

CHAPTER I

INTRODUCTION

A. Background

Diabetes mellitus (DM) is one of the major global health challenges, with its prevalence continuing to increase each year. According to the World Health Organization (2024), DM was responsible for approximately 1.6 million deaths worldwide in 2021. The International Diabetes Federation (IDF) reports that by 2024 there will be around 589 million adults with DM in the age range of 20-79 years. In 2050, it is predicted that the number of people with DM will increase to 853 million. The countries with the highest prevalence rate of DM in 2024 based on a report from the International Diabetes Federation (IDF) include China ranked first with 148 million DM people, India ranked second with 89.8 million DM people, and the United States ranked third with 38.5 million DM people. Meanwhile, Indonesia itself ranks fifth with a prevalence of DM people of 20.4 million people (IDF, 2025).

Data from Survei Kesehatan Indonesia (SKI) in 2023, the highest prevalence of DM disease is in West Java Province as the first with a total of 156,977 people, East Java as the second with a total of 130,683, and Central Java as the third with a total of 118,184 people. Bengkulu Province ranks 26th with 6,571 people with DM (Kemenkes RI, 2023). Data from the Bengkulu City Health Office in 2024, in Bengkulu City there are 2,691 people with DM with the highest prevalence in the Sawah Lebar Health Center area of 273 people with DM (Dinas Kesehatan Kota Bengkulu, 2025). Meanwhile, in 2023, the Sawah Lebar Health Center area of Bengkulu City recorded 223 people with DM. Based on this data, it can be seen that there will be an increase in the number of people with DM in 2024. The increasing population of people with DM has resulted in an increase in complications, one of which is Diabetic Peripheral Neuropathy (DPN) (Caravaggi et al., 2021).

Diabetic Peripheral Neuropathy (DPN) is one of the most common complications of DM, and is associated with damage to blood vessels and nerves (Caravaggi et al., 2021). Cases of DPN were found to occur in around 30% in people with DM and more than 50% in patients in the age group over 50 years. Distal symmetrical polyneuropathy is a type of diabetic neuropathy that is often found, experienced by almost 75% of patients with diabetic neuropathy (Zang et al., 2023). Diabetic peripheral neuropathy arises due to two main factors, namely microvascular disorders that inhibit the supply of oxygen and nerve nutrients and direct metabolic damage that has an impact due to high blood sugar levels (Hasaini et al., 2023).

Peripheral neuropathy in DM generally occurs due to chronic hyperglycemia, causing oxidative stress, inflammatory reactions, and damage to small blood vessels. This condition inhibits blood flow and nutrient intake to the nerve tissues causing a decrease in sensory function (Ibrahim et al., 2022). Other factors that affect the acceleration of the development of peripheral neuropathy in DM include advanced age, long duration of DM, suboptimal glycemic control, and the presence of comorbidities such as hypertension and dyslipidemia. (Gayatri et al., 2024). Lifestyle habits such as physical activity and unhealthy food consumption also contribute significantly (Djafar et al., 2024). Clinically, these factors may explain why some patients experience a faster decrease in foot sensitivity, while others remain stable (Rezkiansyah et al., 2023).

Peripheral neuropathy causes sensory nerve disorders (loss of sensitivity of the legs), motor (deformity), and autonomic (calluses appear) (Zhu et al., 2024). The characteristic clinical manifestations include symmetrical sensory disturbances in the lower extremities, such as numbness, loss of sensation, pain, and stiffness. (Zang et al., 2023). Decreased sensitivity of the feet causes the patient to be unaware of the presence of small wounds, which have the impact of diabetic foot ulcers and risk causing severe infections to lower extremity amputations in people with DM (Hasaini et al., 2023). Similarly, Aithal & Bhat (2024) reported that

46.5% of 43 patients in India exhibited reduced foot sensitivity, indicative of peripheral neuropathy, based on screening using the Semmes Weinstein 10-g monofilament test.

Reduced foot sensitivity increases the risk of foot injuries that may progress to serious complications, including lower-extremity amputation. According to the American Diabetes Association, approximately 15–25% of people with DM who experience reduced foot sensitivity are at risk of developing diabetic foot ulcers during their lifetime, with a proportion of these cases ultimately requiring lower-extremity amputation (ADA, 2025). Beyond its physical consequences, reduced foot sensitivity also increases the risk of falls, limits mobility, and adversely affects patients' psychosocial well-being, including anxiety and depression (Gayatri et al., 2024).

The treatment of diabetic neuropathy has been more directed towards optimal glycemic control and pain management through pharmacological therapy, including the use of tricyclic antidepressants and anticonvulsants (PERKENI, 2021). However, the use of pharmacological therapy still has limitations, as it often causes side effects and does not completely restore impaired nerve function or sensitivity (Yang et al., 2025). This encourages people with diabetic peripheral neuropathy not only to perform pharmacological therapy, but the management of non-pharmacological therapies such as routine screening, foot treatments, physical therapy, foot exercises and rehabilitation programs need to be carried out (Hasaini et al., 2023). This condition indicates the need for safe, effective, and accessible non-pharmacological therapies as an adjunct therapy in improving the foot sensitivity and reducing the risk of further complications (Syahriyani et al., 2021).

Various complementary therapies have been developed to improve peripheral blood circulation and peripheral nerve function, one of which is Foot Reflexology using a Foot Reflection Board. This device is equipped with raised pressure nodes designed to stimulate specific plantar reflex points, thereby enhancing peripheral blood circulation and alleviating the

symptoms of peripheral neuropathy. Such stimulation may improve foot sensitivity in people with DM while reducing the severity of peripheral neuropathy (Surya & Desnita, 2020).

A study conducted by Dewi et al., (2023) at Depok 3 Primary Health Center demonstrated that acupressure therapy using a Foot Reflection Board significantly reduced the severity of peripheral neuropathy among 30 people with type 2 DM ($p < 0.001$). Similarly, Suwannarat et al., (2025) reported that reflexology therapy using a Palm Seed Insole was effective in reducing numbness among 35 people with DM treated at Ban Klong Yai Hospital ($p < 0.001$). Collectively, these findings suggest that mechanical stimulation based reflexology and acupressure interventions, including the Foot Reflection Board, are effective in improving foot sensitivity and alleviating symptoms of peripheral neuropathy in people with DM.

Foot Reflection Board has emerged as a promising option for foot care in people with DM. Another non-pharmacological intervention with a similar therapeutic objective of improving peripheral circulation is the Buerger Allen Exercise. When performed consistently, Buerger Allen Exercise enhances blood perfusion to the lower extremities, thereby ensuring an adequate supply of oxygen and nutrients to peripheral tissues, which supports nerve repair and improves peripheral nerve function. Radhika et al., (2020) conducted a study at Sri Ramachandra Hospital, Porur, Chennai, involving 50 people with DM, and found that Buerger Allen Exercise significantly improved lower extremity perfusion and reduced the symptoms of peripheral neuropathy ($p < 0.001$). Similarly, a study conducted by Hasaini et al., (2023) in the catchment area of Martapura Primary Health Center, Indonesia, reported that Buerger Allen Exercise significantly improved foot sensitivity among 36 people with DM ($p = 0.020$). Consistent with these findings, Mukaromah et al., (2026) demonstrated that Buerger Allen Exercise significantly enhanced foot sensitivity among 82 people with DM in the catchment area of Pancur Primary Health Center, Central Java, Indonesia ($p < 0.001$).

Both the Foot Reflection Board and Buerger Allen Exercise share a common therapeutic goal of improving peripheral blood circulation and foot sensitivity, making them promising non-pharmacological interventions for people with DM. However, a significant research gap remains regarding the direct comparison of their effectiveness. Most previous studies have evaluated each intervention independently, making it difficult to determine which approach is more effective in improving foot sensitivity among people with DM.

Based on a preliminary study conducted in the catchment area of Sawah Lebar Primary Health Center, Bengkulu City, a total of 136 people with DM were registered between June and August 2025. Foot sensitivity was assessed in 10 people with DM using the Semmes Weinstein 10-g monofilament test. The assessment revealed varying degrees of reduced foot sensitivity, with one participant classified as having severe sensory impairment, six as having moderate impairment, and three as having mild impairment. The most commonly reported symptoms included tingling, muscle cramps, burning sensations, and numbness. Interviews further revealed that seven participants rarely engaged in physical exercise, such as diabetic foot exercises.

Although the Chronic Disease Management Program in Sawah Lebar Primary Health Center continues to be implemented on a regular basis, diabetes management remains predominantly focused on pharmacological treatment. Non-pharmacological interventions have not yet been optimally implemented due to low patient participation in the weekly exercise sessions provided through the program. Therefore, this study aims to compare the effectiveness of the Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise as alternative non-pharmacological interventions for improving foot sensitivity among people with DM.

B. Research Problem

DM is a major global health concern with a continuously increasing prevalence. In Indonesia, the country ranked fifth worldwide in 2024, with an estimated 20.4 million people living with DM, according to the International Diabetes Federation in 2025. The growing burden of DM has contributed to the increasing occurrence of diabetic peripheral neuropathy, which leads to the loss of foot sensitivity. Nearly 75% of patients with diabetic neuropathy develop distal symmetric polyneuropathy, the most common form of diabetic neuropathy. Reduced foot sensitivity substantially increases the risk of diabetic foot ulcers and lower-extremity amputation. Although non-pharmacological interventions such as Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise have each been shown to be effective in improving foot sensitivity, no previous study has directly compared the effectiveness of these two interventions. Therefore, the research question addressed in this study is: “Is there a difference in the effectiveness of Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise on foot sensitivity among people with DM?”

C. Research Objective

1. General Objective

To determine the effectiveness of Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise on foot sensitivity among people with DM in The Sawah Lebar Public Health Center Working Area, Bengkulu City, in 2026.

2. Specific Objective

- a. To describe the characteristics of the participants, including age, sex, random blood glucose level, and duration of DM.
- b. To determine the mean foot sensitivity scores before and after Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise.

- c. To compare the differences in changes in foot sensitivity between Foot Reflexology using a Foot Reflection Board and Buerger Allen Exercise among people with DM.

D. Significance of The Research

1. Theoretical Significance

a. For Educational Institutions

This research can be a reference for lecturers and students on how to improve foot sensitivity in people with DM through Foot Reflexology interventions with Foot Reflection Board and Buerger Allen Exercise. It can be used as teaching materials, discussions, and guidelines for clinical practice and can be an idea for community service activities for lecturers and students.

b. Next Researcher

The results of this study can be used as basic data and material for further research considerations related to the foot sensitivity of people with DM.

2. Practical Significance

a. For Nurses

This research can be a clinical practice guide to improve the ability of nurses to perform nursing interventions in increasing the foot sensitivity of people with DM who experience complications of diabetic neuropathy.

b. For People with DM and Family

The results of this study are expected to provide education and alternatives to safe and practical home-based interventions for DM sufferers and their families. Understanding this information allows patients to take a more active role in preventing severe complications, including ulcers and amputations, which lead to improved quality of life.