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The Effect of Active Stretching Exercise with Reflective Wooden Sandals on Blood Sugar Levels and Ulcer Risk in Patients with Type II Diabetes Mellitus

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Abstract

A common complication of diabetes mellitus is peripheral neuropathy, which can lead to diabetic ulcers. This research contributed to assessing physical exercises such as active stretching, which are increasingly recommended for people with diabetes as a complementary approach to improve circulation and nerve function. This study used a pre-experimental, pre-post-test, single-group design and was conducted at the Kubu II Community Health Center from January to February 2025. A total of 56 patients with type 2 diabetes mellitus were selected using purposive sampling. Inclusion criteria included patients aged ≥35 years, having blood sugar levels ≥200 mg/dL, and having no comorbidities other than type 2 diabetes. Data were collected using an observation sheet to measure blood sugar levels and a Neuropathy Symptom Score (NSS) questionnaire to assess ulcer risk. Data analysis used a paired t-test to compare pre- and post-intervention values. The results showed that active stretching exercises using wooden reflexology sandals resulted in a significant reduction in blood sugar levels and ulcer risk ($p < 0.05$). This study provides evidence that combining active stretching with reflexology stimulation may serve as an effective complementary intervention to improve glycemic control and reduce the risk of ulcers in patients with type 2 diabetes mellitus.

Keywords: *Active Stretching Exercise, Reflexology Sandals, Blood Sugar, Type 2 Diabetes*.

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1. Introduction

Diabetic ulcers are a type of wound that appears in patients with diabetes mellitus due to complications of microangiopathy and macroangiopathy (Qurotulnguyun et al., 2023). According to information from the International Diabetes Federation (IDF) in 2019, people with diabetes internationally amounted to 9.3% of the total population in similar age groups (IDF, 2021).

In patients with diabetes mellitus who continue to lead a poor lifestyle by eating fruits and vegetables irregularly, not exercising/doing physical activity irregularly (Dearmisa Damanik et al., (2024). One alternative to reducing glucose levels in people with DM by doing active stretching. According to research Dearmisa Damanik et al. (2024) The fact that the intensity of blood sugar levels decreases after active stretching is very effective in reducing blood sugar levels in people with DM and can prevent changes in leg shape, as well as strengthen small muscles and improve blood circulation.In line with research by Puspita et al. (2022) that active stretching exercises have been shown to be effective in improving blood circulation in the leg area, increasing insulin function, and widening blood vessels that function to increase systolic tension in the legs.

The study conducted by Permata & Lubis (2019) is the effect of wearing footwear on the incidence of diabetic foot ulcers in people with diabetes was tested using the chi-square statistical test, which obtained a value of p = 0.003 <0.05, meaning that there is an effect of wearing footwear on the incidence of diabetic foot ulcers in people with diabetes mellitus. This research is also supported by Mutiara (2023) The results of the study found that there are differences in the value of the control group before and after being given special footwear.

Poor lifestyle, such as irregular fruit and vegetable consumption, as well as reduced physical activity, also aggravates the condition of diabetic patients and increases the risk of ulcers. Previous studies have shown that active stretching can

reduce blood glucose levels, improve blood circulation, and prevent deformities in the feet of diabetic patients. In addition, the use of specialized footwear has also been shown to significantly reduce the incidence of diabetic foot ulcers. However, efforts to prevent diabetic foot ulcers integratively through a combination of active stretching and footwear use are rarely explored scientifically. Seeing the above background, the author is interested in examining whether active stretching exercises with reflection wood sandals have an effect on reducing blood sugar levels and the risk of ulcers in patients with type II diabetes mellitus at Health Center Kubu II.

This study was conducted to determine the effect of Active Stretching Exercise with Reflection Wood Slippers on Reducing Blood Sugar Levels and the Risk of Ulcers in Type II Diabetes Mellitus Patients at Health Center Kubu II.

2. Method

This study employed a One Group Pre-Test Post-Test design involving 56 respondents selected through purposive sampling. The inclusion criteria consisted of patients aged 35 years and older, diagnosed with Type 2 Diabetes Mellitus, having blood sugar levels of ≥200 mg/dL, willing to participate, and able to follow the intervention schedule. Meanwhile, the exclusion criteria included patients who had diabetic foot ulcers, severe neuropathy, cardiovascular complications, physical limitations that prevented stretching exercises, or other comorbidities that could interfere with the intervention. The research was conducted at the Kubu II Health Center located in Tianyar Timur Village, Kubu District, Karangasem Regency, from January to February 2025. Ethical clearance for this study was issued by the Health Research Ethics Committee of Sekolah Tinggi Ilmu Kesehatan Buleleng (STIKES Buleleng) under number 835/EC-KEPK-SB/XII/2024, and the institutional research permit was granted with number 1138/BAAK/SK-SB/V-12-2024.

The intervention consisted of Active Stretching Exercise combined with the use of wooden reflexology sandals, performed three times per week over a two-week period. Each session lasted 15–20 minutes and included a series of lower-limb stretching movements while respondents stood and applied pressure to reflex points using wooden reflexology sandals, following the standardized procedure provided by the research team. Data were collected using two main instruments: blood sugar levels were measured using a glucometer and recorded on an observation sheet following standard operational procedures, while ulcer risk was assessed using the Neuropathy Symptom Score (NSS) questionnaire, which evaluates neuropathic symptoms associated with the risk of diabetic ulcer development. Data analysis consisted of univariate analysis to describe respondent characteristics and bivariate analysis using the paired t-test to determine changes before and after the intervention, specifically assessing the effects of Active Stretching Exercise with wooden reflexology sandals on blood sugar levels and ulcer risk in patients with Type 2 Diabetes Mellitus at the Kubu II Health Center.

3. Results and Discussion

This chapter describes the results of research on the Effect of Active Stretching Exercises with Reflexology Wooden Sandals on Blood Sugar Levels and Ulcer Risk in Type II Diabetes Mellitus Patients at Kubu II Health Center. Respondent Characteristics Based on Age: The lowest age is 41 years, and the highest age is 79 years. The majority of Type II DM sufferers at Kubu II Health Center are women, amounting to 31 (55.4%) people. The pretest results for respondents were in the severe ulcer risk category, as many as 56 (100.0%) people, and the posttest results for ulcer risk showed that the majority of respondents were in the moderate ulcer risk category, as many as 46 (82.1%) people, and the severe ulcer risk category, as many as 10 (17.9%) people. The results of the study showed that there was a difference in blood sugar levels before and after the Active Stretching Exercises with Reflexology Wooden Sandals intervention. Before the intervention, the blood sugar level results showed a blood sugar level of 200 mg/dl and after the intervention, there was a decrease in blood sugar levels to 172 mg/dl. The results of the study in Table 5 show that there was a difference in ulcer risk before, from 7 to 5 after being given the Active Stretching Exercises with Reflexology Wooden Sandals intervention.

Table 1: Frequency Distribution of Respondents Based on Age in Type II Diabetes Mellitus Patients at Kubu II Health Center

Variable	N	Min	Max	Std Deviation
Age	56	41	79	8.242

Table 2: Frequency Distribution of Respondents Based on Gender

Category	Frequency (f)	Percentage (%)
Gender		
Male	25	44.6
Female	31	55.4
Total	56	100.0

Based on the results of the study before active stretching exercises with reflective wood sandals on blood sugar levels, it was found that 56

(100%) respondents had GDS> 200 mg/dL with the lowest blood sugar level of 200 mg/dL and the highest of 350 mg/dL while at the risk of ulcers it was found that 56 (100%) were in the category of severe ulcer risk with the lowest score of 7 and the highest of 10. According to the researcher's assumption, high blood sugar levels in subjects with severe ulcer risk are interrelated; respondents often complain that their feet lose sensation/freedom and their fingertips feel cold.

According to Kindang, Suaib, & Fadiansyah (2023) revealed that people with diabetes mellitus often experience foot deformities as one of the symptoms. This condition has the potential to cause ulceration to amputation of the lower extremities, which can be neuropathic, ischemic, or a combination of both. When on the move, patients often feel cramps, pain in the wound, and a heavy sensation in the foot (Wu et al., 2021). Peripheral neuropathy experienced by patients with diabetes mellitus has an impact on reducing quality of life due to the appearance of neuropathic pain, limited mobility, and impaired balance (Banik et al., 2020).

Table 3: Ulcer Risk in Type II Diabetes Mellitus Patients Before and After Active Stretching Exercises with Reflexology Wooden Sandals

Category	*Pre-test*		*Post-test*	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Light (3-4)	0	0.0	0	0.0
Medium (5-6)	0	0.0	46	82.1
Heavy (7-10)	56	100.0	10	17.9
Total	56	100.0	56	100.0

Table 4 Analysis of the Effect of Active Stretching Exercises with Reflexology Wooden Sandals on Blood Sugar Levels of Type II Diabetes Mellitus Patients at Kubu II Health Center

Variable	N	Minimum Value	Maximum Value	Mean	Standard Deviation	*P-value*
Blood Sugar Level Pre-test	56	200	350	219.46	27.559	0.000
Post-test Blood Sugar Levels	56	172	281	204.89	22.012	

Table 5 Analysis of the Effect of Active Stretching Exercises with Reflexology Wooden Sandals on the Risk of Ulcers in Type II Diabetes Mellitus Patients at Kubu II Health Center

Variable	N	Minimum Value	Maximum Value	Mean	Standard Deviation	*P-value*
Ulcer Risk Pre-test	56	7	10	8.70	0.989	
Post-test Ulcer Risk	56	5	8	5.66	0.859	0.000

Based on the results of research after active stretching exercises with reflexology wooden sandals on blood sugar levels obtained from 56 respondents, the majority of 30 (53.6%) respondents GDS < 200 mg/dL and 26 (46.4%) people GDS> 200 mg/dL, with the lowest blood sugar level is 172 mg/dL and the highest is 281 mg/dL, while the risk of ulcers obtained that the majority of 46 (82.1%) people are in the moderate category and the category of severe ulcer risk is 10 (17.9%) people, with the lowest score is 5 and the highest is 8. According to the researcher's assumption, it can be stated that after active stretching exercises with reflexology wooden sandals, there is a decrease in glucose and the risk of ulcers.

Active stretching is a light muscle stretching exercise that aims to relax and reduce pressure on the muscles. This exercise applies specific strategies to maintain muscle mobility physiologically, involving mechanical and neurophysiological reactions as the main standard (Vihandayani, Wiratmo, & Hijriati, 2019). Active stretching has been shown to improve blood circulation in the leg area, optimize the effectiveness of insulin, and enlarge the diameter of blood vessels, which contributes to an increase in systolic blood pressure in the legs (Gholami et al., 2021).

Analysis of the Effect of Active Stretching Exercise with Reflection Wood Slippers on Blood Sugar Levels and Risk of Ulcers in Type II Diabetes Mellitus Patients

In this study, the Wilcoxon test output p-value = 0.000 (p <0.05), meaning there is an effect

of Active Stretching Exercise with Reflection Wood Sandals on Blood Sugar Levels and Risk of Ulcers in Type II Diabetes Mellitus Patients.

A poor lifestyle can increase the risk of diabetic foot ulcers in people with diabetes mellitus. Individuals with an irregular diet tend to have higher glucose levels, while those with mild exertion are at greater risk of developing ulcers compared to physically active individuals (Gomaa et al., 2022; Mohammed & Abdelmoneam, 2018). The risk of diabetic foot ulcers can be reduced by maintaining a healthy diet, increasing physical activity, and optimally controlling blood sugar levels (Irham Saif Rasyadi, 2024; Mansyah & Rahmawati, 2021).

In line with the results of the research by the study (Vihandayani, M., Wiratmo, A. P., & Hijriati, 2019) These findings indicate that active stretching kakiber contributes to effectively reducing blood glucose levels in people with DM. Researchers developed an innovation in the form of reflection wood sandals for alternative therapy for people with diabetes mellitus. This innovation aims to increase the effectiveness of active stretching exercises in maintaining the health of the feet of diabetic patients and is reinforced by the study of Made et al. (2022) examined related to active lower rom assisted by reflexology wood to increase foot moisture in people with type II DM, the output of the independent sample t-test test between the treatment and control groups showed a significant difference in p-value 0.000 (α = 0.05), indicating that there was a significant effect between active lower rom exercises assisted by reflexology wood on increasing foot moisture in patients with type II diabetes mellitus.

The results of a study conducted found that the majority of individuals from 30 respondents showed normal blood glucose levels after the intervention as many as 17 (57%) people. The decrease in the intensity of blood glucose levels observed shows that active leg stretching exercises have a high effectiveness in reducing blood glucose levels in people with DM. In addition, a study by Dewi (2023) showed that active stretching combined with foot reflexology can increase blood circulation to the lower extremities, which helps improve nerve sensitivity and reduce the incidence of diabetic ulcers. These results are in line with the findings of Lewen. (2022) which revealed that patients who received reflexology and active stretching therapy interventions experienced a decrease in peripheral neuropathy symptoms, such as tingling and numbness, so that the risk of repetitive pressure injuries could be significantly reduced.

The use of active stretching exercises with reflexology slippers has a positive impact on glucose levels and ulcer risk in patients with DM, although the effectiveness may vary depending on individual factors (Wekoadi et al., 2024). Reflexology slippers stimulate acupressure points on the soles of the feet that are connected to organs, including the pancreas, thus helping to improve blood circulation and regulate sugar levels more optimally (Purnamawati et al., 2022). In addition, the active stretching motion with the reflexology wooden sandals improves blood flow to the lower extremities, reduces the risk of peripheral neuropathy, and accelerates wound healing, which can reduce the risk of diabetic ulcers.

4. Conclusions and Suggestions

Active Stretching Exercise with Reflection Wood Slippers significantly reduces blood sugar levels and the risk of diabetic foot ulcers in patients with type II diabetes mellitus. This intervention is a simple, effective, and inexpensive method that can be integrated into nursing practice to improve glycemic control and foot health. Nurses are advised to apply this as a complementary therapy. Further research with a control group and longer duration is recommended to validate and extend this study.

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