

The Effect of Reflexology Therapy on Blood Sugar Levels and Risk of Ulcer Risk in Patients with Type 2 Diabetes

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Abstract

High blood sugar levels and the risk of ulcers in type 2 DM sufferers can increase complications and even increase mortality. This research contributed to improve innovation of Rubber Roller reflexology therapy. This study used a pre-experimental. Purposive sampling technique with a total sample of 101 respondents, with the inclusion criteria of patients with type 2 DM aged 30-80 years, willing to become respondents. The exclusion criteria for this study were patients who had complications. The data collection tools in this study are SOP, glucometer, rubber roller therapeutic reflexology massage device, observation sheet, and Neuropathy Symptom Score (NSS) questionnaire. Statistical test results using Wilcoxon test to see the effect before and after reflexology massage on blood sugar levels and ulcer risk. Results: the average GDS before the intervention was 239.77, while the average GDS after the intervention was 235.56. The results of the statistical test using the Wilcoxon test obtained a p value of 0.002 ($p < 0.05$). Conclusion: The Effect of Reflexology with Rubber Roller Therapy on Blood Sugar Levels and Ulcer Risk in Patients with Type 2 DM in Kubutambahan Village, Kubutambahan Health Center Working Area 1.

Keywords: Blood Sugar Levels; Reflexology; Type 2 DM; Ulcer Risk

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1. Introduction

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia due to impaired secretion, action, or both of the hormone insulin (Sari, Sagitarini, and Sanjaya 2022). One of the most common types is type 2 diabetes mellitus, a condition in which the body becomes resistant to insulin or fails to use it effectively, leading to elevated blood glucose levels (Ministry of Health RI, 2022). Unhealthy lifestyle factors, such as poor diet, lack of physical activity, smoking, and genetic predisposition, contribute significantly to poor glycemic control in diabetes patients (Yusnita, Hi. A. Djafar, and Tuharea 2021; Prameswari and Zuraida 2023).

According to the International Diabetes Federation (IDF), there were approximately 537 million people with diabetes worldwide in 2021, and this number is projected to increase to 783 million by 2045. Indonesia ranks fifth globally, with 19.5 million affected in 2021 and an estimated 28.6 million by 2045 (Ministry of Health RI, 2022). At the local level, the 2023 Buleleng District Health Profile reported 8,606 people aged ≥ 15 years living with diabetes mellitus, with 90.84% having received standard health services. In Kubutambahan Village, 135 people were recorded as having diabetes mellitus in the same year (Department of Health Buleleng, 2024). These figures

illustrate that diabetes remains a significant and growing public health problem both globally and locally.

If not properly controlled, diabetes mellitus can cause complications that damage vital organs such as the eyes, kidneys, nerves, and blood vessels. One of the most common microvascular complications is diabetic peripheral neuropathy, which is characterized by sensory, motor, and autonomic dysfunction (Rezkiansyah et al. 2023). This condition often increases the risk of diabetic ulcers, which can lead to infection or even amputation. Contributing factors include low patient awareness of diabetes management, poor adherence to therapy, and limited understanding of non-pharmacological approaches to control blood sugar and improve circulation (Della, Subiyanto, and Maria 2023).

Reflexology therapy has emerged as a promising non-pharmacological intervention for diabetes management. This therapy involves massaging specific reflex points on the feet associated with the pancreas, stomach, and other related organs. Several studies have shown that reflexology can improve blood circulation, reduce peripheral nerve pain, and help regulate blood glucose levels (Novita et al. 2023). One innovative form of this therapy is Rubber Roller Therapy, a simple, locally designed tool

made of wood and rubber that allows patients to stimulate reflex points by pressing on them for 15 minutes. This technique is believed to improve nerve and muscle function, improve peripheral blood flow, and potentially prevent diabetic ulcers (Mardiana 2021).

A preliminary study conducted at Kubutambahan I Community Health Center revealed that most type 2 diabetes patients had blood sugar levels above 200 mg/dL and were unaware of reflexology or other non-pharmacological therapies. These findings suggest that despite the increasing number of diabetes cases, non-pharmacological treatments remain underutilized, creating a gap between knowledge, behavior, and practice in holistic diabetes care. Furthermore, few studies have specifically examined the effectiveness of reflexology using Rubber Roller Therapy in reducing blood sugar levels and the risk of gastric ulcers in type 2 diabetes patients, especially in public health facilities.

Nurses, as healthcare professionals with a central role in promotive, preventive, and rehabilitative care, are expected to integrate complementary therapies into diabetes management. Through training and the application of reflexology, nurses can help patients maintain peripheral circulation, prevent peptic ulcers, and improve self-care management. Emphasizing this role strengthens the contribution of nursing practice in implementing holistic, evidence-based, and patient-centered interventions for people with diabetes. Therefore, this study aims to determine the effect of reflexology therapy using Rubber Roller Therapy on blood sugar levels and the risk of gastric ulcers before and after intervention in type 2 diabetes mellitus patients in the working area of Kubutambahan I Community Health Center.

2. Method

This study employed a pre-experimental design with a one-group pre-test and post-test approach. All respondents were given baseline measurements before the intervention and re-measured after the intervention to determine any changes. The study was conducted at the Kubutambahan I Community Health Center, Buleleng Regency, for three weeks, from January 1, 2024, to February 1, 2024. The study population was all Type 2 Diabetes Mellitus patients participating in the health center's service program. The sample size was determined using the Slovin formula, resulting in 101 respondents, using a purposive sampling technique based on specific criteria. Inclusion criteria for this study included patients diagnosed with Type 2 Diabetes Mellitus, aged 30–80 years, willing to participate, and willing to participate in the entire intervention series. Exclusion criteria included patients with severe complications such as diabetic ulcers or other health problems that could hinder therapy implementation.

The research instruments consisted of an EasyTouch GCU glucometer to measure blood sugar levels, with an accuracy of $\pm 10\%$ and a reading time of 10 seconds, a rubber roller therapy device as a reflexology therapy medium, standard operating procedures (SOPs) for therapy implementation, an observation sheet to record the intervention, and a Neuropathy Symptom Score (NSS) questionnaire to assess neuropathy symptoms. The intervention, which involved foot reflexology therapy using a rubber roller, was conducted for three weeks, three times a week (a total of nine sessions). Each session lasted 15–20 minutes for each foot, in accordance with the SOP for reflexology points for diabetes patients. Blood sugar levels and NSS scores were measured before the first session (pre-test) and after the last session (post-test). Data collection included recording respondent characteristics, checking blood sugar with a glucometer at the same time each time, completing the NSS questionnaire, and observing the participants during the intervention. The collected data then underwent editing, coding, entry, and cleaning before being analyzed. Univariate analysis was used to describe the distribution of respondents' age, gender, and education level. Bivariate analysis was performed using paired t-tests or Wilcoxon tests to determine the effect of reflexology therapy on blood sugar levels and peripheral neuropathy symptoms, according to data normality. This study received ethical approval from the Health Research Ethics Commission under number 805/EC-KEPK-SB/XI/2024, and all respondents signed informed consent before participating.

3. Results and Discussion

The following are the results of research on the effect of Reflexology Massage Therapy on Blood Sugar Levels and Risk of Ulcer in Type 2 Diabetes Patients, consisting of univariate and bivariate analysis. Table 1 describes the characteristics of 101 respondents with type 2 DM in Kubutambahan Village. Most respondents were female (55.4%) and in the age range of 51–80 years (78.2%). In terms of education, most had only completed primary education, with 28.7% graduating from elementary school and 25.7% having no education. The most common occupation was trader (29.7%), followed by housewife (22.8%). The duration of DM was dominated by respondents with a duration of less than 5 years (55.4%).

Table 2 shows changes in blood sugar levels in 101 patients with type 2 diabetes before and after reflexology therapy using rubber rollers. Before the intervention, all respondents (100%) had high blood sugar levels. After the therapy, 10 respondents (9.9%) showed a decrease in blood sugar levels to normal levels, while 91 respondents (90.1%) were still in the high category.

Table 3 shows the changes in ulcer risk levels in 101 patients with type 2 DM before and after

reflexology therapy using rubber rollers. Before the intervention, most respondents were in the severe ulcer risk category (85.1%), 13.9% were in the moderate category, and only 1% were classified as mild risk. After therapy, there was a significant change, where severe risk decreased to 7.9%, while moderate risk increased to 68.3%, and mild risk increased to 23.8%. These results suggest that reflexology therapy with rubber rollers contributes to reducing the risk level of ulcers in patients with type 2 DM.

Table 1. Frequency Distribution of Respondents Based on Patients with Type 2 DM in Kubutambahan Village Health Center Working Area

No	Variable	Frequency (F)	Percentage (%)
Gender			
	Male	45	44.6
	Female	56	55.4
Age			
	30-50 Years	22	21.8
	51-80 Years	79	78.2
Level of Education			
	Not In School	26	25.7
	Elementary School	29	28.7
	Junior High School	23	22.8
	Senior High School	18	17.8
	College	5	5.0
Jobs			
	Not Working	9	8.9
	Labor	18	17.8
	Farmers	16	15.8
	Merchant	30	29.7
	Housewife	23	22.8
	Civil Servants	5	5.0
Long-time suffering from DM			
	<5 years	56	55.4
	>5 years	45	44.6
	Total	101	100.0

Table 4. Wilcoxon test results of blood sugar before and after being given Reflexology with Rubber Roller Therapy on Blood Sugar Levels and Risk of Ulcers in Patients with Type 2 DM

		N	Mean Rank	Sum Of Ranks	p-value
Pre_GDS	- Negative Ranks	10	5.50	55.00	0.002
PostGDS	Positive Ranks	0	0.00	0.00	
	Ties	91			
	Total	101			

Table 5. Wilcoxon NSS test results before and after Reflexology with Rubber Roller Therapy on Blood Sugar Levels and Ulcer Risk in Patients with Type 2 DM

		N	Mean Rank	Sum Of Ranks	p-value
Pre_Risk Ulcus	- Negative Ranks	100	50.00	4950.00	0.000
Post_Risk Ulcus	Positive Ranks	0	0.00	0.00	
	Ties	1			
	Total	101			

Table 2. Timed Blood Sugar of Patients with Type 2 DM Pre and Post Reflexology with Rubber Roller Therapy.

	Instantaneous Blood Sugar	Frequency (F)	Percentage (%)
Pre	High	101	100.0
	Total	101	100.0
Post	Normal	10	9.9
	High	91	90.1
	Total	101	100.0

Table 3. Risk of Ulcers in Patients with Type 2 DM Pre and Post given Reflexology with Rubber Roller Therapy

	Risk Ulcer	Frequency (F)	Percentage (%)
Pre	Mild	1	1.0
	Medium	14	13.9
	Weight	86	85.1
	Total	101	100.0
Post	Mild	24	23.8
	Medium	69	68.3
	Weight	8	7.9
	Total	101	100.0

Table 4 shows the results of the Wilcoxon test on blood sugar levels before and after reflexology therapy with rubber rollers in type 2 DM patients. A total of 10 respondents experienced a decrease in blood sugar levels (negative rating), while 91 respondents experienced no change. No one experienced an increase. The test results show a p value = 0.002 ($p < 0.05$), which means there is a significant difference between blood sugar levels before and after therapy. This indicates that reflexology therapy is effective in reducing blood sugar levels in some patients.

Table 5 shows a significant decrease in ulcer risk after reflexology therapy with rubber rollers ($p = 0.000$). A total of 100 respondents experienced a decrease in risk, without any increase. These results prove that reflexology therapy is effective in reducing the risk of ulcers in type 2 DM patients.

Respondent characteristics

Most respondents were female (55.4%), in line with the findings of [Ratnawati et al. \(2024\)](#) who showed that women are more susceptible to type 2 DM due to hormonal factors and low physical activity. Respondents were predominantly aged 51-80 years (78.2%), supporting the research of [Suniyadewi et al, 2024; Susanti et al, 2024](#)) which state that the risk of diabetes increases with age due to decreased pancreatic function and insulin resistance. The majority of education levels are elementary school (28.7%) and not in school (25.7%), similar to the research of [Sayuti et al. \(2024\)](#) which stresses that low education has an impact on the lack of knowledge about health. Most respondents' occupations were traders (29.7%) and housewives (22.8%), in accordance with [Nakazawa et al. \(2022\)](#), who show that occupations with low physical activity are at risk of causing DM. Most of the respondents had DM <5 years (55.4%), supporting the findings of [Demeke & Deshimo \(2025\)](#), who mentioned that in the early days of diagnosis, patients are often not able to manage the disease optimally due to a lack of lifestyle adjustments.

Blood sugar levels before and after being given reflexology massage therapy with Rubber Roller Therapy in Type 2 DM patients

High blood sugar levels before being given reflexology massage therapy with Rubber Roller Therapy are caused by minimal physical activity and inadequate food intake, and can cause complications, one of which is the risk of ulcers or neuropathy, resulting in decreased sensitivity in the feet ([Lu et al. 2024](#)). In line with research conducted by [Mardiana \(2021\)](#) showing that patients with type 2 DM have decreased foot sensitivity and uncontrolled blood sugar levels before being given a reflexology foot massage.

After being given reflexology massage therapy with a rubber roller, there was a decrease in blood sugar levels but still in the range of >200 mg/dl. Reflexology therapy is able to provide positive stimulation for blood vessels. The pressure generated during the massage can increase the smooth flow of blood ([Wiratama, Muhith, and Zahro 2023](#)). Rubber Roller Therapy, as an aid in reflexology, can promote even pressure and accelerate stimulation at specific reflexology points.

Research by [Wiratama et al. \(2023\)](#) The use of foot reflexology rollers shows that the use of aids such as rubber rollers can increase the effectiveness of

massage therapy in lowering blood glucose by increasing the mechanism of local blood circulation and peripheral nerve stimulation. Kombinasi antara spa kaki, rubber dan terapi musik dapat mengontrol kadar gula darah pasien pada DM tipe 2 ([Wardani et al. 2023](#)). This study is also supported by [Cicek et al. \(2021\)](#). By comparing the results of this study with the theory and results of previous studies, it appears that reflexology therapy using Rubber Roller Therapy provides consistent benefits in maintaining blood sugar levels in type 2 DM patients. The decrease in blood sugar levels can be caused by increased circulation, muscle relaxation, and stress reduction through neuroendocrine mechanisms.

Risk of Ulcers in Patients with Type 2 DM Pre and Post given Reflexology with Rubber Roller Therapy

Before the intervention of foot reflexology with rubber roller therapy, out of 101 respondents who experienced peripheral neuropathy, a high frequency of 86 respondents (85.1%). Severe neuropathy is often found in elderly patients. Neuropathy in old age is related to the accumulation of damage caused by free radicals, including increased lipid peroxide levels and changes in enzyme function, which then cause tissue damage ([Castelli, Desai, and Cantone 2020](#)).

After giving foot reflexology intervention with rubber roller therapy, the risk of ulcers is mostly moderate as many as 69 respondents (68.3%). Reflexology tools in the form of rubber roller therapy can help relieve nerve complaints, such as pain, tingling, or cramps caused by diabetic neuropathy, because reflexology can help press certain points in the sole area of the foot, so as to improve blood circulation, increase the supply of oxygen and nutrients to body tissues ([Novita et al. 2023](#)).

Reflexology with rubber roller therapy works multi-mechanistically: improving circulation, improving nerve function, reducing excess pressure on the soles of the feet, and controlling inflammation, so it is effective in reducing the risk of diabetic foot ulcers in Type 2 DM patients. This research is also in line with the results of research by [Isnainy et al. \(2021\)](#) The provision of foot reflexology therapy in patients with Type 2 DM for 2 weeks is proven to increase peripheral blood flow and nerve sensitivity, and reduce the risk of ulcers. The use of rubber rollers on the soles of the feet for 15 minutes/day for 7 days increases capillary perfusion and reduces neuropathy symptoms such as tingling and numbness. ([Suniyadewi et al. 2024](#)). Another study showed a decrease in the risk of ulcers in patients with Type 2 DM based on the Diabetic Foot Ulcer Risk Assessment Tool (DFURAT) scoring after roller therapy was given regularly ([Novita et al. 2023](#)).

In this study, it was found that ulcer risk scores in Type 2 DM patients significantly decreased after the administration of reflexology therapy with rubber

rollers, compared to before the intervention. This suggests that this intervention can improve blood circulation in the lower extremities, improving sensory sensitivity and perception. In addition to physiological benefits, this therapy also provides a relaxing effect that helps reduce stress, which indirectly has a positive impact on blood glucose regulation and peripheral perfusion.

Effect of Reflexology on Blood Sugar Levels and Ulcer Risk with Rubber Roller Teraphy in patients with Type 2 DM in Kubutambahan Village, Kubutambahan I Health Center working area.

There is an effect of Reflexology on Blood Sugar Levels and Ulcer Risk with Rubber Roller Teraphy in patients with Type 2 DM. Reflexology, which involves applying pressure to specific points on the foot, can have a number of positive health effects, including a reduction in blood glucose levels and a reduction in the risk of developing diabetic ulcers. This intervention is proven to be effective as it combines the principles of reflexology and mechanical stimulation focusing on nerve points on the sole of the foot that are associated with various organs, including the pancreas and peripheral circulatory system.

Reflexology has the potential to promote relaxation, which can generally help in the control of blood sugar levels. In line with the findings [Mardiana \(2021\)](#) showed that after receiving reflexology, blood sugar levels ranged from 150-199 mg/dl for 5 respondents (24%), while levels were below 200 mg/dl for 16 respondents (76.8%). This finding is reinforced by several previous studies. Research by Novita et al. (2023) also proved that the use of rollers on the feet can reduce symptoms of peripheral neuropathy and increase capillary blood flow. In addition [Isnainy et al. \(2021\)](#) showed a reduction in ulcer risk based on risk scoring after roller therapy was given regularly.

Thus, reflexology using rubber rollers works through integrative neurological, vascular, and hormonal mechanisms-which synergistically play a role in lowering blood sugar levels and preventing diabetic foot complications. This intervention is not only clinically beneficial, but also has the advantage of being a non-pharmacological therapy that is cheap and easy to perform.

4. Conclusions and Suggestions

This study concludes that reflexology therapy using a blood rubber roller can provide significant improvements in glucose control and reduce the risk of ulcers in patients with Type 2 Diabetes Mellitus, in accordance with the aim of assessing the effectiveness of non-pharmacological interventions in supporting diabetes management. Applying targeted pressure to reflex points using a rubber roller has been shown to help improve peripheral circulation, increase nerve sensitivity, and support physiological regulatory

processes that contribute to the prevention of diabetic foot complications. These results confirm that reflexology with a rubber roller is worthy of consideration as part of complementary services in primary health care facilities. For further research, it is recommended to conduct long-term observations, expand variables including diet and physical activity control, conduct comparisons with other reflexology techniques or control groups, and enable the implementation of this intervention in a broader public health program scale.

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