

ORIGINAL RESEARCH

EFFECTIVENESS OF DIABETIC FOOT EXERCISES USING SPONGES AND NEWSPAPERS ON FOOT SENSITIVITY IN PATIENTS WITH DIABETES MELLITUS

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Abstract

Background: Diabetes mellitus is a critical public health problem, and its prevalence in Indonesia remains high. Diabetes mellitus may cause complications, one of which is neuropathy that can impair foot sensitivity. This requires a treatment by doing diabetic foot exercises using sponges and paper.

Objective: To examine the effectiveness of diabetic foot exercise using sponges and newspapers on foot sensitivity in patients with diabetes mellitus.

Methods: This is a quasi-experimental study with pretest posttest with a control group research design, which was conducted at Public Health Center Depok III, Sleman Regency, Yogyakarta, Indonesia. An accidental sampling technique was used to select participants, with a total sample of 108 respondents consisting of 36 respondents in a control group, 36 respondents in a sponge group, and 36 respondents in a newspaper group. Data were analyzed using Wilcoxon and Mann-Whitney test.

Results: Among the three groups, only those who received foot exercises using sponges and newspapers had a significant effect on foot sensitivity ($p < .05$). However, there was no significant difference on the effect of foot exercise on foot sensitivity between sponges and newspapers group ($p > .05$).

Conclusion: The use of sponges and newspapers in foot exercise could significantly improve foot sensitivity in patients with type 2 diabetes mellitus. It is therefore recommended for nurses to provide the foot exercise as a part of nursing practice in both hospitals and community health centers.

KEYWORDS

diabetes mellitus; diabetic foot; peripheral neuropathy; sensitivity

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INTRODUCTION

The number of persons with diabetes mellitus increased from 108 millions in 1980 to 422 millions in 2014 ([World Health Organization, 2016](#)). The global prevalence of diabetes has almost doubled from 4.7% to 8.5% in the adult population ([World Health Organization, 2016](#)). According to [International Diabetes Federation \(2017\)](#), the number of people with diabetes worldwide in 2017 among 20-79 years old was approximately 425 million and is expected to exceed 629 million in 2045. The top three countries/territories for some people with diabetes are China (114.4 million), India (72.9 million), and the United States (30.2 million). Indonesia ranks sixth as the country with the highest

number of DM patients as many as 10.3 million ([International Diabetes Federation, 2017](#)).

Diabetes mellitus can cause microvascular disease (small blood vessels) that cause neuropathy, which leads to foot ulcers ([Smeltzer et al., 2010](#)). Consequently, sensory loss occurs in both feet and hands, which results in a disturbance of sensitivity to the foot causing inability to feel pain, heat or cold, tingling sensation, feeling like being pierced and numbness ([Baradero et al., 2009](#)). Foot sensitivity is significant for patients with diabetes mellitus because it can cause trauma. Patients who experience a decrease in foot sensitivity will lose sensation to feel pain

although the foot is injured, which potentially cause of ulcers due to the absence of foot care (Sari, 2015). Foot exercise activity is one of therapies that can be given to people with diabetes. Diabetic foot exercises are a series of foot movements carried out by someone who has diabetes mellitus to prevent injury and help facilitate blood circulation in the feet (Setyoadi, 2011). A study has proven that routine diabetic foot exercises are very effective in increasing foot sensitivity (Rusandi et al., 2015).

Diabetic foot exercises are usually done using a medium such as paper, or newspaper. Newspaper is used because it has a thin sheet and a smooth surface that will not injure the soles of the foot, and it is easily torn by the foot. Endriyanto et al. (2013) showed that one-time foot exercise for patients with diabetes mellitus using newspapers could increase foot sensitivity in patients with type 2 diabetes. In addition to the newspapers, sponges are considered effective in increasing the foot sensitivity in patients with diabetes mellitus type 2, as indicated by a previous study. Sponges' structure is porous with a soft and very flexible surface that can be used in everyday life as a bath sponge and rubbing tool (Aryulina et al., 2007).

Our preliminary study at Depok III Sleman Yogyakarta Health Center in ten patients with diabetes mellitus found that six patients had never done foot exercises at home, and four patients routinely did foot exercises at home but did not use media. The average of blood sugar among those patients was 113-190 mg/dl. From the results of our examination of foot sensitivity with monofilament, it was found that all patients experienced a decrease in foot sensitivity, less feeling of touch sensation in more than 3 points on both feet. Therefore, this study aimed to examine the effectiveness of diabetic foot exercise using sponges and newspapers on foot sensitivity in patients with diabetes mellitus, and to compare the effect of both media.

METHODS

Study Design and Sample

This was a quasi-experimental study with pretest posttest with nonequivalent control group. Population in this study was all patients with diabetes mellitus at Public Health Center of Depok III, Sleman Regency, Yogyakarta. Sample was calculated using Slovin formula with a margin error of 5% in 148 patients as a total population. A total of sample was 108 respondents, which assigned in a control group ($n=36$), a sponge group ($n=36$), and a newspaper group ($n=36$), selected using accidental sampling technique. The inclusion criteria of the sample were a patient with type 2 diabetes mellitus, length of disease is > 2 years, aged 35-64 years, and willing to follow the entire research process. The exclusion criteria were patients with diabetes mellitus who had diabetic foot ulcers.

Instruments

Foot sensitivity was measured using a monofilament 10 g. Monofilament was placed perpendicular to the skin. The emphasis was made as far as monofilament could be bent and held for 2-3 seconds. Monofilament was used at 10 location points on the left and right feet, namely on the first toe, the first,

third and fifth metatarsal heads, three plantar parts from the heel, and the dorsum of the foot. The examination was carried out before and after diabetic foot exercises, with scale 0-10 to indicate the number of points that can feel monofilament. The higher the score, the better of foot sensitivity.

Intervention

The first group of respondents received diabetic foot exercise using a sponge (with a size of 30 cm \times 25 cm \times 1 cm), and the second group using two-sheets newspaper (with a size of 70 cm \times 58 cm) for the exercise. Both groups performed the exercise in both feet for 10 minutes 3 times a week (1st day, 4th day, and 7th day). The third group did not receive any treatments as a control group.

Data Collection

This research was conducted at Public Health Center of Depok III, Sleman Regency, Yogyakarta from 4th April to 15th June 2018. The researchers led diabetic foot exercises on the first and seventh day and measured the foot sensitivity, assisted by two assistants. The first assistant is the nurse on duty at the public health center. The second assistant is a nursing student at Respati Yogyakarta University. The assistants helped the researchers to lead the 4th-day of diabetic foot exercise and measured the sensitivity of the feet of some respondents. The foot sensitivity of the pretest was measured before (the 1st day) and after diabetic foot (the 7th day).

Data Analysis

Based on the results of Kolmogorov Smirnov, the data were not normally distributed. Therefore, Mann Whitney and Wilcoxon test were used for data analysis.

Ethical Consideration

The ethical approval was obtained from Ethics Commission of Respati Yogyakarta University with approval number of 110.2/UNRIYO/PL/III/2018. The study permission was also obtained from the Head of Public Health Center of Depok III, Sleman Regency, Yogyakarta. An informed consent was signed to all respondents prior to data collection.

RESULTS

Majority of participants aged 56-65 years, with most likely equal gender. Most of participants have the length of suffering from diabetes mellitus for less than 10 years (Table 1). In Table 2, it shows that those who received sponge and newspaper intervention had a higher delta median than those in the control group. The highest foot sensitivity in both intervention groups was in the left foot than the right foot.

And among the three groups shown in Table 3, only those who received foot exercises using sponge and newspaper had a significant effect on foot sensitivity ($p < .05$). Those in the control group significantly had no impact on foot sensitivity. Further, it shows that there was no significant difference on the effect of foot exercise using sponge and newspaper on foot sensitivity among patients with diabetes mellitus ($p > .05$) (Table 4).

Table 1 Characteristic of Respondents

Category	Control Group		Sponge Group		Newspaper Group	
	f	%	f	%	f	%
Age (years)						
35-40	4	11.1	0	00.0	2	5.6
41-55	13	36.1	18	50.0	6	16.7
56-64	19	52.8	18	50.0	28	77.8
Total	30	100.0	36	100.0	36	100.0
Gender						
Female	15	41.7	22	61.1	16	44.4
Male	21	58.3	14	38.9	20	55.6
Total	36	100.0	36	100.0	36	100.0
Length of disease						
<10 years	8	22.2	28	77.8	26	72.2
>10 years	28	77.8	8	22.2	10	27.8
Total	36	100.0	36	100.0	36	100.0

Table 2 Foot Sensitivity of Pretest-Posttest Diabetic Foot Exercises Among Groups

Group	Location	Foot Sensitivity Pretest-Posttest			
		Min	Max	Median	Delta Median
Control	Right Foot	0-1	8-8	6.0-6.5	0.5
	Left Foot	0-2	8-9	7.0-7.5	0.5
Sponge Intervention	Right Foot	2-5	9-10	7.5-10.0	2.5
	Left Foot	0-3	9-10	7.0-10.0	3.0
Newspaper Intervention	Right Foot	3-5	9-10	8.0-10.0	2.0
	Left Foot	1-7	8-10	7.0-10.0	3.0

Table 3 Effectiveness of Foot Exercises on Foot Sensitivity

Group	N	Variable	Delta Median of Foot Sensitivity	p-value
Control	36	Pretest-Posttest Right Foot	0.5	0.798*
		Pretest-Posttest Left Foot	0.5	0.864*
Sponge Intervention	36	Pretest-Posttest Right Foot	2.5	0.000*
		Pretest-Posttest Left Foot	3.0	0.000*
Newspaper Intervention	36	Pretest-Posttest Right Foot	2.0	0.000*
		Pretest-Posttest Left Foot	3.0	0.000*

*Wilcoxon Test

Table 4 Differences in the Effectiveness of Diabetic Foot Exercises Using Sponge and Newspaper on Foot Sensitivity

Variable	N	p-value
Pretest Sponge Intervention Group	36	0.673**
Pretest Newspaper Intervention Group	36	
Posttest Sponge Intervention Group	36	0.584**
Posttest Newspaper Intervention Group	36	

**Mann Whitney Test

DISCUSSION

Our study aimed to examine the effectiveness of diabetic foot exercise using sponges and newspapers on foot sensitivity in patients with diabetes mellitus, and to compare the effect of both media. The result showed that diabetic foot exercises using sponges and newspapers have significant effects on foot sensitivity. Sensitivity is the ability to feel various stimulations such as pain, pressure, and movements that activate receptors to respond (Dorland, 2011). The increase of minimum-maximal value after foot exercises showed that diabetic foot exercises using sponge and newspaper are useful for increasing foot sensitivity.

Our findings supports the study stated that foot exercises can help facilitate blood circulation, strengthen small muscles, and prevent foot deformities (Misnadiarly, 2006). In addition, foot exercises help strengthen the foot muscles and help blood circulation to the lower extremities. However, foot exercises provides stimulation to the nerve points associated with the pancreas to produce insulin through nerve points located on foot, and prevent the occurrence of complications in the foot and increase the sensitivity of body cells, especially the foot sensitivity (Mangoenprasodjo & Hidayati, 2005). In addition, foot exercises can lead to recovery peripheral nerve function by inhibiting aldose reductase which leads to decreased Nicotinamide Adenine Dinucleotide Phosphate Hydroxide (NADPH) which will increase endothelial cell activity. A decrease in NADPH can contribute in increase the synthesis of nitric oxide (NO) which will eliminate hypoxia in the nerves. Enhancement Nitric oxide (NO)-derived endothelium can also cause recovery of nerve function in diabetic peripheral neuropathy patients. The action of diabetic foot exercises can increase nitric oxide and inhibit production excessive protein kinase C (McIntosh et al., 2003).

Although there was no significant difference on the impact of foot exercise between sponge and newspaper group, but the median of foot sensitivity was slightly different, which is higher in the sponge group compared to the median in the newspaper group. A sponge was more challenging to tear than the newspaper. Based on our opinion, using a sponge, patients need to focus the strength and energy on the feet to tear the sponge and do the maximum foot exercises. The more foot pressure is given, the better the stimulation of blood circulation in the area of the foot. However, both media are effective, as indicated in our study.

With our study results, foot exercises using newspaper and sponge media can be included in the nursing intervention to prevent a decrease in foot sensitivity due to chronic complications of diabetes mellitus. Diabetic foot exercises are comfortable, safe, and affordable. In addition, it can be performed in daily activities.

Limitation of the Study

The short period of duration and foot exercise might be considered as a limitation. Thus, future research needs to pay

attention to this issue, which the foot sensitivity could be measured in time series. In addition, ankle brachial index can be used as another variable for measuring the effectiveness of foot exercise.

CONCLUSION

Foot exercises using sponge and newspaper effectively improve foot sensitivity in patients with type 2 diabetes mellitus. It is therefore recommended for nurses to provide the foot exercise as a part of nursing practice in both hospitals and community health centers.

Declaration of Conflicting Interest

There was no conflict of interest in this study.

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Authors Contributions

This study from beginning to end was conducted by SF, AS, and NHR. Study conception and writing draft were done by first author. Data collection by SF, AS and 2 assistants (AW and PD), data analysis and interpretation were done by SF, AS, and NHR. All work in this study was carried out by the author.

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References

- Aryulina, D., Muslim, C., Manaf, S., & Winarni, E. (2007). *Biologi I [Biology I]*. Jakarta: Erlangga.
- Baradero, M., Dayrit, M. W., & Siswadi, Y. (2009). *Klien gangguan endokrin [Clients with endocrine disorders]*. Jakarta: EGC.
- Dorland, W. (2011). *Dorland medical pocket dictionary*. Jakarta: EGC.
- Endriyanto, E., Hasneli, Y., & Dewi, Y. I. (2013). *Efektifitas senam kaki diabetes militus dengan koran terhadap tingkat sensitivitas kaki pada pasien DM tipe 2 [Effectiveness of foot gymnastics diabetes mellitus with newspapers on the level of foot sensitivity in type 2 DM patients]*. Retrieved from <https://repository.unri.ac.id/xmlui/bitstream/handle/123456789/4265/JURNAL%20PDF%20EKO%20ENDRIYANTO.pdf?sequence=1>
- International Diabetes Federation. (2017). *Diabetes atlas* (8th ed.). Brussels, Belgium: International Diabetes Federation.
- Mangoenprasodjo, A., & Hidayati, S. (2005). *Terapi alternatif dan gaya hidup sehat [Alternative therapy and healthy lifestyle]*. Yogyakarta: Pradipta Publishing.
- McIntosh, A., Chiverton, R., Clarkson, S., Feder, G., Foster, A., Gadsby, R., . . . Peters, J. (2003). *Prevention and management of foot problems in type 2 diabetes: clinical guidelines and evidence*. Sheffield: University of Sheffield.

- Misnadiarly. (2006). *Diabetes mellitus : gangren, ulcer, infeksi, mengenal gejala, menanggulangi, dan mencegah komplikasi [Diabetes mellitus: gangrene, ulcers, infection, knowing symptoms, overcoming, and preventing complications]*. Jakarta: Pusat Populer Obor.
- Rusandi, D., Prabowo, T., & Adinugraha, T. S. (2015). Pengaruh senam kaki diabetes terhadap tingkat sensitivitas kaki dan kadar glukosa darah pada penderita diabetes militus di Kelurahan Banyuraden Gamping Sleman [The effect of diabetes foot gymnastics on the level of foot sensitivity and blood glucose level in patients with diabetes mellitus in Banyuraden Gamping Village Sleman]. *Jurnal Media Ilmu Kesehatan*, 4(1), 44-54.
- Sari, Y. (2015). *Perawatan kaki diabetik: Berdasarkan konsep manajemen luka modern dan penelitian terkini [Diabetic foot care: Based on the concept of modern wound management and current research]*. Yogyakarta: Graha Ilmu.
- Setyoadi, K. (2011). *Terapi modalitas keperawatan pada klien psikogeriatrik [Nursing modality therapy for psychogeriatric clients]*. Jakarta: Salemba Medika.
- Smeltzer, S. C., Bare, B. G., Hinkle, J. L., & Cheever, K. H. (2010). *Brunner & Suddarth's textbook of medical-surgical nursing* (12th ed.). Philadelphia: Lippincott Williams & Walkins.
- World Health Organization. (2016). *Global report on diabetes*. Geneva: World Health Organization.

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