



THE EFFECT OF DIABETES MELLITUS FOOT EXERCISES ON THE STABILITY OF BLOOD SUGAR LEVELS IN PATIENTS WITH DIABETES MELLITUS: A LITERATURE REVIEW

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ABSTRACT

Diabetes is a degenerative disease that has special characteristics, namely hyperglycemia due to abnormal insulin secretion and suboptimal insulin performance or both. Treatment measures taken by health/medical personnel include: pharmacological treatments such as administering drugs and non-pharmacological treatments such as routine metabolic control, vascular control, ulcer evaluation, foot care and other exercise measures such as foot exercises. Objective: of this study was to apply diabetic foot exercise therapy to reduce blood sugar levels in patients with diabetes mellitus Method: uses a literature review method through a data search base through search engines such as PubMed, Croseff and Google Scholar, with keywords namely: "Foot Exercise" OR "Foot Gymnastics" AND "Blood Sugar Level" AND "DM" OR "Diabetes Mellitus" AND "Sugar Level" with a time span of 2020 - 2024. The search results obtained a total of 9 articles that were eligible for review according to the PRISMA flowchart. The inclusion criteria used are adult patients aged 30-60 years who experience diabetes mellitus, using Quasy Experiment, RCT and Narrative methods and articles in English that are freely accessible and Indonesian language journals. The intervention was diabetic foot exercise therapy, and aerobic exercise therapy and exercise media using newspapers. Results: showed that the therapy effectively helped reduce blood sugar levels in patients with diabetes mellitus. Conclusions: effectively helped reduce blood sugar levels.

Keywords: blood sugar level; diabetes mellitus; foot exercise

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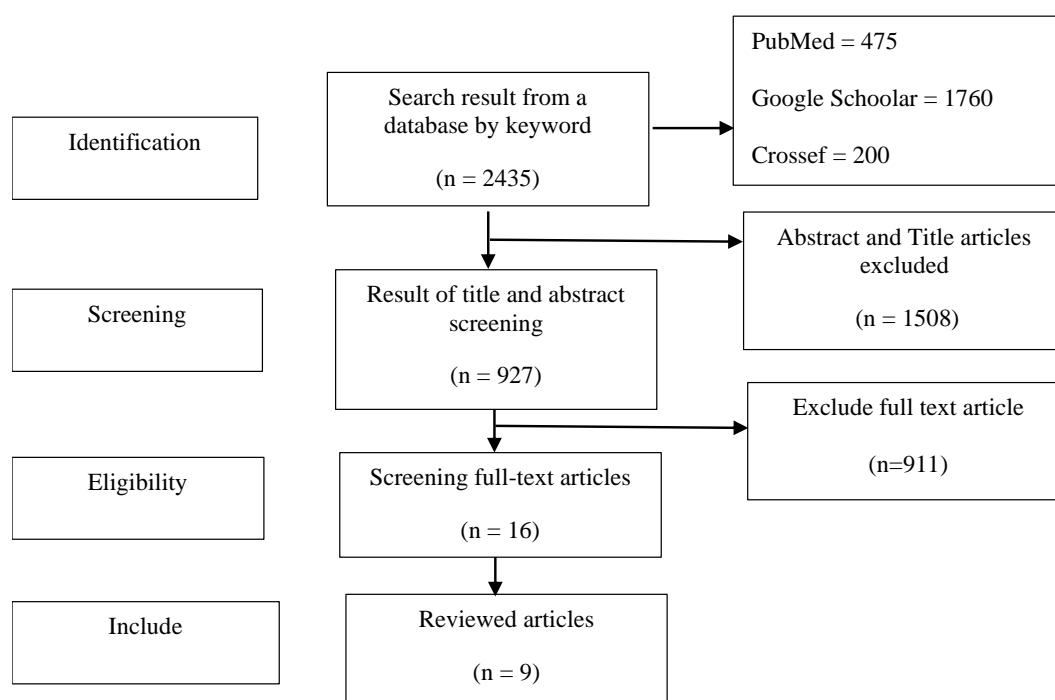
INTRODUCTION

Diabetes is a degenerative disease that has special characteristics, namely hyperglycemia due to abnormal insulin secretion and suboptimal insulin performance or both (Nelyta Oktavianisya & Aliftitah, 2022). The increase in the number of DM sufferers in Indonesia is predicted by WHO, in 2020 as many as eight point four million there will be an increase in 2030 of 21.3 million DM sufferers. So it can be concluded that the increase in the number of diabetes patients in 2035 will reach two to three times (Widiyono et al., 2021). The prevalence of the Indonesian population diagnosed with DM in 2013 increased by 2.1%, this figure compared to 2007. as much as 1.1% greater. the prevalence of diabetes mellitus in Indonesia ranks 3rd in the Southeast Asia region with a prevalence of 11.3% and while according to Riskesdas (2018) in Maya (2021), shows that the prevalence of diabetes mellitus in Indonesia based on doctor's diagnosis at the age of ≥ 15 years is 2%. Uncontrolled increases in blood sugar levels in people with diabetes mellitus can cause serious disturbances in the body, especially in nerves and blood vessels (Syaipuddin et al., 2023).

High and uncontrolled blood sugar levels for a long time can cause complications in people with diabetes mellitus (Faizah et al., 2021). There are 3 mechanisms in diabetic exercise to regulate blood sugar, namely stimulating rapid muscle sugar transport, strengthening the rapid action of insulin and increasing the amount of insulin (Nopriani & Silvia Ramadhani Saputri, 2021). Insulin receptor affinity has an effect on improving insulin sensitivity, sugar is controlled to delay vascular basement membrane thickening (Afridon & Komalasari Centia, 2018). Various types of diabetes management include education, diet, physical exercise, and pharmacological interventions (Rosyid, 2022). Physical exercise is one of the first efforts made to prevent, control and overcome DM (Wardani et al., 2019). Treatment measures taken by health/medical personnel include: pharmacological treatments such as administering drugs and non-pharmacological treatments such as routine metabolic control, vascular control, ulcer evaluation, foot care and other exercise measures such as foot exercises (Bulan et al., 2023). Foot gymnastics is an activity or physical exercise performed by diabetes mellitus patients by moving their feet with the aim of controlling blood sugar levels (Wardani et al., 2023). Changes in blood sugar levels are the status or state of glucose in the blood measured before and after being given foot exercises (Abdurrasyid et al., 2020). Foot gymnastics is classified as a sport or activity that is light and easy because it can be done indoors or outdoors, especially at home with chairs and newspapers and does not require a long time of only about 20-30 minutes which is beneficial to avoid foot injuries and help improve blood circulation in the legs (Nelyanti et al., 2020). Referring to this information, the author aims to find and analyze articles related to the application of diabetic foot exercises to improve blood sugar levels in patients with diabetes mellitus.

METHOD

The method used in this research is the literature review method using seven journals from 2020-2023. Literature review is a research method that reviews the results of primary research to produce more comprehensive and balanced facts (Anita, 2018). Data search bases through search engines such as PubMed, Google Scholar and Crosref, with the keywords used namely: "Foot Exercise" OR "Foot Gymnastics" AND "Blood Sugar Level" AND "DM" OR "Diabetes Mellitus" AND "Sugar Level". The inclusion criteria used were adult patients aged 30-60 years who had diabetes mellitus, using the Quasy Experiment method and free English-language articles and Indonesian-language journals. Interventions carried out in the form of diabetic foot exercise therapy, and added aerobic exercise therapy and exercise media using newspapers published in the range 2020 to 2024. The total journals obtained from the search engines mentioned were 762 journals (Pubmed: 475, Google Scholar: 1760 and Crosref: 200). Not all of these reviews are in accordance with the theme of the research conducted, there are still a number of duplicated articles. The researcher then downloaded 16 articles in RIS format that were in accordance with the title and abstract that the researcher wanted. Furthermore, the article was entered into a tool called Publish or Perish and then the article selection process was carried out. The remaining articles from checking the full text were 16 articles. Then the eligibility assessment was carried out using the PRISMA method with the final result getting 9 articles that were eligible for review. The flow of article search can be seen in Figure 1.



Picture 1. Flow of Article Search in accordance with PRISMA Flowchart

RESULTS

Table 1. Summary of Intervention, Outcome Measures, and Research Results

No	Judul, Penulis	Tahun	Metode, Sampel	Intervensi	Hasil
1	Effect of Diabetes Mellitus Foot Gymnastics Changes in Blood Sugar Levels in Type Ii Diabetes Mellitus Patients at Puledagel Blora Health Center (Pramesti et al., 2020)	2020	Pre-experimental research with One Group Pretest Posttest design. The population in this study was type II diabetes patients, and purposive sampling technique was used to select a sample size of 35 people.	Diabetic exercises for 3x a week	The majority of respondents were female with 21 respondents (60%) with an average age of 49 years, Fasting Blood Sugar Levels before DM Foot Gymnastics 145 mg/dL to 261 mg/dL. Blood Sugar Levels after DM Foot Gymnastics 138 mg/dL to 265 mg/dL. Wilcoxon test P value = 0.000.
2	Application of Foot Gymnastics to Reduce Blood Glucose Levels in Type II Diabetes Mellitus Patients (Astuti & Hartutik, 2023)	2023	descriptive research with a case study research design (case study) of Mr.P	leg exercises for 3 consecutive days within 15 minutes	There was a decrease in blood glucose levels in Mr. P from 154 mg/dl to 141 mg/dl and in Mrs. S from 326 mg/dl to 217 mg/dl.
3	Effectiveness of Diabetes Gymnastics on Blood Sugar Levels in Diabetes	2020	One Group Pretest and posttest Design, The population of this	Diabetes exercises that are done regularly 3 times a week with a duration	Based on the calculation of the paired sample T-Test test, the t value = 10.202 with p = 0.00001

	Mellitus Patients in Lamongan (Sari & Effendi, 2020)		study was 43 people, with a sample of 39 people.	of 15-40 minutes	or <0.05, meaning that there is a significant difference in blood glucose levels between pre test and post test, meaning that Diabetes Gymnastics is effective for reducing blood glucose levels in patients with Type-2 Diabetes Mellitus in Lamongan Regency.
4	<i>The Influence Of Gymnastics Diabetic Foot To Decrease Blood Sugar Levels In Patients With Type 2 Diabetes Mellitus</i> (Untung Halajur & Riki, 2021)	2021	<i>quantitative research study design</i> <i>Preexperimental Design, the design of the study one-group pre-post-test design. The number of respondents 30 people.</i>	<i>regular exercise</i>	<i>physical</i> <i>Ho refused and Ha accepted which means there is a significant difference between random blood sugar levels before and after exercisefeet.</i>
5	<i>The importance of physical activity in management of type 2 diabetes and COVID-19</i> (Soiza et al., 2021)	2021	<i>randomised controlled trial assessed exercise in the prevention of meta-bolic syndrome</i>	<i>in both aerobic and resistance exercise see the greatest improvements in insulin sensitivity</i>	<i>physical exercise can be easily regulated and monitored using step counters and activity trackers, enabling individuals to manage health issues that benefit from physical exercise.</i>
6	<i>The impact of exercise modalities on blood glucose, blood pressure and body composition in patients with type 2 diabetes mellitus</i> (Ambelu & Teferi, 2023)	2023	<i>40 subjects with T2DM (mean age 42.45 years, 29 men, 11 women) were randomly assigned to one of three intervention groups or the control group</i>	<i>The aim of this study was to investigate the effects of 12 weeks of strength, aerobic, and a combination of aerobic and resistance training on blood glucose level, blood pressure, and body composition in patients with T2DM.</i>	<i>Body composition, blood pressure, and fasting blood glucose were significantly lower in the combined (aerobic plus strength) treatment than in the individual treatment, indicating that the combined exercise intervention was more successful in altering these parameters.</i>
7	<i>The Effectiveness of Neuromuscular Taping (NMT) And Foot Exercise in Improving Microcirculations in Diabetes Mellitus Patients</i> (Susanti & Arofiati, 2022)	2022	<i>Quantitative research design with quasi-experimental methods pre-test and post-test with control group design. The population in this study was 356 patients, a sample of 66 respondents.</i>	<i>intervention of Neuromuscular Taping (NMT) and diabetic foot exercise. There</i>	<i>there is an effect on changes in the value of the Ankle Brachial Index (ABI) before and after being given Neuromuscular Taping (NMT) and diabetic foot exercises.</i>
8	<i>The Effectiveness of Acupressure and Smart Gymnastic on Fasting Blood Sugar Levels among</i>	2020	<i>True experimental study pretest and post-test with non-equivalent control group design were applied in this</i>	<i>acupressure and smart gymnastic</i>	<i>Accupressure therapy with smart gymnastics three times a week for four weeks effectively reduces fasting blood sugar level in a patient</i>

<p><i>Patients with Type II Diabetes Mellitus</i> (Nelyanti et al., 2020)</p>	<p><i>study.</i></p>	<p><i>with type II diabetes mellitus</i></p>
<p><i>Exercise intervention under hypoxic condition as a new paradigm for type 2 diabetes mellitus: A narrative review</i> (Kim SW, Jung WS, Chung S, 2021)</p>	<p><i>Narrative review</i> <i>The population in this study was 24 patients,</i></p>	<p><i>Regular exercise under short-term hypoxic conditions can improve blood glucose control at lower workloads than in normoxic conditions</i> <i>that exercise under hypoxic conditions can yield health benefits, which is potentially valuable in terms of clinical care as a new intervention for T2DM patients.</i></p>

DISCUSSION

The articles that have passed the inclusion criteria all evaluate blood sugar levels in patients with type 2 diabetes mellitus. Blood sugar scores are the result of primary research, but not all articles discuss the results of primary research. After searching for articles in the range of 2020 to 2024, article results were obtained that showed that there was an effect on blood sugar levels in patients with type 2 diabetes mellitus who were given an intervention in the form of diabetic foot exercises. The number of 9 articles reviewed has similarities and differences in each study. The same research method was carried out by (Nelyanti et al., 2020), (Pramesti et al., 2020), (Sari & Effendi, 2020), (Untung Halajur & Riki, 2021), and (Susanti & Arofiati, 2022), all five used the Quasy Experiment research method with Pre Post Test. While research from; (Kim SW, Jung WS, Chung S, 2021) uses a narrative review, and there is one study (Soiza et al., 2021) using the Randomized Control Trial (RCT) method, and one study from (Astuti & Hartutik, 2023) using the case study method. The research used is a type of experimental research (quasi-experimental design). This research aims to test directly the effect of one variable with another variable and to test the hypothesis of cause and effect relationships (Rosyid et al., 2023). This experimental design has an experimental class and a control class, but the control class cannot function fully to control variables from outside that can affect the implementation of the experiment. It is called Pre Experimental Design because this design does not include a real experiment, because there are still outside variables that contribute to the formation of the dependent variable. So the experiment which is the dependent variable is not only influenced by the independent variable. This can occur when there are no control variables, and the sample is not randomly selected. Found 9 articles obtained, the authors concluded that the 9 articles were successful in providing diabetic foot exercise interventions to reduce blood sugar levels in patients with type 2 diabetes mellitus.

This is evidenced in the results of research conducted by (Nelyanti et al., 2020), (Pramesti et al., 2020), (Sari & Effendi, 2020), (Untung Halajur & Riki, 2021), and (Susanti & Arofiati, 2022), (Kim SW, Jung WS, Chung S, 2021) and (Astuti & Hartutik, 2023). Reduction in blood glucose levels of patients with diabetes mellitus (DM) is also influenced by the achievement of good intensity during the intervention (Embuai et al., 2019). The intensity of the exercise was assessed from the target pulse, blood pressure and blood glucose levels before and after the intervention (Ratnawati et al., 2019). This condition is in accordance with the concept that exercise will be beneficial if it reaches optimal conditions, namely blood pressure after exercise is not more than 180 mmHg and pulse rate reaches 60-79% MHR (Nurlaela & Purwanti, 2020). If less than 60% of the exercise is less useful and if more than 79% will endanger the patient's health (Untung Halajur & Riki, 2021). According to research by Putriyani et al (2020) Diabetes mellitus management is needed to control blood glucose levels and its complications which include education, food planning, physical activity,

pharmacological therapy, and blood sugar checks (Nurhayani, 2022) One of the physical exercises that can be done by people with diabetes mellitus is diabetes mellitus foot exercises (Zakiudin et al., 2022). Diabetes mellitus foot exercises are low impact aerobic exercises with movements that are rhythmic, fun, not boring and can be done and followed by all ages so that they can attract public enthusiasm in order to improve their physical health (Pramesti et al., 2020). Based on the same statement, the results of research conducted by can be concluded that diabetic foot exercises can have an effect on blood sugar levels, this can occur due to direct physical activity or exercise Associated with an increase in muscle glucose recovery rate (how much muscle takes glucose from the bloodstream) (Bulan et al., 2023). This is in line with the opinion that explains that diabetic foot exercise is an activity that can be done by diabetic patients to improve blood circulation and also reduce the risk of foot injuries (Astuti & Hartutik, 2023). Foot exercises can also increase energy needs in the muscles so that they make the muscles more sensitive and active to make insulin receptors become more active and there is a decrease in blood glucose levels so that glucose levels are within normal limits (Ismail & Yulian, 2019). The thing that can control blood glucose levels is the regularity of patients in doing gymnastic activities (Elyta & Sari Octarina Piko, 2022).

CONCLUSION

The conclusion that can be drawn based on the results of the analysis of 9 articles selected according to the inclusion criteria from 2020-2024 shows that diabetes mellitus foot exercises using newspaper media and coupled with aerobic exercises are most effective in reducing blood sugar levels in patients with diabetes mellitus before doing foot exercises with a comparison after being given diabetic foot exercise therapy.

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