise. This type of movement in this foot exercise is in the form of

a Range of Movement (ROM) that involves the Foot and ankle that aims to increase flexibility and resistance of the Foot and ankle.

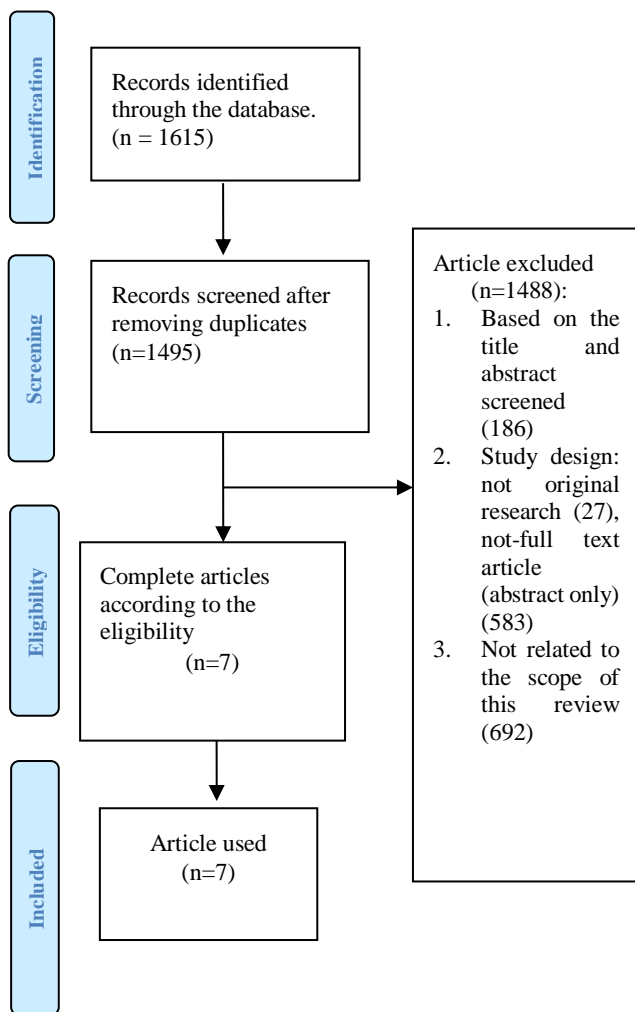


Figure 1. The selection process of literature based on the PRISMA 2009 Flow Diagram

Foot exercise can consist of some phases, such as 1) Warm-up exercise, 2) Intrinsic leg muscle strengthening, 3) Extrinsic muscle strengthening, 4) Functional exercise: balance and gait training and 5) Cool-down exercise.

There are several effects of foot exercise:

1) Risk of diabetic foot ulcer

Foot exercise affects several risk factors associated with the incidence of diabetic ulcers. Research shows an improvement in neuropathy symptoms and ankle-brachial index (ABI) in patients with diabetes mellitus who did regular foot-related exercises. Foot exercises also significantly reduce foot pronation and improve

dynamic postural control and walking speed (15–20).

2) Wound healing and recurrence of ulcer

Foot exercise significantly affects wound healing and the incidence of recurrent diabetic ulcers. Patients with diabetic wounds who underwent regular foot exercises experienced faster-wound healing compared to those who did not undergo foot exercises. In addition to the speed of wound healing, foot exercises can also prevent the occurrence of recurrent diabetic ulcers (14,16).

Studies show the effect of foot exercise on DM patients with or without ulcers. Foot-related exercise can reduce the risk of diabetic foot ulcers, such as improving foot sensory conditions, ABI, foot pronation, dynamic postural control, and walking speed. Foot exercise not only decreases the risk of diabetic foot ulcers but also can accelerate wound healing and recurrence of ulcers in patients with diabetic ulcers.

DISCUSSION

Neuropathy and abnormal ankle-brachial index are predisposing factors for diabetic foot ulcers (21). Neuropathy is a microvascular complication that causes loss of peripheral sensation, while a low ankle-brachial index indicates impaired peripheral circulation, especially in the legs (10). Patients with diabetes mellitus with neuropathic conditions may experience loss of protective sensation, muscle weakness, muscle atrophy, and autonomic sympathetic dysfunction. Circulatory disorders in patients with diabetes mellitus cause blood that carries oxygen and nutrients not to reach the distal lower extremities (22). Physical activity that involves flexibility and resistance movements of the feet and ankles can improve circulation, especially in the lower extremities.

Motor neuropathy conditions can cause intrinsic foot muscle atrophy. This atrophy can affect postural instability when walking. The movements performed in foot exercises also involve the activity of the intrinsic and extrinsic foot muscles. Foot exercises can improve intrinsic foot muscle strength, preventing foot pronation and improving the patient's postural stability and gait speed (15,20).

In addition to reducing the risk of diabetic foot ulcers, foot exercise can accelerate wound healing. Regular foot exercises can reduce the size and depth of the wound and promote wound healing (14). Patients with diabetes mellitus can experience a recurrence of diabetic ulcers (23). The incidence of recurrent diabetic ulcers can also be prevented by doing regular foot exercises where foot exercises can improve neuropathy and ankle-brachial index (16).

Peripheral sensory and vascular disorders can be overcome by doing regular foot exercises. Foot exercises increase nitric oxide synthase (NOS) expression and release of nitric oxide (NO). NO affects vasodilation, thereby increasing blood supply. Foot exercises improve the peripheral vascular status and nerve cell damage due to hyperglycemia and neurovascular disorders, increase muscle strength, and prevent foot deformities (24,25,26). Optimal blood supply, especially in the lower extremities, can accelerate ulcers' healing and prevent ulcer recurrence (14,16).

CONCLUSION

Routine foot-related exercises can prevent risk factors for diabetic ulcers, namely neuropathy and low ABI values. Besides preventing diabetic ulcers by improving several risk factors, regular foot exercises can accelerate the healing of diabetic wounds and prevent the recurrence of injuries.

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