Journal for Research in Public Health, Volume 2, Issue 2, January 2021, pp: 77-82
ISSN: 2685-5283 (print), ISSN: 2685-5275 (online)
DOI: 10.30994/jrph.v2i2.31

Effectiveness of Diabetic Foot Exercise in Preventing the Risk of Diabetic Foot Ulcers in Type 2 Diabetes Mellitus Patients: Literature Review

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ABSTRACT

Diabetic foot ulcers are one of the most common complications in diabetic patients and cause 10% of patients undergo amputation. One of the efforts to prevent the risk of more severe complications is diabetic foot exercises to reduce the risk to patients and the economic burden it causes to society. This literature review aims to summarize, assess and synthesize study results regarding the effectiveness of diabetic foot exercises in preventing the risk of diabetic foot ulcers in type 2 diabetes mellitus patients. This study used a literature review method. The literature search strategy used the database pubmed, proquest, science direct, and the cochrane library in the period 2010-2020. From 4 databases, 97 relevant articles were obtained. The exclusion of duplicate articles, titles, abstracts, and research results was left with 5 articles. The results showed a significant difference between the size of diabetic foot ulcers in the intervention group at week 4 and 12 compared to the control group ($p \leq 0.05$), the chance of reducing the risk of diabetic foot ulcers was 1.238 times in the intervention group ($p= 0.001$) , the difference in mean scores posttest in the intervention group and the control group after exercise for 6 times in 2 weeks was 9.24 ($p = 0.002$), after the intervention the risk of diabetic foot ulcers decreased by 82% ($p = 0.001$). Diabetic foot exercise is effective in preventing the risk of diabetic foot ulcers, and can reduce and accelerate wound healing in DM patients with diabetic foot ulcers.

Keywords: Diabetes Mellitus Type 2, Diabetic Foot Ulcer, Diabetic Foot Exercise

INTRODUCTION

Diabetes mellitus (DM) is a serious and complex metabolic disease that attacks almost all vital organs in the body (Singh et al., 2013), characterized by hyperglycemia as a result of decreased insulin secretion and damaged insulin activity or even both (Widiawati et al., 2020). In adults, type 2 diabetes is most commonly found with symptoms of excessive urination (polyuria), frequent thirst (polydipsia), frequent hunger, weight loss, blurred vision and fatigue (WHO, 2020). This disease is associated with various chronic problems as well as micro-involvement and macroangiopathy and polyneuropathy (Gariani et al., 2020). One of the most common complications in diabetes mellitus patients is diabetic foot ulcers (Mirtha et al., 2018).

Diabetic foot ulcers are injuries to all layers of the skin, necrosis or gangrene that usually occurs on the soles of the feet (Rosyid, 2017), due to peripheral neuropathy or peripheral artery disease, secondary infection due to trauma or ulceration, soft tissue and bone deformities in DM patients (Ahmad, 2016). These complications have a significant impact on health and socioeconomic status and are a cause of disability, morbidity and mortality in DM patients (Mariam et al., 2017). The prevalence of diabetic foot ulcers continues to increase worldwide every year (Rosyid, 2017).

Diabetic foot ulcers are one of the major complications of diabetes mellitus with prevalence which is quite high in some countries. Various epidemiological studies have confirmed the high prevalence of this complication. In the UK, the prevalence of diabetic foot ulcers is reported to be 5.3% (Lauterbach et al., 2010), in Ghana 11.0% (Atosona & Larbie, 2019),

in Ethiopia 13.6% (Mariam et al., 2017), in United States 15-20% (Rosyid, 2017), in Spain 17.4% (Dòria et al., 2016), while in Indonesia the mortality and amputation rates are still high, 16% and 25% respectively (Rosyid, 2017). This high prevalence rate makes prevention efforts important to reduce the risk to patients and the economic burden it causes to society (Bus et al., 2020).

Various efforts to prevent the risk of diabetic foot ulcers have been carried out in clinical practice (Liao et al., 2019). According to the Indonesian Association of Endocrinologists (PERKENI), one of the efforts that can be done to prevent the risk of diabetic foot ulcers is physical exercise such as diabetic foot exercise (Noor et al., 2015). Gymnastics diabetic foot memiLiki effect of light and rhythmic and done with some nice gesture, not saturated and can be done by anyone at that age is not limited to (Damayanti, 2015). This exercise can be done regularly 3 to 5 times each week at intensity moderate with a duration of 30-60 minutes per exercise (Ruben et al., 2016). Diabetic foot exercise can facilitate movement of joints and muscles, increase blood flow to the area, and provide adequate wound perfusion (Eraydin & Avsar, 2018). If the patient exercises regularly, the supply of oxygen and nutrients circulating in the bloodstream will increase and gradually control blood sugar levels as a result of improving insulin sensitivity. In addition, this exercise can also accelerate wound healing, prevent amputation, improve quality of life, and reduce costs (Alexiadou & Doupis, 2012).

A number of studies have proven that diabetic foot exercise can prevent and reduce the risk of diabetic foot ulcers in type 2 diabetes mellitus patients, including a study conducted by (Sunaryo & Sudiro, 2014), showing that patients who do diabetic foot exercise have a chance to reduce their risk. and prevent the occurrence of diabetic foot ulcers by 1,238 compared to patients who did not do diabetic foot exercises. Another study conducted by (Eraydin & Avsar, 2018), showed a significant reduction in the ulcer area up to 14.43% in patients who did diabetic exercise. This is the case with research (Kurdi & Ratna Puji Priyanti, 2019), which shows a reduction in the risk of diabetic foot ulcers by up to 80% in patients who do diabetic foot exercises. Therefore, this literature review aims to summarize, assess and synthesize the results of studies on the effectiveness of diabetic foot exercise in preventing the risk of diabetic foot ulcers in type 2 diabetes mellitus patients.

RESEARCH METHODS

This study used a literature review method. The data in this literature review were obtained through search results related to the effectiveness of diabetic foot exercise in preventing the risk of diabetic foot ulcers in type 2 diabetes mellitus patients. The search strategy and article selection used 4 databases, namely pubmed, proquest, science direct, and cochrane library using keyword "Diabetic foot exercise AND diabetic foot ulcer AND diabetes mellitus type 2". The inclusion criteria included: (1) studies with patients diagnosed with diabetes mellitus type 2, (2) types of diabetic foot exercise interventions, (3) research conducted between 2010-2020, (4) indexed English and Indonesian articles national and international, and (5) has full text. Studies using two interventions at once, and nonhuman samples were excluded.

The database pubmed found 131 articles. Then the article restriction was carried out based on free full text = 44 articles, publication year 2010-2020 = 37 articles, and human samples = 30 articles. Proquest found 708 articles. Then the article restriction was carried out based on free full text = 404 articles, journals academic = 241 articles, and publication year 2010-2020 = 33 articles. Science direct found 1,797 articles. Then the article limitation was carried out based on the publication year of 2010-2020 = 857 articles, and free full text = 27 articles. Meanwhile, the database cochrane library) found 79 articles. Then the article limitation was carried out based on the publication year 2010-2020 = 29 articles, and free full text = 7 articles.

From the search results literature in the 4 databases above, it was obtained 97 articles that were relevant to keywords they entered. The next step was exclusion of articles with the same title (n = 23), titles and abstracts not relevant to the research question (n = 36), the remaining 38 articles. Then the exclusion of articles that were not relevant to the results of the study (n = 33), so that the remaining 5 articles. Therefore, the author uses 5 articles as
the main reference in compiling this literature review.

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RESULTS

Based on the results of a literature search, there were five studies related to the effectiveness of diabetic foot exercise in preventing the risk of diabetic foot ulcers in type 2 diabetes mellitus patients, including research (Sunaryo & Sudiro, 2014), in 2013 with the aim of knowing the effect of diabetic exercise on diabetes mellitus. Decreased risk of diabetic foot ulcers in type 2 diabetes mellitus patients in the Surakarta Prov. Central Java Indonesia, with 101 respondents (49 intervention groups and 52 control groups). The research design used quantitative descriptive with 2 sample groups. The results of the analysis using the test chi square obtained value p= 0.001, this means that diabetic foot exercise has an effect on reducing the risk of diabetic foot ulcers. In the results of the simple regression analysis, the OR value was 1.238, meaning that respondents who did diabetic exercise had a 1.238 chance of reducing the risk and preventing the occurrence of diabetic foot ulcers compared to respondents who did not do diabetic exercise.

Research (Eraydin & Avsar, 2018), in 2014-2015 with the aim of knowing the effect of diabetic foot exercise on wound healing in type 2 diabetes patients with diabetic foot ulcers in 2 hospitals in Tokat province, Turkey, with 116 respondents (study group = 33, randomized = 65, control group = 32). This study is a type prospective using a randomized controlled study design. The results showed that the ulcer area decreased significantly in the intervention group compared to the control group for 3 follow-up measurements with mean ulcer area was 12.63 (14.43), 6.91 (5.44), 4.30 (3.70), and 3.29 (3.80) cm 2 (P <.05) in the intervention group, and 24.67 (20.70), 24.75 (20.84)), 20.33 (20.79)), and 18.52 (21.49) cm 2 in the control group at week 4, 8, and 12, respectively. A significant difference was found between the size of diabetic foot ulcers in the study intervention group at 4 and 12 weeks compared to baseline ($p \leq 0.05$). However, only 12 weeks differed from baseline in the control group ($p = 0.000$). The mean depth of ulcers was 0.56 (0.85), 0.42 (0.68), 0.36 (0.50), and 0.28 (0.38) cm in the study intervention group ($p < 0.05$) and 0.61 (0.84), 0.82 (1.07), 0.83 (1.21), and 0.80 (1.26) cm in the control group, respectively, at baseline. , and at weeks 4, 8, and 12, respectively ($p = 0.000$). The area of diabetic foot ulcers was found to have decreased the most in respondents who did diabetic foot exercises compared to respondents who did not do diabetic foot exercises. This means that diabetic foot exercise can affect wound healing and prevent the risk of diabetic foot ulcers in type 2 diabetes patients, therefore this exercise should be included in the treatment plan in diabetes mellitus patients with diabetic foot ulcers.

Research (Rumaolat et al., 2017), in 2017 with the aim of analyzing the effect of diabetes mellitus exercise on the risk of diabetic ulcers in type 2 diabetes mellitus sufferers in Telaga Piru Hamlet, West Seram Regency, Prov. Maluku Indonesia, with 26 respondents (13 intervention groups and 13 control groups). This research is a quantitative type using a quasi experimental design with an approach of two-group posttest control design. The results showed that the score posttest in the intervention group after giving diabetes exercise for 6 times in 2 weeks was 8.88 and the control group was 18.12, with a difference of 9.24. The results of the analysis using the test Mann Whitney-U obtained value $p = 0.002$, meaning that H0 is rejected. This means that diabetes mellitus exercise affects the risk and prevention of diabetic ulcers in type 2 diabetes mellitus sufferers.

Research (Kurdi & Ratna Puji Priyanti, 2019), in 2019 with the aim of knowing the effectiveness of diabetic foot exercise against the risk of DFU (Diabetic Foot Ulcers) for diabetes mellitus patients at Al Hijrah Wound Care Center Jombang, East Java Province, Indonesia, with 40 respondents.. This type of research is quantitative using a quasi experimental design with approach one group pre-post design. The results showed a decreased risk of DFU before and after giving diabetic foot exercises. The results pretest found that 30 (75%) respondents had a risk moderate, and after the intervention, 32 (80%) respondents were found to have a low risk. The results of the analysis Wilcoxon showed that

the value of p = 0.001, which means that there is a significant influence between diabetic foot exercise in preventing the risk of DFU.

Recent research by (Hati et al., 2020), in 2020 with the aim to determine the effect of exercise on reduction of diabetic foot risk ulcers in diabetic patients with diabetes mellitus type 2inhealth centers Teupah the west sub-district Teupah west Simeulue Prov. Aceh Indonesia, with 20 respondents. This research is a quantitative type using a quasi experimental design with approach one group pre-post design. The results showed a reduced risk of diabetic ulcers before and after diabetic foot exercise. At the time of the pretest found 8 (40%) respondents with low risk, and 12 (60%) respondents with high risk. However, after the intervention found 17 (85%) respondents with low risk, and only 3 (15%) respondents with high risk. The results of the analysis using the paired-sample t test, the value of p = 0.001, this means that diabetes foot exercise has an effect in reducing and preventing the risk of diabetic ulcers in patients with type 2 diabetes mellitus.

DISCUSSION

In this review literature, data from 5 articles indicate that exercise Diabetic foot gymnastics can effectively prevent risks and reduce and accelerate wound healing in DM patients with diabetic foot ulcers. In a study (Sunaryo & Sudiro, 2014), diabetic exercise was carried out 4 times for 1 month. Although there are still some patients who do not participate in regular exercise due to various reasons, including patient awareness to improve health and control blood sugar, fill in doctor's activities and recommendations, statistically, there is a significant reduction in the risk of diabetic foot ulcers in type 2 DM patients. Diabetic exercise can help improve blood lipid profiles, lower total cholesterol, Low Density Lipoprotein (LDL), triglycerides and increase High Density Lipoprotein (HDL) and improve the hemostatic system and blood pressure.

In the study (Eraydin & Avsar, 2018), patients in the intervention group received standard wound care and did daily leg exercises for 12 weeks, while the control group only received wound care. The results showed that regular leg exercises reduced ulcer size and depth, accelerated wound healing, and demonstrated a relationship between exercise application time and healing speed. The control group experienced a change in wound size after week 8, while the intervention group began to experience improvement after week 4, this is related to changes that occur due to exercise (muscle activity, increased blood flow to the wound area, and decreased hypoxia).

In the results of the study (Rumaolat et al., 2017), there were no patients who had callus rings and no respondents were at risk of developing diabetic ulcers after being given diabetic foot exercises for 14 days. Although all the patients experienced temporary tingling in the feet, the condition of the toenails was not maintained, the feet were rough and they were briefly red. Diabetic foot exercise has shown a positive effect on reducing the risk of diabetic ulcers. When the patient performs diabetic foot exercises, the condition of the membrane permeability to glucose increases in the contracting muscles so that insulin resistance decreases and there is an increase in insulin sensitivity.

Research (Rumaolat et al., 2017), shows that diabetic foot exercise can prevent the risk of foot diabeticulcers. The risk reduction from moderate to low risk occurred in patients who were given diabetic foot exercise 2 times / week for 4 weeks with a duration of 30 minutes each time. Diabetic foot exercise that is carried out regularly and regularly will increase nerve sensitivity and improve blood circulation, especially in the leg area.

Likewise, the results of the study (Hati et al., 2020), showed a reduction in the risk of diabetic ulcers from high risk to low risk after the patient was given diabetic foot exercises. When the patient does diabetic foot exercises, there is an increase in energy, making the muscles active and the use of glucose increases, causing blood sugar levels to decrease.

CONCLUSION

This literature review shows that diabetic foot exercise is effective in preventing the risk of diabetic foot ulcers in type 2 diabetes mellitus patients. Diabetic foot exercise can also reduce and accelerate wound healing in DM patients with diabetic foot ulcers.

SUGGESTION

It is hoped that health service providers, especially nurses, should provide health education related to diabetic foot exercise starting from the goal to the procedure for implementing diabetic foot exercise so that patients can do it independently at home and save on maintenance costs.

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